3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the general South Gillette analysis area for all four of the LBA[1] tracts (the affected environment) and analyzes the direct and indirect impacts to those resources that would be associated with mining the tracts (the environmental consequences) if they are leased under the Proposed Action or Alternative 2 or 3 for each tract.

> Additional information about the affected environment in the general South Gillette analysis area is contained in a separate document entitled *Supplementary Information on the Affected Environment in the General South Gillette Analysis Area for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II Coal Lease Applications EIS,* which is available on request.

The probable environmental consequences of the No Action Alternative for each tract (Alternative 1, rejecting the application) with respect to each of the environmental resources are also considered in this analysis.

In addition, this chapter considers regulatory compliance, mitigation, monitoring, residual impacts, the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible and irretrievable commitments of resources that would occur with implementation of the Proposed Action or Alternative 2 or 3 for each tract. As discussed in Chapter 2, regulatory compliance and mitigation and monitoring measures that are required by federal and/or state law are considered to be part of the Action Alternatives for each tract.

The elements of the human environment (BLM 2008a) that could potentially be affected by the Action Alternatives for each tract include air quality, cultural resources, Native American religious concerns, T&E species, migratory birds, hazardous or solid wastes, water quality, wetlands/riparian zones, floodplains, invasive non-native species, and environmental justice. Four other elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, and wilderness) are not present in the analysis area and are not addressed further. In addition to the elements that are potentially present in the general South Gillette analysis area, this EIS discusses the status and potential effects of mining each LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics.

[1] Refer to page xxii for a list of abbreviations and acronyms used in this document.

The resources that are addressed in this EIS were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

Figure 3-1 shows the general South Gillette analysis area for general resource discussions. The general South Gillette analysis area does not have a defined boundary but includes a general area around the combined BLM study areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts (the tracts as applied for and the additional area evaluated under other action alternatives for each tract), and the combined resource analysis areas (the BLM study area for an LBA tract plus a ¼-mile disturbance buffer around the study area).

Tables 3-1 through 3-4 shows the total leased and total disturbance areas for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines (which represent the No Action Alternatives), and how the leased areas and estimated disturbance areas would change under the Action Alternatives.

As indicated in Table 3-1, Belle Ayr's current coal leases include approximately 6,345 acres and, under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 11,621 acres in order to recover that coal. According to Belle Ayr Mine's 2007 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 5,477 acres as of January 7, 2007 (FCW 2007). Of that area of disturbance, approximately 2,174 acres were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings and coal loading facilities, railroad loop, environmental monitoring areas, etc.), 1,006 acres were being actively mined, and 2,297 acres had been mined and reclaimed or were in the process of being reclaimed (FCW 2007).

Coal Creek's current coal leases include approximately 6,854 acres and, under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 8,355 acres in order to recover that coal (Table 3-2). According to Coal Creek Mine's 2006-2007 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 1,975 acres as of December 31, 2006 (TBCC 2007). Of that area of disturbance, approximately 874 acres were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings and coal loading facilities, railroad loop, environmental monitoring areas, etc.), 530 acres were being actively mined, and 571 acres had been mined and reclaimed or were in the process of being reclaimed (TBCC 2007).

As indicated in Table 3-3, Caballo's current coal leases include approximately 11,705 acres and, under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 16,898 acres in order to recover that coal. According to Caballo Mine's 2006 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 6,571 acres as of October 7, 2006 (CCC 2006). Of that area of disturbance, approximately 1,544 acres were occupied by

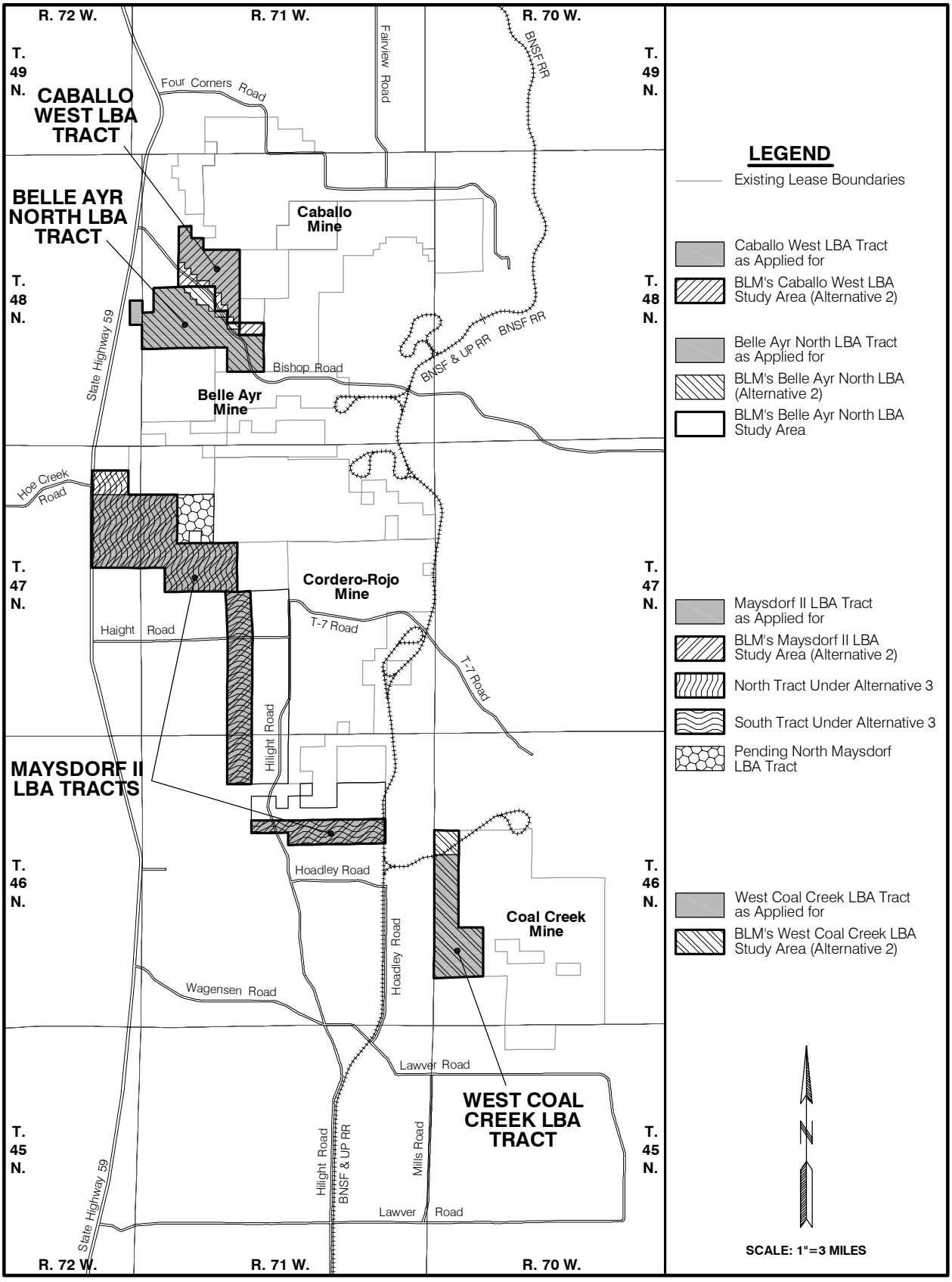

Figure 3-1. General South Gillette Analysis Area.

Table 3-1. Comparison of Existing and Proposed Belle Ayr Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2
Additional Lease Area (Acres)	---	1,578.7	1,671.0
Total Lease Area (Acres)[1]	6,345.3	7,924.0	8,016.3
Increase in Lease Area (Percent)	---	24.9	26.3
Estimated Additional Mine Disturbance Area (Acres)[2]	---	1,274.9	1,658.4
Estimated Total Mine Disturbance Area (Acres)	11,621.0	12,895.9	13,279.4
Increase in Estimated Disturbance Area (Percent)	---	11.0	14.3
Estimated Additional Recoverable Coal (Million Tons)[3]	---	158.1	152.8
Estimated Recoverable Coal for Mine as of 1/08 (Million Tons)	249.5	407.6	402.3
Increase in Estimated Recoverable Coal as of 1/08 (Percent)	---	63.4	61.2

[1] Includes federal, state, and private coal.
[2] Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
[3] Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (94 percent).

Table 3-2. Comparison of Existing and Proposed Coal Creek Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2
Additional Lease Area (Acres)	---	1,151.3	1,313.3
Total Lease Area (Acres)[1]	6,854.4	8,005.7	8,167.7
Increase in Lease Area (Percent)	---	16.8	19.2
Estimated Additional Mine Disturbance Area (Acres)[2]	---	1,925.4	2,210.1
Estimated Total Mine Disturbance Area (Acres)	8,354.9	10,280.3	10,565.0
Increase in Estimated Disturbance Area (Percent)	---	23.0	26.5
Estimated Additional Recoverable Coal (Million Tons)[3]	---	57.0	57.0
Estimated Recoverable Coal for Mine as of 1/08 (Million Tons)	223.2	280.2	280.2
Increase in Estimated Recoverable Coal as of 1/08 (Percent)	---	25.5	25.5

[1] Includes federal, state, and private coal.
[2] Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
[3] Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (90 percent).

Table 3-3. Comparison of Existing and Proposed Caballo Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternative 2
Additional Lease Area (Acres)	---	777.5	1,023.4
Total Lease Area (Acres)[1]	11,704.5	12,482.0	12,727.9
Increase in Lease Area (Percent)	---	6.6	8.7
Estimated Additional Mine Disturbance Area (Acres)[2]	---	1,213.0	1,253.6
Estimated Total Mine Disturbance Area (Acres)	16,898.0	18,111.0	18,151.6
Increase in Estimated Disturbance Area (Percent)	---	7.2	7.4
Estimated Additional Recoverable Coal (Million Tons)[3]	---	81.8	91.7
Estimated Recoverable Coal for Mine as of 1/08 (Million Tons)	600.3	682.1	692.0
Increase in Estimated Recoverable Coal as of 1/08 (Percent)	---	13.6	15.3

[1] Includes federal, state, and private coal.
[2] Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
[3] Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (93.5 percent).

Table 3-4. Comparison of Existing and Proposed Cordero Rojo Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternatives 2 and 3
Additional Lease Area (Acres)	---	4,653.8	4,895.6
Total Lease Area (Acres)[1]	14,442.4	19,096.2	19,338.0
Increase in Lease Area (Percent)	---	32.2	33.9
Estimated Additional Mine Disturbance Area (Acres)[2]	---	6,200.8	6,422.5
Estimated Total Mine Disturbance Area (Acres)	14,694.0	20,894.8	21,116.5
Increase in Estimated Disturbance Area (Percent)	---	42.2	43.7
Estimated Additional Recoverable Coal (Million Tons)[3]	---	434.3	459.3
Estimated Recoverable Coal for Mine as of 1/08 (Million Tons)	274.1	708.4	733.4
Increase in Estimated Recoverable Coal as of 1/08 (Percent)	---	158.4	167.6

[1] Includes federal, state, and private coal.
[2] Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
[3] Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (90 percent).

permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings and coal loading facilities, railroad loop, environmental monitoring areas, etc.), 1,338 acres were being actively mined, and 3,689 acres had been mined and reclaimed or were in the process of being reclaimed (CCC 2006).

Cordero Rojo's current federal coal leases include approximately 14,442 acres and, under the currently approved mining and reclamation plan, the mine would disturb a total of approximately 14,694 acres in order to recover that coal (Table 3-4). According to Cordero Rojo's 2006-2007 Annual Report submitted to WDEQ/LQD, the mine had disturbed a total of about 11,354 acres as of June 30, 2007 (CMC 2007a). Of that area of disturbance, approximately 2,969 acres were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings and coal loading facilities, railroad loop, environmental monitoring areas, etc.), 4,615 acres were being actively mined, and 3,770 acres had been mined and reclaimed or were in the process of being reclaimed (CMC 2007a).

If the LBA tracts are leased to the applicants as maintenance tracts under the Proposed Actions or other action alternatives, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed by mining activities. Tables 3-1 through 3-4 also show how the leased areas and disturbance areas would change for the tracts as applied for and Action Alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, respectively. The estimates of recoverable coal, associated disturbance, and mine lives shown in Tables 3-1 through 3-4 and elsewhere in this chapter assume that coal currently unsuitable for mining due to the presence of public roads and/or the Maysdorf Point Cemetery is not mined. If the authorized agencies determine that the roads and/or the Maysdorf Point Cemetery can be moved, the estimated tons of recoverable coal, associated disturbance, and Cordero Rojo Mine life would increase as discussed in Section 2.4. Portions of the LBA tracts lie inside current mine permit areas (Figure 1-5). If the tracts are leased, the area that would have to be added to an existing mine permit area would be that portion of the LBA tract that lies outside the existing permit boundary plus an adjacent strip of land that would be used for highwall reduction after mining and such mine-related activities as construction of diversions, flood and sediment control structures, roads, and stockpiles. Some portions of the tracts have been disturbed by the current mining operations in order to recover the coal in the existing coal leases (Figure 3-1). The environmental consequences of leasing the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts under the Proposed Action or Alternative 2 or 3 would be similar in nature, but selection of a Proposed Action would disturb slightly smaller area of land surface.

Surface mining and reclamation have been ongoing in the eastern PRB for about 3 decades. During this time, effective mining and reclamation technologies have been developed and continue to be refined. Mining and reclamation operations

are regulated under SMCRA and Wyoming statutes. WDEQ technically reviews all mine permit application packages to ensure that the mining and reclamation plans comply with all state permitting requirements and that the proposed coal mining operations comply with the performance standards of the DOI-approved Wyoming program. BLM attaches special stipulations to all coal leases (Appendix D), and there are a number of federal and state permit approvals that are required in order to conduct surface mining operations (Appendix A). The regulations are designed to ensure that surface coal mining impacts are mitigated.

Impacts can range from beneficial to adverse and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation), or short-term (persisting during mining and reclamation and until the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

3.1 General Setting

The general South Gillette analysis area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie.

3.1.1 Climate and Meteorology

The climate in the general South Gillette analysis area is typical of a semi-arid, high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. The average annual precipitation at a NOAA meteorological station (Gillette 9ESE), located about 18 miles northwest of the general South Gillette analysis area, is 15.60 inches (WRCC 2007). June (2.69 inches) and May (2.60 inches) are the wettest months, and January (0.57 inch) and February (0.55 inch) are the driest. Snowfall averages 56.5 inches per year, with most occurring in March (10.4 inches) and April (8.5 inches). Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation. Summers are relatively short and warm, while winters are longer and cold. The average daily mean temperature is 45.2 degrees F. The highest recorded temperature was 107 degrees F and the lowest was minus 40 degrees F. July is the warmest month, with a mean daily temperature of 71.0 degrees F, and January is the coldest month, with a mean daily temperature of 21.7 degrees F. The frost-free period is 100-130 days.

In the general South Gillette analysis area, surface wind speeds range from more than 30 mph during the winter and spring to 10 to 12 mph during the summer.

The area also experiences extreme wind gusts, especially during thunderstorm activity that occurs in June, July, and August. Distinct diurnal changes occur, with average wind velocities increasing during the day and decreasing during the night. Local variations in wind speed and direction are primarily due to differences in topography. Wind speeds are highest in the winter and spring (October through April) and are predominantly from the western and northern sectors. During the warmer months (May through September), wind directions are more random, although winds from the northern or southeastern sectors are slightly more predominant.

During periods of strong wind, dust may impact air quality across the region. An average of 15 air-stagnation events occurs annually in the PRB with an average duration of 2 days each (BLM 1974).

3.2 Topography and Physiography

3.2.1 Affected Environment

The general South Gillette analysis area is a high plains area within the eastern portion of the PRB. The PRB is an elongated, asymmetrical structural downfold that is bounded by the Black Hills on the east; the Big Horn Mountains on the west; the Hartville Uplift, Casper Arch, and Laramie Mountains on the south; and the Miles City Arch and the Yellowstone River on the north. The general South Gillette analysis area is located on the gently dipping eastern limb of the structural downfold. The regional dip in the general South Gillette analysis area is to the west.

Landforms of the area consist of a dissected rolling upland plain with low relief, broken by low red-capped buttes, mesas, hills, and ridges. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. Elevations in the PRB range from less than 2,500 ft to greater than 6,000 ft above sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the area are incised, typically are ephemeral or intermittent, and do not provide year-round water sources.

The general South Gillette analysis area is drained by the Caballo Creek and Belle Fourche River, which are the most prominent topographic features. The topography is comprised of intermittent and ephemeral drainage bottomlands, rough breaks, and gently rolling uplands. Unmined lands surrounding the general South Gillette analysis area are characterized by low rolling hills. Surface mine lands, both active and reclaimed, dominate the landscape in the vicinity of the general South Gillette analysis area and east of Wyoming Highway 59. Elevations in the general South Gillette analysis area range from about 4,515 ft to 4,885 ft above sea level and slopes range from flat to around 57 percent. In the individual tracts, the average slopes range from 4 to 5 percent.

Habitat types within the general South Gillette analysis area include sagebrush-grassland, upland-grassland, seeded pastures/cropland, and areas of previous disturbance. Nearly 43 percent of the combined vegetation analysis areas is currently sagebrush-Sagebrush/Grassland. Other habitats present in limited extent include bottomland or riparian areas and some open water along the Belle Fourche River and Caballo Creek. Rough breaks and bottomland or riparian areas occur along the ephemeral drainages. Caballo Creek passes from west to east through the north central part of the general South Gillette analysis area and the Belle Fourche River passes through the southern part of the area from southwest to northeast. Overall, the LBA tracts are similar in topography.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action and Action Alternatives

Surface coal mining would permanently alter the topography of each LBA tract that is leased and mined. Topsoil would be removed from the land and stockpiled or placed directly on recontoured areas. Overburden would be blasted and stockpiled or directly placed into already mined pits, and coal would be removed. The existing topography on each LBA tract would be substantially changed during mining. Highwalls with vertical heights equal to overburden/interburden plus coal thickness would exist in the active pits. If necessary, streams would be diverted into temporary channels to prevent pits from being flooded.

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography in Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts ranges from relatively flat to gently rolling hills. As discussed above, slopes range from flat to around 57 percent and the average slopes range from 4 to 5 percent. The expected postmining topography would be similar to the premining topography, but somewhat gentler and more uniform. Following reclamation, the average surface elevation on each LBA tract as proposed would be lower due to coal removal. The removal of the coal would be partially offset by the swelling that occurs when the overburden (and interburden, if present) is blasted, removed, and replaced. Table 3-5 present the approximate postmining surface elevation change for each LBA tract as applied for under the Action Alternatives. After the coal is removed, the land surface would be restored to approximate original contour or to a configuration approved by WDEQ/LQD when the mining and reclamation permit for the existing mine is amended to include coal removal from the LBA tract.

Direct adverse impacts resulting from topographic moderation include a reduction in microhabitats (e.g., cutbank slopes) for some wildlife species and a reduction in habitat diversity, particularly a reduction in slope-dependent shrub communities and associated habitat. These impacts, which would be greater in those areas

Table 3-5. Average Overburden, Interburden, and Coal Thicknesses and Approximate Postmining Surface Elevation Changes of the Four LBA Tracts.

LBA Tract and Configuration	Overburden Thickness (ft)	Interburden Thickness (ft)	Coal Thickness (ft)	Swell Factor (percent)	Coal Recovery Factor (percent)	Postmining Elevation Change[1]
Belle Ayr North						
Proposed Action	295	--	72	13	94	29 ft lower
Alternative 2	295	--	72	13	94	29 ft lower
West Coal Creek						
Proposed Action	81	1-6	36	19	88	16 ft lower
Alternative 2	81	1-6	36	19	88	16 ft lower
Caballo West						
Proposed Action	270	--	74	19	94	18 ft lower
Alternative 2	286	--	74	19	94	15 ft lower
Maysdorf II						
Proposed Action	303	0.3	63	16	93	10 ft lower
Alternative 2	303	0.3	62	16	93	9 ft lower
Alternative 3 North	322	0	65	16	93	9 ft lower
Alternative 3 South	207	2	50	16	93	13 ft lower

[1] Reclaimed (postmining) surface elevation change calculated as: ((overburden thickness + interburden thickness) × swell factor) – (coal thickness × coal recovery factor).

characterized as rough breaks, may result in a long-term reduction in the carrying capacity for some species. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and result in a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur as a result of higher near-surface bulk density of the reclaimed soils (Section 3.8.2.1). It may also increase vegetative productivity, and potentially accelerate recharge of groundwater.

The approximate original drainage pattern for each LBA tract, including the diverted portions of Caballo Creek and the Belle Fourche River, would be restored. Stockponds and playas would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support anticipated land use.

These impacts are occurring on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action or Alternative 2 or 3, the areas that would be permanently topographically changed would increase as shown in Tables 3-1 through 3-4.

3.2.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal would not occur on the LBA tracts. Mining operations and the associated impacts to topography and physiography would continue as permitted on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine leases. Table 3-5 present the approximate postmining surface elevation change for the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mines. Portions of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts that are contiguous to operating mines would be disturbed to recover the coal in the existing leases.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.2.3 Regulatory Compliance, Mitigation and Monitoring

The mined-out areas must be restored to approximate original contour or other topographic configuration approved by WDEQ/LQD. Topographic configurations would be developed and approved as part of the required mining and reclamation plans for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. WDEQ/LQD monitors topographic restoration by checking the as-built topography in the annual reports filed by the mines to see if it conforms to the approved topography.

3.2.4 Residual Impacts

Topographic moderation is a permanent consequence of mining. The indirect impacts of topographic moderation on wildlife habitat diversity would also be considered permanent.

3.3 Geology, Mineral Resources, and Paleontology

3.3.1 General Geology and Coal Resources

3.3.1.1 Affected Environment

Stratigraphic units in the general South Gillette analysis area that would be impacted if the tracts under consideration for leasing are mined include, in descending order, recent (Quaternary age) alluvial and eolian deposits; the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal seams). Figure 3-2 is a chart showing the stratigraphic relationships of the surface and subsurface geologic units in the general South Gillette analysis area. Additional information about these units is included in the Groundwater section of this document (Section 3.5).

Surficial deposits in the general South Gillette analysis area include alluvial and eolian deposits and weathered Wasatch Formation. Alluvial deposits occupy the Caballo Creek and Belle Fourche River valleys and the lower portions of tributary draws where they join the stream channels.

The Eocene Wasatch Formation forms most of the overburden in the general South Gillette analysis area. The boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation is not distinct. From a practical standpoint, the top of the mineable coal zone is considered as the contact between the two formations. Table 3-5 indicates the overburden thicknesses in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts as applied for and under other action alternatives. As discussed in Section 3.2.1, the regional dip in this area is to the west; as a result, the overburden thickness is generally thinner to the east and increases to the west.

As shown in Figure 3-2, the Fort Union Formation is divided into three members: the Tongue River, the Lebo, and the Tullock, in descending order.

The mineable coal seams in the PRB are part of the Tongue River Member of the Fort Union. There is one mineable coal zone within the general South Gillette analysis area. Locally, this coal zone is referred to as either the Wyodak or the Wyodak-Anderson. The mineable coal seams are referred to as the Anderson and Canyon, Wyodak-Anderson, and Wyodak coal beds by mines in the eastern PRB. The “Wyodak-Anderson Zone” is the official USGS nomenclature. The average thickness Wyodak coal seam within each LBA tract is shown in Table 3-5. Up to

Geologic Unit			Hydrologic Characteristics
RECENT ALLUVIUM HOLOCENE			Typically fine grained and poorly sorted sands interbedded with silts and clays in ephemeral drainages. Occasional very thin, clean interbedded sand lenses. More laterally extensive, thicker, and coarse-grained along the larger stream courses. Excessive dissolved solids generally make this aquifer unsuitable for domestic and agricultural use and marginal for livestock (Class III) use standards. Low infiltration capacity in ephemeral draws unless covered by sandy eolian blanket. Low to moderate infiltration along Little Rawhide Creek.
CLINKER HOLOCENE TO PLEISTOCENE			Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria, red dog, etc.) formed by melting and partial fusing of overburden above the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated. Considered to be part of the Wasatch Formation.
WASATCH FORMATION EOCENE			Lenticular fine sands interbedded in predominantly very fine grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch Formation generally does not meet Wyoming Class I (drinking water) standards due to the dissolved mineral content. Some wells do, however, produce water of considerably better quality that does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER	W / R / S	The coal serves as a regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use. W = Wyodak Coal; R = Roland; S = Smith.
	LEBO MEMBER		The Lebo member, also referred to as the "Lebo Confining Layer" or "Lebo Shale". Has a mean thickness of 711 ft in the PRB and a thickness of about 400 ft in the vicinity of Gillette. The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm.
	TULLOCK MEMBER		The Tullock member has a mean thickness of 785 ft in the PRB and a mean sand content of 53 percent which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gpm are common but vary locally and may be as much as 40 gpm. Records from the SEO indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
UPPER CRETACEOUS	LANCE FM/ HELL CREEK FM		This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.
	FOX HILLS SANDSTONE		Marine sandstones and sandy shales. Has a mean thickness of 666 ft and a mean sand content over 50 percent in the PRB. Yields up to 200 gpm are common; however, yields can be significantly less. Water quality is good, with TDS concentrations commonly less than 1,000 mg/L. The City of Gillette is currently using five wells completed in this aquifer to meet municipal water requirements.
	PIERRE SHALE		This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.

Stratigraphy from Stratigraphic Nomenclature Committee, Wyoming Geological Association, 1969.

Figure 3-2. Stratigraphic Relationship and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming.

five noncoal splits or partings occur within the seam, but they are typically local, discontinuous lenses of carbonaceous clay or shale that are less than 1 ft thick.

As discussed in Chapter 2, a "no-coal" zone is present within the Maysdorf II tract. It trends east-west throughout the central portion of Section 4 and 5, T.46N., R.71W. It is postulated that an ancient drainage channel (or paleochannel) eroded and removed the coal in this area and replaced it with unconsolidated fine sand, occasional gravel, and silty clays (CMC 2007b).

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined in the PRB has a higher heating value and lower sulfur content south of Gillette than north of Gillette. In the tracts under consideration for leasing, the heating value of the coal seams is expected to average approximately 8,481 Btu/lb, with an average of about 0.30 percent sulfur, 4.76 percent ash, and 30.07 percent moisture.

3.3.1.2 Environmental Consequences

3.3.1.2.1 Proposed Action and Action Alternatives

The geology from the base of the lowest coal seam mined to the land surface would be subject to permanent change after the coal is removed on the LBA tracts under the Proposed Action or Alternative 2 or 3. The subsurface characteristics of these lands would be radically changed by mining. The replaced overburden and interburden (backfill) would be a mixture of the geologically distinct layers of sandstone, siltstone, and shale that currently exist. As a result, there would be an alteration of the physical characteristics of the backfill.

3.3.1.2.1.1 Belle Ayr North LBA Tract

Mining would remove an average of 295 ft of overburden and 72 ft of coal on about 1,579 acres under the Proposed Action. Mining would remove an average of 295 ft of overburden and 72 ft of coal on about 1,669 acres under BLM's tract configuration for Alternative 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 3-5 presents the average overburden and coal thicknesses for the Belle Ayr North LBA Tract as applied for and Alternative 2.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 338 ft in thickness under the Proposed Action and under Alternative 2. Approximately 195.5 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 207.2 million tons under BLM's tract configuration for Alternative 2.

3.3.1.2.1.2 West Coal Creek LBA Tract

Mining would remove an average of 81 ft of overburden and 36 ft of coal on about 1,151 acres under the Proposed Action. Mining would remove an average of 81 ft of overburden and 36 ft of coal on about 1,313 acres under BLM's tract configuration for Alternative 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 3-5 presents the average overburden and coal thicknesses for the West Coal Creek LBA Tract as applied for and Alternative 2.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 105 ft in thickness under the Proposed Action and Alternative 2. Approximately 57 million additional tons of coal would be recovered under the Proposed Action and Alternative 2.

3.3.1.2.1.3 Caballo West LBA Tract

Mining would remove an average of 270 ft of overburden and 74 ft of coal on about 778 acres under the Proposed Action. Mining would remove an average of 286 ft of overburden and 74 ft of coal on about 1,024 acres under BLM's tract configuration for Alternative 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 3-5 presents the average overburden and coal thicknesses for the Caballo West LBA Tract as applied for and Alternative 2.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 326 ft in thickness under the Proposed Action and about 345 ft in thickness under Alternative 2. Approximately 81.8 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 91.7 million tons under BLM's tract configuration for Alternative 2.

3.3.1.2.1.4 Maysdorf II LBA Tract

Mining would remove an average of 303 ft of overburden and 63 ft of coal on about 4,654 acres under the Proposed Action. Mining would remove an average of 303 ft of overburden and 62 ft of coal on about 4,895 acres under BLM's tract configuration for Alternative 2. Mining would remove an average of 322 ft of overburden and 65 ft of coal on about 2,825 acres under BLM's tract configuration for the north block under Alternative 3 and an average of 207 ft of overburden and 50 ft of coal on about 2,070 acres under BLM's tract configuration for the south block under Alternative 3. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternatives 2 and 3. Table 3-

5 presents the average overburden and coal thicknesses for the Maysdorf II LBA Tract as applied for and Alternatives 2 and 3.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 356 ft in thickness under the Proposed Action and under Alternative 2, and about 378 and 244 ft in thickness over the north and south blocks, respectively, under Alternative 3. Approximately 437.9 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 458.9 million tons under BLM's tract configuration for Alternative 2 and 3.

3.3.1.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the LBA tracts. Mining operations and associated impacts would continue as permitted on the existing adjacent mine coal leases. Table 3-5 presents the average overburden and coal thicknesses for the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine permit areas. There would be impacts to the overburden on portions of the LBA tracts adjacent to the existing mines as a result of recovery of the remaining coal in the existing leases.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.3.1.3 Regulatory Compliance, Mitigation and Monitoring

Drilling and sampling programs are conducted on existing leases by all mine operators to identify overburden material that may be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents, such as selenium, or adverse pH levels). As part of the mine permitting process, each mine operator develops a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. Each mine operator also develops backfill monitoring plans as part of the mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and would be developed for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts if they are leased.

3.3.1.4 Residual Impacts

Geology from the base of the coal to the surface would be subject to significant, permanent change.

3.3.2 Other Mineral Resources

3.3.2.1 Affected Environment

3.3.2.1.1 Conventional Oil and Gas

The following discussion is based on information in the Task 2 Report (Past, Present & Reasonably Foreseeable Development Activities) of the Powder River Basin Coal Review (BLM 2005d), on a December 2007 review of WOGCC data, and on a 2008 reserve estimate prepared by Allen & Crouch Petroleum Engineers, Inc. (A&C) of conventional oil and gas resources in the general South Gillette analysis area (A&C 2008).

The Powder River structural basin is one of the richest petroleum provinces in the Rocky Mountain Area. Hydrocarbons occur in reservoirs ranging from Mississippian to early Tertiary, in both structural and stratigraphic traps. As discussed in the PRB Coal Review Task 2 Report, oil was first produced from the PRB in 1887 from the Lower Cretaceous Newcastle Sandstone on the east flank of the basin near Moorcroft, Wyoming. In the 1960s and 1970s, drilling moved into deeper parts of the basin that resulted in the discovery of prolific oil fields in stratigraphic traps in Upper and Lower Cretaceous rocks. The discovery of oil from the Lower Cretaceous Muddy sandstone on the Montana side of the basin set off a flurry of exploration that resulted in a number of discoveries in Wyoming in the Muddy Sandstone. Muddy Sandstone production fields in the vicinity of the general South Gillette analysis area include portions of the Hilight Field and other smaller fields. Drilling continued for deeper targets and resulted in the recovery of oil and gas in deeper reserves in the Hilight Field and other fields in the Permian-Pennsylvanian Minnelusa Formation. Through 2005, there had been a 15-year period of very little conventional oil and gas development activity in the PRB (BLM 2005d).

Wyoming Oil and Gas Conservation Commission (WOGCC) data indicate that the Mowry Shale, Muddy Sandstone, and Minnelusa Formation have produced both oil and conventional gas to date in the general South Gillette analysis area. Approximately 77 percent of the wells have been completed in the Minnelusa Formation, which produce from discontinuous, marginal marine, eolian sandstone deposits. As a result, Minnelusa Formation reservoirs tend to be small and irregularly distributed. Depths to productive traps range from 5,000 feet to 15,000 feet, with most in the 8,000 to 14,000 feet range. The Upper Minnelusa sandstone play is well established, and most of the Minnelusa wells in the general South Gillette analysis area were drilled in the early 1980s. Field development

has tended to occur on a 40-acre well spacing. Conventional oil and/or gas wells have been drilled on all four LBA tracts.

A total of 223 conventional oil and gas wells have been drilled in a 57-section area within or immediately adjacent to the four LBA tract study areas, including a total of 60 within the four LBA tract study areas. As of December 2007 only two oil wells have been drilled within in the LBA tracts since 2000, with the most recent well completed in 2006 (WOGCC 2007a). No conventional gas wells have been completed within the four LBA tracts study areas since 1997.

There are currently 18 wells capable of producing oil or conventional gas located on the four LBA tract study areas. Of the 18 wells, 13 are considered to have recoverable reserves, using in-place oil and gas recovery methods. Estimated remaining recoverable reserves from these 13 wells are just over 273,700 barrels of oil and 12 million cubic feet (mmcf) of gas (A&C 2008).

Higher oil prices experienced recently have helped prevent the abandonment of low-producing wells and could potentially increase conventional oil and gas exploration in the PRB. Enhanced oil recovery using carbon dioxide (CO_2) flooding has the potential to increase convention oil recovery in the south Gillette analysis area but the infrastructure (e.g., CO_2 pipelines, etc.) is not currently in place (BLM 2005d).

Section 3.11 includes a discussion of the ownership of the oil and gas resources in the four LBA tract study areas. Conventional oil and gas wells located in the individual LBA tracts oil and gas general analysis areas that are capable of production are listed in Appendix J.

3.3.2.1.2 Coal Bed Natural Gas (CBNG)

CBNG has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field, northwest of Gillette (De Bruin and Lyman 1999). Extensive development of CBNG in the Wyodak-Anderson coal has occurred in the vicinity of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts. Extensive CBNG development has also occurred immediately west of the general South Gillette analysis area.

WOGCC records show that as of December 13, 2007, 445 wells had been drilled for CBNG production in 57-section area encompassing or immediately adjacent to the general South Gillette analysis area and 288 were capable of producing (WOGCC 2007a). There are 153 CBNG wells within the four LBA tracts.

CBNG is also being produced locally from other deeper seams in the PRB. Fifteen wells have been completed in the deeper Pawnee coal seam on and west of the Maysdorf II LBA tract. All of these Pawnee wells are either shut-in or are producing water (WOGCC 2007a).

The Wyoming State Office Reservoir Management Group (RMG) has prepared a variety of detailed analyses of CBNG resources near the mining areas for the coal leasing and other actions over the past few years. The RMG recently completed a report that describes the existing/affected environment of the coal mining areas and adjacent lands, with respect to CBNG resources, and documents the observed and inferred resource depletion that has and will continue to occurred (WSO-RMG 2006). The following discussion includes references to site specific CBNG/LBA analysis reports and the more recent report regarding CBNG resources in the general South Gillette analysis area.

CBNG wells were initially drilled on 40-acre spacing in the Wyoming PRB. Production/reservoir analyses that have been submitted to the WOGCC in various public hearings have indicated that CBNG wells in the PRB will produce reserves from larger areas than 40 acres. As a result, the WOGCC established an 80-acre spacing pattern as the default spacing for CBNG wells completed in the PRB within the Fort Union and Wasatch Formations. Most CBNG wells on and near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts were drilled on a 40-acre pattern, either because the wells were drilled before the spacing was changed to 80 acres or under the authorization of spacing exceptions granted by WOGCC. Certain townships in the PRB are exempt from the 80-acre spacing pattern rule, including Ts.46 through 48N., R.71W. (WOGCC 2005b). Although CBNG has been produced in this area for almost 10 years, there are still undrilled 40-acre spacing units in and around the general South Gillette analysis area and there has been little recent interest in drilling additional wells in this area.

The WOGCC well data from the mining townships generally shows that operator interest in the eastern PRB mining areas peaked prior to 2000 and declined rapidly following 2001. Activity had declined to almost negligible levels during 2005 (WSO-RMG 2007).

The Reservoir Management Group and U.S. Geological Survey (USGS) have collected extensive CBNG data, including coal gas content, from coal cores taken across the PRB. These include samples in the Wyodak-Anderson coal zone at locations near existing PRB mines. The cores were taken from depths comparable to the mined seams, ranging from 134 to 407 ft. All of the near-mines cores were collected in 2000, well after mine dewatering had been initiated and near the peak period of CBNG drilling in the mining areas. The core data generally show that coal seams were already substantially depleted of CBNG in the vicinity of the mines at the time the samples were taken (WSO-RMG 2007).

The ownership of oil and gas resources in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, which includes the CBNG resources, is discussed in Section 3.11. CBNG wells capable of production on or in sections adjacent to the LBA tracts are listed in Appendix J.

3.3.2.1.3 Other Minerals

Bentonite, uranium, and scoria are commercially produced in the PRB in addition to conventional oil and gas and CBNG (WSGS 2004a and 2005a).

Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined around the edges of the PRB. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including drilling mud and cat litter. No mineable bentonite reserves have been identified on the LBA tracts under the Action Alternatives.

There are substantial uranium resources in Johnson, Campbell, and Converse counties. As of 2006, there was one operating in-situ uranium recovery site in the Wyoming, which was located in the southern PRB (WSGS 2006). No known uranium reserves exist within the general South Gillette analysis area.

Scoria, also called clinker or burn has been and continues to be a major source of aggregate for road construction in the area due to the shortage of more competent materials. Scoria consists of sediments that were baked, fused, or melted in place when the underlying coal burned spontaneously. Scoria is present within the general South Gillette analysis area, predominantly east of the coal limit. Scoria occurs only in limited amounts on the LBA tracts as applied for under the Proposed Actions or within the additional areas evaluated under the other action alternatives. See Section 3.5.1.1.2 for additional information on scoria.

A search of the BLM Land and Mineral Use Records revealed that no active mining claims are presently located on the LBA tracts as applied for under the Proposed Actions or within the additional areas evaluated under Alternatives 2 or 3 (BLM 2007a).

3.3.2.2 Environmental Consequences

3.3.2.2.1 Proposed Action and Action Alternatives

During mining, other minerals present on the LBA tracts could not be developed. Some of these minerals could, however, be developed after mining. The conventional oil and gas reservoirs and the CBNG reservoirs below the Wyodak-Anderson coal would not be directly disturbed by removal of the mineable coal. The oil and gas lessees could drill wells to recover oil and gas resources from any oil and conventional gas or CBNG reservoirs below the mineable coal seams following mining and reclamation. This would only occur if they believe that the value of the reserves would justify the expense of drilling the wells.

Although the general South Gillette analysis area generally appears to be unfavorable for additional conventional oil and gas discoveries, the entire study

area has not been tested. The formations producing conventional oil and gas in the general South Gillette analysis area occur at much greater depths than would be affected by mining. The average depths of the producing wells in the area range from approximately 8,310 – 8,860 feet for the Mowry Shale, approximately 8,500 – 9,050 feet for the Muddy Sandstone, and nearly 10,125 – 10,800 feet for the Minnelusa Formation. However, conflicts could arise between the conventional oil and gas production and mining if conventional wells are in production at the time the well locations are to be mined.

Before mining operations could begin, all conventional oil and gas wells would have to be plugged and abandoned, and all production equipment would have to be removed. The remaining recoverable oil and conventional gas reserves that have not been recovered prior to mining could not be recovered until mining and reclamation has been completed. A&C (2008) reviewed the existing conventional oil and gas production data in the general South Gillette analysis area. Sufficient production data are available from Minnelusa wells in the vicinity of the tracts to prepare reserve estimates using decline analyses. As discussed above, WOGCC records show that there are currently 18 conventional oil and gas wells that are capable of producing located on the four LBA tracts' study areas. These 18 wells include 16 active wells, one temporarily abandoned well, and one shut-in well. Seven injector wells are located on the LBA tract study areas. While these wells are not capable of producing, they are important to continued field production. According the A&C's 2008 evaluation, actively producing wells within the LBA tracts appear to have exhausted most of their recoverable reserves, with approximately 8 percent of the recoverable oil and 2 percent of the recoverable gas remaining in these wells. There has been little interest in exploration and development of Minnelusa reservoirs in this area in recent years.

Before mining operations could begin, all active CBNG wells would have to be plugged and abandoned, and all gas production equipment would have to be removed. CBNG resources that have not been recovered from the Wyodak-Anderson zone prior to mining would be lost when the coal is removed.

CBNG production requires withdrawal of water from the coal seams to reduce hydrostatic pressure and enable methane desorption from the coals. Mine-related dewatering of the coal seams reduces hydrostatic pressure and allows the methane to escape in the same way that CBNG well dewatering of the coal seam does. BLM WSO-RMG's review and other CBNG reservoir analyses indicate that depletion of the hydrostatic pressures and methane resources starts to occur adjacent to mining areas a short time after mining begins. Coal mining operations have been ongoing for more than 20 years and are continuing at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and other surface coal mines in this area. The ongoing reduction of hydrostatic pressure in the coal due to mining has been accelerated by extensive CBNG production from surrounding lands.

BLM WSO-RMG's analyses of the production and reservoirs indicate that the CBNG resource within the Wyodak-Anderson seam has been substantially depleted, either by mining or by recovery from producing wells. Approximately 65 percent of the CBNG wells drilled on or adjacent to the LBA tracts remain in production and it seems likely that these will have exhausted their economic reserves prior to initiation of mining in the LBA tracts. Most production or reservoir analyses submitted to WOGCC at various public hearings indicate that a CBNG well will generally produce reserves from larger areas than 40 acres; therefore, it is likely that any undrilled spacing units in the BLM study area have been drained by production from the existing wells and nearby mining activity. Overall, BLM WSO-RMG's analyses suggest that there are insufficient reserves remaining in the tracts to support additional drilling. As a result, mining the proposed Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts is unlikely to affect, or to be affected by, CBNG production from the Wyodak-Anderson coal seams.

Production from the coal zones underlying the Wyodak-Anderson could be delayed as the parcel is mined. If production from these lower seams is established on the LBA tracts in the future, additional measures would be required to accommodate both mining and CBNG production (see Section 3.3.2.3).

Section 3.11.1 includes a discussion on the ownership of the oil and gas resources on the LBA tracts and the oil and gas facilities in the area of the tracts.

3.3.2.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal would not occur on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts. Mining operations would continue to limit the development of other mineral resources described above on the existing adjacent Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine coal leases. Mineral development limitations related to mining operations at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.3.2.3 Regulatory Compliance, Mitigation and Monitoring

The reservoir analyses conducted by the A&C indicate that most of the recoverable conventional oil and gas and CBNG resources on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts have been extracted by the existing wells. Potential does exist for conflicts between coal operations and

CBNG and conventional oil and gas wells completed in formations and coal zones below the Wyodak-Anderson seam.

If the federal coal in the tract is leased and conflicts do develop between the operators of the oil and gas wells and the surface coal mine operator, there are several mechanisms that can be used to facilitate recovery of the conventional oil and gas and CBNG resources prior to mining. These include:

- BLM will attach a Multiple Mineral Development stipulation to the Federal coal lease, which states that BLM has the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued prior to the coal lease (see Appendix D).

- Conventional oil and gas wells must be plugged and abandoned while mining and reclamation operations are in progress but could be recompleted or redrilled following mining if the value of the remaining reserves would justify the expense of reestablishing production.

- BLM has a policy in place on CBNG-coal conflicts (BLM Instruction Memorandum No. 2006-153), which directs BLM decision-makers to optimize the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006a). This memorandum offers royalty incentives to CBNG operators to accelerate production in order to recover the natural gas while simultaneously allowing uninterrupted coal mining operations. In addition, this memorandum also states that it is the policy of the BLM to encourage oil and gas and coal companies to resolve conflicts between themselves; when requested, the BLM will assist in facilitating agreements between the companies.

- Mining of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts cannot occur until the coal lessees have a permit to mine the tract approved by the WDEQ/LQD and a MLA mining plan approved by the Secretary of the Interior. Before the MLA mining plans can be approved, BLM must approve each R2P2 for mining the tracts. Prior to approving the each R2P2, BLM can review the status of CBNG and conventional oil and gas development on the tract and the mining sequence proposed by the coal lessee. The permit approval process generally takes the coal lessee several years, during which time CBNG resources can be recovered.

- Prior to mining the Federal coal, the coal lessee can negotiate an agreement with owners and operators of existing oil and gas facilities on the tract, including owners and operators of oil and gas well and pipeline facilities, regarding removal and relocation of those facilities prior to mining.

3.3.2.4 Residual Impacts

CBNG resources not recovered prior to mining would be vented to the atmosphere and permanently lost.

3.3.3 Paleontology

3.3.3.1 Affected Environment

The formation exposed on the surface of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts is the sedimentary Eocene Wasatch Formation, which is known to produce fossil vertebrates of scientific significance throughout Wyoming, including the PRB (Delson 1971, Winterfeld 1978, EVG 2001).

BLM ranks areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The Wasatch Formation is ranked as fulfilling BLM Paleontology Condition No. 1, which is described in the Paleontological Resource Management Handbook 8270-I as "areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils." According to the handbook, "consideration of paleontological resources will be necessary if the Field Office review of available information indicates that such fossils are present in the area".

The BLM in Wyoming uses an additional planning tool, called the Possible Fossil Yield Classification (PFYC), to classify geological units, usually at the formation or member level, according to the probability that they will yield paleontological resources that are of concern to land managers. This classification system is based largely on how likely a geologic unit is to produce scientifically significant fossils. BLM considers the Wasatch Formation to fulfill either the PFYC Class 4 or Class 5, depending on the nature of bedrock exposures present. PFYC classes 4 and 5 are described as follows:

> Class 4 - These geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.
>
> Class 5 - Fossilferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant non-vertebrate (plant and invertebrate) fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

Although the Wasatch Formation is known to produce fossil vertebrates of scientific significance in Wyoming, outcrops of the Wasatch Formation in the PRB are not generally well-exposed and the conditions of deposition of the formation have contributed to a low preservation potential for fossils. Vertebrate fossils that

have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores, and multituberculates; reptiles such as crocodilians, alligators, lizards, and turtles; birds; eggs; amphibians; and fish. Non-marine invertebrates such as mollusks and ostrocods have also been described from the Wasatch.

Fossil plant material is common in the Wasatch Formation. The fossil plants inventoried are primarily leaves and fossilized wood. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. Fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

Paleontological surveys were conducted in conjunction with the cultural resource inventories of the current Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine permit areas and the BLM study areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts (the tracts as applied for and the additional area evaluated under other action alternatives). Pedestrian examinations for fossil indications were conducted along rock outcrops. One of the primary goals of the paleontological surveys was to locate unique pockets of fossilized bone such as those reported elsewhere in the Wasatch Formation in the PRB. Such concentrations of fossilized bone were not found, nor were any fossil vertebrates. Several fossil localities occur in exposures of the Wasatch Formation south of the Belle Fourche River in Sections 9, 10, and 14, T.46N., R.71W. None of the fossil material found at these localities or at other localities within the general South Gillette analysis area is considered to have much scientific significance and as a result no specimens were collected. Vertebrate fossils appear to be very scarce. Fossil wood is much more common and observed at many unrecorded locations, particularly associated with coal.

No significant or unique paleontological resource localities have been recorded on federal lands in the general South Gillette analysis area and no specific mitigation has been recommended for paleontology.

3.3.3.2 Environmental Consequences

3.3.3.2.1 Proposed Action and Action Alternatives

The rock outcrops present on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts were examined for the presence of fossils, as discussed above, and no scientifically significant fossils were located. Fossils with scientific significance could be present on the tract but not exposed at the surface. If the tracts are leased under the Proposed Actions or Alternatives 2 or 3,

paleontological resources located on the tract that are not exposed on the surface would be destroyed when the overburden is removed.

3.3.3.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal would not occur on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts. Mining operations and the associated potential impacts to paleontological resources described above would continue as permitted on the existing adjacent mine coal leases and on portions of the LBA tracts adjacent to the applicant mines, which would be disturbed to recover the coal in the existing leases.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.3.3.3 Regulatory Compliance, Mitigation and Monitoring

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tract are leased, BLM will attach a stipulation to each lease requiring the operator to report significant paleontological finds to the authorized federal agency and suspend production in the vicinity of the find until an approved paleontologist can evaluate the paleontological resource (Appendix D).

3.3.3.4 Residual Impacts

Paleontological resources that are not identified and removed prior to or during mining operations would be lost.

3.4 Air Quality

The information in this section and in the supplemental air quality Information appendix (Appendix K) is based on the air quality information provided by the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and from various state and federal sources. This section summarizes the affected environment in the general South Gillette analysis area and the potential air quality impacts if the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA tracts are leased and mined. Appendix K provides background information on the air quality regulatory framework, regional conditions, dispersion model methodology, the BACT process, etc. Existing and projected cumulative air quality impacts are discussed in Section 4.2.3.

3.4.1 Background

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general weather regime and are most important when the large-scale wind flow is weak.

Wyoming can be characterized as having a combination of both highland and mid-latitude semiarid climates. The dominant factors that affect the climate of the area are elevation, local relief, and the mountain barrier effect. This barrier effect can produce marked temperature and precipitation differences between windward and leeward slopes. Generally, temperature decreases and precipitation increases with increasing elevation. See Section 3.1.1 for additional information about the climate in the general South Gillette analysis area.

The general South Gillette analysis area, shown in Figure 3-1, is located in the east-central portion of the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. As discussed in Section 3.2.1, the topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys and buttes). Elevations range from about 4,520 ft to 4,885 ft above sea level. The Big Horn Mountains lie approximately 60 miles to the west and the Black Hills lie approximately 60 miles to the east.

Air Quality regulations applicable to surface coal mining may include NAAQS/WAAQS, PSD, NSPS, and the Federal Operating Permit Program (Title V). These regulatory programs are described in Appendix K. Air pollution impacts are limited by local, state, tribal, and federal air quality regulations and standards, and state implementation plans, or SIPs, established under the federal CAA and the CAAA of 1990. In Wyoming, air pollution impacts are managed by WDEQ/AQD under the WAQSR and the EPA-approved SIP.

3.4.1.1 Emission Sources

Air quality conditions in rural areas in the PRB are likely to be very good, as they are characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Occasional high concentrations of CO and particulate matter may occur in more urbanized areas (e.g., cities of Gillette, Sheridan, and Buffalo) and around industrial facilities, especially under stable atmospheric conditions that occur during winter.

Surface coal mining activities generate fugitive dust and particulate and gaseous tailpipe emissions from large mining equipment. Specifically, activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are emitted from small boilers and off-road diesel engines. Wyoming's ambient air standards for particulates are shown in Table 3-6.

Blasting is also responsible for another type of emission from surface coal mining. Overburden and coal blasting sometimes produces gaseous, orange-colored clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, as discussed in Section 3.4.3. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO_2 are shown in Table 3-6.

Other existing air pollutant emission sources within the region include:

- CO and NO_x from internal combustion engines used at natural gas and CBNG pipeline compressor stations;
- CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, and VOCs from gasoline and diesel vehicle tailpipe emissions;
- Particulate matter (dust) generated by vehicle travel on unpaved graded roads, agricultural activities such as plowing, and paved road sanding during the winter months, as well as windblown dust from neighboring areas;
- NO_2 and PM_{10} emissions from railroad locomotives used to haul coal;
- SO_2 and NO_x from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 78-91 miles south-southwest of the LBA tracts, and the Wyodak, Wygen, and Neil Simpson plants, located 9-22 miles north of the LBA tracts; and
- Air pollutants transported from emission sources located outside the PRB.

3.4.2 Particulate Emissions

3.4.2.1 Affected Environment for Particulate Emissions

The federal standard for particulate matter was measured as TSP until 1987. This measurement included all suspendable dust (generally less than 100 microns in diameter). In 1987, EPA changed from a TSP-based standard to a PM_{10}-based standard. PM_{10} is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. In 1997, EPA set separate standards for fine particles ($PM_{2.5}$), based on their link to serious health problems. In 2006, EPA again revised the air quality standards for particulate matter by tightening the 24-hour fine particle standard from the previous level of 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and revoking the annual PM_{10} standard of

Table 3-6. Assumed Background Air Pollutant Concentrations, Applicable AAQS, and PSD Increment Values (in µg/m[3]).

Criteria Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,336[4]	40,000	40,000	40,000	---	---
	8-hour	1,381	10,000	10,000	10,000	---	---
Nitrogen dioxide	Annual	5[5]	100	100	100	2.5	25
Ozone	8-hour	70[6]	157	157	157	---	---
Sulfur dioxide	3-hour	181[7]	---	1,300	1,300	25	512
	24-hour	62[7]	365	---	260	5	91
	Annual	13[7]	80	---	60	2	20
PM_{10}[8]	24-hour	54[9]	150	150	150	8	30
	Annual	13[9]	--	--	50	4	17
$PM_{2.5}$[8]	24-hour	13[10]	35	35	65	---	---
	Annual	4[10]	15	15	15	---	---

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
3 All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.
4 Data collected by Amoco at Ryckman Creek for an eight-month period during 1978-1979, summarized in Riley Ridge EIS (BLM 1983).
5 Data collected at Thunder Basin National Grassland, Campbell County, Wyoming in 2002.
6 Data collected at Thunder Basin National Grassland, Campbell County, Wyoming in 2002-2004 (8-hour 4th high).
7 Data collected by Black Hills Power & Light at Wygen 2, Campbell County, Wyoming in 2002.
8 On October 17, 2006, EPA published final revisions to the NAAQS for particulate matter that took effect on December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 µg/m[3] and revokes the annual PM_{10} standard of 50 µg/m[3]. The State of Wyoming will enter into rulemaking to revise the WAAQS.
9 Data collected at the Eagle Butte Mine, Campbell County, Wyoming in 2002.
10 Data collected at the Buckskin Mine in 2002.

Source: (BLM 2005a and WDEQ/AQD)

50 µg/m^3. EPA retained the existing annual $PM_{2.5}$ standard of 15 µg/m^3 and the 24-hour PM_{10} standard of 150 µg/m^3. These revisions took effect on December 18, 2006. The current federal ambient air standards are shown in Table 3-6.

While retaining the TSP standard until March 2000, Wyoming added the PM_{10} standard in 1989. Wyoming also adopted a $PM_{2.5}$ standard in March 2000. In view of the December 2006 revisions to the NAAQS for particulate matter, the State of Wyoming will enter into rulemaking to revise the WAAQS for particulate matter so that they remain as stringent as or more stringent than the NAAQS. Even with the evolution of state or federal small size particulate standards, TSP is still monitored in some PRB locations as a surrogate for PM_{10} and as an indication of overall atmospheric levels of particulate matter.

As a result of WDEQ/AQD requirements for the PRB mines to collect air quality data, which is discussed in Section 3.4.2.3, the eastern PRB is one of the most intensely monitored areas in the world. According to EPA AirData, in 2007 there were six TSP monitors, five $PM_{2.5}$ monitors and 36 PM_{10} monitors in the Wyoming portion of the PRB. Data for TSP date back to 1980 and data for PM_{10} date back to 1989. Through 2004, approximately 57,000 TSP samples had been collected and approximately 47,550 PM_{10} samples had been collected through 2007. Information about the regulatory framework, the monitoring network, and PM_{10} concentration trends since monitoring began are included in Appendix K. Existing site specific air quality information is included in the SGAC EIS Supplementary Information document, which is available on request.

Historical particulate matter ambient air quality data for the general South Gillette analysis area air quality monitoring sites generally show the same results as described above for the PRB as a whole. The locations of PM_{10}, $PM_{2.5}$, and TSP (if monitored) particulate emission monitoring samplers at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines are shown on Figures 3-3 through 3-6, respectively. The progression of mining operations requires that the location and number of particulate monitors be adjusted in order to provide the best documentation of the ambient air quality. Figure 3-7 presents the average annual emission measured by general South Gillette analysis area particulate monitors from 1997 through 2007 for PM_{10} emission. Annual coal and overburden production for the general South Gillette analysis area mines for these years are also shown on Figure 3-7.

No exceedances of the 24-hour or annual PM_{10} particulate standards had been documented by the Belle Ayr, Coal Creek, Caballo, or Cordero Rojo Mines through 2006.

3.4.2.2 Environmental Consequences Related to Particulate Emissions

Particulates include solid particles and liquid droplets that can be suspended in air. Particulates, especially fine particles, have been linked to numerous

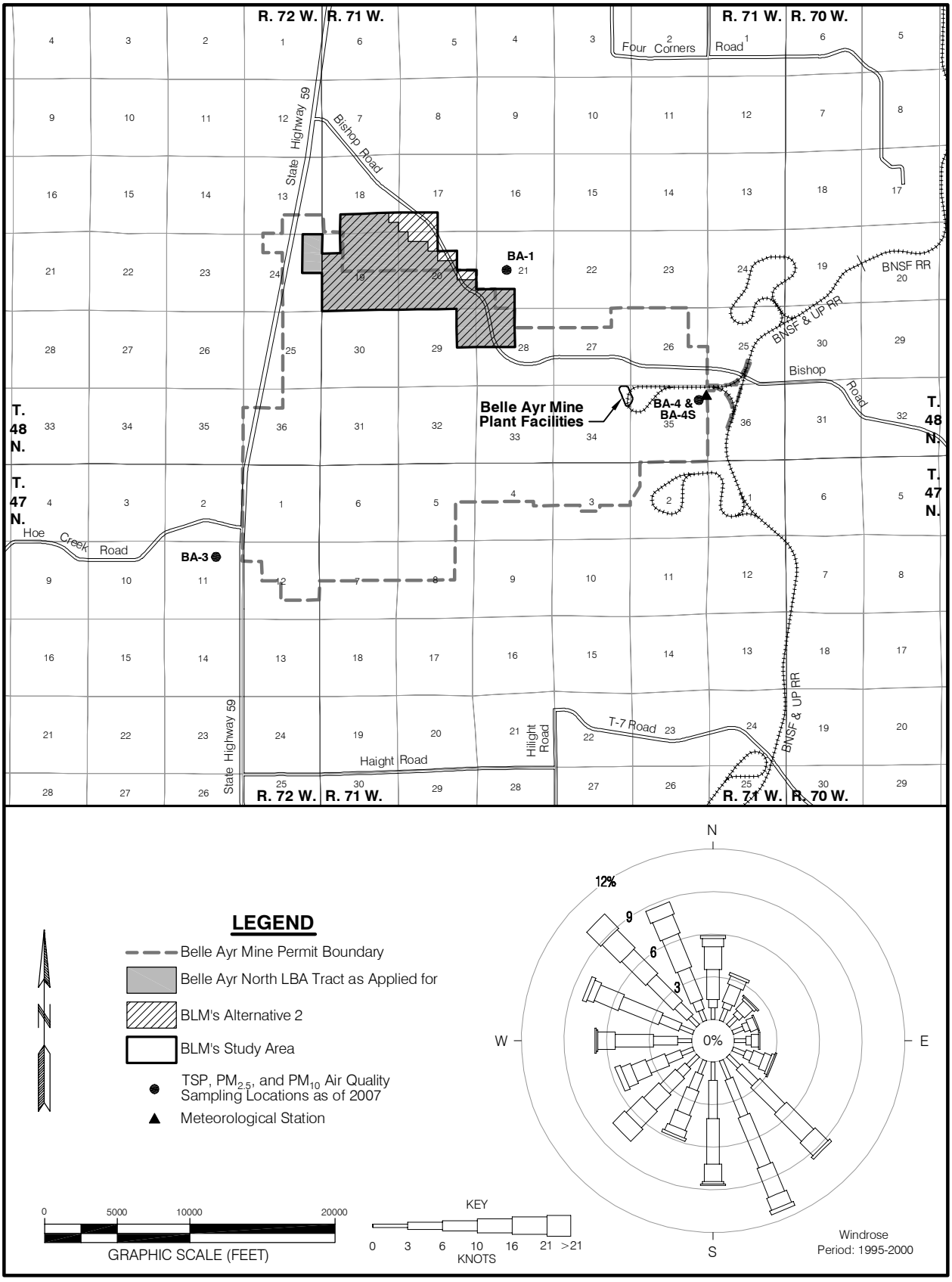

Figure 3-3. Wind Rose, Air Quality and Meteorological Stations at the Belle Ayr Mine.

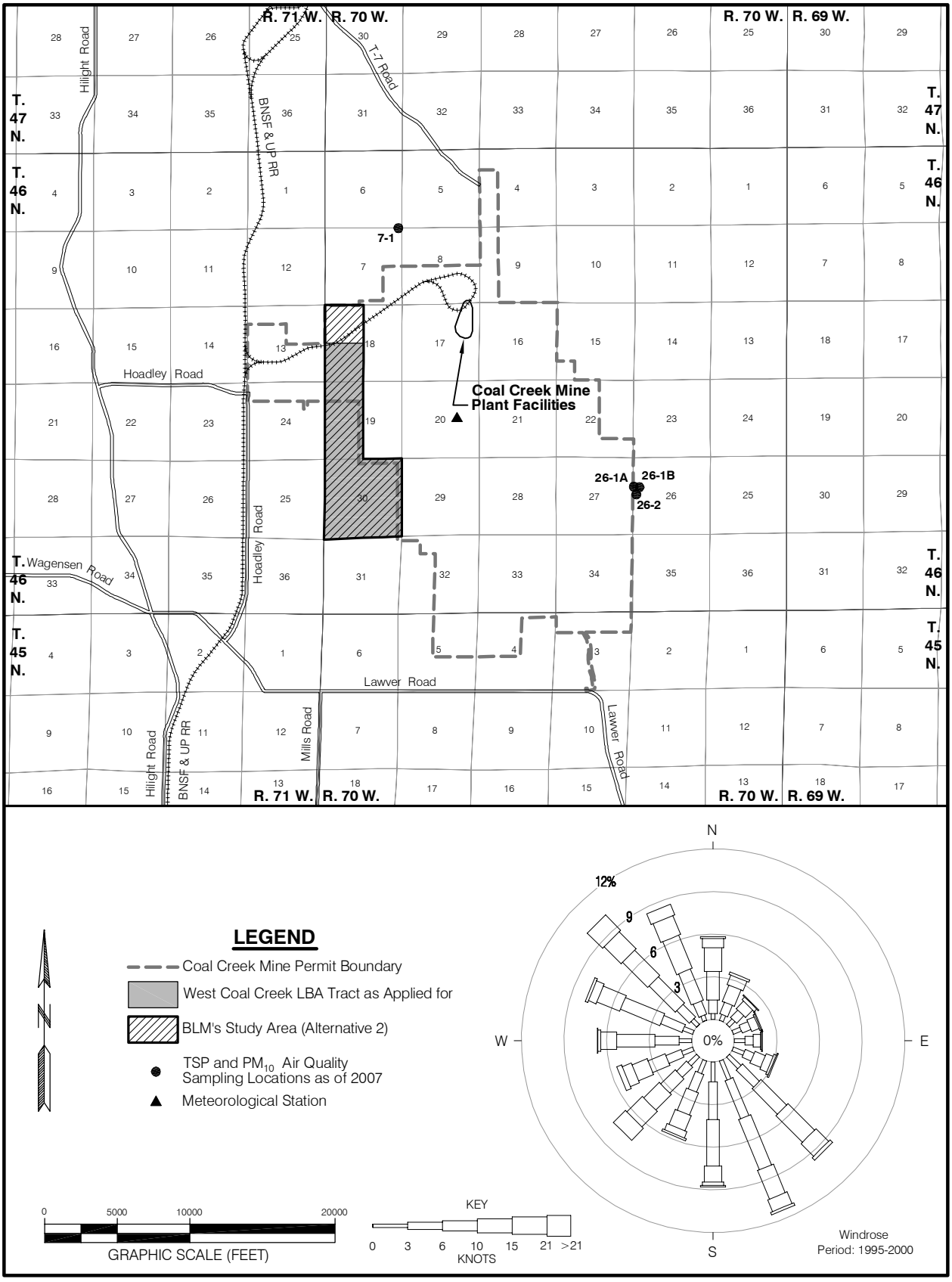

Figure 3-4. Wind Rose, Air Quality and Meteorological Stations at the Coal Creek Mine.

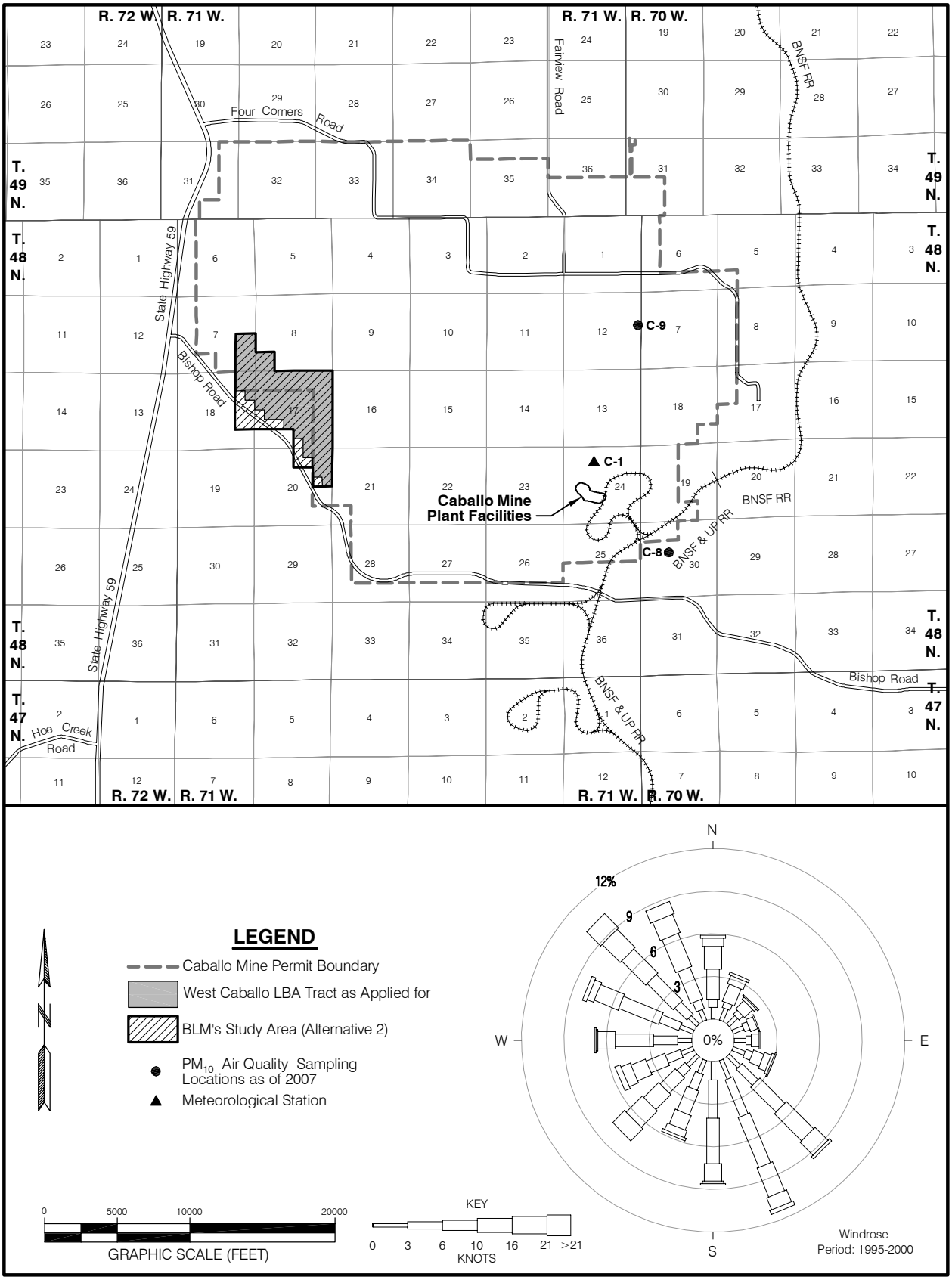

Figure 3-5. Wind Rose, Air Quality and Meteorological Stations at the Caballo Mine.

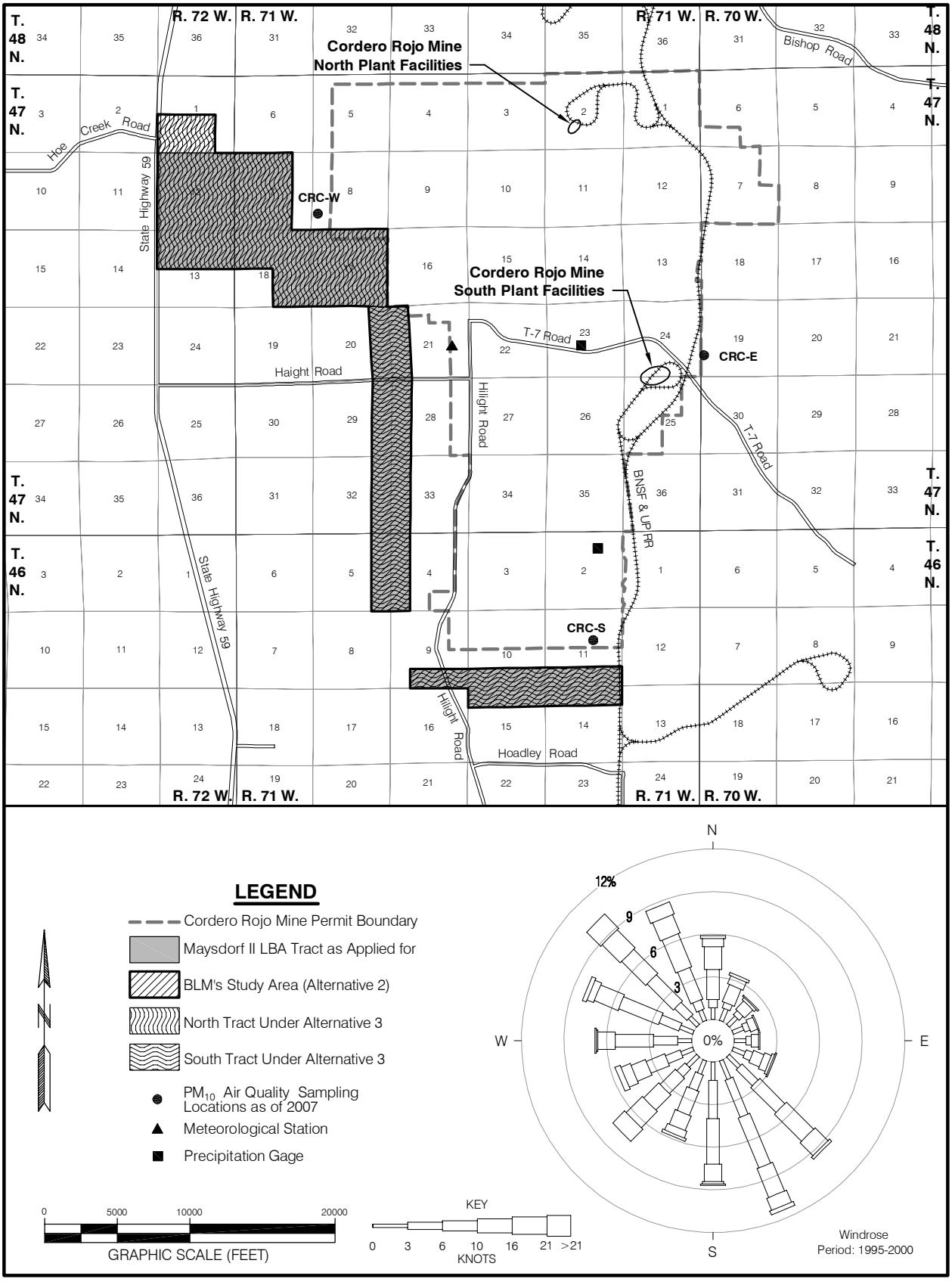

Figure 3-6. Wind Rose, Air Quality and Meteorological Stations at the Cordero Rojo Mine.

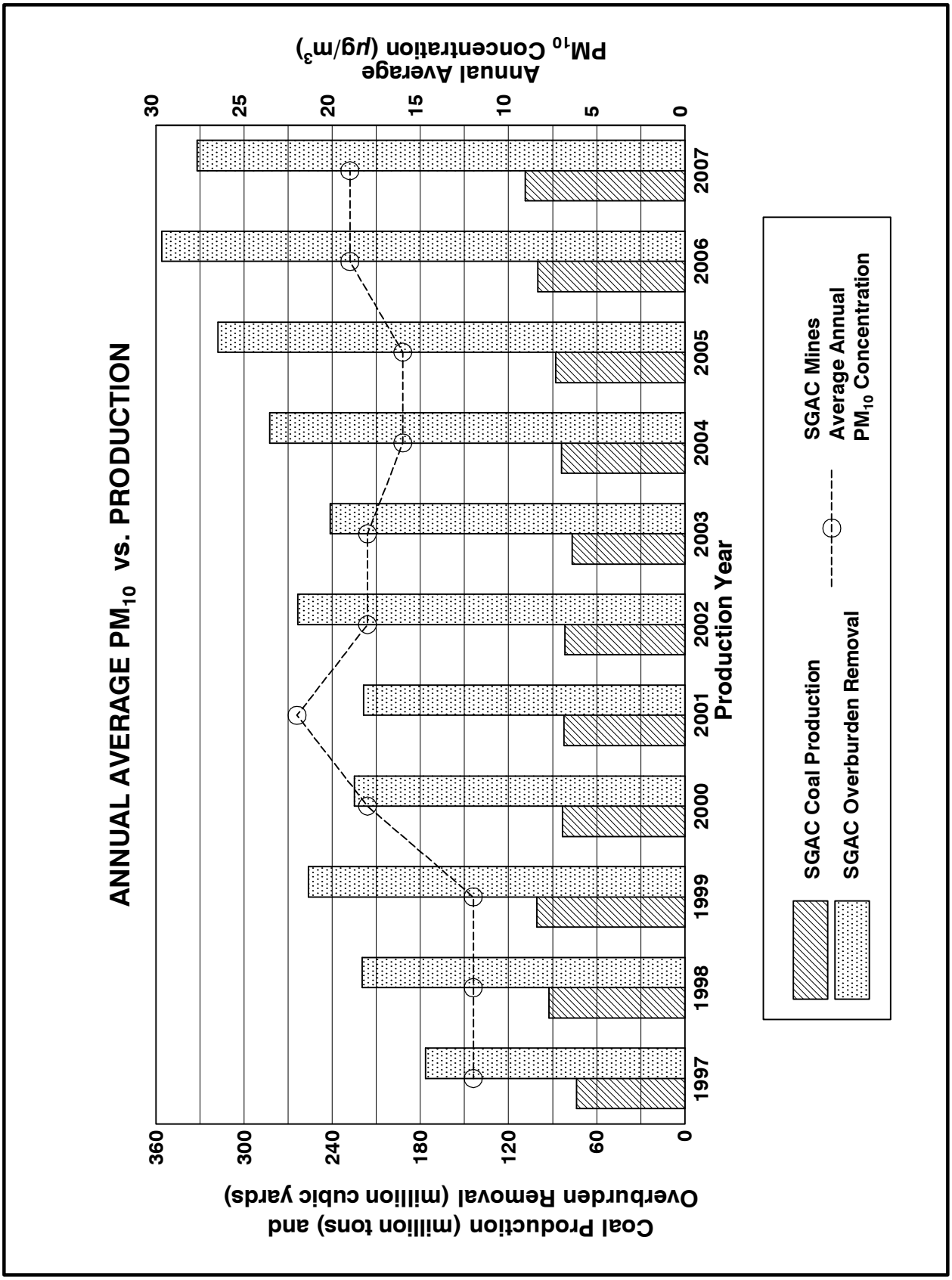

Figure 3-7. Annual Coal Production and Overburden Removal vs. Ambient Particulates for the General South Gillette Analysis Area (1997 through 2007).

respiratory-related illnesses and can adversely affect individuals with pre-existing heart or lung diseases (EPA 2007a). They are also a major cause of visibility impairment in many parts of the United States. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes.

