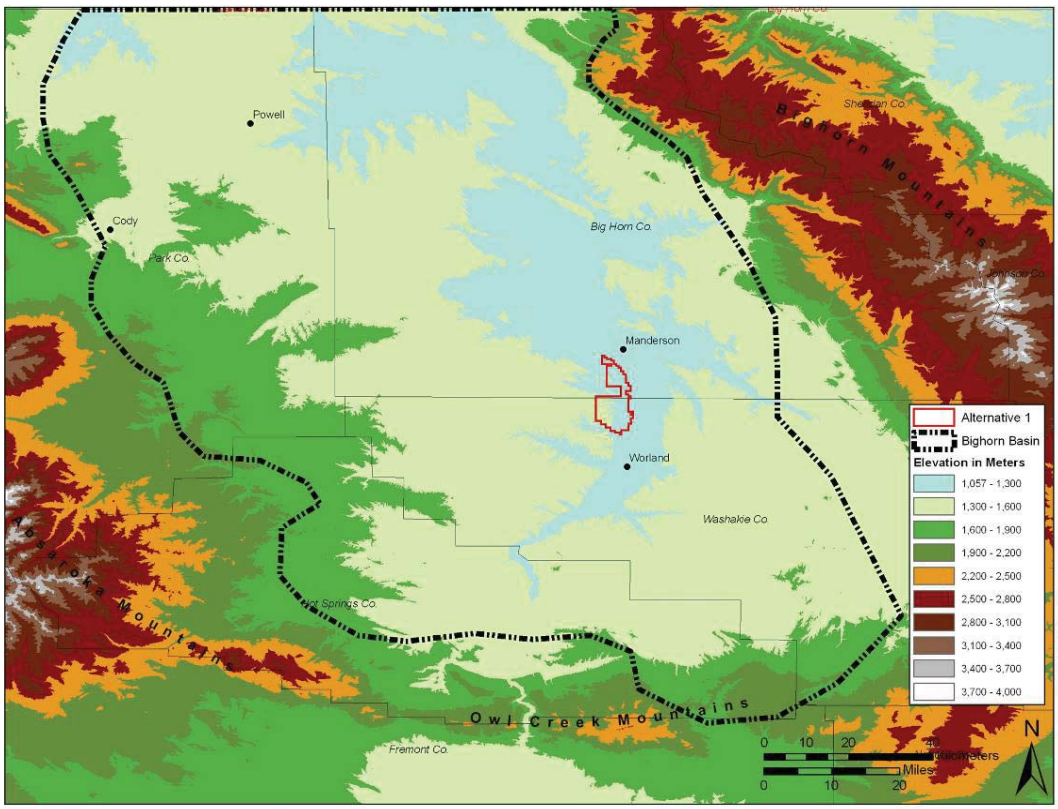
3.0 Affected Environment

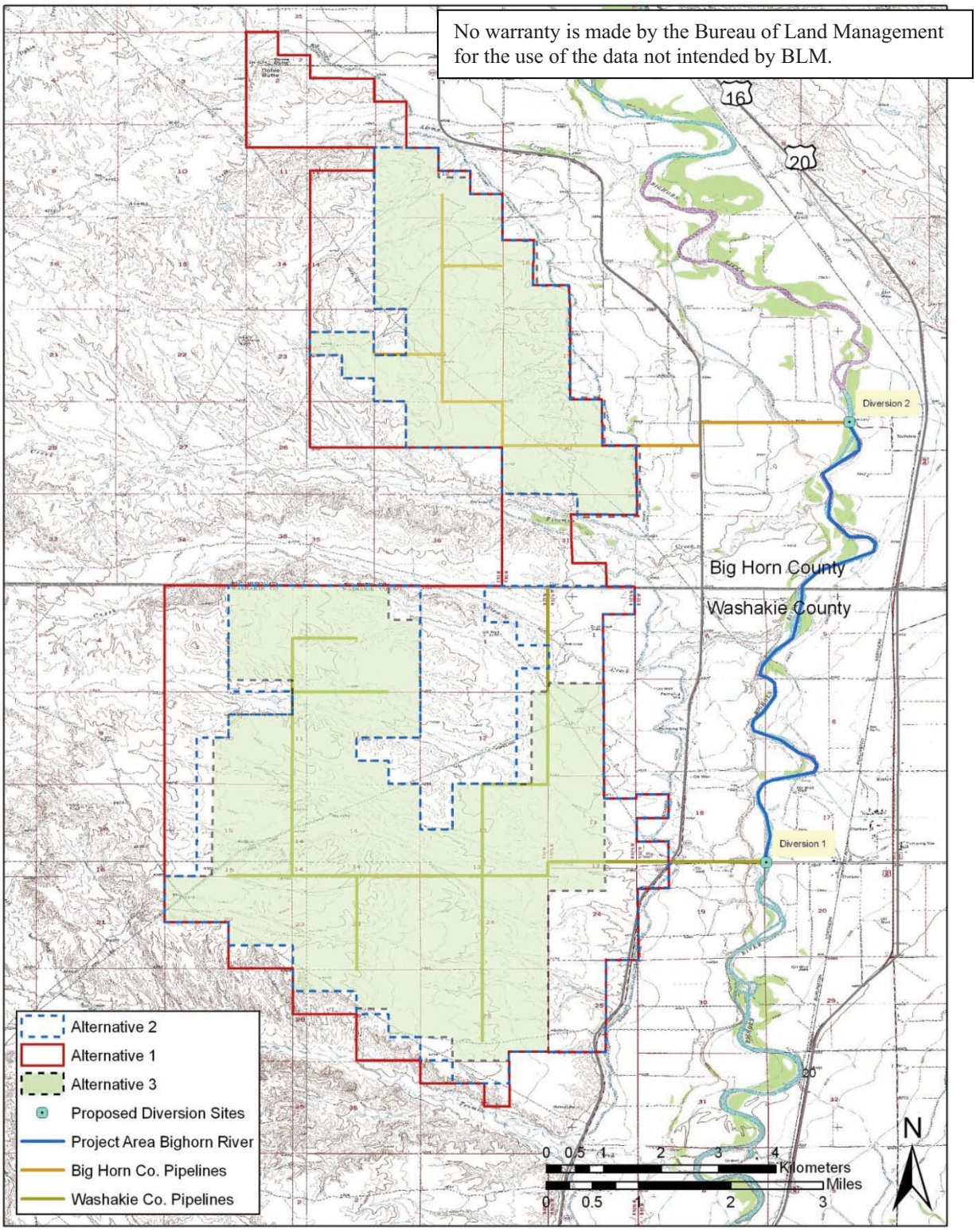
3.1 INTRODUCTION

This Chapter describes the physical, biological, social, and economic components of the environment that may be affected by implementing the proposed action or the alternatives. Descriptions of the physical and biological components apply generally to the Bighorn Basin between Manderson and Worland and more specifically to those areas that would be directly and indirectly affected by the land conveyance. Economic, social, agricultural, and cultural elements deal with both the larger context of State, Bighorn Basin, and Big Horn and Washakie Counties as well as within the project area. The Bighorn Basin for this project is defined by the Bighorn Mountains to the east, the Owl Creek Mountains to the south, the Absaroka Mountains to the west, and the state border with Montana to the north (Map 3-1).



Map 3-1. Bighorn Basin.

The project area for all action alternatives is defined as: the area that will be conveyed from BLM to WID ownership, water pipeline corridors, pumping station locations, and the Bighorn River corridor between water diversions and return flows (Map 3-2). The environment for all alternatives is primarily the same, but differs in amount of land conveyed. If important environmental differences exist between the alternatives, they are discussed in the appropriate sections of this Chapter



Map 3-2. Project Area Showing Alternatives and the Distribution Lines for Water Delivery.

3.2 LAND FEATURES

3.2.1 General Setting

3.2.1.1 Location

The project area is located in the north-central portion of Wyoming in the Bighorn Basin, between Worland, approximately 4.4 miles (7 km) south, and Manderson, approximately 1.8 miles (3 km) north (Map 3-1). The acreage is positioned on the west side of the Big Horn Canal and located on the county line between the Big Horn County and Washakie County (Map 3-2). It is situated in T48N R92W, the eastern half of T48N R93W, western extreme of T49N R92W, and the eastern third of T49N R93W. Lands within the project area consist entirely of public lands managed by the BLM. Lands to the east are privately-owned; land to the west is a mixture of public land and State of Wyoming land.

3.2.1.2 Climate

The region is arid, with 1971-2000 mean annual precipitation of 6.77 inches in Basin, Wyoming and 8.03 inches in Worland, Wyoming. About 60 to 70 percent of the annual precipitation occurs during the irrigation season. The irrigation season has been characterized as an average frost-free period of 133 days (Wyoming Water Planning Program Report, 1972), or a normal period of at least 40 degree Fahrenheit mean daily temperatures which occurs during the months of April through October (U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climate Data Center, 2002).