3.4.2.2.1 Proposed Action and Action Alternatives

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would be mined as an integral part of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively.

Potential particulate emissions related to mining operations at the existing mines are described below. Because of the similarities in mining rates and mining operations, the potential impacts of mining the LBA tracts have been inferred from the projected impacts of mining the existing coal leases as currently permitted.

Receptor locations were placed at approximately 500-meter intervals along the ambient air quality (or LNCM) boundaries. As discussed in Appendix K, a PM_{10} concentration of 15 µg/m^3 was added to most modeled emissions to account for background fugitive dust. The Caballo Mine used a 14.4 µg/m^3 concentration value for PM_{10} modeling. Predicted PM_{10} emissions from the other regional mining operations were inventoried using those mines' most recent WDEQ/AQD air quality permit applications. Impacts on ambient air from the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and other regional mines vary by year due to annual changes in emission strength, emission density, pit proximity to defined ambient air boundaries, and pit configuration. Emissions for each year are ranked and candidate worst-case years are further evaluated regarding proximity to neighboring mining operations and emissions. The total PM_{10} concentration at each receptor was determined by summing the concentration due to each active mine in the general area and adding the appropriate background concentration. The resulting particulate levels were then compared to the average annual PM_{10} standard of 50 µg/m^3 to determine compliance with the annual WAAQS. This constitutes a demonstration of compliance with the "long-term" or annual WAAQS.

As discussed in Appendix K, surface coal mines in the Wyoming PRB have not been subject to PSD requirements. Only some fraction of the mine emissions included in the WDEQ/AQD air quality permit analyses consumes increment based on permits in place in the baseline year of 1997. As a result, the concentrations predicted by the WDEQ/AQD air quality permit analyses should not be compared to PSD increments.

The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine point source emissions inventories includes all coal preparation and processing facilities (i.e., crushers, material transfer points, silos, and loadouts). All point source parameters for the regional mining operations, which were obtained from WDEQ/AQD files, were also

considered in the modeling analysis. As discussed in Appendix K, a proposed new point source that has the potential to emit more than 250 tpy of any criteria pollutant (the primary pollutant being particulate matter) must undergo a regulatory PSD increment consumption analysis as well as a BACT review.

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the State of Wyoming. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. There have been no violations for exceeding the 24-hour or annual ambient air standards at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines through August 2007 and none are expected from mining the LBA tracts.

The estimated average overburden thickness is generally greater in each of the LBA tracts than within the current leases, but the thickness of the coal in the LBA tracts is about the same as in the existing mine areas (see Table 3-5). The acquisition and mining of the LBA tracts by the applicant mines could result in an increase in fugitive emissions per ton of coal mined from current levels due to the increased volume of overburden that would have to be removed to recover the coal. The increase in fugitive dust emissions could potentially be moderated somewhat if removal of the larger volume of overburden material results in a slower rate of mining advancement through the LBA tracts. This would potentially decrease the number of acres disturbed annually and cause haul distances to increase more slowly.

Current mining techniques (i.e., haulage, blasting, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permits. Material movement of overburden and coal would continue to utilize shovels and trucks in overburden and shovels and trucks in coal. Facilities shown in the current air quality permits would not change as a result of proposed mining of the LBA tracts. There are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tracts. In addition, current BACT measures for particulates would continue to be employed.

3.4.2.2.1.1 Belle Ayr North LBA Tract

FCW projects that the annual coal production is expected to average 30 million tons, with or without the Belle Ayr North LBA Tract. Belle Ayr Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 45 million tons of coal. According to FCW, if they acquire the additional coal in the LBA tract, production would continue at an average rate of 30 mmtpy for a longer period of time (approximately 6 years).

WDEQ/AQD issued air quality permit MD-1271 for the Belle Ayr Mine on November 18, 2005. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1476 on September 7, 2006 to modify operations at the Belle Ayr Mine and to increase permitted annual production to 45 mmtpy (FCW 2007).

Particulate emission inventories for the mining activities at Belle Ayr Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Fugitive emission sources and point sources were modeled using the ISCLT3 Model to estimate average annual PM_{10} concentrations.

Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Belle Ayr Mine. Based on mine plan parameters and highest emissions inventories, the years 2008 and 2013 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Belle Ayr LNCM boundary of 39.79 $\mu g/m^3$ in 2008 and 42.02 $\mu g/m^3$ in 2013. Coal production in both years was modeled at the maximum permitted production level of 45 million tons (FCW 2006). The locations of the maximum-modeled PM_{10} concentrations for 2008 and 2013 are shown on Figures 3-8 and 3-9, respectively.

An inventory of all point sources, controls, and emissions for the MD-1476 air quality permit showed a maximum potential to emit 61.5 tpy; therefore, a PSD increment consumption analysis was not necessary. Because this value is below the 100 tpy major source threshold limit specified in Chapter 6, Section 3 of the WAQSR, Belle Ayr Mine will not be subject to the Title V Operating Permit program (FCW 2006).

Modeling conducted for the current Belle Ayr Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 45-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. FCW estimates that the mine would produce at an average annual rate of 30 mmtpy if it acquires and mines the Belle Ayr North LBA Tract. At that average rate of production, there would be an extension of over 5 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mines, including several along State Highway 59, which is located less than ¼-mile west of the Belle Ayr North LBA Tract. Roads, highways, currently

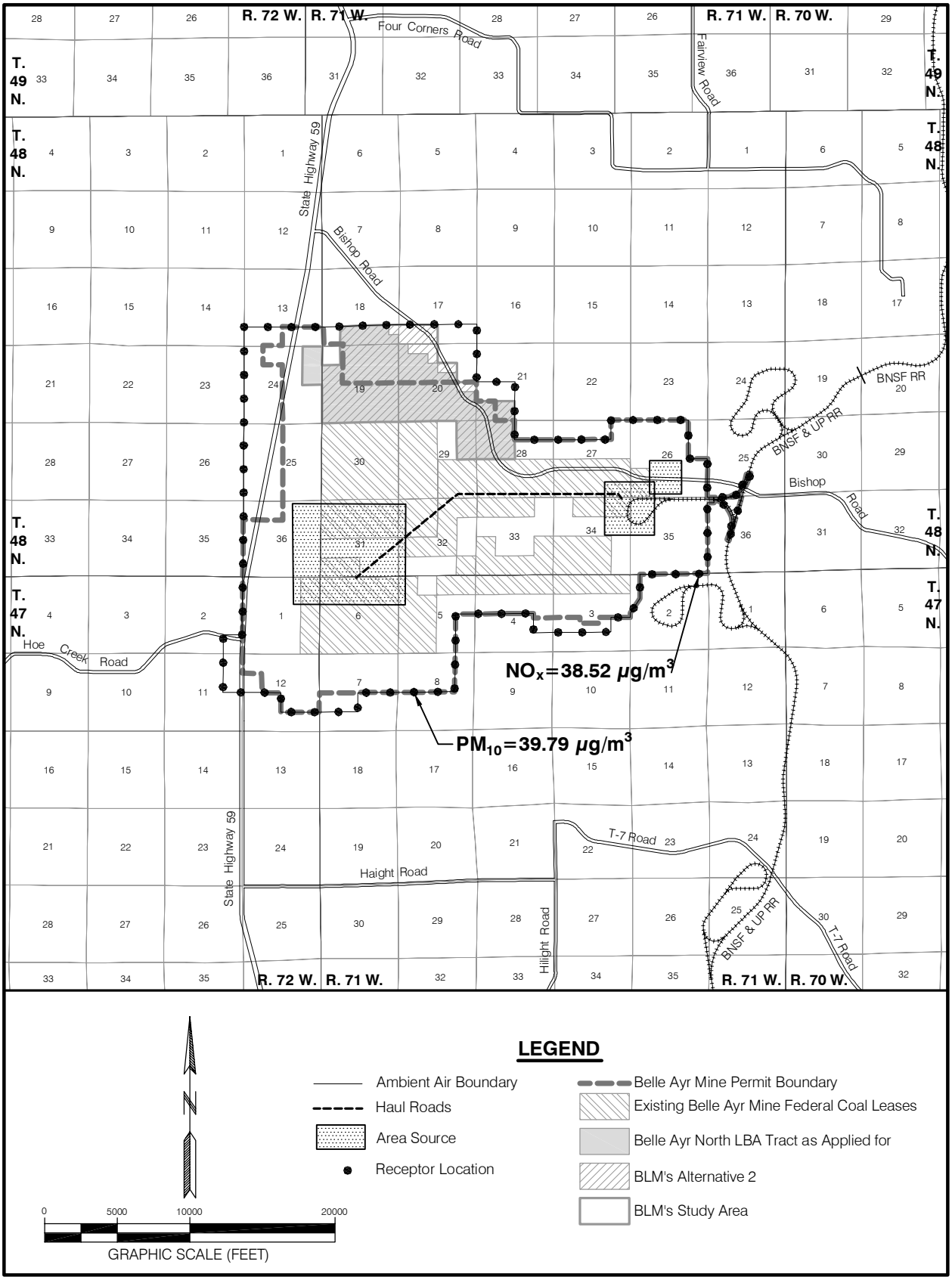

Figure 3-8. Maximum Modeled PM_{10} and NO_X Concentrations at the Belle Ayr Mine Ambient Air Boundary for the Year 2008.

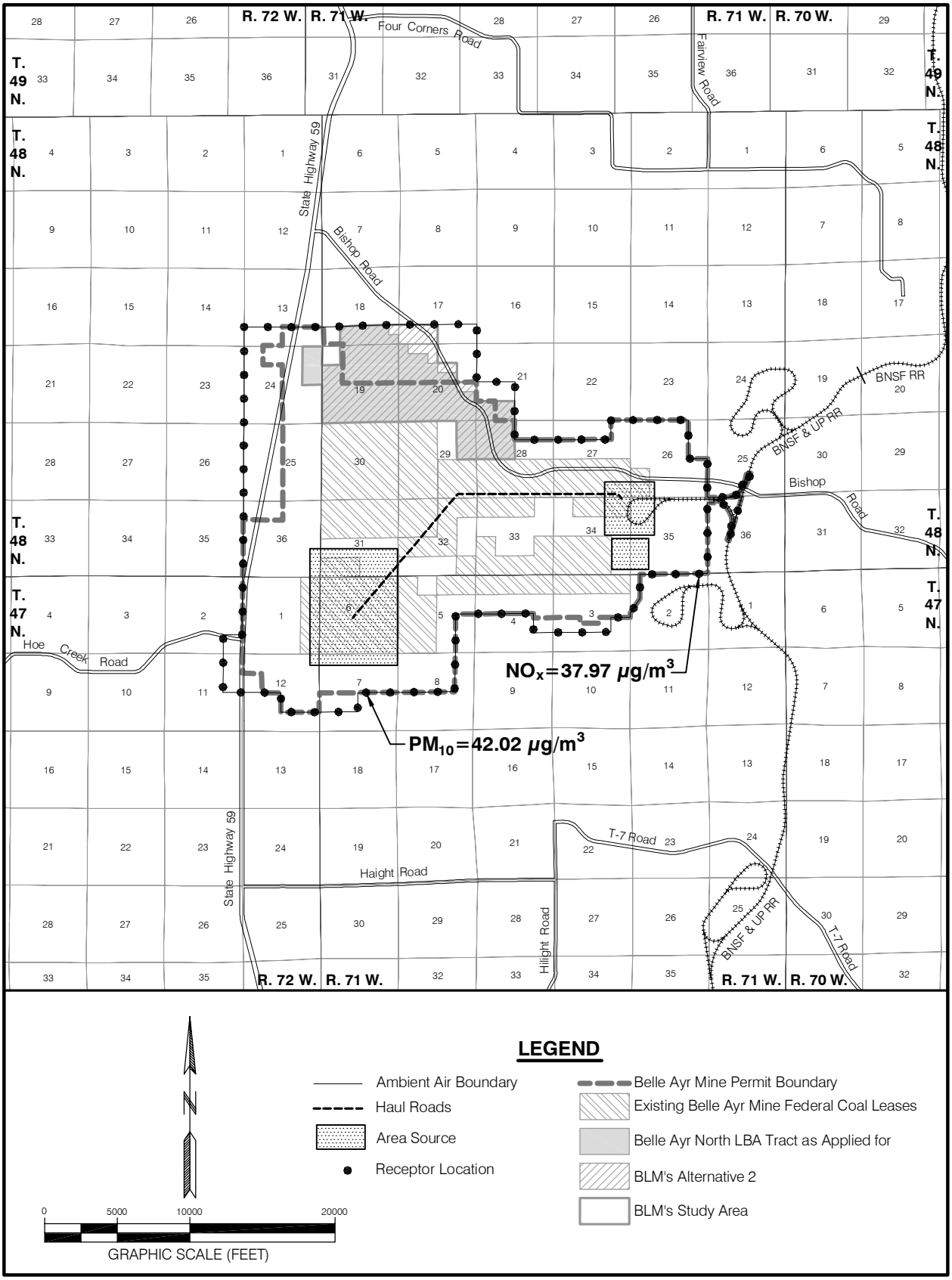

Figure 3-9. Maximum Modeled PM_{10} and NO_X Concentrations at the Belle Ayr Mine Ambient Air Boundary for the Year 2013.

occupied dwellings, and school bus stops in the vicinity of the Belle Ayr North LBA Tract are shown in Figure 3-10.

3.4.2.2.1.2 West Coal Creek LBA Tract

TBCC estimates that the annual coal production is expected to average 13.4 million tons, with or without the West Coal Creek LBA Tract. Coal Creek Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 25 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 13.4 mmtpy for a longer period of time (approximately 4 years).

WDEQ/AQD issued air quality permit MD-1282 for the Coal Creek Mine on December 1, 2005. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1343 on March 30, 2006 to modify operations at the Coal Creek Mine with the addition of atomizer/fogger dust control systems, which replaced existing conventional baghouses. Material movement utilizes draglines, shovels, and trucks for removal of overburden, and shovels and trucks for removal of coal (TBCC 2005).

Particulate emission inventories for the mining activities at Coal Creek Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Fugitive emission sources and point sources were modeled using the ISCLT3 Model to estimate average annual PM_{10} concentrations (TBCC 2006).

Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Coal Creek Mine. Based on mine plan parameters and highest emissions inventories, the years 2009 and 2016 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Coal Creek LNCM boundary of 15.2 $\mu g/m^3$ in 2009 and 23.1 $\mu g/m^3$ in 2016. Coal production in both years was projected to be the maximum permitted production level of 25 million tons (TBCC 2006). The locations of the maximum-modeled PM_{10} concentrations for 2009 and 2016 are shown on Figures 3-11 and 3-12, respectively.

An inventory of all point sources, controls, and emissions for the MD-1343 air quality permit showed a potential to emit 64.5 tpy; therefore, a PSD increment consumption analysis was not necessary. Because this value is below the 100 tpy major source threshold limit specified in Chapter 6, Section 3 of the WAQSR, Coal Creek Mine will not be subject to the Title V Operating Permit program (FCW 2006).

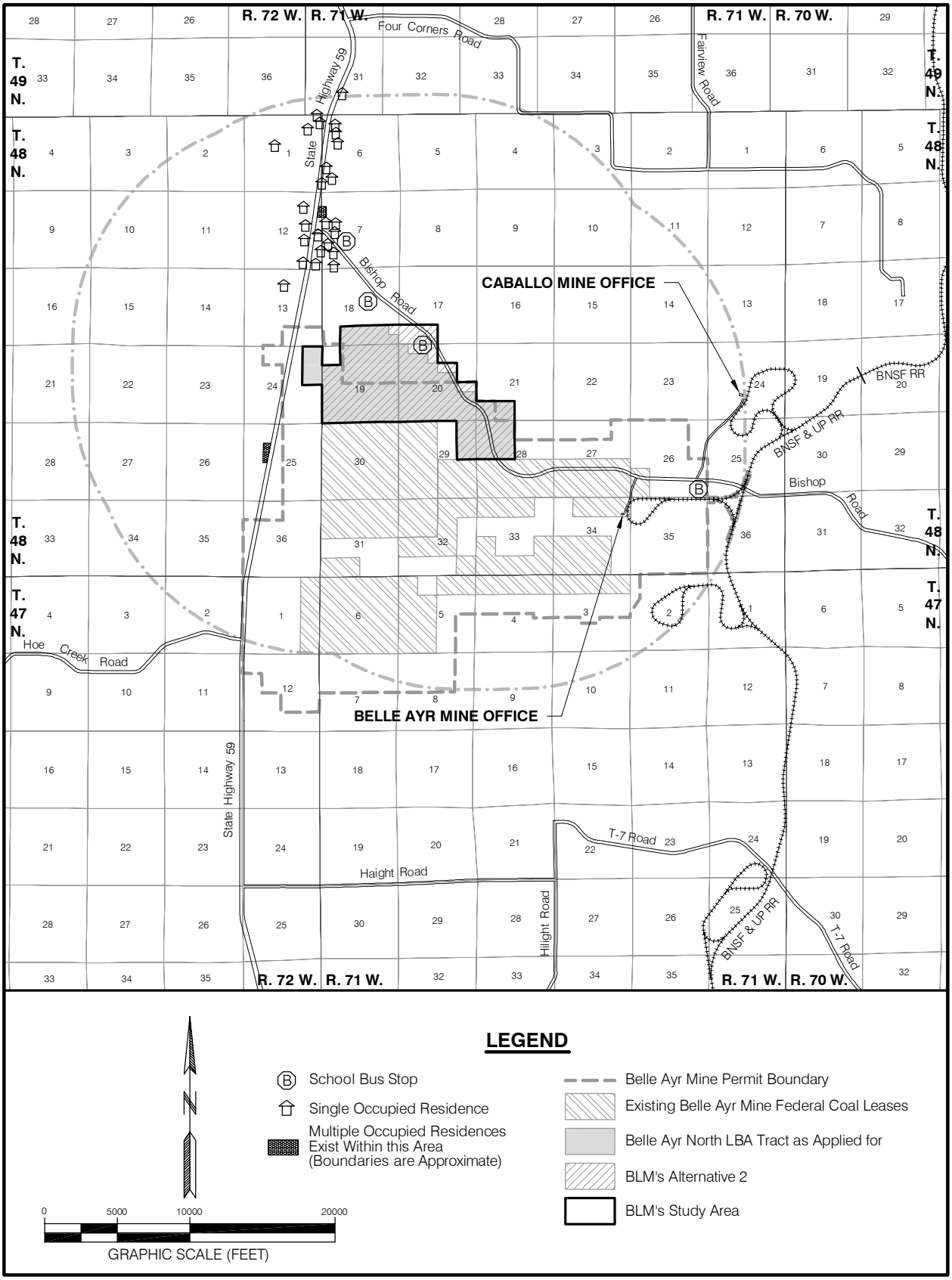

Figure 3-10. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Belle Ayr North LBA Study Area.

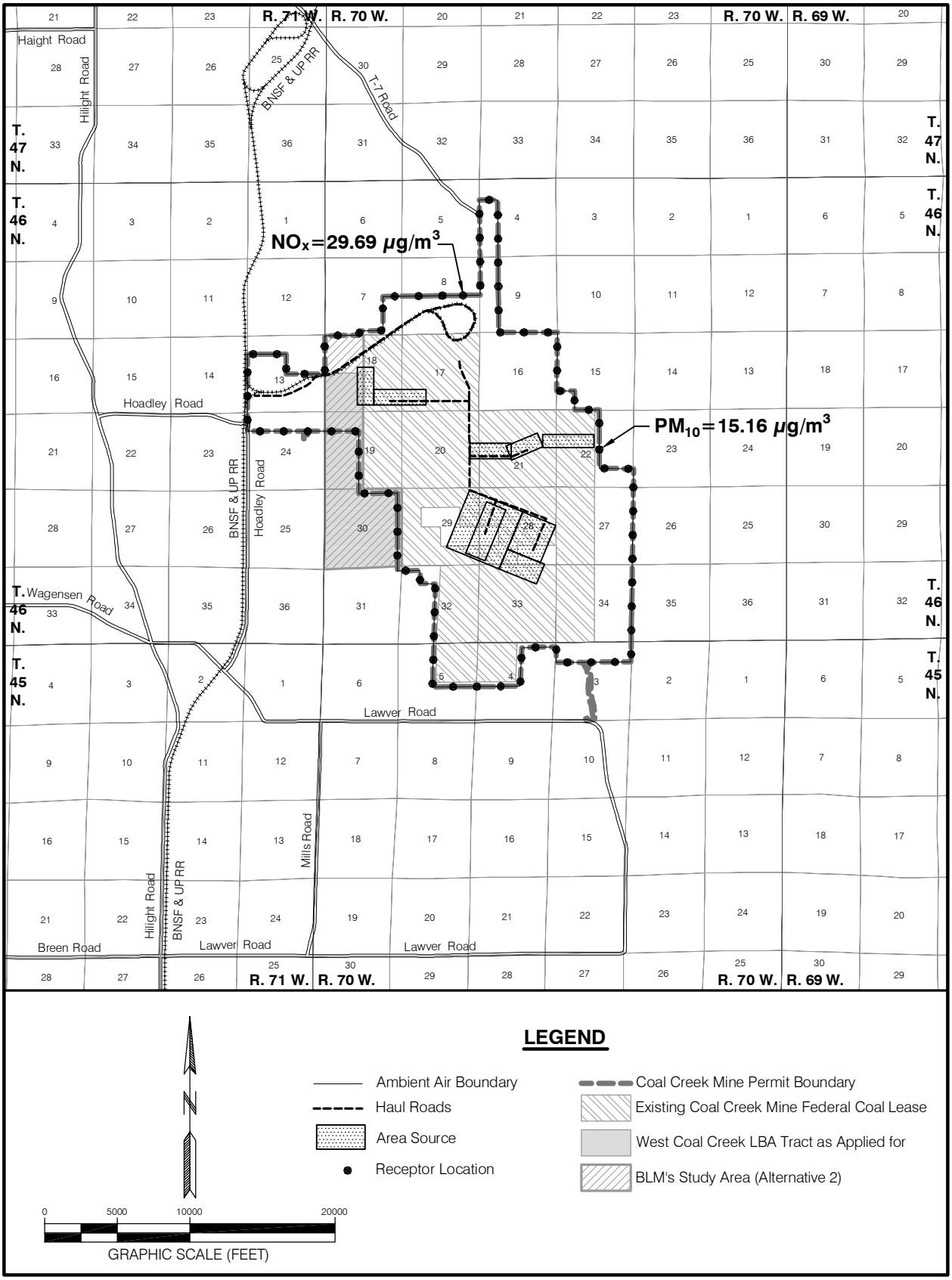

Figure 3-11. Maximum Modeled PM_{10} and NO_X Concentrations at the Coal Creek Mine Ambient Air Boundary for the Year 2009.

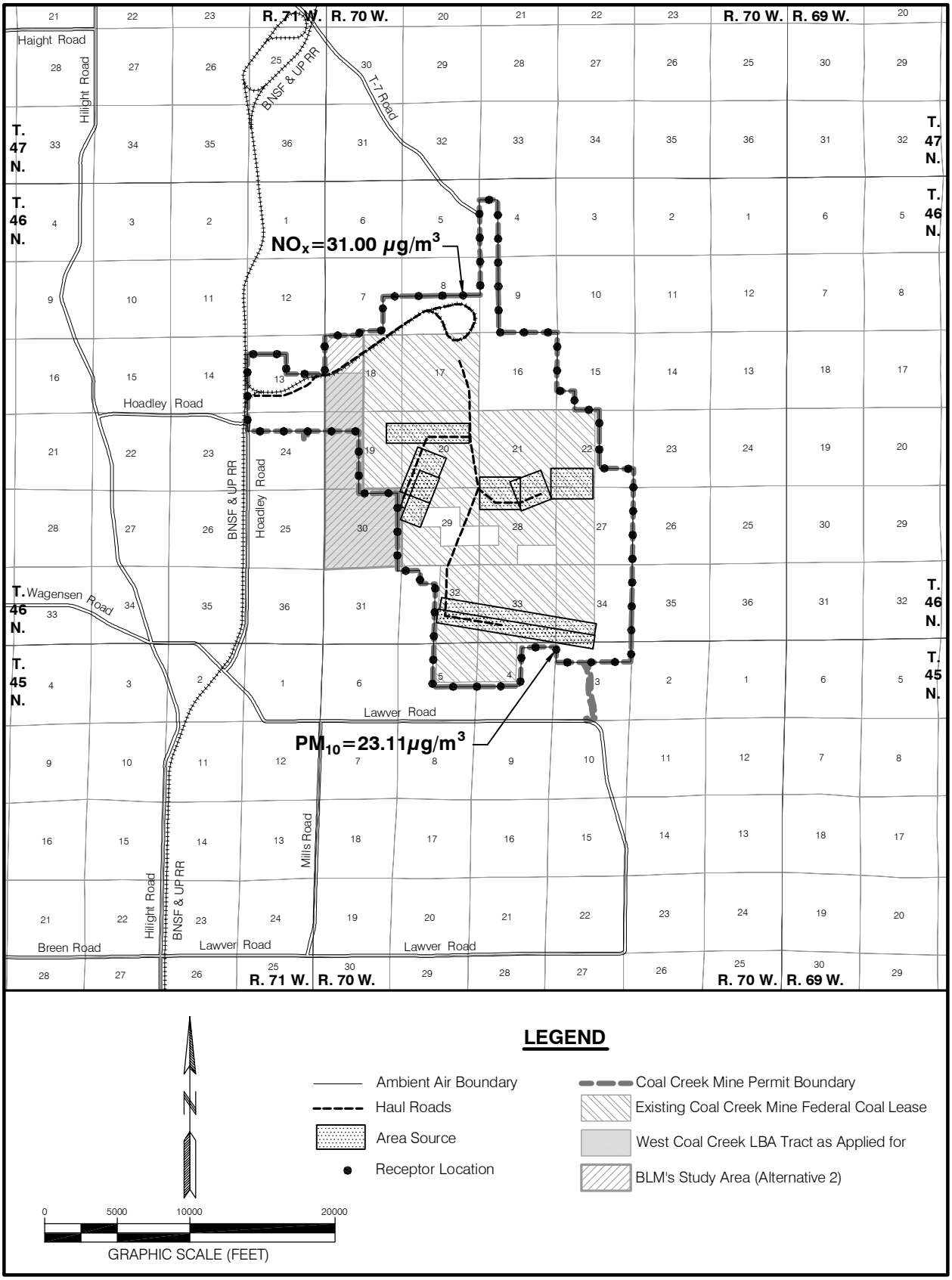

Figure 3-12. Maximum Modeled PM_{10} and NO_X Concentrations at the Coal Creek Mine Ambient Air Boundary for the Year 2016.

Modeling conducted for the current Coal Creek Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 25-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. TBCC estimates that the mine would produce at an average annual rate of 13.4 mmtpy if it acquires and mines the West Coal Creek LBA Tract. At that average rate of production, there would be an extension of over 4 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mine. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the West Coal Creek LBA Tract are shown in Figure 3-13.

3.4.2.2.1.3 Caballo West LBA Tract

CCC projects that the annual coal production is expected to average 37.8 million tons, with or without the Caballo West LBA Tract. Caballo Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 50 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 37.8 mmtpy for a longer period of time (approximately 2 years).

WDEQ/AQD issued air quality permit MD-1125 for the Caballo Mine on February 18, 2005. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1477 on November 7, 2006 to modify operations at the Caballo Mine to increase the permitted production to 50 mmtyp, add a dragline for overburden removal, revise the coal progression sequence, revise the location for the near-pit truck dump/crusher and overland conveyor system, and add passive enclosure control systems to the overland conveyor system. Material movement currently utilizes shovels and trucks for removal of overburden and coal (CCC 2006).

Particulate emission inventories for the mining activities at Caballo Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Fugitive emission sources and point sources were modeled using the ISCLT3 Model to estimate average annual PM_{10} concentrations.

Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Caballo Mine. Based on mine plan parameters and highest emissions inventories, the

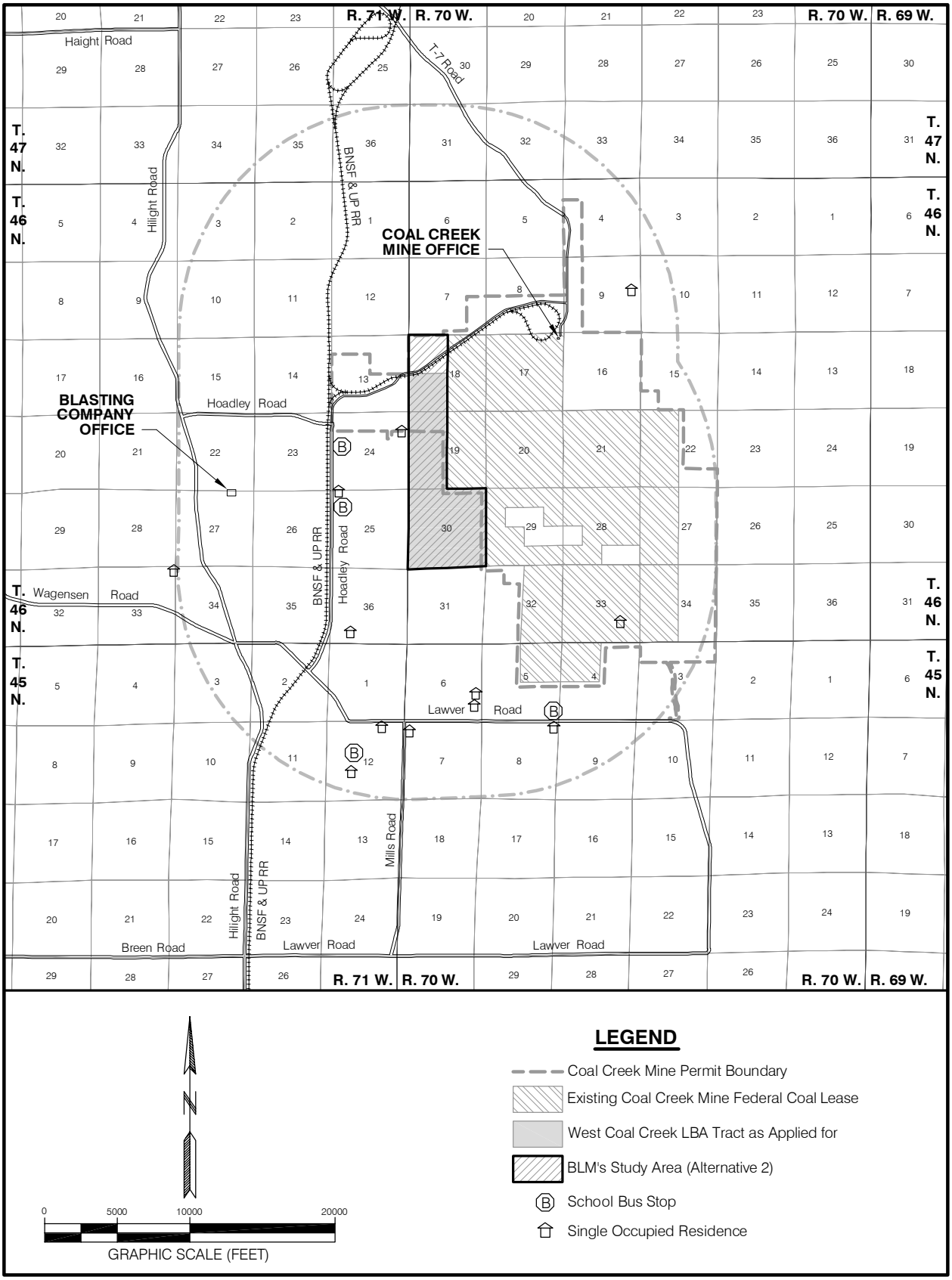

Figure 3-13. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the West Coal Creek LBA Study Area.

years 2008 and 2014 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Caballo LNCM boundary of 36.77 µg/m^3 in 2008 and 46.98 µg/m^3 in 2014. Coal production in both years was projected to be the maximum permitted production level of 50 million tons (CCC 2006). The locations of the maximum-modeled PM_{10} concentrations for 2008 and 2014 are shown on Figures 3-14 and 3-15, respectively.

An inventory of all point sources, controls, and emissions for the MD-1477 air quality permit showed a potential to emit of 26.3 tpy; therefore, a PSD increment consumption analysis was not necessary. Because this value is below the 100 tpy major source threshold limit specified in Chapter 6, Section 3 of the WAQSR, Caballo Mine will not be subject to the Title V Operating Permit program (CCC 2006).

Modeling conducted for the current Caballo Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 50-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. CCC estimates that the mine would produce at an average annual rate of 37.8 mmtpy if it acquires and mines the Caballo West LBA Tract. At that average rate of production, there would be an extension of over 2 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mine, including several along State Highway 59, which is located less than 1 mile west of the Caballo West LBA Tract. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the Caballo West LBA Tract are shown in Figure 3-16.

3.4.2.2.1.4 Maysdorf II LBA Tract

CMC estimates the annual coal production is expected to average 46.3 million tons, with or without the Maysdorf II LBA Tract. Cordero Rojo Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 65 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 46.3 mmtpy for a longer period of time (approximately 10 years).

WDEQ/AQD issued air quality permit MD-457 for the Cordero Rojo Mine on May 2, 2000. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. WDEQ/AQD issued air quality permit MD-1058 on September 17, 2004 to modify operations at the Cordero Rojo Mine with the addition of atomizer/fogger

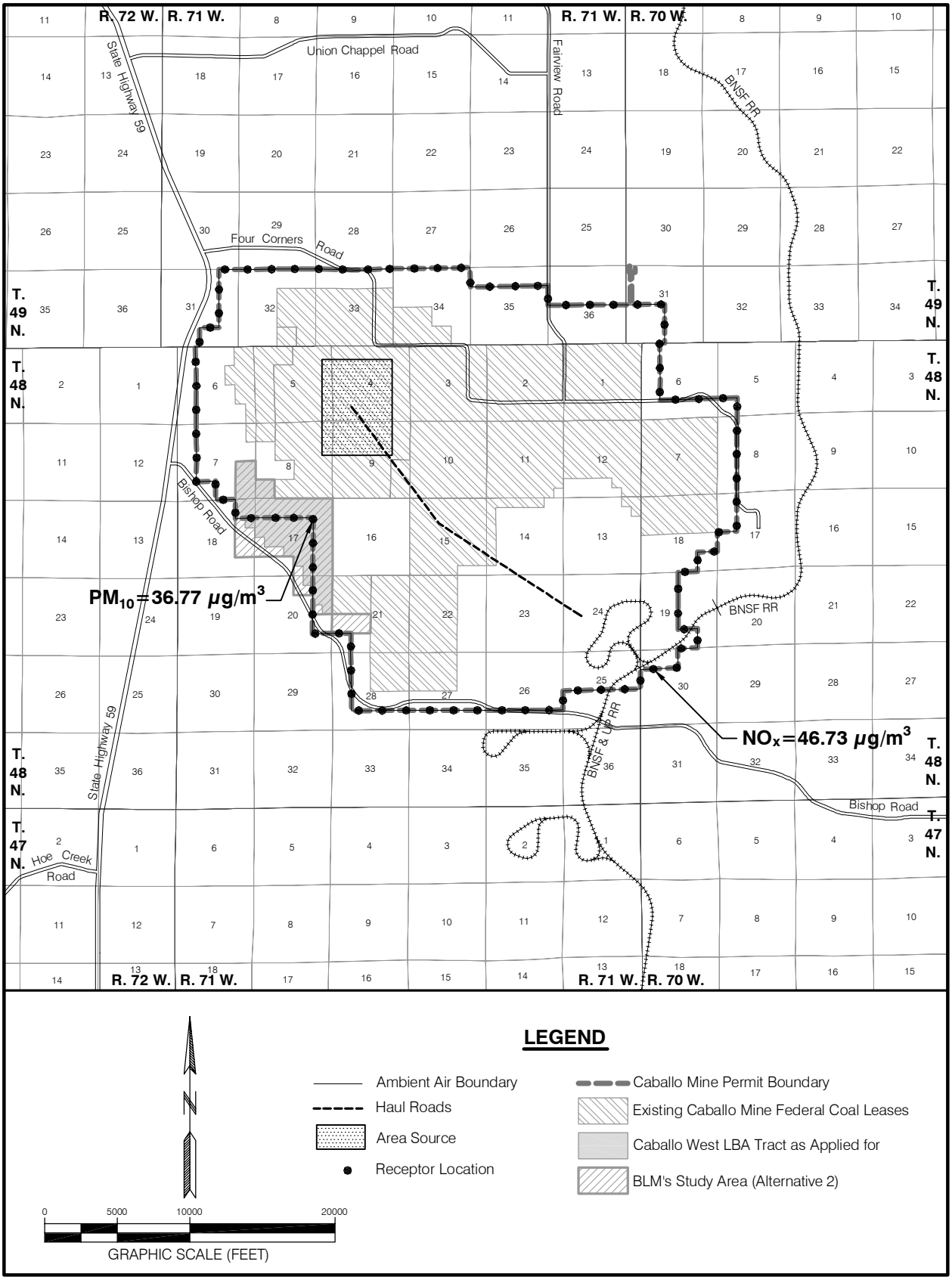

Figure 3-14. Maximum Modeled PM_{10} and NO_x Concentrations at the Caballo Mine Ambient Air Boundary for the Year 2008.

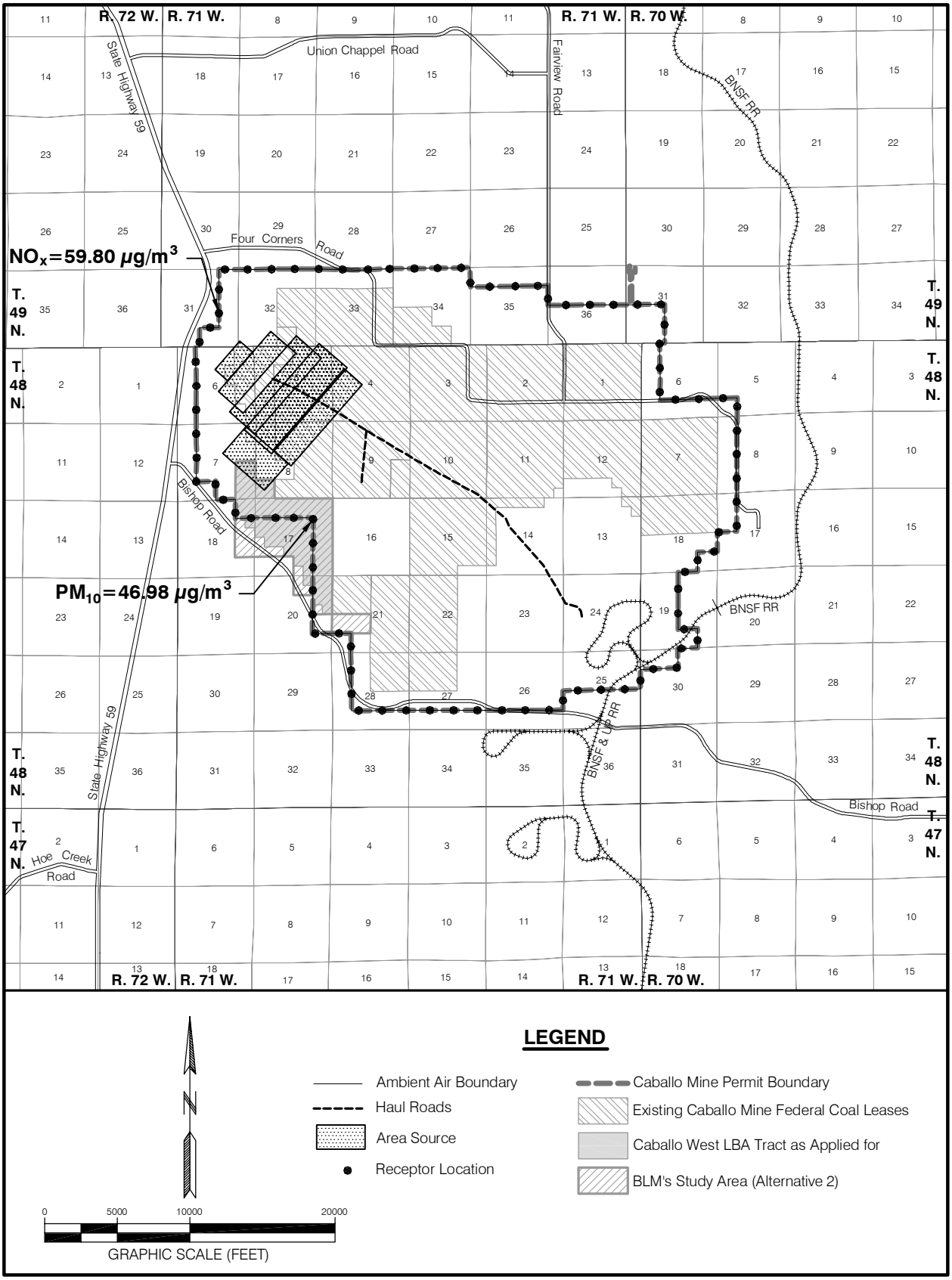

Figure 3-15. Maximum Modeled PM_{10} and NO_x Concentrations at the Caballo Mine Ambient Air Boundary for the Year 2014.

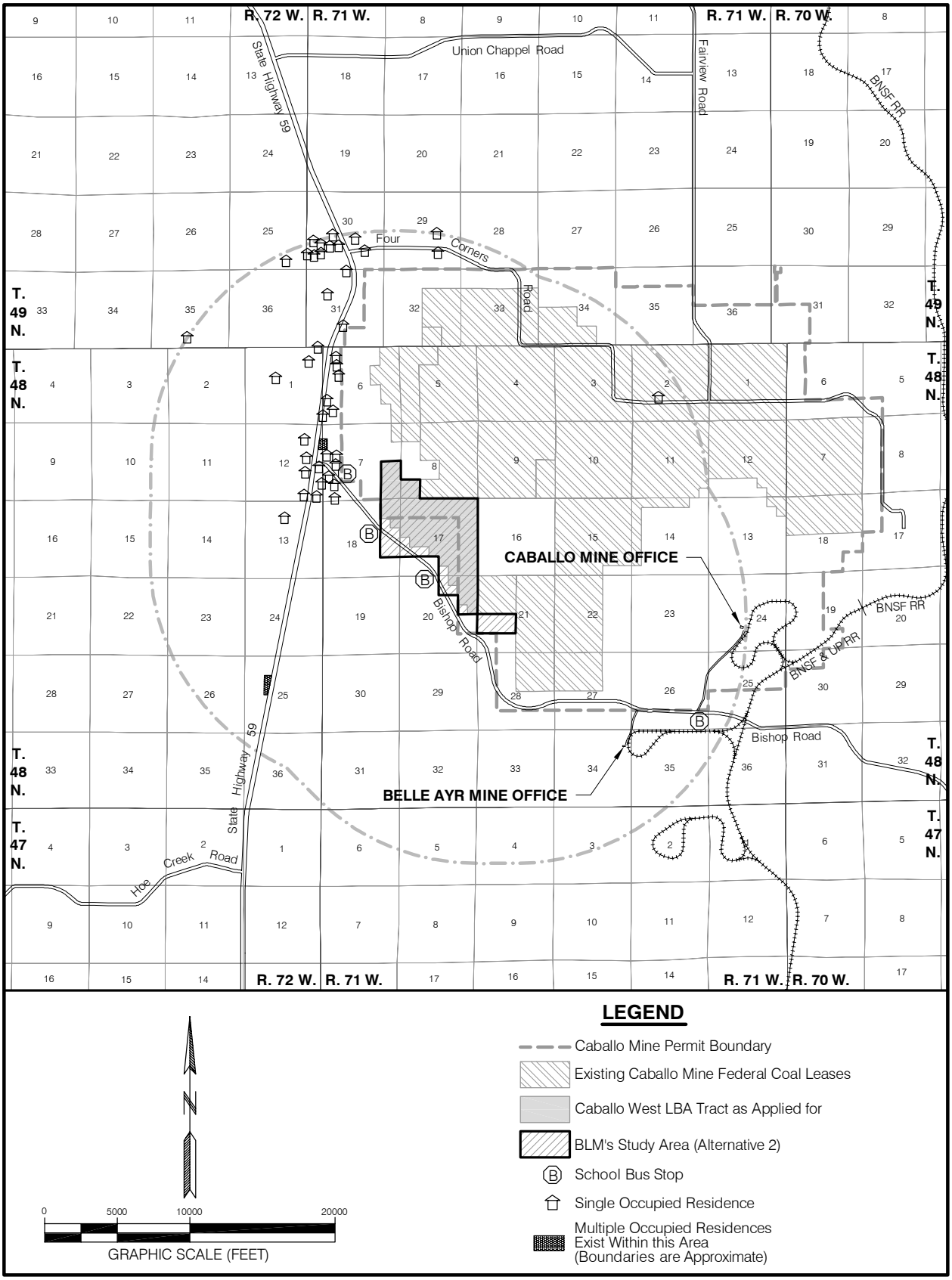

Figure 3-16. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Caballo West LBA Study Area.

dust control systems, which replaced existing conventional baghouses. Material movement utilizes draglines, shovels, and trucks for removal of overburden, and shovels and trucks for removal of coal (CMC 1999).

Particulate emission inventories for the mining activities at Cordero Rojo Mine were prepared for all years in the currently anticipated life of the mine. Two years were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Area and line sources were modeled using the FDM to estimate average annual PM_{10} concentrations and the ISCLT3 Model was used to model all point sources.

Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Cordero Rojo Mine. Based on mine plan parameters and highest emissions inventories, the years 2005 and 2007 were selected as the worst-case years. The dispersion model showed a maximum concentration on the Cordero Rojo LNCM boundary of 46.56 $\mu g/m^3$ in 2005 and 45.66 $\mu g/m^3$ in 2007. Coal production in both years was projected to be the maximum permitted production level of 65 million tons (CMC 1999). The locations of the maximum-modeled PM_{10} concentrations for 2005 and 2007 are shown on Figures 3-17 and 3-18, respectively.

An inventory of all point sources, controls, and emissions for the MD-457A air quality permit showed a potential to emit of 241 tpy; as a result, it was considered a major source, as defined by Chapter 6, Section 3 of the WAQSR, and required a Title V Operating Permit. However, when WDEQ/AQD issued air quality permit MD-1058 on September 17, 2004 to modify operations at the Cordero Rojo Mine, the replacement of the 14 existing conventional baghouses by the atomizer/fogger dust control systems reduced point source particulate emission levels such that the facility is no longer considered a major source and is no longer required to have a Title V Operating Permit (WDEQ/AQD 2004).

Modeling conducted for the current Cordero Rojo Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 65-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. CMC estimates that the mine would produce at an average annual rate of 46.3 mmtpy if it acquires and mines the Maysdorf II LBA Tract. At that average rate of production, there would be an extension of nearly 10 years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mine, including several along State Highway 59, which is located adjacent to the Maysdorf II LBA Tract. Roads, highways, currently occupied dwellings, and

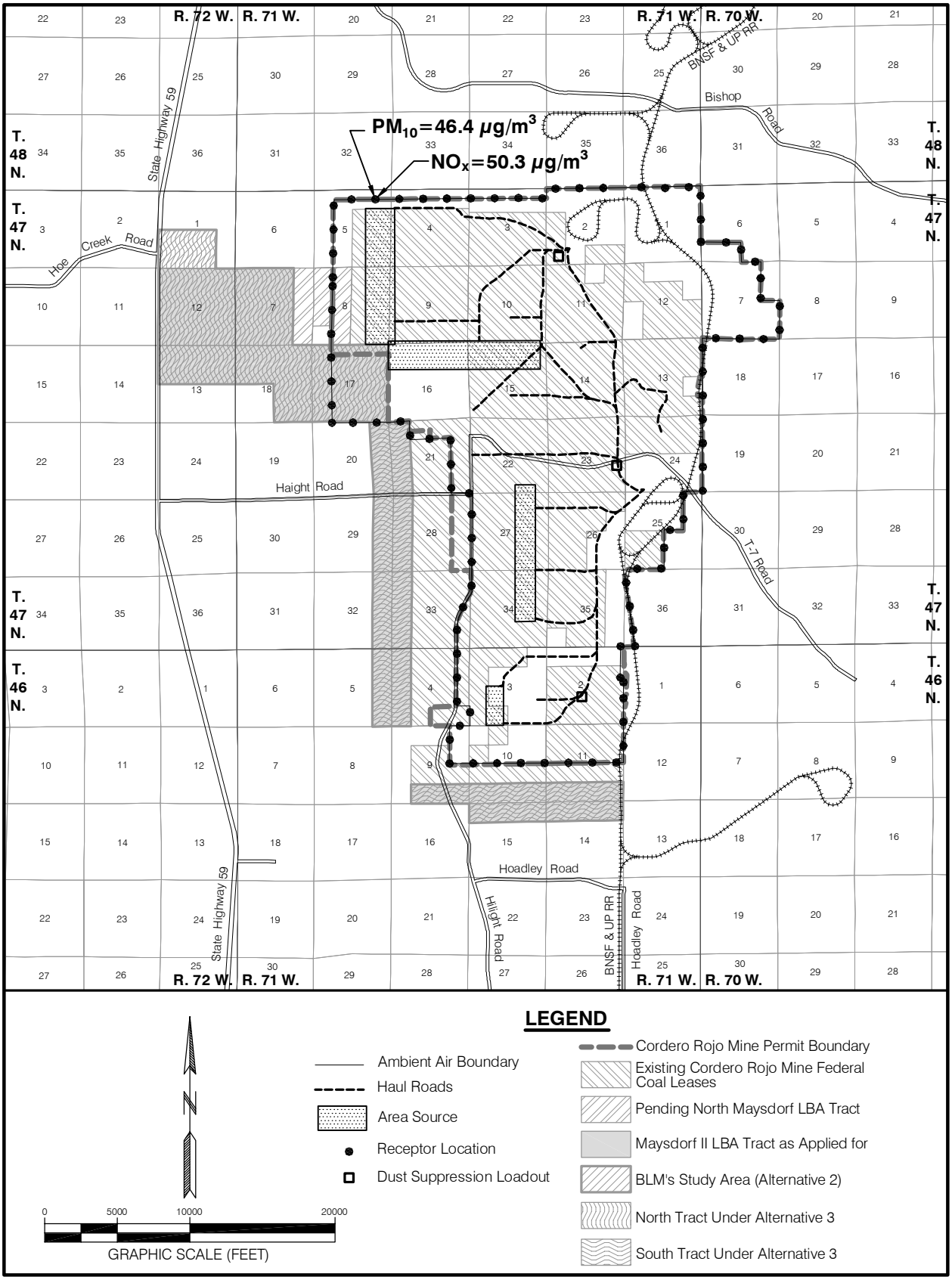

Figure 3-17. Maximum Modeled PM_{10} and NO_x Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2005.

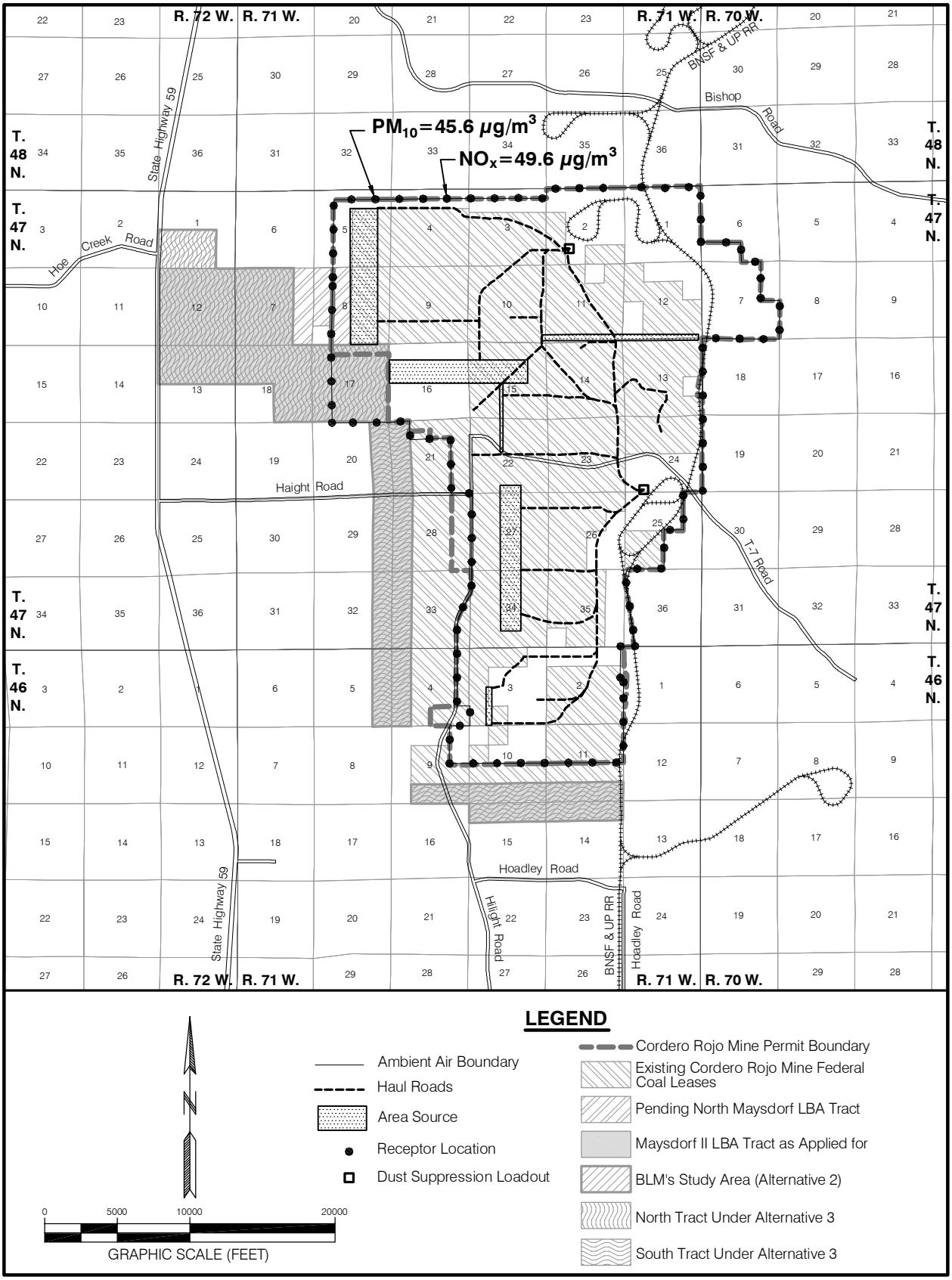

Figure 3-18. Maximum Modeled PM_{10} and NO_x Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2007.

school bus stops in the vicinity of the Maysdorf II LBA Tract are shown in Figure 3-19.

3.4.2.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would continue to operate as currently permitted for about 8, 16, 15, and 11 more years, respectively.

A discussion of the currently permitted mining operations and potential impacts related to PM_{10} emissions is included in Section 3.4.2.2.1, above. Portions of the LBA tracts adjacent to the operating mines would be disturbed to recover the coal in the existing leases. Impacts related to mining operations at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would continue on the existing mine areas as permitted, but mining operations would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.2.3 Regulatory Compliance, Mitigation, and Monitoring for Particulate Emissions

Control of particulate emissions at all PRB coal mines is accomplished with a variety of measures. The WDEQ/AQD permits for all of the surface coal mines in the PRB require the following dust control measures, which are considered to be BACT measures:

1. No mines are allowed to have out-or-pit open coal stockpiles. All coal removed from the mine pits must be stored in totally enclosed coal silos or barns.
2. Unless specifically exempted, all coal mine main access roads are paved.
3. As use and condition warrant, the minor access roads at coal mines that are unpaved must be watered or treated with dust suppressants.
4. All coal conveyor transfer points are shrouded or otherwise enclose to direct coal fines from one belt to the next.
5. The transfer point and crushers within coal processing plants are equipped with control devices and measures specified in individual permits. These control devices and measures may include, but are not limited to, the use of dust collection baghouses, cyclones, scrubbers, fog systems, and controlled flow transfer chutes.
6. All out-of-pit conveyors are hooded or contained in a conveyor gallery.
7. All out-of-pit coal dump hoppers are fitted with a dust control stilling shed, water sprays, or a baghouse dust collector.

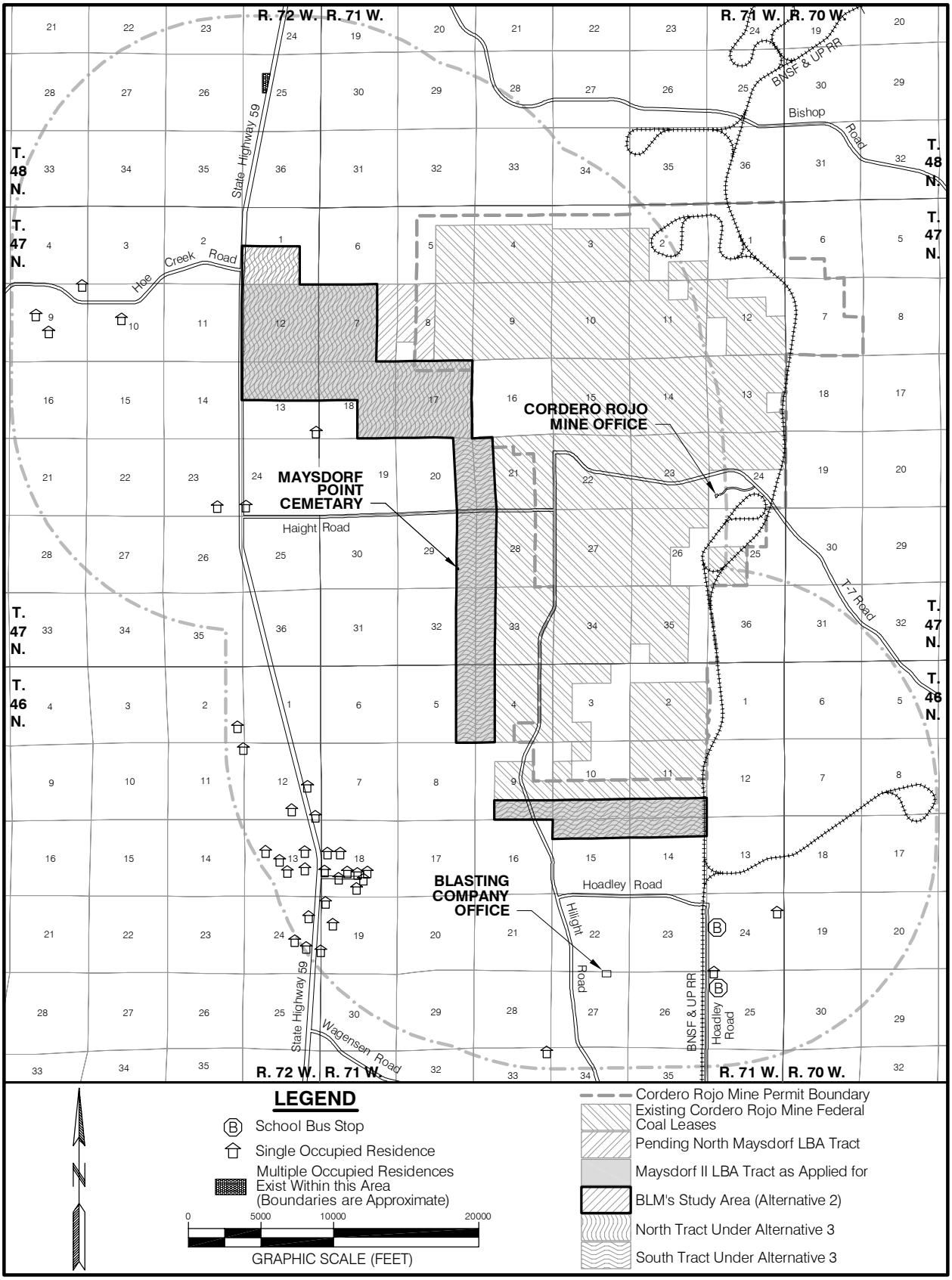

Figure 3-19. Residences, School Bus Stops, Public Roads, and Other Publicly Accessible Facilities Within 3 Miles of the Maysdorf II LBA Study Area.

8. Active longer-term coal haul roads are treated with dust control chemicals and/or water.
9. Active short-term mine haul roads that are continuously being relocated are maintained and watered while in use.
10. All haul roads are regularly maintained to reduce the amount of dust re-entrained by haulage equipment (WDEQ/AQD 2007).

Additional site-specific requirements related to mine-specific layout and mining practices may be included in individual mine permits.

Fugitive emissions are also controlled with a variety of other measures that the WDEQ/AQD considers BACT. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely temporary and permanent revegetation of disturbed areas is utilized to minimize wind erosion. All of these control measures are employed at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines.

In response to the measured exceedances of the PM_{10} NAAQS in certain areas of the PRB and in anticipation of possible future exceedances, the WDEQ/AQD has collaborated with the Wyoming Mining Association to develop a Natural Events Action Plan for the coal mines of the PRB, based on EPA Natural Event Policy guidance. A report describing the plan can be accessed on the WDEQ/AQD's website on the Internet (WDEQ/AQD 2007). The Natural Events Action Plan is discussed in Appendix K. If a Natural Events Action Plan is designed and implemented to minimize PM_{10} concentrations, EPA will exercise its discretion, under Section 107(d)(3) of the CAA, not to redesignate areas as nonattainment, provided that the exeedances are demonstrated to be the result of natural events. Based on EPA's Natural Events Policy, PM_{10} concentrations due to dust raised by unusually high winds will be treated as uncontrollable natural events under the following conditions: 1) the dust originated from non-anthropogenic sources, or 2) the dust originated from anthropogenic sources controlled with BACM.

WDEQ/AQD may require implementation of the control steps outlined in the Natural Events Action Plan and may require continual evaluation of activity plans when exceedances are monitored at surface coal mines. Some of these measures have been formally implemented at the Black Thunder, North Rochelle, and Jacobs Ranch Mines through the establishment of a formal, site-specific mitigative response plan at each of those mines. A mitigative response plan will be developed by any mine that records an exceedance or violation of the NAAQS downwind of its mining operations.

Other operational control measures that WDEQ/AQD may require at specific mines when exceedances occur include, but are not limited to, site-specific watering of inactive areas and problem areas; relocation of overburden truck-dumping operations and deferring blasting. The mines are experimenting with

dust control treatments, including magnesium chloride, surfactants, and petroleum-based products. In addition, WDEQ/AQD may require additional monitoring, action levels based on continuous monitoring, expedited reporting of monitored exceedances, detailed reporting of contributing factors (e.g., meteorological conditions), and continual evaluation of activity plans when exceedances are monitored at surface coal mines.

The WDEQ/AQD is continually reviewing the data and considering regulatory options, such as increasing the frequency of monitoring. Where elevated emissions have occurred, continuous PM_{10} monitors, or TEOMs, are installed, which allows monitoring of emissions on a real-time basis (WDEQ/AQD 2007). Other regulatory options may include enforcement actions such as Notices of Violation resulting in a consent decree and/or modified permit conditions. WDEQ/AQD is also coordinating with EPA to develop additional monitoring requirements in CBNG development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the SIP.

The eastern side of the PRB has one of the most extensive networks of monitoring sites for PM_{10} in the nation. As discussed in Appendix K, the monitors include six TSP monitors, five $PM_{2.5}$ monitors and 36 PM_{10} monitors, including TEOMs. Information about the monitoring network, the data that have been collected and PM_{10} concentration trends since monitoring began are included in Appendix K.

3.4.3 Emissions of Nitrogen Oxides (NO_x)

3.4.3.1 Affected Environment for NO_x Emissions

Gases that contain nitrogen and oxygen in varying amounts are referred to as nitrogen oxides, or NO_x. One type of NO_x is nitrogen dioxide (NO_2), a reddish brown gas that is heavier than air and has a pungent odor. NO_2 is by far the most toxic of several species of NO_x. NO_2 can combine with atmospheric moisture to form nitric acid and nitric oxide. Because several NO_x species can be chemically converted to NO_2 in the atmosphere, NO_2 emissions control is focused on all NO_x species, while the ambient standard is expressed in terms of NO_2.

According to the EPA (EPA 2001a):

- NO_2 may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes, and skin.
- Acute exposure to NO_2 may cause death by damaging the pulmonary system.
- Chronic or repeated exposure to lower concentrations of NO_2 may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections.

Nitrogen oxides form when fuel is burned at high temperatures. They can be formed naturally or by human activities. The primary manmade sources are motor vehicles, electric utilities, and other fuel-burning sources. According to EPA, motor vehicles produce about 55 percent of the manmade NO_x emissions, utilities and industrial/commercial/residential activities each produce about 22 percent of the manmade NO_x emissions, and other sources account for the remaining 1 percent of the manmade emissions (EPA 2007b).

The primary direct source of emissions of nitrogen oxides during coal mining operations is tailpipe emissions from large mining equipment and other vehicle traffic inside the mine permit area. Blasting that is done to remove the material overlying the coal (the overburden) can result in emissions of several products, including NO_2, as a result of the incomplete combustion of nitrogen-based explosives used in the blasting process. When this occurs, gaseous, orange-colored clouds may be formed and they can drift or be blown off mine permit areas. The rate of release is not well known but is believed to be dependent on a wide number of factors which likely include, but are not necessarily limited to: downhole confinement; downhole moisture; type/blend of ammonium nitrate, fuel oil (ANFO), and emulsion; and detonation velocity.

3.4.3.1.1 Site Specific NO_x Emissions

Sources of fugitive NO_x emissions at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines include overburden removal and coal blasting events, tailpipe emissions from the mining equipment, and emissions from the trains used to haul the coal from the mine. NO_x point sources at the mines could include stationary engines and natural-gas fired heaters.

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. The WDEQ has not required the mines to implement any specific measures to control or limit public exposure to NO_2 from blasting.

3.4.3.1.1.1 Belle Ayr North LBA Tract

As discussed in Section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1476) for the Belle Ayr Mine on November 7, 2006, and the mine was required to conduct NO_2 dispersion modeling in their permit. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. The amount of NO_x emissions from blasting is related to the amount of ANFO utilized. NO_x emission rates for 2008 and 2013 are expected to be 1,333 tpy and 1,398 tpy, respectively. NO_x modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Area source, haul road, and point source information for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and information for railroads, roads, power plants, and regional sources provided by

WDEQ/AQD were included in the model. Long-term modeling indicated the currently projected mine activities will be in compliance with the annual NO_x AAQS for the life of the Belle Ayr Mine. For year 2008, the maximum annual NO_x concentration along the Belle Ayr LNCM boundary was 38.5 µg/m^3 and for year 2013, the maximum annual NO_x concentration along the Belle Ayr LNCM boundary was 38.0 µg/m^3 (FCW 2006). Coal production in both years was assumed to be the maximum permitted production level of 45 million tons. The locations of the maximum-modeled NO_x concentrations along the Belle Ayr LNCM boundary for 2008 and 2013 are shown on Figures 3-8 and 3-9, respectively.

3.4.3.1.1.2 West Coal Creek LBA Tract

As discussed in Section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1343) for the Coal Creek Mine on March 30, 2006, and the mine was required to conduct NO_2 dispersion modeling in their permit. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. The amount of NO_x emissions from blasting is related to the amount of ANFO utilized. NO_x emission rates for 2009 and 2016 are expected to be 1,032 tpy and 1,493 tpy, respectively. NO_x modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Area source, haul road, and point source information for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and information for railroads, roads, power plants, and regional sources provided by WDEQ/AQD were included in the model. Long-term modeling indicated the currently projected mine activities will be in compliance with the annual NO_x AAQS for the life of the Coal Creek Mine. For year 2009, the maximum annual NO_x concentration along the Coal Creek LNCM boundary was 29.7 µg/m^3 and for year 2016, the maximum annual NO_x concentration along the Coal Creek LNCM boundary was 31.0 µg/m^3 (TBCC 2007). Coal production in both years was assumed to be the maximum permitted production level of 25 million tons. The locations of the maximum-modeled NO_x concentrations for 2009 and 2016 are shown on Figures 3-11 and 3-12, respectively.

3.4.3.1.1.3 Caballo West LBA Tract

As discussed in Section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1477) for the Caballo Mine on November 7, 2006, and the mine was required to conduct NO_2 dispersion modeling in their permit. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. The amount of NO_x emissions from blasting is related to the amount of ANFO utilized. NO_x emission rates for 2008 and 2014 are expected to be 1,597 tpy and 1,830 tpy, respectively. NO_x modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Area source, haul road, and point source information for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and information for railroads, roads, power plants, and regional sources provided by

WDEQ/AQD were included in the model. Long-term modeling indicated the currently projected mine activities will be in compliance with the annual NO_x AAQS for the life of the Caballo Mine. For year 2008, the maximum annual NO_x concentration along the Caballo LNCM boundary was 46.7 µg/m^3 and for year 2014, the maximum annual NO_x concentration along the Caballo LNCM boundary was 59.8 µg/m^3 (CCC 2006). Coal production in both years was assumed to be the maximum permitted production level of 50 million tons. The locations of the maximum-modeled NO_x concentrations for 2008 and 2014 are shown on Figures 3-14 and 3-15, respectively. The potential NO_x impacts from mining the Caballo West LBA Tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Caballo Mine because of the similarities in mining rates and mining operations.

3.4.3.1.1.4 Maysdorf II LBA Tract

As discussed in Section 3.4.2.2, WDEQ/AQD issued the most recent air quality permit (MD-1058) for the Cordero Rojo Mine on September 17, 2004, and the mine was required to conduct NO_2 dispersion modeling in their permit. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. The amount of NO_x emissions from blasting is related to the amount of ANFO utilized. NO_x emission rates for 2005 and 2007 are expected to be 2,708 tpy and 3,022 tpy, respectively. NO_x modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Only the Cordero Rojo Mine was modeled, regional activity was not considered. No NO_x point sources exist at the mine. Additional area sources and line sources were added to describe the railroad tracks/loops on the Cordero Rojo Mine site. Long-term modeling indicated the currently projected mine activities will be in compliance with the annual NO_x AAQS for the life of the Cordero Rojo Mine. For year 2005, the maximum annual NO_x concentration along the Cordero Rojo LNCM boundary was 50.3 µg/m^3 and for year 2007, the maximum annual NO_x concentration along the Cordero Rojo LNCM boundary was 49.6 µg/m^3 (CMC 1999). Coal production in both years was assumed to be the maximum permitted production level of 65 million tons. The locations of the maximum-modeled NO_x concentrations for 2005 and 2007 are shown on Figures 3-17 and 3-18, respectively. The potential NO_x impacts from mining the Maysdorf LBA Tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Cordero Rojo Mine because of the similarities in mining rates and mining operations.

3.4.3.2 Environmental Consequences Related to Short-Term NO_x Emissions

There are various compounds and derivatives in the family of nitrogen oxides, including NO_2, nitric acid, nitrous oxide, nitrates, and nitric oxide, which may cause a wide variety of health and environmental impacts. According to EPA, the main causes of concern with respect to NO_x are:

- it is one of the main ingredients involved in the formation of ground level ozone, which can trigger serious respiratory problems;
- it reacts to form nitrate particles, acid aerosols, as well as NO_2, which also cause respiratory problems;
- it contributes to the formation of acid rain;
- it contributes to nutrient overload that deteriorates water quality;
- it contributes to atmospheric particles that cause visibility impairment, most noticeably in national parks;
- it reacts to form toxic chemicals;
- Nitrous oxide or N_2O, is a greenhouse gas that contributes to global warming; and
- it can be transported over long distances (EPA 2007c).

Potential health risks associated with inhalation of ground level ozone and NO_x related particles include acute respiratory problems, aggravated asthma, decreases in lung capacity in some healthy adults, inflammation of lung tissue, respiratory-related hospital admissions and emergency room visits, and increased susceptibility to respiratory illnesses, including bronchitis and pneumonia (EPA 2007d).

Neither the EPA nor the WDEQ have established NAAQS for NO_2 for averaging times shorter than one year. According to EPA, "…the exact concentrations at which NO_2 will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response" (EPA 2001a).

While extensive expert testimony was provided to the Wyoming EQC during hearings in 2002 arguing for the establishment of a de facto "standard" ranging from 0.5 to 5.0 ppm for a 10-minute exposure, the EQC determined there was insufficient evidence to establish a short-term exposure limit and concluded additional study was required. The primary control measure for mitigating exposures to offsite residences is to avoid shooting cast blasts when wind direction or atmospheric conditions are unfavorable. Such approaches are employed at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and will be continued to be employed. Studies that have been conducted to evaluate NO_2 exposures from blast clouds in the PRB are described in Appendix K.

Although there is no NAAQS that regulates short-term NO_2 levels, there is concern about the potential health risk associated with short-term exposure to NO_2 from blasting emissions. NIOSH, OSHA, and EPA have identified the following short-term exposure criteria for NO_2:

- NIOSH's recommended Immediately Dangerous to Life and Health level is 20.0 ppm (37,600 $\mu g/m^3$);

- EPA's Significant Harm Level, a 1-hour average, is 2.0 ppm (3,760 µg/m^3);
- OSHA's Short-Term Exposure Limit, a 15-minute time-weighted average, which was developed for workers, is 5.0 ppm (9,400 µg/m^3), which must not be exceeded during any part of the workday, as measured instantaneously);
- NIOSH's recommendation for workers is a limit of 1.0 ppm (1,880 µg/m^3) based on a 15-minute exposure that should not be exceeded at any time during the workday; and
- EPA recommends that concentrations not exceed 0.5 ppm (940 µg/m^3) for a 10-minute exposure to protect sensitive members of the public (EPA 2003a).

Blast clouds are of a short-term, transient nature. While disagreement still exists regarding acceptable exposure levels, a large amount of actual data are now available from which informed decisions can be made regarding blasting practices. The data show clearly that reduction in blast (agent) size and increases in setback distances are effective methods for mitigating the frequency and extent of public exposure to blasting clouds. See Appendix K for additional information about studies that were conducted to evaluate the levels of public exposure to NO_x.

3.4.3.2.1 Proposed Action and Action Alternatives

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would be mined as an integral part of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively. The average annual coal production for each of the four mines is anticipated to remain at the projected post-2007, with or without the LBA tracts. If the mines acquire the additional coal in the LBA tracts, they would continue to produce at the current average rates for a longer period of time.

Potential NO_x emissions related to mining operations at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines are described below. Because of the similarities in mining rates and mining operations, the potential impacts of mining the LBA tracts have been inferred from the projected impacts of mining the existing coal leases as currently permitted.

The WDEQ/AQD has determined that an assessment of annual NO_x impacts must be included as part of an air quality permitting analysis for new surface coal mines and existing mine plans revisions. Pursuant to WDEQ/AQD requirements, emissions from all stationary engines and natural-gas fired heaters, which are considered to be NO_x point sources at the mine, were considered in the inventory. The regional background NO_x annual concentration used was 20 µg/m^3. The Coal Creek Mine used a regional background concentration of 14 µg/m^3. Additional mobile sources were added to describe the railroad locomotives and large mining equipment on each mine site.

3.4.3.2.1.1 Belle Ayr North LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Belle Ayr Mine through August 2007. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.75 miles north of the LBA tract, and three school bus stops are located on the Bishop Road, one within the LBA tract (Figure 3-10).

3.4.3.2.1.2 West Coal Creek LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Coal Creek Mine through August 2007. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.2 miles and 1 mile west of the LBA tract, and two school bus stops are located on the Hoadley Road, approximately 1 mile west of the LBA tract (Figure 3-13).

3.4.3.2.1.3 Caballo West LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Caballo Mine through August 2007. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.6 miles west of the LBA tract, and three school bus stops are located along the Bishop Road, adjacent to the LBA tract (Figure 3-16).

3.4.3.2.1.4 Maysdorf II LBA Tract

There have been no reported events of public exposure to NO_2 from blasting activities at the Cordero Rojo Mine through August 2007. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly

accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately 0.4 miles south of the northern portion of the LBA tract and over 0.5 miles east of the LBA tract, and a school bus stop is located along the Hoadley Road, approximately 1.25 miles south of the LBA tract (Figure 3-19).

The average overburden thickness is generally greater in the LBA tracts than within the current leases, but the thickness of the coal is about the same as in the existing mine areas (Tables 3-1 through 3-4). If the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines acquire the LBA tracts, there are no plans to change blasting procedures or blast sizes associated with the mining of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts. However, if the average annual rates of production are maintained, there would potentially be an increase in the frequency of blasting in order to remove the additional volume of overburden overlying the coal.

One cause of incomplete combustion and formation of NO_2 in the blasting clouds is downhole moisture. Roughly 30 years of surface mining and CBNG development has drawn down the water level in the coal in the general South Gillette analysis area; however, there are discontinuous sand bodies in the overburden, which are generally saturated. The presence of these saturated sand bodies may create conditions that are more favorable to the formation of NO_2 when blasting is conducted; however, as discussed in Section 3.4.3.3, surface coal mine operators have developed various techniques to avoid formation of NO_2 in the blasting clouds. These measures include the use of plastic liners within the shot holes, which reduces or eliminates the exposure of the blasting agents to moisture. The Belle Ayr and Cordero Rojo Mines have utilized plastic liners in shot holes in the past and the mines may need to extend that practice to mining operations on the LBA tracts in order to avoid public exposure to blasting clouds during mining operations.

Specific blasting control measures that are used to control NO_x are discussed in more detail in Section 3.4.3.3. If the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines acquire the LBA tracts, they will have to amend their current permits to include the new leases before mining activities can proceed into the new lease areas. According to WDEQ, permit conditions designed to control or limit public exposure to NO_2 and flyrock from blasting operations would be no less stringent for mining operations on the LBA tracts than the permit conditions that are in place for blasting operations on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases (Emme 2007).

If the applicant mines acquire the LBA tracts, current mining techniques for removing coal and overburden would be expected to continue for a longer period of time than is shown in the currently approved air quality permits. Modeling for the current Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine permits projected

no exceedances of the annual NO_x NAAQS at the permitted production rates. Therefore, air quality impacts that result from mining the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA Tracts by the applicants at their present production rates should also be within annual NAAQS limits.

3.4.3.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would continue to operate as currently permitted. A discussion of the currently permitted mining operations and potential impacts related to NO_x emissions is included in Section 3.4.3.2.1, above. Impacts related to mining operations at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would continue on the existing mine areas as permitted, but mining operations would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.3.3 Regulatory Compliance, Mitigation, and Monitoring for NO_x Emissions

Several of the surface coal mines in the PRB have undertaken voluntary blasting restrictions to avoid NO_x impact to the public. Voluntary measures that have been instituted, particularly when large blasts are planned include:

- telephone notification of neighbors (both private parties and other mining operations) in the general area of the mine prior to large blasts;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a large blast;
- minimizing blast size to the extent possible;
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;
- closing public roads that enter the general mine area, depending on wind conditions and blast location with respect to the road; and
- providing post-blast notification to neighbors of potential exposure to the blasting cloud.

After WDEQ received reports of public exposure to NO_2 from blasting operations at some of the PRB mines prior to 2001, measures to prevent future such incidences were instituted at those mines when large overburden blasts are planned. WDEQ has required several mines, including North Antelope Rochelle, Black Thunder, Belle Ayr, Eagle Butte, and Wyodak (Figure 1-1), to stop traffic on public roads during blasting due to concerns with fly rock and the “startle factor”. Other measures that have been instituted as mine permit requirements include:

- notification of neighbors and workers in the general area of the mine prior to a blast;
- blast detonation between 12:00 p.m. and 3:00 p.m. whenever possible to avoid temperature inversions and minimize inconvenience to neighbors;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a blast;
- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;
- closing public roads when appropriate to protect the public; and
- establishment of safe setback distances for blasting operations from the mine boundary.

The Wyoming EQC has issued orders that address procedures and notification protocols related to providing protections from overburden blasting within PRB mine area. The conditions stated that the specific procedures would be used when overburden blasting occurs within a certain distance residences and businesses adjacent to the mines. Orders have also placed limits of the size of the blasting that can be conducted within the mine areas and restricted blasting in the under certain atmospheric conditions.

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the four mines within the general South Gillette analysis area. The WDEQ has not required the mines to implement any specific measures to control or limit public exposure to NO_2 from blasting, although the mine has voluntarily committed to control blasting emissions. Public access to some of the roads in the area, including the Haight, Hilight, and T-7 Roads, are currently blocked and will continue to be blocked during blasting operations when wind directions or proximity to the road warrant such closure.

Mine operators in the eastern PRB have also been working with blasting agent manufacturers to reduce NO_x emissions. Efforts to eliminate NO_x production have included use of different blasting agents, different blends of blasting agents, different additives, different initiation systems and sequencing, borehole liners, and smaller cast blasts. Operators have tried adding substances like microspheres and rice hulls, using different blends of ANFO and slurries and gels, using electronic detonation systems that can vary shot timing, different shot hole patterns, and using plastic liners within the shot holes. No one single procedure or variation has proven consistently successful due to the numerous factors that are believed to contribute to the production of NO_2. The most successful control measure has been reducing the size of the cast blasting shots (Emme 2003, Chancellor 2003). Using the techniques described above, several mines within the PRB have significantly reduced NO_x production (Chancellor 2003).

NO_2 was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. Table 3-7 summarizes the results of that monitoring.

Table 3-7. Annual Ambient NO_2 Concentration Data.

Site	Gillette, WY	Black Thunder Mine	Belle Ayr Mine	Bill, WY
Year	Percent of Standard[1]	Percent of Standard[1]	Percent of Standard[1]	Percent of Standard[1]
1975	6*			
1976	4*			1*
1977	4*			5*
1978	11*			
1979	11			
1980	12			
1981	14			
1982	11			
1983[2]	17			
1996-97[3]	16	16	22	22

[1] Based on arithmetic averaging of data.
[2] Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
[3] Arithmetic average – actual sampling ran from March 1996 to April 1997.
* Inadequate number of samples for a valid annual average.
Source: (McVehil-Monnett 1997)

Due to public concerns about emissions of nitrogen dioxides as a result of blasting and a general concern of the WDEQ about levels of nitrogen dioxides due to development of all types in the eastern PRB, the coal mining industry instituted a monitoring network in cooperation with WDEQ/AQD to gather data on NO_2 beginning in 2001. Industry funded and operated the network for approximately 3 years. The WDEQ now funds and operates the NO_2 monitoring network along the east side of the basin. Ownership of the monitoring equipment was transferred to WDEQ by the mines and the mines have given ongoing access to the monitoring sites and provide electrical power for the instrumentation. The 2002 through 2007 data from this regional network are summarized in Table 3-8.

Table 3-8. 2002 Through 2007 Annual Mean NO_2 Concentration Data.

Site Address	2002 ($\mu g/m^3$)	2003 ($\mu g/m^3$)	2004 ($\mu g/m^3$)	2005 ($\mu g/m^3$)	2006 ($\mu g/m^3$)	2007 ($\mu g/m^3$)
Thunder Basin National Grassland	5.7	5.7	3.8	3.8	3.8	3.8
Belle Ayr	--	13.2	13.2	15.1	17.0	--
Antelope Mine	--	7.5	7.5	9.4	7.5	--
Campbell County	--	13.2	9.4	7.5	5.7	7.5
Tracy Ranch	--	--	7.5	--	--	--

* Data for May through December 2001. Monitor was not operational until May 2, 2001. Source EPA AIRDATA website

As represented by Table 3-8, NO_2 monitoring data are available from five monitoring sites in the PRB. Two monitoring sites (Thunder Basin National Grassland Site and the Campbell County Site) reported NO_2 values in 2007. With respect to the general South Gillette analysis area, the Thunder Basin National Grassland Site is approximately 41 miles north-northeast and the Campbell County Site is approximately 8 miles west.

These monitoring stations are maintained by WDEQ/AQD and respective mines. The WDEQ/AQD is relying on the on-going monitoring data and emission inventories in air quality permit applications to demonstrate compliance with the annual NO_2 ambient air standard (Table 3-6).

3.4.4 Air Quality Related Values (AQRVs)

AQRVs are evaluated by the land management agency responsible for a Class I area, according to the agency's level of acceptable change (LAC). These AQRVs include potential air pollutant effects on visibility and the acidification of lakes and streams. The AQRVs, and the associated LAC, are applied to PSD Class I and sensitive Class II areas and are the land management agency's policy and are not legally enforceable as a standard.

3.4.4.1 Visibility

Visibility refers to the clarity with which scenic vistas and landscape features are perceived at great distances. Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Without the effects of human-caused air pollution, a natural visual range is estimated to be about 140 miles in the western U.S. and 90 miles in the eastern U.S. (EPA 2001b).

Visibility is also expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA's Regional Haze Rule to achieve the National Visibility Goal. The National Visibility Goal was established as part of the CAA in order to prevent any future, and remedy any existing, impairment of visibility in mandatory Federal Class I areas that result from manmade air pollution. The deciview index is a scale related to visual perception that has a value near zero for a pristine atmosphere. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment.

3.4.4.1.1 Affected Environment for Visibility

AQRVs, including the potential air pollutant effects on visibility, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets an LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Table 3-9 shows the distances from 31 PSD Class I and Class II areas in the vicinity of the PRB to the general South Gillette analysis area.

The *Wyoming State Implementation Plan for Class I Visibility Protection* states: "Wyoming's long term strategy will focus on the prevention of any future visibility impairment in Class I areas that can be attributed to a source or small group of sources as the Federal Land Managers have not identified any current impairment in the State's Class I areas due to such sources" (WDEQ/AQD 2005b). WDEQ/AQD prepared the *2003 Review Report on Wyoming's Long Term Strategy for Visibility Protection in Class I Areas*, as required by WAQSR, which calls for AQD to review and revise, if appropriate, the Long Term Strategy every 3 years. The 2003 Review Report is available on the WDEQ/AQD website at <http://deq.state.wy.us/aqd/visibility.asp>.

The Regional Haze Rule calls for improved visibility on the most-impaired days and no additional impairment on the least-impaired days. EPA participates in the IMPROVE visibility monitoring program as part of its visibility protection program. The IMPROVE monitoring sites were established to be representative of all Class I areas. On December 20, 2005, the IMPROVE Steering Committee approved a new algorithm for calculating current and natural background visibility. Figure 3-20 shows annual averages, based on the new algorithm, for the 20 percent best, average, and worst visibility days at Badlands and Bridger Wilderness Areas from 1989 through 2005 (IMPROVE 2007). To date, Badlands National Park has shown a trend toward improved visibility on the least, average, and most-impaired days. Bridger Wilderness has shown a trend toward improved visibility on the average and least-impaired days and no change in visibility on the most-impaired days.

3.4.4.1.2 Environmental Consequences for Visibility

3.4.4.1.2.1 Proposed Action and Action Alternatives

The impacts to visibility from mining the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts have been inferred from the currently permitted impacts of mining the existing coal leases at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively. The LBA tracts would be mined as an integral part of the applicant mines. The average annual coal production for each mine is anticipated to remain at the projected post-2007 rates, with or without the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tract. Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines coal production and currently approved air quality permitted tons are shown in Tables 2-1

Table 3-9. Approximate Distances and Directions from the General South Gillette Analysis Area to PSD Class I and Class II Sensitive Receptor Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I Area		
Badlands Wilderness Area[1]	147	E
Bridger Wilderness Area	206	WSW
Fitzpatrick Wilderness Area	208	WSW
Gates of the Mountain Wilderness Area	364	NW
Grand Teton National Park	256	W
North Absaroka Wilderness Area	202	WNW
Red Rocks Lake Wilderness Area	312	W
Scapegoat Wilderness Area	408	WNW
Teton Wilderness Area	215	W
Theodore Roosevelt National Park (North Unit)	266	NNE
Theodore Roosevelt National Park (South Unit)	218	NNE
U.L. Bend Wilderness Area	264	NNW
Washakie Wilderness Area	183	W
Wind Cave National Park	98	ESE
Yellowstone National Park	224	WNW
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	275	N
Northern Cheyenne Indian Reservation	108	NNW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	210	WNW
Agate Fossil Beds National Monument	137	SE
Badlands National Park	127	ESE
Bighorn Canyon National Recreation Area	150	WNW
Black Elk Wilderness Area	91	E
Cloud Peak Wilderness Area	81	W
Crow Indian Reservation	103	NW
Devils Tower National Monument	50	NE
Fort Belknap Indian Reservation	302	NNW
Fort Laramie National Historic Site	134	SSE
Jewel Cave National Monument	80	ESE
Mount Rushmore National Memorial	96	E
Popo Agie Wilderness Area	201	WSW
Soldier Creek Wilderness Area	126	SE

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

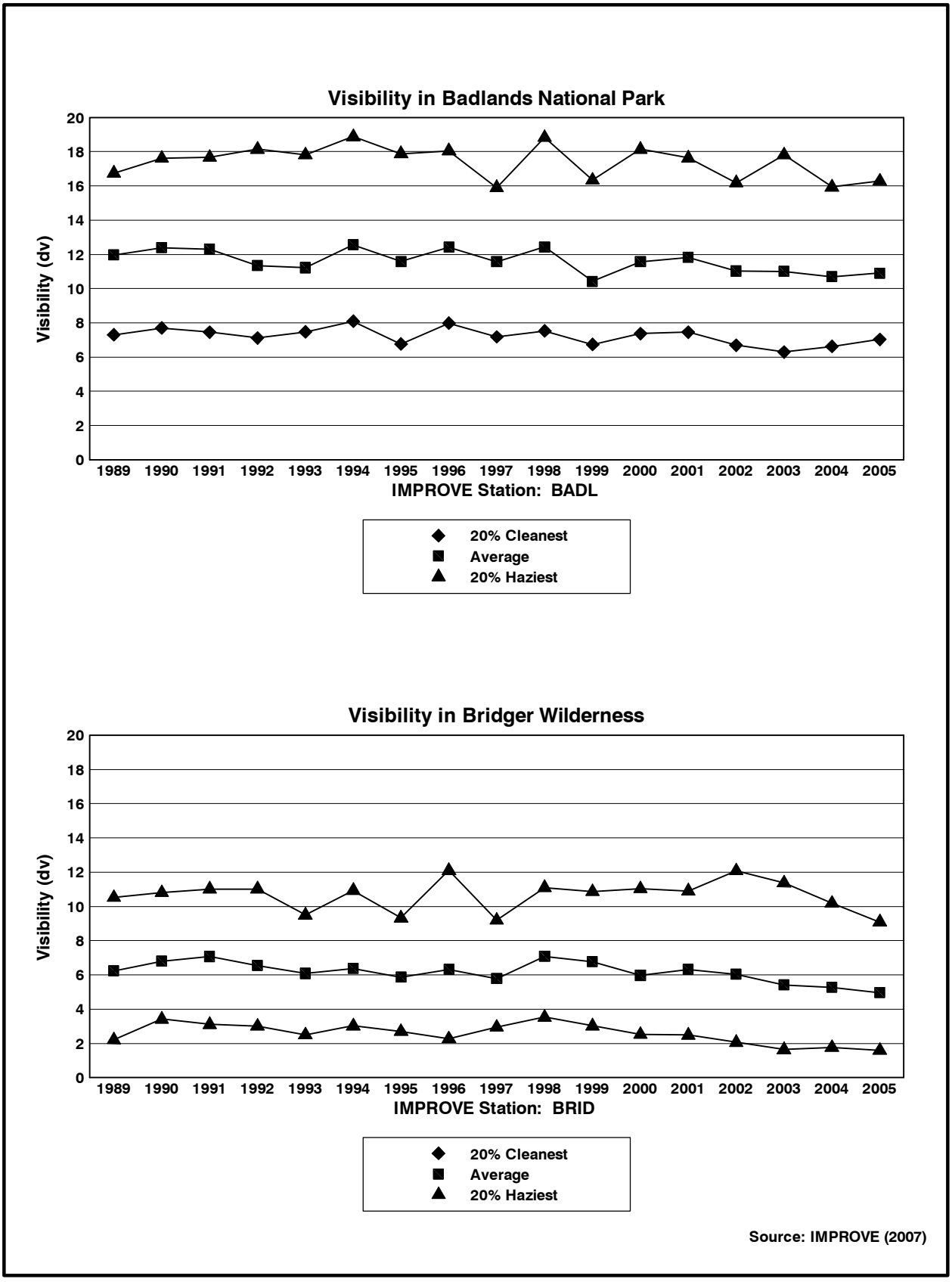

Figure 3-20. Visibility in the Badlands and Bridger Wilderness Area.

through 2-4, respectively. If the mines acquire the additional coal in the LBA tracts, they would continue to produce at existing rates for a longer period of time (2 to 10 years). Therefore, impacts to visibility under the Proposed Action and Action Alternatives for each tract would be similar to the impacts under the No Action Alternative, but they would be extended by 2 to 10 years.

Mining operations using the current Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mining techniques for blasting, coal removal, and coal hauling, etc. would be expected to continue for a longer period of time than is shown in the currently approved air quality permits. Material movement would continue to utilize draglines and shovels and trucks in overburden and coal. Facilities shown in the current air quality permits would not change as a result of proposed mining of the LBA tracts. There are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tracts; however, the blasting processes and required mitigation measures would be reviewed when the mining permits are amended to include the new lease areas. At that time, the blasting plans would be reviewed and modified to incorporate the BACT protection measures that are in effect.

Surface coal mines are not considered to be major emitting facilities in accordance with Chapter 6, Section 4 of WDEQ/AQD Rules and Regulations. Therefore, the State of Wyoming does not require mines to evaluate their impacts on Class I areas; however, BLM considers such issues during leasing.

3.4.4.1.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would continue to operate as currently permitted for about 8, 16, 15, and 11 more years, respectively. Coal removal would not occur on the LBA tracts. Impacts to visibility related to mining operations at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.4.1.3 Regulatory Compliance, Mitigation and Monitoring for Visibility Impacts

As discussed above, fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Mitigation measures being used to limit emissions of particulate matter are discussed in Section 3.4.2.3.

Visibility monitoring within the State of Wyoming consists of both the WDEQ/AQD sponsored Wyoming Visibility Monitoring Network and the IMPROVE program. WDEQ has sited two visibility monitoring stations in the PRB. One of these sites (the Thunder Basin National Grasslands site) is 32 miles north of Gillette and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure ozone and instruments to measure oxides of nitrogen (NO, NO_2, NO_x). The second visibility monitoring station (the Cloud Peak Wilderness Area site) is located 14 miles west of Buffalo and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters, and a digital camera.

These sites are being utilized to characterize the extent, frequency of occurrence, and magnitude of visual air quality impacts. The IMPROVE Steering Committee approved the incorporation of the Thunder Basin and Cloud Peak sites into the IMPROVE network in June 2002. Although these stations are not located in areas classified as Class I areas, the collected data will be comparable to monitoring data available from the state's Class I areas. This information can help scientists determine the types and concentrations of air pollutants and their direction of travel in order to project visibility impacts to Class I areas. The Wyoming Visibility Monitoring Network was recently supplemented with the development of a website (http://www.wyvisnet.com/all.html) to allow public access to real-time monitored visibility and air quality conditions (WDEQ/AQD 2005a).

3.4.4.2 Acidification of Lakes

Atmospheric deposition of pollutants (acid rain) causes acidification of lakes and streams. According to EPA, sulfur dioxide and NO_x, primarily derived from the burning of fossil fuels, are the primary causes of acid rain. Most lakes and streams have a pH between 6 and 8. Some lakes are more easily affected by, and therefore more sensitive to, acid rain than others. The response of lakes to acid rain is described in terms of changes to acid-neutralizing capacity, or ANC. The lake is the sensitive resource and ANC is the indicator. ANC is a measure of buffering capacity, measured in microequivalents per liter (μeq/L), which indicates the lake's capacity to resist acidification from acid rain. Lakes and streams become more acidic (i.e., the pH value of the water in the lake goes down) when the water itself and its surrounding soil cannot buffer the acid rain enough to neutralize it. The more sensitive lakes are generally located in watersheds whose soils have a limited ability to neutralize acidic compounds (a lower buffering capacity). In areas where buffering capacity is low, acid rain also releases aluminum from soils into lakes and streams; aluminum is highly toxic to many species of aquatic organisms.

Several regions in the U.S. were identified in a national surface water survey as containing many of the surface waters sensitive to acidification. They include the Adirondacks and Catskill Mountains in New York State, the mid-Appalachian

highlands along the east coast, the upper Midwest, and mountainous areas of the western U.S.

Scientists predict that the decrease in SO_2 emissions required by the Acid Rain Program will significantly reduce acidification due to atmospheric sulfur. Without the reductions in SO_2 emissions, the proportions of acidic aquatic ecosystems would remain high or dramatically worsen (EPA 2005c). The USDA-FS has been monitoring air quality in the Wind River Mountain Range in Wyoming since 1984 and is seeing a general trend of decreasing sulfates. Nitrates, on the other hand, have been increasing globally.

3.4.4.2.1 Affected Environment

AQRVs, including the potential air pollutant effects on the acidification of lakes and streams, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets a LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Lake acidification is expressed as the change in ANC measured in microequivalents per liter (µeq/L), the lake's capacity to resist acidification from acid rain. Table 3-10 shows the existing ANC monitored in some mountain lakes and their distance from the general South Gillette analysis area.

Table 3-10. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	Lake	Background ANC (µeq/L)	Distance from General South Gillette Analysis Area (miles)
Bridger	BlackJoe	69.0	240
	Deep	61.0	230
	Hobbs	68.0	245
	Upper Frozen	5.8[1]	250
Cloud Peak	Emerald	55.3	105
	Florence	32.7	95
Fitzpatrick	Ross	61.4	240
Popo Agie	Lower Saddlebag	55.5	230

[1] The background ANC is based on only six samples taken between 1997 and 2001.
Source: Argonne (2002)

3.4.4.2.2 Environmental Consequences

3.4.4.2.2.1 Proposed Action and Action Alternatives

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tract would be mined as an integral part of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively; therefore, the impacts to air quality from mining the LBA tracts have been inferred from the impacts at the currently permitted

mining operations. The applicant mines anticipate that coal production would remain unchanged from projected post-2007 levels if the LBA tracts are acquired.

Impacts to air quality related to lake acidification under the Proposed Actions and other action alternatives for each tract would be similar to the impacts under the No Action Alternative, but they would be extended from 2 to 10 years. Therefore, current mining techniques (i.e., haulage, blasting, etc.) would be expected to continue for longer period of time than is shown in the currently approved air quality permit for each applicant mine. Additional information about the air quality associated with the LBA tracts is included in the supplemental information document, which is available on request.

3.4.4.2.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would continue to operate as currently permitted for about 8, 16, 15, and 11 more years, respectively. Coal removal would not occur on the LBA tracts. Lake acidification impacts related to mining operations at the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would not be extended onto those portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications at this time would not preclude an application to lease the tracts in the future.

3.4.4.2.3 Regulatory Compliance, Mitigation, and Monitoring

Mitigation and monitoring for coal mine emissions, including the emissions that contribute to the acidification of lakes, are discussed in Sections 3.4.2.3, 3.4.2.4., 3.4.3.3, and 3.4.3.4. Other air quality monitoring programs that are in place in the PRB include WARMS monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and NADP monitoring of precipitation chemistry in Newcastle.

3.4.5 Residual Impacts to Air Quality

No residual impacts to air quality would occur following mining and reclamation.

3.5 Water Resources

3.5.1 Groundwater

3.5.1.1 Affected Environment

The general South Gillette analysis area contains three water-bearing geologic units that have been directly affected by existing mining activities and would be directly affected by mining the four LBA tracts. In descending order, these units are the recent alluvium, the Wasatch Formation overburden, and the mineable coal seam in the Tongue River Member of the Fort Union Formation, which is referred to as the Wyodak or Wyodak-Anderson. The underlying, sub-coal Fort Union Formation, the Lance Formation, and the Fox Hills Sandstone are utilized for water supply at the four coal mines within the general South Gillette analysis area, but these units are not physically disturbed by mining activities. Both regional and site-specific baseline hydrogeologic environments within and around the general South Gillette analysis area are extensively characterized in the WDEQ/LQD mining and reclamation permits for the four applicant mines included in this analysis (CCC 2003, FCW 2003, CMC 2007a, and TBCC 2006). Figure 3-2 presents the hydrostratigraphic units underlying the general South Gillette analysis area.

3.5.1.1.1 Recent Alluvium

Within the general South Gillette analysis area, alluvial (unconsolidated stream laid) deposits are present and primarily occupy the valleys of the larger drainages, namely the Belle Fourche River, Coal Creek, Caballo Creek, Duck Nest Creek, and Tisdale Creek. Less extensive deposits of alluvium are also found along the lower reaches of draws that are tributary to these major streams. Colluvial and playa deposits associated with other minor surface drainages within the general South Gillette analysis area are generally very thin and not laterally extensive enough to be considered aquifers.

Within the Belle Ayr North LBA Tract, alluvial deposits are associated with Duck Nest Creek, an ephemeral tributary of Caballo Creek. The alluvial deposits consist of intermixed fine-grained sands, silts, and clays. The surficial deposits adjacent to the alluvium consist of fan and sheetwash materials where the terrain is nearly flat. The textures of these deposits are similar, making the outer edge of alluvial deposits difficult to distinguish. Thickness of alluvial deposits along Duck Nest Creek varies from 0 to approximately 20 feet, and is typically around 10 to 15 feet. The alluvium's saturated thickness averages about 10 feet, and alluvial groundwater flow is downvalley. Duck Nest Creek alluvium is recharged by streamflow, water in the channel impoundments, and groundwater discharged from a bedrock source that underlies the alluvial deposits. The overburden groundwater discharge rate was estimated by FCW to be less than 0.1 acre-feet per year, which is only enough to create a marshy area with some small shallow

pools of stagnant water. Patches of thick alkali crust is present around the edges of the pools and on the soil surface in this marshy area, which is referred to as the "saline seeps". The saline seeps were located near the southern edge of the Belle Ayr North LBA Tract, but were disturbed by the currently permitted mining operation in 2006 and are no longer present. Groundwater yields measured by FCW at some Duck Nest Creek alluvial monitoring wells are very low, ranging from 0 to 3 gallons per minute (gpm). Aquifer testing indicates that the Duck Nest Creek alluvial aquifer has a very low hydraulic conductivity (ranging from about 0.05 – 0.35 ft/day).

Duck Nest Creek alluvial groundwater quality is highly variable spatially and poor to very poor. In the saline seeps area, the TDS concentration ranges from roughly 3,800 mg/L to over 51,000 mg/L. The alluvial groundwater type is generally a magnesium or sodium sulfate, with the sulfate concentration averaging over 25,000 mg/L and ranging up to almost 33,000 mg/L. Both TDS and sulfate concentrations are well over the maximum allowed in any WDEQ/WQD use classification (WDEQ/WQD 2005). Discharge from underlying bedrock (Wasatch Formation overburden) units in the saline seeps area contributes to the poor alluvial water quality. Alluvial groundwater quality upstream of the saline seeps area, within the LBA tract, is somewhat better but still poor and does not meet WDEQ/WQD standards for any use classification. The TDS concentration is generally around 20,000 mg/L to 25,000 mg/L, the sulfate concentration ranges from approximately 12,500 mg/L to over 15,000 mg/L, and the SAR values are high, ranging from 17.6 to 19.8.

Within the West Coal Creek LBA Tract, alluvial deposits are associated with Coal Creek, an ephemeral tributary of the Belle Fourche River. These unconsolidated stream laid deposits consist of intermixed fine-grained sands, silts, and clays, and range from 10 to 25 feet thick. Saturated thicknesses range from 0 to a maximum of approximately 15 feet at the confluence of East Fork Coal Creek and Middle Fork Coal Creek. Field aquifer tests indicated that the Coal Creek alluvium has a very low hydraulic conductivity, ranging from nearly 0 to 2.35 ft/day. Due to its limited areal extent, limited saturated thickness, and low hydraulic conductivity, Coal Creek alluvium does not consistently produce enough water to be put to beneficial use. In addition, Coal Creek alluvial groundwater is generally poor quality and does not meet WDEQ/WQD standards for domestic and agricultural uses, and is marginal for livestock and wildlife use.

Within the Caballo West LBA Tract, alluvial deposits are associated with Tisdale Creek, an ephemeral tributary of Caballo Creek. The Tisdale Creek alluvial deposits are typified by both lateral and vertical heterogeneity and are generally comprised of gravels, coarse- to fine-grained sands, and local lenses of silty, commonly organic-rich clays. Alluvial materials presently being deposited by fluvial processes along Tisdale Creek are clayey and heavy-textured. The thickness of Tisdale Creek alluvial deposits within the LBA tract average approximately 12 feet, and the saturated thickness varies from almost 0 to more

than 10 feet, and is greatest near the stream channel. Tisdale Creek alluvial monitor well water levels indicate that alluvial groundwater progresses down-valley under a hydraulic gradient similar to that of the valley profile. Recharge to the alluvium is from direct precipitation, streamflow infiltration, and groundwater contributions from underlying bedrock (Wasatch Formation overburden). The water table geometry near the stream suggests that the stream generally loses water to the alluvium, but may gain water depending on the season and extent of saturation in the alluvium. Like the adjacent Duck Nest Creek, Tisdale Creek alluvial groundwater quality is poor, with a mean TDS concentration ranging from approximately 4,900 mg/L to 36,000 mg/L. Due to the high salinity, Tisdale Creek alluvial groundwater is considered unsuitable for domestic and irrigation uses, and is marginal in some areas for livestock and wildlife use. The low hydraulic conductivities and limited areal extent of saturation indicate that the alluvium does not exhibit aquifer characteristics adequate for producing groundwater in sufficient quantities for agricultural or domestic uses. There is currently no known use of alluvial groundwater in or near the Caballo West LBA Tract.

Within the Maysdorf II LBA Tract, alluvial deposits are found primarily within the Belle Fourche River valley. The alluvium consists of recent stream channel deposits and topographically higher terrace deposits that predate the recent deposition. The recent deposits and the lower terrace deposits are typified by both lateral and vertical heterogeneity and are generally comprised of gravels, coarse- to fine-grained sands, and local lenses of silty, commonly organic-rich clays. The upper-most terrace is comprised predominately of relatively homogeneous sandy silts and clays overlying basal gravel deposits. The alluvial materials presently being deposited by the stream are clayey and heavy-textured. The thickness of Belle Fourche River alluvial deposits varies from absent where bedrock is exposed in the stream channel to more than 40 feet. Saturated alluvium along the Belle Fourche varies from absent (dry from land surface to the top of the underlying Wasatch Formation) to more than 10 feet thick, and is greatest near the stream channel. Field and laboratory aquifer tests indicate that the Belle Fourche River alluvium has very low productivity and low hydraulic conductivity. Alluvial monitor well water levels recorded by the Cordero Rojo Mine indicate that alluvial groundwater flows down-valley, and exhibits a hydraulic gradient similar to that of the valley profile. Recharge to the alluvium is from direct precipitation, stream flow infiltration, and adjacent upland overburden areas. In general, the groundwater quality in the saturated Belle Fourche River alluvium within the LBA tract is poor, with a total dissolved solids (TDS) concentration averaging around 4,100 milligrams per liter (mg/L) and the water type is characterized as a sodium/calcium-sulfate.

Due to the high salinity, Belle Fourche River alluvial groundwater is considered unsuitable for domestic consumption and irrigation, and marginal for livestock and wildlife use. The alluvial groundwater quality is similar to that of the underlying Wasatch Formation. The low hydraulic conductivities and limited

areal extent of saturation indicate that the Belle Fourche River alluvium does not exhibit aquifer characteristics adequate for agricultural or domestic uses. There is currently no known use of alluvial groundwater in or near the Maysdorf II LBA Tract.

3.5.1.1.2 Wasatch Formation

Within the PRB, the Wasatch Formation (the strata lying above the mineable coal, also called the overburden) consists of various non-marine, fluvial and aeolian deposits of interbedded sands, silts, and clays with occasional discontinuous deposits of coal and carbonaceous material. The Wasatch strata range in cohesion from unconsolidated (i.e., loose sands and silts) to lithified (i.e., sandstones, siltstones, shales, and coal stringers). Any of the deposits may be water bearing, although the sands and sandstones possess a greater, but laterally limited, potential for groundwater yield. These sands are generally discontinuous and separated laterally and vertically by fine-grained deposits. This basic description generally holds true for all of the general South Gillette analysis area.

The discontinuous nature of the sediments produces considerable variability in the occurrence of groundwater in the overburden both laterally and vertically. The hydraulic connection between water-bearing units is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. Due to the discontinuous nature of the permeable overburden sediments, premine overburden groundwater movement generally follows the topography. Because the water-bearing units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer. However, Wasatch sands and sandstones do provide limited amounts of groundwater for livestock and domestic uses on a local scale, provided the water quality is suitable. Channel-like deposits of unconsolidated sand (paleochannel sands) with up to about 60 feet of saturation occasionally occur in the Wasatch overburden, and wells developed in these sands may individually yield up to 50 gpm. Paleochannels are typically less than 500 feet wide and are isolated laterally and vertically by silt and clay deposits of very low permeabilities.

Another geologic unit that may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of sediments that were baked, fused, and melted in place when the underlying coal burned spontaneously. These burned sediments collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. The occurrence of scoria is site specific, typically occurring in areas where coal seams crop out at the surface. The hydrologic function of scoria includes providing infiltration of precipitation and recharge to laterally contiguous overburden and coal beds. The West Coal Creek LBA Tract is the only tract in the general South Gillette analysis area that contains scoria deposits; however, they are isolated and not extensive or saturated enough to be considered an aquifer or a source of recharge.

Recharge to the Wasatch Formation is from the infiltration of precipitation, infiltration of surface water stored in playas and in-channel reservoirs, and lateral movement of water from adjacent scoria bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, by drainage into mine excavations, and by seepage into the alluvium along stream courses. Overburden groundwater is not generally connected to the underlying Wyodak coal seam due to a low-permeability stratum at the base of the overburden, which is fairly widespread in the general South Gillette analysis area. However, there is likely some leakage between the aquifers that provides vertical recharge to the coal aquifer.

For the Wasatch Formation as a whole in the PRB, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well. Martin et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^{-4} ft/day to 10^{2} ft/day, and the geometric mean hydraulic conductivity based on 203 tests was 0.2 ft/day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 ft/day, while that from 63 aquifer tests using wells completed in siltstone and claystone in the Wasatch overburden was 0.007 ft/day (Rehm et al. 1980). Field aquifer tests conducted in the general South Gillette analysis area by the four applicant mines indicate that the water-bearing Wasatch overburden strata typically have a low hydraulic conductivity, ranging from 0.004 ft/day to 78.0 ft/day, and verify that the overburden sand bodies are isolated hydraulically from one another.

The quality of groundwater in the Wasatch Formation is extremely variable and generally poor. In the general South Gillette analysis area, TDS concentrations range from 525 mg/L to 13,000 mg/L and the water type is typically a calcium-sulfate, magnesium-sulfate, or a sodium-sulfate. The median TDS for the Wasatch Formation for the group of mines located between Gillette and Wright, as calculated by WDEQ/LQD based on 1,109 samples, is 2,996 mg/L (Ogle et al. 2005). Overburden groundwater is generally considered to be unsuitable for domestic consumption and irrigation use, but is suitable for livestock and wildlife use.

3.5.1.1.3 Wyodak/Wyodak-Anderson Coal

The Tongue River Member of the Fort Union Formation contains the mineable coal zone, which is often divided by partings that separate it into two or more units. The mineable coal zones are variously referred to as the Anderson and Canyon, Roland and Smith, Wyodak-Anderson, Upper and Lower Wyodak, or Wyodak seams. A general discussion of the coal seam aquifer is presented as follows.

Due to its continuity, the Wyodak coal seam is considered a regional aquifer because it is water bearing and is laterally continuous throughout the area.

Historically, the Fort Union coal seams have been a source of groundwater for domestic and livestock uses in the eastern PRB. However, due to the 1 to 3 degree west-northwest dip of the coal beds, the coal generally becomes too deep to be an economical source of water within a couple of miles west of the PRB surface coal mines.

Hydraulic conductivity within the Wyodak coal seam is highly variable and reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. Field aquifer tests indicate that the coal has a low to moderate transmissivity with a range of roughly three orders of magnitude. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, are created by the expansion of the coal as the weight of overlying sediments is slowly removed by erosion. Localized zones of moderately high transmissivity occur due to increased fracturing, and the highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as "lineaments". Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only. Such increased aquifer transmissivity occurs west of the Cordero Rojo Mine area, and is attributed to structural development that has produced additional fracturing.

Field aquifer tests conducted in the general South Gillette analysis area by the four applicant mines indicate that the coal aquifer is non-homogeneous and generally low in transmissivity with some local areas of high transmissivity. Hydraulic conductivity values reported by the four applicant mines in the general South Gillette analysis area for the Wyodak/Wyodak-Anderson coal seam ranges from 0.008 ft/day to 66.7 ft/day, with means ranging from approximately 4.0 ft/day to 14.0 ft/day. Storage coefficients measured within and around the general South Gillette analysis area range from 10^{-3} to 10^{-4}, indicative of a confined aquifer.

Recharge to the coal occurs principally by infiltration of precipitation in the clinker outcrop areas along the flank of the eastern Powder River structural basin. Secondary vertical recharge from the overburden also occurs, but is highly variable. Prior to mining, the direction of groundwater flow within the areally continuous coal aquifer was generally from recharge areas at the coal seam's outcrop westward into the PRB, following the dip of the coal. Groundwater conditions varied from unconfined to confined, depending on the coal elevation and proximity to the outcrop area. Water levels were generally above the top of the coal away from the outcrop.

Site-specific water-level data collected from coal monitoring wells by mining companies and the BLM in the general South Gillette analysis area and presented in the GAGMO 25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near active mining areas prior to 1997 were likely due to mine dewatering alone and the groundwater flow direction within the coal aquifer was typically toward the mine pits. By year 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development. Roughly 30 years of surface mining and the more recent CBNG development has resulted in complete dewatering of the coal aquifer in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

Coal groundwater is typically only suitable for livestock and wildlife watering purposes because certain constituent concentrations commonly exceed many suitability criteria for domestic uses, and the water may have a high salinity and sodium hazard, which makes it unsuitable for agricultural uses. Within the general South Gillette analysis area, Wyodak coal groundwater quality is generally poor, but exhibits lower TDS concentrations than alluvial or overburden groundwater. The composition of groundwater in the coal is fairly uniform and there are no seasonal or long-term trends in composition. The composition of groundwater in the coal is generally characterized as a calcium/magnesium-sulfate type near the scoria outcrop recharge areas and transitions to a sodium-bicarbonate type as the groundwater moves downgradient. In the general South Gillette analysis area, TDS concentrations range from 442 mg/L to 4,400 mg/L, with averages reported by the four applicant mines ranging from approximately 950 mg/L to 1,700 mg/L. This compares to a median TDS of 920 mg/L calculated by the WDEQ/LQD for the Belle Aye Mine and adjacent mines, based on 1,200 samples collected from the coal aquifer (Ogle et al. 2005).

3.5.1.1.4 Subcoal Fort Union Formation

The Fort Union Formation is divided into three members, which are, in descending order: the Tongue River Member, the Lebo Member, and the Tullock Member. The mineable coal seams occur within the Tongue River Member. The subcoal Fort Union Formation consists primarily of lithified sands and shales, and is divided into three hydrogeologic units: the upper Tongue River aquifer, the Lebo confining

layer, and the Tullock aquifer (Law 1976). Of the three units, the Tullock is the most prolific in terms of groundwater yield.

Mining does not directly disturb the hydrogeologic units below the mineable coal, but many PRB mines use them for industrial water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBNG development (BLM 2001). The upper Tongue River aquifer consists of lenticular, fine-grained sandstone interbedded with mudstone. The Lebo confining layer is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Lebo confining layer typically separates the Tongue River and Tullock aquifers hydraulically. The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone.

Transmissivity is equal to an aquifer's hydraulic conductivity, or permeability, times the aquifer's saturated thickness, and is commonly used when discussing the hydraulic properties of the subcoal Fort Union Formation where wells are completed by exposing many discrete sand lenses to the well bore. Transmissivities are generally higher in the deeper Tullock aquifer than in the shallower Tongue River aquifer, and many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988). The City of Gillette also utilizes the Tullock aquifer to meet part of its municipal water requirements. The average transmissivity for the Tullock, as reported by OSM (1984), is 290 ft^2/day. The four applicant mines located within the general South Gillette analysis area use a total of eight wells completed in the subcoal Fort Union Formation for water supply, and they range in depth from approximately 850 feet to 2,487 feet.

The water quality of the subcoal Fort Union Formation is generally good. TDS concentrations measured in various subcoal Fort Union Formation water supply wells in the eastern PRB range from 230 mg/L to 520 mg/L. Water from the subcoal Fort Union Formation is typically of the sodium-bicarbonate type. This water is generally suitable for livestock and wildlife watering and may be suitable for domestic use. Depending upon site-specific TDS concentrations and SAR values, groundwater from Fort Union Formation supply wells may also be suitable for irrigation.

3.5.1.1.5 Lance Formation-Fox Hills Sandstone

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. The Lance Formation is comprised of an upper confining layer and a lower aquifer. Individual sandstone beds of the lower aquifer sequence are up to about 100 feet thick, are fine-grained, and contain variable amounts of interbedded clay and silt. The Fox Hills Sandstone underlies the Lance Formation and is usually difficult to distinguish from the Lance. The Fox Hills is described as a well-developed, fine- to medium-grained, marine sandstone that contains thin beds of sandy shale and

probably averages around 250 feet thick beneath the general South Gillette analysis area.

The Caballo and Cordero Rojo mines each have one industrial water supply well completed in the Fox Hills Sandstone, while two industrial water supply wells within Belle Ayr Mine's existing permit area are completed in the Lance/Fox Hills aquifer. These wells are all around 4,000 feet deep. The City of Gillette also utilizes the Lance/Fox Hills aquifer to meet part of its municipal water requirements, as do the Wyodak Power Plant and various other eastern PRB surface coal mines. The quality of groundwater from the Lance/Fox Hills aquifer is generally good enough to meet the standards for domestic use, depending upon the concentrations of TDS and various constituents such as fluoride. Sodium and bicarbonate are typically the predominant ionic constituents.

3.5.1.2 Environmental Consequences

3.5.1.2.1 Proposed Action and Action Alternatives

Surface coal mining impacts the quantity of the groundwater resource in two ways: 1) the coal aquifer and any aquifers present in the overburden are removed from the mined areas during mining and replaced with unconsolidated backfill after the coal is removed, and 2) water levels in the coal and overburden aquifers adjacent to the mine pits are depressed as a result of seepage into and dewatering from the open excavations in the area of coal and overburden removal.

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are leased under the Proposed Actions or Action Alternatives and mined, the overall regional extent of coal removal and reclamation would increase, along with a potential increase in the extent of mining-related impacts to groundwater quantity. As mining expands, additional water-bearing bedrock strata would be exposed and groundwater would drain by gravity into the active pits. The overburden and coal aquifers within the tracts would be completely dewatered and removed, and the area of drawdown caused by overburden and coal removal would be extended further to the west of the active mine areas. However, the amount and extent of additional drawdown may not be great, as current drawdown associated with mining the existing leases combined with drawdown associated with CBNG development has nearly dewatered the coal aquifer within and immediately west of the general South Gillette analysis area.

Currently approved mining will continue to remove the Wasatch Formation overburden, Fort Union Formation interburden (where present), and coal on the existing leases at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines and replace these stratified units with backfill material composed of an unlayered mixture of the shale, siltstone, and sandstone that makes up the existing Wasatch Formation overburden and Fort Union Formation interburden. The existing leases currently include approximately 39,346.6 acres. Mining each of the LBA tracts as

maintenance leases would extend the area of overburden and coal removal by about 11,886.9 acres under the Proposed Action up to about 12,464.8 acres under the Action Alternatives.

The 25-year Gillette Area Groundwater Monitoring Organization (GAGMO) Report (Hydro-Engineering 2007) presents drawdowns that have developed in the last 25 years as a result of coal mining activity or other stresses to the groundwater system. The 25-year drawdown map for the general South Gillette analysis area is included within the 25-year GAGMO Report, and it shows a continuous cone of depression exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their proximity to each other and due to the large drawdowns caused to the west by CBNG development. Hydro-Engineering (2007) states that the extent of drawdown caused by mining alone to the west of the mines can no longer be defined due to the much larger drawdown caused by CBNG development. Drawdowns to the west of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines are very large, mainly due to the discharge of groundwater from the Wyodak coal aquifer that is associated with the production of CBNG. Greater drawdowns exist west of these mines than near their present western boundaries. The present drawdown of the Wyodak coal potentiometric surface has made the comparison between the 25-year drawdowns and the modeled groundwater drawdown predictions using the conservative, worst-case scenario for each mine to be unrealistic. Drawdowns in all areas have greatly increased in the last few years due to water production from the coal aquifer by CBNG production. Potential overlapping impacts of the existing mining activities with other proposed activities are addressed further in Chapter 4 of this EIS.

Due to the inconsistent lithologic makeup of the Wasatch Formation overburden (discontinuous sandstone and sand lenses in a matrix of siltstone and shale), drawdowns in the overburden are variable and do not extend great distances from the active mine pits. Due to the varied nature of the water-bearing units within the Wasatch Formation overburden, the extent of water level drawdowns are variable as well. Water level drawdowns propagate much farther and in a more consistent manner in the coal seam aquifers than in the overburden due to the regional continuity and higher transmissivity of the coal seam. Drawdowns in the coal seam are primarily a function of distance from the pit, although geologic and hydrologic barriers and boundaries such as crop lines, fracture zones, and recharge sources can also influence drawdowns. As discussed below, each mine evaluated groundwater level drawdowns resulting from their existing operations based on site-specific characteristics such as hydraulic conductivity, mining sequence, and local geology. Mines usually model groundwater level drawdown using the conservative, worst-case scenario. Therefore, it is unlikely that the actual drawdown will extend as far from the mine pits as predicted. It is also difficult to predict the time for groundwater recovery since each mine uses different predictive modeling techniques and assumptions, and reports different recovery time periods. In general, drawdown in groundwater levels in both the

coal and overburden will be greatest adjacent to the pit area and decrease with distance from the pits (Ogle et al. 2005).

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. All four of the applicant mines located within the general South Gillette analysis area utilize water supply wells completed in aquifers stratigraphically below the Wyodak coal. If these four LBA tracts are leased and mined by the applicants, water would be produced from these wells for a longer period of time, but none of the mines would require additional sub-coal wells for industrial water supply to continue mining and reclaiming, including the LBA tracts.

As noted above, the existing layers of sediment and rock in the area of coal removal would be replaced by generally homogeneous, unconsolidated backfill material, which would recover as a single hydrostratigraphic unit. The backfill unit created in the LBA tract areas would be in hydraulic communication with the undisturbed coal, overburden, and the adjacent mine backfill. Premining recharge areas, described in Section 3.5.1.1 would not be disturbed by mining. Surface infiltration recharge rates for the backfill materials should be equivalent to or somewhat greater than infiltration recharge through undisturbed overburden, due primarily to the swelling of the mined strata attendant with excavating the strata, and due to generally flatter postmining topography resulting in less surface runoff. Water levels in the affected aquifers would remain depressed below premining levels for a long period of time, since groundwater discharge rates from the affected aquifers into the proposed mine pits are expected to be low. Groundwater would accumulated in the backfill and eventually discharge to hydrostratigraphic units bordering he backfilled pit, at which time, groundwater levels and flow patterns are expected to be similar to premining condition. Groundwater flow through the backfill and undisturbed bedrock near the pits would be interrupted until saturation levels in the backfilled pits have increased, and the rates of recharge to and discharge from the backfill have equilibrated. Postmining groundwater levels should approach steady state conditions some time after mine reclamation and impacts from CBNG development in the cumulative impact areas are completed. The rate at which the mine backfill resaturates and the postmining potentiometric surface reaches equilibrium is dependent upon the hydraulic conductivity of the backfill and on sources of recharge water.

The hydraulic properties of the backfill aquifer based on the results of aquifer testing at mines in the PRB are quite variable, although generally equal to or greater than the undisturbed overburden and coal aquifers (Van Voast et al. 1978 and Rahn 1976). It is early in the process of full reclamation and to date, not all of the backfilled materials have reached an adequate saturated thickness to be aquifer tested at the four applicant mines in the general South Gillette analysis area. The composition of the backfilled overburden materials at these four adjacent mines is quite similar; therefore, the hydraulic characteristics of the

backfill at these four mines are also expected to be similar. To date, the backfill has not yet been aquifer tested at the Cordero Rojo and Coal Creek mines. Hydraulic conductivity values measured in existing monitoring wells completed in the saturated backfill at the Belle Ayr and Caballo mines range from 0.002 ft/day to 2.0 ft/day (FCW 2003 and CCC 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined for the Wasatch overburden and Wyodak coal seam. These data therefore provide an indication that the backfill would readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in these four LBA tracts) would be capable of supplying sufficient yields to wells constructed for livestock watering uses.

Mining and reclamation also impacts groundwater quality; the TDS concentration in the water resaturating the backfill is generally higher than the TDS concentration in groundwater from the overburden coal seam aquifers prior to mining. This is due to the increased porosity and surface area of backfilled overburden sediments, causing exposure of fresh mineral surfaces to groundwater that moves through the backfill and increased oxidation that occurs from exposure of sediments during mining. Scientific tests in the laboratory and in the field show the predominant cause for high dissolved-solids contents in mine backfill is the availability of highly soluble salts in the overburden sediments. The soluble salts that are exposed to groundwater are readily mobilized; therefore, groundwater quality in recently backfilled mine pits is highly diverse due to the variable distribution of soluble salts and the variable permeability of the backfill. As the backfill is resaturated and groundwater flow patterns are reestablished, the soluble salts are leached by groundwater inflow. Groundwater quality in the backfill then depends on a balance between the introduction of new salts by groundwater that recharges the backfill and the flushing of the newly exposed soluble salts by groundwater flow. Studies of backfill groundwater quality are not yet conclusive due to a relatively short period of monitoring available in the PRB. A general observation is that the content of TDS, calcium, magnesium, and sodium sulfates, when compared to the undisturbed aquifers, is roughly two to three times as high at present. However, these elevated levels should decline as flushing and leaching of soluble salts reaches equilibrium. Even at a two to three fold increase in TDS concentration, the water in the backfill will, in most cases, be suitable for its predominant premining use, stock watering (Straskraba 1986).

Using data compiled from 10 surface coal mines in the eastern PRB, Martin et al. (1988) concluded that backfill groundwater quality improves markedly after the backfill is leached with one pore volume of water. Van Voast and Reiten (1988) reached the same conclusions after analyzing data from the Decker and Colstrip mines located in the northern PRB. Their research indicates that upon initial saturation, mine backfill is generally high in TDS concentration and contains soluble salts of calcium, magnesium and sodium sulfates. TDS concentrations tend to decrease with time, indicating that the long-term groundwater quality in mined and adjacent lands would not be compromised. Clark (1995) conducted a

study to determine if the decreases predicted by laboratory studies actually occur onsite. In the area of the West Decker Mine near Decker, Montana, Clark's study found that dissolved solids concentrations increased when water from an upgradient coal aquifer flowed into a backfill aquifer, and apparently decreased along an inferred flow path from a backfill aquifer to a downgradient coal aquifer. WDEQ/LQD calculated a median TDS concentration of 3,293 mg/L for the backfill aquifer in the east-central area of the PRB, which includes the mines in the general South Gillette analysis area, based on 1,384 samples (Ogle et al. 2005).

Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of alluvial groundwater are expected to be minor after final reclamation, because the applicant mines would be required to maintain the essential hydrologic functions of the alluvial valley floors (AVFs) declared in the general South Gillette analysis area and their alluvial aquifer systems (as is currently required for the already-approved mining operations). See additional discussion in Sections 3.5.1.3. and 3.6.

As discussed in Chapter 2, the Proposed Actions and Action Alternatives assume that these four LBA tracts would be leased as maintenance tracts to existing mines. Direct and indirect impacts to the groundwater system resulting from mining the LBA tracts included in this analysis would add to the cumulative impacts that will occur due to mining existing leases. As discussed above, there have been drawdowns in the coal and overlying aquifers as a result of this existing approved mining and the existing coal bed natural gas (CBNG) development in the vicinity of the LBA tracts. As of 2005, the level of groundwater in the Wyodak coal seam had already been lowered to around 40 feet above the base of the coal in the general South Gillette analysis area as a result of dewatering by existing mining and CBNG development activities in the area.

The probable groundwater impacts from the leasing and subsequent mining of each of the LBA tracts under the Proposed Actions or Action Alternatives are described in the following paragraphs. Some or all of the impacts to the groundwater levels in the coal aquifer described below may occur prior to the mining of the LBA tracts, if they are leased, as a result of currently approved surface coal mining adjacent to the LBA tracts and development of CBNG resources on and adjacent to the LBA tracts.

3.5.1.2.1.1 Belle Ayr North LBA Tract

The existing leases at the Belle Aye Mine currently include approximately 6,345.3 acres. Mining the Belle Ayr North LBA Tract as a maintenance lease would extend the area of overburden and coal removal by about 1,937 acres under the Proposed Action up to about 1,947 acres under Alternative 2.

Mining has affected alluvial groundwater level elevations only where the alluvial aquifer has been mined out. If the Belle Ayr North LBA Tract is leased, mining

would dewater and physically remove the Duck Nest Creek alluvial materials within the tract. Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of the alluvial groundwater are expected to be minor after final reclamation, because Belle Ayr Mine would be required to maintain the essential hydrologic functions of Duck Nest Creek and its alluvial aquifer system. See additional discussions in Sections 3.5.1.3 and 3.6.

Overburden thickness in the Belle Ayr North LBA Tract ranges from about 120 feet to 400 feet and averages around 295 feet. Most of the overburden is composed of massive silty and clayey shales of very low permeability, although discontinuous, lenticular-shaped sand bodies occur in the Belle Ayr North general analysis area. Some of these isolated sand bodies in the overburden are saturated, but groundwater yields from them are generally low. Due to the discontinuous nature of the permeable overburden sediments, premining overburden groundwater movement generally followed the topography, and before mining, overburden groundwater flow in the vicinity of the Belle Ayr Mine was generally toward, and discharged to the Belle Fourche River and Caballo Creek valleys. Groundwater flow has since been affected by the removal of overburden. Monitor well data indicate that overburden groundwater in the Belle Ayr North general analysis area now flows toward the Belle Ayr Mine's and neighboring mines' open pits. Mining has and will continue to depress water levels in the overburden, although the historical monitoring data do not indicate a correlation between water level drawdown in the overburden to distance and direction from the open pits. In general, overburden groundwater levels will begin to show steady decline in areas that are within about one-half mile of the mine pits as mining progresses. Future drawdown in the overburden is expected to be similar to that measured to date, and would be expected to continue to have a limited impact outside of the mined area.

Water level drawdowns have propagated much farther and in a more consistent manner in the Wyodak coal seam aquifer than in the overburden. Groundwater level monitoring data collected by the Belle Ayr Mine and the other three mines located in the general South Gillette analysis area and presented in the GAGMO 25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near active mining areas prior to 1997 were likely due to mine dewatering alone and the groundwater flow direction within the coal aquifer was typically toward the mine where it would drain by gravity into the open pits. By year 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges (Hydro-Engineering 2007). The extent of drawdown west of the mines that is

specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) illustrate that approximately 150 feet of drawdown has occurred near the western edge of the Belle Ayr North LBA Tract, and approximately 50 feet of drawdown has occurred near the tract's eastern edge. The 2005 coal seam water level contours in the area of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines depict the groundwater flow direction to be entirely to the west, away from the open pits. Roughly 30 years of surface mining and CBNG development has resulted in nearly complete dewatering of the coal seams in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

In 1997, the numerical groundwater flow model MODFLOW was used to predict the extent of water level drawdown in the Wyodak coal aquifer attributable to mining the existing leases at the Belle Ayr Mine. The results of the groundwater modeling are reported in Appendix 3.5-7 of the Belle Ayr Mine Permit 214-T6 (FCW 2003). Groundwater level monitoring data prior to CBNG activity approximated the modeled drawdown predictions done in 1997. For the purpose of this analysis, the extent of coal-mining related drawdown (5-foot contour) in the Wyodak seam over the life of the Belle Ayr Mine if the Belle Ayr North LBA Tract is mined was extrapolated by extending FCW's 1997-modeled life-of-mine drawdown contour to the north and west by the dimensions of the Belle Ayr North LBA Tract (Figure 3-21). The area subject to lower water levels would increase roughly in proportion to the increase in area mined. This extrapolation serves as a general approximation of the potential impacts, based on experience, but it does not take variations in hydrologic properties, the time the pits are open, and the distance from previous mining and CBNG development into account.

The rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This has occurred as drawdown caused by extensive CBNG development west of the Belle Ayr Mine permit area and the Belle Ayr North LBA Tract has overlapped with drawdown caused by mining operations. Therefore, numerical groundwater flow models are no longer practical to predict drawdown in the coal aquifer due to mining alone, especially in this portion of the eastern PRB.

Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak coal aquifer from mining the approved leases and the Belle Ayr North LBA Tract would be expected to be negligible due to the fact that the coal seam has essentially been dewatered. Groundwater elevation data collected by the Belle Ayr Mine for more than 30 years have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These data will continue to be

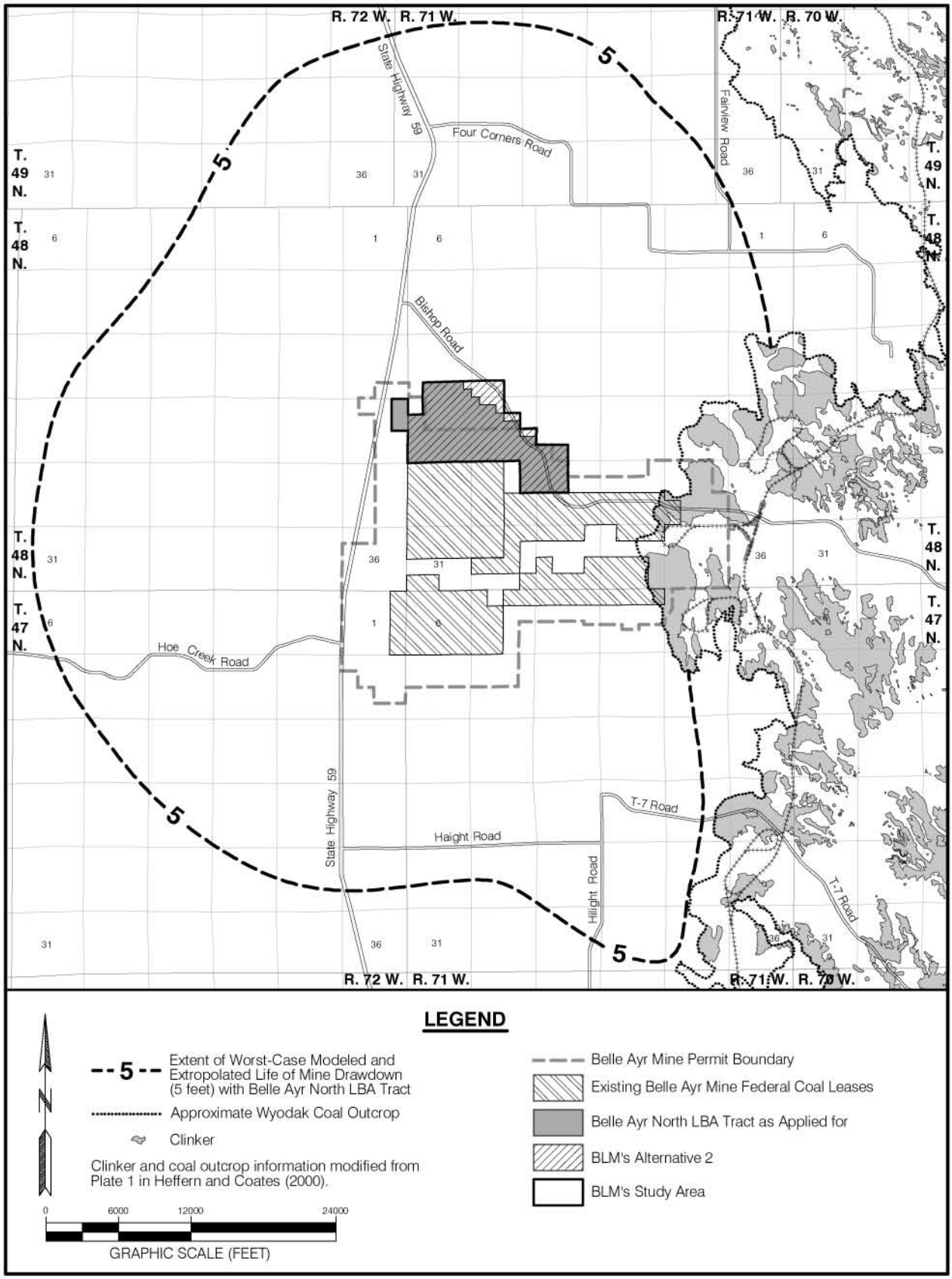

Figure 3-21. Belle Ayr Mine Life of Mine Drawdown Map, Resulting from Currently Approved Mining with the Addition of the Belle Ayr North LBA Tract.

recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Belle Ayr Mine submits to the WDEQ/LQD, as well as the GAGMO Annual Reports. If FCW acquires the Belle Ayr North LBA Tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Belle Ayr Mine permit area (Section 3.5.1.3).

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. The Belle Ayr Mine has four water supply wells completed in aquifers below the Wyodak coal. If the Belle Ayr North LBA Tract is leased by the applicant, water would be produced from these wells for a longer period of time, but FCW would not require additional sub-coal wells to mine the LBA tract.

To date, 19 wells have been installed in the backfill at the Belle Ayr Mine to monitor groundwater levels and groundwater quality (17 of which were actively monitored as of 2006). Most of these wells were installed between the early 1980s and early 1990s, and the historic groundwater hydrographs recorded by these wells indicate that the level of backfill saturation has increased at variable rates at nearly every well location. Aquifer tests performed in 1993 on selected backfill wells at the Belle Ayr Mine indicate the hydraulic conductivity ranges from 0.002 ft/day to 0.78 ft/day (FCW 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam within the Belle Ayr Mine area. These data therefore provide an indication that the backfill will readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in the Belle Ayr North LBA Tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses. The exact configurations and hydraulic gradients of the postmining potentiometric surfaces may vary from premine conditions, reflecting the composite of overburden and coal heads in the backfill aquifer. However, postmining equilibrium groundwater movement should exhibit a hydraulic gradient toward Caballo Creek, as existed prior to mining (FCW 2003).

Groundwater quality within the backfill at the Belle Ayr North LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the Belle Ayr Mine backfill. The Belle Ayr Mine has an extensive backfill groundwater monitoring network, having 14 wells that are currently sampled on a quarterly basis (FCW 2007). Over the period of record, the TDS concentration of the groundwater at five of these wells has decreased, while it has increased at five wells, and remained essentially constant at four wells. Based on the 2006 sampling results, the mean annual TDS concentration ranged from about 760 mg/L to 5,580 mg/L. TDS concentrations in only one of the 14 wells have consistently or normally exceeded 5,000 mg/L, but they have consistently remained below this value in the remaining 13 wells. The TDS concentration in

three of the 14 wells has consistently been around or under 1,000 mg/L. The 2006 average TDS concentration in the entire 14-well database was 2,889 mg/L (FCW 2007).

TDS concentrations observed in the Belle Ayr Mine backfill monitoring wells to date are similar to those found in the undisturbed Wasatch Formation overburden but typically larger than those found in the Wyodak coal aquifer. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to be quite similar to the premining overburden aquifer, and meet Wyoming Class III standards for use as stock water.

3.5.1.2.1.2 West Coal Creek LBA Tract

The existing leases at the Coal Creek Mine currently include approximately 6,854 acres. Mining the West Coal Creek LBA Tract as a maintenance lease would extend the area of overburden and coal removal by about 1,925 acres under the Proposed Action up to about 2,210 acres under Alternative 2.

With the exception of seasonal variations, Coal Creek alluvial groundwater levels have generally declined in recent years due to drought conditions. Mining has physically removed alluvial deposits associated with one unnamed tributary of Coal Creek within the current mine permit area. Coal Creek Mine's approved mine and reclamation plan does not require that Coal Creek's alluvial deposits be selectively removed and replaced (TBCC 2006). If the West Coal Creek LBA Tract is leased, mining would physically remove additional alluvial deposits associated with Coal Creek; however, it is unlikely that WDEQ/LQD would require Coal Creek Mine to selectively remove and replace the alluvial deposits within the tract. See additional discussions in Sections 3.5.1.3 and 3.6.

Hydrologic baseline studies conducted by TBCC in the Coal Creek Mine area and the West Coal Creek general analysis area concluded that the Wasatch Formation overburden is an aquitard that lacks saturated areas (e.g., paleochannel sands) capable of yielding enough water to justify well construction (TBCC 2006). Therefore, due to the lack of a continuous saturated zone within the overburden, there have been no impacts to an overburden aquifer due to mining and no impacts are anticipated if the West Coal Creek LBA Tract is leased and mined.

Groundwater level monitoring data collected by the Coal Creek Mine and the other three mines located in the general South Gillette analysis area indicate that the groundwater flow directions in the Wyodak-Anderson coal aquifer have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Coal Creek Mine development began in 1982 and groundwater level declines observed at coal monitoring wells located near active mining areas prior to 1997 were likely due to mine dewatering alone and the groundwater flow direction within the coal aquifer was typically toward the mine

where it would drain by gravity into the open pits. By year 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mine was overlapping with drawdown caused by mining operations. The extent of drawdown west of the mine that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) and Coal Creek Mine's 2007 WDEQ/LQD Annual Report (TBCC 2007) indicate that approximately 50 to 70 feet of drawdown has occurred near the western edge of the West Coal Creek LBA Tract. Wyodak-Anderson coal monitoring wells located further than ½ mile west of the West Coal Creek general analysis area have shown drawdowns in excess of 400 feet due to CBNG development, whereas drawdowns between 25 and 50 feet have occurred to date in monitor wells located within ½ mile of Coal Creek Mine's open pits. The 2005 coal seam water level contours in the West Coal Creek general analysis area depict the groundwater flow direction to be west-northwest, rather than towards Coal Creek Mine's open pits to the east-northeast (Hydro-Engineering 2007).

In 2005, the extent of water level drawdown in the coal aquifer attributable to mining the existing leases at the Coal Creek Mine was estimated using the analytical line slot method. The results of the line sink analysis are reported in Addendum 3.5.1 of the Coal Creek Mine Permit 483-T5 (TBCC 2006). For the purpose of this analysis, the extent of coal-mining related drawdown (5-foot contour) in the Wyodak-Anderson seam over the life of the Coal Creek Mine if the West Coal Creek LBA Tract is mined was extrapolated by extending TBCC's predicted life of mine, line sink drawdown contour to the north, west, and south by the dimensions of the West Coal Creek LBA Tract (Figure 3-22). The area subject to lower water levels would increase roughly in proportion to the increase in area mined. This extrapolation serves as a general approximation of the potential impacts, based on experience, but it does not take variations in hydrologic properties, the time the pits are open, and the distance from previous mining and CBNG development into account

The rate and extent of the actual drawdown in the coal is currently much greater than the predicted life-of-mine drawdown. This has occurred as drawdown caused by extensive CBNG development west of the Coal Creek Mine permit area and the West Coal Creek LBA Tract has overlapped with drawdown caused by mining operations. Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak-Anderson coal aquifer from mining the approved leases and the West Coal Creek LBA Tract would be expected to be negligible due to the fact that the coal seam has essentially been dewatered in the general South Gillette analysis area. Groundwater elevation data collected by the Coal Creek Mine since 1982 have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with

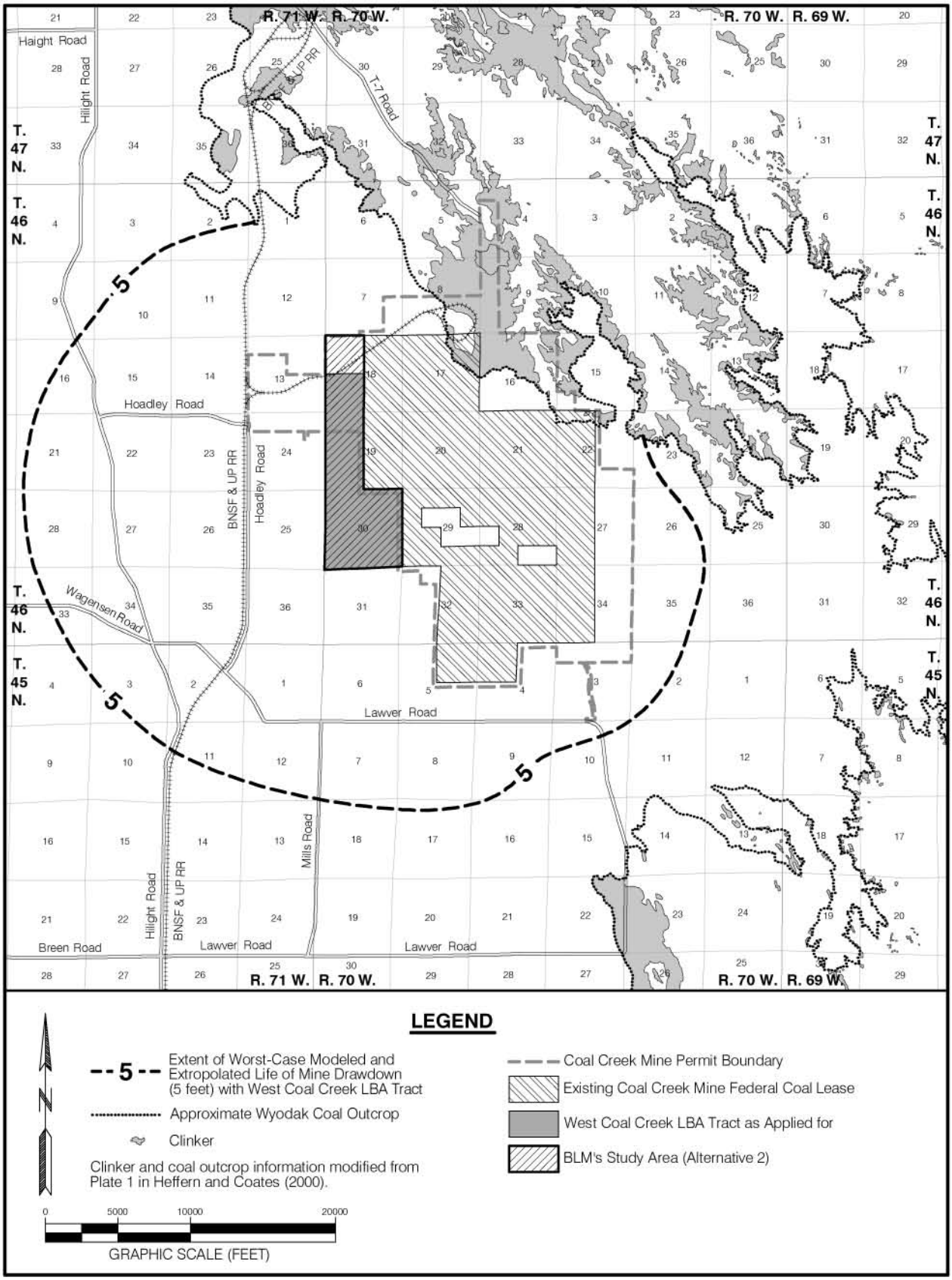

Figure 3-22. Coal Creek Mine Life of Mine Drawdown Map, Resulting from Currently Approved Mining with the Addition of the West Coal Creek LBA Tract.

dewatering due to future mining. These data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Caballo Mine submits to the WDEQ/LQD, as well as the GAGMO Annual Reports. If ALC acquires the West Coal Creek LBA Tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Coal Creek Mine permit area (Section 3.5.1.3).