In this arid region there are also slight microclimate changes around the plants that occupy the landscape. A microclimate occurs in an area where there is a local modification of the general climate that is imposed by special configuration of a small area. It is influenced by topography, ground surface and plant cover, and man-made activities (e.g., irrigated agriculture). Plants can alter the form of the surface, increase the area for radiation and transpiration, shade the ground, change air movements, and trap air. All these factors cause a cooler, more humid and stable microclimate.

The proposed Big Horn County lands are at elevations ranging from about 1,237.5 to 1,298.5 meters. Lands in Washakie County range up to 46 meters higher.

3.2.2 Geology and Soils

The proposed project area is dominated by Quaternary terrace deposits that slope gently eastward toward the Bighorn River. The terraces are approximately 30-feet in depth, and are bounded and intersected by outcrops of the underlying Tertiary Willwood Formation predominantly within the rolling landscape of gullies and tributary drainages. Moderate to heavy surface gravel and cobble are present on eroded terrace edges and drainage side slopes. The Willwood Formation is a variegated claystone, shale and sandstone.

Soils in the project area are formed on alluvial fans, shale uplands and terraces under arid conditions. The NRCS has rated the soils as Class III or poorer for irrigation capability; that is,

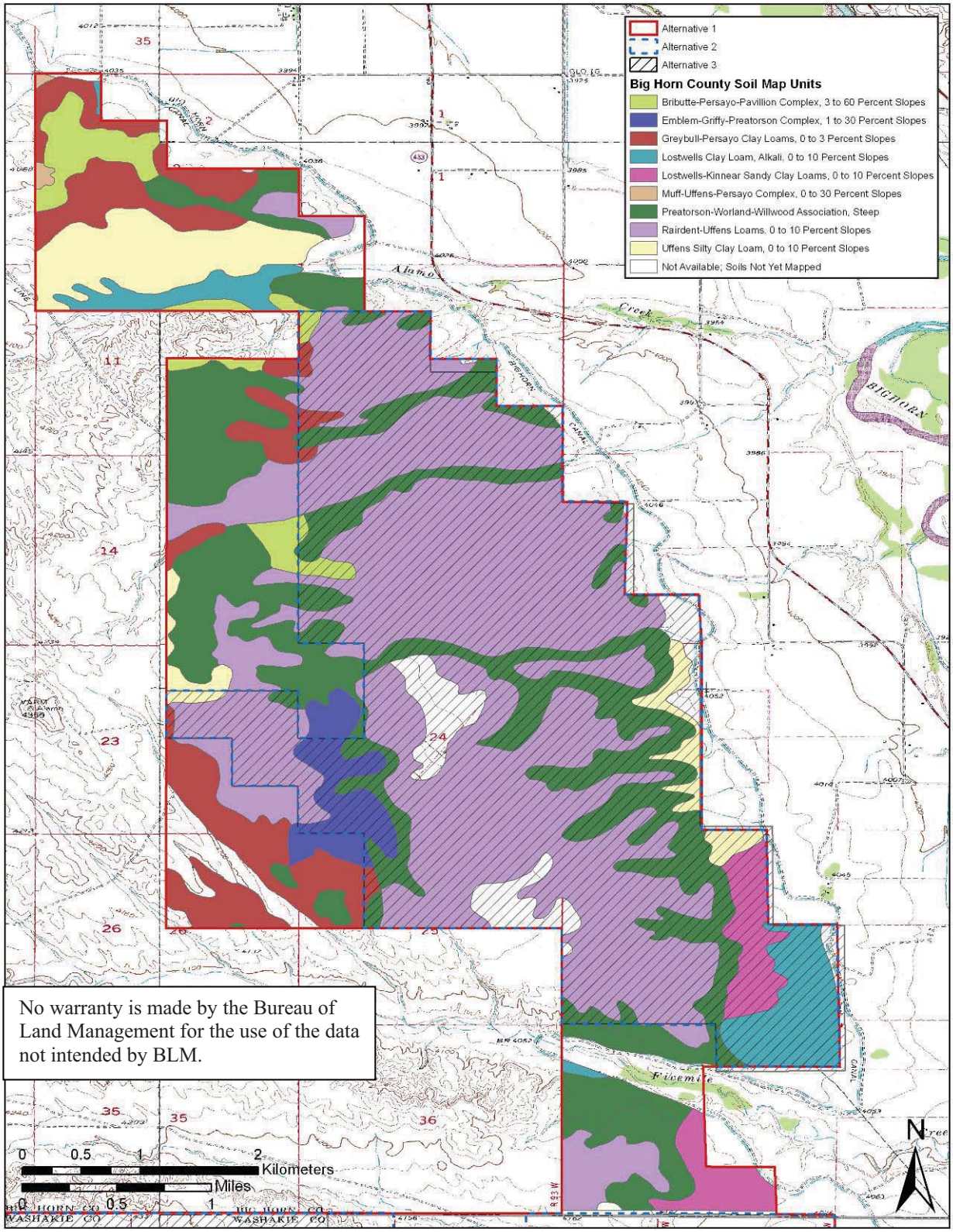
suitable for 2-3 years of row crop production in rotation with the equivalent period of hay and pasture use.

Within the project area, soils in the sloping fans, swales, and drainages are usually deep and well drained. These have formed from material washed from the terraces or sandstone escarpments immediately above them. Soils in the uplands are typically shallow and are formed by weathering of underlying saline shale bedrock. Much of these lands are deemed unirrigable for lack of subsurface drainage to leach the salts that would inevitably build with continued irrigation.

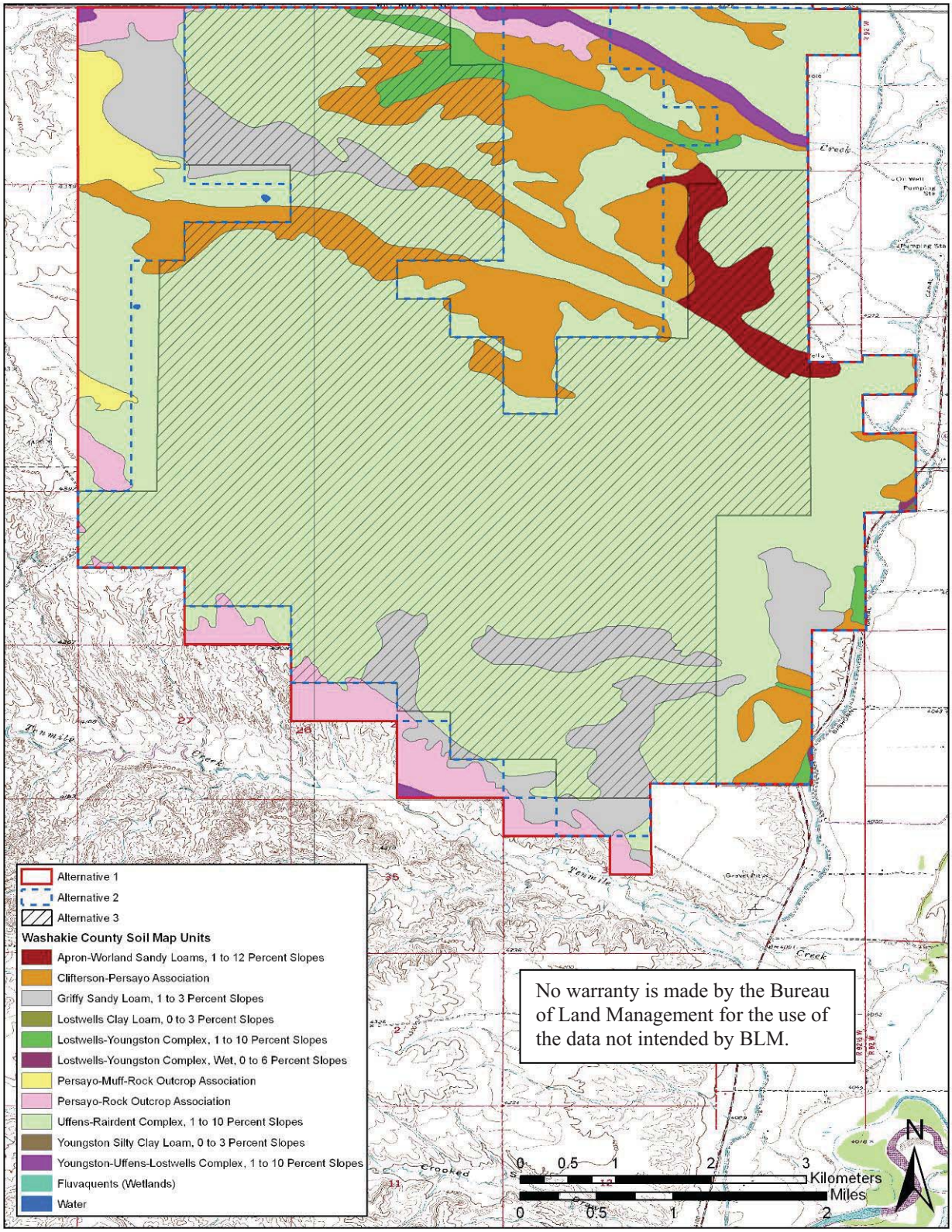
Soils on the uniform, nearly level to sloping terraces are usually deep and well drained. They have sand and/or gravel substrata underlain by shale bedrock. Lime, gypsum and salts have been leached and deposited in subsurface horizons. Limited precipitation has resulted in a relatively thin (8 to 17 inches) leaching zone. In some instances, clay layers, some high in sodium, can be within a few inches of the surface.