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. Coal Creek Mine has two water supply wells completed in aquifers below the Wyodak-Anderson coal; both of which are completed in the Fort Union Formation at depths of approximately 850 feet and 2,500 feet. If the West Coal Creek LBA Tract is leased by the applicant, water would be produced from these wells for a longer period of time, but TBCC would not require additional sub-coal wells to mine the LBA tract.

To date, two monitoring wells have been installed in Coal Creek Mine's backfill. The groundwater level hydrographs recorded by these two wells indicate that the level of saturation in the backfill has fluctuated very little since they were installed in 2001 and 2003. Current water level data indicate that approximately 12 feet and 65 feet of the backfill is saturated at their respective locations. Although neither of these wells has been aquifer tested to determine the hydraulic properties of the backfill, overburden at the four applicant mines within the general South Gillette analysis area is lithologically similar; therefore, the hydraulic characteristics of the backfill at all four mines should also be similar. Hydraulic conductivity values reported from tests conducted at the nearby Caballo and Belle Ayr mines range from 0.002 ft/day to 2.0 ft/day, which is an indication that the backfill will have comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam. The backfill should readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and wells completed in the backfill (including in the West Coal Creek LBA Tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses. The exact configuration and hydraulic gradient of the postmining potentiometric surface may vary from premine conditions; however, postmining equilibrium groundwater movement should exhibit a hydraulic gradient from recharge areas along the coal outcrop east of and along the eastern border of the Coal Creek Mine, toward the west and eventually discharge to the valleys of the Belle Fourche River and Caballo Creek, with some regional flow into the PRB, similar to premining conditions (TBCC 2006).

Groundwater quality within the backfill at the West Coal Creek LBA Tract would be expected to be similar to groundwater quality measured in Coal Creek Mine's existing backfill monitoring wells. Based on the historical sampling results of the mine's two existing backfill wells, one of which has been sampled since 2002 and

the other beginning in 2004, the groundwater quality has been relatively constant over the period of record and relatively similar at both well locations. TDS concentrations have consistently ranged from around 2,700 to 3,000 mg/L (Hydro-Engineering 2007), which are similar to those found in the undisturbed Wasatch Formation overburden and the Wyodak-Anderson coal aquifers. Based upon the current information, the mine backfill groundwater TDS can be expected to meet Wyoming Class III standards for use as stock water.

3.5.1.2.1.3 Caballo West LBA Tract

The existing leases at the Caballo Mine currently include approximately 11,705 acres. Mining the Caballo West LBA Tract as a maintenance lease would extend the area of overburden and coal removal by about 1,350 acres under the Proposed Action up to about 1,390 acres under Alternative 2.

Mining has physically removed Tisdale Creek alluvial deposits within the current mine permit area. With the exception of the alluvial deposits at the confluence of Tisdale Creek and Gold Mine Draw (which is a declared AVF), Caballo Mine's approved mine and reclamation plan does not require that Tisdale Creek's alluvial deposits be selectively removed and replaced (CCC 2003). If the Caballo West LBA Tract is leased, mining would physically remove additional alluvial deposits associated with Tisdale Creek; however, it is unlikely that WDEQ/LQD would require Caballo Mine to selectively remove and replace the alluvial deposits within the tract. See additional discussions in Sections 3.5.1.3 and 3.6.

Prior to all mining in the general South Gillette analysis area, the saturated thickness of the overburden was more than 200 feet in the western portion of the Caballo West LBA Tract. Most of the overburden is composed of massive silty and clayey shales of very low permeability, although discontinuous, lenticular-shaped sand bodies (paleochannel sands) occur in the Caballo West general analysis area. Some of these isolated sand bodies in the overburden are saturated, and groundwater yields from them may be great enough to necessitate pre-mine dewatering in order to improve highwall stability. Due to the discontinuous nature of the permeable overburden sediments, premining overburden groundwater movement generally followed the topography, and before mining, overburden groundwater flow in the vicinity of the Caballo Mine was generally toward, and discharged to the Caballo Creek valley. Groundwater flow has since been affected by the dewatering and removal of overburden. Monitor well data indicate that overburden groundwater in the Caballo West general analysis area now flows toward the Caballo Mine's and neighboring mines' open pits; however, water levels in overburden monitoring wells located more than 500 feet from the pits have shown no significant decline and any changes are generally only in response to seasonal fluctuations. Currently, overburden groundwater levels in the vicinity of the Caballo West general analysis area vary from approximately 25 feet to over 180 feet below land surface (Hydro-Engineering 2007). Mining operations have and will continue to depress water levels in the overburden,

although the historical monitoring data do not indicate a correlation between water level drawdown in the overburden to distance and direction from the open pits. In general, overburden groundwater levels will begin to show steady decline in areas that are within about one-half mile of the mine pits as mining progresses. Future drawdown in the overburden is expected to be similar to that measured to date, and would be expected to continue to have a limited impact outside of the mined area.

Water level drawdowns have propagated much farther and in a more consistent manner in the Wyodak coal seam aquifer than in the overburden. Groundwater level monitoring data collected by the Caballo Mine and the other three mines located in the general South Gillette analysis area and presented in the GAGMO 25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near the active mining areas prior to 1997 were likely due to mine dewatering alone and the groundwater flow direction within the coal aquifer was typically toward the mines where it would drain by gravity into the open pits. By year 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression currently exists around the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) and Caballo Mine's 2007 WDEQ/LQD Annual Report (CCC 2007) illustrate that approximately 150 feet of drawdown has occurred near the western edge of the Caballo West LBA Tract, and approximately 80 feet of drawdown has occurred near the LBA tract's eastern edge, which is nearly a mile west of the Caballo Mine pits. Coal monitoring wells located over a mile north of the LBA tract had also recorded around 150 feet of drawdown. Due to safety, environmental, and economic reasons, many of the Caballo Mine's coal monitoring wells west and north of the mine have been plugged and abandoned to prevent methane gas from escaping. The 2005 coal seam water level contours in the general South Gillette analysis area depict the groundwater flow direction to be predominantly to the west, away from the open pits (Hydro-Engineering 2007). Roughly 30 years of surface mining and CBNG development has resulted in nearly complete dewatering of the coal seams in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

In 1999, the numerical groundwater flow model MODFLOW was used to predict the extent of water level drawdown in the Wyodak coal aquifer attributable to

mining the existing leases at the Caballo Mine. The results of the groundwater modeling are reported in Addendum MP-C of the Caballo Mine Permit 433-T5 (CCC 2003). Groundwater level monitoring data through 1990, prior to CBNG activity, were selected to compare the observed to the predicted drawdown, and the verification provided good correlation to the 1990 conditions of the modeled area. For the purpose of this analysis, the extent of coal-mining related drawdown (5-foot contour) in the Wyodak seam over the life of the Caballo Mine if the Caballo West LBA Tract is mined was extrapolated by extending CCC's 1999-modeled life-of-mine drawdown contour to the north and west by the dimensions of the Caballo West LBA Tract (Figure 3-23). The area subject to lower water levels would increase roughly in proportion to the increase in area mined. This extrapolation serves as a general approximation of the potential impacts, based on experience, but it does not take variations in hydrologic properties, the time the pits are open, and the distance from previous mining and CBNG development into account.

The rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This has occurred as drawdown caused by extensive CBNG development west of the Caballo Mine permit area and the Caballo West LBA Tract has overlapped with drawdown caused by mining operations. Therefore, numerical groundwater flow models are no longer practical to predict drawdown in the coal aquifer due to mining alone, especially in this portion of the eastern PRB.

Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak coal aquifer from mining the approved leases and the Caballo West LBA Tract would be expected to be negligible due to the fact that the coal seam has essentially been dewatered. Groundwater elevation data collected by the Caballo Mine for nearly 30 years have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Caballo Mine submits to the WDEQ/LQD, as well as the GAGMO Annual Reports. If CCC acquires the Caballo West LBA Tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Caballo Mine permit area (Section 3.5.1.3).

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. The Caballo Mine has three water supply wells completed in aquifers below the Wyodak coal; two in the Fort Union Formation and one in the Fox Hills Sandstone. If the Caballo West LBA Tract is leased by the applicant, water would be produced from these wells for a longer period of time, but CCC would not require additional sub-coal wells to mine the LBA tract.

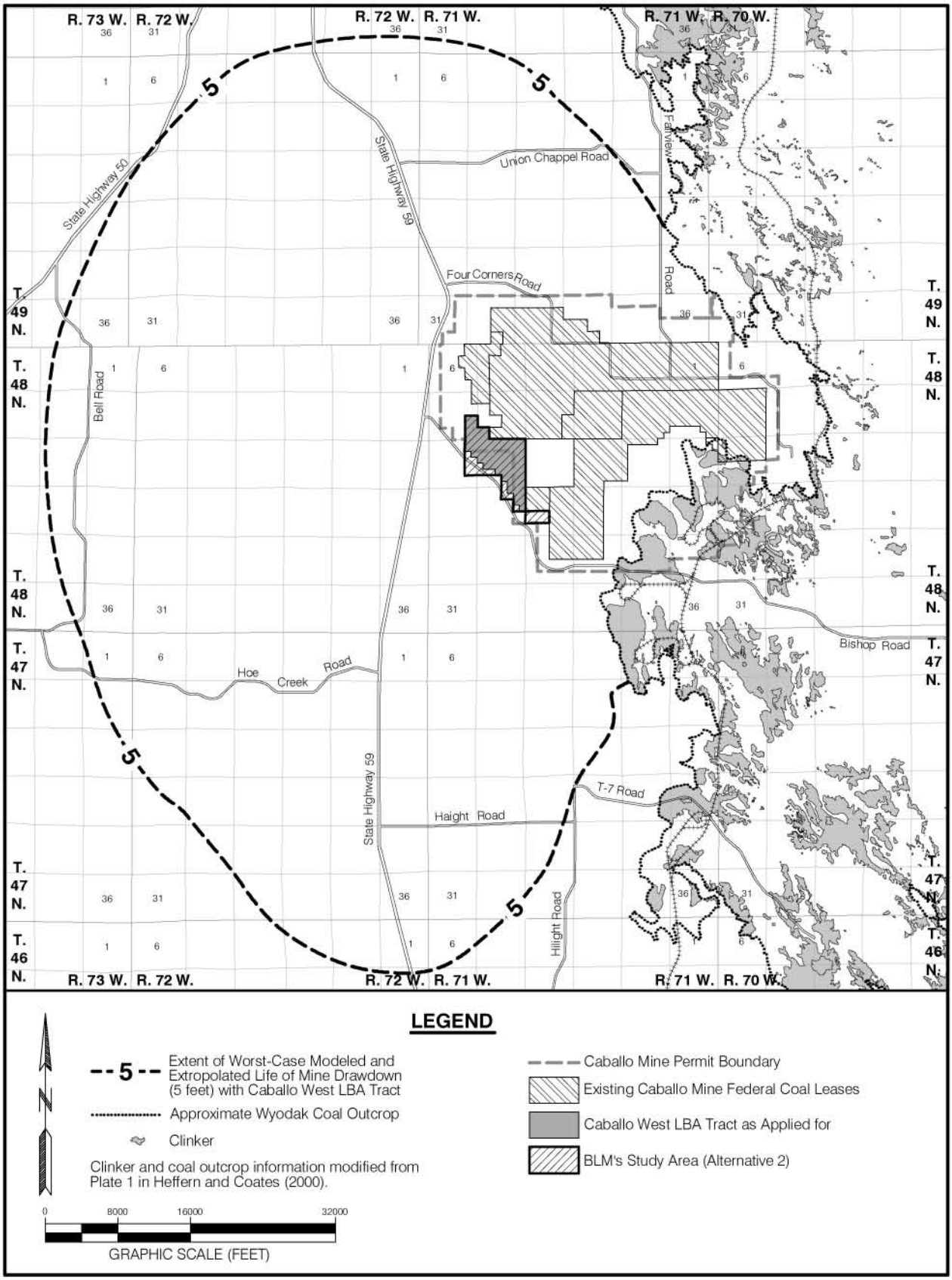

Figure 3-23. Caballo Mine Life of Mine Drawdown Map, Resulting from Currently Approved Mining with the Addition of the Caballo West LBA Tract.

To date, 18 wells have been installed to monitor water levels and water quality in the backfill at Caballo Mine. Ten of these wells were constructed between 1981 and 1984, four additional backfill wells were constructed between 1984 and 1989, and the remaining four wells were installed between 1989 and 1998. Eight of these backfill wells were included in the mine's current (2007) groundwater monitoring program. The groundwater level hydrographs recorded by these wells over the period of record indicate that the level of saturation in the backfill has fluctuated considerably and is largely dependant upon the well's location with respect to the thickness of backfill, the physical characteristics of the backfill materials, and the source of groundwater recharge. At the present time, groundwater levels have increased by 5 to 12 feet at six well locations, remained stable at one well location, and declined 9 feet at the remaining well location (CCC 2007). In general, water level recovery has been greatest near recharge areas (e.g., the reclaimed Tisdale Creek channel and the coal crop line in the southeastern portion of the mine's permit area).

Aquifer tests performed to date on selected backfill wells at the Caballo Mine indicate the hydraulic conductivity ranges from 0.09 ft/day to 2.0 ft/day (CCC 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam within Caballo Mine's permit area. Aquifer tests conducted on wells completed in backfill comprised primarily of alluvial deposits from the Tisdale Creek drainage show hydraulic conductivity values ranging from 0.5 ft/day to 28.3 ft/day, which is much higher than that of the overburden and coal seam at the mine. These data therefore provide an indication that the backfill will readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in the Caballo West LBA Tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses. The exact configuration and hydraulic gradient of the postmining potentiometric surface may vary from premine conditions; however, postmining equilibrium groundwater movement should exhibit a hydraulic gradient from east to west, as existed prior to mining (CCC 2003).

Groundwater quality observed in Caballo Mine's backfill is a function of the backfill material at the sampled well's location as well as the source of recharge water (CCC 2003). The ten backfill monitoring wells that were constructed between 1981 and 1984 are all located in an area of the mine's backfill that yields groundwater of relatively poor quality. Most of the samples collected initially from these wells had high total dissolved solids (TDS), selenium, and nitrate concentrations that exceeded Wyoming Class III standards for use as stock water. These ten wells were constructed in an area of the backfill that contains large amounts of alluvial material (originating from the Tisdale Creek drainage), which prior to mining yielded alluvial groundwater of very poor quality. The TDS, selenium, and nitrate concentrations at these wells have declined significantly over time. The four wells that were constructed between 1984 and 1989 are

located in a different area of the mine's backfill (originating from upland areas) that yields groundwater of much better quality. Groundwater samples collected from three of the mine's remaining four backfill monitoring wells, which were installed between 1989 and 1998 in yet another area of the mine's backfill, are of relatively good quality, meeting Wyoming Class III standards (CCC 2003 and Murphree 2005).

TDS concentrations observed in the Caballo Mine backfill monitoring wells to date are similar to those found in the undisturbed alluvial and Wasatch Formation overburden aquifers, but greater than those found in the Wyodak coal aquifer. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine's backfill groundwater quality can be expected to be similar to the premining overburden aquifer and meet Wyoming Class III standards; however, there could be localized areas in the backfill that yield groundwater that does not meet Wyoming Class III standards, particularly where the poorer quality alluvial materials happen to be concentrated. Groundwater quality within the backfill at the Caballo West LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the Caballo Mine backfill.

3.5.1.2.1.4 Maysdorf II LBA Tract

The existing leases at the Cordero Rojo Mine currently include approximately 14,442.4 acres. Mining the Maysdorf II LBA Tract as a maintenance lease would extend the area of overburden and coal removal by about 6,675 acres under the Proposed Action up to about 6,917 acres under Alternatives 2 and 3.

With the exception of seasonal variations, alluvial groundwater levels adjacent to the Belle Fourche River has generally remained constant. Except for locations where the alluvium has been mined out, or where the river has been diverted, mining has not affected alluvial groundwater elevations, and is not expected to do so in the future, except where mining physically removes the alluvium, diverts the Belle Fourche River, or removes a source of recharge to the alluvium (CMC 2007a). Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of the alluvial groundwater are expected to be minor after final reclamation, because Cordero Rojo Mine is required to maintain the essential hydrologic functions of the Belle Fourche River and its alluvial groundwater system. See additional discussion in Section 3.5.1.3.

Mining has directly impacted overburden groundwater within the mined areas by the removal of the water-bearing strata in the overburden, resulting in dewatering of the aquifer near the mine. Overburden groundwater levels ahead of (generally west) and adjacent to the mine have exhibited considerable variation, and mining has not necessarily caused water drawdowns in the overburden to be depressed in proportion to distance and direction from the open pits or in time since mining began. Water levels in overburden monitoring wells located more than about one-

half mile from the Cordero Rojo Mine pits have shown no significant decline. Overburden at the mine-pit face is typically fully dewatered, so the overburden's potentiometric surface steepens considerably near the pits. Future drawdown in the overburden is expected to be similar to that measured to date, and would be expected to continue to have a limited impact outside of the mined area.

Water level drawdowns propagate much farther and in a more consistent manner in the Wyodak coal seam than in the overburden because of the coal aquifer's regional continuity and higher transmissivity. Coal groundwater has experienced the most pronounced drawdowns, and exhibits a spatially broader range of drawdown compared to that in the overburden (CMC 2007a). Cumulative drawdowns within the coal from 1980 to 1995 were generally in excess of 5 feet within 12 miles west and 3 miles south of the active pits at the Cordero Rojo Mine (Hydro-Engineering 1996). Water level declines in most of the mine's coal monitoring wells were fairly gradual and mainly due to mine dewatering alone until 1994. Preliminary and experimental coal bed natural gas (CBNG) production immediately west of the mine began in 1994, and then increased to full-scale production by 1998. As a result of CBNG development, larger water level declines began to be observed in coal wells located roughly 3 miles or more west of the active pits than were observed in coal wells located within 3 miles of the open pits. Since 1995, coal monitoring wells located more than 1 mile west of the mine pits have recorded an increased rate of drawdown as a result of dewatering associated with CBNG production. By year 2000, the extent of drawdown to the west of the Cordero Rojo Mine caused by mine dewatering could not be defined due to the much larger drawdown caused by CBNG development (Hydro-Engineering 2001). In 2000, monitoring wells located within one mile west of the mine pits had recorded less than 100 feet of historical drawdown. However, monitoring wells located 3 or more miles west of the mine pits had recorded total drawdowns of 150 feet or more. Near State Highway 59, which was 4 to 5 miles west of the mine pits in 2000, approximately 180 feet of drawdown had occurred (Hydro-Engineering 2001). As of 2003, minimal additional drawdown had occurred immediately west of the advancing pits, although an additional 60 to 80 feet of drawdown had occurred in the vicinity of Highway 59 (Hydro-Engineering 2004). As of 2007, dewatering by existing mining and CBNG development activities had nearly completely drained the groundwater from the Wyodak coal aquifer in the area of the Cordero Rojo Mine, particularly where the coal seam is structurally highest. The Wyodak coal aquifer's groundwater level is currently around 40 feet above the base of the seam within the Maysdorf II general analysis area, and the direction of groundwater flow within the Maysdorf II general analysis area is predominantly to the west rather than towards Cordero Rojo Mine's open pits to the east (Hydro-Engineering 2007 and CMC 2007A).

The numerical groundwater flow model MODFLOW was used to predict the long-term, cumulative water level drawdown in the Wyodak coal aquifer attributable to mining the existing leases at the Caballo, Belle Ayr, Cordero Rojo, and Coal Creek mines. The results of these predictions are included within the Cordero Rojo Mine

permit (CMC 2007a). Overall, actual groundwater level monitoring data prior to CBNG activity approximated the modeled drawdown predictions impacts relatively well through the mid-1990s. However, both the rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This has occurred as drawdown caused by extensive CBNG development west of the Cordero Rojo Mine permit area and within and west of the Maysdorf II LBA Tract has overlapped with drawdown caused by mining operations. Drawdown in the coal has substantially exceeded the modeled predictions due to CBNG production and will likely continue to do so as long as CBNG production continues (CMC 2007a). Therefore, numerical groundwater flow models are no longer practical to predict cumulative drawdown in the coal aquifer. Historic drawdowns observed at the Cordero Rojo Mine are addressed within the mine's currently approved permit, although the extent of the life-of-mine Wyodak coal drawdown attributed to mining only CRM's existing leases is not included in the analysis. If CRM acquires the Maysdorf II LBA Tract, WDEQ/LQD would require that future drawdown impacts due to mining alone be predicted in order to amend the tract into the Cordero Rojo Mine permit area (Section 3.5.1.3).

As mining progresses, the extent of drawdown in the Wyodak coal's groundwater level elevations will depend on variations in hydrologic properties of the coal seam aquifer, the time the pits are open, the distance from mining and dewatering that has occurred as a result of previous mining, and to a greater extent, CBNG development. Continued drawdown effects from CBNG withdrawals will be likely; therefore, future drawdown to the Wyodak coal aquifer from mining the approved leases and the Maysdorf II LBA Tract would be expected to be negligible due to the fact that the coal seam has essentially been dewatered. Groundwater elevation data collected by the Cordero Rojo Mine since 1974 have formed the basis for quantifying groundwater level drawdowns since mining began and provide a reasonable and reliable means to predict trends in groundwater elevations associated with dewatering due to future mining. These data will continue to be recorded according to the mine's WDEQ-approved groundwater monitoring program and included in the annual progress report that the Cordero Rojo Mine submits to the WDEQ/LQD, as well as the GAGMO Annual Reports.

A "no-coal" zone that exists in the southwest corner of the LBA tract, in Sections 4 and 5, T.46N., R.71W., appears to be a paleochannel that is comprised of non-indurated sand overlying fractured siltstone and claystone sequences (Section 3.3). This no-coal zone will not be significantly disturbed by mining operations; therefore, the hydrogeologic functions of this potential aquifer will not be disrupted if the Cordero Rojo Mine acquires the Maysdorf II LBA Tract.

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. The Cordero Rojo Mine has five water supply wells completed in aquifers below the Wyodak coal. If the Maysdorf

II LBA Tract is leased by the applicant, water would be produced from these wells for a longer period of time, but CRM would not require additional sub-coal wells to mine the LBA tract.

It is early in the process of full reclamation and to date, the backfilled materials have not reached an adequate saturated thickness to be aquifer tested at the Cordero Rojo Mine. Therefore, no site-specific data are available for the hydraulic properties of the applicant mine's backfill. The composition of backfill material at the adjacent Belle Ayr Mine is quite similar to that of the Cordero Rojo Mine, and the hydraulic properties of the backfill at both mines, as well as the Maysdorf II LBA Tract, are also expected to be quite similar. Permeability values measured in existing monitoring wells completed in the saturated backfill at the Belle Ayr Mine range from 0.002 to 0.78 ft/day (FCW 2003), which is comparable but slightly lower than the reported hydraulic conductivity values determined from most tests of the overburden and Wyodak coal seam within the Cordero Rojo Mine area. These data therefore provide an indication that the Cordero Rojo Mine backfill will readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in the Maysdorf II LBA Tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses.

Groundwater quality within the backfill at the Maysdorf II LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Cordero Rojo Mine. To date, nine wells have been installed to monitor water levels and water quality in the backfill at Cordero Rojo Mine. Based on the sampling results of six of these wells beginning as early as 1982 and extending through spring 2004, average TDS concentrations have ranged from about 1,600 mg/L to 6,200 mg/L. TDS concentrations in two of the six wells have consistently or normally exceeded 5,000 mg/L, but they have consistently remained below this value in the remaining four wells. The TDS concentration in one of the six wells has consistently remained below 2,000 mg/L. The average TDS concentration in the entire six-well database was 3,803 mg/L.

TDS concentrations observed in the Cordero Rojo Mine backfill monitoring wells to date are similar to those found in the undisturbed Wasatch Formation overburden but typically larger than those found in the Wyodak coal aquifer. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to range from less than 2,000 mg/L to about 6,000 mg/L, similar to the premining Wasatch Formation aquifer, and meet Wyoming Class III standards for use as stock water.

3.5.1.2.2 No Action Alternative

Under the No Action Alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would

not be offered for lease, and coal removal would not occur on that tract at this time. Impacts to groundwater resources related to existing approved mining and CBNG development, described above, would continue as permitted on the existing applicant mine leases. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in Section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.5.1.3 Regulatory Compliance, Mitigation, and Monitoring

In order to obtain a mining and reclamation permit, the Surface Mine Control and Reclamation Act (SMCRA) and state law require surface coal mine operators to evaluate regional and site-specific baseline hydrogeologic environments within and around their mines. Prior to the cumulative drawdown effects of CBNG development and mining on the Wyodak coal seam aquifer, WDEQ required each mine to use a numeric groundwater flow model to predict the extent of water level drawdown that would occur as a result of mining its existing leases. Current mine permit requirements require that future drawdown impacts due to mining alone be addressed, although less rigorous methods such as historical groundwater level trend analyses and simple analytical models can be used rather than complex numerical groundwater flow models. Results of these studies are included in the WDEQ/LQD mine permits for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines (FCW 2003, TBCC 2006, CCC 2003, and CMC 2007a). These studies would be revised accordingly and included in the mine permit amendment that would be required for each respective LBA tract that is leased. Permit revisions must be approved before mining could occur on each tract that is leased, regardless of who acquires the tract.

As discussed in Section 3.5.3.3, SMCRA and Wyoming regulations require mine operators to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality.

The surface coal mines are also required to monitor water levels and water quality in the overburden, coal, interburden, underburden, and backfill. Operational groundwater monitoring programs are dynamic and modified through time as wells are removed by mining, discontinued from monitoring to eliminate redundancy, or added to replace those removed by mining and to facilitate monitoring of future mine expansion areas as mining has progressed. Additional wells have also been installed in the reclaimed backfill to monitor recovering, postmine groundwater conditions. Many groundwater monitoring wells installed by Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines within and around their current permit areas have been used to evaluate groundwater conditions in

the general South Gillette analysis area since the early 1970s and continue to be monitored to reveal a long-term record of groundwater conditions. Wells for which monitoring has been discontinued are still in place and may be reincorporated into the monitoring network in the future.

SMCRA and state regulations require surface coal mines to maintain the essential hydrologic functions of drainages declared AVFs not significant to farming and their alluvial groundwater systems that are disturbed by mining. In order to meet this requirement, the mines are typically required to salvage and stockpile the stream laid alluvial materials during mining and replace them upon final reclamation.

3.5.2 Surface Water

3.5.2.1 Affected Environment

The Belle Fourche River and its tributaries drain the general South Gillette analysis area. For the purpose of this analysis, the general South Gillette analysis area encompasses the four applicant mines (often referred to collectively as the middle PRB mines), the four LBA tracts that are proposed for leasing, the BLM study areas for these four LBA tracts, and the adjacent lands that would disturbed by mining the BLM study areas. From north to south, the general South Gillette analysis area is drained by Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and the Belle Fourche River. Tisdale Creek and Duck Nest Creek are tributaries of Caballo Creek, and Caballo Creek and Coal Creek are tributaries of the Belle Fourche River (Figure 3-24). The general South Gillette analysis area lies within the mid-eastern part of the Powder River Structural Basin and within the Belle Fourche River drainage basin (Hydrologic Unit Code [HUC] 101202), a tributary of the larger Cheyenne River drainage basin.

The Belle Ayr North general analysis area and the existing Belle Ayr Mine permit area are located in the Caballo Creek watershed. The Belle Ayr Mine disturbs Caballo Creek and several of its tributaries, and is currently permitted to disturb approximately 7 percent of the Caballo Creek watershed. A large portion of the Belle Ayr North LBA Tract is within the mine's existing permit area. Duck Nest Creek, a southeasterly-flowing ephemeral tributary of Caballo Creek, drains the southern and western portions of the Belle Ayr North general analysis area. Two small, first order tributaries of Caballo Creek and two internally-drained playas drain the remainder of the Belle Ayr North general analysis area.

Coal Creek and its three main branches, East Fork, Middle Fork, and West Fork, drain the West Coal Creek general analysis area and the existing Coal Creek Mine permit area. Typical of this semi-arid area, Coal Creek and its tributaries are all ephemeral streams. No playas or internally-drained topographic depressions have been identified within the West Coal Creek general analysis area.

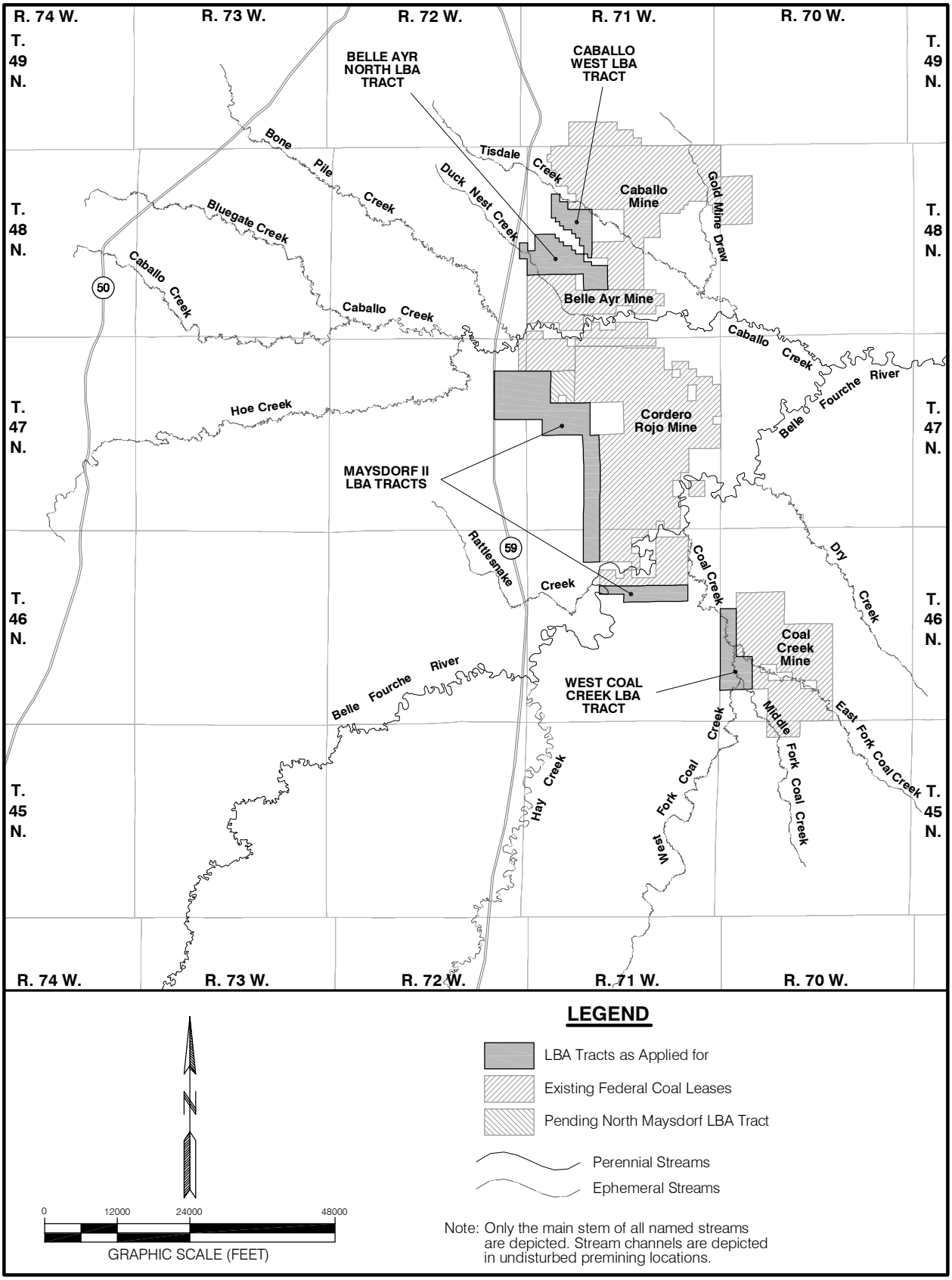

Figure 3-24. Surface Drainage in the General South Gillette Analysis Area.

The Caballo West general analysis area and the existing Caballo Mine permit area are located in the Caballo Creek watershed. The Caballo Mine is currently permitted to disturb approximately 12 percent of the Caballo Creek watershed. The mine's existing permit area is located primarily within the Tisdale Creek drainage. There are also approximately 2,220 acres of area within the existing Caballo Mine permit area that drain internally toward playas formed by natural topographic depressions. A large portion of the Caballo West general analysis area is within the mine's existing permit area. Tisdale Creek, a southeasterly-flowing ephemeral tributary of Caballo Creek, drains the northern and eastern portions of the Caballo West general analysis area, and a large playa drains the southern and western portions. This same playa also drains the northern portion of the adjacent Belle Ayr North LBA Tract.

The Belle Fourche River and its tributaries drain the existing Cordero Rojo Mine permit area and the Maysdorf II general analysis area. The Belle Fourche River flows east-northeasterly through the southern portion of the LBA tract. The central and southern portions of the Maysdorf II general analysis area are drained by several first order tributaries of the Belle Fourche River, while the northern portion is drained by a few first order tributaries that flow north to Caballo Creek. Two areas on and contiguous to the central portion of the Maysdorf II general analysis area do not contribute runoff to any stream and playas have formed in the lowest portions of these non-contributing drainage basins.

As mentioned above, Tisdale Creek, Duck Nest Creek, and Coal Creek are ephemeral streams that flow only in response to rainfall or snowmelt runoff. Caballo Creek and Belle Fourche River demonstrate characteristics of both an ephemeral and intermittent stream. Streamflow monitoring stations have been operated by the U.S. Geological Survey (USGS) and the applicant mines on these streams in the general South Gillette analysis area since the mid-1970s. Some stream segments flow only in response to snowmelt runoff in the spring and thunderstorm runoff in the summer months, although there are some stream segments that flow throughout the year in response to alluvial groundwater discharge. Currently, and for some indefinite time into the future, CBNG discharge water is adding flow to Caballo Creek and Belle Fourche River. Streamflow is still very much a function of the amount and timing of precipitation and snowmelt runoff; however, since 1999, the PRB of northeastern Wyoming has experienced extreme drought conditions. Therefore, the mean annual streamflow rate and annual discharge volume has not significantly increased in these streams as a result of the discharge of CBNG-produced waters into surface drainages west of and generally upstream of the applicant mine, although extended periods of no flow are less common.

Water quality in each of these streams is highly dependent on flow. Dissolved solids concentrations and specific conductance generally have an inverse relationship with streamflow; thus, the highest concentrations occur during low flows and lowest concentrations occur during high flows. Total suspended solids

(TSS) show a direct relationship with streamflow; TSS concentrations are typically high during high flow and low during low flows. Due to the sparse vegetative cover and the infrequent occurrence of surface water runoff in this semi-arid environment, high TSS concentrations can be expected, especially from floods caused by thunderstorms.

The Coal Creek drainage basin, in particular, has been identified as a significant source of sediment to the Belle Fourche River. The Coal Creek drainage is highly dissected and slopes are relatively steep, so combined with the occurrence of erodible soils, the sediment yields are greater than those in upland areas of the Belle Fourche River drainage basin (Ogle et al. 2004).

Surface water monitoring programs required by WDEQ/LQD are included in the four applicant mines' permits, which ensures that streamflows are measured and water quality samples are collected on a regular basis from Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and Belle Fourche River at sites located upstream and downstream of the respective mine operation. As a result, comprehensive flow and water quality records are submitted to the WDEQ/LQD in the mines' existing permits and annual reports that are on file and available for public review at WDEQ's offices in Cheyenne and Sheridan, Wyoming.

A study by the USGS within an area of CBNG development in the PRB was conducted from 2000 to 2005 to characterize the water quality of streams and assess change through time. That study concluded that annual runoff in all major drainage basins was less than average during 2001-2005 due to drought conditions, and that water-quality characteristics were highly variable generally because of streamflow variability, geologic controls, and potential land-use effects. No significant trends in water quality were determined for sites in the Belle Fourche River drainage basin; however, drought conditions during the study period may not represent long-term water quality conditions for all sites studied (Clark and Mason 2007).

The Belle Fourche River is listed in the WDEQ/WQD Surface Water Classification List as a Class 2ABww stream that is protected for drinking water, aquatic life (classified as a warm water fishery), recreation, wildlife, agriculture, industry and scenic value. However, the numeric human health criteria for iron and manganese do not apply to Class 2 waters in the Belle Fourche River drainage and the main stem of the river. Tisdale Creek, Duck Nest Creek, Caballo Creek, and Coal Creek are listed as Class 3B streams, which are non-fisheries, but are protected for other aquatic life, recreation, wildlife, agricultural and other uses (WDEQ/WQD 2007).

Springs are uncommon in the general South Gillette analysis area. No springs have been identified within the four LBA tracts' general analysis areas, although seeps created by groundwater discharging from the Wasatch overburden to the overlying Duck Nest Creek alluvium exist at the southern boundary of the Belle

Ayr North LBA Tract. The seepage rate is insufficient to sustain a base flow in the stream channel and only enough to create a marshy area and a few shallow pools of stagnant water.

A few small in-channel reservoirs used for livestock water are located in the four LBA tracts' general analysis areas. Most of these stock ponds are many decades old and have not been permitted with the Wyoming State Engineer's Office (SEO). The SEO records have been searched for surface water rights within a three-mile radius of the four LBA tracts and listed in Section 3.5.3 and the supplementary information document for this EIS.

3.5.2.2 Environmental Consequences

3.5.2.2.1 Proposed Action and Action Alternatives

Changes in surface runoff characteristics and sediment discharges would occur during mining of each of the LBA tracts as a result of the destruction and reconstruction of drainage channels as mining progresses and the use of sediment control structures to manage discharges of surface water from the mine permit areas. Since the LBA tracts would be mined as extensions of the existing mines under the Proposed Actions or Action Alternatives, there would not be a large increase in the size of the area that is disturbed and not reclaimed at any given time as a result of leasing these tracts. Impacts would be similar for both the Proposed Actions and Action Alternatives to the expected impacts for the currently permitted mining operations. Reclamation would be ongoing and concurrent with mining.

The removal of soil and vegetation exposes overburden, which results in a potential for increased sediment production during runoff events. However, both state and federal regulations require all surface water runoff from mined lands be treated by passing through sediment control structures to meet Wyoming Pollutant Discharge Elimination System (WYPDES) and/or National Pollutant Discharge Elimination System (NPDES) discharge criteria before it is released downstream. Generally, the surface runoff sediment is deposited in ponds or alternative sediment control measures (ASCMs) inside the mine's permit area before the surface runoff water is allowed to leave the permit area and be discharged to receiving streams. While mining is in progress, surface water quality would continue to be protected by directing surface runoff from affected areas to various sediment control structures, including sediment ponds, traps, ditches, sumps, and mine pits. Under normal conditions, exceedances of effluent limitations are not expected in the future as mining extends into new drainages and additional sediment control facilities are added. The presence of disturbed areas creates a potential that sediment produced by large storms (i.e., greater than the 10-year, 24-hour storm) could potentially adversely impact areas downstream of the mining operations. This potential for adverse downstream impacts would be extended if the LBA tracts were leased.

The temporary diversion and impoundment of runoff water for sediment control may reduce stream flow volumes and peak flows downstream of the mined lands. Impounded water may be used on the mine site for dust control or lost due to infiltration and evaporation. However, in order to maintain adequate available storage volume in sedimentation ponds, the impounded water is discharged when if meets WPDES criteria. The WDEQ/LQD encourages the use of ASCMs to trap sediment and allow runoff to continue downstream (Ogle and Calle 2006).

Immediately following reclamation, the loss of soil structure would act to increase runoff rates on the LBA tracts. However, the general decrease in average slope in reclaimed areas, as discussed in Section 3.2.2, and drainage densities common in reclamation would tend to outweigh the potential for an increase in runoff due to a loss of soil structure. Soil structure would gradually recover over time, and vegetation (after successful reclamation) would provide erosion protection from raindrop impact, retard surface flows, and control runoff at approximately premining levels. All surface drainage from reclaimed areas would be controlled using best management practices (BMPs), such as contour furrows, ponds or small depressions for sediment traps, and vegetation buffers, until the area is sufficiently stable that drainage control is no longer required. Surface water monitoring would continue to be conducted to evaluate and identify anomalous variations in surface water quantity and quality and ensure that runoff leaving the site meets specific water quality criteria.

Once mining is completed the pits would be backfilled and drainage would be reestablished. Surface water drainages would be designed and reconstructed to approximate the premining drainage basin and channel characteristics. The reclaimed drainageways would be constructed to approximate the premine condition and blend with the existing drainage system above and below the area disturbed by the mining operation, providing a complete drainage system with hydrologic functions similar to premining conditions. After mining and reclamation are complete, surface water flow and quality would approximate premining conditions. The impacts described above would be similar to the expected impacts for currently permitted mining operations.

Direct and indirect impacts to the surface water system resulting from mining the four LBA tracts would add to the cumulative impacts that would occur due to mining existing leases. These cumulative impacts are discussed in Chapter 4 of this EIS. Following is a description of surface water impacts from the leasing and subsequent mining of each of the LBA tracts under the Proposed Action or Action Alternatives.

3.5.2.2.1.1 Belle Ayr North LBA Tract

Due to its location near the headwater areas of three ephemeral Caballo Creek tributaries (Duck Nest Creek and two small drainages, locally named Draw No. 1 and Draw No. 2), and due to fact that much of the tract drains internally to two

closed basins, runoff within the Belle Ayr North LBA Tract would not be expected to be significant. During mining, hydrologic control would most likely consist of allowing runoff to accrue to the mine pit, or to a flood control reservoir, where it would be treated and discharged according to the standards of WDEQ/WQD.

3.5.2.2.1.2 West Coal Creek LBA Tract

The West Coal Creek LBA Tract is located at the confluences of the East Fork, Middle Fork, and West Fork of Coal Creek, which are all ephemeral streams. Hydrologic control during mining would most likely consist of containing these ephemeral streams in flood control reservoirs, diverting flows around active pits, or allowing runoff to accrue to the mine pit, where it would be treated and discharged according to the standards of WDEQ/WQD.

Coal Creek Mine's existing hydrologic restoration plan includes the construction of 12 permanent impoundments intended to provide replacement water storage for existing surface water rights in the permit area (TBCC 2006). Additional postmining impoundments would most likely be included in the reclamation plan for the LBA tract. Significant changes to the area's overall sediment yield after mining would therefore be less likely due to the capture of sediment within the reconstructed stock ponds.

3.5.2.2.1.3 Caballo West LBA Tract

The Caballo West LBA Tract is located near the headwaters of Tisdale Creek, an ephemeral tributary of Caballo Creek. Tisdale Creek drains the northern and eastern portions of the Caballo West general analysis area, and a large playa drains the southern and western portions of the Caballo West general analysis area. Therefore, runoff within the Caballo West LBA Tract would not be expected to be significant. During mining, hydrologic control would most likely consist of allowing runoff to accrue to the mine pit, or constructing small flood control reservoirs upstream of the pit where it would be treated and discharged according to the standards of WDEQ/WQD.

3.5.2.2.1.4 Maysdorf II LBA Tract

The Belle Fourche River has been diverted around active pits and mine facilities within the existing Cordero Rojo Mine permit area. During mining of the Maysdorf II LBA Tract, hydrologic control would likely consist of constructing another diversion channel for the river around the open pit area. Due to its location in the headwaters area of ephemeral Belle Fourche River and Caballo Creek tributaries, and due to the fact that much of the LBA tract drains internally to closed basins, runoff within the tract would be expected to be insignificant. In addition to diverting the Belle Fourche River, hydrologic control during mining would most likely consist of allowing runoff to accrue to the mine pit where it would be treated

and discharged according to the standards of the WDEQ/WQD. A need for large flood control reservoirs is not anticipated for the LBA tract.

3.5.2.2.2 No Action Alternative

Under the No Action Alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal and the associated disturbance to Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and/or the Belle Fourche River would not occur on that tract at this time. The impacts to surface water resources related to existing approved mining and CBNG development, described above, would continue as permitted on the existing applicant mine leases. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in Section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.5.2.3 Regulatory Compliance, Mitigation, and Monitoring

In accordance with SMCRA and Wyoming State Statutes, Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and Belle Fourche River stream channels would be restored after surface mining operations are completed on these four LBA tracts. Surface water flow, quality, and sediment discharge would approximate premining conditions. The drainages that intersect the applicant mines' permit areas would be reclaimed to exhibit channel geometry characteristics similar to the premining characteristics. Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and Belle Fourche River stream channels would be restored in approximately the same location as the natural channel, and its premining hydrologic functions would be restored. (See additional discussion in Section 3.5.1.3.).

Other WDEQ/LQD permit requirements for the existing Belle Aye, Coal Creek, Caballo, and Cordero Rojo mines include constructing sediment control structures to manage discharges of surface water from the mine permit areas; treatment of all surface runoff from mined lands as necessary to meet effluent standards; and restoration of stock ponds, playas, and in-channel impoundments disturbed during mining. These requirements would be extended to include the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts when the respective mine permit is amended to include the tract.

Monitoring requirements for each of the existing applicant mines include a program to assure that sediment ponds would always have adequate space reserved for sediment accumulation and collection of streamflow and water quality

data from Tisdale Creek, Duck Nest Creek, Caballo Creek, Coal Creek, and the Belle Fourche River. These requirements would be extended to include the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts when the respective mine permit is amended to include the tract.

3.5.3 Water Rights

3.5.3.1 Affected Environment

The Wyoming State Engineer's Office (SEO) administers water rights in Wyoming. Water rights are granted for both groundwater and surface water appropriations. Prior to development of water resources associated with energy development, water appropriations (either groundwater or surface water) in the PRB were typically for livestock use. Currently, mining companies and CBNG development companies hold the majority of the water rights in the general South Gillette analysis area.

Records of the SEO have been searched for groundwater rights within a 3-mile radius of the BLM study area for each LBA tract. This information is required for WDEQ permitting. The results of the most recent searches are provided below for each tract. A more detailed listing of the non-coal mine related groundwater rights within a 3-mile radius of each tract is presented in the supplementary information document for this EIS, which is available on request.

For the Belle Ayr North LBA Tract, SEO data indicate that, as of June 28, 2007, there were 1,103 permitted water wells within 3 miles of the tract, of which, 717 are owned by coal mining companies. The other 386 non-coal mine related, permitted water wells, which include 315 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 315 CBNG
- 31 livestock
- 21 domestic
- 11 monitoring
- 5 industrial
- 2 miscellaneous
- 1 irrigation

For the West Coal Creek LBA Tract, SEO data indicate that, as of November 16, 2007, there were 284 permitted water wells within 3 miles of the tract, of which, 141 are owned by coal mining companies. The other 143 non-coal mine related, permitted water wells, which include 69 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 50 CBNG and livestock
- 42 livestock

- 17 CBNG
- 11 industrial
- 11 livestock and domestic
- 5 miscellaneous
- 4 domestic
- 1 CBNG and miscellaneous
- 1 miscellaneous, dewatering, and CBNG
- 1 unknown

For the Caballo West LBA Tract, SEO data indicate that, as of July 25, 2007, there were 1,382 permitted water wells within 3 miles of the tract, of which, 677 are owned by coal mining companies. The other 705 non-coal mine related, permitted water wells, which include 587 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 282 CBNG
- 260 CBNG and livestock
- 37 livestock
- 36 domestic
- 26 CBNG and miscellaneous
- 19 CBNG, livestock, and miscellaneous
- 18 domestic and livestock
- 8 monitoring
- 7 industrial
- 5 miscellaneous
- 1 domestic, livestock, and miscellaneous
- 1 irrigation
- 1 municipal and miscellaneous
- 1 reservoir supply, industrial, and miscellaneous
- 1 livestock and industrial
- 1 livestock and irrigation
- 1 livestock and miscellaneous

For the Maysdorf II LBA Tract, SEO data indicate that, as of May 29, 2007 there were 987 non-coal mine related, permitted water wells within 3 miles of the tract, which include 780 wells permitted for uses related to CBNG development. Those 987 wells are permitted for the following uses:

- 429 CBNG
- 225 livestock and CBNG
- 66 livestock
- 57 livestock, miscellaneous, and CBNG
- 52 miscellaneous and CBNG
- 33 monitoring
- 29 domestic and livestock
- 26 miscellaneous

- 21 industrial
- 21 domestic
- 16 miscellaneous, dewatering, and CBNG
- 2 livestock and miscellaneous
- 2 unknown
- 1 CBNG and reservoir
- 1 dewatering and miscellaneous
- 1 dewatering, reservoir, and industrial
- 1 miscellaneous and domestic
- 1 livestock and industrial
- 1 livestock and irrigation
- 1 livestock, irrigation, and domestic
- 1 temporary, industrial, and drilling

SEO records have been searched for surface water rights within a 3-mile radius of the BLM study area for each LBA Tract (the tract as applied for under the Proposed Action and the additional area evaluated by BLM under Alternative 1). Like the groundwater rights, this information is also required for WDEQ permitting. The results of the most recent searches are provided below for each tract. A more detailed listing of the non-coal mine related surface water rights is presented in the supplementary information document for this EIS, which is available on request.

For the Belle Ayr North LBA Tract, SEO records indicate that as of July 6, 2007, there were 186 permitted surface water rights within the search area, of which 95 are owned by coal mining companies. The other 91 non-coal mine related, permitted surface water rights are permitted for the following uses:

- 16 irrigation
- 13 livestock
- 4 irrigation and domestic
- 1 livestock and domestic
- 1 reservoir supply
- 56 not designated

For the West Coal Creek LBA Tract, SEO records indicate that as of November 16, 2007, there were 54 permitted surface water rights within the search area, of which 30 are owned by coal mining companies. The other 24 non-coal mine related, permitted surface water rights are permitted for the following uses:

- 7 livestock
- 17 not designated

For the Caballo West LBA Tract, SEO records indicate that as of July 2, 2007, there were 9 non-coal mine related, permitted surface water rights within the search area. These surface water rights are permitted for the following uses:

- 3 irrigation
- 2 livestock
- 1 temporary and industrial
- 1 reservoir supply
- 1 reservoir supply and irrigation
- 1 reservoir supply, irrigation, and domestic

For the Maysdorf II LBA Tract, SEO records indicate that as of May 29, 2007, there were 90 non-coal mine related, permitted surface water rights within the search area. These surface water rights are permitted for the following uses:

- 46 livestock
- 16 irrigation
- 10 irrigation and domestic
- 8 temporary oil production, drilling, and industrial
- 4 livestock and domestic
- 3 temporary industrial
- 1 livestock and irrigation
- 1 reservoir supply and domestic
- 1 livestock and fisheries

3.5.3.2 Environmental Consequences

3.5.3.2.1 Proposed Action and Action Alternatives

As discussed above, there have already been significant drawdowns in the coal and overlying aquifers (where present) as a result of the past and existing mining activities and CBNG development in the general South Gillette analysis area. As a result, private water supply wells listed in Section 3.5.3.1 have already been impacted. Continued effects from groundwater withdrawals associated with CBNG development activities will be likely, and future drawdown to the Wyodak coal aquifer resulting from mining the approved coal leases by the four applicant mines is expected to be negligible due to the fact that the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be indirectly impacted by water level drawdown to a greater extent than current conditions; however, private wells may be physically removed by activities associated with mining the proposed LBA tracts.

Only a slight reduction in streamflow downstream of the applicant mines during mining is expected due to the containment of runoff from the disturbed areas by mine pits and other runoff control structures. Downstream surface water rights would be protected by minimizing detention of surface runoff for sediment control and maintaining unrestricted flow in Caballo Creek and Belle Fourche River. Changes to the overall flow and water quality of these streams during mining are expected to be negligible. Any surface water rights listed in Section 3.5.3.1 that

are located within the proposed mining disturbance areas would be interrupted until the disturbance area is reclaimed.

3.5.3.2.1.1 Belle Ayr North LBA Tract

In June 2007, Wyoming SEO records indicated that a total of 1,103 permitted water wells were located within 3 miles of the Belle Ayr North LBA Tract. As discussed above, 717, or approximately 65 percent of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. Approximately 82 percent of the remaining 386 non-coal mine related wells are permitted for uses related to CBNG development; 8 percent are permitted for livestock use; 5 percent are permitted for domestic use; 3 percent are permitted for monitoring uses; 1 percent are permitted for industrial uses; and about 1 percent are permitted for miscellaneous and irrigation uses.

As discussed above, some of these privately permitted water wells have been or will likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining at the Belle Ayr and adjacent mines and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible due to the fact that the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if the Belle Ayr North LBA Tract is leased and mined.

3.5.3.2.1.2 West Coal Creek LBA Tract

In November 2007, Wyoming SEO records indicated that a total of 284 permitted water wells were located within 3 miles of the West Coal Creek LBA Tract. As discussed above, 141, almost half of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. The majority of the remaining 143 non-coal mine related wells are permitted for multiple uses. Approximately 48 percent are permitted either for CBNG development only or for CBNG development and other uses; 72 percent are permitted either for livestock use only or for livestock and other uses; 8 percent are permitted for industrial uses; 5 percent are permitted for miscellaneous uses or for miscellaneous and other uses; and about 10 percent are permitted for domestic use or for domestic and other uses.

As discussed above, some of these privately permitted water wells have been or will likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining at the Coal Creek and adjacent mines and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible due to the fact that the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if the West Coal Creek LBA Tract is leased and mined.

3.5.3.2.1.3 Caballo West LBA Tract

In July 2007, Wyoming SEO records indicated that a total of 1,382 permitted water wells were located within 3 miles of the Caballo West LBA Tract. As discussed above, 677, or approximately 49 percent of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. The majority of the remaining 705 non-coal mine related wells are permitted for multiple uses. Approximately 83 percent are permitted either for CBNG development only or for CBNG development and other uses; 48 percent are permitted either for livestock use only or for livestock and other uses; 8 percent are permitted for domestic use only or for domestic and other uses; 1 percent are permitted for monitoring; 1 percent are permitted for industrial use; and about 1 percent are permitted for miscellaneous and irrigation uses.

As discussed above, some of these privately permitted water wells have been or will likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining at the Caballo and adjacent mines and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible due to the fact that the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if the Caballo West LBA Tract is leased and mined.

3.5.3.2.1.4 Maysdorf II LBA Tract

In May 2007, Wyoming SEO records indicated that there were a total of 987 non-coal mine related, permitted water wells within 3 miles of the Maysdorf II LBA Tract. The majority of these wells are permitted for multiple uses. Approximately 79 percent are permitted either for CBNG development only or for CBNG development and other uses; 39 percent are permitted either for livestock use only or for livestock and other uses; 16 percent are permitted for miscellaneous use only or for miscellaneous and other uses; 5 percent are permitted either for domestic uses only or for domestic and other uses; 3 percent are permitted for monitoring use only; 2 percent are permitted for industrial uses; and about 1 percent are permitted for irrigation and other uses.

As discussed above, some of these privately permitted water wells have been or will likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining at the Cordero Rojo and adjacent mines and CBNG development. Future drawdowns to the Wyodak coal aquifer are expected to be negligible due to the fact that the coal seam has essentially been dewatered. Therefore, it is unlikely that any of these privately permitted water wells would be impacted by water level drawdown to a greater extent than they currently are if the Maysdorf II LBA Tract is leased and mined.

3.5.3.2.2 No Action Alternative

Under the No Action Alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal would not occur on that tract at this time. The impacts to water rights associated with existing approved mining and CBNG development, described above, would continue to occur. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in Section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.5.3.3 Regulatory Compliance, Mitigation and Monitoring

SMCRA and Wyoming regulations require mine operators to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality. This required mitigation is considered to be part of the Action Alternatives. The most probable source of replacement water would be one of the aquifers underlying the coal. For example, the subcoal Fort Union Formation aquifers are not removed or disturbed by coal mining, and would therefore be a potential source of replacement water.

If the Belle Ayr North, West Coal Creek, Caballo West, and/or Maysdorf II LBA Tracts are leased, the mine operator would be required to update the list of potentially impacted private water supply wells and predict impacts to those wells within the 5-ft drawdown contour as part of the permitting process. The operator would be required to commit to replacing those water supplies that are determined to be affected by mining with water of equivalent quality and quantity.

3.5.4 Residual Impacts

The area of coal and overburden removal and replacement of overburden and associated groundwater drawdowns would be increased under the Action Alternatives compared with the area of coal and overburden removal and overburden replacement and associated groundwater drawdowns for each of the four existing applicant mines. The postmining backfill may take in excess of 100 years to reach equilibrium water levels and water quality. Less time would be required near the mining boundaries. Monitoring data from wells completed in existing backfilled areas in the PRB suggest that there would be an adequate quantity of water in the backfill to replace current use, which is for livestock. Water quality in the backfill would generally be expected to meet the Wyoming Class III standards for use as stock water.

3.6 Alluvial Valley Floors

3.6.1 Affected Environment

Prior to leasing and mining, alluvial valley floors (AVFs) must be identified because, under the federal Surface Mining Control and Reclamation Act of 1977 (SMCRA), mining on AVFs is prohibited unless the affected AVF is undeveloped rangeland that is not significant to farming or if the affected AVF is of such small acreage that it would have a negligible impact on a farm's agricultural production. These restrictions also apply to AVFs that are downstream of the area of disturbance but might be affected by disruptions in streamflow. AVFs that are determined not to be significant to agriculture can be disturbed during mining but must be restored as part of the reclamation process.

Wyoming Department of Environmental Quality (WDEQ)/Land Quality Division (LQD) regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Guidelines established by the Office of Surface Mining Reclamation and Enforcement (OSM) and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These studies are used to identify the following conditions: 1) the presence of unconsolidated stream laid deposits, 2) the possibility for artificial flood irrigation, 3) past and/or present flood irrigation, and 4) apparent subirrigated areas and the possibility for natural flood irrigation. Areas that are identified as AVFs following these investigations are evaluated for their significance to farming by WDEQ/LQD.

Investigations have been conducted by FCW, TBCC, CCC, and CRM to determine the presence of AVFs within and surrounding the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mines, respectively. AVF investigations conducted within the general South Gillette analysis area have identified an AVF that occurs along Duck Nest Creek on the Belle Ayr North LBA Tract. AVFs have also been identified along Tisdale and Caballo Creeks; however, those lands are located at considerable distances downstream of any of the LBA tracts. Refer to Figure 3-24 for the location of the major streams with respect to the applicant mines and LBA tracts in the general South Gillette analysis area.

3.6.1.1 Belle Ayr North LBA Tract

Duck Nest Creek, a southeast-flowing ephemeral tributary of Caballo Creek, drains the western portion of the Belle Ayr North LBA Tract. Two smaller, unnamed ephemeral tributaries of Caballo Creek and three playas formed by natural topographic depressions drain the balance of the LBA tract. Those portions of Caballo Creek and its tributaries that lie within Belle Ayr Mine's existing permit area have been investigated for the presence of AVFs. A large portion of the BLM study area for the Belle Ayr North LBA Tract is within the mine's existing permit area; therefore, the entire reach of Duck Nest Creek within

the BLM study area has been investigated for the presence of an AVF. The small unnamed ephemeral tributaries of Caballo Creek that also drain the LBA tract are almost completely within the mine's existing permit area, but they were not investigated for the presence of an AVF because no streamlaid deposits were found to be present along those drainages.

The Belle Ayr Mine conducted AVF studies along the reach of Duck Nest Creek that is located within and adjacent to the Belle Ayr North LBA Tract in 1986 and 1987. These studies were combined into a comprehensive AVF assessment in 1991 (WWC 1992), which was part of the WDEQ mine permitting process for the purpose of recovering coal in Belle Ayr Mine's existing federal leases that are located in the western portion of the mine's current permit area. The AVF assessment was referred to as the Duck Nest Tracts or Duck Nest Amendment Area AVF Study. Drainages within that study area included Caballo Creek, Bone Pile Creek, and Duck Nest Creek. Based on the original (1980) AVF study for the Belle Ayr Mine, WDEQ made a determination that the portions of Caballo, Bone Pile, and Duck Nest Creeks located in the Duck Nest Amendment Area are not significant to farming (WDEQ 1988). Following the submittal of the 1991 AVF assessment to the WDEQ, a total of approximately 24.3 acres of AVF on Duck Nest Creek were formally declared within the Duck Nest Amendment Area AVF study area. Approximately 14.9 acres of that total declared acreage on Duck Nest Creek are located within the Belle Ayr North general analysis area.

3.6.1.2 West Coal Creek LBA Tract

Coal Creek and its associated ephemeral tributaries within the existing Coal Creek Mine permit area, including a portion of the BLM study area for the West Coal Creek LBA Tract, have been evaluated for the presence of AVFs. Appendix D-11 in Coal Creek Mine's approved mine permit (TBCC 2006) contains the AVF assessment for lands included within the current mine permit boundary. WDEQ/LQD determined that the AVF characteristics of Coal Creek are negligible and it does not meet the regulatory definition of an AVF because the stream laid deposits are limited in extent and not capable of supporting subirrigation or flood irrigation agricultural activities (WDEQ/LQD 2005). Coal Creek's narrow valley and terrain limitations reduce areas that could support agricultural activities. Surface water quantity is insufficient to support natural or artificial flood irrigation practices, and historic flood irrigation attempts have not been identified along Coal Creek. Due to its limited areal extent, limited saturated thickness, and low hydraulic conductivity, Coal Creek alluvium does not consistently produce enough water to be put to beneficial use. In addition, Coal Creek alluvial groundwater is generally of such poor quality that it does not meet WDEQ/WQD standards for agricultural use (WDEQ/LQD 2005).

If the West Coal Creek LBA Tract is leased and proposed for mining, an AVF assessment would be part of the mine permitting process, and formal declarations of the presence or absence of an AVF, its significance to agriculture, and the

appropriate perimeter (areal extent) would be made by the WDEQ/LQD as part of the permitting process. Based on previous non-AVF declarations made on Coal Creek within and adjacent to the existing Coal Creek Mine permit area, which includes a portion of the BLM study area for the West Coal Creek LBA Tract, as well as some preliminary investigations that have been made by TBCC, it is unlikely that the WDEQ/LQD would declare an AVF is present on the LBA tract that lies outside of Coal Creek Mine's existing permit boundary.

3.6.1.3 Caballo West LBA Tract

Tisdale Creek and its associated ephemeral tributaries within the existing Caballo Mine permit area, which includes a portion of the BLM study area for the Caballo West LBA Tract, have been investigated for the presence of AVFs by the Caballo Mine. Appendix D-11 in Caballo Mine's approved mine permit (CCC 2003) contains the AVF assessment for lands included within the current mine permit boundary. The only portion of Tisdale Creek determined to be an AVF is at the stream's confluence with Gold Mine Draw, which is located approximately 4 miles downstream and to the southeast of the Caballo West general analysis area. Within Section 13, T.48N., R.71W., Gold Mine Draw was declared by WDEQ/LQD to be an AVF significant to agriculture. A tributary of Tisdale Creek, known locally as North Tisdale Creek, is located east and north of the Caballo West LBA Tract, and it too has received a negative AVF declaration from WDEQ/LQD (2004).

An AVF predetermination document has been submitted to the WDEQ/LQD by the Caballo Mine for lands within a proposed permit amendment area, which includes that portion of the Caballo West general analysis area that is outside of the existing permit boundary. There are no streams that meet the definition of an AVF within one-half mile of the proposed permit amendment area, because the streams are incised and contain few stream laid deposits. In addition, there are no present or historical records of agricultural use, other than undeveloped range land, of the stream channels and associated stream laid deposits within the proposed permit amendment area. Based on previous non-AVF declarations made on Tisdale Creek within and adjacent to the Caballo West LBA Tract, it is unlikely that the WDEQ/LQD would declare an AVF is present on the LBA tract that lies outside of Caballo Mine's existing permit boundary where the drainages are smaller and AVF characteristics are negligible.

3.6.1.4 Maysdorf II LBA Tract

Portions of the Belle Fourche River and its associated ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit boundary, and portions of Caballo Creek within and adjacent to the existing Belle Ayr Mine permit boundary (north of the Maysdorf II LBA Tract), have been investigated for the presence of AVFs (CMC 2007a and FCW 2003).

Three separate areas along Caballo Creek, located within and upstream of the existing Belle Ayr Mine permit boundary and north of the Maysdorf II LBA Tract, were studied by FCW and determined by WDEQ/LQD to be AVFs (FCW 2003). One of these areas (located in Sections 35 and 36, T.48N., R.71W.) was determined to be an AVF with possible significance to agriculture. The second area along Caballo Creek (located in Sections 32 and 33, T.48N., R.71W. and Section 5, T.47N., R.71W.) was determined to be an AVF not significant to agriculture. The third AVF study was conducted in 1996 by the Belle Ayr Mine to determine the presence of AVFs west of that mine's original AVF study area. As a result of that study, WDEQ/LQD determined an area along Caballo Creek (located in Section 31, T.48N., R.71W., Section 36, T.48N., R.72W., and Section 1, T.47N., R.72W.) to be an AVF that is not significant to farming. The declared AVF located in Section 1, T.47N., R.72W. is within the Maysdorf II general analysis area.

Several AVF studies have been conducted on the Belle Fourche River and its associated ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit boundary. WDEQ/LQD has determined that the Belle Fourche River valley in the vicinity of the Cordero Rojo Mine is not an AVF because it is not capable of supporting subirrigation or flood irrigation agricultural activities, and that all lands within the existing permit area are considered undeveloped rangeland (CMC 2007a). The Belle Fourche River is considered an impractical water source for artificial flood irrigation practices due to poor water quality and infrequent water availability. Historic flood irrigation attempts have not been identified along the Belle Fourche River or its ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit area. CRM's baseline studies also determined that there is a small amount of groundwater in storage in the unconsolidated deposits of the Belle Fourche River, with subirrigation confined to a narrow area immediately adjacent to the channel (CMC 2007a).

The most recent AVF study along the Belle Fourche River was completed by CRM in 2007 as part of a mine permit amendment process. The study area included approximately 7.5 miles of the river upstream of the existing permit boundary through Sections 9 and 16, T.46N., R.71W., which includes the southern portion of the Maysdorf II general analysis area. Formal declaration of the presence or absence of an AVF, its significance to agriculture, and the appropriate areal extent would be made by the WDEQ/LQD as part of the mine permitting process if the LBA tract is leased and proposed for mining. Based on previous non-AVF declarations made on the Belle Fourche River within and adjacent to the Maysdorf II LBA Tract, it is unlikely that the WDEQ/LQD would declare that an AVF is present.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action and Action Alternatives

AVF investigations conducted within the general South Gillette analysis area have identified an AVF that occurs along Duck Nest Creek on the Belle Ayr North LBA Tract. AVFs have also been identified along Tisdale and Caballo Creeks; however, those lands are located downstream of the LBA tracts.

If the Belle Ayr North LBA Tract is mined by the applicant as an extension of the existing Belle Ayr Mine operations under the Proposed Action or Alternative 2, the mining operations would affect approximately 14.9 acres of declared AVF along Duck Nest Creek. Mining activity would not be restricted in the AVF areas because the WDEQ/LQD has declared them not to be significant to farming (WDEQ 1988). The entire reach of Duck Nest Creek downstream of the LBA tract has been affected by previous and current mining operations at the Belle Ayr Mine.

AVF investigations conducted within and adjacent to the existing Coal Creek Mine permit area have determined that the AVF characteristics of Coal Creek and its associated ephemeral tributaries (West, Middle, and East Forks) are negligible and do not meet the regulatory definition of an AVF (WDEQ/LQD 2005). As indicated above, the entire West Coal Creek general analysis area has not yet been formally evaluated for the presence of AVFs, but the general absence of flood and subirrigation activity in this area indicates it is unlikely that mining the LBA tract under the Proposed Action or Alternative 2 by the applicant as an extension of the existing Coal Creek Mine would be precluded by the presence of an AVF.

Based on previous non-AVF declarations made on Tisdale Creek within and adjacent to the Caballo West LBA Tract (WDEQ/LQD 2004), it is unlikely that the WDEQ/LQD would declare an AVF is present on the LBA tract that lies outside of Caballo Mine's existing permit boundary where the drainages are smaller and AVF characteristics are negligible. As stated above, the nearest AVF in the vicinity of the Caballo West LBA Tract is approximately 4 miles downstream on Tisdale Creek, and it was declared insignificant to farming. The entire reach of Tisdale Creek downstream of the LBA tract has been affected by previous and current mining operations at the Caballo Mine. It is unlikely that mining the LBA tract under the Proposed Action or Alternative 2 by the applicant as an extension of the existing Caballo Mine would be precluded by the presence of an AVF.

AVF investigations conducted within and adjacent to the Maysdorf II general analysis area have identified three small AVF areas that occur along Caballo Creek, downstream of the northern portion of the Maysdorf II LBA Tract. No AVFs have been identified along the Belle Fourche River and its associated ephemeral draws within and adjacent to the existing Cordero Rojo Mine permit boundary. As indicated above, CRM conducted an AVF assessment in 2007 along the Belle

Fourche River upstream of the mine's existing permit boundary and within the southern portion of the Maysdorf II general analysis area.

The most recent AVF study along the Belle Fourche River was completed by CRM in 2007 as part of a mine permit amendment process. The study area included approximately 7.5 miles of the river upstream of the existing permit boundary through Sections 9 and 16, T.46N., R.71W., which includes the southern portion of the Maysdorf II general analysis area. Formal declaration of the presence or absence of an AVF, its significance to agriculture, and the appropriate areal extent would be made by the WDEQ/LQD as part of the mine permitting process if the LBA tract is leased and proposed for mining. Based on previous non-AVF declarations made on the Belle Fourche River within and adjacent to the Maysdorf II LBA Tract and the general absence of flood irrigation activity in this area, it is unlikely that mining the LBA tract under the Proposed Action or Alternative 2 by the applicant as an extension of the existing Cordero Rojo Mine would be precluded by the presence of an AVF.

No direct, indirect, or cumulative impacts are anticipated to off-site AVFs through mining of the four LBA tracts in the general South Gillette analysis area. Streamflows in the Belle Fourche River would be diverted around the active mining areas in a temporary diversion channel. Consequently, disruptions to streamflow that might supply AVFs on the Belle Fourche River downstream of the Belle Ayr Mine would not be expected to be substantial. Streamflows in the other drainages within the Belle Ayr North, West Coal Creek, Caballo West, or the Maysdorf II LBA Tracts would be diverted around the active mining areas in temporary diversion channels, captured in flood control reservoirs above the pit, or allowed to flow into the mine pit and routed through settling ponds. If flood control impoundments and/or settling ponds are used, it would be necessary to evacuate them following major runoff events to provide storage volume for the next flood. Consequently, disruptions to streamflows that might supply downstream AVFs are expected to be negligible. Groundwater and surface runoff intercepted by the mine pits would be routed through settling ponds to meet state and federal quality criteria, and the pond discharges would likely increase the frequency and amount of flow in these streams, thereby increasing surface water supplies to downstream AVFs.

If the LBA tracts are mined as an extension of existing operations, the mining would generally extend upstream on streams already in active mine areas. Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVFs through mining of the Belle Ayr North, West Coal Creek, Caballo West, or the Maysdorf II LBA Tracts.

3.6.2.2 No Action Alternative

Under the No Action Alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would

not be offered for lease, and coal removal would not occur on that tract at this time. Impacts to AVFs related to existing approved mining operations would continue to occur as currently permitted. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in Section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.6.3 Regulatory Compliance, Mitigation and Monitoring

As discussed above, AVFs must be identified because SMCRA restricts mining activities that would affect AVFs that are determined to be significant to agriculture. Impacts are generally not permitted to AVFs that are determined to be significant to agriculture. AVFs that are determined not to be significant to agriculture or that were permitted to be disturbed prior to the effective date of SMCRA can be disturbed during mining but must be restored as part of the reclamation process. The determination of significance to agriculture is made by WDEQ/LQD, and it is based on specific calculations related to the production of crops or forage on the AVF and the size of the existing agricultural operations on the land of which the AVF is a part. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of any affected AVF will be protected. Mines are required to restore the essential hydrologic functions of any affected AVF and preserve the hydrologic functions of AVFs on adjacent lands. Downstream AVFs must also be protected during mining. The applicant mines are required to monitor impacts of downstream AVFs by measuring discharges from sedimentation ponds for quantity and quality.

These measures are required by regulation and would be included in the mine permit amendment that would be revised accordingly and included in the mine permit amendment that would be required for each respective LBA tract that is leased. Mine permit revisions must be approved before mining could occur on each tract that is leased, regardless of who acquires the tract, and are therefore considered to be part of the Proposed Action and Action Alternatives for each LBA tract.

3.6.4 Residual Impacts

No residual impacts to AVFs would occur following mining.

3.7 Wetlands

3.7.1 Affected Environment

Wetlands are aquatic features defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b)). The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland (hydric) soils (EPA 2007e). Vegetation in wetland environments is highly productive and diverse and provides habitat for many wildlife species. These systems as a whole play important roles in controlling floodwaters, recharging groundwater, and filtering pollutants (Niering 1985).

Wetlands must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology. When the upper part of the soil is saturated with water at growing season temperatures, soil organisms consume the oxygen in the soil and cause conditions unsuitable for most plants. Such conditions also cause the development of soil characteristics (such as color and texture) of so-called "hydric soils". The plants that can grow in such conditions, such as marsh grasses, are called "hydrophytes". Together, hydric soils and hydrophytes give clues that a wetlands area is present. The presence of water by ponding, flooding, or soil saturation is not always a good indicator of wetlands. Except for wetlands flooded by ocean tides, the amount of water present in wetlands fluctuates as a result of rainfall patterns, snow melt, dry seasons and longer droughts.

Waters of the United States is a collective term for those water bodies subject to regulation pursuant to the Clean Water Act (CWA), which typically include lakes, streams, wetlands, and certain other water bodies. Wetlands subject to the CWA jurisdiction are known as "jurisdictional wetlands", while those wetlands not subject to CWA jurisdiction are known as "non-jurisdictional" wetlands. Section 404 of the CWA requires a permit for the discharge of dredged or fill materials into Waters of the U.S. including jurisdictional wetlands. CWA Section 404 is administered by the U.S. Army Corps of Engineers (COE), and any required Section 404 permits must be obtained from the COE. Compliance with Section 404 and its implementing regulations requires a sequence of avoidance, minimization and mitigation of wetlands.

A U.S. Supreme Court decision (*Rapanos v. United States* and *Carabell v. United States*, collectively referred to as the "Rapanos" decision) in 2006 attempted to address federal jurisdiction over Waters of the U.S. under the CWA (EPA 2007e). According to the Court's decision, the Environmental Protection Agency (EPA) and COE must ensure that jurisdictional determinations, permitting actions, and other

relevant actions are consistent with the Rapanos decision. The decision addressed where the Federal government can apply the CWA, specifically by determining whether a wetland or tributary is a "Water of the U.S.", being "relatively permanent, standing or continuously flowing bodies of water" connected to traditional navigable waters, and to "wetlands with a continuous surface connection (nexus) to" such relatively permanent waters.

Briefly, the agencies will assert jurisdiction over the following waters:

- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

The agencies will decide jurisdiction over the following waters based on a fact-specific analysis to determine whether they have a significant nexus (connection) with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent;
- Wetlands adjacent to non-navigable tributaries that are not relatively permanent; and
- Wetlands adjacent to, but do not directly abut, a relatively permanent non-navigable tributary.

The agencies will generally not assert jurisdiction over the following features:

- Swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow); and
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

Wetlands occur in a variety of forms and are somewhat limited in size within the general South Gillette analysis area. Riverine wetlands, defined by their close association with perennial and intermittent streams, occur sporadically along drainages. Periodic flooding events can also support Riverine wetlands areas. Common vegetation species in these settings can include willows (*Salix* spp.), scouring rush (*Equisetum* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.). Palustrine wetlands, defined by their close association with emergent herbaceous marshes, swales, and wet meadows, support a variety of lush plant life and occur sporadically along major drainages and where topographic depression areas are naturally subirrigated and/or sporadically flooded. Common species in these settings can include sedges, rushes, cordgrass (*Spartina* spp.), mint (*Mentha* spp.), and buttercup (*Ranunculus* spp.). Depressional areas that hold water may support lacustrine wetlands. When natural, these wetland areas are called

playas; however, manmade structures such as stock ponds also may support these systems. The most common species in these settings include cattails (*Typha* spp.) and bulrush (*Scirpus* spp.), although lady's thumb (*Polygonum* spp.), verbena (*Verbena* spp.), and milkweed (*Asclepias* spp.) may also occur (USDA-FS 1987). In addition to wetlands, the general South Gillette analysis area may include jurisdictional other Waters of the U.S., as defined by 33 CFR 328.3. These other Waters of the U.S. are primarily ephemeral stream channels, open water, and other stream channels that carry water but do not meet the criteria for classification as wetlands.

3.7.1.1 Belle Ayr North LBA Tract

The wetlands analysis area for the Belle Ayr North LBA Tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Belle Ayr Mine operation. A formal wetland delineation has been confirmed by the COE for the portion of the LBA tract wetlands analysis area that is within the adjacent existing Belle Ayr Mine permit area (FCW 2003). A formal wetland survey for the portion of the wetlands analysis area that is outside of the current Belle Ayr Mine permit area has not yet been completed; however, a portion of the large playa located in Sections 18 and 19, T.48N., R.71W. and Section 13, T.48N., R.72W. is the only Water of the U.S. within the wetlands analysis area that has not yet had a determination made by the COE.

A total of approximately 193.9 acres of Waters of the U.S., including a total of 14.4 acres of jurisdictional Waters of the U.S., occur within the wetlands analysis area for the Belle Ayr North LBA Tract. Approximately 11.9 of those acres are jurisdictional wetlands that occur along the watercourse of Duck Nest Creek. The 2.5 acres of jurisdictional other Waters of the U.S. that did not qualify as jurisdictional wetlands consist primarily of open water that is held within the in-channel impoundments and intermittent pools along Duck Nest Creek. The non-jurisdictional Waters of the U.S. contained in the wetlands analysis area consists of the internally drained playas and total approximately 179.5 acres in area. As a result of recent court directives, playas are no longer identified as jurisdictional Waters of the U.S. under Section 404 of the CWA (refer to Section 3.7.1.3 below). These non-jurisdictional wetland features can however have significant biological and hydrological importance.

3.7.1.2 West Coal Creek LBA Tract

The wetlands analysis area for the West Coal Creek LBA Tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Coal Creek Mine operation. A formal wetland delineation has been confirmed by the COE for the portion of the LBA tract wetlands analysis area that is within the adjacent existing Coal Creek Mine permit area (TBCC 2006). Coal Creek Mine conducted a

preliminary wetlands inventory in 2007, based on U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping and vegetation mapping in the field (BKS 2007a), for the non-delineated portions of the wetlands analysis area. Some wetland areas previously mapped by the USFWS NWI project have been recently altered somewhat due to CBNG-related water production within and upstream of the West Coal Creek wetlands analysis area. The boundaries of the existing potential wetlands may vary to a greater or lesser extent from the boundaries shown on the NWI maps, and current field conditions may not be representative of the field conditions in the future. A formal wetland delineation of the area proposed for mining would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process, if the West Coal Creek LBA Tract is leased.

Coal Creek, an ephemeral stream, drains the West Coal Creek wetlands analysis area. No emergent vegetation or hydric soils were identified along the stream channel and its banks within the wetlands analysis area during the vegetation survey conducted in the summer of 2007; however, standing water was present within its banks in many places as a result of recent thunderstorm events. A few in-channel, diked stock ponds are present and NWI mapping identifies them as probable wetlands; however, no palustrine emergent vegetation was found to be supported by these ponds and some were in fact dry. The primary plant species found along the channel and surrounding the stock ponds were *Carex* species (sedge), *Elymus smithii* (western wheatgrass), *Bromus tectorum* (cheatgrass brome). Occasionally occurring plant species included *Vicia americana* (American vetch), *Eleocharis palustris* (bald spikerush), *Thlaspi arvense* (field pennycress) and *Spartina pectinata* (prairie cordgrass). These stock ponds would be characterized as other Waters of the U.S. and they total approximately 3.8 acres in area.

During the 2007 vegetation field mapping, a tributary to West Fork Coal Creek, located in the southwestern portion of Section 30, T.46N., R.70W., was found to be receiving CBNG discharge water from upstream of the wetlands analysis area. Approximately 4.2 acres of open water presently occurs within the channel, but wetland characteristics (e.g., hydrophytic wetland vegetation and hydric soils) were not identified.

Based on the existing USFWS NWI mapping data (which may be somewhat outdated), the wetlands confirmed to be present within the adjacent Coal Creek Mine's permit area, and the vegetation mapping that was conducted in 2007, a total of approximately 16.92 acres of wetlands and other Waters of the U.S. occur within the West Coal Creek wetlands analysis area. The earlier wetland delineation confirmed by the COE identified a total of approximately 3.48 acres of wetlands, which are associated with the stream channels (both riverine- and palustrine marsh-types), within the wetlands analysis area. The 2007 preliminary wetlands survey identified approximately 13.44 acres of other Waters of the U.S., which were areas of open water held within the stream channels, or in-channel impoundments identified by NWI mapping that were found to be dry at the time.

Non-jurisdictional wetlands and other Waters of the U.S. were included in the above acreages and were not identified separately because only the COE has the authorization to make such determinations. Non-jurisdictional wetlands are generally associated with internally drained depressions/playas that are isolated, and non-jurisdictional other Waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. No internally drained playas have been identified within the West Coal Creek general analysis area.

3.7.1.3 Caballo West LBA Tract

The wetlands analysis area for the Caballo West LBA Tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Caballo Mine operation. A formal wetland delineation has been confirmed by the COE for the portion of the LBA tract wetlands analysis area that is within the adjacent existing Caballo Mine permit area (CCC 2003). Caballo Mine conducted a preliminary wetlands inventory in 2007, based on USFWS NWI mapping and vegetation mapping in the field, for the non-delineated portions of the wetlands analysis area. A formal wetland delineation survey would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process, if the tract is leased.

Most of the wetlands within the wetlands analysis area are associated with the watercourses of Tisdale Creek and an internally drained playa. Within the portion of the wetlands analysis area that is inside the adjacent existing Caballo Mine permit area, a total of 5.96 acres of jurisdictional wetlands are located along Tisdale Creek. NWI mapping shows small areas (approximately 0.55 acre total) of probable wetlands located in stock ponds or pools along a tributary draw in Section 17, T.48N., R.71W., which are outside of Caballo Mine's permit area, and therefore have not been previously confirmed by the COE. Within the wetlands analysis area is approximately 3,964 feet of ephemeral stream channel that is jurisdictional other Waters of the U.S.

Therefore, based on preliminary wetlands mapping completed in 2007 and earlier wetland delineation confirmed by the COE, a total of approximately 15.0 acres of Waters of the U.S., including a total of 8.63 acres of jurisdictional Waters of the U.S., occur within the entire wetlands analysis area. Approximately 6.51 of those acres are jurisdictional wetlands that occur along the water courses of Tisdale Creek. The 2.12 acres of jurisdictional other Waters of the U.S. that did not qualify as wetlands consist primarily of open water that is held within the in-channel impoundments along Tisdale Creek.

The playa located near the center of Section 7, T.48N., R.71W., adjacent to the LBA tract as applied for and within the wetlands analysis area, was delineated in 1996 as a jurisdictional wetland, but was later declared non-jurisdictional by the COE following a decision of the U.S. Supreme Court in *Solid Waste Agency of*

Northern Cook County v U.S. Army Corps of Engineers (No. 99-1178, January 9, 2001). Approximately 6.37 acres of non-jurisdictional wetlands are included in this playa.

3.7.1.4 Maysdorf II LBA Tract

The wetlands analysis area for the Maysdorf II LBA Tract includes the BLM study area for the LBA tract plus a ¼-mile disturbance buffer around the BLM study area sufficient to mine and reclaim the tract as a part of the Cordero Rojo Mine operation. Cordero Rojo Mine conducted a preliminary wetlands inventory in 2005 and 2006 of the lands within the wetlands analysis area, based on USFWS NWI mapping and vegetation mapping in the field (ESCO 2007). The area investigated is located almost entirely outside of the existing Cordero Rojo Mine permit area, west and south of the current permit boundary. Some wetland areas previously mapped by the USFWS NWI project have been recently altered somewhat due to CBNG-related water production within and upstream of the Maysdorf II wetlands analysis area. The boundaries of the existing potential wetlands may vary to a greater or lesser extent from the boundaries shown on the NWI maps, and current field conditions may not be representative of the field conditions in the future. Due to the ephemeral nature of CBNG dewatering activities, the wetland boundaries and areas are likewise ephemeral. A formal wetland delineation survey of the area proposed for mining would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process, if the LBA tract is leased.

Wetlands occur in a variety of forms within the wetlands analysis area and are generally associated with the watercourses of the Belle Fourche River and Caballo Creek, diked or impounded ponds, and internally drained playas. The wetland areas mapped by USFWS in this area are described as palustrine (marshy) emergent vegetation. These wetlands support a variety of lush plant life and occur along the banks of the Belle Fourche River and Caballo Creek, around a few diked or impounded livestock ponds, and within a few closed depressions. The palustrine wetlands, which are supported by temporarily or seasonally flooded soils, are adequately supplied with surface runoff and/or discharged waters from CBNG production.

The Streamside Bottomland vegetation community, which was mapped in 2005 and 2006 along the banks of the Belle Fourche River and Caballo Creek, is considered wetlands by COE's wetland delineation standards. The well-wetted banks of the Belle Fourche River have, at present, wetland vegetation, soils and hydrology; the latter being somewhat dependant upon the volume of water discharged into the drainage basin from CBNG dewatering activities.

The Streamside Bottomland vegetation community also occurs along Caballo Creek in the wetlands analysis area. Through this reach, the steep banks of Caballo Creek has helped to minimize an increase in the wetted area caused by

increased streamflow from CBNG development-related inflow. However, some areas adjacent to the stream have become more extensively moistened and are likely to exceed pre-CBNG development extents. As a result, some portions of these areas may now be considered wetlands (ESCO 2007). In addition, increased water-borne salt load in Caballo Creek seems to have altered the Streamside Bottomland species composition from what it was in the mid-1990s (ESCO 1996).

Based on the existing USFWS NWI mapping data (which may be somewhat outdated) and the vegetation mapping that was conducted in 2005 and 2006, a total of approximately 140.15 acres of wetlands and other Waters of the U.S. occur within the wetlands analysis area. Of this 140.15 acres identified, approximately 133.54 acres are vegetated wetlands and the remaining 6.61 acres are other Waters of the U.S. The majority of the wetlands are associated with the watercourses of the Belle Fourche River and Caballo Creek, diked or impounded reservoirs, and internally drained depressions/playas, while the majority of the other Waters of the U.S. are associated with ephemeral stream channels and areas of open water.

Non-jurisdictional wetlands and other Waters of the U.S. were included in the above acreages and were not identified separately because only the COE has the authorization to make such determinations. Non-jurisdictional wetlands are generally associated with internally drained depressions/playas that are isolated, and non-jurisdictional other Waters of the U.S. generally occur where areas of open water are ponded in a depression/playa area. Approximately 49.94 acres of playas occur in the area, and those internally drained areas would probably be considered non-jurisdictional by the COE.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action and Action Alternatives

Formal delineations have been confirmed by the COE for wetland areas and other Waters of the U.S. included in the proposed LBA tracts that lie within the four applicant mines' existing permit areas. Based on those previous wetland surveys, NWI mapping by USFWS, and the vegetation mapping in the field that was completed from 2005 to 2007, a maximum of approximately 366 acres of wetlands and other Waters of the U.S. would be disturbed if each of the four LBA tracts is leased and subsequently mined under the largest Action Alternative tract configuration. Formal wetland inventories covering the remainder of the wetlands analysis areas for the LBA tracts that are leased would be conducted and submitted to the COE for verification as part of the process of obtaining a surface coal mining permit. In Wyoming, once the delineation has been verified by the COE, it would be made a part of the mine permit document. The reclamation plan would then be revised to incorporated replacement of at least equal types and number of jurisdictional wetlands.

Disturbed non-jurisdictional wetlands would be restored as required by the authorized federal or state agency or private surface land owner as specified in the mining and reclamation permit, which would have to be approved by WDEQ/LQD before mining operations could be conducted on the LBA tracts that are leased.

During the period of time after mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not duplicate the exact function and landscape features of the premine wetlands, but replacement plans would be evaluated by the COE and replacement would be in accordance with the requirements of Section 404 of the CWA as determined by the COE.

3.7.2.2 No Action Alternative

Under the No Action Alternative for each of these four LBA tracts, the coal lease application for that tract would be rejected, the area included in that tract would not be offered for lease, and coal removal would not occur on that tract at this time. Impacts to wetlands and other Waters of the U.S. related to existing approved mining operations would continue to occur as currently permitted. Mining operations would not be extended onto portions of these LBA tracts that will not be affected under the currently approved mining and reclamation plans.

As discussed in Section 2.2, a decision to reject one or more of these four lease applications at this time would not preclude an application to lease that respective tract in the future.

3.7.3 Regulatory Compliance, Mitigation and Monitoring

The presence of jurisdictional wetlands on a mine property does not preclude mining. A formal wetland delineation survey must be conducted prior to mining according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands and other waters present. Once the delineation has been verified, it is made part of the mine and reclamation permit. There are special required permitting procedures to assure that after mining there will be no net loss of wetlands. The COE requires replacement of all impacted jurisdictional wetlands in accordance with Section 404 of the CWA, and all wetland replacement plans have to be approved by the COE. The reclamation plan must incorporate at least equal types and acres of disturbed jurisdictional wetlands.

As such, a formal jurisdictional wetland delineation survey would be conducted and submitted to the COE for verification as part of the mining and reclamation permit process for each of these four LBA tracts that are leased and proposed for mining. Formal wetland delineations have been confirmed by the COE for wetland areas included in the proposed LBA tracts that lie within existing adjacent mine permit areas. In light of the 2006 Rapanos decision (refer to Section 3.7.1 above),

previous jurisdictional determinations by the COE in the general South Gillette analysis area may in fact need to be revisited.

In addition, Executive Order (EO) No. 11990 – Protection of Wetlands (May 24, 1977) directs each federal agency to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agencies' responsibilities for: (1) acquiring, managing, and disposing of federal land and facilities; (2) providing federally undertaken, financed, or assisted construction and improvement; and (3) conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating and licensing activities. EO 11990 is not limited in application to only those wetlands subject to CWA jurisdiction, but applies to all wetlands within the scope of the EO.

Mitigation for impacts to non-jurisdictional wetlands located on the four LBA tracts will be specified during the permitting process as required by the authorized state or federal agency (which may include the WDEQ, OSM, or the federal surface managing agency, if any federal surface is included in the tract) or the private surface owner. Surface land ownership on the general South Gillette analysis area is private and federal (see Section 3.11). The federal surface is administered by the BLM. WDEQ/LQD allows and sometimes requires mitigation of non-jurisdictional wetlands affected by mining, depending on the values associated with the wetland features. WDEQ/LQD may also require replacement of sites with hydrologic significance. If any playas with hydrologic significance are located on the tract that is leased, WDEQ/LQD would also require their replacement.

Finally, the surface mining regulatory authorities (WDEQ/LQD and OSM) typically require replacement of non-jurisdictional and functional wetlands as a measure to protect and enhance wildlife.

Reclaimed wetlands are monitored using the same procedures used to identify wetlands prior to mining disturbances.

3.7.4 Residual Impacts

Replaced wetlands may not duplicate the exact function and landscape features of the premining wetland.

3.8 Soils

3.8.1 Affected Environment

Numerous baseline soil surveys associated with surface mining operations and oil field development have been conducted in the eastern PRB. Soil surveys of Campbell County, Wyoming, including the four LBA soils analysis areas, have also

recently been conducted by the NRCS (Westerman and Prink 2004). Each of the LBA soils analysis areas includes the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under Action Alternatives), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries).

Soils vary depending upon where and how they were formed. Major factors involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Four primary soil formation processes causing different soil types were noted in this area: 1) soils developing predominantly in thin residuum from sandstone or shale on upland ridges, 2) soils developing predominantly in slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands, 3) soils developing predominantly in coarse-textured alluvium or sandy eolian deposits on rolling uplands, and 4) drainage soils developing in mixed stream laid alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins.

The soil depths and types on the four LBA tracts soils general analysis areas are similar to soils currently being salvaged and utilized for reclamation at the adjacent Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines and other mines in the eastern PRB. Additional detailed information about the soil types on the Belle Ayr North, West Coal Creek, Caballo West and Maysdorf II LBA tracts is included in the supplemental information document, which is available on request. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils, which are one component used in identifying wetlands. Areas with soils that are not suitable to support plant growth include sites with high alkalinity, salinity, or clay content.

3.8.1.1 Belle Ayr North LBA Tract

The Belle Ayr North LBA Tract soils general analysis area (1,947.0 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternative 2), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by James Nyenhuis to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the Belle Ayr North soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.1.2 West Coal Creek LBA Tract

The West Coal Creek LBA Tract soils general analysis area (2,210.1 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternative 2), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by BKS Environmental to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.1.3 Caballo West LBA Tract

The Caballo West LBA Tract soils general analysis area (1,390.4 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternative 2), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by BKS Environmental to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.1.4 Maysdorf II LBA Tract

The Maysdorf II LBA Tract soils general analysis area (6,917 total acres) is the BLM study area for the tract (the LBA tract as applied for and the additional area evaluated under Alternatives 2 and 3), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area outside of existing permit boundaries). Soil surveys were completed in 2007 by James Nyenhuis to an Order 1-2 resolution. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the soils general analysis area were identified by series, which consist of soils that have similar horizons in their profile.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action and Action Alternatives

Removal and replacement of soils during mining and reclamation would cause changes in the soil resources. In reclaimed areas, soil chemistry and soil nutrient distribution would generally be more uniform and average topsoil quality would be

improved because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land.

The baseline soils analyses for the LBA tracts indicate that the amount of suitable topsoil that would be available for redistribution on all disturbed acres within the soils general analysis areas during reclamation would vary from an average depth of 1.9 ft to an average depth of 3.1 ft. The replaced topsoil would support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

There would be an increase in the near-surface bulk density of the soil resources on the LBA tract after reclamation. As a result, the average soil infiltration rates would generally decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation would potentially decrease runoff, which would tend to offset the effects of decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering action would form a new soil structure in the reclaimed soils, and infiltration rates would gradually return to premining levels. The reclaimed landscape would contain stable landforms and drainage systems that would support the postmining land uses. Reconstructed stream channels and floodplains would be designed and established to be erosionally stable.

Direct biological impacts to soil resources on each LBA tract would include short-term to long-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts for soil resources that are stockpiled before placement. The following discussion is a description of potential impacts to soil resources on each LBA tract following reclamation under the Proposed Action or Alternatives 2 or 3.

3.8.2.1.1 Belle Ayr North LBA Tract

Potential impacts to soil resources on the Belle Ayr North LBA tract after final reclamation under the Proposed Action or Alternative 2 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 11,621 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Belle Ayr Mine (Table 3-1). The Belle Ayr North LBA Tract soil general analysis area is disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 1,937 additional acres of soil resources not already permitted for disturbance, or approximately 1,947 acres under Alternative 2 (Table 3-1). Average topsoil thickness would be about 26.8 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Belle Ayr North LBA Tract under the Action Alternatives considered in this EIS are similar to the soils on the existing leases at the Belle Ayr Mine.

3.8.2.1.2 West Coal Creek LBA Tract

Potential impacts to soil resources on the West Coal Creek LBA tract after final reclamation under the Proposed Action or Alternative 2 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 8,355 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Coal Creek Mine (Table 3-2). Preliminary estimates indicate that if the West Coal Creek LBA Tract is leased, disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 1,925 additional acres of soil resources not already permitted for disturbance, or approximately 2,210 acres under Alternative 2 (Table 3-2). Average topsoil thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the West Coal Creek LBA Tract under the Action Alternatives considered in this EIS are similar to the soils on the existing leases at the Coal Creek Mine.

3.8.2.1.3 Caballo West LBA Tract

Potential impacts to soil resources on the Caballo West LBA tract after final reclamation under the Proposed Action or Alternative 2 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 16,898 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Caballo Mine (Table 3-3). Preliminary estimates indicate that if the Caballo West LBA Tract is leased, disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 1,350 additional acres of soil resources not already permitted for disturbance, or approximately 1,390 additional acres under Alternative 2 (Table 3-3). Average topsoil thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Caballo West LBA Tract under the Action Alternatives considered in this EIS are similar to the soils on the existing leases at the Caballo Mine.

3.8.2.1.4 Maysdorf II LBA Tract

Potential impacts to soil resources on the Maysdorf II LBA tract after final reclamation under the Proposed Action or Alternative 2 and 3 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 14,694 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Cordero Rojo Mine (Table 3-4). Preliminary estimates indicate that if the Maysdorf II LBA Tract is leased, disturbance related to removing coal from the LBA tract under the Proposed Action would directly affect approximately 6,675 additional acres of soil resources, or approximately 6,917 additional acres under Alternatives 2 and 3 (Table 3-4). Average topsoil thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Maysdorf II

LBA Tract under the Action Alternatives considered in this EIS are similar to the soils on the existing leases at the Cordero Rojo Mine.

3.8.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and coal removal and the associated disturbance and impacts to soils would not occur on the additional acres included in the four LBA tracts. The additional acres disturbed in the Proposed Action or other action alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are listed in Tables 2-1 through 2-4, respectively. Coal removal and the associated soil removal and replacement would occur on the existing mine leases as currently permitted (as summarized in Tables 3-1 through 3-4). Impacts to soils related to mining operations at the existing mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.8.3 Regulatory Compliance, Mitigation and Monitoring

Soils suitable to support plant growth would be salvaged for use in reclamation. Soil stockpiles would be protected from disturbance and erosional influences. Soil material that is not suitable to support plant growth would not be salvaged. Soil or overburden materials containing potentially harmful chemical constituents (such as selenium) would be specially handled.

At least 4 ft of suitable overburden would be selectively placed on the graded backfill surface below the replaced topsoil to meet guidelines for vegetation root zones. After topsoil is replaced on reclaimed surfaces, revegetation would reduce wind erosion. The mine would construct sediment control structures as needed to trap eroded soil.

Regraded overburden would be sampled for compliance with root zone criteria. Vegetation growth would be monitored on reclaimed areas to determine if soil amendments are needed.

These measures are required by regulation and are therefore considered to be part of the Proposed Action and other action alternatives for the Belle Ayr South, West Coal Creek, Caballo West and Maysdorf II LBA Tracts.

3.8.4 Residual Impacts

Existing soils would be mixed and redistributed, and soil-forming processes would be disturbed by mining. This would result in long-term alteration of soil characteristics.

3.9 Vegetation

3.9.1 Affected Environment

The vegetation general analysis area for each tract includes the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under the other action alternatives plus an additional area (assumed to be a ¼-mile buffer that would be disturbed in order to recover the coal in the BLM study area outside of existing permit boundaries). Each of the SGAC LBA tracts' vegetation general analysis area contains portions that are partially located within and adjacent to current mine permit boundaries. Consequently, portions of the vegetation general analysis areas were previously mapped and sampled in accordance with the current WDEQ/LQD mine permitting requirements. The balance of the vegetation assessments were completed for the Belle Ayr North and for the Maysdorf II LBA Tracts by ESCO Associates, Inc. of Boulder, Colorado in 2006and 2007 and for the West Coal Creek and Caballo West LBA Tracts by BKS Environmental Associates, Inc. of Gillette, Wyoming in 2007. The vegetation communities in theses areas were appraised and mapped to provide a preliminary assessment.

The vegetation within the vegetation general analysis areas consists of species common to eastern Wyoming and consistent with vegetation that occurs within the adjacent mine permit areas. Water and disturbed areas were also mapped. The following vegetation types were identified in the combined LBA vegetation general analysis areas:

- Crested Wheatgrass Pasture
- Cropland
- Hayland
- Grainland
- Sagebrush/Grassland
- Big Sagebrush
- Silver Sagebrush
- Saline Grassland
- Sandy Grassland
- Loamy Grassland
- Playa Grassland
- Upland Grassland
- Mixed Grass Prairie
- Rough Breaks

- Rock Outcrop/Blowout
- Streamside Bottomlands
- Meadow
- Lowland Grassland
- Draw Bottomland
- Water
- Topsoil Stockpiles
- Reclaimed Area
- Disturbed Area
- Pre-Mining Disturbance
- Developed

Table 3-11 presents the acreage and percent of the combined general analysis areas encompassed by each vegetation type. Additional more-detailed information about the vegetation types within the LBA tract is included in the supplemental information document, which is available on request.

In terms of total acres of occurrence in the combined vegetation general analysis areas, the predominant vegetation types are the Sagebrush/Grassland (38.07percent) and Sandy Grassland (18.41 percent). Common plant species on these types include crested wheatgrass, smooth brome, needle and thread, threadleaf sedge, western wheatgrass, blue grama, and cheatgrass brome. Dominant shrubs/subshrubs in the Sagebrush/Grassland and Sandy Grassland vegetation communities include Wyoming big sagebrush and fringed sage. Lichens and manyspine plains pricklypear cactus are frequently large components of the vegetation cover.

The predominant vegetation type on approximately 10 percent of the vegetation general analysis area is the crested wheatgrass pasture. This type consists of areas that have been converted (at least originally and intentionally) from native vegetation of one of the above-described types to a monoculture of crested wheatgrass. Through time, those areas that have not been actively managed are likely to experience invasion by native plant species from adjacent areas. Blue grama, purple threeawn, Junegrass, and needle and thread are among the more commonly invading grasses.

The various categories of disturbance (topsoil stockpiles, reclaimed area, disturbed area, pre-mining disturbance, and developed areas) account for approximately 8 percent of the vegetation general analysis area. Areas mapped as disturbed are mostly associated with advancing excavation associated with the backslopes of mine pits, disturbance associated with CBNG activity (roads to drill pads, wellpads, and pipeline construction), areas recently excavated and contoured as part of construction of a flood control, and rights-of-way for public roads.

Table 3-11. Vegetation Types Identified and Mapped Within the Combined LBA Vegetation General Analysis Areas.

Vegetation Type	Acres	Percent of Area
Sagebrush Grassland	4,744.73	38.07%
Sandy Grassland	2,294.52	18.41%
Crested Wheatgrass Pasture	1,238.36	9.93%
Mixed Grass Prairie	740.57	5.94%
Disturbed Area	693.24	5.56%
Saline Grassland	314.64	2.52%
Big Sagebrush	302.65	2.43%
Cropland	296.80	2.38%
Silver Sagebrush	276.85	2.22%
Rough Breaks	228.01	1.83%
Streamside Bottomlands	209.94	1.68%
Playa Grassland	208.35	1.67%
Pre-Mining Disturbance	177.26	1.42%
Loamy Grassland	171.77	1.38%
Hayland	98.55	0.79%
Topsoil Stockpiles	90.00	0.72%
Grainland	83.90	0.67%
Upland Grassland	83.90	0.67%
Reclaimed Area	73.41	0.59%
Draw Bottomland	55.16	0.44%
Pastureland	28.00	0.22%
Lowland Grassland	21.60	0.17%
Burn	13.22	0.11%
Rock Outcrop/Blowout	5.50	0.04%
Meadow	5.40	0.04%
Developed	4.60	0.04%
Water	3.80	0.03%
Total	12,464.73	100.00%

Source: BKS 2007a and 2007b, ESCO 2007a and 2007b

There are few occurrences of noxious weeds in the mine area; however, there are native areas adjacent to mine permit areas that are infested with noxious weeds, primarily Canada thistle

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action and Action Alternatives

Under the currently approved mining and reclamation plans, approximately 51,568 acres of vegetation will be disturbed in order to mine the coal in the

existing leases at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. Under the Proposed Action, mining of the four LBA tracts would progressively remove the native vegetation on approximately 12,465 additional acres on and near the LBA tracts. Vegetation removal on the LBA tracts under the Proposed Action and other action alternatives is presented as the additional mine disturbance area in Tables 3-1 through 3-4.

Short-term impacts associated with the removal of vegetation from the LBA tracts would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-term impacts include loss of habitat or loss of habitat carrying capacity for some wildlife species as a result of reduced plant species diversity or reduced plant density for some species, particularly big sagebrush, on reclaimed lands. However, grassland-dependent wildlife species and livestock would benefit from the increased grass cover and production.

Reclamation, including revegetation of these lands, would occur contemporaneously with mining on adjacent lands, i.e., reclamation would begin once an area is mined. Estimates of the time elapsed from soil stripping through reseeding of any given area range from 2 to 4 years. This would be longer for areas occupied by stockpiles, haulroads, sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. No new life-of-mine facilities would be located on the LBA tracts under the Proposed Action or Alternatives 2 or 3 because the LBA tracts would be mined as an extension of an existing mine using existing facilities.

Grazing restrictions prior to mining and during reclamation would remove up to 100 percent of the LBA areas from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region, and long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. There would not be a substantial restriction of wildlife use of the area throughout the operations.

In an effort to approximate premining conditions, the applicants would plan to reestablish vegetation types that are similar to the premine types during the reclamation operation. Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ). The majority of the approved species are native to the LBA tracts. Initially, the reclaimed lands would be primarily a mixture of prairie grasslands with graminoid/forb-dominated areas. An overall reduction in species diversity, especially for the shrub component, would occur. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Estimates for the time it would take to restore shrubs, including sagebrush, to premining density levels range from 20 to 100 years. As indicated previously, sagebrush is a component of the Sagebrush/Grassland vegetation community, which occupies about 39 percent of

the vegetation general analysis areas. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond (a minimum of 10 years), a diverse, productive, and permanent vegetative cover would be established on the LBA tracts. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, regardless of the alternative selected. The proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. Native vegetation from surrounding areas would gradually invade and become established on the reclaimed land.

Following reclamation bond release, management of the privately owned surface areas would revert back to the private surface owners, who would have the right to manipulate the reclaimed vegetation.

A reduction in sagebrush would result in a long term reduction of habitat for some species and may delay use of the reclaimed area by shrub-dependent species, such as the sage-grouse (*Centrocercus urophasianus*). An indirect impact of this vegetative change could be decreased big game habitat carrying capacity.

On average, roughly 1,600 to 2,000 acres of surface would be disturbed per year of mining if all four proposed lease areas are mined concurrently, regardless of which alternatives are selected. By the time mining ceases, over 75 percent of these disturbed lands would have been reseeded. The remaining 25 percent would be reseeded during the following 2 to 3 years as the life-of-mine facilities area is reclaimed.

The reclamation plans for the existing mines include steps to control invasion by weedy (invasive nonnative) plant species because WDEQ/LQD rules and regulations require surface coal mine operators to control and minimize the introduction of noxious weeds until bond release, in accordance with Federal and State requirements. As a result, there are few occurrences of noxious weeds in the mine area. The reclamation plan for each LBA tract would also include steps to control invasion from such species.

The climatic record of the western U.S. suggests that droughts could occur during the life of the mine. Such droughts could reduce germination and could damage newly established plants, but droughts could also result in stands of vegetation in which less gregarious plants like warm season grasses are better established. Severe thunderstorms could also adversely affect newly seeded areas. Once a stable vegetative cover is established, however, these events would have similar impacts as would occur on native vegetation.

Changes expected in the surface water network on each LBA tract as a result of mining and reclamation would affect the reestablishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum overland slope would be 20 percent, in accordance with WDEQ policy. The average reclaimed

overland slope on each LBA tract would not be known until WDEQ's technical review of each permit revision application is complete. No major changes in the average overland slope are predicted.

There would be no net loss of jurisdictional wetlands. They would be restored under the jurisdiction of the COE (Section 3.7). Non-jurisdictional and functional wetlands would be restored in accordance with the requirements of the surface landowner or as required by WDEQ/LQD.

3.9.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and coal removal and the associated disturbance and impacts to vegetation would not occur on the additional acres included in the four LBA tracts. The additional acres disturbed in the Proposed Action or other action alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are listed in Tables 2-1 through 2-4, respectively. Coal removal and the associated removal and replacement of vegetation would occur on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines leases as currently permitted (as summarized in Tables 3-1 through 3-4, respectively). Impacts to vegetation related to mining operations at the existing mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plans.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.9.3 Threatened, Endangered, Proposed, and Candidate Plant Species, and BLM Sensitive Species

Refer to Appendices E through I.

3.9.4 Regulatory Compliance, Mitigation and Monitoring

Reclaimed areas would be revegetated as specified in the approved mine plan using reclamation seed mixtures that would be approved by WDEQ. The majority of the species would be native to the LBA tract. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Shrubs would be selectively planted in riparian areas.

WDEQ/LQD Rules and Regulations require that:

- Permit applications for surface coal mines include a description of any weeds or other plants listed by the local Weed and Pest Control District as harmful (Chapter 2, Section 2(a)(vi)(C)(2)); and

- Surface coal mine operators control and minimize the introduction of noxious weeds in accordance with federal or state requirements (Chapter 4, Section 2(d)(xiv)).

In accordance with these requirements, the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines work with the Campbell County Weed and Pest Department and conducts an active noxious weed control program on their existing coal leases and would be required to continue those practices if the mines acquire leases for the applied for LBA tracts.

Detailed wetland mitigation plans would be developed and approved by COE during the permitting stage to ensure no net loss of jurisdictional wetlands occurs within the total disturbance areas (Section 3.7). Non-Jurisdictional and functional wetlands would be restored in accordance with the requirements of the surface landowner or as required by WDEQ/LQD, as discussed in Section 3.7.

Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for post-mining land uses.

3.9.5 Residual Impacts

Reclaimed vegetative communities may never completely match the surrounding native plant community.

3.10 Wildlife

3.10.1 General Setting

This section discusses the affected environment and potential environmental consequences to wildlife in general. The subsequent sections address the potential impacts to specific groups of wildlife species.

3.10.1.1 Affected Environment

Background information on wildlife in the general South Gillette analysis area was drawn from several sources, including the Maysdorf Coal Lease Application FEIS (BLM 2007b), WGFD and USFWS records, and personal contacts with WGFD and USFWS biologists. Site-specific data for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts were obtained from several sources, including WDEQ/LQD mine permit applications and annual wildlife monitoring reports for the applicant mines. In addition, FCW conducted baseline investigations during 2006 and early 2007 specifically for the Belle Ayr North LBA

Tract; TBCC conducted baseline investigations during 2006 and early 2007 expressly for the West Coal Creek LBA Tract; CCC conducted baseline investigations during 2006 and early 2007 expressly for the Caballo West LBA Tract; and CMC conducted baseline investigations during 2006 specifically for the Maysdorf II LBA Tract. Baseline and annual wildlife surveys cover a large perimeter around the mine permit areas; consequently, a majority of the proposed lease areas have been surveyed as part of the required monitoring surveys for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. Site-specific surveys for each lease area and appropriate perimeter would be part of the mine permitting process if the tracts are leased.

The topography within the general South Gillette analysis area is mainly gently rolling and of moderate relief, influenced by the Belle Fourche River and it's tributaries. Elevation ranges from approximately 4,515 to 4,885 ft above sea level. Rough breaks and streamside bottomland areas occur near the Belle Fourche River and Tisdale, Caballo, and Coal Creeks, which flow through the general South Gillette analysis area (Figure 3-24).

In an undisturbed condition, the major vegetation types in the vegetation general analysis areas (discussed in Section 3.9) provide high quality habitats for many species. Vegetation types tend to occur in a mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Wildlife habitat types for the LBA tracts generally coordinated with the mapped vegetation communities but the general habitat types for the general South Gillette analysis area include shrubland, native grasslands, seeded grassland, streamside bottomland, and rough breaks. Various parcels of cultivated land also occur throughout the area. As a result of oil and gas development, there are networks of road and well-pad disturbance areas overlaying much of the areas, as well as tank batteries and miles of pipeline disturbance with varying degrees of recovering vegetative cover. No designated critical, crucial, or unique habitats are present.

The predominant habitat is Sagebrush/Grassland and Sandy Grassland is the next largest habitat type (Table 3-11). Seeded grassland is dominated by crested wheatgrass, but older seedings have a mixture of less dominant native plant species and, with the passage of time, these seedings begin to resemble Sagebrush/Grassland again. Bottomland grassland or streamside bottomland habitat is limited to a narrow band along the edges of the Belle Fourche River in the southern portion of the general South Gillette analysis area. Trees are limited along the river and its tributaries within the general South Gillette analysis area. Rough breaks habitat is distinguished by the irregularity of vegetation, slopes, and soils. Vegetation on the rough breaks is typically sparse, although the diversity of vascular plant species is greater than in the Sagebrush/Grassland and sandy grassland communities.

Under natural conditions portions of Caballo Creek and the Belle Fourche River demonstrate characteristics of both an intermittent and ephemeral stream. All other streams within and adjacent to the LBA tracts are ephemeral. In response to surface discharge of groundwater associated with CBNG production upstream of the LBA tracts, which is a relatively recent phenomenon, streamflow occurrence is now more persistent. The Belle Fourche River and the distinctive shallow pools that are present along its natural course in the general South Gillette analysis area are now seldom completely dry, resulting in an increase in habitat for waterfowl, shorebirds, and aquatic species. Twenty-five small stock reservoirs and three playa areas exist within the four LBA tract study boundaries. One of the playas has been turned into a temporary shallow pond as the result of a CBNG well discharging within its drainage area.

Cordero Rojo Mine's approved WDEQ/LQD mine permit allows disturbance of the Belle Fourche River channel. Approximately 6 miles of the natural channel have been diverted to date within the Cordero Rojo Mine's current permit area. CMC would propose another diversion of the Belle Fourche River if they acquire a lease for the Maysdorf II LBA Tract.

3.10.1.2 Environmental Consequences

3.10.1.2.1 Proposed Action and Action Alternatives

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts were leased under the Proposed Action or Alternative 2 (2 and 3 for the Maysdorf II LBA Tract), coal removal and associated mining disturbance would extend onto the LBA tracts. Mining would be extended more than 5 years at the Belle Ayr Mine, 4 years at the Coal Creek Mine, 2 years at the Caballo Mine, and nearly 10 years at the Cordero Rojo Mine. Impacts to wildlife that would be caused by mining the LBA tracts would be addressed by the WGFD and the WDEQ/LQD when the mining and reclamation permits are amended to include the LBA tracts.

Mining directly and indirectly impacts local wildlife populations. These impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include road kills by mine-related traffic, restrictions on wildlife movement created by fences, spoil piles, and pits, and displacement of wildlife from active mining areas. Displaced animals may find equally suitable habitat that is not occupied by other animals, occupy suitable habitat that is already being used by other individuals, or occupy poorer quality habitat than that from which they were displaced. In the second and third situations, the animals may suffer from increased competition with other animals and are less likely to survive and reproduce. If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts were leased and mined, the direct impacts related to mine traffic and

mine operations would be extended within the general South Gillette analysis area by nearly 10 years.

The indirect impacts are longer term. After the LBA tracts are leased, mined, and reclaimed, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density, would cause a decrease in carrying capacity for some species and a decrease in vegetative diversity. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent. Microhabitats may be reduced on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

3.10.1.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and coal removal and the associated disturbance and impacts to wildlife would not occur on the additional acres included in the four LBA tracts. The additional acres disturbed in the Proposed Action or other action alternatives for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are listed in Tables 2-1 through 2-4, respectively. Coal removal and the associated impacts to wildlife would occur on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines leases as currently permitted to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.10.2 Big Game

3.10.2.1 Affected Environment

The two big game species that are common in suitable habitat throughout the general South Gillette analysis area are pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*). White-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) are transients east of the general South Gillette analysis area. No crucial big game habitat or migration corridors are recognized by the WGFD in this area.

Pronghorn are by far the most common big game species in this area. This species is most abundant in the Sagebrush/Grassland or mixed-grass prairie habitats. Reclaimed grassland constitutes only a small portion of the available habitat around the PRB mines, although pronghorn are observed during all seasonal surveys in these areas. Home range for pronghorn can vary between 400 acres to 5,600 acres, according to several factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movement does not exceed 6 miles. Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by

availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). The WGFD has classified the general South Gillette analysis area as primarily winter/yearlong pronghorn range (a population or a portion of a population of animals makes general use of this habitat on a year-round basis, with a significant influx of additional animals onto this habitat from other seasonal ranges in the winter) and yearlong pronghorn range (a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion). The entire general South Gillette analysis area is within the WGFD Hilight Herd Unit. In post-season 2006, the WGFD estimated the Hilight Herd Unit to be 13,725 animals, with an objective of 11,000 (WGFD 2007).

Mule deer use nearly all habitats, but prefer Sagebrush/Grassland, rough breaks, and riparian bottomland. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). Mule deer are frequently observed on mine reclaimed lands. In certain areas of the state this species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. However, monitoring has indicated that mule deer are not very migratory in the vicinity of the general South Gillette analysis area. The WGFD has classified a majority of the general South Gillette analysis area as being out of normal mule deer use range and a small portion as being yearlong mule deer use range, which means that a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion. The entire area is located within the WGFD Thunder Basin Mule Deer Herd Unit. No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the general South Gillette analysis area. Crucial range is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. The WGFD estimated the 2006 post-season mule deer for the herd unit at 22,036, which is above the current objective of 20,000 (WGFD 2007).

White-tailed deer are generally managed separately by the WGFD in the Central Herd Unit. White-tailed deer prefer riparian habitats and are therefore seldom observed in the general South Gillette analysis area due to the lack of that particular habitat. The WGFD classifies the entire general South Gillette analysis area as out of the normal white-tailed deer use range. A narrow corridor along the Belle Fourche River east of the Belle Ayr North LBA Tract wildlife general analysis area is classified as yearlong range. White-tailed deer are occasionally recorded along the Belle Fourche River and Pine Hills to the east but have rarely been recorded in the general South Gillette analysis area.

A resident elk herd resides in the Rochelle Hills south of the general South Gillette analysis area. Elk do wander from the protection of the Rochelle Hills to forage in

native and reclaimed grasslands in the vicinity of the general South Gillette analysis area. None of the general South Gillette analysis area is classified by the WGFD as within normal elk use range. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately 5 square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Oedekoven 1994). RTEA (owner of the Jacobs Ranch Mine) and the RMEF finalized a formal agreement that created the Rochelle Hills Conservation Easement. The easement contains nearly 1,000 acres, with 75 percent of that total comprised of reclaimed mining lands on RTEA's Jacobs Ranch Mine. The easement acreage was donated to RMEF by RTEA to ensure that the reclaimed land continues to be used as grazing land and wildlife habitat for the extended future (RMEF 2007). The Jacobs Ranch Mine is located about 9 miles south of the general South Gillette analysis area (Figure 1-1). Elk have been observed within the general South Gillette analysis area in recent years, but they are typically restricted to the pine breaks east of the Cordero Rojo and Coal Creek Mines. Limited observations have also been documented in and near the Belle Ayr Mine permit area in the last few years.

3.10.2.2 Environmental Consequences

3.10.2.2.1 Proposed Action and Action Alternatives

Under the Proposed Action and Action Alternatives, big game would be displaced from portions of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts to adjacent ranges during mining. Pronghorn would be most affected; however, no areas classified as crucial pronghorn habitat occur on or within 2 miles of the LBA tracts. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. White-tailed deer are not usually found in the area but are occasionally observed to the east. None of the land within the general South Gillette analysis area is considered by WGFD to be an elk use area and few elk have been observed within the vicinity of the general South Gillette analysis area in recent years. Those elk that were seen in the area were largely restricted to the pine breaks habitats in the eastern-most perimeter. Big game displacement would be incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game residing in the adjacent areas could be impacted by increased competition with displaced animals. Noise, dust, and associated human presence would cause some localized avoidance of foraging areas adjacent to mining activities. On the existing coal leases, however, big game have continued to occupy areas adjacent to and within active mining operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can move to undisturbed areas. There would be more restrictions on big game movement on or through the proposed LBA tracts, however, due to the construction of additional fences, spoil piles, and

pits related to mining. During winter storms, pronghorn may not be able to negotiate these barriers. WDEQ guidelines require fencing to be designed to permit pronghorn passage to the extent possible.

Following reclamation, topographic moderation and changes in vegetation may result in a long-term reduction in big game carrying capacity, with effects varying by species. Eventual restoration of important shrub habitats would allow for the return of some animals to reclaimed mine lands over time.

3.10.2.2.2 No Action Alternative

The impacts to big game under the No Action Alternatives would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas.

3.10.3 Other Mammals

3.10.3.1 Affected Environment

A variety of small and medium-sized mammal species occur in the vicinity of the general South Gillette analysis area, although not all have been observed on the LBA tracts themselves. These include predators and furbearers, such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents (such as mice, rats, voles, gophers, ground squirrels, chipmunks, muskrats, black-tailed prairie dogs [*Cynomys ludovicianus*], and lagomorphs [jackrabbits and cottontails]). These prey species are cyclically common and widespread throughout the region. Porcupines (*Erethizon dorsatum*) and bats (such as hoary [*Lasiurus cinereus*] and big brown [*Eptesicus fuscus*]) also have habitat in the vicinity, primarily east of the Cordero Rojo Mine area. The prey species are important for raptors and other predators.

The black-tailed prairie dog was added to the list of candidate species for federal listing on February 4, 2000 (USFWS 2000a). The USFWS has since removed the black-tailed prairie dog from the list of candidate species (USFWS 2002a), but continues to encourage the protection of prairie dog colonies for their value to the prairie ecosystem and the myriad of species that rely on them (USFWS 2004).

The black-tailed prairie dog is a highly social, diurnally active, burrowing mammal. Aggregations of individual burrows, known as colonies, form the basic unit of prairie dog populations. Found throughout the Great Plains in short-grass and mixed-grass prairie areas (Fitzgerald et al. 1994), the black-tailed prairie dog has declined in population numbers and extent of colonies in recent years. The three major impacts that have influenced black-tailed prairie dog populations are the initial conversion of prairie grasslands to cropland in the eastern portion of its

range from approximately the 1880s-1920s; large-scale control efforts conducted from approximately 1918 through 1972, when an Executive Order was issued banning the use of compound 1080; and the introduction of sylvatic plague into North American ecosystems in 1908 (USFWS 2000b). In Wyoming, this species is primarily currently found in isolated populations in the eastern half of the state (Clark and Stromberg 1987). USFWS recently estimated that about 125,000 acres of black-tailed prairie dog occupied habitat exists in Wyoming (USFWS 2000b). Many other wildlife species, such as the black-footed ferret (*Mustela nigripes*), swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*) may be dependent on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000b).

The species is considered a common resident in eastern Wyoming, utilizing short-grass and mid-grass habitats (Cerovski et al. 2004). According to USDA-FS observations on the Thunder Basin National Grassland, the largest concentrations of prairie dog colonies in the vicinity of the eastern PRB surface coal mines are found east of the coal burnline, which is outside and east of the area of surface coal mining (Tim Byer, personal communication 9/11/2003). The large prairie dog complexes in this area east of the coal burnline have been drastically impacted by outbreaks of plague. The prairie dog colonies west of the burnline, including the areas near the Belle Ayr North, West Coal Creek, Caballo West or Maysdorf II LBA Tracts, are generally smaller and less densely concentrated. These colonies have not been affected by plague to the same degree, likely due to their reduced size and density.

Qualified wildlife biologists with Intermountain Resources and Jones & Stokes have mapped the current acreage of prairie dog colonies in the vicinity of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines by walking the perimeters of colonies and delineating them using hand-held global positioning system receivers and/or by visually mapping them on topographic maps (Figures 3-25 through 3-28, respectively). No colonies are currently present on or within 2 miles of the Belle Ayr North or Caballo West LBA Tracts under the Proposed Actions or Action Alternatives. One small colony is present approximately 1.25 miles southeast of the West Coal Creek LBA Tract (Figure 3-26). That colony was poisoned in the past and was only occupied again beginning in 2000. One black-tailed prairie dog colony is located less than 1 mile east of the Cordero Rojo Mine's current permit area while two other small colonies are located within 2 miles of the Maysdorf II LBA Tract (Figure 3-28). The colony located east of the CMC mine permit area is currently smaller than that depicted. The boundaries shown on Figures 3-26 and 3-28 are historical town boundaries and, although black-tailed prairie dogs still exist in the areas, their numbers and distribution may be much smaller than previously recorded.

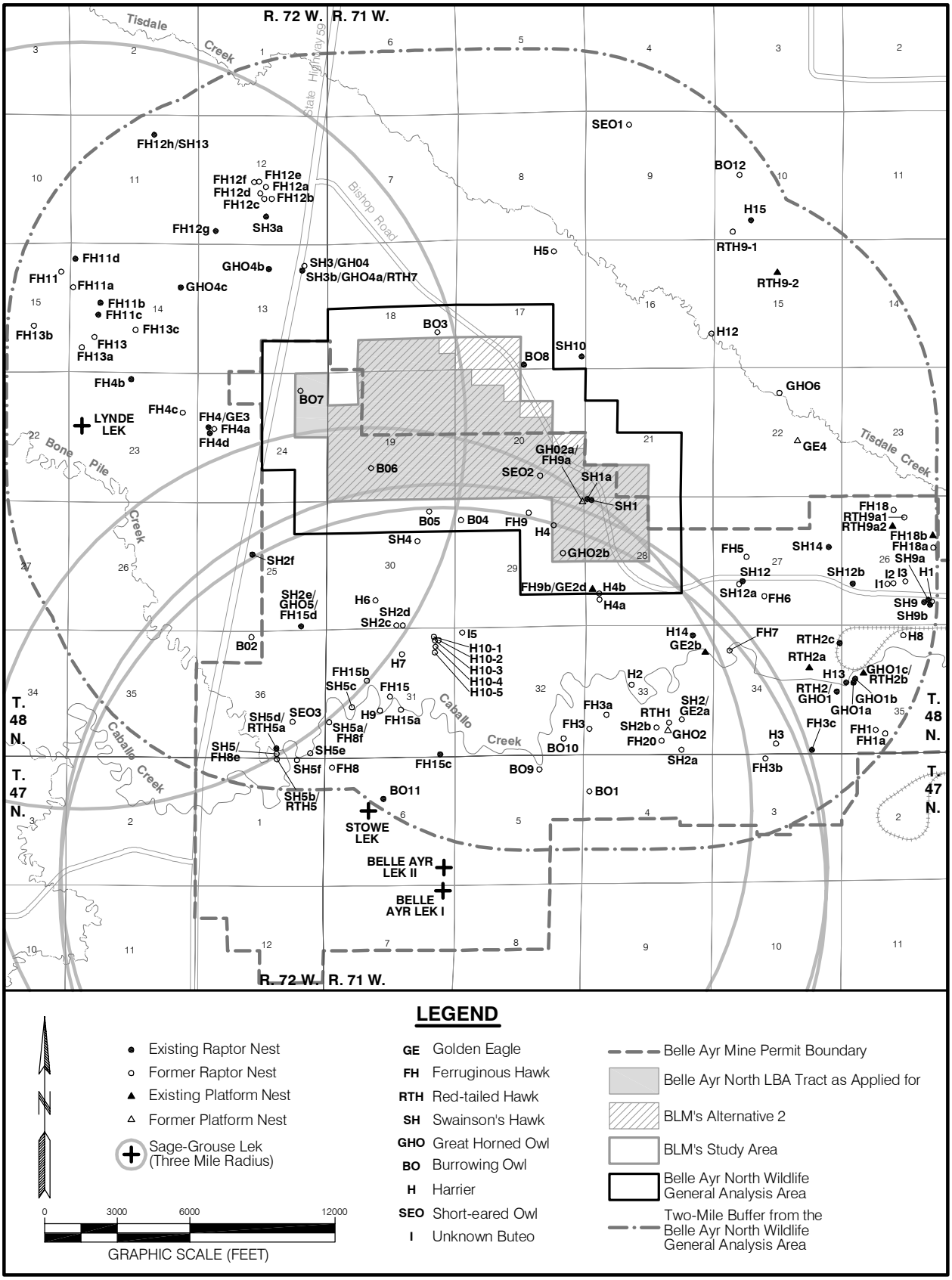

Figure 3-25. Raptor Nest Sites and Sage-Grouse Leks Within and Adjacent to the Belle Ayr North LBA Tract.

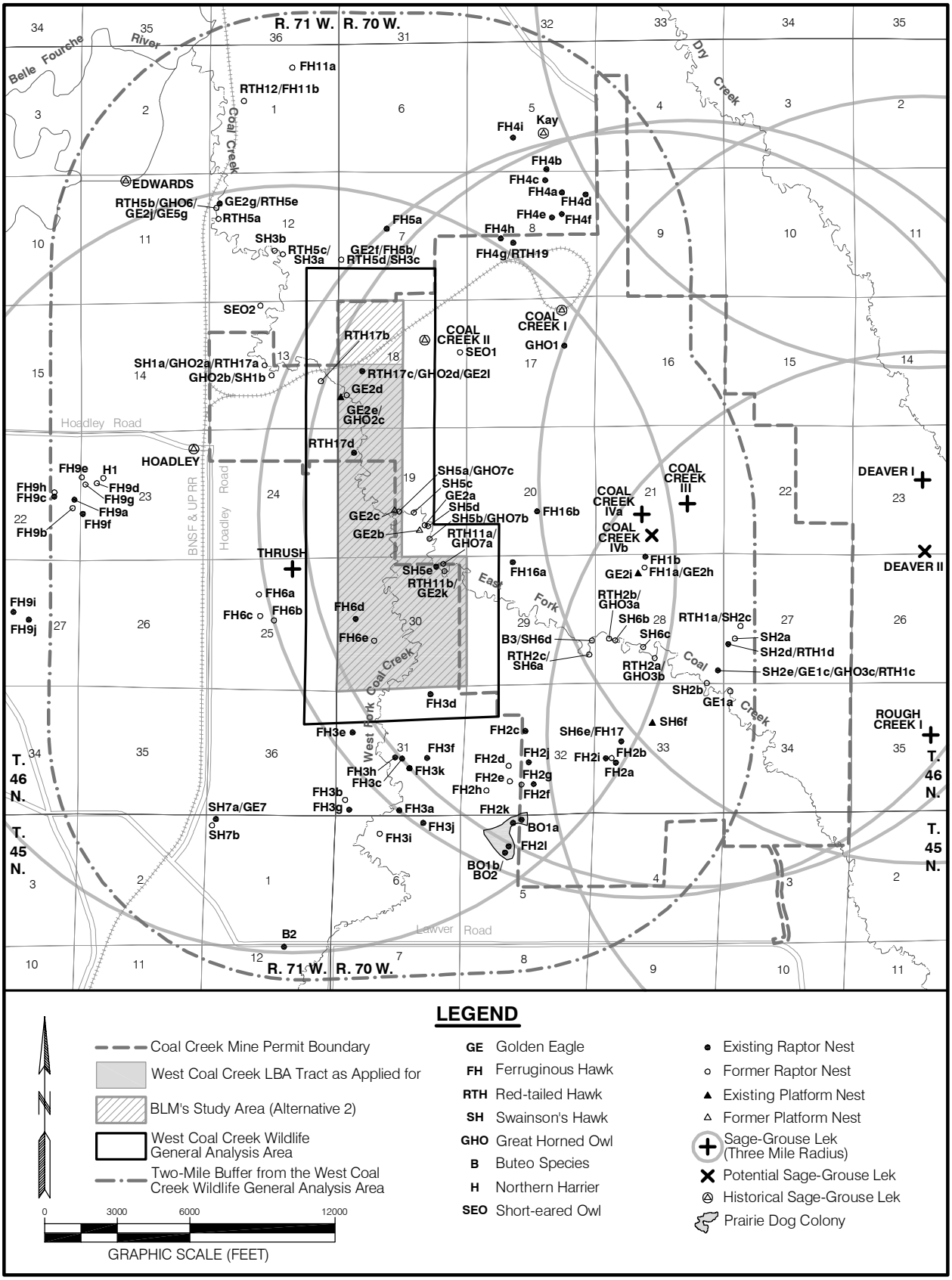

Figure 3-26. Raptor Nest Sites, Sage-Grouse Leks, and Prairie Dog Colonies Within and Adjacent to the West Coal Creek LBA Tract.

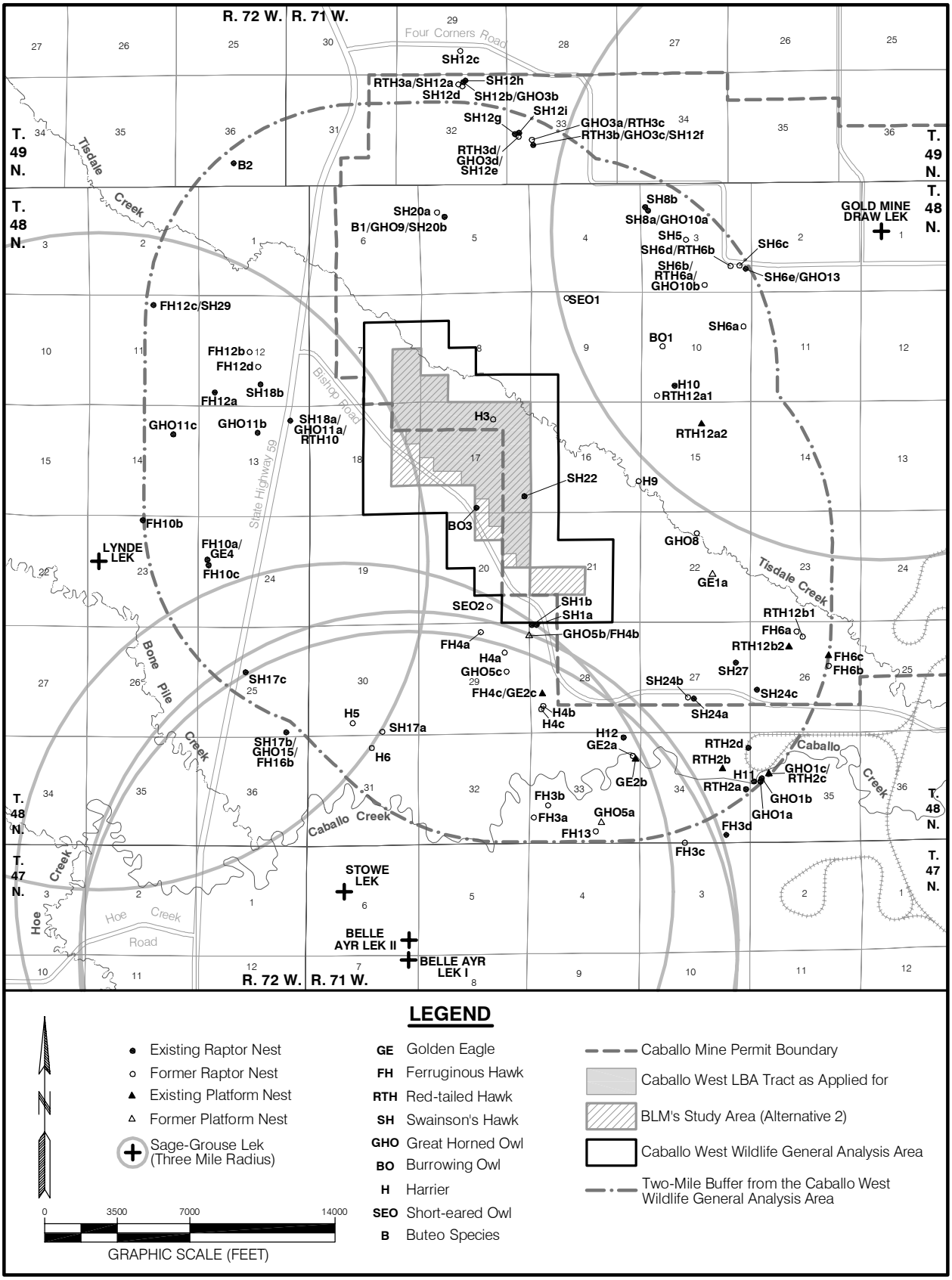

Figure 3-27. Raptor Nest Sites and Sage-Grouse Leks Within and Adjacent to the Caballo West LBA Tract.

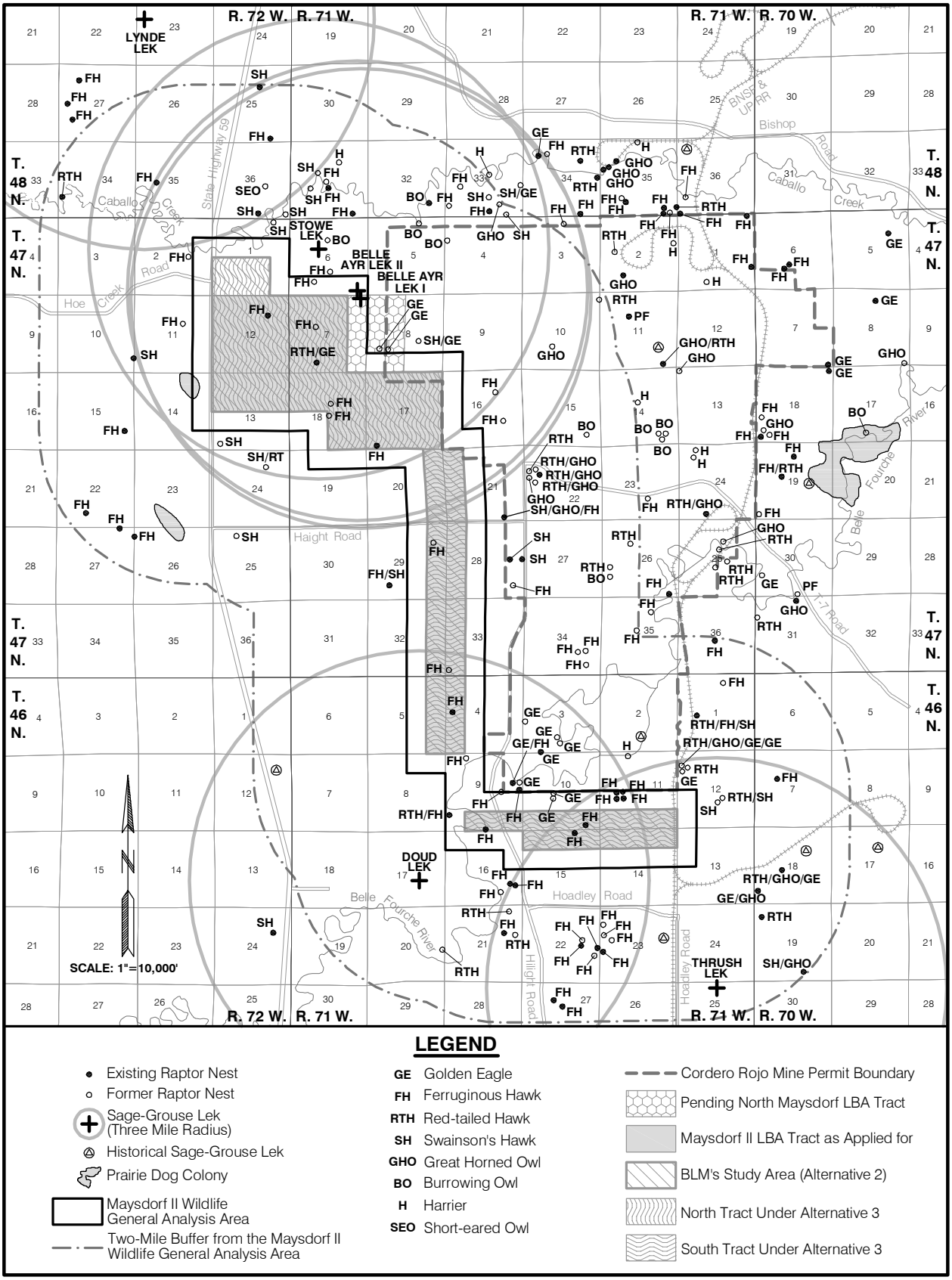

Figure 3-28. Raptor Nest Sites, Sage-Grouse Leks, and Prairie Dog Colonies Within and Adjacent to the Maysdorf II LBA Tract.

3.10.3.2 Environmental Consequences

3.10.3.2.1 Proposed Action and Action Alternatives

Medium-sized mammals (such as lagomorphs, coyotes, and foxes) would be temporarily displaced to other habitats by mining, potentially resulting in increased competition and mortality. However, these animals would rebound as forage is developed or small mammal prey species recolonize the reclaimed areas. Direct losses of small mammals would be higher than for other wildlife, since the mobility of small mammals is limited and many will retreat into burrows when disturbed. Therefore, populations of such prey animals as voles, ground squirrels and mice would decline during mining. However, these animals have a high reproductive potential and tend to re-occupy and adapt to reclaimed areas quickly. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that reclamation objectives to encourage recolonization by small mammal communities are being achieved (Clayton et al. 2006 and Shelley 1992). That study evaluated sites at five separate mines.

Leasing and mining the Belle Ayr North, West Coal Creek, Caballo West or Maysdorf II LBA Tracts would not affect black-tailed prairie dogs because no colonies are currently present on the tracts as applied for or the areas added by the Action Alternatives. One colony is located approximately 1.3 miles south of the West Coal Creek LBA tract. The colony is not within the anticipated disturbance area for the LBA tract. Similarly, two colonies are located within 2 miles of the Maysdorf II LBA Tract, but they are west of Highway 59 and not within the anticipated Maysdorf II disturbance area.

3.10.3.2.2 No Action Alternative

The impacts to small mammals under the No Action Alternatives would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas.

3.10.4 Raptors

3.10.4.1 Affected Environment

The raptor species expected to occur in suitable habitats in the general South Gillette analysis area include the golden eagle (*Aquila chrysaetos*), ferruginous hawk, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), and short-eared owl (*Asio flammeus*). The bald eagle (*Haliaeetus leucocephalus*) is a migrant and winter resident. Those species that commonly nest in the general South Gillette analysis area are the ferruginous hawk, golden eagle, red-tailed hawk, Swainson's hawk,

northern harrier, and great horned owl. The burrowing owl and short-eared owl occasionally nest in the area. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species have adapted to nesting on the ground, creek banks, buttes, mine highwalls, or rock outcrops.

Figures 3-25 through 3-28 show the locations of raptor nests identified since monitoring began in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, respectively, in the areas included in the respective wildlife general analysis areas and 2-mile buffers. Over time, new nests have been built, natural forces have destroyed many nests, while others have been relocated for mitigation or removed by mining activities. In some cases, nests have been created to mitigate other nest sites impacted by mining operations.

3.10.4.1.1 Belle Ayr North LBA Tract

Through 2006, surveys conducted by Jones & Stokes had documented eight raptor species (golden eagle, ferruginous hawk, northern harrier, red-tailed hawk, Swainson's hawk, great horned owl, burrowing owl, and short-eared owl) nesting at least once within the Belle Ayr North LBA Tract raptor survey area. That raptor survey area is defined as a 2-mile radius around the Belle Ayr North wildlife general analysis area (Figure 3-25).

In 2006, 42 intact raptor nests were present within the Belle Ayr North raptor survey area, 17 of these nests were active (eggs laid), and one nest was tended (new material added, no eggs laid). Only one (a Swainson's hawk nest) of the 17 active nests in 2006 is located on the Belle Ayr North LBA Tract as applied for under the Proposed Action. The only other intact raptor nest present on the LBA tract area as applied for or in the area added by Alternative 2 is an alternate nest adjacent to the Swainson's hawk nest active in 2006. Two additional intact nest sites are present within the Belle Ayr North wildlife general analysis area: a burrowing owl nest site and a platform nest used by ferruginous hawks and golden eagles in the past (Figure 3-25). All intact raptor nests except the burrowing owl nest site are already encompassed by the existing Belle Ayr Mine permit area.

3.10.4.1.2 West Coal Creek LBA Tract

Through 2006, surveys conducted by Jones & Stokes had documented eight raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, northern harrier, great horned owl, short-eared owl, and burrowing owl) that had nested at least once within the raptor survey area for the West Coal Creek LBA Tract. That raptor survey area is defined as a 2-mile radius around the West Coal Creek wildlife general analysis area (Figure 3-26). Five of those eight species have regularly nested in the raptor survey area since annual monitoring began in 1982. Northern harriers and short-eared owls are heavily dependent on cyclic small rodent populations, and their presence tends to follow peaks and valleys in those

prey populations. The recent occurrence of nesting burrowing owls in the raptor survey area coincided with the re-colonization of the small prairie dog colony southeast of the tract as applied for.

Forty-eight raptor nests were intact within the raptor survey area during the 2006 breeding season. Five intact nests were on the West Coal Creek LBA Tract as applied for, including one red-tailed hawk nest, one ferruginous hawk nest, one Swainson's hawk nest, and two multi-species nests (Figure 3-26). Four of those five nests are also within or immediately adjacent to the existing Coal Creek permit area. No intact nests were present in lands added under Alternative 2, and only one additional nest (ferruginous hawk) was within the West Coal Creek wildlife general analysis area. Only two of the six intact nests encompassed by the West Coal Creek wildlife general analysis area were active (eggs laid) during 2006, with one nest tended (new material added but no eggs laid). The remaining intact nests were alternates to other active or tended nests within their respective territories.

3.10.4.1.3 Caballo West LBA Tract

Through 2006, surveys conducted by Jones & Stokes had documented eight raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, northern harrier, great horned owl, short-eared owl, and burrowing owl) that had nested at least once within the wildlife survey area for the Caballo West LBA Tract. That raptor survey area is defined as a 2-mile radius around the Caballo West wildlife general analysis area (Figure 3-27). Of those eight species, the Swainson's hawk has been the most common nester in the raptor survey area for this tract over time. The presence of other nesting raptor species has been associated with cyclic lagomorph or small rodent populations and the availability of nest sites (e.g., intact nests of other species for great horned owls, and the presence of platform nests for ferruginous hawks and golden eagles).

In 2006, 39 intact raptor nests were present in the Caballo West raptor survey area; 18 of those nests were active (eggs laid). No active nests were observed in the Caballo West wildlife general analysis area, though one active Swainson's hawk nest was located immediately south of the Caballo West wildlife general analysis area. The only intact nests within the Caballo West wildlife general analysis area were a Swainson's hawk nest (on the tract as applied for) and a burrowing owl nest site (on lands added under Alternative 2). The Swainson's hawk nest is also within the current permit area for the Caballo mine; that nest was last active in 2002. The burrowing owl nest was active only in 1988.

3.10.4.1.4 Maysdorf II LBA Tract

Surveys conducted by Intermountain Resources documented eight raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, northern harrier, great horned owl, short-eared owl, and burrowing owl) that had nested at

least once within the wildlife survey area for the Maysdorf II LBA Tract. That raptor survey area is defined as a 2-mile radius around the Maysdorf II wildlife general analysis area (Figure 3-28). During surveys that were completed in 2006-2007 a total of five raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, and great horned owl) were found to be currently nesting within the Maysdorf II survey area. In the past, the prairie falcon, northern harrier, short-eared owl, and burrowing owl have also been identified nesting within or adjacent to the survey area.

The 2007 survey identified 49 intact raptor nests in the raptor survey area, 20 of these nests were active. There were 12 intact nests within the Maysdorf II wildlife general analysis area including 10 ferruginous hawk nests, one red-tailed hawk/ferruginous hawk nest and one red-tailed hawk/golden eagle nest. Six of the 12 nests were occupied (two red-tailed hawks and four ferruginous hawks) in 2007. Five of the 12 intact nests were unoccupied, alternate nests for several pairs of raptors.

3.10.4.2 Environmental Consequences

3.10.4.2.1 Proposed Action and Action Alternatives

Mining the LBA tracts would not impact regional raptor populations; however, individual birds or pairs may be impacted. Mining activity could cause raptors to abandon nests proximate to disturbance. The USFWS recommends a 1-mile buffer around all ferruginous hawk nests.

3.10.4.2.1.1 Belle Ayr North LBA Tract

No intact ferruginous hawk nests were present on the Belle Ayr North LBA Tract under the Proposed Action or on lands added by Alternative 2 in 2006, though one platform nest does exist at the extreme southern end of that tract's wildlife general analysis area. That platform nest is on reclamation inside the existing Belle Ayr mine permit area.