The most detailed soils study of the area to date was conducted by Engineering Associates (1978). Soil boring tests and soil samples were taken at 35 locations, but only 6 of these are within the presently proposed WID boundary. The samples verify adverse salinity and/or drainage capacity in soils of the Rairdent-Uffens Complex; however, actual on-site investigation is necessary to determine the exact locations and the extent of the Uffens or Rairdent Series. Although the percentages of soil series have been specified within mapped units, it must be emphasized that these are average percentages; the actual percentage of problematic soils within a smaller tract of land may be much larger.

Soil classification maps divided into Big Horn and Washakie County are based on NRCS information and provide a visualization of soil characteristics and distribution throughout the project area (Maps 3-3 and 3-4). Categorized soil reports provide soil parameters such as irrigated and non-irrigated capability class, drainage capability, permeability, water capacity, salinity, soil depth, slope, and erodibility (Appendix C).



Map 3-3. Soils in the Big Horn County Portion of the Project Area.



Map 3-4. Soils in the Washakie County Portion of the Project Area.

3.2.3 Mineral Resources

Federally owned oil and gas leases exist in the project area. Five oil wells presently exist within or very near the proposed WID boundary. Coal resources likely also underlie the area, but no evident plans exist for their exploitation. Sand and gravel deposits exist in the project area and associated exploration and development are possible, although there is not a foreseeable demand.

The project area is covered by the GCRMP. Surface-disturbing and disruptive activities associated with all types of minerals exploration and development and with geophysical exploration are subject to appropriate mitigation developed through use of the mitigation guidelines described in Appendix 3 of the GCRMP.

3.3 WATER RESOURCES

3.3.1 Surface Hydrology

The Wind River flows more than 120 miles through central Wyoming from its headwaters near the Continental Divide to the Bureau of Reclamation's Boysen Reservoir south of Thermopolis. At the "Wedding of the Waters" below the Wind River Canyon, the river becomes the Bighorn River. Flows in the Bighorn River are controlled by Boysen Dam and Reservoir. The Bighorn River below Boysen Reservoir has an average discharge of 1,387 cfs, or 1,004,000 acre-feet per year. The Bighorn River between Thermopolis and Kane (near Bighorn Lake) has a historic mean annual discharge that exceeded 1,100 cfs 90 percent of the time.

Table 3-1. Water Availability in Bighorn River between Boysen Reservoir and Bighorn Lake During a Dry Year Measured at Fifteenmile Creek.

Month	Discharge (cfs)
May	970
June	990
July	950
August	800
September	530

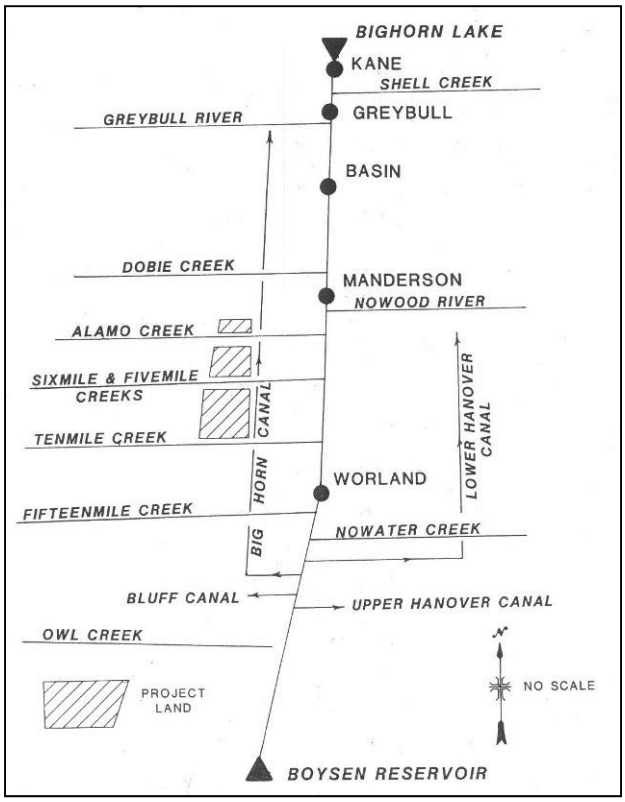


Figure 3-1. WWDC Wind/Bighorn Basin Planning Flow Model.

The WWDC Wind/Bighorn Basin Planning Flow Model provides estimates of stream flow in the Bighorn River upstream of the project area at the confluence with Fifteenmile Creek (Figure 3-1). Referencing the "Existing Conditions—Dry Year"

scenario, the model estimates the water availability during the irrigation season generally decrease through the growing (farming) season (Table 3-1). Within the Upper Bighorn River drainage below Boysen Reservoir, and above Basin, Wyoming (and exclusive of the Nowood Creek drainage above Manderson), there are 88,135 acres of presently irrigated lands. The flow volumes reported in the Basin Planning Flow Model and indicated in Table 3-1 include return flows from the irrigated lands.

The town of Basin, Wyoming diverts Bighorn River water for municipal use (State of Wyoming 1998). The WWDC Water System Survey Report for 1998 states Basin's average daily use at 300,000 gallons per day, or about 336 acre-feet per year. However, Basin must divert at least 454 acre-feet per year to compensate for leakage loss of about 35 percent.

3.3.2 Water Quality

Bighorn River water is a sodium sulfate or sodium calcium sulfate type. When the discharge of the river is large, most of the water is derived from snowmelt and rainfall and the water has a low specific conductance. When the discharge is small, a large part of the water is derived from return flow from irrigation, thermal springs, and oilfields and the specific conductance of the water is high (specific conductance (EC) is generally proportional to total dissolved solids (TDS)).

Several mineral hot springs flow into the Bighorn River around Thermopolis. These contribute approximately 20 percent of the average annual salt load between Boysen Reservoir and the Kane gauging station (above Bighorn Lake).

The effect of irrigation return flows on water quality is not readily available. Oilfields provide discharge waters to water-starved tributaries of the Bighorn River. Much of this discharged water is used to irrigate pastures within the drainage. The local landowners readily accept the net benefit of this water without regard for its substandard quality for irrigation purposes. This, combined with channel losses, results in fairly small quantities of oilfield discharges actually reaching the main stem of the Bighorn River during the irrigation season.

Water quality data from the Bighorn River at Boysen Reservoir (number 06259000) and at the Kane gauging station (number 06279500) indicates that arsenic and selenium concentrations increase markedly between the two sampling stations (Table 3-2). There is an anticipated rise in EC as a result of the influx of mineral spring waters at Thermopolis. EC ranges from 322 to 1460 µS/cm at Boysen and from 321 to 3030 µS/cm at Kane.

Table 3-2. Water Quality of Bighorn River below Boysen Reservoir and Kane Gauge Station.

Constituents (µg/l):	Below Boysen Reservoir (averages)	Sampling Period Below Boysen Reservoir	Kane Gauging Station (averages)	Sampling Period at Kane Gauging Station	Standard (µg/l)
EC (µS/cm)	713	11/24/1953-3/1/2002	938	3/16/1947-8/30/2005	(TDS=500mg/l)
Arsenic	2.1	12/13/1977 - 8/31/1992	3.9	10/1/1970-10/26/1999	50
Cadmium	1.0	12/13/1977-8/31/1992	1.0	10/1/1970-8/5/2002	10
Iron (unfiltered)	28	12/1/1953-8/21/2001	28	3/26/1947-9/15/1971	300
Iron (filtered)	51	10/20/1071-8/31/1992	47	8/29/1969-8/5/2002	300
Selenium	1.1	12/13/1977-8/31/1992	2.5	11/4/1987-10/26/1999	10

The downstream Kane gauge was upgraded to collect baseline pesticide data in October 1987 to enable accurate assessment of the actual effects of the Westside Project (USDOI, 1988). The four pesticides assessed are commonly used in crop production including two insecticides, aldicarb and carbaryl, and two herbicides dicamba and picloram. A review of the data indicates that collection of dicamba data actually began in 1984, and carbaryl and aldicarb analysis did not begin until 1996 (Table 3-3). The availability of this data provides for the possibility of assessing actual pesticide loads to the Bighorn River from Westside agricultural practices, and may serve as a means of regulating or enforcement of protective measures if toxicity levels become acute. Current measurements indicate that pesticide concentrations are at or below trace amounts. The trace amounts that occur are results of the extensive crop production that occurs along the Bighorn River.

Table 3-3. Record of Pesticide Concentrations at Kane Gauge Station.