3.10.4.2.1.2 West Coal Creek LBA Tract

There are two intact ferruginous hawk nests within the West Coal Creek wildlife general analysis area; one intact ferruginous hawk nest within the West Coal Creek LBA Tract under the Proposed Action. No intact nests were located on lands added by Alternative 2 in 2006. Both nests in the West Coal Creek wildlife general analysis area have alternate nests and/or nest sites within their respective territories that are outside of the wildlife general analysis area for that tract.

3.10.4.2.1.3 Caballo West LBA Tract

No intact ferruginous hawk nests were present within the entire Caballo West wildlife general analysis area in 2006.

3.10.4.2.1.4 Maysdorf II LBA Tract

In 2007 there were ten intact ferruginous hawk nests within the Maysdorf II wildlife general analysis area; five of these intact ferruginous hawk nests were within the Maysdorf II LBA Tract under the Proposed Action. No intact nests were located on lands added by Alternatives 2 and 3.

USFWS and WDEQ/LQD approval would be required before mining would occur within buffer zones for active raptor nests. The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines annually monitor territorial occupancy and nest productivity on and around their existing leases. Raptor nesting activity has previously occurred in active mining and construction areas. Many of those nests have succeeded due to a combination of raptors becoming acclimated to the gradual encroachment of mine operations, and successfully executed state-of-the-art mitigation techniques to maintain viable raptor territories and protect nest productivity.

Mining near raptor territories would impact the availability of native foraging habitats for nesting birds. However, equipment yards associated with mining provide additional habitat for prey species such as cottontails, and several raptor pairs voluntarily nest quite near those areas. Additionally, increased acreage of reclamation within the permit areas would offset new habitat loss as mining progresses. At surface mines throughout the region, raptor nesting efforts have typically been influenced primarily by natural factors such as prey abundance and availability of nesting substrates. Due to the paucity of woody vegetation, raptors that nest in trees or on cliffs are not as abundant as those that either nest on the ground or are adaptable to nesting on mine facilities or other man-made structures (platform nests, etc.). During mining, nesting habitat is created by the excavation process (highwalls), as well as through enhancement efforts (nest platforms, nest boxes, and tree plantings). Nests in highwalls within active mining areas, and in other areas of potential conflict, will be moved following proper permitting requirements and coordination with all corresponding agencies.

3.10.4.2.2 No Action Alternative

The impacts to raptor species for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas under the No Action Alternatives would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.5 Upland Game Birds

3.10.5.1 Affected Environment

Four upland game bird species are known to occur in suitable habitats in the general South Gillette analysis area. These species are sage-grouse, mourning doves (*Zenaida macroura*), sharp-tailed grouse (*Tympanuchus phasianellus*), and gray partridge (*Perdix perdix*).

Sage-grouse are a large upland game bird considered a "landscape species", annually using widespread areas of sagebrush habitats. This grouse is referred to as both sage-grouse and greater sage-grouse, and the terms are interchangeable. Sage-grouse are found in sagebrush shrub-land habitat, and sagebrush is essential for sage-grouse during all seasons of the year. During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage-grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Population and habitat analyses suggest that wintering habitat can be as limiting as mating and breeding habitats. Breeding occurs on strutting grounds (leks) during late March and April. Leks are generally situated on sites with low vegetation and little or no sagebrush, broad ridge tops, grassy openings, and disturbed sites such as burns, abandoned well locations, airstrips or roads. However, often there are areas of denser sagebrush near the lek that are used for foraging, loafing, and hiding cover (WGFD 2003). Approximately two-thirds of hens nest within 3 miles of the lek where they were bred. The rest of the hens usually nest within 15 miles of the lek. Sage-grouse typically nest under tall sagebrush, but may use other large shrubs. Sagebrush stands used for nesting range in height from 8 to 18 inches, with individual plants reaching up to 32 inches tall. Both new spring herbaceous growth and residual cover are important in the understory for nesting sage-grouse (WGFD 2003). Hens move their brood immediately upon hatching from the nest site to brood-rearing areas. Sites used during the first 10-14 days after hatching are typically within 1.5 miles of the nest. The vast majority of chick mortality (87 percent of total brood loss in four studies conducted in Wyoming) occurs during this period. After the first 10 days, broods may have dispersed 5 or more miles from the nest. As summer progresses and food plants mature and dry, sage-grouse move to areas still supporting succulent herbaceous vegetation. They continue to rely on adjacent sagebrush for protection from weather and predators, and for roosting and loafing. Sage-grouse normally move off late brood-rearing habitat onto transitional fall habitat before moving onto winter range (WGFD 2003).

On and after July 2, 2002, the USFWS received three petitions requesting that the greater sage-grouse be listed as endangered across its entire range. Following a 12-month status review of the best available scientific and commercial information on the species, the USFWS found that listing was not warranted at this time. However, the USFWS continues to have concerns regarding sage-grouse

population status, trends and threats, as well as concerns for other sagebrush obligates (USFWS 2005). USFWS indicated there is a need for continued efforts to conserve sage-grouse and sagebrush habitat on a long-term basis. USFWS encourages continued development and implementation of conservation strategies throughout the grouse's range.

On September 11, 2003, the Wyoming Game and Fish Commission announced that the 2003 hunting season for sage-grouse in Johnson, Sheridan, and Campbell counties would be closed, following the deaths of 11 sage-grouse in northeastern Wyoming from West Nile virus in August and early September of that year. According to a press release, the commission took this action because the incidence of infection is much higher in northeastern Wyoming than the rest of the state and the area is on the fringe of sage-grouse range with marginal, fragmented habitat (WGFD September 11, 2003 press release). Recent lek, or strutting ground, count data indicate that Wyoming's sage-grouse populations increased slightly in 2004 and 2005. According to a 2004 summary report on sage-grouse trends related to hunting, all the biological data from Wyoming and past research throughout the range of sage-grouse indicate that current levels of harvest will not cause population declines nor prevent sage-grouse population recovery when habitat conditions improve (Christiansen 2004). Sage-grouse hunting seasons were consequently reopened in 2004.

In May 2002, the USFWS office in Cheyenne, Wyoming released a list entitled *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming,* which replaced the previous *Migratory Birds of High Federal Interest List*. The greater sage-grouse is included on the list and, as a result, the presence of sage-grouse and sage-grouse sign are included in the annual migratory bird surveys that are conducted by the coal mines in both spring and summer.

On August 1, 2008, Wyoming Governor Dave Freudenthal released an executive order regarding greater sage-grouse core area protection (Office of the Governor 2008). The sage-grouse focus area protection concept came about as a result of work by the Sage-Grouse Implementation Team, which emerged from Governor Freudenthal's 2007 Sage-Grouse Summit. The Implementation Team developed a Core Population Strategy for the State of Wyoming "to maintain habitats and viable populations of Sage-grouse in areas where they are most abundant" and delineated approximately 40 areas around the state with a focus of maintenance and enhancement of grouse habitats and populations within the focus areas (Sage-Grouse Implementation Team 2008). The areas were delineated by evaluating habitats within a 4-mile radius of selected sage-grouse leks in high lek-density areas. The BLM Wyoming State Office has indicated that the sage-grouse management strategy for management of future surface disturbance (including actions proposed in this EIS) will likely be based on the sage-grouse focus areas (BLM 2008c) and has delineated sage-grouse focus area based on the core area concept. The association of the SGAC tracts to these focus area is shown on Figure 3-29.

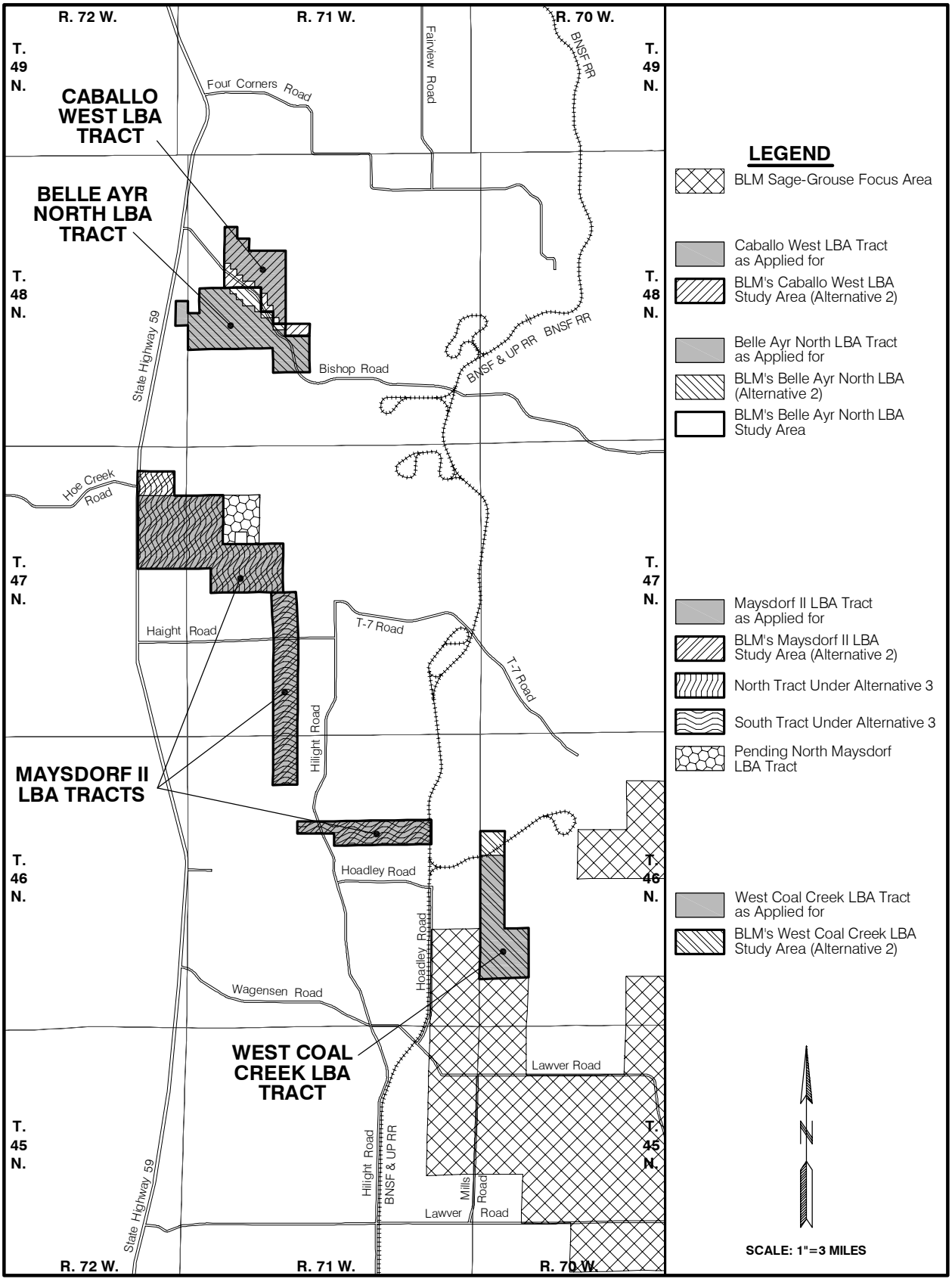

Figure 3-29. General South Gillette Analysis Area and Associated BLM Sage-Grouse Focus Areas.

The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines conduct surveys to identify new sage-grouse leks and sage-grouse lek attendance at previously identified leks in the spring as part of the annual wildlife surveys that are conducted for the mines. Each active lek is generally surveyed three times each breeding season. These surveys and baseline inventories, which include the mines' permit areas and a 1-mile perimeter, were initiated when the mines were initially permitted. As a result, most of the areas included in the proposed LBA Tracts have been included in previous annual survey areas.

Although sage-grouse may occasionally occur in the general South Gillette analysis area, it is unlikely that grouse are yearlong residents of the specific wildlife general analysis areas for any of the four proposed LBA tracts for the following reasons:

- As discussed in Section 3.9, the Sagebrush/Grassland vegetation type, which is characterized by the moderate to heavy presence of Wyoming big sagebrush, occupies about 38 percent of the combined vegetation analysis areas. As indicated, that 38 percent does not represent a contiguous stand of big sagebrush, but rather is the total of all sage communities within the combined evaluation area.
- Few active leks occur within 3 miles of a given wildlife general analysis area surrounding the tracts, and many of those that are present have experienced declines in peak male attendance in recent years.
- The lands within each wildlife general analysis area have been included in annual wildlife monitoring surveys for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines for at least the last 15 years (1992-2006), and longer at some mines. No confirmed sage-grouse nests were encountered during that period.
- Specific pedestrian surveys for sage-grouse broods were conducted twice annually from 1993 through 1999 in appropriate habitat within the existing permit areas of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. Coincidentally, those survey routes included drainages that passed through, or were within one mile of, one or more of the proposed LBA tracts. Such surveys were no longer required by WDEQ/LQD after 1999. However, biologists watched for and recorded any sage-grouse broods seen incidental to other wildlife surveys during all subsequent monitoring years.

The only observations of sage-grouse broods recorded during those targeted surveys occurred more than 2 miles southeast of the West Coal Creek LBA Tract during surveys along East Fork Coal Creek. Those sightings occurred in 1998 and 1999. No other sage-grouse broods or their sign (e.g., droppings, feathers) were recorded during similar surveys conducted from 1993-1999 within any of the four wildlife general analysis areas. Sage-grouse broods were infrequently documented in the vicinity of the Belle Ayr North LBA tract during early fall in the late 1990s. Those sightings consisted of mixed groups of female and juvenile grouse walking or feeding along the Bishop Road in the northern portion of the Belle Ayr North

wildlife general analysis area; broods were last observed there in 1999. The only other sage-grouse brood recorded at any of the four wildlife general analysis areas was within the 2-mile survey perimeter of the Belle Ayr North wildlife general analysis area. Six young upland game birds (presumed to be grouse) were seen along Caballo Creek in early May 2004, near a grouse carcass. No grouse of any age have been observed in that area since then.

As discussed above, 18 sage-grouse leks have been documented within the combined evaluation area. Thirteen of the leks have been active during recent survey years, and five have not been attended by displaying grouse for at least the last 10 consecutive years (historical leks). Sage-grouse populations are generally considered to be cyclic, with periodic intervals between peaks in region-wide male lek attendance. However, sage-grouse populations and their distribution in Wyoming have declined over the last five decades (WGFD long-term data, provided by L. Jahnke, Regional Biologist) despite higher counts in some years.

3.10.5.1.1 Belle Ayr North LBA Tract

No greater sage-grouse leks occur within the Belle Ayr North LBA Tract as applied for, or within lands added under Alternative 2. Only one sage-grouse lek (Lynde) has been documented within 2 miles of the Belle Ayr North wildlife general analysis area during previous wildlife surveys conducted for the adjacent Belle Ayr and Caballo Mines (Figure 3-25). The Lynde lek was last active in 1999. Three additional sage-grouse leks are present approximately 2.5 miles south of the Belle Ayr North wildlife general analysis area: Belle Ayr I, Belle Ayr II, and Stowe. Due to their proximity to one another, the WGFD considers all three to be within the Belle Ayr Complex. All three leks have essentially been inactive since 2004. Although the Belle Ayr Complex leks themselves are beyond the 2-mile wildlife survey perimeter for the wildlife general analysis area, the 3-mile radius of concern for each lek overlaps the southern portion of the Belle Ayr North LBA Tract as applied for. That radius represents the area in which two-thirds of the hens that were bred at those leks would be expected to nest.

3.10.5.1.2 West Coal Creek LBA Tract

No leks have been discovered within the West Coal Creek LBA Tract as applied for or on lands added under Alternative 2 (Figure 3-26). One historical lek site (Coal Creek II) was found within the West Coal Creek wildlife general analysis area; that lek was last active in 1985. Since annual monitoring began in 1980, eight additional known or potential lek sites have been identified within the 2-mile wildlife survey area surrounding the West Coal Creek wildlife general analysis area (Figure 3-26). Four known lek sites (Kay, Hoadley, Coal Creek I, and Edwards) are considered historical, with no active use for at least the last 11 consecutive years (1996-2006). The remaining four sites have also experienced lengthy periods of little or no activity over the last 10-12 years, but have not yet met the criteria (10 consecutive years) to be officially designated as historical. The Thrush lek was

active during only 1 of the last 10 years (1997-2006), with two males seen there in 2000. One male was seen displaying within the Coal Creek Complex (Coal Creek III, IVa, and IVb) during 3 of the last 10 years. Four active leks are located east of, and beyond, the 2-mile wildlife survey perimeter, but in the general vicinity of the West Coal Creek LBA Tract (Figure 3-26): Deaver I and II, Rough Creek I, and Flora (not shown in the figure). The leks themselves are located more than 3 miles from the West Coal Creek wildlife general analysis area. Consequently, their respective 3-mile radii do not overlap the tract itself (as applied or lands added under Alternative 2). However, the 3-mile radii of concern for all four leks do overlap the eastern third of the 2-mile wildlife survey area (Figure 3-26). Of those four sites, the Rough Creek lek has been the most active over time, with males observed every year since monitoring began in 1980. That lek is part of the five-lek Rough Creek Complex, which has been visited by up to 300 grouse (males and hens) in a given year. The Deaver lek was discovered in 1989, and has gone through varying degrees of activity since then, including a shift in location that occurred in 2006. The Flora lek is on private lands northeast of the West Coal Creek wildlife general analysis area; lands that have not been consistently accessible for monitoring. The lek was known to be active as recently as 2001, but accurate records for the last 10 years are not available.

Annual monitoring efforts conducted at the adjacent Coal Creek Mine since the early 1980s, which overlapped the LBA tract and its two-mile perimeter, have demonstrated that sage-grouse use has been concentrated approximately 4 to 5 miles east of the tract. It is unlikely that sage-grouse are regular yearlong residents in the West Coal Creek LBA Tract (including Alternative 2 lands) or its two-mile perimeter due to area being dominated by a grassland vegetation type and not sagebrush. A more detailed discussion regarding sage-grouse use of the West Coal Creek LBA Tract is included in the SGAC EIS Supplementary Information document, which is available on request.

3.10.5.1.3 Caballo West LBA Tract

No sage-grouse leks have ever been documented on or within 2 miles of the Caballo West wildlife general analysis area. Four greater sage-grouse leks (Belle Ayr I, Belle Ayr II, Lynde, Stowe) were found within 3 miles of the Caballo West wildlife general analysis area during previous studies conducted for the adjacent Caballo and Belle Ayr Mines. The Gold Mine Draw lek is located just outside of this 3-mile radius. These five leks have essentially been inactive since at least 2004. The 3-mile radius around the Lynde lek overlaps the west-central portion of the Caballo West LBA Tract as applied for, as well as lands added under Alternative 2 and the Caballo West wildlife general analysis area in that region (Figure 3-27). The 3-mile radius for the Stowe lek just overlaps the extreme southern extent of the Caballo West wildlife general analysis area, while the radii for the Belle Ayr I and Belle Ayr II leks fall just outside of that perimeter. The 3-mile radius for the Gold Mine Draw lek does not intersect the Caballo West wildlife

general analysis area, but does overlap the 2-mile wildlife survey area for the Caballo West LBA Tract.

3.10.5.1.4 Maysdorf II LBA Tract

Five recently active sage-grouse leks have been surveyed within 3 miles of the Maysdorf II wildlife general analysis area: the Belle Ayr, Stowe, Thrush, Doud (Cordero Mine), and Lynde leks. Figure 3-28 shows the location of the five active leks and the seven historical lek sites. The Belle Ayr lek consists of at least two contiguous areas where sage grouse were observed strutting (Belle Ayr I and Belle Ayr II). The Belle Ayr I and Belle Ayr II leks are located within the wildlife general analysis area. The peak number of males was 12 in 1991, while no males were recorded in surveys conducted in 1992, 1993, 2004, 2006 or 2007. One male was recorded on the Belle Ayr lek in 2005. Attendance has been relatively low, averaging less than four males over the last 18 years. The Stowe lek is located approximately 0.4 miles north of the wildlife general analysis area. The Stowe lek had a peak of eight males in 2001, but no birds were recorded on this lek in 2003, 2004, 2005, 2006 or 2007. Due to their proximity to one another, the WGFD considers the Belle Ayr I, Belle Ayr II and Stowe to be within the Belle Ayr Complex. The Thrush lek is located over 1.5 mile southeast of the Maysdorf II wildlife general analysis area. The Thrush lek was not active in 1995 through 1999 and 2001 through 2007. The peak number of males observed on the Thrush lek was 19 (1990 and 1991). The Doud (Cordero Mine) lek is located approximately 0.5 mile from the southwest corner of the wildlife general analysis area. A maximum of seven males were recorded at the Doud lek in 2003, but no birds were in attendance in 2004, 2005, 2006 or 2007. The Lynde lek is located approximately 2.9 miles northwest of the wildlife general analysis area and its 3-mile radius just intersects the northwest corner of the analysis area. The 3-mile radii around the Stowe, Belle Ayr I and II, Thrush, and Doud (Cordero Mine) leks also extend onto the Maysdorf II wildlife general analysis area (Figure 3-28).

There is limited potential for use of the four LBA tracts or their respective analysis areas by nesting sage-grouse hens due to the relatively small amount of nesting habitat (sagebrush) in those areas and the general paucity of sage-grouse residing there year-round. As discussed above, no sage-grouse broods were recorded on any of the four LBA Tracts as applied for, or on lands added under each respective Alternative 2, during specific surveys or incidental to other wildlife surveys conducted in those areas annually since at least 1993.

Although winter surveys for sage-grouse are not required as part of the annual wildlife programs for the four mines discussed in this EIS, such surveys have been conducted as part of baseline inventories for their respective expansions. Additionally, winter surveys for other species (big game, bald eagle roosts, other wintering raptors) have occurred at all four locations in recent years. Due to their proximity to existing mine permit areas, all four LBA tracts, their Alternative added lands, and their analysis areas have been included in a minimum of seven

consecutive years (big game surveys 1993-1999) of some level of winter surveys. No sage-grouse were ever documented in or near the four LBA tracts during those surveys.

Based on annual lek searches since the mid 1980's, sharp-tailed grouse do not appear to be as prevalent as sage-grouse near the surface coal mines in northeast Wyoming. The nearest sharp-tailed grouse lek (Timber Creek) to the general South Gillette analysis area is located approximately 8 miles northeast of the Caballo West wildlife general analysis area.

Mourning doves are a migrant and relatively common in the area during migration, particularly near sites with water sources and trees and in the summer for breeding and nesting. This species is a relatively common breeding bird in Campbell County and may be found in a variety of habitat types. Mourning doves were common on the general South Gillette analysis area in 2006-07.

Gray (or Hungarian) partridge, an introduced species, have been infrequently observed on reclaimed areas, sagebrush shrublands, upland grassland, and cultivated lands within the general South Gillette analysis area. In some years this species is occasionally encountered while in other years partridge appear to be totally absent. Gray partridge were not observed on the general South Gillette analysis area in 2006-07.

3.10.5.2 Environmental Consequences

3.10.5.2.1 Proposed Action and Action Alternatives

Overall, the sage-grouse population has been steadily declining in Wyoming and across the rest of the west. A study prepared by the Western Association of Fish and Wildlife Agencies estimated that sage-grouse populations in western North America declined at an overall rate of 2.0 percent per year from 1965 to 2003 (Connelly et al. 2004). The decline rate was greater from 1965 to 1985, with populations stabilizing and some increasing from 1986 to 2003. For Wyoming, this study estimated that sage-grouse populations declined at an average rate of 9.66 percent from 1968 to 1986 (0.51 percent per year), and at an average rate of 0.33 percent per year from 1987 to 2003. Population lows were reached in the mid-1990s and there has been some gradual increase in numbers since that time (Connelly et al. 2004).

The Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are within the Northeast Wyoming Local Sage-Grouse Working Group (NWLSWG) Area, which includes portions of the WGFD Sheridan and Casper regions and the Thunder Basin National Grassland, which is located south of the general South Gillette analysis area. Sage-grouse monitoring has occurred within the NWLSWG since 1967. Within this area, sage-grouse population trends have exhibited a cyclical pattern, with each successive peak of a cycle being lower than the

preceding peak. This suggests a long term population decline since at least 1967 (Figure 3-30).

Population trends within the NWLSWG appear to be mirroring statewide trends in Wyoming, although the average number of males per lek in the NWLSWG Area, including in the Thunder Basin National Grassland, has typically been lower than those observed state wide (Figure 3-31). Since 1996, sage-grouse populations within the state and in northeast Wyoming have fluctuated but exhibited an overall increase, with a recent peak in male lek attendance occurring in 2000 or 2001.

The causes of the range-wide decline in sage-grouse population levels are not completely understood, but they may be influenced by local conditions. However, habitat loss due to disturbance of leks, nesting and brood-rearing areas as a result of increasing development, drought, and the potential for West Nile virus, as well as loss of population connectivity are key threats to this species (Naugle et al. 2004).

Some potential impacts of mineral development (including coal mining and oil and gas development) on sage-grouse include: 1) direct habitat loss and fragmentation from mine, well, road, pipeline, transmission and power line construction, 2) alteration of plant and animal communities, 3) increased human activity which could cause animals to avoid the area, 4) increased noise, which could cause animals to avoid an area or reduce their breeding efficiency, 5) increased motorized access by the public leading to legal and illegal harvest, 6) direct mortality associated with water evaporation ponds and production pits, and 7) reduced water tables resulting in the loss of herbaceous vegetation. Some impacts may be long-term (30 years or more), and rehabilitation of impacted habitats may take many years to complete (WGFD 2003). In the case of sage-grouse lek attendance near the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, the decline in attendance preceded physical mining disturbance and thus may not be attributable to mine-related activities (Orpet 2007, TJS 2007).

Areas of suitable habitat for nesting and strutting grounds are needed to sustain sage-grouse populations. One recent study suggests that availability of winter habitat may also affect sage-grouse populations (Naugle et al. 2006). The Sage-Grouse Implementation Team has delineated sage-grouse focus areas within Wyoming and a portion of the West Coal Creek LBA Tract is adjacent to one of these focus areas (Figure 3-29). According to the Implementation Team, development could occur within the sage-grouse core areas “when it can be demonstrated that the activity will have no negative effects on Sage-grouse, using a case-by-case localized approach and appropriate ground-truthing” (Sage-Grouse Implementation Team 2008).

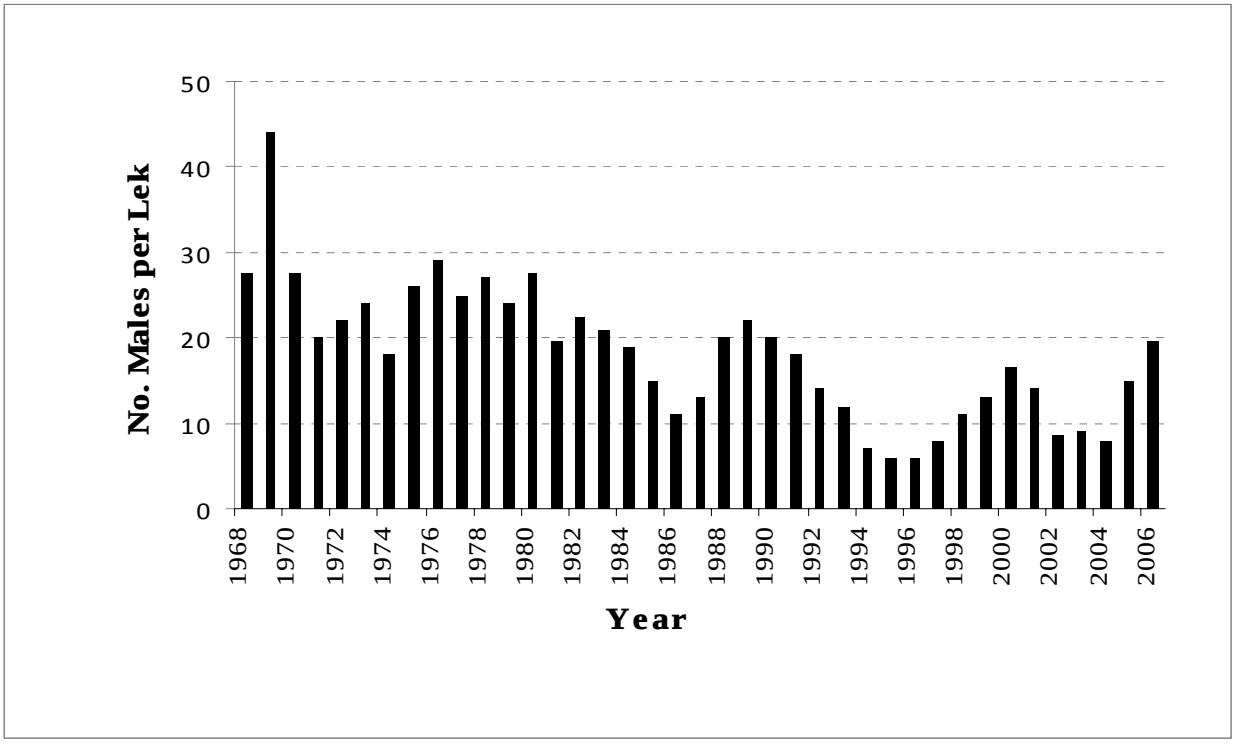

Figure 3-30. Average Male Sage-grouse Lek Attendance Within the Northeast Wyoming Local Working Group Area (1968-2006).
Source: TJS (2007)

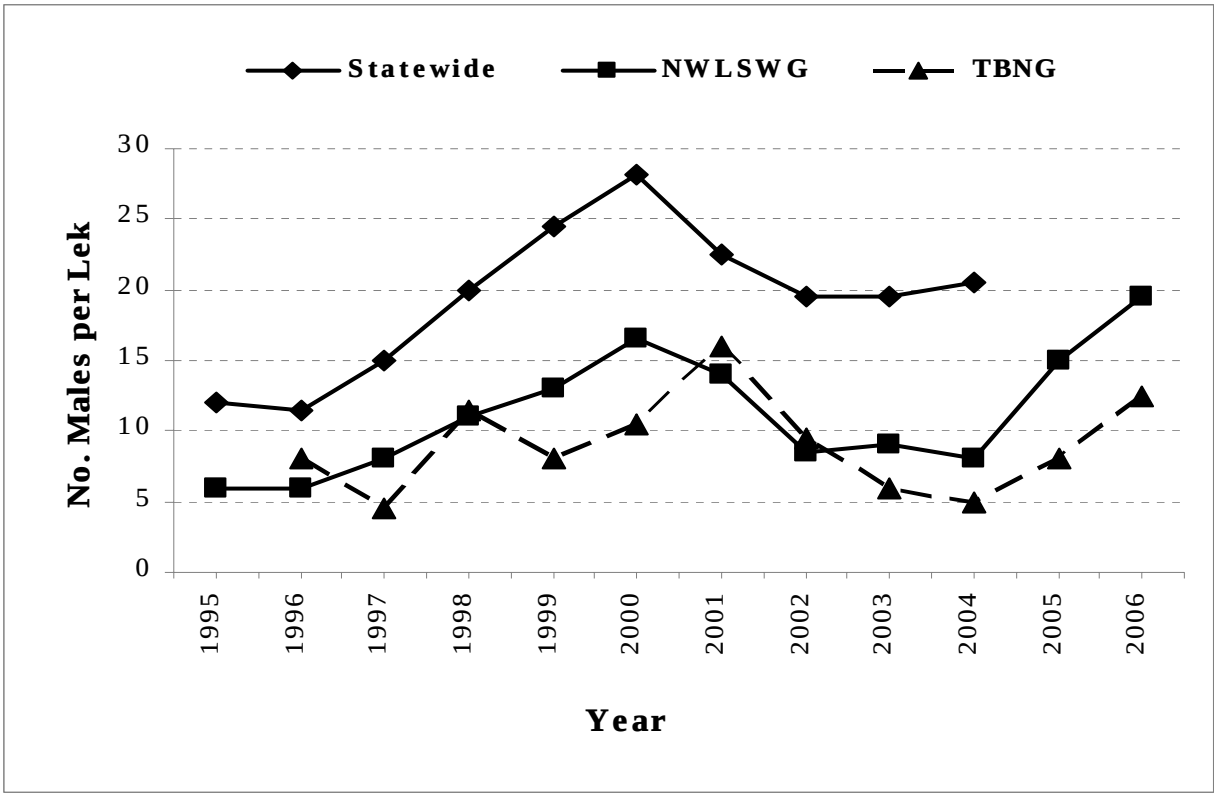

Figure 3-31. Average Male Sage-grouse Lek Attendance Statewide and Within the Northeast Wyoming Local Sage-grouse Working Group Area and the Thunder Basin National Grasslands (1995-2006).
Source: TJS (2007)

During mining, there is a short term loss of potential nesting habitat and potential disturbance to breeding activities, especially when mining operations occur in proximity to sage-grouse leks. Following reclamation, there may be a long term loss of nesting and winter habitat, including sage-grouse focus areas, depending on the amount of sagebrush that is restored relative to the amount of sagebrush that is present before mining. Sagebrush is a component of both the Sagebrush/Grassland and Big Sagebrush vegetation communities, which occupy nearly 38 percent of the vegetation analysis areas. WDEQ/LQD reclamation standards call for restoration of sagebrush on at least 20 percent of the reclaimed area. Estimates for the time it would take to restore shrubs, including sagebrush, to premining density levels range from 20 to 100 years. Until sagebrush returns to its premining density levels, there would be a reduction in potential sage-grouse nesting habitat and winter habitat on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts.

If mining activities disturb a lek, sage-grouse would have to use an alternate lek or establish a new lek site for breeding activities. There are no documented sage-grouse leks within any of the four LBA tracts, either as applied for or with added lands under each respective Alternative 2. Only one historical (inactive 10 or more consecutive years) lek has ever been documented within the specific wildlife general analysis areas: West Coal Creek. Fidelity to lek sites has been well documented in the region as a whole (WGFD 2003), but monitoring of sage-grouse activities has indicated that the birds may change lek sites within a given complex.

As discussed in Section 3.10.5.1, 18 known or potential sage-grouse leks have been identified in the combined evaluation area for the four LBA tracts analyzed in this EIS (Figures 3-25 through 3-28). Five of those 18 sites are classified by the WGFD as historical, and 5 others have been largely inactive over the last 10-12 years. The eight leks with the most recent activity are all more than 2 miles from the specific wildlife general analysis area of each LBA tract. However, the 3-mile radii of concern for those eight leks overlap one or more LBA tracts or tract wildlife general analysis areas. The 3-mile radius is the area in which two-thirds of the hens that were bred at those leks would be expected to nest. If the LBA tracts and/or added lands are leased and mined, potential nesting habitat for grouse that were bred at those leks would be affected by mining activity in those areas. However, as also previously discussed, no sage-grouse nests or broods have been recorded on any of the four LBA Tracts as applied for or on lands added under each respective Alternative 2, during specific surveys or incidental to other wildlife surveys conducted in those areas annually since at least 1994. The noise associated with mining operations may also disrupt sage-grouse breeding and nesting activities that might occur in those areas.

There is some evidence that sage-grouse populations do repopulate areas after reclamation for the species, but there is no evidence that populations attain their previous levels and reestablishment in reclaimed areas may take 20 to 30 years,

or longer (Braun 1998). Estimates for the time it would take to restore shrubs, including sagebrush, to premine density levels range from 20 to 100 years, which may delay sage-grouse repopulation in the reclaimed areas.

Leasing and mining the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would also affect potential habitat for mourning doves, sharp-tailed grouse, and gray partridge; however, the tracts do not provide unique habitat for these species. Sightings of sharp-tailed grouse and gray partridge are infrequent in this area.

3.10.6 Other Birds

3.10.6.1 Affected Environment

USFWS uses a list entitled *Migratory Bird Species of Management Concern in Wyoming*, specifically the *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming,* for reviews related to existing and proposed coal mine leased land (USFWS 2002b). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2001), and was current through 2006. The *Migratory Bird Species of Management Concern in Wyoming* list replaced the *Migratory Birds of High Federal Interest* list. All four mines have conducted specific surveys for migratory birds of concern annually since at least 1993, incorporating new lists and survey protocols as they were issued. The surveys, which are conducted in the spring and summer, include the existing permit area and a ½-mile perimeter (1-mile perimeter for bald eagles). Due to the proximity of the proposed LBA tracts (including added lands and respective wildlife general analysis areas) to existing mine permit areas, a significant portion of all four LBA tracts has been included in annual surveys for avian species of concern since 1993.

The Wildlife Section of the supplemental information document to this EIS, which is available on request, includes a tabulation of the regional status and expected occurrence, historical observations, and breeding records for each of the species on the *Coal Mine list of 40 Migratory Bird Species of Management Concern in Wyoming*, based on a compilation of the results of the annual surveys conducted on and near the respective LBA tracts (as applied for and added lands). Twenty-three of the 40 listed species have historically been observed within the combined evaluation area for the four proposed LBA tracts. Species that historically have been recorded, or are suspected of, nesting in the area include the burrowing owl, Brewer's sparrow (*Spizella breweri*), Swainson's hawk, short-eared owl, ferruginous hawk, lark bunting (*Calamospiza melanocorys*), grasshopper sparrow (*Ammodramus savannarum*), upland sandpiper (*Bartramia longicauda*), loggerhead shrike (*Lanius ludovicianus*), lark sparrow (*Chondestes grammacus*), sage thrasher (*Oreoscoptes montanus*), chestnut-collared longspur (*Calcarius ornatus*), McCown's longspur (*Calcarius mccownii*), greater sage-grouse, and the vesper sparrow (*Pooecetes gramineus*). Other species documented less often in the area include

the peregrine falcon (*Falcon peregrinus*), bald eagle, bobolink (*Dolichonyx oryzivorus*), common loon (*Gavia immer*), long-billed curlew (*Numenius americanus*), red-headed woodpecker (*Melanerpes erthrocephalus*), sage sparrow (*Amphispiza belli*), and merlin (*Falco coumbarius*). The bald eagle is only observed in the winter or as a migrant. The other non-nesting species have been observed infrequently as migrants.

The mountain plover is included on the list of *Coal Mine list of 40 Migratory Bird Species of Management Concern in Wyoming*. The USFWS proposed listing the mountain plover as a threatened species in February 1999 but in September 2003 the agency withdrew the proposed rule to list the mountain plover as threatened (USFWS 2008). The USFWS continues to encourage provisions that would provide protection for this species, as it continues to be protected under the Migratory Bird Treaty Act and as a sensitive species under BLM policy (Bureau Manual 6840.06 E. Sensitive Species).

Wildlife surveys conducted at the Belle Ayr, Coal Creek, and Cordero Rojo Mines have failed to detect the presence of this species in their respective survey areas. The survey areas, which include the mines' permit areas and a half-mile perimeter, are inventoried for suitable mountain plover habitat annually. Only a single observation of mountain plovers has been reported in the vicinity of the Caballo West LBA Tract. In August 1992, a migrant flock of 12 individuals was seen in saline grassland habitat within the LBA tract as applied for. No plovers have been documented in that area or elsewhere in the general South Gillette analysis area during the subsequent 14 years (through 2006) of annual monitoring.

The bald eagle is seasonally common and most frequently observed during the winter months. Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB. No bald eagle roosting habitat is present on the Belle Ayr North, Caballo West, or Maysdorf II LBA Tracts or areas added by the other alternatives. No bald eagle winter roosts have ever been documented in or within one mile of either the Belle Ayr North or Caballo West wildlife general analysis areas. Potential winter roosting habitat for this species is present, but limited, in the vicinity of the West Coal Creek and Maysdorf II LBA Tracts and adjacent lands. The West Coal Creek habitat consists of a relatively sparse cottonwood corridor along East Fork Coal Creek in the east-central portion of the LBA tract as applied for, and other isolated trees in that general area. Potential winter roosting habitat is located approximately ¾-mile east of the Maysdorf II tract. No known nest sites, or consistent yearly concentrated prey or carrion sources for bald eagles are present in the vicinity of the Belle Ayr, Coal Creek, or Caballo Mines, including the LBA tracts and their adjacent lands. However, a sheep ranching operation is located just west of the Maysdorf II LBA Tract as applied for, on the north side of Haight Road. Eagles may feed or scavenge upon adult sheep carcasses in this area in the winter, although that source of food

would not be consistent or abundant, and wintering migrant eagles have typically left the area prior to spring lambing season.

In the winters of 2004-2005, 2005-2006, and 2006-2007, the bald eagle has been far more common and abundant in the area than in previous years. This may have been a result of mild winters and the abundance of lagomorphs (rabbits) to prey upon. Bald eagles also scavenged road-killed rabbits off of adjacent roads. Lagomorph numbers appeared to be at or near a peak in their cycle during those years. During those three winters, bald eagles frequently used a large windbreak within the existing Cordero Rojo Mine permit area approximately ¾- mile east of the Maysdorf II tract. Bald eagles had never been observed concentrating in this windbreak during the previous 25+ years of wildlife surveys. A maximum of 29 bald eagles were observed at this roost site on February 16 of 2005 with maximums of 20 and 15 recorded in 2005-2006 and 2006-2007, respectively. Very few birds had been observed at the roost site through late 2007. This roost site is within ¼-mile of active mining operations and bald eagles were commonly observed around mining activities. The only winter roost site documented in the vicinity of the West Coal Creek LBA Tract since 1980 was recorded during February 2007, when two to three adult bald eagles were observed perched in the same mature cottonwood on three different occasions. That tree is located within the LBA tract as applied for and immediately south of the current Coal Creek Mine permit area.

The burrowing owl is uncommon and is observed as an occasional breeder in the combined evaluation area. Sage-grouse, recently added to the Level I list of avian species of concern at coal mines, are becoming less common in the general South Gillette analysis area but are still classified as a common breeder on and within 4 miles of the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA Tracts (see Section 3.10.5 above). The USFWS considers Level I species as in need of conservation action, which includes having a monitoring and mitigation plan for those birds.

Suitable nesting habitat is scarce if not absent in the general South Gillette analysis area for the remainder of the *40 Migratory Bird Species of Management Concern in Wyoming*; therefore, the other species have rarely or never been recorded.

Under natural conditions, the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA Tracts and adjacent lands provide limited waterfowl and shorebird habitat. The natural aquatic habitat, prior to CBNG development within the Belle Fourche River drainage basin, was mainly available during spring migration as ponds (primarily stock reservoirs and playa areas) and intermittent and ephemeral streams. Many of these water features generally got quite low or dried up during the summer. However, the relatively recent development of CBNG resources upstream and within the wildlife general analysis area has supplied the river, its tributaries, ponds, and playas with water nearly continuously, resulting

in an increase in habitat for waterfowl and shorebird species. Broods of Canada geese (*Branta Canadensis*) American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), and green-winged teal (*Anas crecca*) were observed during 2005 and/or 2006 throughout the area.

3.10.6.2 Environmental Consequences

3.10.6.2.1 Proposed Action and Action Alternatives

Of the twenty-three *Migratory Bird Species of Management Concern* for Wyoming coal mines that have historically been observed in the wildlife general analysis area, the Level I species (those identified as needing conservation action) that have historically been recorded nesting in the area include the ferruginous hawk, burrowing owl, greater sage-grouse, Brewer's sparrow, Swainson's hawk, and McCown's longspur. Level I species that do not have abundant nesting habitat available in the wildlife general analysis areas, but have been documented or presumed to nest, include the short-eared owl and upland sand piper. Other Level I species observed in the area include the peregrine falcon, long-billed curlew, sage sparrow, and bald eagle, with varying degrees of frequency.

The existing habitat for these species on the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA Tracts and their respective wildlife general analysis areas (tracts as applied for, added lands, and a one-quarter-mile perimeter around that combined area) would be destroyed during mining. The habitat loss would be short-term for grassland species, but would last longer for shrub-dependent species. There are currently no trees on three of the four LBA tracts (as applied for and with added lands). The West Coal Creek LBA Tract and its wildlife general analysis area do support scattered trees along the primary drainages in that location. Current reclamation practices at the applicant mines are designed to provide a mosaic of upland grass and sagebrush habitats that would potentially host most of these species. Periodic breeding bird surveys at other surface mines with similar habitats in the region since the mid-1980s have demonstrated that species richness and abundance in reclaimed habitats are equal to or greater than in their native counterparts, though species composition may not be the same due to differences between pre- and post-mining vegetation. Additionally, surface coal mines in the PRB of northeastern Wyoming are required to replace each tree lost to mining, though it will take many years for newly planted trees to reach maturity. Research projects on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was less than on adjacent undisturbed areas, although their overall numbers were greater (Clayton et al. 2006 and Shelley 1992).

No impacts to mountain plovers are anticipated because they have only been observed one time in the last 14 years at or near any of the four LBA tracts,

despite annual monitoring in those areas every year since the lone observation was recorded (1992). Additionally, the typical suitable habitat for this species is not currently present on the tracts.

Potential impacts to the bald eagle, sage-grouse and other raptors in general, as well as measures in place to prevent impacts to these species from existing mining operations are included in the preceding discussions, in Appendices E through H, or the Supplementary Information document (available on request).

Mining the LBA tracts would have a negligible effect on migrating and breeding waterfowl and shorebirds. Sedimentation ponds created during mining would provide interim habitat for these fauna. Cordero Rojo Mine's current reclamation plan requires that the portion of the Belle Fourche River channel affected by currently permitted mining be reclaimed to restore its premining functions and aquatic habitats. Similar requirements would be put into place whenever primary channels are diverted for mine operations at other properties. The Belle Fourche River diversion channel and other future diversions would not provide the same habitat as the natural channels, although natural stream flow and the presence of CBNG discharge water would not be affected. If the Maysdorf II LBA tract is leased and mined, current reclamation efforts would be extended onto the portion of the river affected by mining the tract. Replacement of all impacted jurisdictional wetlands would be required in accordance with Section 404 of the Clean Water Act (Section 3.7) for all four tracts, as applicable. If the replaced wetlands on the LBA Tracts do not duplicate the exact function and/or landscape features of the pre-mine wetlands, waterfowl and shorebirds could be beneficially or adversely affected as a result.

3.10.6.2.2 No Action Alternative

Impacts to migratory bird species, waterfowl, and shorebirds under the No Action Alternatives would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas.

3.10.7 Amphibians, Reptiles, and Aquatic Species

3.10.7.1 Affected Environment

Wildlife surveys completed specifically for the applicants and adjacent mines, as well as biological research projects in the eastern PRB, have documented numerous other wildlife species that inhabit the region, including various amphibians, reptiles, and aquatic species. All these species are generally common inhabitants of the general South Gillette analysis area.

Numerous reptile and amphibian species have been recorded during the various surveys on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine areas and

adjacent lands, including the specific wildlife general analysis areas. These species include the tiger salamander (*Ambystoma tigrinum*), plains spadefoot (*Scaohiopus bombifrons*), great plains toad (*Bufo cognatus*), Woodhouse's toad (*Bufo woodhousei*), boreal chorus frog (*Pseudacris triseriata maculata*), northern leopard frog (*Rana pipiens*), common snapping turtle (*Chelydra serpentina serpentina*), western painted turtle (*Chrysemys picta belli*), eastern short-horned lizard (*Phrynosoma douglassi brevirostre*), northern sagebrush lizard (*Sceloporus graciosus graciosus*), prairie rattlesnake (*Crotalus viridis viridis*), plains hognose snake (*Heterondon nasicus nasicus*), bullsnake (*Pituophis melanoleucas sayi*), western plains garter snake (*Thamnophis radix haydeni*), red-sided garter snake (*Thamnophis sirtalis parietalis*), and eastern yellowbelly racer (*Coluber constrictor flaviventris*). The abundance of these reptiles and amphibians is difficult to determine but these species appear to be common to the area.

Under natural conditions, aquatic habitat is limited by the temporary nature of most surface waters in the combined evaluation area. The lack of deep-water habitat and extensive and persistent water sources within that region limits the presence and diversity of fish and other aquatic species.

3.10.7.1.1 Belle North LBA Tract

The scarcity of mesic habitats throughout the majority of the Belle Ayr North wildlife general analysis area reduces the potential of the area to attract aquatic species. The adjacent Belle Ayr Mine has conducted a voluntary program of aquatic monitoring on Caballo Creek (south of the LBA tract) twice annually from fall 1986 through fall 1999, and in alternate years from 2001-2006. Those surveys were expanded in 2006 to include a new diversion on the creek. Caballo Creek has demonstrated characteristics of both an ephemeral and intermittent stream. Some stream segments flow only in response to snowmelt runoff in the spring and thunderstorm runoff in the summer months, although there are some stream segments that flow throughout the year in response to alluvial groundwater discharge. Recent influxes of CBNG discharge water into the creek have provided extended periods of surface water in some, but not all, of the last few years. During 2006, several fish were documented in stretches of Caballo Creek, including the sand shiner (*Notropis stramineus*), fathead minnow (*Pimephales promelas*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*). Despite the presence of these species, Caballo Creek is not considered a viable fishery.

3.10.7.1.2 West Coal Creek LBA Tract

Coal Creek and its various tributaries associated with the West Coal Creek wildlife general analysis area have not historically exhibited flow persistent enough to warrant aquatic sampling. Nevertheless, limited fisheries sampling was conducted during the baseline studies for the Coal Creek Mine in three stock ponds within the existing permit area in 1975. The nearest survey site during those efforts was

a pond located approximately one mile east of the LBA tract as applied for. The common fathead minnow (*Pimephales promelas*) was the only species captured at the pond. No specific sampling was required or conducted for herptiles or aquatic species during the West Coal Creek LBA Tract baseline studies. Nevertheless, biologists watched for and recorded all incidental sightings of those animals during each site visit.

3.10.7.1.3 Caballo West LBA Tract

Monitoring of aquatic species is not regularly conducted at the Caballo Mine, and fish surveys were not required or conducted specifically for the Caballo West LBA Tract. The nearest regular monitoring of aquatic species occurs as part of regular surveys in Caballo Creek, south of the Caballo West LBA Tract, for the neighboring Belle Ayr Mine. All baseline and annual report documents for the Caballo and Belle Ayr Mines are on file with WDEQ/LQD in Sheridan, Wyoming.

3.10.7.1.4 Maysdorf LBA II Tract

Fish surveys were conducted in the Belle Fourche River during baseline studies for the Cordero Rojo Mine in 1975 and on the Maysdorf LBA II Tract in 2005. These surveys were completed in the southern and southeastern portion of the existing Cordero Rojo Mine area in 1975 and throughout the Maysdorf LBA II Tract in 2005. Fish species observed during those surveys include the common carp (*Cyprinus carpio*), creek chub (*Semotilus atromaculatus*), flathead chub (*Platygobio gracilis*), sand shiner, brassy minnow (*Hybognathus hankinsoni*), fathead minnow, white sucker (*Catostomus commersoni*), black bullhead (*Ameiurus melas*), green sunfish, and yellow perch (*Perca flavescens*). The most abundant fish were the white sucker and various minnow species.

In 1997, the Belle Fourche River was sampled at a location several miles upstream from the Maysdorf II LBA Tract. The black bullhead, creek chub, carp, fathead minnow, green sunfish, sand shiner, and white sucker were found during those surveys (Patton 1997). WGFD has categorized the black bullhead as a Status 3 species. Status 3 species are widely distributed throughout their native range with stable populations; however, habitat is declining or vulnerable.

Excluding the black bullhead, none of the other aquatic species found during the 1975, 1997, or 2005 surveys are of specific concern to state or federal agencies and the Belle Fourche River channel through the Maysdorf II LBA Tract is not considered a viable fishery. The site rating for this stream reach was poor to very poor, based on the 2005 macroinvertebrate samplings and the WDEQ Indices.

As discussed above, water discharged from CBNG wells has recently supplied the Belle Fourche River and some tributaries, ponds, and playas with water nearly continuously, resulting in an increase in habitat for aquatic species. However, in July of 2005 only 40 percent of the river's channel length through the Maysdorf II

LBA Tract contained water, while the remaining 60 percent of the channel length was dry. These observations document that this reach of the Belle Fourche River has not become perennial, even with the addition of CBNG discharge water.

3.10.7.2 Environmental Consequences

3.10.7.2.1 Proposed Action and Action Alternatives

Mining the tracts would remove habitat for aquatic species, amphibians and reptiles in a portion of the Belle Fourche River and sections of the ephemeral tributaries to the Belle Fourche. Although the channel and surface water flow would be restored during reclamation, the river would be diverted and habitat for these species would be lost during mining operations. Under natural conditions, habitat for aquatic species is limited on each of the four LBA tracts (as applied for and with added lands), however, as discussed above, a variety of aquatic species and reptiles and amphibians have been observed on and in the vicinity of the tracts.

Under jurisdiction of Cordero Rojo Mine's current WDEQ/LQD mine permit, two sections of the Belle Fourche River have been diverted in order to recover coal from the existing coal leases (Section 3.5.2.1). A portion of one of these existing diversion channels that was approved by WDEQ in 1996 (WDEQ/LQD 1996) is just north of the Maysdorf LBA II Tract as applied for.

Reclamation of the various drainage channels and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions would restore fish habitat and aquatic resources of the Belle Fourche River and other smaller drainages within the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts.

3.10.7.2.2 No Action Alternative

Impacts to reptiles, amphibian, and aquatic species under the No Action Alternatives would be similar to the impacts described in Section 3.10.1.2.2 above.

3.10.8 Threatened, Endangered, Proposed, and Candidate Animal Species, and BLM Sensitive Species

Refer to Appendices E through I.

3.10.9 Regulatory Compliance, Mitigation and Monitoring

Regulatory guidelines and requirements designed to prevent or reduce surface coal mining impacts to wildlife include:

- fencing designed to permit pronghorn passage to the extent possible;

- creation of raptor nests to mitigate other nest sites impacted by mining operations at this mine;

- relocation of raptor nests that would be impacted by mining in accordance with the approved raptor monitoring and mitigation plan;

- obtaining a permit for removal and mitigation of golden eagle nests;

- buffer zones for protection of raptor nests;

- restriction of mine-related disturbances from encroaching in the near vicinity of any active raptor nest from March until fledglings have left the nest;

- restriction of disturbances near raptor nests containing nestlings to prevent danger to, or abandonment of, the young;

- creation of nesting habitat through enhancement efforts (nest platforms, nest boxes, and tree plantings);

- reestablishment of the ground cover necessary for the return of a suitable raptor prey base after mining;

- restoration of sage-grouse habitat after mining including reestablishment of sagebrush and other shrubs on reclaimed lands and grading of reclaimed lands to create swales and depressions consistent with the pre-mining topography;

- development of a *Migratory Bird Species of Management Concern for Coal Mines in Wyoming Monitoring and Mitigation Plan,* which must be approved by USFWS;

- required use of raptor-safe power lines (APLIC 2006);

- restoration of diverse landforms, direct topsoil replacement, and the construction of brush piles, snags, and rock piles to enhance habitat for wildlife;

- restoration of habitat provided by jurisdictional wetlands; and

- reclamation of the stream channels and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions.

Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines' current mine permits require reconstruction of bed form features in major stream channels, such as pools and runs, that should help restore the channels' natural function, as well as

provide habitat. Restoration will be or may be achieved by salvaging sufficient material from channel terrace alluvium or material having the same physical characteristics to reconstruct pool features. Current reclamation, as well as future reclamation of the Belle Fourche River by the Cordero Rojo Mine would incorporate alluvium salvaged from the original channel.

These measures are included in the existing mining and reclamation permit and would be included in the amended mining and reclamation plans, if the LBA tract were leased and proposed for mining.

Baseline wildlife surveys were conducted for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines before mining operations began at the mines. Annual wildlife monitoring surveys have been conducted since the mid-1980s. These surveys are required by state and federal regulations. All four mines also voluntarily conduct annual and/or periodic surveys for additional species that are not included in the monitoring required by state or federal regulations. The wildlife monitoring surveys cover the areas included in the mine permit areas and a perimeter beyond the permit areas that varies in size according to the species being surveyed. As a result, a majority of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts (as applied for, plus added alternative lands and a surrounding one-quarter-mile perimeter) have been surveyed as part of the required monitoring surveys for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively.

The annual monitoring programs include:

- spring surveys for new and/or occupied raptor nests, upland game bird lek locations, T&E species, and migratory birds;
- late spring surveys of raptor production for occupied nests, opportunistic observations of all wildlife species, T&E species, and migratory birds;
- raptor territorial occupancy and nest productivity is surveyed annually on and within a 1- or 2-mile perimeter surrounding the existing permit areas, depending on the mine;
- summer surveys for raptors, migratory birds, and lagomorph density;
- winter surveys for bald eagle winter roosts on and within 1 mile of the permit area (conducted as needed based on proximity of disturbance to potential roosting habitat);
- voluntary winter surveys for big game on and surrounding the permit area (currently conducted during alternate years) (Belle Ayr, Coal Creek, and Caballo Mines only);

- voluntary aquatic surveys for fish and macro-invertebrates within the existing permit area (previous annual schedule, currently conducted during alternate years) (Belle Ayr Mine only);

- voluntary annual surveys for migrating and nesting waterfowl, shorebirds, and other water obligate avian species (historically Belle Ayr and Coal Creek Mines, currently only Belle Ayr Mine); and

- breeding bird surveys (previously voluntary and periodic at Belle Ayr Mine, now required annually at all mines).

Monitoring data were collected by all of the surface coal mines in the PRB for big game species from at least 1995 until 1999, with most mines conducting annual surveys since the mid- to late 1980s. At that time, the WGFD reviewed monitoring data and requirements for big game species on those mine sites. They concluded that the monitoring had demonstrated a lack of impacts to big game on existing mine sites. No severe mine-caused mortalities had occurred and no long-lasting impacts on big game had been noted on existing mine sites. The WGFD therefore recommended at that time that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which are present within the wildlife general analysis area. Although big game surveys are no longer required as part of the annual wildlife monitoring program at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, FCW, TBCC, and PRCC have voluntarily continued these surveys on a reduced but regular schedule.

There are approved raptor monitoring and mitigation plans for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. These monitoring and mitigation plans would be amended to include the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts (as applied for and added lands) if they are leased and proposed for mining. The amended raptor mitigation plans would be subject to review and approval by USFWS before the amended mining plans are approved.

Monitoring and mitigation plans for Migratory Bird Species of Management Concern have also been developed in cooperation with USFWS for the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo mining operations, and those plans would be amended to include the LBA tracts and any added lands. If additional species are documented nesting or using the area regularly, a mitigation plan would be developed to protect those birds and their habitat.

3.10.10 Residual Impacts

Although the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would be reclaimed in accordance with the requirements of SMCRA and Wyoming statutes, there would be some residual wildlife impacts. The

topographic moderation would result in a permanent loss of habitat diversity and a potential decrease in slope-dependent shrub communities. This would reduce the carrying capacity of the land for shrub-dependent species. Reclamation standards may limit replacement of habitat for some species. Some species, such as sage-grouse, may repopulate reclaimed areas but populations may not attain pre-mining levels.

3.11 Land Use and Recreation

3.11.1 Affected Environment

Surface ownership within the general South Gillette analysis area consists primarily of private lands with some intermingled federal lands. The federally owned lands included in the tract are administered by the BLM. Surface ownership for each LBA tract study area is shown in Table 3-12 and in Figures 3-32 through 3-35.

Table 3-12. Distribution of Surface Ownership Within the Each LBA Tract Study Area.

	Federal Ownership		Private Ownership	
LBA Tract Configuration	**(Acres)**	**(Percent)[1]**	**(Acres)**	**(Percent)[1]**
Belle Ayr North	0.00	0.0	1,752.03	100.0
West Coal Creek	0.00	0.0	1,313.26	100.0
Caballo West	0.00	0.0	1,024.00	100.0
Maysdorf II	284.96	5.8	4,610.67	94.2
Total	**284.96**	**3.2**	**8,699.96**	**96.8**

[1] Based on total acres (Proposed Action plus Action Alternatives).
[2] Includes BLM's tract delineation under Action Alternatives.

Livestock grazing on native rangeland is the primary land use, while oil and gas production, wildlife habitat, communication and power lines, transportation, and recreation are secondary land uses for both public and private lands.

Areas of disturbance within and near the proposed lease are generally associated with roads, oil and gas wells and production facilities, surface mine-related facilities, and ranching operations. State Highway 59 is adjacent to one LBA tract and up to several miles west of the other LBA tracts. Several county and unnamed two-track roads traverse and provide public and private access within and near the proposed lease areas. The county roads include the Haight Road, T-7 Road, Hoadley Road, Bishop Road, and the Hilight Road. The BNSF & UP railroad right-of-way also crosses a small portion of the Maysdorf II Tact.

The oil and gas estate within the general South Gillette analysis area is federally, privately, and state owned, with the majority (approximately 90 percent) being

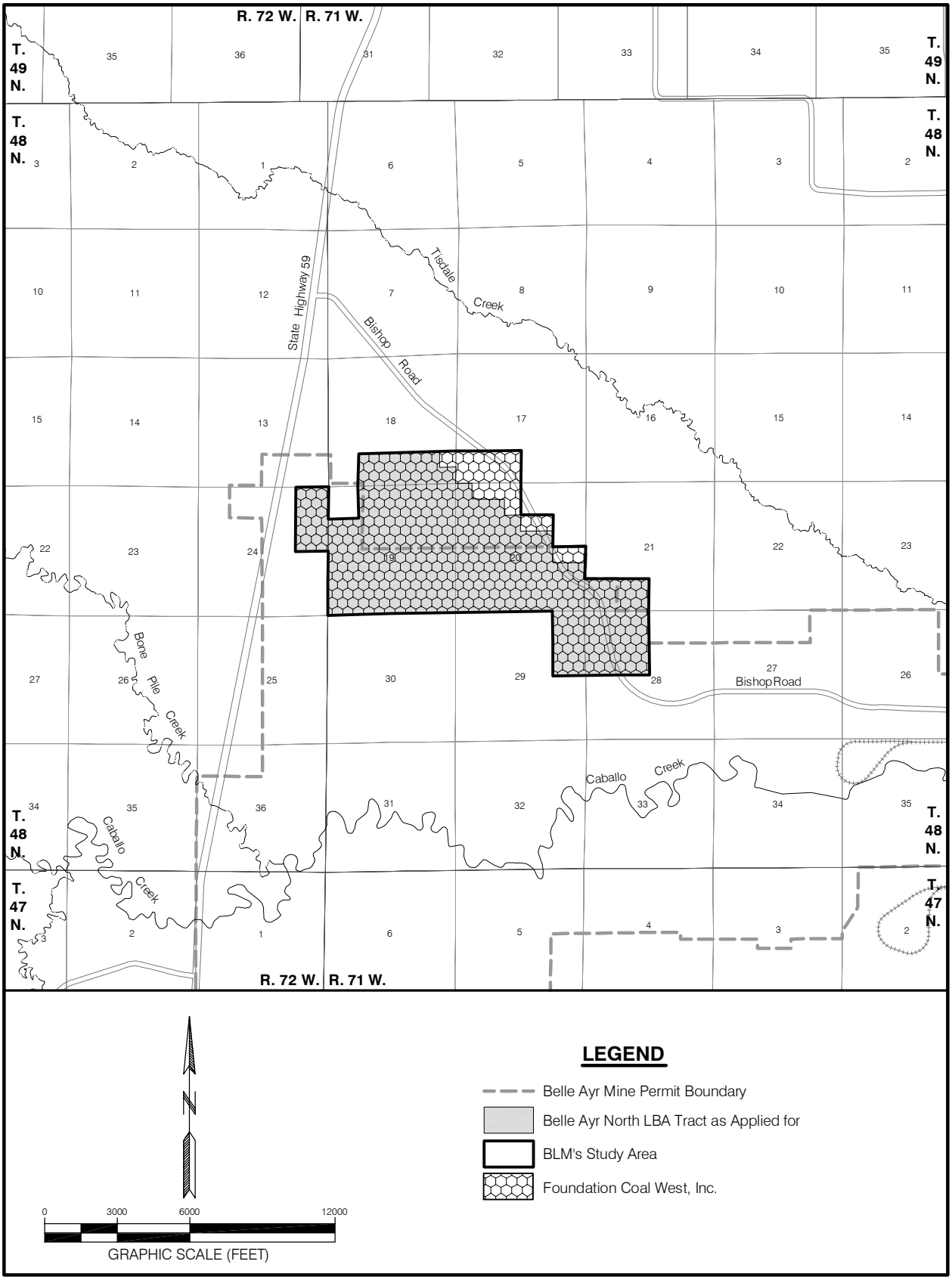

Figure 3-32. Surface Ownership Within the Belle Ayr North LBA Tract Alternatives.

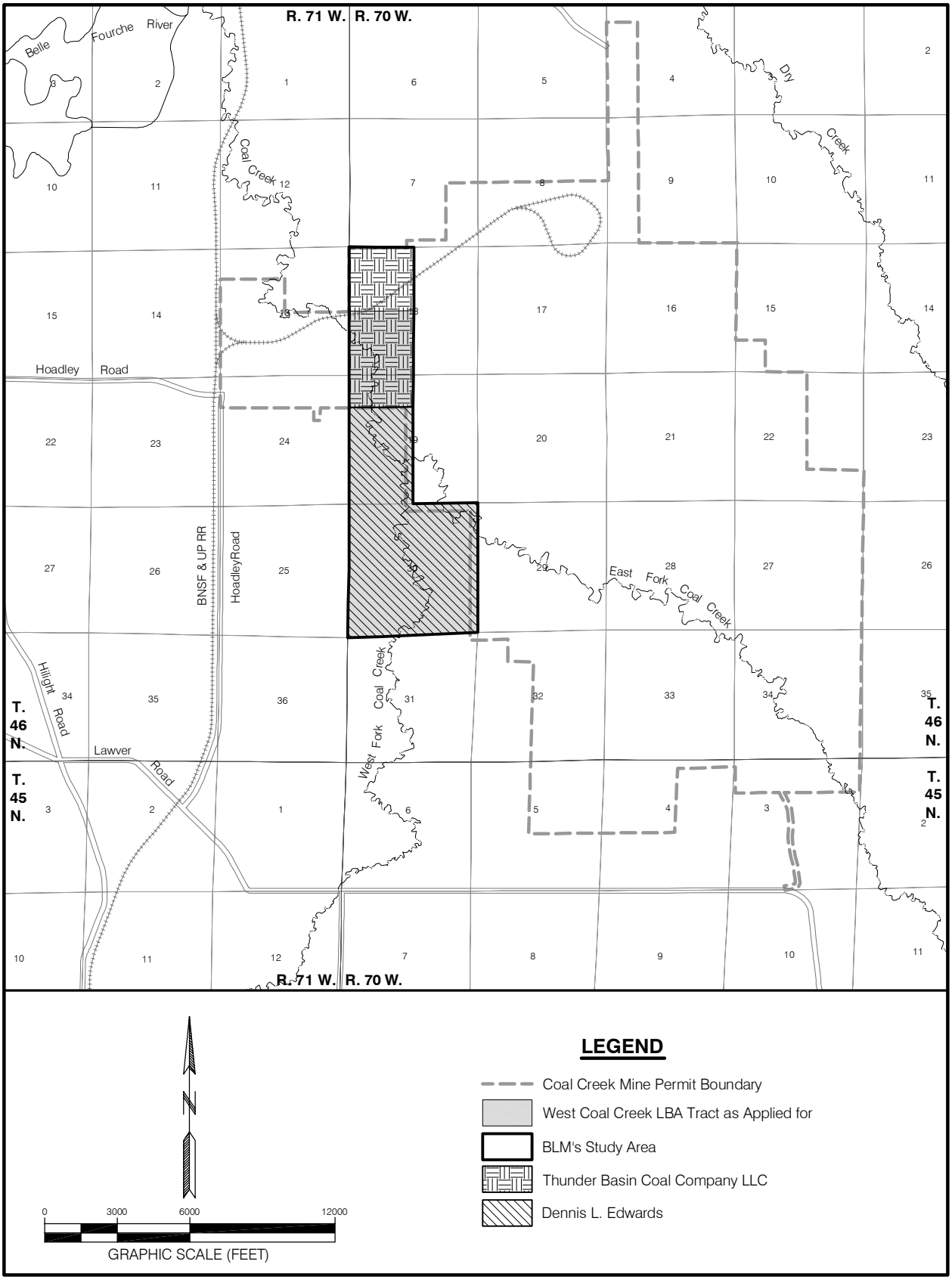

Figure 3-33. Surface Ownership Within the West Coal Creek LBA Tract Alternatives.

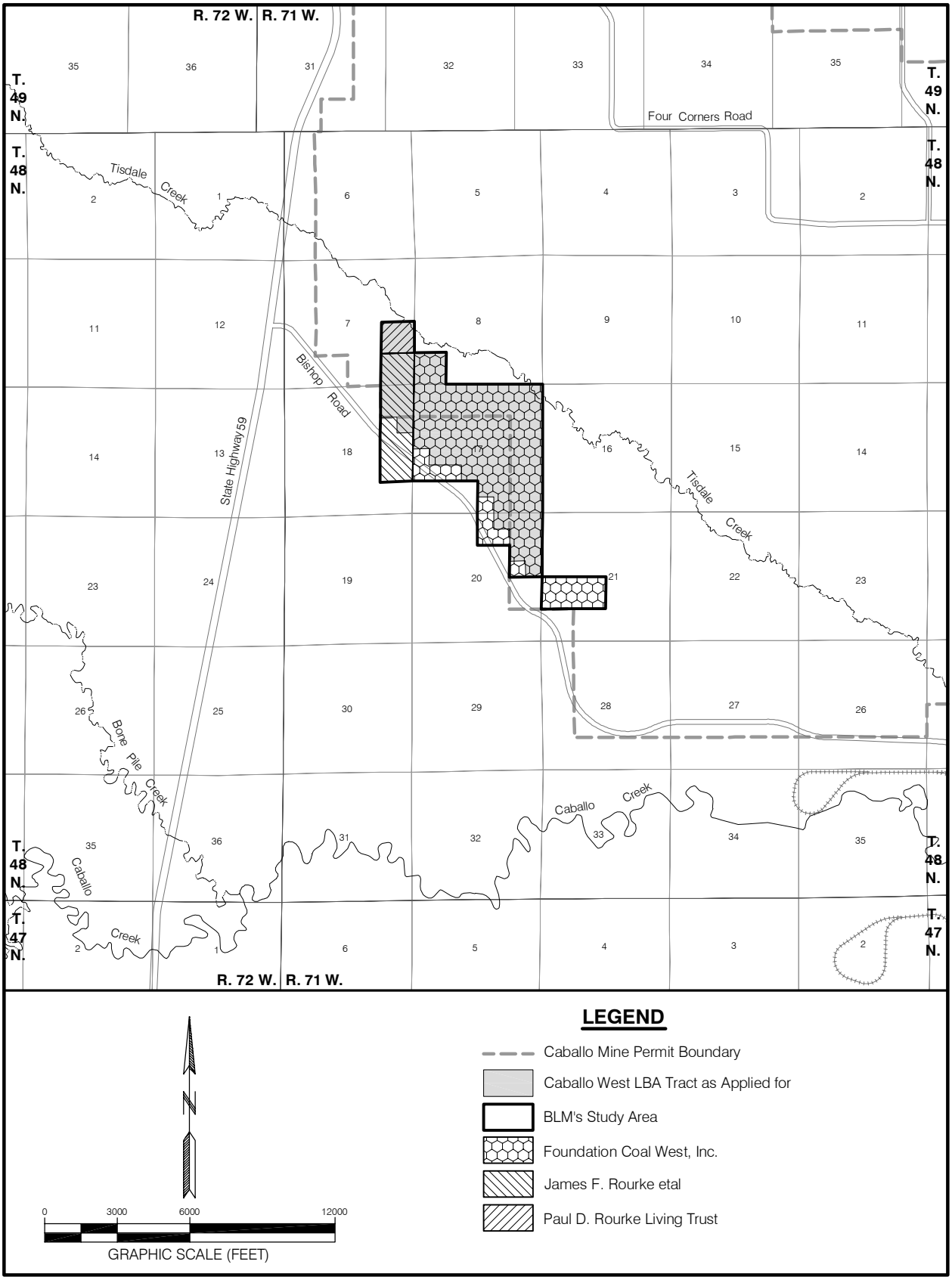

Figure 3-34. Surface Ownership Within the Caballo West LBA Tract Alternatives.

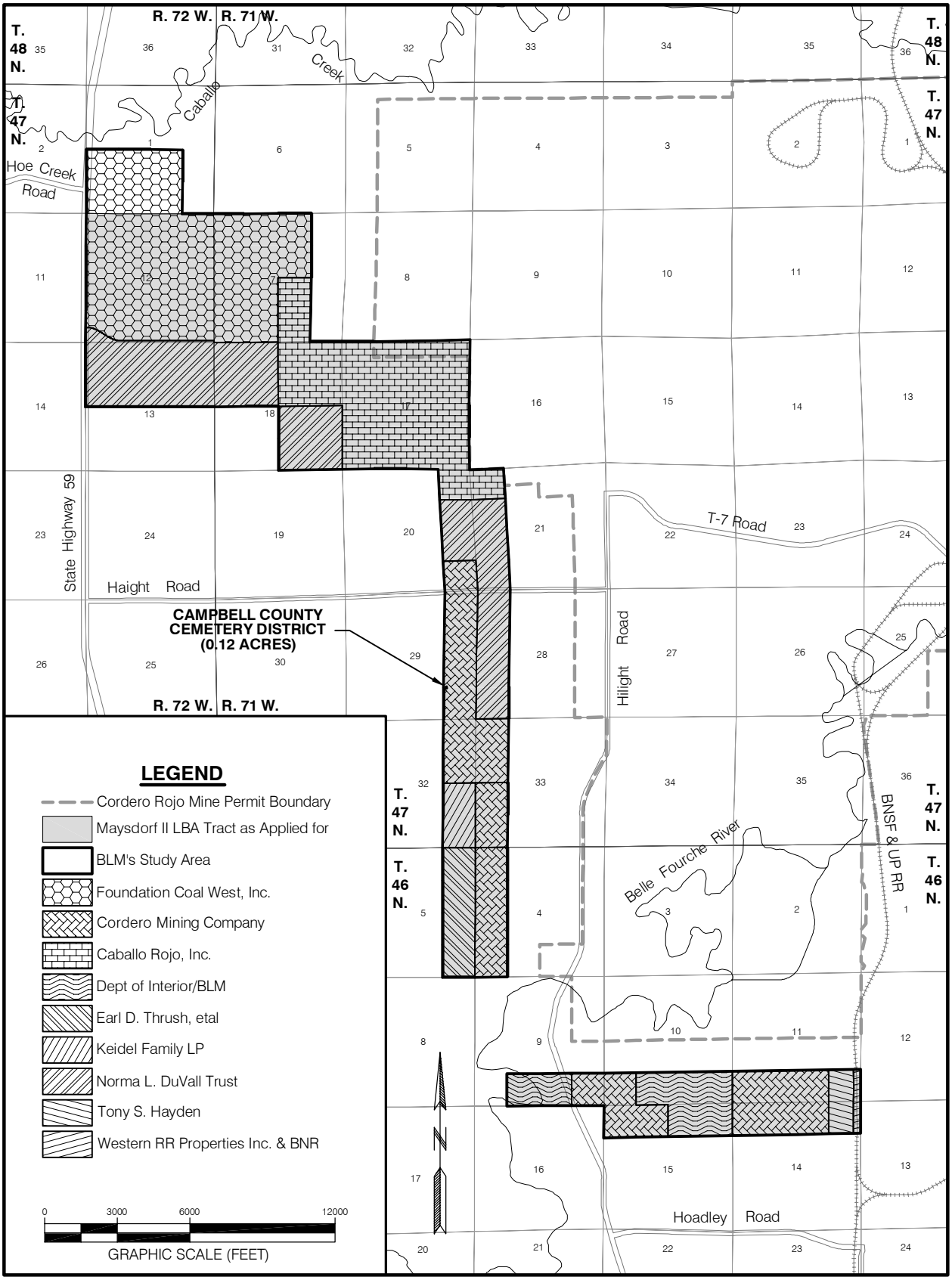

Figure 3-35. Surface Ownership Within the Maysdorf II LBA Tract Alternatives.

privately owned. Most of the federally owned oil and gas estate is leased. The ownership of the oil and gas estate for the LBA tracts is shown on Figures 3-36 through 3-39. Lists of the current federal oil and gas lessees within the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are listed in Tables 3-13 through 3-16, respectively.