Pesticide	Number of Samples	Average (mg/L)	First Sample Date	Last Sample Date
Aldicarb sulfone, water, filtered (0.7 micron glass fiber filter), recoverable, micrograms per liter	11	0.07	3/26/1996	7/1/1999
Aldicarb sulfoxide, water, filtered (0.7 micron glass fiber filter), recoverable, micrograms per liter	11	0.04	3/26/1996	7/1/1999
Aldicarb, water, filtered (0.7 micron glass fiber filter), recoverable, micrograms per liter	11	0.34	3/26/1996	7/1/1999
Carbaryl, water, filtered (0.7 micron glass fiber filter), recoverable, micrograms per liter	11	0.01	3/26/1996	7/1/1999

Table 3-3. Record of Pesticide Concentrations at Kane Gauge Station.

Pesticide	Number of Samples	Average (mg/L)	First Sample Date	Last Sample Date
Carbaryl, water, filtered (0.7 micron glass fiber filter), recoverable, micrograms per liter	26	0.00	3/26/1996	8/5/2002
Dicamba, water, filtered (0.7 micron glass fiber filter), recoverable, micrograms per liter	11	0.04	3/26/1996	7/1/1999
Dicamba, water, unfiltered, recoverable, micrograms per liter	34	0.03	6/20/1984	8/31/1992
Picloram, water, unfiltered, recoverable, micrograms per liter	34	0.01	6/20/1984	8/31/1992

3.3.3 Groundwater Resources

As of 2006, the Wyoming State Engineer's Office has 187 existing groundwater well permits in the 4-Township vicinity of the project area (Table 3-4). Seventy domestic or livestock water wells were located west of the Bighorn River closer to the proposed district.

Table 3-4. State Engineer's Office Groundwater Records.

	Wells in Adjoining 4-Township Area			West of Bighorn River		
Uses	# Wells	Total GPM	Avg Depth	# Wells	Total GPM	Avg Depth
Unspecified	2	18	25			
Domestic	99	1052	120	39	455	137
Domestic, Livestock	46	509	96	20	276	74
Livestock	32	361	83	11	160	77
Industrial	8	40	3374	0	0	0
TOTAL	**187**	**1980**	**244**	**70**	**891**	**110**

Existing domestic wells along the eastern boundary of the project area were sampled around 1988. Well depths range from 40-180 feet, with static water levels averaging 26 feet. Nitrate concentrations from these samples ranged from 50-141 parts per billion (ppb), selenium ranged from 4-27 ppb and iron from 241-508 ppb. Two arsenic samples were slightly above detection, at concentrations of 1 and 2 ppb. All cadmium values were below detection. Twenty-four other constituents included in the analysis were either insignificant or below detection. Historic samples were reported to have shown TDS as high as 1,590 parts per million (ppm).

3.3.4 Water Rights

Water rights in Wyoming are issued by the Wyoming State Engineer's Office through a permitting process. Priority of water rights is decided by date of application, "first in time, first in right". Water rights for surface irrigation in Wyoming are issued on the basis of 1 cfs of water per 70 acres of irrigated land. There are a total of approximately 500,000 acres of land covered by adjudicated water rights in the Bighorn River Basin in Wyoming.

The Big Horn Canal Association applied to the Wyoming State Engineer in May of 1974 for enlargement of the Big Horn Canal to divert an additional 1,114 cfs of water from the Bighorn River. In May, 1976 they then applied for the right to pump directly from the Bighorn River to the Big Horn Canal at five locations between Worland and Greybull. These five applications are for a total of 590 cfs. These applications are tabulated below:

Temporary Filing No. 21 4/329 – Priority May 3, 1974	1,114 cfs
Temporary Filing No. 22 6/173 – Priority May 12, 1976	143 cfs
Temporary Filing No. 22 1/174 – Priority May 12, 1976	160 cfs
Temporary Filing No. 22 1/174 – Priority May 12, 1976	63 cfs
Temporary Filing No. 22 3/174 – Priority May 12, 1976	138 cfs
Temporary Filing No. 22 4/174 – Priority May 12, 1976	86 cfs

These applications are still valid but have not been advanced to permit status. They are currently being held within the Wyoming State Engineers Office "Hold File" pending final determination of just what lands should be considered for irrigation. These applications would be available for the proposed WID development. It is anticipated that a small portion of these applications (83 cfs) would be advanced to permit status by the WID for use on the area identified in Alternative 1 or 2 (J. Wildman, WID President, pers. comm.).

3.4 AIR QUALITY

Total suspended particulates (TSP) are the primary air pollutant in Wyoming (USDOI 1996). Sources of TSP include windblown dust and particulates from natural sources, such as exposed topsoil, surface mines, highway and other construction sites, unpaved roads, agriculture activity, fires, and other developments. Increases in TSP concentrations occur during dry windy periods. However, conditions such as atmospheric stability, vertical air movement, and prevailing winds may lower the TSP concentrations by dispersing pollutants.

The Bighorn Basin is lacking in monitoring stations and the nearest State and Local Air Monitoring Station (SLAMS) is in Cody, which would not provide representative data for the project area. Thus there is no baseline data collected by the State (G. Meeker, WDEQ, Air Quality Division, pers. comm.). However, the Wyoming Department of Environmental Quality does maintain a database for permits approved for specific emissions. In an attempt to understand the current air quality of the region, a permit inventory query of the database was conducted to identify potential sources of emissions in close proximity to the project area. Additionally, a review of the emissions in the area would indicate the quantity of emissions that are released by industrial operations. The query resulted in the identification of five facilities in the Big Horn County and four facilities in Washakie County (Table 3-5). The facilities in Big Horn County are all in the vicinity of Lovell, Wyoming except for one near Greybull. All of the facilities in Washakie County are located in close proximity to Worland, Wyoming. These data are for 2002, as that was the most current data available and are reported as tons per year (TPY).

Table 3-5. Emissions measured from permitted facilities in Big Horn and Washakie Counties for 2002.

Facility	Carbon Monoxide (TPY)	Volatile Organic Compounds (TPY)	Nitrogen Oxides (TPY)	Primary PM10 (TPY)	Ammonia (TPY)	Sulfur Dioxide (TPY)	Total Emissions (TPY)
Big Horn County							
Big Horn Gas Plant	0.96	0.85					1.81
Greybull Plant	71.10		12.62	62.05			145.76
Lovell Compressor Station	34.99	6.01	174.59				215.60
Lovell Gypsum Plant	21.85		26.27	19.39		0.17	67.69
Lovell Plant	31.21	0.13	254.49	215.53	11,133.00	47.23	11,681.59
						Big Horn County Total	**12,112.44**
Washakie County							
Hiland Gas Plant	31.39	59.87	52.35			263.93	407.54
Worland	104.30	10.13	26.78	51.64	24.60	3.25	220.71
Worland Can Manufacturing Plant	0.29	76.91	1.36				78.55
Worland Compressor	274.43	26.03	1,164.48				1,464.95
						Washakie County Total	**2,171.75**

The area surrounding the project area is composed primarily of agriculture land and saltbush fans/flats. Air quality in the project area is typical of rural areas. Primary sources of air pollutants in the area include smoke from fires (for example, burning of agriculture fields and irrigation ditches); sulfur compounds associated with oil and gas development; and exhaust from vehicular traffic and agriculture equipment.

3.5 NOISE

Noise in the project area is typical of rural areas. Ambient noise sources are primarily associated with agriculture and livestock operations (for example, farm equipment, herding cattle), intermittent vehicular traffic on roads, seasonal construction activity, and natural sources such as wildlife, wind, or river water). The project area and the surrounding areas are rural and sparsely populated with few sources of loud noises. Ambient noise levels are likely to be between 40-50 decibles (dBA) under calm wind conditions. These noise levels are similar to those experienced in libraries or residential living rooms and are characterized as being very quiet.

3.6 BIOLOGICAL RESOURCES

3.6.1 Vegetation

Vegetation was characterized using aerial photographs, topographic maps, ground surveys, and data from the Wyoming Natural Diversity Database's (WYNDD) Gap Analysis. Ground surveys provided the most accurate description of the plant communities present at the project area and was combined with the more general coverage to create a more accurate characterization of the existing vegetation.

The approximate locations of the proposed pumping sites are within the riparian corridor of the Bighorn River (Map 3-2) and the associated pipeline will extend from the diversion points to the area proposed for agriculture following existing roadways as much as possible, but will likely travel through some irrigated cropland. According to the Wyoming Game and Fish Department (WGFD) description of the current habitat conditions for the Lower Big Horn River Corridor (WGFD 2003, website), the riparian corridor vegetation has been affected by the change in the river dynamics due to the regulation of water for the purpose of crop production in the Bighorn Basin. Flow regulation has prevented natural flooding which is necessary to provide habitat conditions for rejuvenation of native stream bank vegetation, such as cottonwood and willow. Additionally, grazing along the corridor has also limited the health and survival of young plants (WGFD 2003). The WGFD determined that these factors have contributed to the current invasion of noxious weeds within the riparian corridor including tamarisk and Russian olive. Vegetation at Diversion 1 (Map 3-2) consists of a narrow (6-8 feet wide) band of emergent vegetation, forming a fringe wetland along the steep riverbank. The bank rises approximately 10 feet above the river channel and is dominated by reed canarygrass and common reed. Patches of curly dock, beaked sedge, and snowberry are also common. An agricultural field is immediately west of Diversion 1 and adjacent the fringe wetland. A general location was provided for Diversion 2, the lower terrace along the river, which is highly variable in species composition and structure. Portions of this area are dominated by Russian olive and it has a herbaceous understory that has been heavily grazed by livestock. The remaining understory is dominated by upland pasture grasses that have also been heavily grazed. A narrow fringe of emergent vegetation occurs along the river's edge. Relatively large tracts of dense sandbar willow and tall graminoids (e.g., reed canarygrass and common reed) also dominate the river terrace at various locations. Habitats further upstream and downstream of Diversion 2 include mature stands of plains cottonwood, intermixed with willows and herbaceous vegetation.

The vegetation for the 16,050 acre parcel is dominated by saltbush fans/flats with small inclusions of irrigated crops according to the Wyoming Gap Analysis. However, during botanical surveys it was determined that the dominant plant community within the project area is more accurately described by the Wyoming big sagebrush classification (Map 3-5). There are small areas along the western edges where the Saltbush fans/flats extend into the project area (Map 3-5). The plant communities identified in Map 3-5 are described in the following paragraphs.

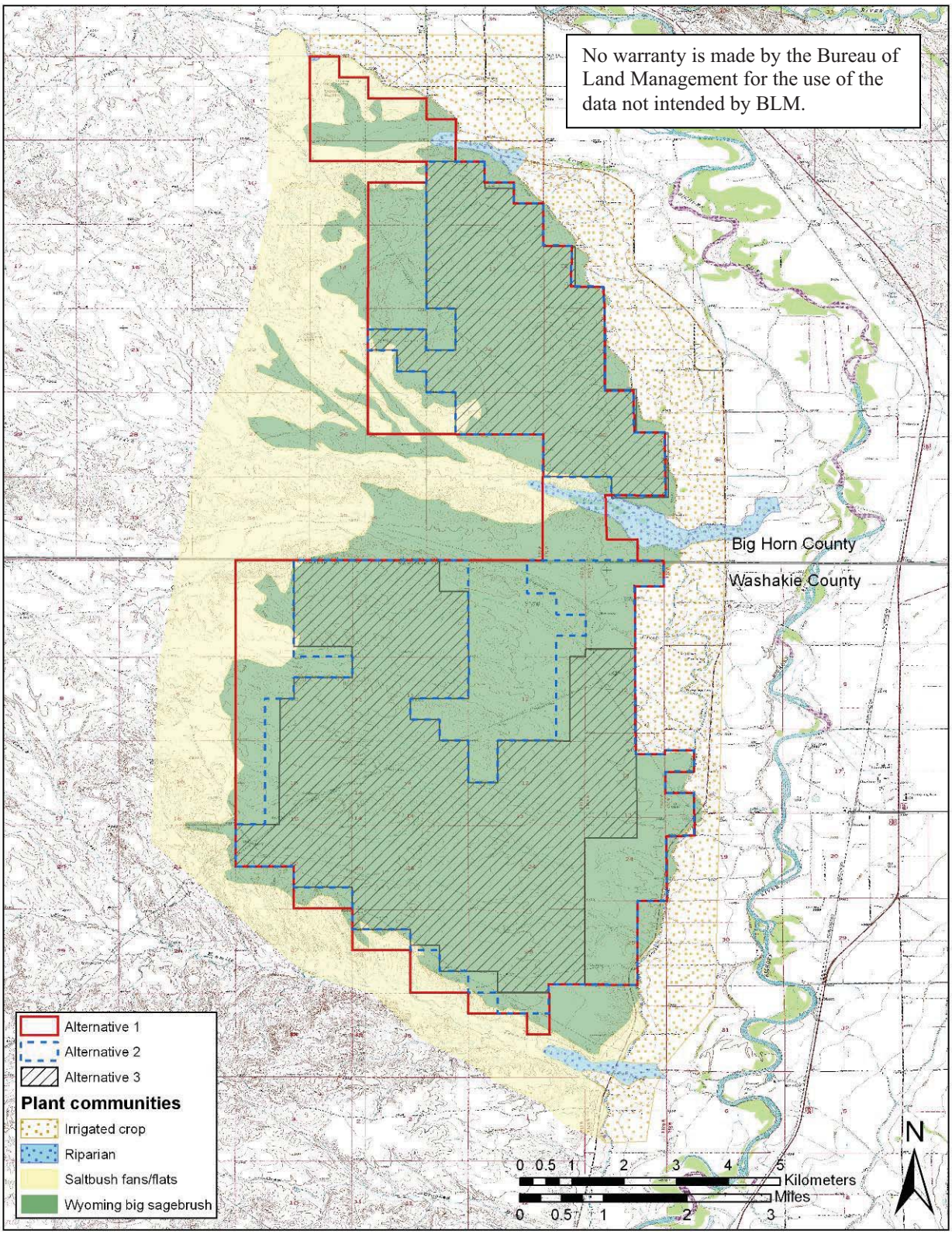
Wyoming big sagebrush. This is a shrub steppe vegetation type with *Artemisia tridentata* spp. *wyomingensis* the dominant shrub. This type is variable in Wyoming and ranges from dense, homogeneous Wyoming big sagebrush stands to sparsely vegetated arid areas where Wyoming

big sage is the dominant shrub where vegetation occurs. This land cover is found throughout most of the state at lower elevations with exception of the extreme southeast corner (Wyoming GAP Analysis 1996).

Saltbush fans/flats. The dominant plant species is *Atriplex gardneri*. These are relatively pure saltbush stands and are often sparsely vegetated with bare soil constituting most of the land surface. Grasses or other shrub species occur in this land cover but these comprise less than 25 percent of total vegetative cover. This land cover is typically found on saline flats or fans at the bottom of western and central basins but can also occur on rapidly eroding slopes of soft marine shales.

Irrigated crop. Any irrigated agricultural area is categorized as this land cover. This includes most row crops, irrigated pastureland and hayfields.

Riparian. This is a riparian zone in which tree species dominate the vegetation of the riparian corridor. Tree species occupy more than 25 percent of the vegetation cover and typically include cottonwood, aspen, box elder, or a variety of conifer species.



Map 3-5. Dominant Plant Communities in Relation to Alternative 1, 2, and 3.

3.6.2 Wildlife

Information on wildlife in the project area was obtained from multiple sources including files and information maintained by the WGFD and the BLM, the Wyoming Observation System Records (WOS) database maintained by WGFD, the Wyoming Natural Diversity Database (WYNDD), maintained at the University of Wyoming, scientific and other technical literature, and ground surveys. Field observations were made during project area visits on 23-24 February, 22 March, 26 April, 3-4 June, 15 June, 27-31 August, and 12-15 September 2005. Appendix D contains scientific names of species discussed in this text. For wildlife resources the project area was defined as the project area and the surrounding Bighorn Basin (Map 3-2). The issues identified during the scoping process were used to determine the primary focus of this section.