According to the WOGCC records as of December 13, 2007, there were 60 permitted conventional oil and gas wells within the LBA tracts as proposed and the lands added under Action Alternatives (Figures 3-36 through 3-39). Of these 60 wells, 34 were permanently abandoned, 16 wells were still producing, seven well were active injectors, one well was shut in, one was a permanently abandoned injector hole, and one was temporarily abandoned. Of the 18 wells capable of producing, 13 have economically recoverable reserves. Eight of the 13 wells with recoverable reserves are on private leases. While the seven injector wells are not capable of producing, they are important to continued field production. Approximately 97 percent of the conventional oil and gas wells within the LBA tract configurations were drilled between 1966 and 1999. Only two convention oil or gas wells were drilled between 2000 and 2007. Conventional oil and gas wells capable of production on or in the individual oil and gas general analysis areas are listed in Appendix J.

The Supreme Court has ruled that the CBNG belongs to the owner of the oil and gas estate (98-830). Therefore, the oil and gas lessees have the right to develop CBNG as well as conventional oil and gas on the LBA tracts.

According to the WOGCC records as of December 13, 2007, there were 153 permitted CBNG wells on lands included in the LBA tracts as proposed and the lands added under Action Alternatives (Figures 3-36 through 3-39). Of these, 37 CBNG wells that were producing, 75 were shut-in, 20 permanently abandoned, one was temporarily abandoned, one was spudded, one had a notice of intent to abandon, and 18 were permanently abandoned strat test holes. Extensive CBNG development has occurred west of the tracts. CBNG wells capable of production on or in sections adjacent to the LBA tracts are listed in Appendix J.

Additional information on the conventional oil and gas and CBNG development in the general South Gillette analysis area and surrounding area is included in Section 3.3.2. Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads, well pads, production equipment at the wellhead (which may be located on the surface and/or underground), well production casing (which extends from the surface to the zone of production), underground pipelines (which gather the oil, gas, and/or water produced by the individual wells and carry it to a larger transmission pipeline or collection facility), facilities for treating, discharging, disposing of, containing, or injecting produced water, central metering facilities, electrical power utilities, gas compressor stations, and high-pressure transmission pipelines for delivering the gas to market. Currently, there are some oil and gas production

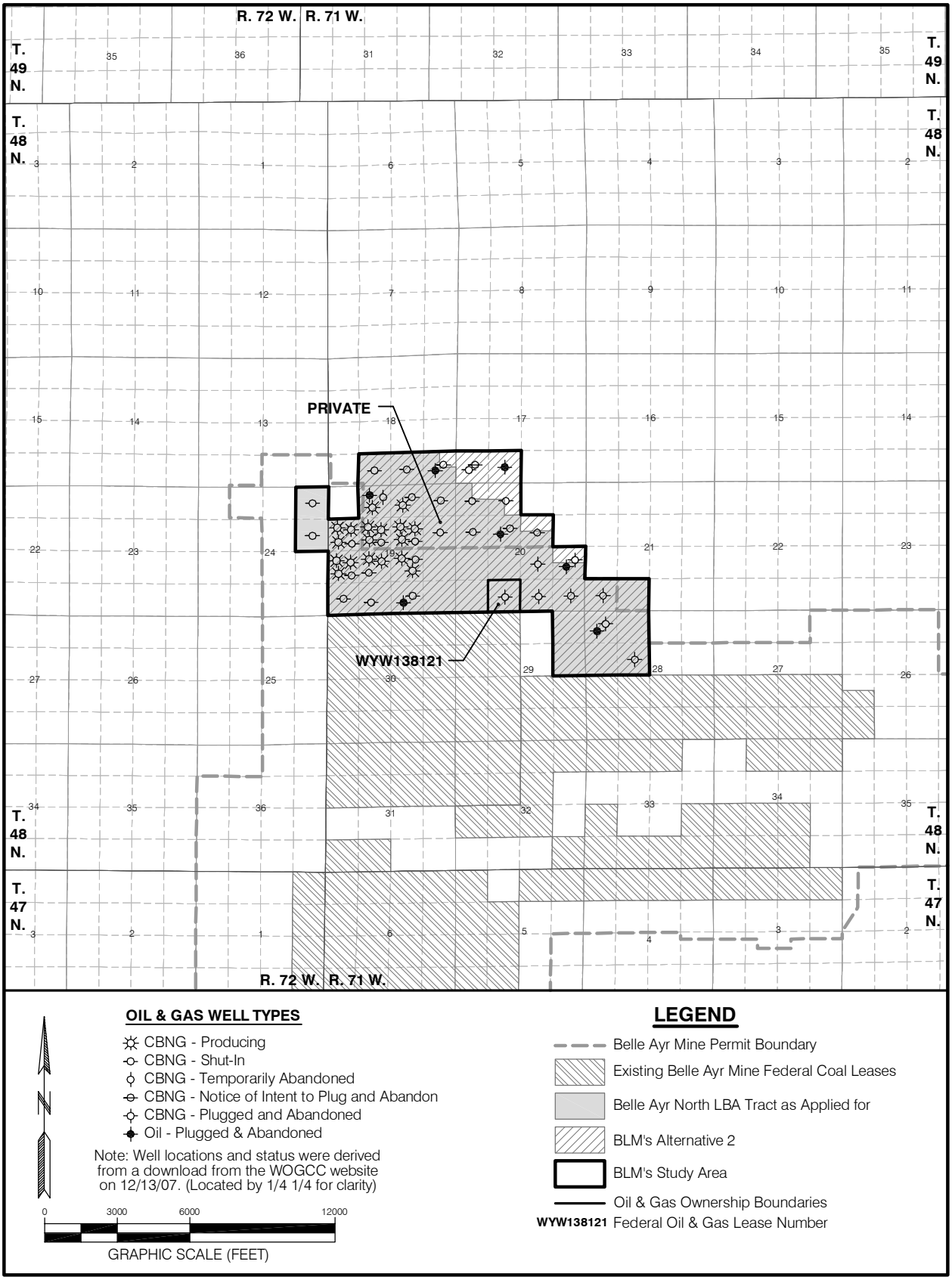

Figure 3-36. Oil and Gas Wells and Oil and Gas Ownership Within the Belle Ayr North LBA Tract Alternatives.

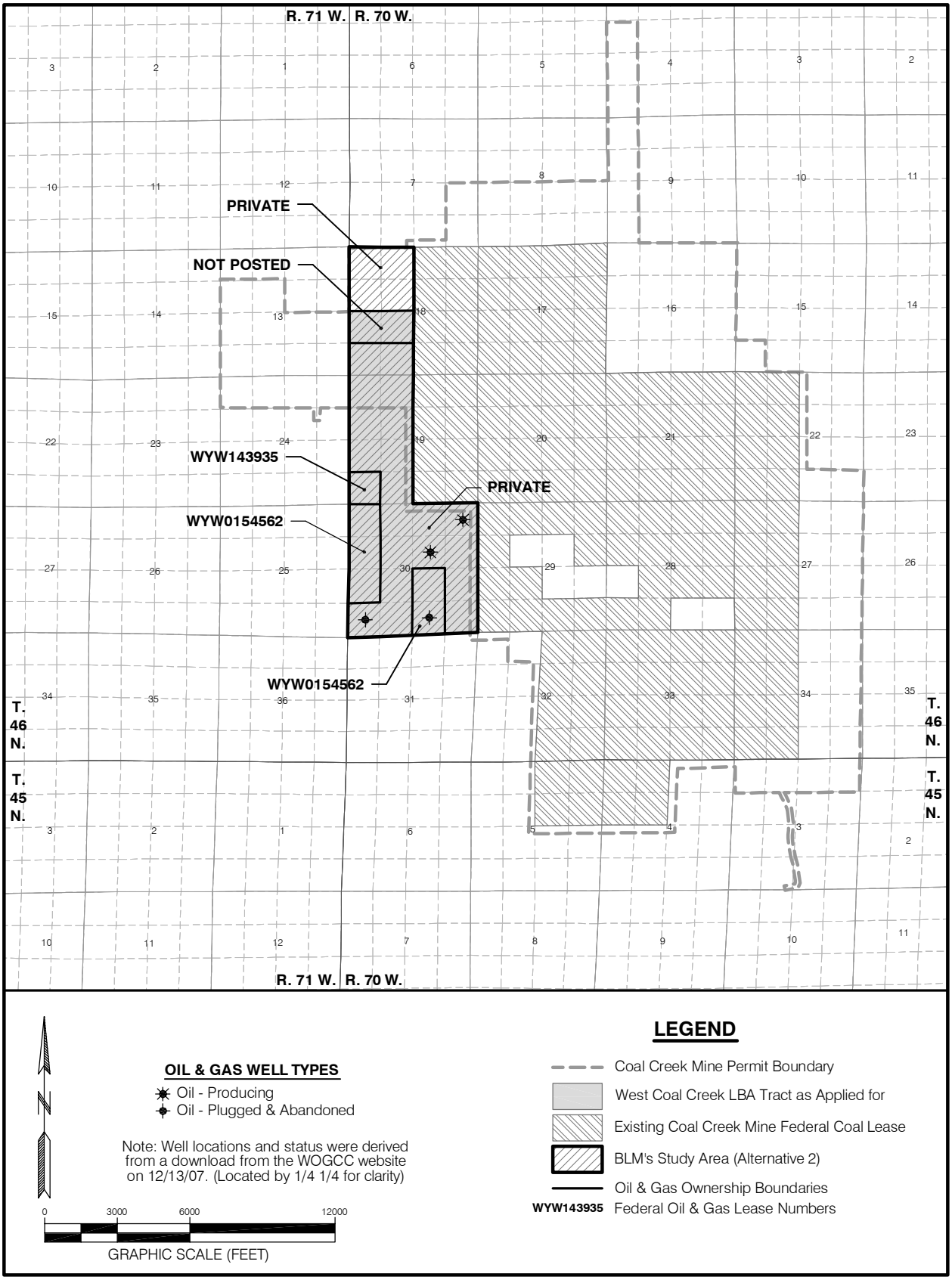

Figure 3-37. Oil and Gas Wells and Oil and Gas Ownership Within the West Coal Creek LBA Tract Alternatives.

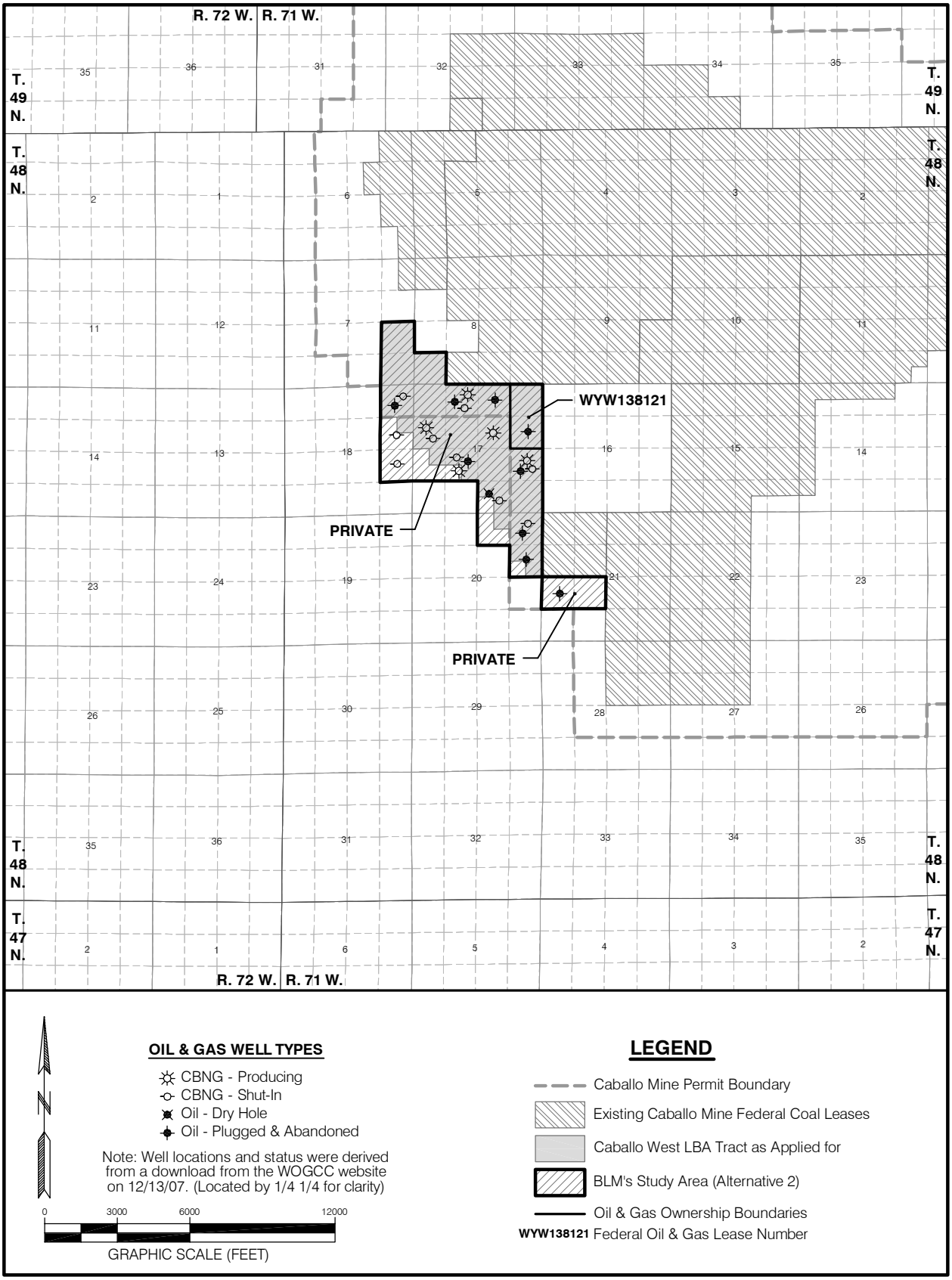

Figure 3-38. Oil and Gas Wells and Oil and Gas Ownership Within the Caballo West LBA Tract Alternatives.

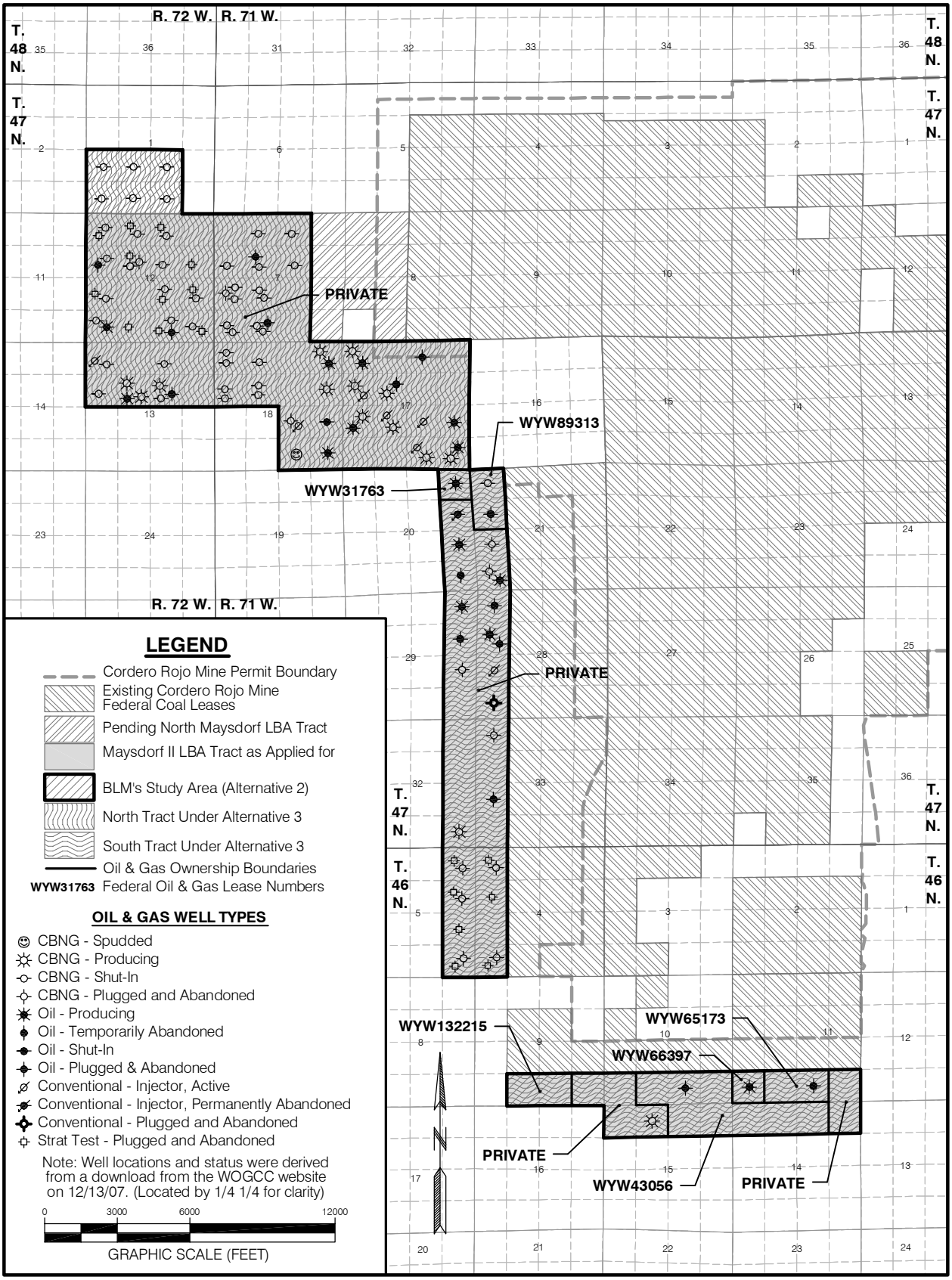

Figure 3-39. Oil and Gas Wells and Oil and Gas Ownership Within the Maysdorf II LBA Tract Alternatives.

Table 3-13. Belle Ayr North LBA Tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.48N., R.71W.		
Section 20 Lot14	WYW 138121	Cavalier Petro Corp. Michael Diefenderfer Pendragon Res. LP

Note: From BLM OG Plat (11/20/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are state or privately owned, and the coal rights are federally owned.

Table 3-14. West Coal Creek LBA Tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.46N., R.70W.		
Section 18 Lots 14, 15	Not Posted	
Section 19 Lot 17	WYW 143935	Maurice W. Brown
Section 30 Lots 8, 9, 14, 16, 19	WYW 0154562	Primary Natural Resources

Note: From BLM OG Plat (10/29/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are state or privately owned, and the coal rights are federally owned.

Table 3-15. Caballo West LBA Tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.48N., R.71W.		
Section 17 Lots 1, 8	WYW 138121	Cavalier Petro Corp. Michael Diefenderfer Pendragon Res. LP

Note: From BLM OG Plat (11/20/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are state or privately owned, and the coal rights are federally owned.

facilities, primarily oil and gas pipelines, on the LBA tracts, as discussed in Section 3.15 of this EIS. It is unlikely that additional support facilities will be constructed on the LBA tracts because approximately 70 percent of the conventional oil and gas and CBNG wells that exist on the tracts have been either shut in or plugged and abandoned due to exhausted reserves and diminished production.

Coal mining is a dominant land use in the general South Gillette analysis area. The Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines form a group of contiguous or nearly contiguous surface coal mines located in Campbell County (Figure 1-1). Coal production from these mines increased by 65 percent between 1994 and 2007 (from approximately 66 million tons in 1994 to 109 million tons in

Table 3-16. Maysdorf II LBA Tract Federal Oil and Gas Lessees of Record.

Location	Lease Number	Lessees of Record
T.47N., R.71W.		
Section 7 Lot 8	WYW 144480	ABO Petro Corp. MYCO Industries Inc. Yates Drilling Co. Yates Petroleum Corp
Section 20 Lot 1	WYW 31763	Bowden Energy Co. Inc.
Section 21 Lots 4, 5	WYW 89313	Club O&G LTD Dunway Investment Co. Electra Investment JWD III Inc. Raymond T Duncan Oil Prop. LTD Walter Duncan Oil
T.46N., R.71W.		
Section 9 Lots 6, 7	WYW 132215	Maurice W. Brown
Section 10 Lots 8, 9, 10	WYW 43056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.
Section 11 Lot 13	WYW 66397	Key Production Co. Nance Petroleum Corp. P&M Petro Mgmt. CCC
Section 11 Lots 14, 15	WYW 65173	Mary Hudson Ard Bill Barrett Corporation Delnar Hudson Lewis Living Trust Edward R Hudson Jr. William A Hudson III Lindy's Living Trust
Section 14 Lots 2, 3, 4	WYW 43056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.
Section 15 Lots 1, 2	WYW 43056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.

Note: From BLM OG Plats (1/12/07 & 10/4/07). The oil and gas rights (including CBNG) and coal rights for the above locations are owned by the federal government. For the rest of the LBA tract, the oil and gas rights (including CBNG) are state or privately owned, and the coal rights are federally owned.

2007). Two leases, the West Rocky Butte lease and the South Maysdorf lease, have been issued within this group of four mines since decertification of the federal coal region. The currently pending Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications evaluated in this EIS are in this group of mines (Tables 1-1 and 1-2).

Campbell County does not have a county-wide land use plan, but has been working on a comprehensive land use plan jointly with the City of Gillette (City of Gillette 1978 and Campbell County 2005). The Gillette area land use plan is an integral part of the overall plan for Campbell County and recommends general types of uses for the area immediately surrounding the City of Gillette (City of Gillette 1978). The proposed lease area does not have a designated zoning classification. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county.

Big game hunting is the principal recreational land use within the general South Gillette analysis area, and pronghorn, mule deer, and white-tailed deer are present within the area (Section 3.10.2). On private lands, hunting is allowed only with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past 2 to 3 decades towards a substantial reduction in private lands that are open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as for sportsmen who desire access to these animals (WGFD 2004).

In general, publicly owned lands (i.e., Forest Service or BLM-administered federal lands and state school sections) are open to hunting if legal access is available. Due to safety concerns, however, public surface lands contained within an active mining area are generally closed to the public, further limiting recreational use. There are approximately 285 acres of public surface lands within the Maysdorf II LBA Tract (Figure 3-35). There are no public surface lands within the Belle Ayr North, West Coal Creek, and Caballo West LBA Tracts (Figures 3-32 through 3-34). A maximum of approximately 82 acres of the public surface are currently accessible to the public under any of the alternatives.

Specific details regarding big game herd management objectives within and near the general South Gillette analysis area are contained in the *Casper* and *Sheridan Region Annual Big Game Herd Unit Job Completion Reports* (WGFD 2007). The WGFD classifies the entire general South Gillette analysis area as yearlong and winter/yearlong habitat for antelope. No crucial or critical pronghorn habitat is recognized by the WGFD in this area (Note: WGFD definitions of big game ranges are included in Section 3.10.2.1). The proposed lease area is within pronghorn antelope Hunt Area 24, which is contained in the Hilight Herd Unit. In post-season 2006, the population of the Hilight Herd Unit was estimated to be approximately 13,725 animals, which is above the WGFD objective of 11,000 (WFGD 2007).

Historical problems associated with the management of the Hilight Herd Unit include hunter access, over harvest on limited public lands, and quantifying

landowner preferences and desires. Prior to 1997, the herd population was fairly stable and near the objective of 11,000 antelope. Losses from severe winters, poor production rates, and disease subsequently decreased the population, but it has recently recovered and is currently above the objective level. Hunt Area 24 contains mostly privately owned surface lands with poor hunter access to limited publicly owned lands; therefore, the number of antelope is expected to steadily increase. If the population exceeds objective levels, more licenses will be needed and these may be difficult to sell in this mostly private land area. Nearly all landowners charge access fees for hunting and private land access is based on the desires and perceptions of the landowners. Increased harvest may be difficult to achieve because of the increased CBNG development, which is limiting rifle hunting on associated lands. Given the predicted harvest and average winter conditions, the 2007 post-season population was expected to be 13,900 antelope.

The WGFD has classified the majority of the general South Gillette analysis area as yearlong mule deer use range. Crucial or critical mule deer habitat does not occur on or within several miles of the general South Gillette analysis area. The proposed lease area is located within mule deer Hunt Area 21, part of the Thunder Basin Mule Deer Herd Unit, which also includes Hunt Areas 7, 8, 9, 10, and 11. The Thunder Basin Herd Unit encompasses 3,642 square miles, of this, 71 percent is privately owned. Access fees are common, resulting in heavy hunting pressure on accessible public lands, particularly in recent years. Between 1983 and 2001, the post-season objective for this mule deer herd was 13,000, but the population was consistently above that objective. The 2003 post-season population was estimated at 19,299, which was 67 percent above the objective. WGFD increased the objective to 20,000 head in December 2001. Due to changes in the modeling program used to estimate mule deer populations, WGFD revised the herd unit population estimates following 2003, reducing the herd estimate. The revised 2003 population estimate was 17,616. The 2006 postseason mule deer population was estimated at 22,036, which is 10% above the herd objective. It is likely that insufficient harvest from private land within Hunt Area 21 will result in a population increase in the future.

A majority of the South Gillette Analysis Area is within HA 129 (a non-herd unit). The southern portion of the general South Gillette analysis area is within Elk Hunt Area 123 of the Rochelle Hills Herd Unit. The Rochelle Hills Elk Herd resides in the Rochelle Hills located east and south of the general South Gillette analysis area. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately five square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Odekoven 1994). RTEA (owner of the Jacobs Ranch Mine) and the RMEF finalized a formal agreement that created the Rochelle Hills Conservation Easement. The easement contains nearly 1,000 acres, with 75 percent of that total comprised of reclaimed mining lands on RTEA's Jacobs Ranch Mine. The

easement acreage was donated to RMEF by RTEA to ensure that the reclaimed land continues to be used as grazing land and wildlife habitat for the extended future (RMEF 2007). The Jacobs Ranch Mine is located about 9 miles south of the general South Gillette analysis area. No elk have been observed recently within any of the tracts but they are occasionally recorded in the Pine Hills to the east. This dispersion is likely due to increasing population density and habitat limitations within the normal herd boundary. Elk may potentially expand into the general South Gillette analysis area in the future.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer are seldom observed within the general South Gillette analysis area due to their preference for riparian woodlands and irrigated agricultural lands. WGFD classifies the entire general South Gillette analysis area, with the exception of a narrow corridor along the Belle Fourche River, as out of normal white-tailed deer use range. The narrow corridor along the Belle Fourche is classified as yearlong range.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the general South Gillette analysis area; therefore, public fishing opportunities are very limited. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. However, water discharged from CBNG wells upstream of the general South Gillette analysis area has supplied the Belle Fourche River with water nearly continuously, resulting in an increase in habitat for aquatic species. The Belle Fourche River currently supports a variety of nongame fish in the general South Gillette analysis area (Section 3.10.6).

Sage-grouse, mourning dove, waterfowl, rabbit, and coyote are hunted in the general vicinity, and some coyote and red fox trapping may occur.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action and Action Alternatives

The major adverse environmental consequences of leasing and mining the LBA tracts on land use would be the reduction of livestock grazing (cattle and sheep), loss of wildlife habitat (particularly big game), and curtailment of oil and gas development while the coal is being mined and during reclamation. This would include removal of all existing oil and gas surface and downhole production and transportation equipment and facilities. Wildlife and livestock use would be displaced while the tract is being mined and reclaimed. Grazing leases would be suspended on approximately 285 acres of federal lands if the LBA tracts were leased under the Proposed Actions and other action alternatives. This federal land is within Grazing Allotment #22027, currently held by Dave Edwards (valid through July 2014) and Grazing Allotment #02349, currently held by Donald Wagensen, Opal Marquis, and Doris Marquis (valid through January 2014).

Access for recreational and other activities (i.e., ranching, oil and gas development) would be restricted during mining operations. Estimated disturbance areas for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts and the tract configurations for the Action Alternatives are presented in Tables 3-1 through 3-4, respectively.

Sections 3.3.2 and 3.11.1 and Appendix J of this document address producing, abandoned, and shut in oil and gas (conventional and CBNG) wells in the BLM study areas. Well location information, federal oil and gas ownership, and federal oil and gas lessee information for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are presented in Figures 3-36 through 3-39, respectively and Tables 3-13 through 3-16, respectively. BLM manages federal lands on a multiple use basis, in accordance with the regulations. In response to conflicts between oil and gas and coal lease holders, BLM policy advocates optimizing the recovery of both coal and CBNG resources to ensure that the public receives a reasonable return for these publicly owned resources. Optimal recovery of both coal and oil and gas resources requires negotiation and cooperation between the oil and gas lessees and the coal lessees. In the past, negotiations between some of the applicant mines and some of the existing oil and gas lessees have resulted in agreements that allow development of both resources in this area. Producing conventional oil and gas and CBNG wells are present on the LBA tracts. In the PRB, royalties have been and would be lost to both the state and federal governments if conventional oil and gas wells are abandoned prematurely, if the federal CBNG is not recovered prior to mining, or if federal coal is not recovered due to conflicts. State and federal governments can also lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

Up to 285 acres of BLM-administered federal surface would be affected during mining operations if the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are leased under the Proposed Action or Action Alternatives, but only about 82 of those acres are currently accessible by the public. The loss of access to federal lands is long term (during mining and reclamation), but is not permanent. Public access to federal lands would be restored after mining and reclamation are complete.

Hunting on the LBA tracts, including the federal surface discussed above would be eliminated during mining and reclamation. Pronghorn and mule deer have been observed on and adjacent to the LBA tracts, as have sage-grouse, mourning doves, waterfowl, rabbits, and coyote. The federal lands actually represent a relatively small portion of the currently accessible public surface lands for recreational opportunity within the respective animal hunt areas.

Following reclamation, the land would be suitable for grazing and wildlife uses, which are the historic land uses. The reclamation standards required by SMCRA and Wyoming State Law meet the standards and guidelines for healthy rangelands

for public lands administered by the BLM in Wyoming. Following reclamation bond release, management of the privately owned surface would revert to the private surface owner and management of the federally owned surface would revert to the federal surface managing agency (BLM).

3.11.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract. Currently approved mining operations would continue on the existing Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Impacts to land use related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.11.3 Regulatory Compliance, Mitigation and Monitoring

Mined areas would be reclaimed as specified in the approved mine plan to support the anticipated post-mining land uses of wildlife habitat and rangeland. The reclamation procedures would include stockpiling and replacing topsoil, using reclamation seed mixtures, which would be approved by WDEQ, and replacing stock reservoirs.

Steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan. (See discussion in Section 3.9.)

Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for anticipated post-mining land uses.

See Section 3.3.2.3 for discussion of regulatory requirements, mitigation and monitoring related to oil and gas development.

3.11.4 Residual Impacts

No residual impacts to land use and recreation are expected.

3.12 Cultural Resources

3.12.1 Affected Environment

Cultural resources, which are protected under the National Historic Preservation Act of 1966, are nonrenewable remains of past human activity. The PRB, including the general South Gillette analysis area, appears to have been inhabited by aboriginal hunting and gathering people for more than 13,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

Frison's (1978, 1991) chronology for the Northwestern Plains divides occupations from early to late into the Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Late Prehistoric, and Protohistoric periods. Frison's chronology is listed below. The Plains designation within the Early, Middle, and Late Archaic periods has been omitted from the list.

- Paleoindian period (13,000 to 7,000 years B.P.)
- Early Archaic period (7,000 to 5,000-4,500 years B.P.)
- Middle Archaic period (5,000-4,500 to 3,000 years B.P.)
- Late Archaic period (3,000 to 1,850 years B.P.)
- Late Prehistoric period (1,850 to 400 years B.P.)
- Protohistoric period (400 to 250 years B.P.)
- Historic period (250 to 120 years B.P.)

The Paleoindian period dates from about 13,000 to 7,000 years ago and includes various complexes (Frison 1978). Each of these complexes is correlated with a distinctive projectile point style derived from a general large lanceolate and/or stemmed point morphology. The Paleoindian period is traditionally thought to be synonymous with "big game hunters" who exploited megafauna such as bison and mammoth (plains Paleoindian groups), although evidence of the use of vegetal resources is noted at a few Paleoindian sites (foothill-mountain groups).

The Early Archaic period dates from about 7,000 to 5,000-4,500 years ago. Projectile point styles reflect the change from large lanceolate types that characterize the earlier Paleoindian complexes to large side- or corner-notched types. Subsistence patterns reflect exploitation of a broad spectrum of resources, with a much-diminished utilization of large mammals.

The onset of the Middle Archaic period (4,500 to 3,000 years B.P.) has been defined on the basis of the appearance of the McKean Complex as the predominant complex on the Northwestern Plains around 4,900 years B.P. (Frison 1978, 1991, 2001). McKean Complex projectile points are stemmed variants of the lanceolate point. These projectile point types continued until 3,100 years B.P. when they were replaced by a variety of large corner-notched points (i.e., Pelican

Lake points) (Martin 1999). Sites dating to this period exhibit a new emphasis on plant procurement and processing.

The Late Archaic period (3,000 to 1,850 years B.P.) is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison 1991). The period witnessed a continual expansion of occupations into the interior grasslands and basins, as well as the foothills and mountains.

The Late Prehistoric period (1,850 to 400 years B.P.) is marked by a transition in projectile point technology around 1,500 years B.P. The large corner-notched dart points characteristic of the Late Archaic period are replaced by smaller corner- and side-notched points for use with the bow and arrow. Around approximately 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison 1991). This population shift appears to reflect a narrower subsistence base focused mainly on communal procurement of pronghorn and bison.

The Protohistoric period (400 to 250 years B.P.) witnesses the beginning of European influence on prehistoric cultures of the Northwestern Plains. Additions to the material culture include most notably the horse and European trade goods, including glass beads, metal, and firearms. Projectile points of this period include side-notched, tri-notched, and unnotched points, with the addition of metal points. The occupants appear to have practiced a highly mobile and unstable residential mobility strategy.

The historic period (250 to 120 years B.P.) is summarized from Schneider et al. (2000). The use of the Oregon Trail by emigrants migrating to the fertile lands of Oregon, California, and the Salt Lake Valley brought numerous pioneers through the state of Wyoming, but few stayed. It was not until the fertile land in the West became highly populated, along with the development of the cattle industry in the late 1860s, that the region currently comprising the state of Wyoming became attractive for settlement. The region offered cattlemen vast grazing land for the fattening of livestock, which could then be shipped across the country via the recently completed (1867-1868) transcontinental railroad in southern Wyoming.

The settling of the region surrounding Gillette, Wyoming began in the late 1800s, after a government treaty in 1876 placed the Sioux Indians on reservations outside the territory. Cattlemen were the first settlers to establish themselves in the area, with dryland farmers entering the area after 1900. The town of Gillette was established by the railroad in 1891 in an effort to promote the settling of undeveloped areas along their rail lines. The presence of the railroad allowed for the greater development of the cattle industry because it facilitated shipping cattle from the area. Several early ranches established in the region include the 4J Ranch (1875), Half Circle L Ranch (1880s), I Bar U Ranch (1888), and the T7 Ranch (1881). Early ranches established in the region surrounding the project

area as of 1883 include the Ritchie Ranch, the McCray Ranch, and the 6 Ranch. Later arrivals to the area (as of 1908) include the Grant Ranch on Hay Creek, the Rooney Ranch on Rawhide Creek, and the Gardner and Wilson Ranches on the Little Powder River. George Oedekoven homesteaded in the area in 1917, and his family still maintains the property today. Site 48CA1918 was homesteaded by Bert Herrod in 1919. This homestead has been abandoned since at least 1983.

A Class III cultural resources survey is an intensive and comprehensive inventory of a proposed project area conducted by professional archaeologists and consultants. The survey is designed to locate and identify all prehistoric and historic cultural properties 50 years and older that have exposed surface manifestations. The goal of the survey is to locate and evaluate for the NRHP all cultural resources within the project area. Cultural properties are recorded at a sufficient level to allow for evaluation for possible inclusion to the NRHP. Determinations of eligibility are made by the managing federal agency in consultation with the SHPO. Consultation with the SHPO must be completed prior to the approval of the mining plan.

After completion of a Class III cultural resources survey, additional investigations may be undertaken to complete an individual site record. If necessary, site-specific testing or limited excavation may be utilized to collect additional data which will: 1) determine the final evaluation status of a site; and/or 2) form the basis of additional work to be conducted during implementation of a treatment plan if the site is determined eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to mining and can include such mitigation measures as avoidance (if possible), large scale excavation, complete recording, Historical American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

Data recovery plans are required for sites that are recommended as eligible for the NRHP and cannot be avoided by project development, following testing and consultation with the SHPO. Until consultation has occurred and agreement regarding NRHP eligibility has been reached, all sites recommended as eligible or undetermined eligibility must be protected from disturbance. Full consultation with the SHPO will be completed prior to approval of the mining plans. Those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment.

Numerous Class I (survey records review) and Class III cultural resource surveys associated with oil and gas field development and surface mining operations have been conducted in the general area.

3.12.1.1 Belle Ayr North LBA Tract

FCW contracted with TRC Mariah Associates, Inc. of Laramie, Wyoming to perform Class I and Class III surveys of the Belle Ayr North LBA Tract and surrounding area in 2006. The 2006 Class I survey covered the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under Alternative 2). The Class III survey area included previously unsurveyed areas within the original BLM study area.

The Belle Ayr North LBA Tract cultural resource analysis area has been entirely surveyed for cultural resources at a Class I level. The Class I review of previous survey records identified 12 archeological sites, of which seven are prehistoric, three are historic, and two are multi-component. Prehistoric sites consist primarily of open camps and lithic scatters. All prehistoric sites are considered not eligible. Historic sites consist primarily of homesteads and historic trails. Of the three historic sites, two sites are not considered eligible to the NRHP. Historic site 48CA1570 (Sawyer's1865 Wagon Road) is unevaluated as to its NRHP eligibility status. The two multi-component sites consist mostly of lithic and historic debris and are considered not eligible. No isolated occurrences were identified during the Class I records search.

A majority of the remainder of the Belle Ayr North cultural resources general analysis area was surveyed at a Class III level in 2006. One archaeological site and five isolated occurrences were identified and recorded during this recent Class III inventory. The five isolates consist of prehistoric flakes and projectile points. The one newly recorded cultural site consists of a prehistoric open campsite and is considered not eligible for the NRHP. Two previously recorded sites (48CA1918 and 48CA3222) located within the analysis area were to be reassessed during the 2006 inventory. Site 48CA1918 consisted of a historic homestead and ranch was recommended as not eligible for the NRHP. The 2006 reassessment found the site to be in similar condition to that described in 1999. Site 48CA3222 consisted of prehistoric lithic scatter and was originally considered not eligible for the NRHP. The site could not be relocated in 2006 due to the dense ground cover in the area.

To summarize the identified cultural properties, a total of 13 archaeological sites are located in the Belle Ayr North LBA Tract cultural survey area. Of these 13 sites, eight are prehistoric, 3 are historic, and two are multi-component. None of the 13 sites are considered eligible to the NRHP by the cultural site recorder. One site, the Sawyer's Expedition Trail (48CA1570), is unevaluated for the NRHP. Five prehistoric isolated occurrences were also recorded. Approximately 54 acres of the 1,947 acre Belle Ayr North cultural resources general analysis area have not been surveyed at a Class III level. Some areas previously surveyed at a Class III level were surveyed prior to 1980 and may be considered substandard in terms of current methodology.

3.12.1.2 West Coal Creek LBA Tract

TBCC contracted with ACR Consultants, Inc. of Sheridan, Wyoming to perform Class I and Class III surveys of the West Coal Creek LBA Tract and surrounding area in 2007. The 2007 Class I survey was larger than and included the West Coal Creek cultural resources general analysis area. The 2007 Class III survey included the entire BLM study area.

The Class I review of previous survey records identified six archeological sites, of which five are prehistoric and one is multi-component within the West Coal Creek cultural resources general analysis area. The prehistoric sites include three lithic scatters, one lithic scatter with hearth, and one hearth. The multi-component site consists of lithic scatter with historic debris. None of the sites are considered eligible for the NRHP, although fives sites were unevaluated for NRHP eligibility. A total of five isolated occurrences (all prehistoric) were identified during the Class I records search.

ACR recorded nine new sites were recorded during the Class III surveys, which covered the BLM study area. Five sites are prehistoric and four are multi-component. The prehistoric sites include two lithic scatters, two lithic scatters with hearths, and one habitation locale with stone circles. The multi-component sites consist two lithic scatter with historic debris and two prehistoric habitation locales with historic debris. All sites are considered not eligible. A total of 21 new isolated finds (17 prehistoric and four historic) during the Class III survey. ACR also revisited the four previously recorded sites within the BLM study area. Two of the sites were subsequently combined into one site, and one site was not found and was removed from the list of existing sites.

Based on the Class I and Class III surveys, 15 archaeological sites have been verified within the West Coal Creek LBA cultural resource analysis area. Only 13 sites could be verified (one site could not be relocated and one site was combined with another site). Of these sites, eight are prehistoric and five are multi-component. None of the 13 verified sites are considered eligible for the NRHP, but one site within the ¼-mile buffer is unevaluated for NRHP eligibility. A total of 26 isolated occurrences were recorded within the analysis area. The entire BLM study area has been surveyed to current standards, but only 1,323 acres of the 2,210 acre West Coal Creek cultural resources general analysis area have been surveyed to current standards.

3.12.1.3 Caballo West LBA Tract

In 2006, Powder River Coal, LLC, Gillette, Wyoming contracted GCM Services to conduct a Class I cultural resource inventory (records search) for the Caballo Mine, consisting of a contiguous block encompassing approximately 27,520 acres. The Caballo West cultural resources general analysis area, comprising roughly 1,390 acres, is wholly contained within the 2006 Class I inventory area. The

Class I review of previous survey records identified seven archeological sites, of which five are prehistoric, one is historic, and one is multi-component, within the Caballo West cultural resources general analysis area. Prehistoric sites consist primarily of lithic scatters and open camps. All prehistoric sites are considered not eligible. Historic sites consist primarily of homesteads and trash dumps. The historic site is considered not eligible. The one multi-component site consists of an open camp and homestead and is considered not eligible. A total of seven isolated occurrences were identified during the Class I records search. The four prehistoric isolates consist of two projectile point/tools and two historic debris items. The three historic isolates consist of trash scatters.

A majority of the Caballo West LBA Tract cultural survey area has been surveyed for cultural resources at a Class III level. Approximately 220 acres of the 1,390 acre Caballo West Cultural resources general analysis area have not been surveyed at a Class III level and approximately 360 acres were surveyed at a Class III level in 1975 and are considered substandard in terms of current methodology.

3.12.1.4 Maysdorf II LBA Tract

CMC contracted with TRC Mariah Associates, Inc. of Laramie, Wyoming to perform Class I and Class III surveys of the Maysdorf II LBA Tract and surrounding area in 2007. The 2007 Class I survey was larger than and included the Maysdorf II cultural resources general analysis area. Areas identified as not having been surveyed at a Class III level were surveyed at that level later in 2007.

The Class I review of previous survey records identified 33 archeological sites, of which 20 are prehistoric, 12 are historic, and one is multi-component. Prehistoric sites consist primarily of open camps and lithic scatters. Fifteen of the prehistoric sites are considered not eligible to the NRHP, two remain unevaluated, and three are considered eligible to the NRHP. Historic sites consist primarily of homesteads, trash dumps, and historic trails. Four historic trails (Hay Creek-Porcupine Road, Hathaway's-Black Hills Trail, Sawyer's Expedition Trail, and Crook's Military Trail) and one homestead are considered eligible to the NRHP. Seven historic sites are considered not eligible. The one multi-component site is a lithic and trash scatter and is unevaluated. A total of 13 isolated occurrences were identified during the Class I records search. The isolates consist of prehistoric flakes and tools.

The remainder of the Maysdorf II cultural resources general analysis area was surveyed at a Class III level in 2007. A total of eight archaeological sites and 16 isolated occurrences were identified and recorded during this recent Class III inventory. The eight newly recorded cultural sites consist of five historic sites (two homesteads, a windmill, a trash scatter, and a cemetery) and three prehistoric sites, including a cairn with artifacts, a stone circle site, and a lithic scatter. Two of the three prehistoric sites will remain unevaluated pending Native American consultation, while the remaining six archaeological sites will be recommended as

not eligible. The 16 isolates consist of nine localities of prehistoric flakes and tools and seven localities of historic debris items.

To summarize the identified cultural properties, a total of 41 archaeological sites are located in the Maysdorf II cultural resources general analysis area. Of these 41 sites, 23 are prehistoric, 17 are historic, and one is multi-component. A total of eight sites are considered eligible to the NRHP. These sites include the four historic trails (Hay Creek-Porcupine Road, Hathaway's-Black Hills Trail, Sawyer's Expedition Trail, and Crook's Military Trail), one homestead, and three prehistoric open campsites. Only the Sawyer's Expedition Trail (48CA1570 and associated reports) has not yet been concurred by SHPO. A total of 11 sites remain unevaluated to the NRHP. The remaining 22 sites have either been determined or are recommended as not eligible to the NRHP. Twenty-two prehistoric isolated finds and seven historic isolated finds were also recorded. The entire Maysdorf II cultural resources general analysis area has been surveyed for cultural resources at a Class III level.

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action and Action Alternatives

Data recovery plans are required for sites that are recommended eligible to the National Register and cannot be avoided, following testing and consultation with the SHPO. In the case of a maintenance lease for an existing mine, full consultation with SHPO must be completed prior to approval of the MLA mining plan amendment for the mine. At that time, those sites determined to be unevaluated or eligible for the NRHP through consultation receive further protection or treatment. Impacts to eligible or unevaluated cultural resources cannot be permitted. Eligible sites that cannot be avoided or that have not already been subjected to data recovery action are carried forward in the mining plan as requiring protective stipulations until a testing, mitigation, or data recovery plan is developed to address the impacts to the sites. Unevaluated sites that cannot be avoided must be evaluated prior to disturbance. Ineligible properties may be destroyed without further work.

Any eligible sites on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts that cannot be avoided or that have not already been subjected to data recovery action would be carried forward in the mining and reclamation plans as requiring protective stipulations until a testing, mitigation, or data recovery plan is developed to address the impacts to the sites. The lead federal and state agencies would consult with Wyoming SHPO on the development of such plans and the manner in which they are carried out.

Cultural resources adjacent to the mine areas may be impacted as a result of increased access to the areas. There may be increased vandalism and

unauthorized collecting associated with recreational activity and other pursuits outside of but adjacent to mine permit areas.

3.12.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract. Currently approved mining operations would continue on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine leases. Impacts to cultural resources related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.12.3 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering, fasting, or vision quest sites. Other sites of cultural interest and importance may include rock art, stone circles, various rock features, fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but have no man-made features.

No Native American heritage, special interest, or sacred sites have been formally identified and recorded to date within the general South Gillette analysis area. However, the geographic position of the general South Gillette analysis area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

Tribes that have been identified as potentially having concerns about actions in the PRB include the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Sioux, Rosebud Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, Cheyenne River Sioux, Apache Tribe of Oklahoma, Comanche Tribe of Oklahoma, and Kiowa Tribe of Oklahoma. These tribal governments and representatives have been sent copies of the EIS. They have also been provided with more specific information about the known cultural sites on the tract in this analysis. Their help has been requested in identifying potentially significant religious or cultural sites in the general South Gillette analysis area.

Native American tribes were consulted at a general level in 1995-1996 as part of an update to the BLM *Buffalo Resource Area RMP*. Some of the Sioux tribes were consulted by BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota in March 2002.

3.12.4 Regulatory Compliance, Mitigation and Monitoring

Class I and III surveys are conducted to identify cultural properties on all lands affected by federal undertakings. Prior to any mining disturbance, SHPO is consulted to evaluate the eligibility of the cultural properties for inclusion in the NRHP. Cultural properties that are determined to be eligible for the NRHP are avoided or, if avoidance is not possible, a recovery plan is implemented prior to disturbance.

Mining activities are monitored during topsoil stripping operations. If a lease is issued for the Belle Ayr North, West Coal Creek, Caballo West, or Maysdorf II LBA Tracts, BLM would attach a stipulation to each lease requiring the lessee to notify appropriate federal personnel if cultural materials are uncovered during mining operations (Appendix D).

3.12.5 Residual Impacts

Cultural sites that are determined to be eligible for the NRHP would be avoided if possible. Eligible sites that cannot be avoided would be destroyed by surface coal mining after data from those sites is recovered. Sites that are not eligible for the NRHP would be lost.

3.13 Visual Resources

3.13.1 Affected Environment

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the general South Gillette analysis area include rolling sagebrush and short-grass prairie, which are common throughout the PRB. There are also areas of altered landscape, such as oil fields and surface coal mines. The existing active surface mines that are located on the eastern side of the PRB form three geographic groups that are separated by areas with no mining operations (Figure 1-1). Two of the groups of surface mines are located east of Highway 59 from south of Gillette to south of Wright; the third mine group is located on the east side of U.S. Highway 14-16 from Gillette north for about 13 miles. Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline rights-of-way, CBNG well shelters, and CBNG compressor stations), transportation facilities (roads and railroads), environmental monitoring installations, road signage, and electrical power transmission lines. The natural scenic quality in and near the immediate lease area is fairly low because of the

industrial nature of the adjacent existing mining operations and oil and gas development.

VRM guidelines for BLM lands are to manage public lands for current VRM classifications and guidelines. The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. The VRM classes constitute a spectrum ranging from Class I through Class V that provides for increasing levels of change within the characteristic landscape.

The inventoried lands were classified into VRM classes as follows:

1 Class I – Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.

2 Class II – Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

3 ClassIII – Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

4 Class IV – Activity attracts attention and is a dominant feature of the landscape in terms of scale.

5 Class V – This classification is applied to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the 2001 BLM Buffalo RMP update (BLM 2001a). In the general South Gillette analysis area, the predominant VRM classifications are Class IV for lands not yet disturbed by mining and Class V for lands that have already been disturbed by mining. For lands classified as VRM Class IV, activities, such as mining, attract attention and are dominant features of the landscape in terms of scale. Class V applies to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action and Action Alternatives

Portions of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are visible from State Highway 59, which is adjacent to the Maysdorf II Tract and from 2 to 3 miles west of the other three tracts. Therefore, some mining activities on the LBA tracts would be visible from this major travel route. Portions

of each LBA tract would also be visible from Hilight Road, T-7 Road, Hoadley Road, Bishop Road, or Haight Road.

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are leased and mined, the portions of the general South Gillette analysis area that would be disturbed under the Proposed Action or other action alternatives for each tract would be considered as VRM Class V prior to reclamation. After reclamation of the LBA tracts and adjoining mines, the areas classified as Class V would improve to resemble the surrounding undisturbed terrain. No visual resources that are unique to this area have been identified on or near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts.

Reclaimed terrain would be almost indistinguishable from the surrounding undisturbed terrain. Slopes might appear smoother (less intricately dissected) and gentler (less steep) than undisturbed terrain and sagebrush would not be as abundant for several years; however, within a few years after reclamation, the mined land would not be distinguishable from the surrounding undisturbed terrain except by someone very familiar with landforms and vegetation.

3.13.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II coal lease applications would be rejected and coal removal and associated disturbance and impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract and the current VRM Class IV and V designations would not change for those lands. Currently approved mining operations would continue on the existing Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mine leases. Impacts to visual resources related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA lease applications at this time would not preclude an application to lease the tracts in the future.

3.13.3 Regulatory Compliance, Mitigation and Monitoring

Landscape character would be restored during reclamation to approximate original contour and would be reseeded with an approved seed mixture, including native species.

See Section 3.2 and Section 3.9 for additional discussion of the regulatory requirements, mitigation, and monitoring for topography and vegetation.

3.13.4 Residual Impacts

No residual impacts to visual resources are expected.

3.14 Noise

3.14.1 Affected Environment

Existing noise sources in the general South Gillette analysis area include coal mining activities, traffic on the nearby highways and county roads, rail traffic, aircraft traffic to and from the nearby airport, wind, and CBNG compressor stations. Noise originating from CBNG development equipment (e.g., drilling rigs and construction vehicles) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities are occurring. The amount of noise overlap between well sites is variable and depends on the timing of drilling activities on adjacent sites and the distance between the site locations.

Studies of background noise levels indicate that ambient sound levels generally are low at many of the PRB mines, owing to the isolated nature of the area. The unit of measure used to represent sound pressure levels (decibels) using the A-weighted scale is a dBA. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3-40 presents noise levels associated with some commonly heard sounds.

No site-specific noise level data are available for the proposed lease areas. Because the four LBA tracts are adjacent to operating mines, the current median noise level is estimated to be 40-60 dBA for day and night, with the noise level increasing with proximity to active mining operations at the adjacent mine. Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992).

OSM prepared a noise impact report for the Caballo Rojo Mine (OSM 1980) that determined that the noise level from crushers and a conveyor would not exceed 45 dBA at a distance of 1,500 ft. The air overpressure created by blasting is estimated to be 123 dBA at the location of the blast. At a distance of approximately 2,500 ft (0.47 mile), the intensity of this blast would be reduced to 55 dBA (no adverse impact level).

In 2004, Kennecott Energy (now RTEA) contracted with MMC to conduct an assessment of environmental noise and vibration conditions at the Cordero Rojo complex. Specifically, the assessment was designed to identify which components of the mine and which mine-related activities were the key contributors to external noise and vibration levels and understand the generation, propagation, and

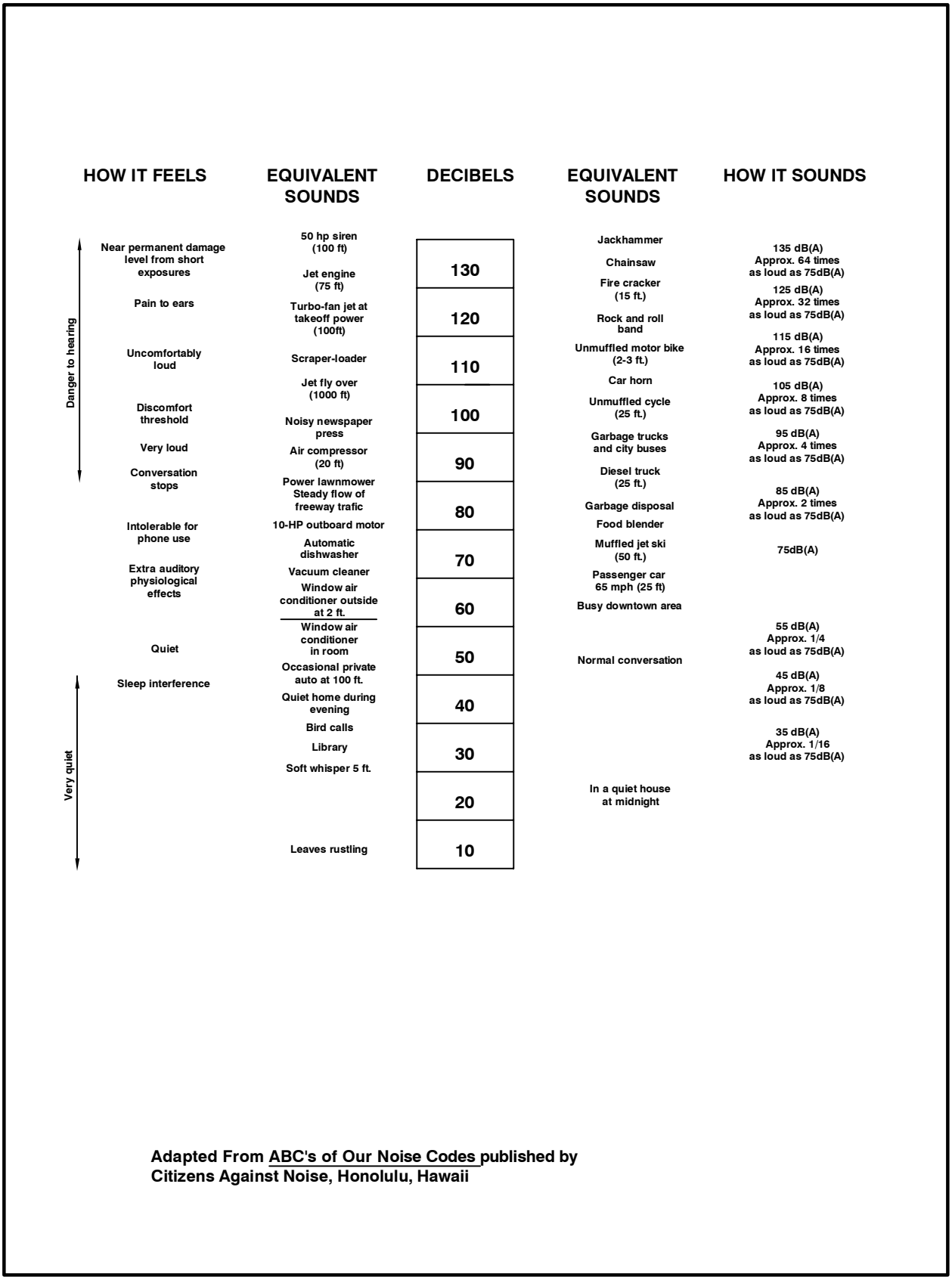

Figure 3-40. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

potential environmental impacts under a range of meteorological and operating conditions. All SPL data measured in 2004 at the residence nearest to mining activity met EPA standards for suitable living. All blasting events were found to be in compliance with OSMRE and USBM safe blasting levels.

The nearest occupied dwellings to the four LBA tracts include in this analysis are presented in Table 3-17.

Table 3-17. Noise Related Impacts for the SGAC LBA Tracts.

LBA Tract	# of Dwellings Within 3 Miles		Distance to Closest Dwelling (ft)	Max Noise Level to Closest (dBA)	Potential Impacts
	Single Family	Multiple Family			
Belle Ayr North	25	2	4,080	51	NAI*
West Coal Creek	12	0	960	63	PI*
Caballo West	41	2	3,160	53	NAI
Maysdorf II	35	1	2,275	56	PI

* NAI: No adverse impact (24-hour equivalent level of less than 55 dBA)
PI: Potential Impacts - no hearing loss (24-hour equivalent level of less than 70 dBA)

Figures 3-10, 3-13, 3-16, and 3-19 depict the locations of occupied residences with respect to the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, respectively.

3.14.2 Environmental Consequences

3.14.2.1 Proposed Action and Action Alternatives

Noise levels on the LBA tracts would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since the LBA tracts would be mined as an extension of existing operations under the Proposed Action or other action alternatives for each tract, no rail car loading would take place on the LBA tracts. Under the authority of the Noise Control Act of 1972, EPA designates that a 24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact (EPA 1974).

Potential blasting related noises impacts for the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are presented in Table 3-17. Because of the remoteness of the LBA tracts and because mining is already on going in the area, noise would have few off-site impacts.

Wildlife in the immediate vicinity of mining may be adversely affected by the noise of the mining operations. Anecdotal observations at surface coal mines in the area suggest that some wildlife may adapt to increased noise associated with coal mining activity. After mining and reclamation are completed, noise would return to premining levels.

3.14.2.2 No Action Alternative

Under the No Action Alternatives, coal removal and the associated noise impacts would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract. Currently approved mining operations and associated noise impacts would continue on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Noise impacts related to mining operations at these mines would not extend onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.14.3 Regulatory Compliance, Mitigation and Monitoring

Mine operators are required to comply with MSHA regulations concerning noise, which include protecting employees from hearing loss associated with noise levels at the mines. MSHA periodically conducts mine inspections to ensure compliance with the requirements of the Federal Mine Safety and Health Act of 1977.

3.14.4 Residual Impacts

No residual impacts to noise are expected.

3.15 Transportation

3.15.1 Affected Environment

Transportation resources near the general South Gillette analysis area include State Highway 59, five improved two-lane county roads (Haight Road, T-7 Road, Hilight Road, Hoadley Road, and Bishop Road), several unimproved local roads and accesses (unnamed two-track trails), the Gillette-Douglas rail line used jointly by BNSF & UP Railroads, oil and gas pipelines, utility/power lines, telephone lines, and associated rights-of-way. Figures 3-41 through 3-44 depict the current transportation facilities, excluding the oil and gas pipelines, within and near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, respectively. Figures 3-45 through 3-48 depict the oil and gas pipelines within and near the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, respectively.

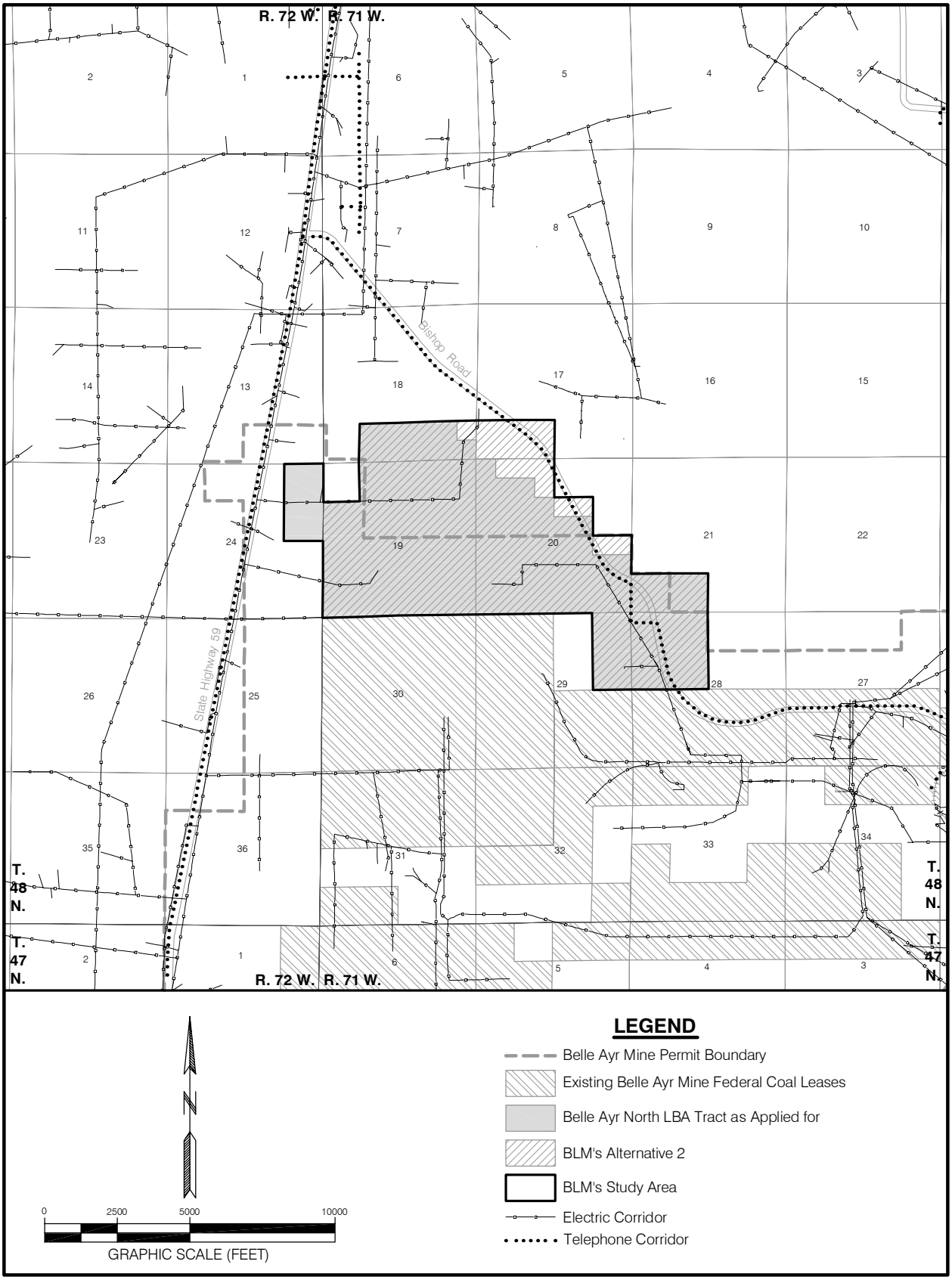

Figure 3-41. Transportation Facilities Within and Adjacent to the Belle Ayr North LBA Tract.

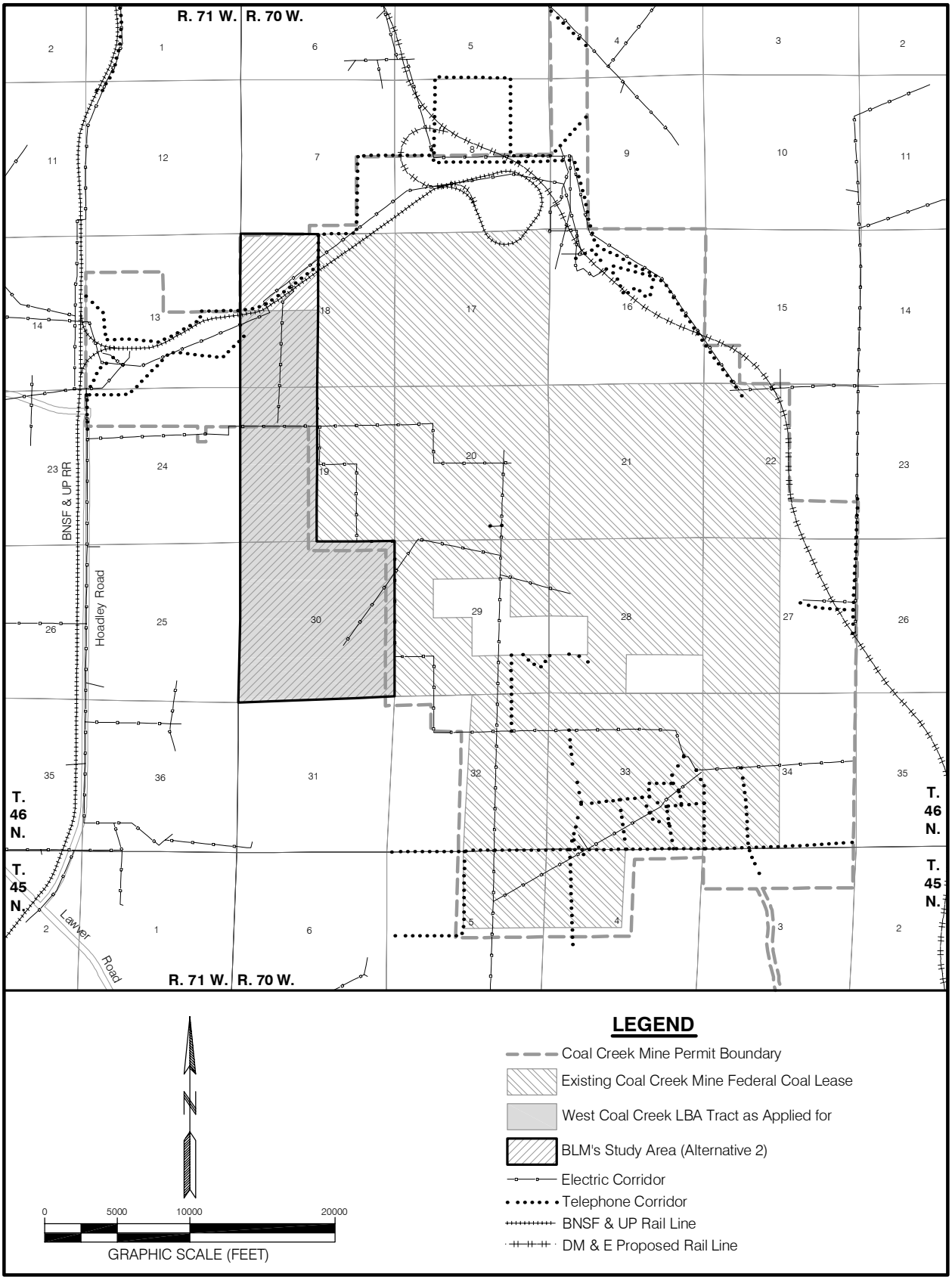

Figure 3-42. Transportation Facilities Within and Adjacent to the West Coal Creek LBA Tract.

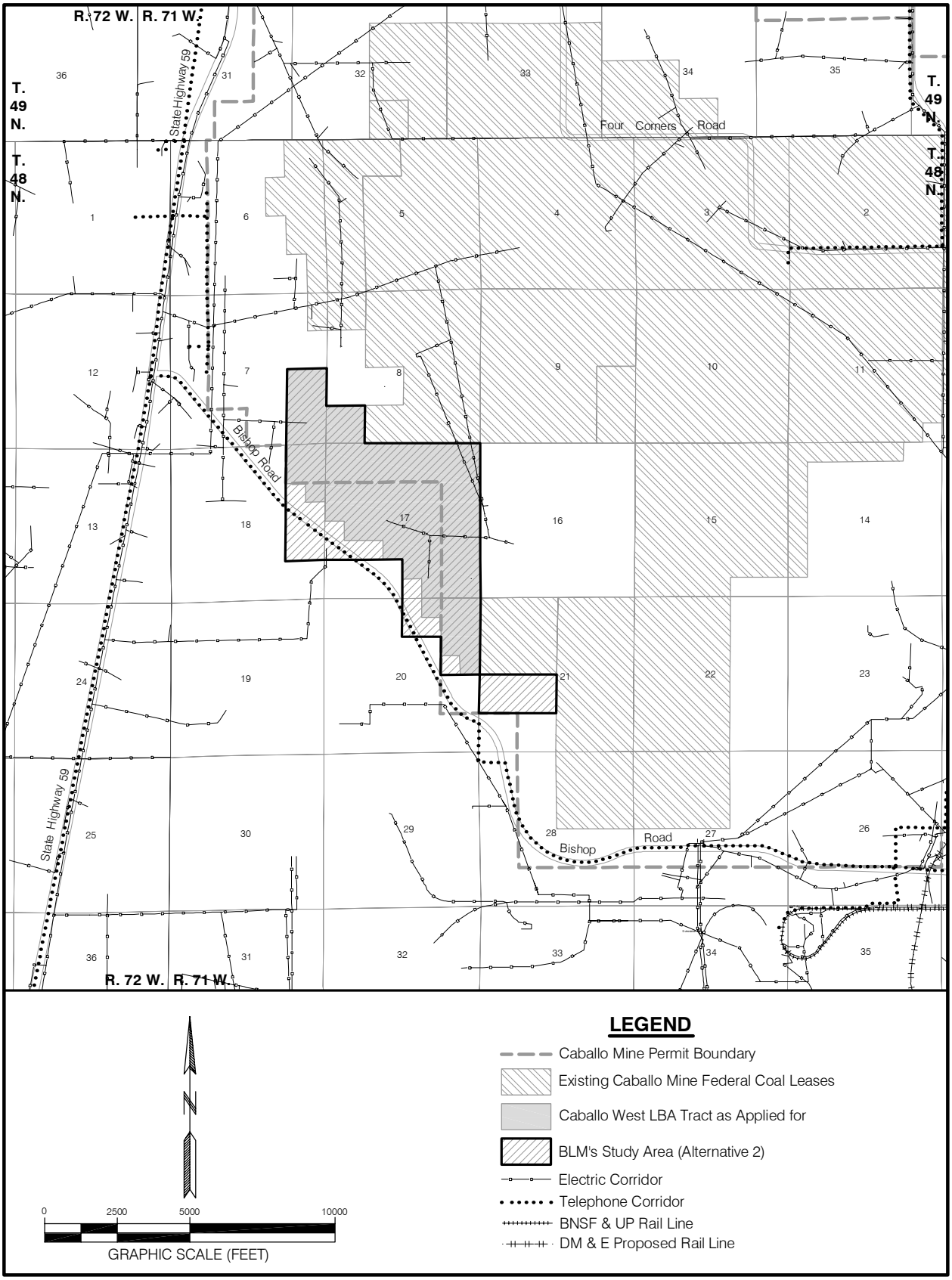

Figure 3-43. Transportation Facilities Within and Adjacent to the Caballo West LBA Tract.