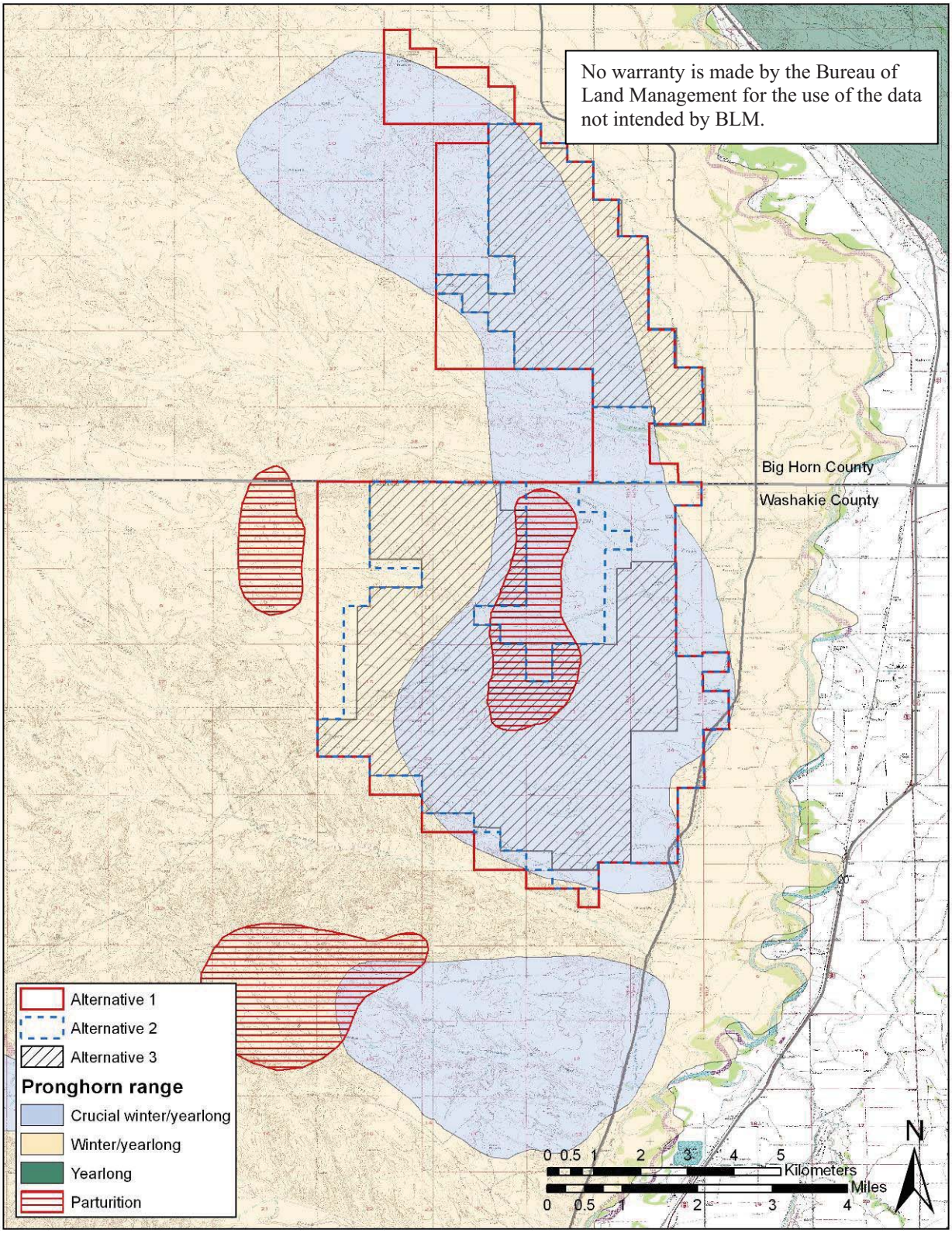
3.6.2.1 Big Game

The project area includes WGFD designated seasonal ranges for pronghorn antelope, white-tailed deer, and mule deer (Maps 3-6, 3-7, and 3-8) (WGFD 2005, 2006a, 2006b). The WGFD defines 6 types of seasonal ranges for big game (Table 3-6).

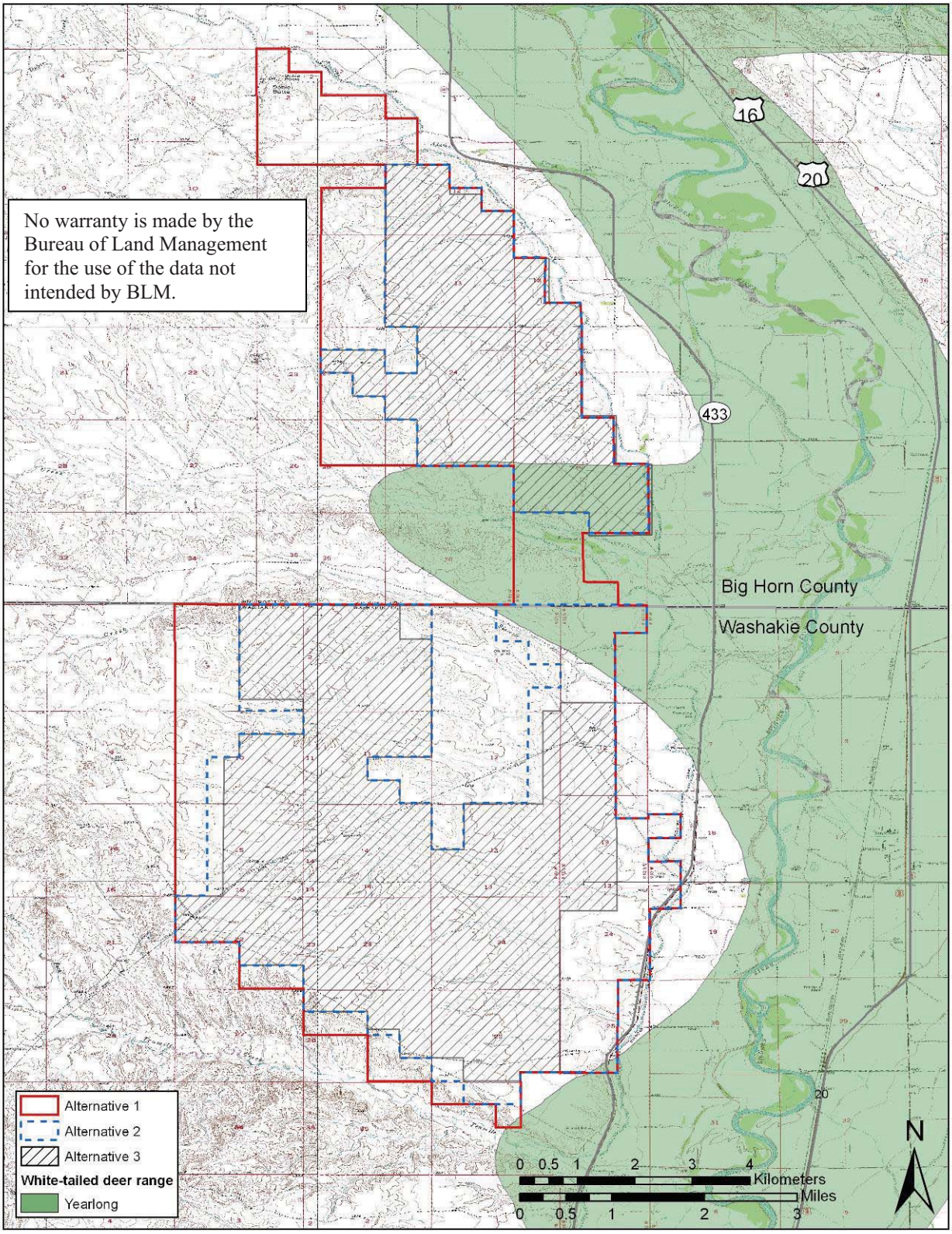
Table 3-6. Seasonal ranges for big game populations as defined by the Wyoming Game and Fish Department (WGFD 2005, 2006a, 2006b).

Range	Definition
Crucial	Crucial range is any particular range or habitat component which determines whether a population maintains and reproduces itself at or above the WGFD population objective over the long term.
Winter	A population or portion of a population uses this habitat annually in substantial numbers only during winter (12/1-4/30).
Winter/Yearlong	A portion of a population uses this habitat yearlong, but during winter there is a significant influx of animals into this area from other seasonal ranges.
Yearlong	A population or substantial portion of a population uses this habitat yearlong.
Spring/Summer/Fall	A population or portion of a population uses this habitat annually (5/1-11/30), excluding winter.
Parturition	Birthing areas commonly used by a substantial number of females from a population.

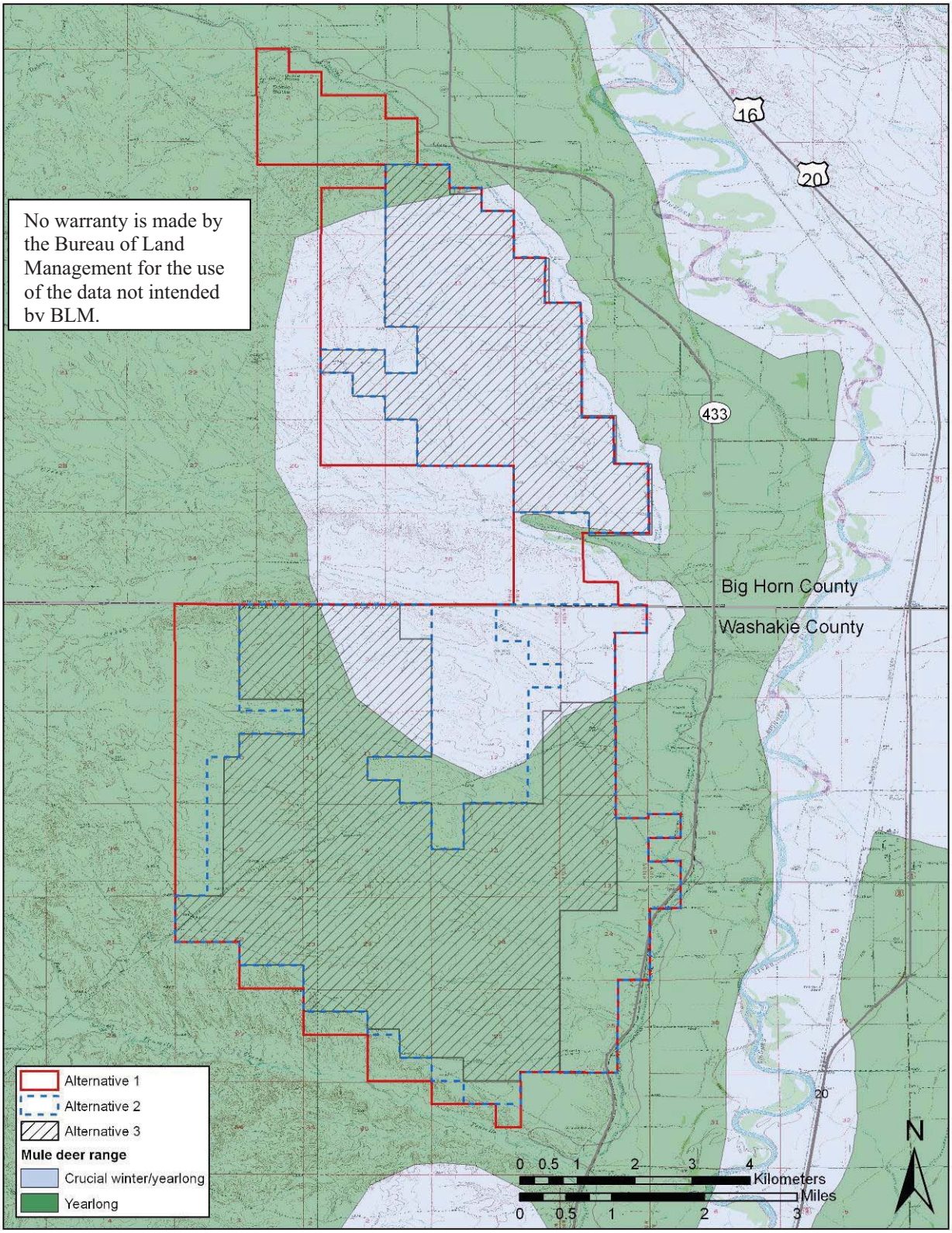
During the late 1970's and early 1980's, there were severe winters with significant snowfall in the project area. The deep snow forced pronghorn antelope to utilize the sagebrush benches in the project area during the winter. These events were the primary reason the sagebrush benches west of the Bighorn River are now mapped as crucial antelope winter range.



Map 3-6. Seasonal Ranges for Pronghorn Antelope (WGFD 2005).



Map 3-7. Seasonal Ranges for White-Tailed Deer (WGFD 2006b).



Map 3-8. Seasonal Ranges for Mule Deer (WGFD 2006a).

The project area contains areas designated as crucial pronghorn and mule deer winter range (WGFD 2005; Table 3-7). Additionally, winter and yearlong ranges for mule deer and white-tailed deer occur within the project area (Table 3-7). The WGFD manages big game species by herd units, which are large geographic regions that contain distinct (<10 percent interchange) populations. The WGFD assigns each herd unit a number (e.g., #204) and a name (e.g., Fifteen Mile). Table 3-7 identifies the size and relative amount of seasonal range for each herd unit that occurs in the project area.

Table 3-7. Big game seasonal ranges available and potentially affected by alternatives, by herd unit.

Species (Herd Unit)	Herd Unit Total Occupied Habitat (Acres)	Acres of Seasonal Range Available in Herd Unit / Acres of Seasonal Range Potentially Affected by Project		
		Crucial Winter/Yearlong	Winter/Yearlong	Yearlong
Action Alternative 1 (16,050 acres)				
Pronghorn (HU #204, Fifteen Mile)	2,019,995	241,211 / 11,374	996,491 / 4,966	177,687 / 0
Mule Deer (HU #209, Basin)	779,722	264,654 / 6,215	5,108 / 0	509,960 / 10,127
White-tailed Deer (HU #201, Bighorn Basin)	8,143,508	0 / 0	0 / 0	857,208 / 1,298
Action Alternative 2 (11,500 acres)				
Pronghorn (HU #204, Fifteen Mile)	2,019,995	241,211/8,394	996,491 / 3,177	177,687 / 0
Mule Deer (HU #209, Basin)	779,722	264,654 / 4,132	5,108 / 0	509,960 / 7,439
White-tailed Deer (HU #201, Bighorn Basin)	8,143,508	0 / 0	0 / 0	857,208 / 765
Action Alternative 3 (9,740 acres)				
Pronghorn (HU #204, Fifteen Mile)	2,019,995	241,211/6,864	996,491 /2,876	177,687 / 0
Mule Deer (HU #209, Basin)	779,722	264,654 / 4,132	5,108 / 0	509,960 / 6,209
White-tailed Deer (HU #201, Bighorn Basin)	8,143,508	0 / 0	0 / 0	857,208 / 443

The WGFD has identified 4,470 acres of parturition range for pronghorn antelope in the Bighorn Basin. The project area contains a total of 1,283 acres identified as parturition range for pronghorn antelope (Map 3-6), all of which are contained in Alternative 1. Approximately half

(651 acres) of the parturition range within the project area would be potentially affected by Alternative 2 and 3. Additionally, the WGFD identified two parturition areas in close proximity to the west and south of the project area.

3.6.2.2 Raptors

Raptor species that may occur in or around the project area based on species range maps include osprey, bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, Swainson's hawk, red-tailed hawk, ferruginous hawk, rough-legged hawk, golden eagle, American kestrel, merlin, peregrine falcon, and prairie falcon (Dorn and Dorn 1999, WGFD 2004a). Most of these raptors are documented or suspected of being breeders in the project area with the exception of sharp-shinned hawk, northern goshawk, and merlin, which are uncommon in the summer, and rough-legged hawk, which is a common winter resident (Dorn and Dorn 1999). Ferruginous hawk and northern harrier could potentially nest in the Wyoming big sagebrush type, while the rest of the species potentially nest along the Bighorn River riparian corridor. Broad-winged hawk and gyrfalcon are rare migrants and visitors to the region (Dorn and Dorn 1999). Thirteen raptor nests were sighted during 2 aerial surveys (March 22 and April 26, 2005) and incidentally during ground surveys. Of these, 3 were active buteo nests, the rest were unknown species (large nests indicating either raptors or corvids) and unknown status.

3.6.2.3 Other Mammals

The following species were recorded during field surveys; white-tailed prairie dogs, desert cottontail, and coyote. Other mammals likely common in the big sagebrush vegetation type but not recorded during project area visits include white-tailed jackrabbit, northern pocket gopher, Ord's kangaroo rat, deer mouse, prairie vole, porcupine, red fox, raccoon, bobcat and badger.

3.6.2.4 Reptiles and Amphibians

Based on range, habitat affinities, and field observations (Oakleaf et al.1992) seven species of reptiles and five species of amphibians potentially occur within the project area. Two species of lizard, northern sagebrush lizard and eastern short-horned lizard, and five species of snake, eastern yellow belly racer, pale milk snake, bull snake, wandering garter snake, and prairie rattlesnake potentially occur in the project area based on habitat and range.

The tiger salamander, plains spadefoot, Woodhouse's toad, northern leopard frog, and boreal chorus frog potentially occur in the project area based on known ranges. Most of these species, other than the plains spadefoot, would be tied to the wetlands and Bighorn River corridor due to life history requirements.

3.6.3 Aquatic Resources

3.6.3.1 Fisheries

Water from the Bighorn River is used extensively for irrigation through the use of irrigation diversion dams and numerous smaller ditch headgates (WGFD 2003, website). Irrigation dams are barriers to upstream spawning and natural dispersion of fish populations. According to the WGFD, regulation of the water flow from the Boysen Reservoir and various irrigation diversion dams has altered the natural course of the Bighorn River (WGFD 2003, website). The river has been modified to accommodate crop production through timed releases and diversions, thus

modifying the river hydrographs, timing and movements of silt loads, river depth, island formation, and bank stability (WGFD 2003, website). These changes result in the loss of meanders, side channels, and backwater habitat, reducing the available habitat for several aquatic species and those with multiple life stages.

The above described modification of the Bighorn River through regulated flows has had an impact on native fish, specifically sauger, shovelnose sturgeon, and sturgeon chub. The WGFD identifies the loss of meanders, side channels, backwaters, and slower water behind large wood debris, as potentially affecting the success of these species and especially success of juvenile fish (WGFD 2003, website). One of the few pure strains of sauger exist in the Bighorn River, but the population is small and of low density when expressed as the number of fish per mile (WGFD 2003, website). The WGFD is currently attempting to reintroduce the shovelnose sturgeon which essentially disappeared from the system (WGFD 2003, website). The sturgeon chub is rare, having not been seen for many years until 2001 (WGFD 2003, website).

Seasonal movements and habitat use of the Bighorn River by sauger between Worland and Yellowtail Reservoir were studied by WGFD during 1999-2000 (Welker et al. 2002). Sauger marked with radio transmitters or visual tags at Worland tended to move shorter distances compared to fish marked at Basin or the ML boat ramp (approximately 4 linear miles upstream of Yellowtail Reservoir). The study concluded that Yellowtail Reservoir may be important wintering habitat for sauger.

The Bighorn River between Worland and Manderson supports a diverse, warm-water game fish population. This segment of the Bighorn River is bounded by private property on both banks, and has limited public access, so very little fish population and angler return creel census data are available.

The WGFD conducted seining surveys of the Bighorn River in July-September of 2000-2002 between Worland and Greybull (WGFD 2002). They identified 20 species during surveys over a 3-year period including plains minnow and sturgeon chub (2 specimens were collected at a site downstream of the town of Basin). No western silvery minnows were detected.