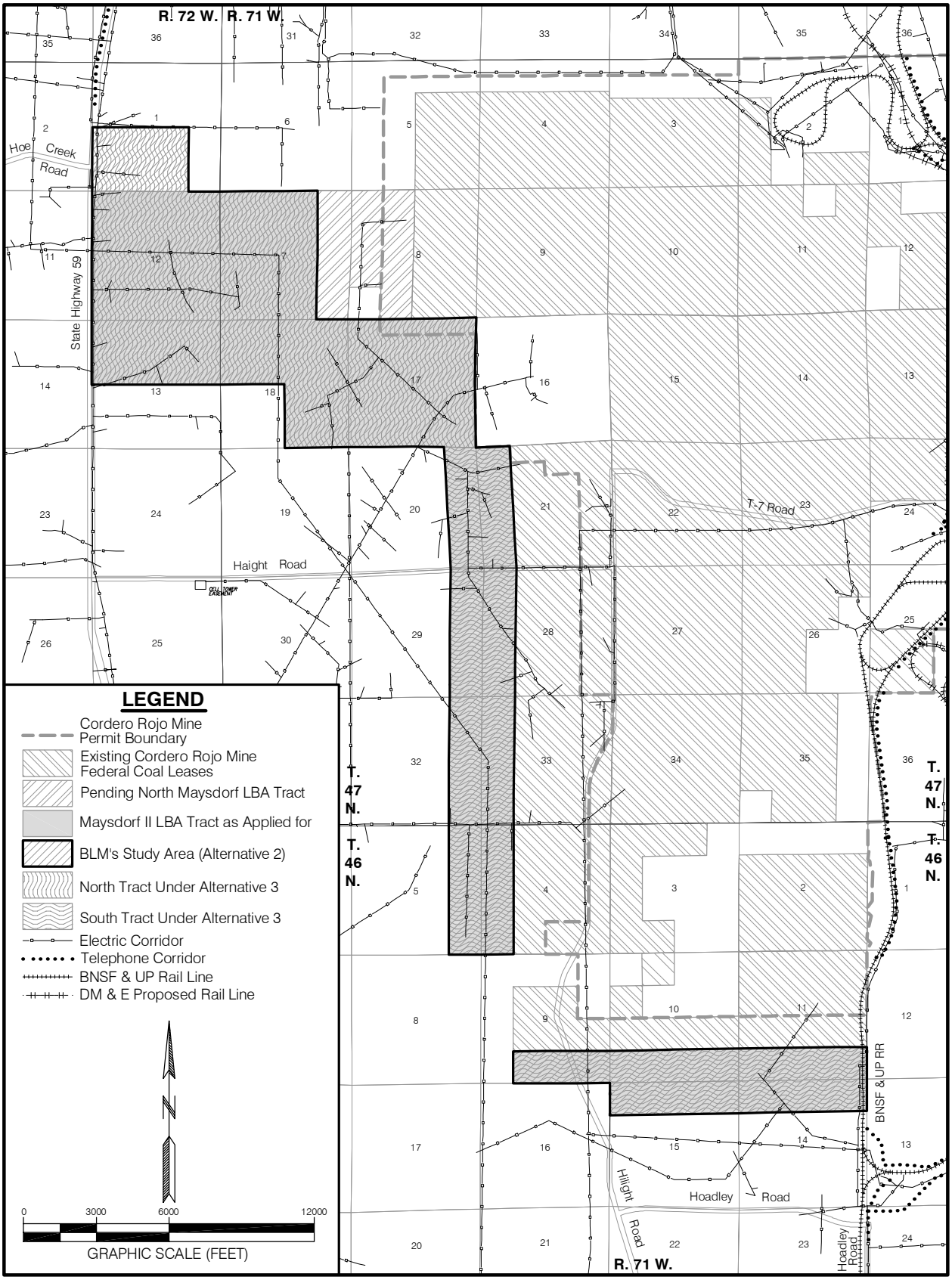

Figure 3-44. Transportation Facilities Within and Adjacent to the Maysdorf II LBA Tract.

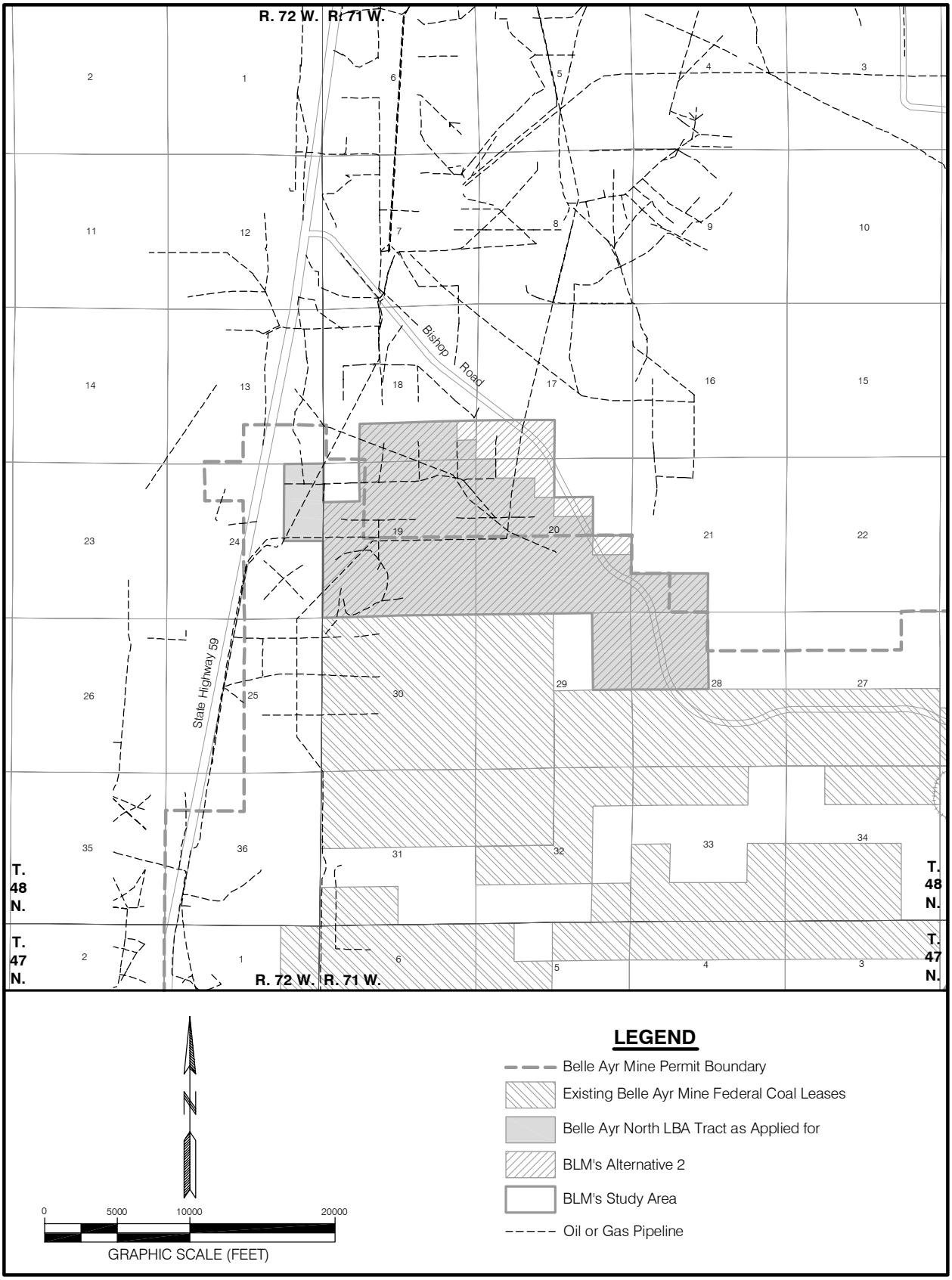

Figure 3-45. Oil and Gas Pipelines Within and Adjacent to the Belle Ayr North LBA Tract.

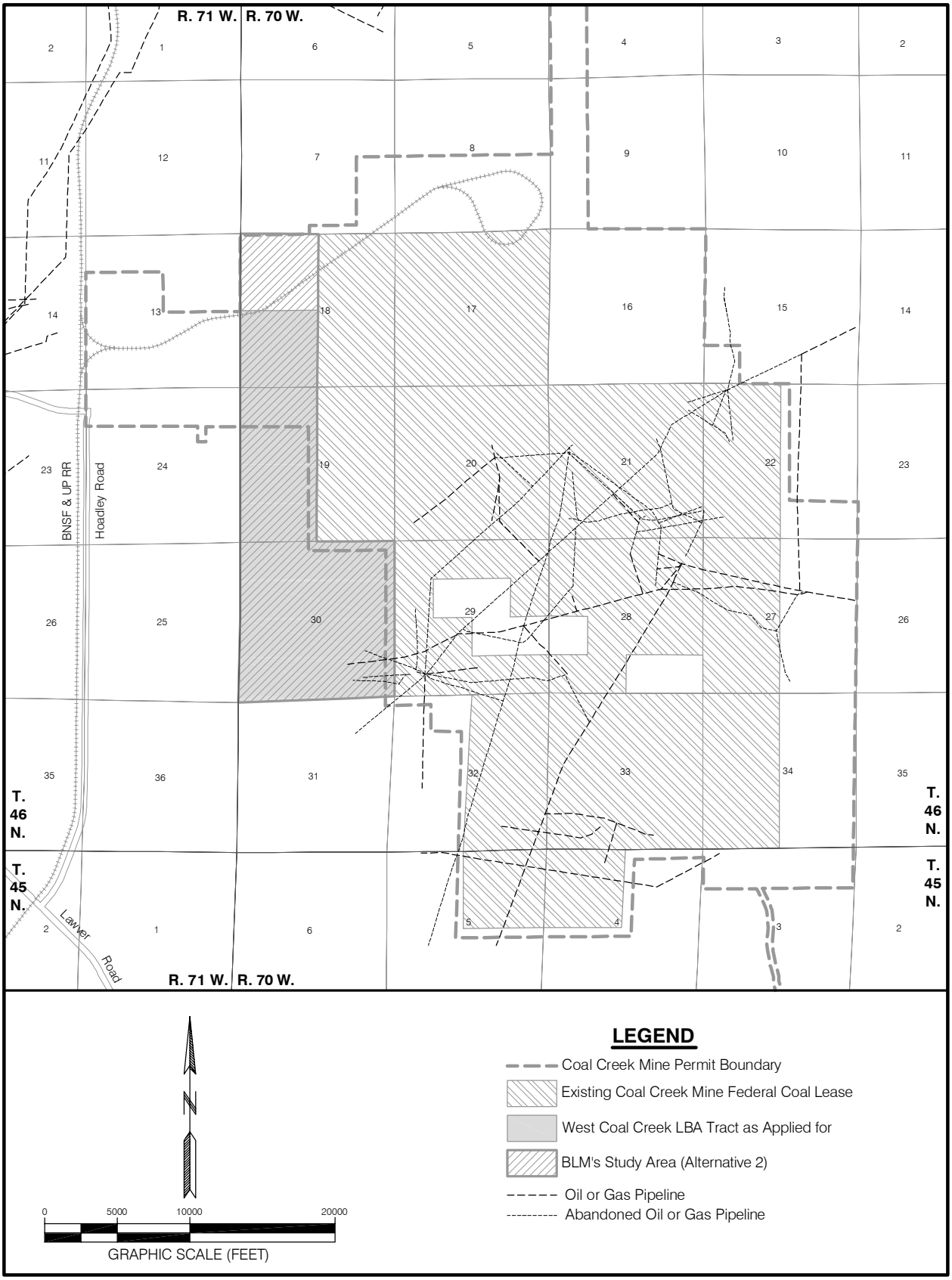

Figure 3-46. Oil and Gas Pipelines Within and Adjacent to the West Coal Creek LBA Tract.

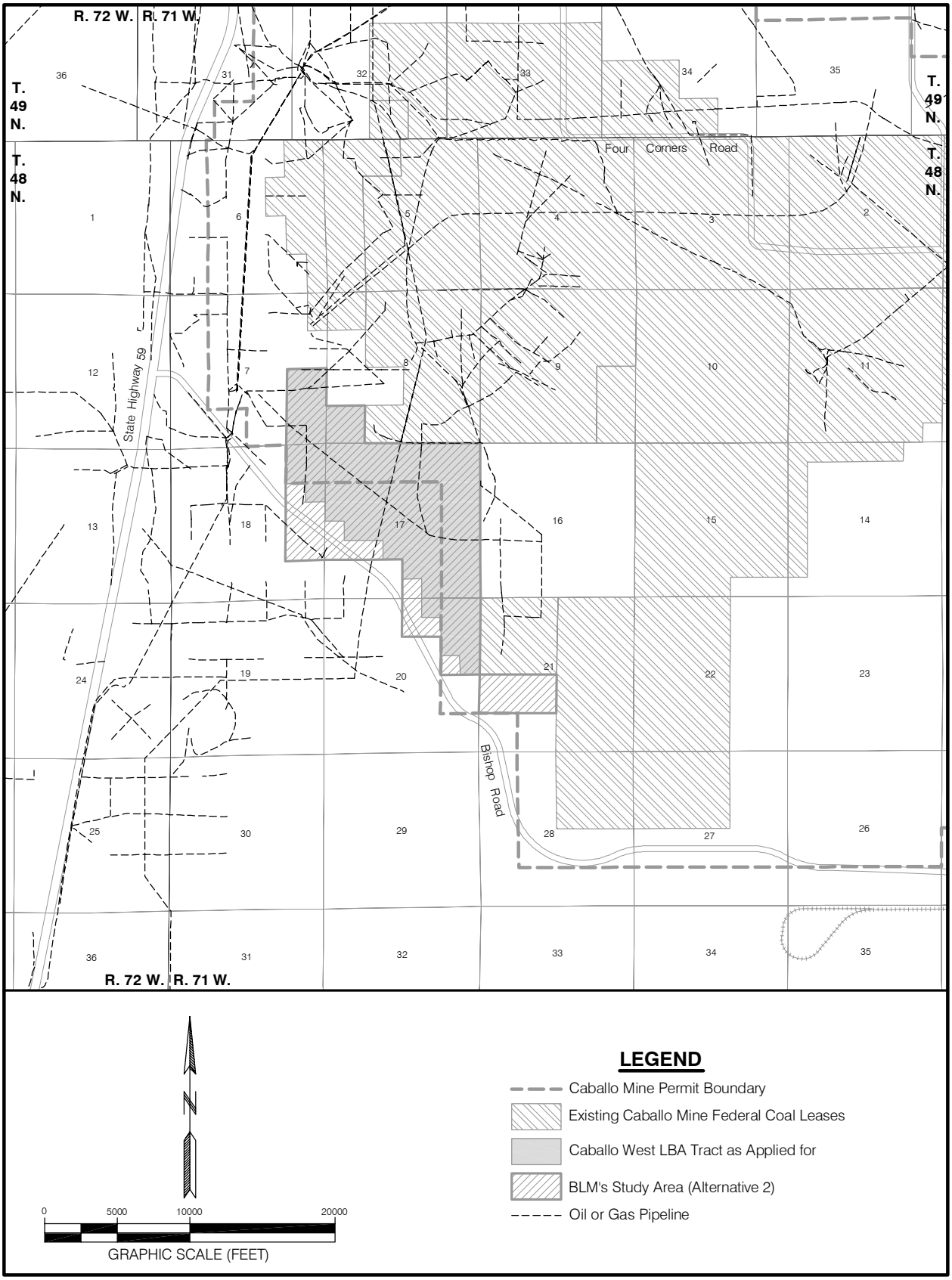

Figure 3-47. Oil and Gas Pipelines Within and Adjacent to the Caballo West LBA Tract.

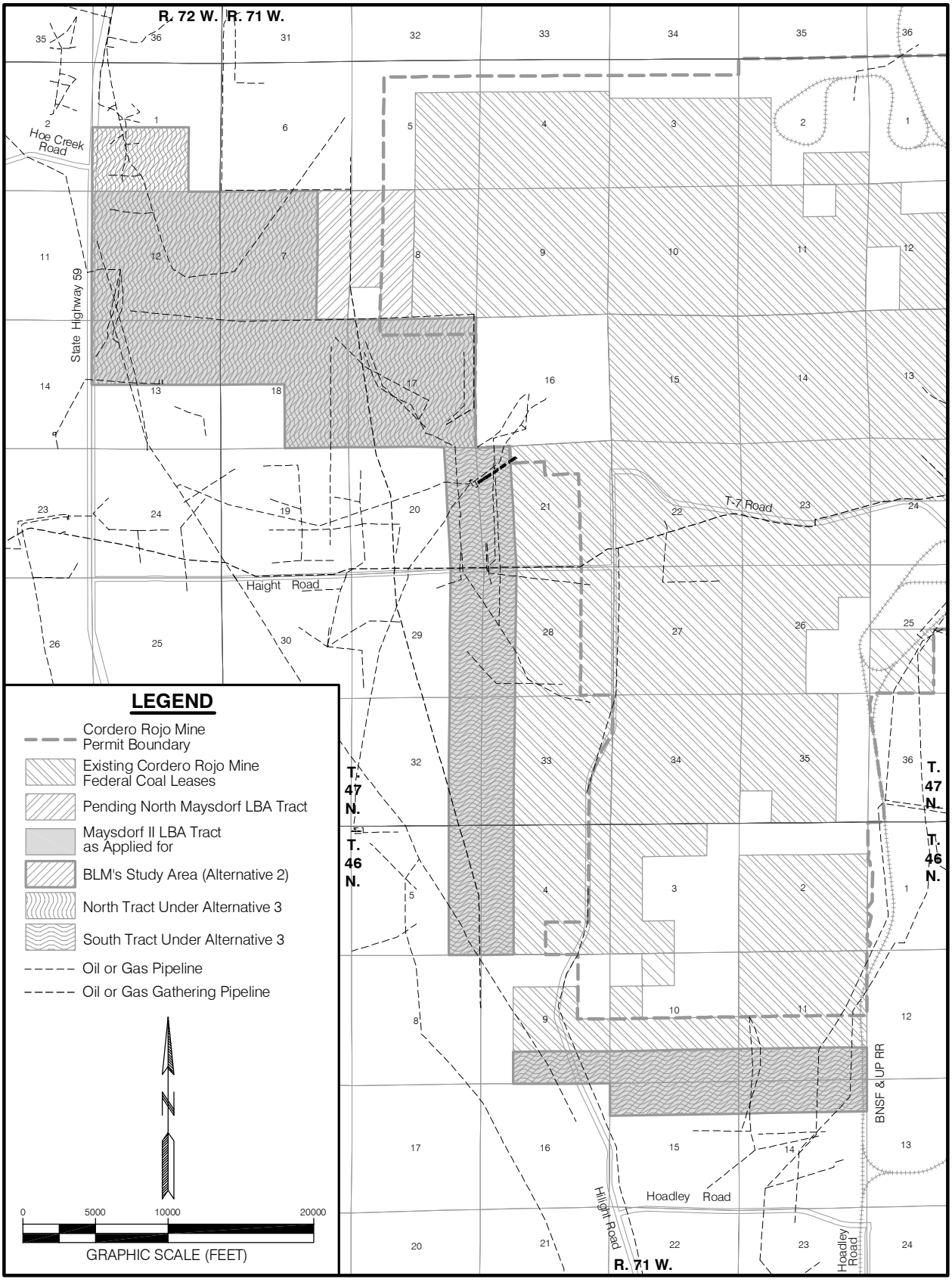

Figure 3-48. Oil and Gas Pipelines Within and Adjacent to the Maysdorf II LBA Tract.

State Highway 59 is the major north-south public transportation corridor in this area. Principal east-west public transportation corridors are the Haight and T-7 Roads, which cross the Cordero Rojo Mine's permit area, and the Wagensen/Hoadley Road, which accesses the Coal Creek Mines from the west. North-south access to the general South Gillette analysis area is on the Bishop Road, which crosses between the Caballo and Belle Ayr Mines and the Hilight Road accesses the Cordero Rojo Mine from the south. The highway and some improved roads provide public and private access within the general South Gillette analysis area. The unimproved local roads and accesses in the area are for both public and private use.

Coal extracted from the existing surface coal mines in the Wyoming PRB, including the four applicant mines in the general South Gillette analysis area, is transported in rail cars along the BNSF and UP rail lines. The coal mines north of Gillette ship most of their coal via the east-west BNSF rail line that runs through Gillette for destinations in the Midwest. The coal mines in the south Gillette and Wright areas ship most of their coal via the Gillette to Douglas BNSF and UP joint trackage that runs south through Campbell and Converse Counties and then east over separate BNSF and UP mainlines for destinations in the Midwest. Individual spur lines connect each PRB mine to the BNSF track or the joint BNSF and UP track. If built, the proposed Dakota, Minnesota and Eastern (DM&E) Railroad PRB Expansion Project would provide additional rail capacity for those mines located in the south Gillette and Wright areas.

The Surface Transportation Board (STB) gave final approval to the DM&E PRB Expansion Project in 2002. However, in response to a successful appeal, the 8th Circuit Court of Appeals directed the STB to give further consideration to four environmental issues that were raised. The STB issued a Final SEIS on the expansion project December 30, 2005, which addressed the four issues that were remanded back to the STB with input from various Federal agencies, Tribes, organizations, environmental groups, businesses, and members of the general public (STB 2006). The issue-driven alignment has been determined and the DM&E rail line would potentially be in a position to haul coal produced by the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. If constructed, the DM&E project would be the largest railroad construction project in the United States in the last 100 years (Sheridan Press 2006). The STB granted final approval to construct the rail line on February 15, 2006. The SEIS was also appealed, but was upheld by the US Court of Appeals for the Eighth Circuit in December 2006. In early October, 2007, Canadian Pacific Railway Ltd announced acquisition of the DM&E and its subsidiaries (Canadian Pacific 2007). The transaction is subject to the review and approval of the STB.

3.15.2 Environmental Consequences

3.15.2.1 Proposed Action and Action Alternatives

Essentially all of the coal mined on the LBA tracts would be transported by rail system. Since the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would be an extension of the operating mines, the existing rail facilities and infrastructure would be used during mining of the proposed lease areas. BNSF & UP have upgraded and are continuing to upgrade their rail capacities to handle the increasing coal volume projected from the PRB, with or without the leasing of the proposed Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts. The proposed DM&E Railroad expansion into this area is not dependent on leasing the four LBA tracts.

Coal dust and fines blowing or sifting from moving, loaded rail cars has been linked to railroad track stability problems resulting in train derailments and to rangeland fires caused by spontaneous combustion of accumulated coal dust. The leasing and mining of the four LBA tracts would not increase the rate of buildup of coal dust and fines but would prolong the issue. A collaborative effort between the National Coal Transportation Association, the mines, and the BNSF and UP Railroads resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load (UPRR 2006). Preliminary results have demonstrated that the new design has resulted in a 30 to 60 percent reduction in coal dust blowing off the top of cars during the early portion of the route. The collaborative team is also analyzing the value of crushing the coal to a 3-inch diameter rather than 2-inch diameter to reduce dust and fines filtering through the bottom gates of rail cars, and using a surfactant applied to the top of the load to reduce coal dust emissions (UPRR 2006).

Active pipelines and utility/power transmission lines currently cross the LBA tracts. Any relocation of these pipelines and utility lines would be handled according to specific agreements between the coal lessee and the pipeline and utility owners, if the need arises. There would be additional surface disturbance associated with construction when pipeline is relocated.

As discussed in Chapters 1 and 2, not all of the coal included in the LBA tracts is mineable. Coal included in the Belle Ayr North LBA Tract and the Maysdorf II LBA Tract under both the Proposed Action and other action alternatives and coal included in the Caballo West LBA Tract under Alternative 2 is overlain by portions of existing county roads. In addition, some of the coal included in the tract under the Maysdorf II Proposed Action and Alternatives 2 and 3 is overlain by State Highway 59. SMCRA prohibits mining within 100 ft of the outside right-of-way line of any public road unless the appropriate public road authority allows the road to be relocated or closed after public notice, an opportunity for a public hearing, and a finding that the interests of the affected public and landowners will be protected [30 CFR 761.11(d)]. As a result, the coal underlying the highway and

county road rights-of-way and adjacent buffer zones has been determined to be unsuitable for mining according to coal leasing Unsuitability Criterion Number 3 [43 CFR 3461(c)].

The coal underlying the Bishop, Haight, and Hilight Roads and Highway 59 is included in the Belle Ayr, Caballo West, and Maysdorf II LBA Tracts being considered for leasing because the coal under the roads could be mined if the authorized public road authorities determine that the roads could be moved [see 43 CFR 3461.5(c)(2)(iii) and discussion in Section 2.1]. If the roads are not moved, including the underlying coal in the leases would allow maximum recovery of all the mineable coal adjacent to the road rights-of-way and buffer zones (100 ft on either side of a road right-of-way). FCW and CCC are evaluating the feasibility of relocating the Bishop Road at this time. CMC does not currently have plans to relocate Highway 59 but is evaluating the feasibility of relocating the Haight and Hilight roads.

All mining related road relocation option plans would be reviewed and approved by the Campbell County Commissioners and/or the WYDOT prior to road relocation, with or without leasing of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts. Vehicular traffic to and from the mines would continue at existing levels for over 10 additional years, depending on the LBA tracts involved and which alternatives are selected.

3.15.2.2 No Action Alternative

Under the No Action Alternatives, coal removal would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract and the transportation resources located in those areas would not be affected by mining. Currently approved mining operations and any associated impacts to transportation resources would continue on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Impacts related to mining operations at these mines would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.15.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding transportation facilities require that no public road be relocated unless the appropriate public road authority allows the road to be relocated or closed and that existing pipelines and utility lines be relocated, if necessary, in accordance with specific agreements between the coal lessee and the pipeline and utility owners.

3.15.4 Residual Impacts

3.15.4.1 Coal Loss During Transport

With the opening of the Powder River Basin in Wyoming in the late 1970s, U.S. coal shipments have grown dramatically from 4.8 million carloads to 8.4 million carloads in 2006, as the railroads deliver low sulfur coal to help electric utilities achieve Clean Air Standards (FRA 2008). The largest rail coal movements are from the Powder River Basin to generating power plants in Illinois, Missouri, and Texas (FRA 2008).

Sifting and blowing coal dust and coal chunks coming off freshly loaded moving railroad cars can accumulate along railroad tracks, railroad rights-of-way, and on adjacent lands. Coal dust can wash into drainages where large deposits of lost coal can accumulate. Accumulated coal dust has been linked to train derailments and can also spontaneously combust and cause wildfires.

Coal can be lost from rail cars through leakage from the rail car discharge doors, spillage over the rail car sides, and can be blown from rail car tops during transit. In testing conducted by Union Pacific Railroad, Burlington Northern Sante Fe Railroad, and the National Coal Transportation Association, the average loss of coal from an individual rail car's rapid discharge doors was about 19 pounds per 216 miles, or 0.09 pounds per mile (NCTA 2007). The same testing indicated that an average of 225 pounds of coal was lost from the top of a coal car through either top spillage or being blown off during a 567 mile test trip, which equated to about 0.40 pounds per mile (NCTA 2007).

The derailment of two trains in the PRB in 2005 suspected to have resulted from track instability problems caused by a buildup of coal dust and other particles on the rail bed in combination with high concentrations of moisture (UPR 2005). BNSF railway officials toured the PRB rail infrastructure in June, 2007. According to a BNSF official, when coal dust is blown off rail cars, it gets lodged in the rail bed, allowing moisture to intrude. The moisture then degrades the structural stability of the rail bed and leaves the rail more vulnerable to buckling under stress (Gillette News-Record 2007). NCTA (2007) testing results suggested that rail car bottom spillage may have more of a negative impact on rail ballast stability than loss from the top of rail cars since the leakage is directly above and near the ballast. NCTA (2007) testing also showed that after the rapid discharge doors were adjusted, there was a 32 percent decrease in bottom spillage of coal.

Accumulating coal dust and deposition has become a concern in Converse County. The majority of coal mined in the PRB travels through Converse County on railroads. Coal dust blows off the freshly loaded coal cars on their way from the PRB mine load-outs to Bill and through Converse County (Casper Star Tribune 2007).

Spontaneous combustion of accumulated coal dust can cause rangeland fires. Smoldering coal dust within a railroad right-of-way can ignite a wildfire and quickly spread to surrounding private lands if the fire is not immediately controlled. The Douglas Volunteer Fire Department Chief, Rick Andrews, estimates that coal fires account for at least 50 percent of the department's average summer call volume (Casper Star Tribune 2007). Coal fires along the railroad tracks are an ongoing problem for the Douglas Volunteer Fire Department (Casper Star Tribune 2007). Often water only temporarily puts down the flames; some fires repeatedly ignite over the course of several hours or days (Casper Star Tribune 2007). While the county's rural fire district is compensated for some of the costs involved in putting out fires caused by transported coal, the compensation doesn't come close to the actual costs, according to the Douglas Volunteer Fire Department Chief (Casper Star Tribune 2007).

BLM was invited by a Converse county private land owner to examine and survey the coal deposition that has occurred from coal trains traveling through his land. On July 7, 2008, BLM personnel met with the private landowner and toured his rangeland that was adjacent to the railroad right-of-way, about 26 miles north of Douglas, Wyoming. BLM surveyed various coal accumulations in Box Creek; one area was found to have a coal accumulation of 1.8 feet thick (BLM 2008a). Water runoff washed coal lost from the trains into drainages, with the amount of coal deposition varying along the tracks (BLM 2008a).

BNSF is working with the utility companies and the mines in trying to encourage a larger diameter of crushed coal to be delivered (3-inch versus 2-inch) in an effort to reduce the amount of small particles that are created in the crushing process (Gillette News-Record 2007). Another possibility that may help lessen blowing coal dust from trains is the use of surfactants applied to the tops of loaded coal cars (Gillette News-Record 2007). When applied to coal, surfactants can adhere coal dust to larger coal chunks. Some tests have shown that coal dust on railroad tracks can be reduced by up to 95 percent with surfactant use (Gillette News-Record 2007). Surfactant application requires large amounts of water and they would need to meet utility companies' burning specifications in order to be used (Burget 2008 and Gillette News-Record 2007).

A collaborative effort between the NCTA, PRB mines, and the BNSF and UP railroads has resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load (UPR 2006). Preliminary results have demonstrated that this new design may result in a 30 to 60 percent reduction in coal dust blowing off the top of cars during the early portion of the route (UPR 2006).

Converse County Commissioners have formally expressed concerns to BLM in regard to fire, health, and safety issues associated with blowing coal dust from trains. The Commissioners have stated that the health and well-being of Converse County citizens downwind of the railroad tracks continue to be jeopardized due to

lack of coal dust mitigation in the coal mining permit process (BLM 2008b). The Converse County Commissioners have urged that coal dust mitigation be applied as a standard condition of approval upfront in the mining permit (BLM 2008b).

BLM does not authorize mining permits nor regulate mining operations with the issuance of a BLM coal lease. In Wyoming, WDEQ has entered into a cooperative agreement with the Secretary of the Interior to enforce mining regulations and regulate surface coal mining operations. Any action related to the mining of leased coal must be approved by WDEQ before mining operations can occur on **the** leased federal coal lands. Mitigation and other requirements are developed as part of the mining and reclamation permit.

Other agencies that may be stakeholders in this issue include the Federal Railroad Administration, which implements U.S. Department of Transportation environmental policies related to U.S. railroads, and the National Coal Transportation Association whose mission includes facilitating the resolution of coal transportation issues in order to serve the needs of the general public and industry (NCTA 2008).

3.16 Hazardous and Solid Waste

3.16.1 Affected Environment

Potential sources of hazardous or solid waste on the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would include spilled, leaked or dumped hazardous substances, petroleum products, and/or solid waste associated with coal and oil and gas exploration, oil and gas development, the BNSF & UP railroad, utility line installation and maintenance, or agricultural activities. No such hazardous or solid wastes are known to be present on any of the four LBA tracts. Wastes produced by current mining activities at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines are handled according to the procedures described in Chapter 2, Section 2.8.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Action and Action Alternatives

If the applicant mines acquire the four LBA tracts, the wastes that would be generated in the course of mining the tract would be similar to those currently being generated by the existing mining operation. The procedures that are used for handling hazardous and solid wastes at the existing mines are described in Chapter 2, Section 2.8. Wastes generated by mining the LBA tracts would be handled in accordance with the existing regulations using the procedures currently in use and in accordance with WDEQ-approved waste disposal plans at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines.

3.16.2.2 No Action Alternative

Under the No Action Alternatives, coal removal would not occur on the additional acres that would be disturbed under the Proposed Action or other action alternatives for each tract and no waste materials would be generated as a result of coal removal on the tracts. Currently approved mining operations would continue on the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mine leases. Impacts related to mining operations at this mine would not be extended onto portions of the LBA tracts that will not be affected under the current mining and reclamation plan.

As discussed in Chapter 2, a decision to reject the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease the tracts in the future.

3.16.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding production, use, and/or disposal of hazardous or extremely hazardous materials are discussed in Chapter 2. All mining activities involving the hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

3.16.4 Residual Impacts

No residual hazardous and solid waste impacts are expected.

3.17 Socioeconomics

The social and economic study area for the proposed project includes Campbell County and the City of Gillette. The community of Gillette would most likely attract the majority of any new residents due to its current population levels and the availability of services and shopping amenities.

3.17.1 Local Economy

3.17.1.1 Affected Environment

Wyoming's coal mines produced 452.1 million tons in 2007, according to the Wyoming State Inspector of Mines. This was an increase of almost 2 percent over the 444.9 million tons produced in 2006. PRB coal production (Campbell and Converse counties, 14 active mines) was over 436.6 million tons in 2007, which represented almost 97 percent of the state coal production (Wyoming Department of Employment 2005a and 2006a).

Approximately 27 percent of the November of 2007 total employment in Campbell County and 40 percent of the second quarter 2007 total payroll was attributed to

the natural resources and mining sector (Wyoming Department of Employment 2007 and Wyoming Department of Employment 2008). In 2007, Campbell County employment grew at a similar rate compared to the statewide average (3.7 percent versus 3.6 percent change, respectively). Job growth occurred in construction, trade, manufacturing, transportation and utilities, and local government, but the most dramatic increase was in the manufacturing sector (Wyoming Department of Employment 2008).

Lease bonus bids are paid to the federal government for the right to enter into lease agreements for federal coal. Bonus bids are paid in five annual installments; the state receives half of each installment. In 2004 and 2005, BLM held competitive sealed-bid lease sales for six coal tracts (NARO South, West Antelope, West Hay Creek, Little Thunder, West Roundup, and NARO North). No coal lease sales were held for federal coal tracts in the PRB in 2006 or 2007. Two lease sales (Eagle Butte West and South Maysdorf) have been held thus far in 2008.

The successful bonus bids for the six lease sales held in 2004 and 2005 ranged from 30 cents per ton to 97 cents per ton and totaled $1.69 billion (BLM 2006c). Annual bonus bid payments from the six lease sales total $338.2 million. Combined with remaining bonus bid payments from lease sales held in previous years of $90.1 million, the annual bonus bid payment total for 2004 was $428.3 million, derived directly from federal coal in Campbell and Converse counties. The Wyoming Consensus Revenue Estimating Group is projecting that coal lease bonus revenues to the state will be $169.8 million for fiscal years 2007, 2008, and 2009. The bonus money received by the state is allocated to fund capital construction for cities and towns, the state's highway fund, community colleges, and school capital construction (Wyoming CREG 2007).

Wyoming, Campbell County, and the cities and towns in the county receive revenue from a variety of taxes and royalties on the production of federal coal in addition to the bonus bids. These include ad valorem taxes, severance taxes, royalty payments, sales and use taxes, and required contributions to the AML program and the Black Lung Disability Trust Fund.

Federal royalties are collected at the time the coal is sold and equal 12.5 percent of the sale price. In the past, federal royalties and bonus bids had been divided equally with the State of Wyoming. Legislation was passed in 2007 that modified the percentage of distribution to 52 percent federal/48 percent state for fiscal year 2008. The percentage of mineral royalty distribution will revert back to 50 percent/50 percent at the end of the 2008 fiscal year unless legislation is passed in the future to maintain or further modify the current percentage of distribution of royalties. Coal mines pay 31.5 cents per ton of surface coal mined to fund AML reclamation programs. Annual appropriations returned to the states vary depending on Congressional authorizations and AML program priorities. Additional sources of revenue include federal income tax and annual rentals that are paid to the government.

Sales and use taxes are distributed to cities and towns within the county and to the county's general fund. According to the Excise Tax Division of the Wyoming Department of Revenue (2004), the sales and use taxes collected from coal mines and coal mining-related services in Campbell County in FY 2004 was $8.2 million.

In 1994, the University of Wyoming estimated that the total fiscal benefit to the State of Wyoming for coal produced in the PRB was $1.10 per ton (Borden et al. 1994). This study did not include AML fees or bonus bid payments in the calculation for fiscal benefits to the State of Wyoming. Calculating the estimated total fiscal benefit to the State of Wyoming in 2005 by including half of the bonus bid payments, half of the federal mineral royalties based on current prices, half of the AML fees, and all of the ad valorem taxes, severance taxes, and sales and use taxes for coal produced in Campbell County in 2005 results in an estimated $661 million, or $1.62 per ton. Figure 3-49 depicts the estimated total revenues to state and federal governments from 2006 coal production in Campbell County.

Recent GSP calculations for Wyoming (2004) indicate that the minerals industry accounted for about 21 percent of the state's total GSP of $24.1 billion, which made it the largest sector of the Wyoming economy. Mining alone accounted for 8.3 percent of the Wyoming GSP (Wyoming Department of Administration and Information 2007).

3.17.1.2 Environmental Consequences

3.17.1.2.1 Proposed Action and Action Alternatives

The federal and state revenues that would be generated by the leasing and mining of the LBA tracts would depend on which alternative is selected and the sale price of the coal. Coal prices increased in 2005, generally as a result of concerns over coal transportation and stockpile issues, but declined in 2006. According to the WSGS, the average spot price of 8,400 Btu coal in the PRB in the second half of 2005 was $11.06 per ton, compared with an average spot price during the first half of 2005 of $7.29 per ton and an average spot price of $4.93 per ton the year before (WSGS 2006). However, PRB spot prices declined throughout 2006. The average spot price for 8,400 Btu coal was $9.86 per ton in 2006 (WSGS 2008). The Wyoming Consensus Revenue Estimating Group is forecasting that the average gross sales prices for Wyoming coal production will ranged from $9.98 to $10.65 per ton from 2007 through 2012 (Wyoming CREG January 2008). PRB prices are generally lower than prices for coal produced in other areas of Wyoming; however, most of the coal produced in Wyoming is from the PRB. For the purposes of this EIS, a conservative average price of $9.98 per ton (Wyoming CREG January 2008) is estimated for the coal included in the Belle Ayr North,

Coal Creek West, Caballo West, and Maysdorf II LBA Tracts, which have an average Btu value of a little over 8,400.

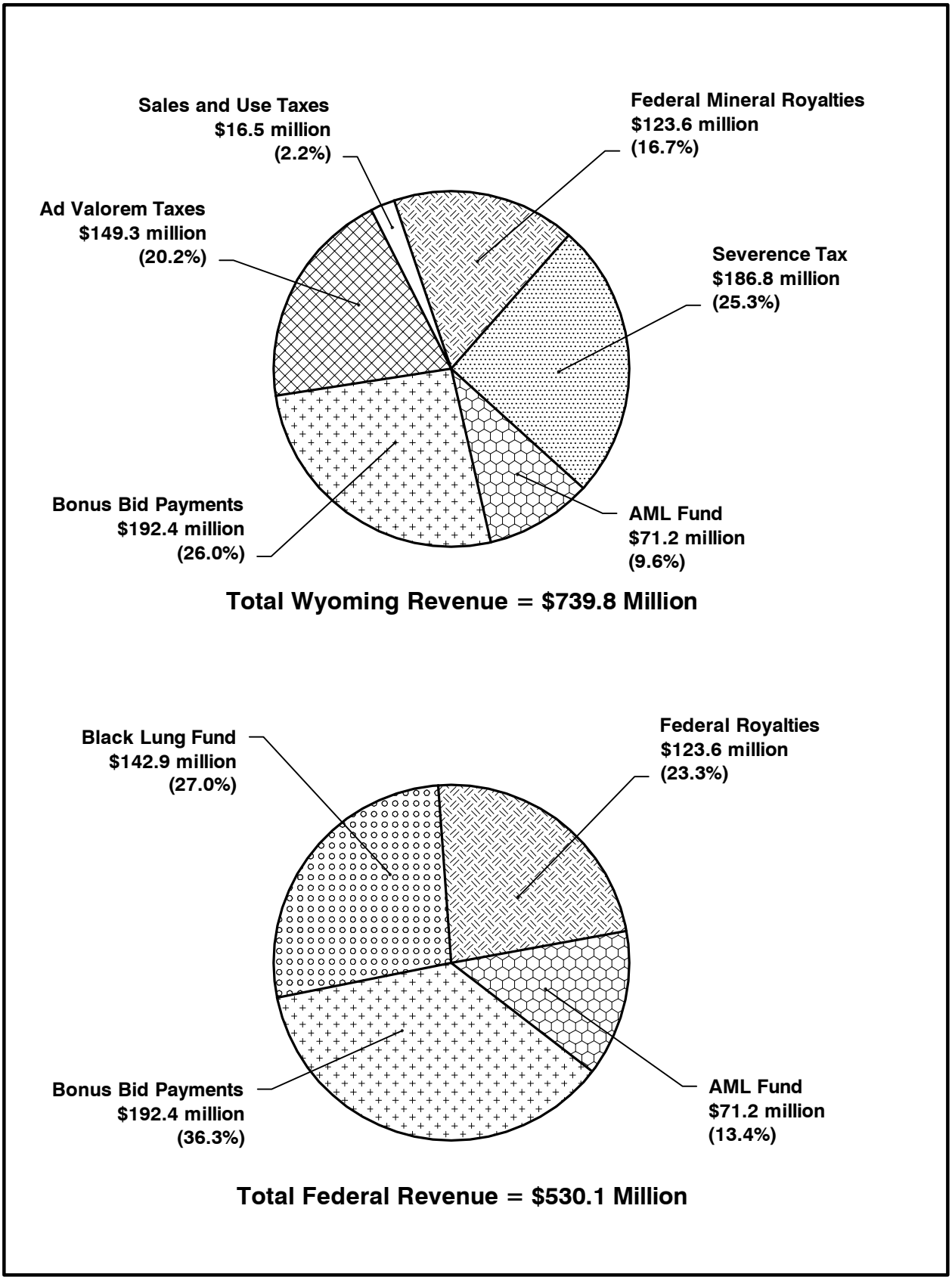

Figure 3-49. Estimated Wyoming and Federal Revenues from 2006 Coal Production in Campbell County.

Using the coal tonnages shown in Tables 3-1 through 3-4, projected federal and state revenues for the LBA tracts are presented in Table 3-18, assuming an average coal price of $9.98 per ton recovered and a potential range of bonus payments on the leased (mineable) coal of 30 to 97 cents per ton.

Table 3-18. Projected Socioeconomic Impacts from Leasing the South Gillette Analysis Area LBA Tracts Under the Proposed Action and Alternatives 2 and 3.

Tract and Item	No Action Alternative Existing Mine	Proposed Action	Alternatives 2 and 3
Belle Ayr North LBA			
State Revenues	$382.9 million	$342.2 to $410.7 million	$364.9 to $437.8 million
Federal Revenues	$283.6 million	$261.5 to $329.9 million	$278.7 to $351.6 million
Increased Mine Life	0 yrs	6.4 yrs	6.8 yrs
Additional Employees	0	8	8
West Coal Creek LBA			
State Revenues	$353.2 million	$102.1 to $123.3 million	$102.1 to $123.3 million
Federal Revenues	$261.6 million	$78.1 to $99.3 million	$78.1 to $99.3 million
Increased Mine Life	0 yrs	4.3 yrs	4.3 yrs
Additional Employees	0	10	10
Caballo West LBA			
State Revenues	$949.6 million	$146.0 to $175.3 million	$175.9 to $211.3 million
Federal Revenues	$703.4 million	$111.5 to $140.8 million	$134.4 to $169.8 million
Increased Mine Life	0 yrs	2.2 yr	2.6 yr
Additional Employees	0	0	0
Maysdorf II LBA			
State Revenues	$854.0 million	$805.0 to $972.3 million	$849.7 to $1026.5 million
Federal Revenues	$632.6 million	$615.7 to $783.1 million	$649.9 to $826.7 million
Increased Mine Life	0 yrs	9.7 yrs	10.3 yrs
Additional Employees	0	60	63

If the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA Tracts are leased and mined under the Proposed Actions or other action alternatives potential federal revenues would vary by LBA tract as indicated below.

3.17.1.2.1.1 Belle Ayr North LBA Tract

Under the Proposed Action, the potential additional federal revenues would range from approximately $261 million to $330 million. Under Alternatives 2, potential additional federal revenues would range from approximately $279 million to $352 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $342 million to $411 million.

Under Alternative 2, potential additional state revenues would range from about $365 million to $438 million.

The base of economic activity provided by wages and local purchases would continue for over 6 additional years, depending on which alternative is selected.

3.17.1.2.1.2 West Coal Creek LBA Tract

Under the Proposed Action and under Alternative 2, the potential additional federal revenues would range from approximately $78 million to $99 million.

If the LBA tract is leased and mined under the Proposed Action and under Alternative 2, the potential additional state revenues would range from about $102 million to $123 million.

The base of economic activity provided by wages and local purchases would continue for just over 4 additional years.

3.17.1.2.1.3 Caballo West LBA Tract

Under the Proposed Action, the potential additional federal revenues would range from approximately $112 million to $141 million. Under Alternative 2, potential additional federal revenues would range from approximately $134 million to about $170 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $146 million to $175 million. Under Alternative 2, potential additional state revenues would range from about $176 million to $211 million.

The base of economic activity provided by wages and local purchases would continue for over 2 additional years.

3.17.1.2.1.4 Maysdorf II LBA Tract

Under the Proposed Action, the potential additional federal revenues would range from approximately $616 million to $783 million. Under Alternatives 2 and 3, potential additional federal revenues would range from approximately $650 million to $827 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $805 million to $972 million. Under Alternatives 2 and 3, potential additional state revenues would range from about $850 million to $1027 million.

The base of economic activity provided by wages and local purchases would continue for over 10 additional years, depending on which alternative is selected.

3.17.1.2.2 No Action Alternative

Under the No Action Alternatives, the potentially recoverable coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined and the economic benefits associated with mining that coal would not be realized by the state or federal government. Currently approved mining operations and associated economic benefits would continue on the existing mine leases. Portions of the LBA tracts adjacent to the existing mines would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.2 Population

3.17.2.1 Affected Environment

Campbell County had a population of 33,698 in 2000, an estimated population of 37,405 in 2005, and an estimated population of 38,934 in 2006. This represents a 15.5 percent growth rate since 2000 and makes Campbell County the second fastest growing county in the state. Campbell County's population ranks it as the fourth largest of Wyoming's 23 counties and Gillette is the fourth largest city in the state, following only Cheyenne, Casper, and Laramie (USDOC 2000, CCEDC 2007, and Wyoming Department of Administration and Information 2007).

Gillette's population totaled 17,054 in 1987 and, according to census data, by 2000 Gillette's population was 19,646 and Wright's population was 1,347. Between 1990 and 2000, Gillette grew by 2,011 persons, averaging 1.1 percent per year. From December 2001 through December 2006, the population of Gillette increased from 22,867 to 27,533 (City of Gillette 2007). Wright had an average growth rate of 0.9 percent during the period from 1990 and 2000. In 2005, Gillette accounted for 22,685, or 61 percent, of the county's residents (USDOC 1990 and 2000 and Wyoming Department of Administration and Information 2007).

3.17.2.2 Environmental Consequences

3.17.2.2.1 Proposed Action and Action Alternatives

As indicated by Table 3-18, leasing and subsequently mining the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA tracts would extend the life of the existing mines and current employment at the mines by nearly 10

additional years, depending on which LBA tract and which alternative is selected. Average yearly employment at the mines would increase by up to 63 positions under the Proposed Action and other action alternatives (Cordero Rojo Mine - Table 3-18). It is likely that the additional employees would be available from the existing workforce in Campbell County and no influx of new residents would occur as a result of filling these new positions.

3.17.2.2.2 No Action Alternative

Under the No Action Alternatives, the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II coal lease applications would be rejected and the coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined. Population levels would not be affected by any additional employment at the existing mines. Currently approved mining operations and associated employment levels would continue on the existing mines leases for from about 6 years at the Cordero Rojo Mine up to approximately 17 years at the Coal Creek Mine.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.3 Employment

3.17.3.1 Affected Environment

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970s. Between 1980 and 1998, overall production rose while employee numbers generally decreased or remained constant. The employment declines followed large industry capital investments in facilities and production equipment, the majority of which were aimed at increasing productivity. Direct employment in Campbell County at coal mines increased from 3,011 to 4,168 between 1998 and 2005 (Wyoming Department of Employment 1998 and 2005a).

The mining sector, which includes oil and gas workers, accounts for almost 28 percent of all employment in Campbell County, nearly four times the statewide percentage.

In the second quarter of 2007, around 7,058 people were directly employed by surface coal mines or coal contractors in Campbell County, representing about 26 percent of the Campbell County employed labor force (Wyoming Department of Employment 2007). Campbell County also has slightly higher percentages of construction and wholesale trade employment, which is keeping with the development demands of continuing growth and the county's position as a commercial center for northeast Wyoming.

3.17.3.2 Environmental Consequences

In November 2007, the unemployment rate in Campbell County was 2.0 percent (517 persons) (Wyoming Department of Employment 2008). It is likely that additional employees would be available from the existing workforce in Campbell County, depending on the timing of the hiring at the mine as compared to the timing of hiring for other ongoing and proposed projects in the county, which are discussed in Section 4.1.

3.17.3.2.1 Proposed Action and Action Alternatives

3.17.3.2.1.1 Belle Ayr North LBA Tract

Leasing and subsequently mining the Belle Ayr North LBA Tract would extend the life of the Belle Ayr Mine by up to nearly 7 additional years, depending on which alternative is selected. As discussed above, average yearly employment at the mine would not increase under the Proposed Action and Alternative 2 (Table 3-18). The economic stability of the community of Gillette would benefit by having the current Belle Ayr Mine workforce living in the community and employed at the mine for up to about 7 additional years.

3.17.3.2.1.2 West Coal Creek LBA Tract

Leasing and subsequently mining the West Coal Creek LBA Tract would extend the life of the Coal Creek Mine by about 4 additional years, regardless of which alternative is selected. As discussed above, average yearly employment at the mine would not increase under the Proposed Action and Alternative 2 (Table 3-18). The economic stability of the community of Gillette would benefit by having the current Coal Creek Mine workforce living in the community and employed at the mine for up to about 4 additional years.

3.17.3.2.1.3 Caballo West LBA Tract

Leasing and subsequently mining the Caballo West LBA Tract would extend the life of the Caballo Mine by up to over 2 additional years, regardless of which alternative is selected. As discussed above, average yearly employment at the mine would not increase under the Proposed Action and Alternative 2 (Table 3-18). The economic stability of the community of Gillette would benefit by having the current Caballo Mine workforce living in the community and employed at the mine for over 2 additional years.

3.17.3.2.1.4 Maysdorf II LBA Tract

Leasing and subsequently mining the Maysdorf II LBA Tract would extend the life of the Cordero Rojo Mine by up to about 10 additional years, regardless of which alternative is selected. As discussed above, average yearly employment at the

mine would increase by up to 63 positions under the Proposed Action and Alternative 2, Alternative 3 (North Tract) and Alternative 3 (South Tract) (Table 3-18). The economic stability of the community of Gillette would benefit by having the current Cordero Rojo Mine workforce living in the community and employed at the mine for up to about 10 additional years.

3.17.3.2.2 No Action Alternative

Under the No Action Alternatives, the LBA tract lease applications would be rejected and the coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined. Mine life and existing employment levels would not be extended for nearly 10 additional years, and any increase in employees associated with mining the coal in the tract would not occur. Currently approved mining operations and associated employment would continue on the existing mines leases for from about 6 years at the Cordero Rojo Mine to approximately 16 years at the Coal Creek Mine. Portions of the LBA tracts adjacent to the existing mines would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.4 Housing

3.17.4.1 Affected Environment

According to a 2001 report on housing needs in Campbell County, roughly 61 percent of PRB surface coal mining employees live in Gillette and surrounding areas, 14 percent live in Wright, and 25 percent live outside of Campbell County (Pederson Planning Consultants 2001).

There were 11,538 housing units in Campbell County reported in the 1990 census. The 2000 census counted 13,288 housing units in Campbell County, of which 12,207 were occupied at the time. There were 8,989 (73.6 percent) owner occupied units and 3,218 (26.4 percent) occupied rental units (U.S. Census Bureau 2000).

The number of housing units in Gillette increased from 7,078 in 1990 to 7,931 in 2000, an increase of 12 percent. According to the City of Gillette, the housing stock in Gillette increased to 10,194 at the end of December 2006 (City of Gillette 2007). The number of units added in unincorporated, rural areas of Campbell County is not known because the county does not require building permits or certificates of occupancy for residential development in unincorporated areas (Braunlin 2004).

The types of housing units counted in 2000 included 6,698 single-family detached units, 794 single-family attached units, 2,276 multi-family units, 3,432 mobile homes, and 88 RVs, vans, or similar types of units. Subsequent construction added 561 single-family detached, 61 single-family attached, 498 manufactured homes, and 352 multi-family units in Gillette and Wright, plus an unknown number of single-family and manufactured units in rural areas. The resulting totals are estimated at 7,259 single-family detached units (49.2 percent), 855 single-family attached units (5.8 percent), 2,628 multi-family units (17.8 percent), 3,930 mobile/manufactured units (26.6 percent), and 88 RV/vans (0.6 percent) (CSI 2005).

The overall vacancy rate in Campbell County in 1990 was 13.6 percent, although the homeowner vacancy rate was just 3.6 percent while rental vacancies were at 19.4 percent (U.S. Census Bureau 1990). By 2000, the overall vacancy rate in the county had dropped to 8.1 percent with the rate for rental units at 9.0 percent and the rate for owner units at 1.2 percent (U.S. Census Bureau 2000). Due to the population growth that has recently occurred in association with CBNG development, the housing vacancy rate within the City of Gillette has continued to decrease. A survey conducted in October 2004 estimated the vacancy rate of rental units to be 7.0 percent, based on a sample of approximately 40 percent of all rental units, mostly in larger complexes (CSI 2005). According to the City of Gillette, there was a 0.2 percent vacancy rate for rental property in 2006, while the average annual vacancy rate for manufactured home/mobile home rentals within the city limits was 9.05 percent (City of Gillette 2007). Many apartments had waiting lists.

In the fourth quarter of 2006, average housing rental costs in Campbell County were $697 for a two-bedroom, unfurnished apartment, $283 for a single-wide mobile home lot and $975 for a two or three-bedroom single family home. In Converse County, the equivalent rates substantially lower; $515 for an apartment, $152 for a mobile home lot and $545 for a single family home (Wyoming Department of Administration and Information 2007).

The average selling price of homes in Campbell County the average sales price, based on 458 sales, was $185,874. That average represents a 7 percent increase over that in 2004 and fifth highest among Wyoming counties (Wyoming Housing Database Partnership 2007).

In addition to permanent housing, temporary or transient housing is a consideration for any project that might have a construction component. Temporary housing can include hotels or motels, campgrounds, and possibly mobile home parks.

There are 17 motels in Gillette with 1,346 guest rooms, one additional 27-room motel in Wright and a two-room bed & breakfast in Gillette. Hotel occupancy rates have recently been very high and several new hotels are proposed for

construction (Gillette News Record, 2006a). Gillette has two year-round commercial campgrounds with 150 hookups for RVs plus tent areas (Gillette Convention and Visitor's Bureau 2004). Campbell County has a multi-event facility, the CAM-PLEX, located in Gillette. It has 1,821 RV sites, which vary from 688 full service sites with rest rooms and shower facilities to electric only sites. The CAM-PLEX facilities are generally available only for scheduled special events, not for public camping (CAM-PLEX 2005).

Gillette also has approximately 1,595 mobile home park spaces. Mobile home parks are generally considered permanent housing resources, but they sometimes provide temporary spaces for RVs as well if there are vacant spaces available. As of early October 2004, the average vacancy rate in Gillette's mobile home parks was 35 percent, or 558 spaces (CSI 2005).

3.17.4.2 Environmental Consequences

3.17.4.2.1 Proposed Action and Action Alternatives

As discussed above, average yearly employment at the mines would increase by up to 63 positions (Cordero Rojo Mine) and employment at the mines would be extended by up to approximately 10 additional years, under the Proposed Actions and other action alternatives. No additional demands on the existing infrastructure or services in the community would be expected because little or no influx of new residents would be needed to fill new jobs. Although housing is tight in Gillette, it is likely that housing for the additional employees would be available from the existing and proposed units in Campbell County.

3.17.4.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and the coal included in an LBA tract under the Proposed Action or other action alternatives would not be mined. Housing occupancy would not be affected by any additional employment at the mines. Currently approved mining operations and associated employment levels would continue on the existing mines leases for from about 6 years at the Cordero Rojo Mine to approximately 17 years at the Coal Creek Mine. Portions of the LBA tracts adjacent to the existing mines would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.5 Local Government Facilities and Services

3.17.5.1 Affected Environment

The availability of revenues generated by mineral production has helped local government facilities and services keep pace with growth and are adequate for the current population.

Campbell County School District No. 1's enrollment as of December 2007 is listed as stable at 7,569 students, making it the third largest school district in Wyoming. The district facilities include: one high school (with two campuses) and two junior high schools in Gillette, a junior-senior high school in Wright and 15 elementary schools (including one in Wright and three in rural areas). The district also operates an alternative high school and aquatic center in Gillette (CCSD 2007).

The Campbell County Sheriff provides police protection throughout the county, except within the City of Gillette. In addition to general law enforcement, the Sheriff's staff provides court security, detention facilities, and animal control. For the 2004 fiscal year, the department budgeted for 60 law enforcement employees. Recent improvements have increased the Campbell County detention facility to 128 beds, which includes separate modules for women and juveniles (BLM 2005b).

Fire protection throughout Campbell County is provided by the Campbell County Fire Department, which is governed by a city-county joint powers board (Vonsik 2005). The department maintains four stations in Gillette and six dispersed throughout the county. The department has 17 full-time staff and 150 trained volunteers. In addition, there are 30 to 40 volunteers in outlying areas who are trained and equipped primarily to fight wildland fires. Campbell County coal mines generally provide equipment and trained staff to fight fires on mine property. The County Fire Department provides backup assistance with personnel and equipment (Vonsik 2005).

The primary medical care facility in Campbell County is Campbell County Memorial Hospital, a 90-bed acute care hospital. The hospital has a medical staff of over 50 affiliated physicians in 20 specialties and a total staff of 800 (CCMH 2005). The hospital also operates the Wright Clinic, a satellite clinic with a full-time, family practice physician. Ambulance service for Campbell County is provided by the hospital, which has a 24-hour emergency service capability. The Campbell County Fire Department provides first responder service to emergency calls, but transport is the responsibility of the hospital affiliated ambulance service (Vonsik 2005).

Water and wastewater treatment systems are provided by the City of Gillette and by the Wright Water and Sewer District. Gillette serves the city and some urbanized areas nearby from groundwater wells. The water system has the

capacity to serve approximately 25,000 people. Water use approaches capacity during the summer months when parks and private lawns are being irrigated (Morovits 2005). An additional well field is being planned for completion in about five years. In the interim, the city has other wells it can pump if necessary, but high natural fluoride levels require careful monitoring if they are used (Morovits 2005). The city is also conducting a Level II Water Study to identify longer term solutions to its water supply problems. The Level II study is likely to identify well field, transmission, pumping station and treatment additions to the current system. If approved by the city and if funding is secured, these improvements are anticipated to come on line during the next three to five years (Petersen 2007).

Gillette's sewer treatment system was designed for a service population of approximately 35,000 and improvements begun in the fall of 2004 were designed to increase treatment capacity to accommodate a projected population of 41,000. Currently, the system serves an estimated 25,000 people in the city and surrounding areas. The Wright district's water and sewage treatment facilities were designed to serve a population of approximately 3,000, albeit with an additional sewage lagoon required when the service population reached about 2,500 people. The district is planning an additional well to increase its water supply capacity by about 30 percent. The district facilities in Wright currently serve a population of approximately 1,400 people; essentially the entire town is hooked on to the water system and most lots are on the sewer system unless they have private septic systems.

3.17.5.2 Environmental Consequences

3.17.5.2.1 Proposed Action and Action Alternatives

As discussed above, average yearly employment at the mines would increase by up to 63 positions (Cordero Rojo Mine) and mine life would be extended by from about 2 years at the Caballo Mine to approximately 10 years at the Cordero Rojo Mine under the Proposed Actions and other action alternatives. No additional demands on the existing community facilities or services in the county would be expected because little or no influx of new residents would be needed to fill new jobs. It is likely that the demand for public facilities and services will be satisfied by the existing facilities and services currently in place in Campbell County.

3.17.5.2.2 No Action Alternative

Under the No Action Alternatives, the coal lease applications would be rejected and the coal included in the LBA tracts under the Proposed Action or other action alternatives would not be mined. Local government facilities and services would not be affected by any additional employment at the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines. Currently approved mining operations and associated employment levels would continue on the existing mine leases for from about 6 years at the Cordero Rojo Mine to approximately 16 years at the Coal

Creek Mine. Portions of the LBA tracts adjacent to the existing mines would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II lease applications at this time would not preclude an application to lease a tract in the future.

3.17.6 Social Setting

3.17.6.1 Affected Environment

The social setting for coal development in the PRB, summarized in Section 4.2.12.9, is described in the Task IC Report for the PRB Coal Review (BLM 2005b). That report emphasizes Campbell County and its communities as the nucleus for coal development in the PRB. The SGAC mines been in production since at least 1972 and the mines and their employees contribute to the social and economic stability of Campbell County and the City of Gillette.

3.17.6.2 Environmental Consequences

3.17.6.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, employment at the mine is not anticipated to increase substantially under the Proposed Actions or Alternatives 2 and 3. Consequently, little or no change in the social setting of Campbell County or the community of Gillette would be anticipated under these alternatives.

3.17.6.2.2 No Action Alternative

Implementation of all of the No Action Alternatives would hasten the loss of approximately 1,500 relatively high paying mining jobs in the PRB. A majority of those losses would occur in Campbell County and the City of Gillette. Loss of the SGAC mine-related economic activity and tax revenues are described in preceding sections. These losses would likely result in a disruption in the social and economic stability of Campbell County and the city of Gillette and some population relocation, unless mine employees were able to find comparable employment within commuting distance of Gillette. Social effects of the No Action Alternatives on the Town of Wright would be less substantial, because of the fewer number of employees involved and the potential for those employees to find other jobs in mines and other energy industries in Campbell County.

3.17.7 Environmental Justice

3.17.7.1 Affected Environment

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, or other factors. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations", was published in the *Federal Register* (59 FR 7629). The Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The Executive Order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of surface coal mines in the area. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning Environmental Justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with consultation and coordination described in Section 1.6 of this document. This EIS and contributing socioeconomic analysis provide a consideration of the impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including Native Americans.

3.17.7.2 Environmental Consequences

3.17.7.2.1 Proposed Action and Action Alternatives

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, or that they would be unequally impacted if the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA Tracts are leased under the Proposed Actions or Alternatives 2 or 3. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the proposed LBA sites. Consequently,

implementation of the proposed project would not adversely affect the environmental justice considerations in the area.

3.17.7.2.2 No Action Alternative

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, or that they would be unequally impacted if the Belle Ayr North, Coal Creek West, Caballo West, and Maysdorf II LBA Tracts are leased under the Proposed Actions or Alternatives 2 or 3. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the existing mines. Consequently, the No Action Alternatives would not adversely affect the environmental justice considerations in the area.

3.17.8 Regulatory Compliance, Mitigation and Monitoring

Surface coal mines are required to pay royalty and taxes as required by federal, state, and local regulations. The BLM compares the amount of coal reported as produced with the estimated amount of coal in the ground to verify that the federal coal is efficiently mined and that royalties are paid on all of the coal that is mined.

3.17.9 Residual Effects

3.17.9.1 Human Health Impact Assessment

In 2008, public concerns were brought to BLM's attention in regard to conducting human health impact assessments in the PRB where coal mining activities occur. These public concerns included emissions from coal mining activities, such as particulate matter and nitrogen oxide exposure, and their potential impact on human health and people living in the local PRB area.

A health impact assessment (HIA) is a method used in assessing potential impacts of a proposed project on human health. HIAs examine health on a broad scale, including social, emotional, and cultural impacts as well as physical impacts. HIAs rely on available scientific data, public testimony, and modeling to predict potential health impacts. BLM does not have jurisdiction in regard to conducting human health assessments. However, BLM has invited the Wyoming Department of Health/Environmental Health Section and the U.S. Center for Disease Control and Prevention to review and provide comment on the SGAC EIS.

In reference to the stated public concerns, air pollution is controlled by state and federal air quality regulations and standards established under the federal Clean Air Act Amendments. State implementation plans are in place to ensure proposed

actions like coal mining comply with all associated air quality regulations and criteria. The Wyoming Ambient Air Quality Standards are stricter than the National Ambient Air Quality Standards and are enforced by WDEQ.

As described in Section 3.4.2.3 of the EIS, the WDEQ/AQD developed a Natural Events Action Plan for the Coal Mines of the Powder River Basin. The plan, based on EPA Natural Event Policy guidance, identifies potential control measures for protecting public health and minimizing exceedences of the PM_{10} NAAQS.

All mines are required to conduct long-term air quality modeling to show that their proposed operations will comply with the National and Wyoming Ambient Air Quality Standards and they are required to monitor to demonstrate that their actual air emissions do not exceed the standards. The WDEQ/Air Quality Division permit process for coal mines requires air quality modeling of the primary air pollutants PM_{10} and NO_2. Refer to Section 3.4.2.3 in the EIS to review air quality mitigation measures that WDEQ/AQD implemented in order to prevent exceedences of the National and Wyoming Ambient Air Quality Standards by surface coal mines.

3.18 The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The NEPA regulations at 40 CFR 1502.16 require a discussion of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" as part of an EIS. This requirement is duplicated in the BLM NEPA Handbook Chapter V, Section B.2.a.(3) and C.3.h.(2).

3.18.1 Local Area

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are leased, almost all components of the present ecological system, which have developed over a long period of time, would be modified as the coal is mined. In the long term, following reclamation, the land surface would be topographically lower and, although the reclaimed surface would resemble original contours, it would lack some of the original diversity of geometric form.

Soils and vegetation would be disturbed and the associated grazing and wildlife habitat that the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts currently provide would be lost in the short term, during mining and reclamation. There would be a loss of native vegetation from 11,886.9 acres (total of all Proposed Actions) up to a maximum of 12,464.8 acres (Alternatives 2 and 3) if the LBA tracts are mined. This disturbance would occur incrementally over a period of years. Soils would be replaced and vegetation would be restored, as required by the mining plan (see Sections 3.8 and 3.9). In the long term, the reclaimed lands would provide equivalent or better forage production capacity for

domestic livestock. This would be required before the performance bond is released. Long-term productivity would depend primarily on post-mining range management practices, which to a large extent, would be controlled by the private landowners.

Mining would disturb pronghorn and mule deer habitat. As discussed in Section 3.10.5, potential sage-grouse habitat is scarce throughout the general project area. There would be loss and displacement of wildlife in the short term but, based on monitoring of previously reclaimed lands, it is anticipated that the reclaimed lands would provide habitat that would support a diversity of wildlife species similar to premining conditions over the long term. The diversity of species found in undisturbed rangeland would not be completely restored on the mined lands for an estimated 50 years after the initiation of disturbance. Re-establishment of mature sagebrush habitat, which is crucial for pronghorn and sage-grouse, would be expected to take even longer.

If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are leased and mined, groundwater quality would be different from pre-mining conditions after reclamation. The water quality would remain adequate for livestock and wildlife. Depth to groundwater would increase in an area extending further to the west and south of the existing mine areas. The water levels in the coal aquifer should return to premining levels at some time after mining has ceased because recharge areas would not be disturbed when recovering the coal in the LBA tracts.

Mining operations and associated activities would degrade the air quality and visual resources of the area on a short-term basis. Following coal removal, removal of surface facilities, and completion of reclamation, there would be no long-term impact on air quality. The long-term impact on visual resources would be minor.

Short-term impacts to recreation values may occur from a reduction in big game populations due to habitat disturbance and reduction in access to some public lands. These changes would primarily impact hunting in the lease areas. However, because reclamation would result in a wildlife habitat similar to that which presently exists and access to any public lands affected by mining would be restored, there should be no long-term adverse impacts on recreation.

The short- and long-term economy of the region would be enhanced as a result of the Proposed Actions and action alternatives. Leasing and subsequently mining the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts would extend the life of the existing mines by just over 10 additional years, depending on which LBA tract and which alternative is selected.

3.18.2 Greenhouse Gas Emissions

There has been, and continues to be, considerable scientific investigation and discussion as to the causes of recent historic rise in global mean temperatures, and whether a warming trend will continue. This section will address greenhouse gas emissions as specifically related to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, the mine adjacent to the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts, respectively.

Greenhouse gases (GHGs) have been raised as a concern due to the greenhouse effect. The greenhouse effect is a theory that certain gases in the atmosphere impede the release of radiation from the earth, trapping heat in the atmosphere like glass over a greenhouse. GHGs currently include carbon dioxide (CO_2), methane (CH_4), water vapor, ozone, and nitrous oxide (NO_2). GHGs are not currently regulated, but there is a consensus in the international community that global climate change is occurring and that GHGs may play a role. If the coal in the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts is leased and mined, additional GHGs would be released into the atmosphere.

As discussed in Chapter 1, BLM does not authorize mining through the issuance of a federal coal lease. WDEQ, with oversight from OSM, has regulatory authority in issuing permits to mine coal in Wyoming. However, BLM considers the impacts of mining coal in this EIS because it is a logical consequence of issuing a maintenance lease to an existing coal mine.

The use of the coal after it is mined is not determined at the time of leasing. However, almost all coal that is currently being mined in the Wyoming PRB is being used to generate electricity by coal-fired power plants. A discussion of emissions and by-products that are generated by burning coal to produce electricity is included in Chapter 4, Section 4.2.14 of the EIS and a more complete discussion of the current status of global climate change and cumulative considerations is included Section 4.2.14.1.

As discussed in Chapter 2, under the No Action Alternatives, the life of the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines would be extended at about current levels for approximately 16 years while the mines recover their remaining estimated 1,564 million tons of recoverable coal reserves. Under the Proposed Actions or Alternatives 2 or 3, the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines' contributions to global mercury emissions would be extended by just over 10 additional years.

Although not all SGAC mines have completed a greenhouse gas emissions inventory, mines near or within the general South Gillette analysis area have conducted inventories of expected emissions that occurred in 2007. These mines also projected emissions for a typical year of operations at the mines if additional lands are leased and mined. Emissions are measured as metric tons of equivalent

CO_2 (CO_2e), a conversion to put any of the various gases emitted, i.e. methane or nitrous oxides, into the equivalent greenhouse effect as compared to CO_2.

The completed inventories included emissions for sources, such as all types of carbon fuels used in mining operations, electricity used on site (facilities lighting and operation, lighting to illuminate roads, power for electrically operated equipment, and conveyors), and mining processes (blasting, methane released from mined coal, and spontaneous combustion). Additional categories contributing to CO_2e emissions, which were not included in SGAC CO_2e emissions estimates due to a lack of information, include on-site rail transport as well as rail transport to buyers.

Combined CO_2e emissions for the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines were estimated (Table 3-19) by correlating the CO_2e emission ratios (CO_2e/MMT coal, CO_2e/MMBCY OB, and CO_2e/disturbance acres) at nearby mines. The correlation was based on the 2007 coal production, overburden production, and disturbance acres (facilities plus active pit acres) for three source types (fuel, electricity, and mining process) compared to Belle Ayr, Coal Creek, and Caballo Mines' 2007 coal production, overburden production, and disturbance acres (WWC 2008). Since the combined CO_2e emissions for SGAC mines are estimated, based on limited information, the estimated values are tentative. These combined total values are only included here as a means of obtaining a representation of potential CO_2e emissions should the SGAC tracts be leased and mined.

Projected greenhouse gas emission rates increase if the SGAC LBA tracts are added to the applicants' mining operations (Table 3-19). The increase in CO_2e emissions would result from the additional diesel fuel that would be used in consideration of the added haul distances and overburden hauling, as well as increased electricity and explosives related to increasing strip ratios.

Under Alternative 1, the No Action Alternatives, the emission rates for the SGAC mines would continue for over 16 years at rates approximately 18 percent above the rates measured in 2007 when production was about 108.5 MMT.

The incremental changes with the addition of the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts to the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively, represent the estimated CO_2e emissions for the proposed actions as well as Alternatives 2 and 3. Estimates assume that the annual production rate is 127.5 MMT. If the Belle Ayr North, West Coal Creek, Caballo West, and Maysdorf II LBA Tracts are leased and mined by the Belle Ayr, Coal Creek, Caballo, and Cordero Rojo Mines, respectively, the tracts would add from over 2 additional years to over 10 additional years to the life of the mines.

Table 3-19. Estimated Equivalent CO_2 Emissions* at the SGAC Mines.

Source	2007	With LBA Tracts
Fuel	303,916	552,285
Electricity	266,443	370,919
Mining Process	115,592	138,223
Total of Three Sources	712,950	1,061,427

* Equivalent CO_2 in metric tons
Source: WWC 2008

Please see Section 4.13 for an assessment of cumulative impacts related to greenhouse gases, and how the proposed action and alternatives contribute.

3.19 Irreversible and Irretrievable Commitments of Resources

The major commitment of resources would be the mining and consumption of 731.2 million tons (Proposed Action for all four LBA tracts) up to a maximum of 760.8 million tons (Action Alternatives for all four LBA tracts) of coal to be used for electrical power generation. CBNG that is not recovered prior to mining would also be irreversibly and irretrievably lost (see additional discussion of the impacts of venting CBNG to the atmosphere in Section 3.18). It is estimated that 1 to 2 percent of the energy produced would be required to mine the coal, and this energy would also be irretrievably lost.

The characteristics of topsoil on approximately 11,846 acres (Proposed Action for all four LBA tracts) up to a maximum of approximately 12,465 acres (Action Alternatives for all four LBA tracts) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining-related activities. Newly formed soil material would be unlike that in the natural landscape.

Direct and indirect wildlife deaths caused by mining operations or associated activity would be an irreversible loss.

Loss of life may conceivably occur due to the mining operations and vehicular and train traffic. On the basis of surface coal mine accident rates in Wyoming as determined by the Mine Safety and Health Administration (1997) for the 10-year period 1987-1996, fatal accidents (excluding contractors) occur at the rate of 0.003 per 200,000 man-hours worked. Disabling (lost-time) injuries occur at the rate of 1.46 per 200,000 man-hours worked. Any injury or loss of life would be an irretrievable commitment of human resources.

Disturbance of all known historic and prehistoric sites on the mine areas would be mitigated to the maximum extent possible. However, accidental destruction of presently unknown archeological or paleontological values would be irreversible and irretrievable.