To confirm if the river contained species of concern, the EIS Team conducted a fish survey in the area of the river potentially affected by the proposed action (Appendix E, WEST 2006). The study area started 3.6 river miles north of the town of Worland, Wyoming, and extended to the bridge at Manderson, including three reaches each approximately six river miles in length. The three reaches include an upstream site (upstream of proposed diversion-1, approximately half mile upstream of gravel pit), impact-2 site (between proposed diversion-1 and diversion-2), and impact-3 site (proposed diversion-2 to Manderson). The physical nature of the river was characterized as a run (water flowing swiftly, 0.5->1.5m deep), pool (eddy or deep part of the river with little or no current), side channel (generally intermediate to pool and run, with slow current), or riffle (water flowing swiftly over gravel or cobble, 0.1-0.5m deep) in accordance with Platts, et al 1983. In the study reach the river is characterized by extensive runs, with some side channels, pools, and riffles. Substrates were varied and ranged from cobbles and some boulders to deep silt. The sample period (28-31 August 2005) was during the time of year when the Bighorn River typically experiences very low flows due to irrigation withdrawals, but due to

abundant precipitation during 2005, flows were higher than in the previous 5 years (USBR 2005, website). These high flows likely made some normally occurring side channel and pool habitats unavailable.

The study was designed to detect fish species that occur in the areas that are classified by the WGFD as sensitive, including the sturgeon chub, plains minnow, and western silvery minnow. Fifteen reaches of suitable habitat and 2 areas of potential habitat were sampled during the study period. Suitable habitat for the target species is generally turbid, shallow water (<3ft [91cm]), with swift flows (~ 0.3-3 ft/sec [9-91 cm/sec]) over sand, gravel, or rock substrates, or shallow protected areas adjacent to such habitats. Each area was sampled with a 25-ft (7.6-m) bag seine; a 15-ft (4.6-m) straight seine was used when the habitat area was small or had obstructions. Mesh size for both seines was 3/16-in (7.5mm). A seine haul was initiated from the downstream end of the reach and progressed upstream. In some cases, multiple haul-outs were necessary to cover the sample area, but no backtracking downstream occurred. All fish were transferred to 5-gallon buckets filled with river water (at least four buckets were available along shoreline). Fish were processed and returned to water after 50 meters of river was seined; however, all fish were returned to the river below the sampled reach before seining the upper reach, reducing the likelihood that individuals would be recaptured.

The EIS Team identified 12 fish species between Worland and Manderson (WEST 2006; Table 3-8), including sauger, which was not detected by WGFD in their 2000-2002 surveys. No sturgeon chub, plains minnow, or western silvery minnow were detected by the EIS Team.

Table 3-8. List of Fish Species Caught by Seining in the Bighorn River 28-31 August 2005.

Common Name	Scientific Name	Habitat
River carp sucker	*Carpiodes carpio*	Pool/Side Channel
Fathead minnow	*Pimephales promelas*	Pool/Side Channel
Sand shiner	*Notropis stramineus*	Pool/Side Channel, Riffle
Channel catfish	*Ictalurus punctatus*	Pool/Side Channel
Yellow perch	*Perca flavescens*	Pool/Side Channel
White sucker	*Catostomus commersoni*	Pool/Side Channel
Longnose dace	*Rhinichthys cararactae*	Riffle
Flathead chub	*Platygobio gracilis*	Pool/Side Channel
Common shiner	*Notropis cornuta*	Pool/Side Channel
Shorthead redhorse	*Moxostoma macrolepidotum*	Pool/Side Channel, Riffle
Sauger	*Stizostedion canadense*	Pool/Side Channel
Common carp	*Carassius carassius*	Pool/Side Channel
Unidentified minnow		Pool/Side Channel, Riffle

Another species that is of interest is the burbot, a freshwater codfish that is native to the Bighorn-Wind, Tongue, and Powder River drainages. The burbot has been illegally introduced to other drainages in Wyoming, namely the Green River drainage. This species is adapted for cold water, occupies riverine and standing water, avoids waters above approximately 55^{o}F, and is most abundant in native lakes and reservoirs, including Boysen Reservoir. The burbot is most active in the late-fall and early spring, therefore it is typically not detected by normal fish population

sampling techniques. The WGFD has initiated a study to gain more information regarding the population of this species throughout the state (WGFD 2007, website).

3.6.3.2 Invertebrate Community

Little data are available on benthic macroinvertebrate species in the Bighorn River. During the seining surveys conducted by the EIS Team, invertebrates were noted on overturned rocks and in the nets. Larvae of Hydropsychids (caddisfly sp.), Baetids (mayfly sp.), and Libellulids (dragonfly sp.) were abundant.

3.6.4 Wetlands

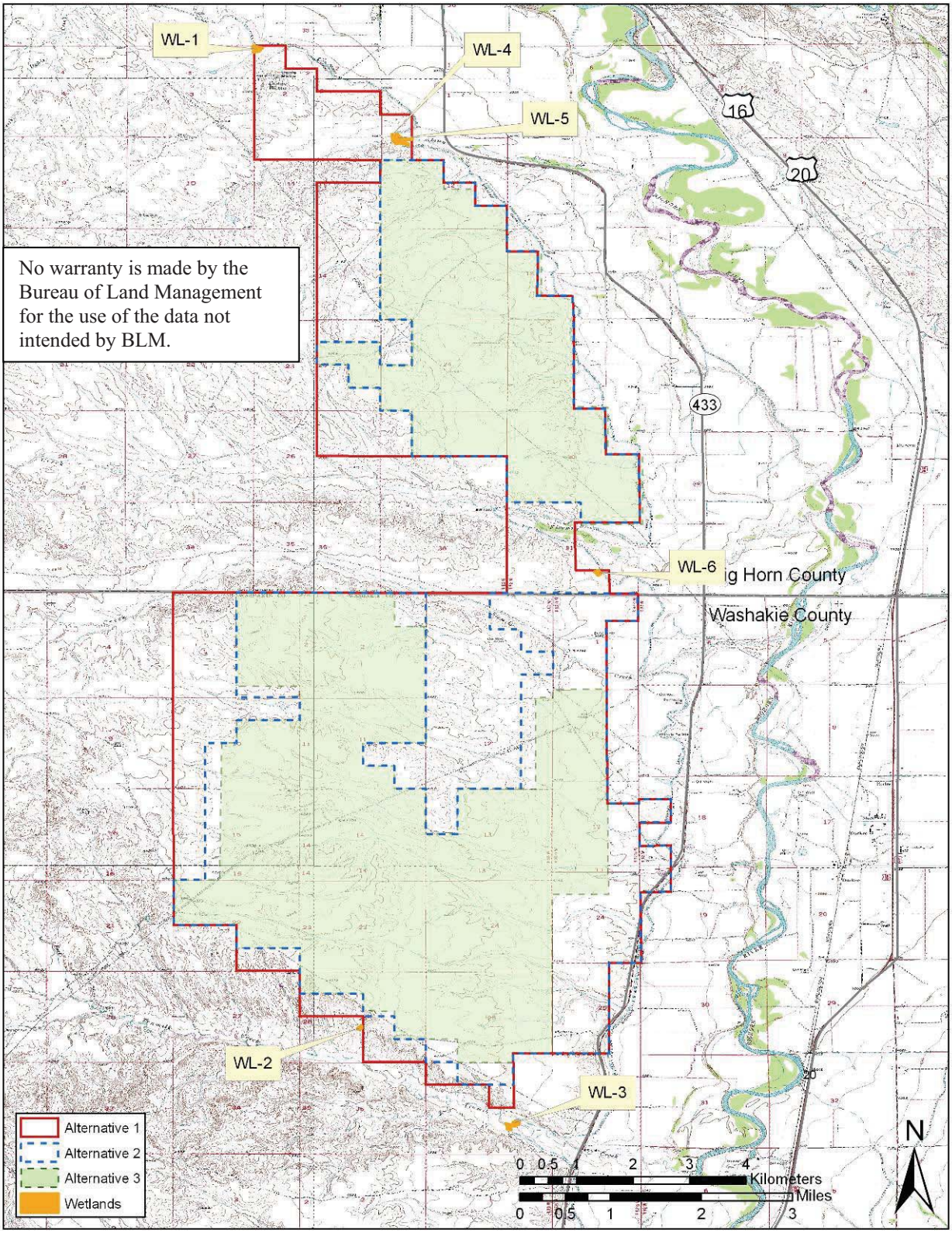
Wetlands are protected under the CWA as special aquatic sites. These areas have important functional values for wildlife and in the maintenance of a healthy riparian ecosystem. Wetlands provide resting, feeding, nesting, and brooding habitat for a variety of fish and wildlife, function in water quality enhancement by filtering pollutants and sediments from runoff, provide protection from erosion, and store flood waters.

National Wetland Inventory maps identify few wetlands within the land to be conveyed. Scattered stockponds form some palustrine wetland habitat in the area. The majority of wetland habitat in the project area is associated with the portion of the Big Horn Canal around Fivemile Creek. Seepage and diversions along the Big Horn Canal support cottonwoods, willows, and shrub-scrub wetland vegetation.

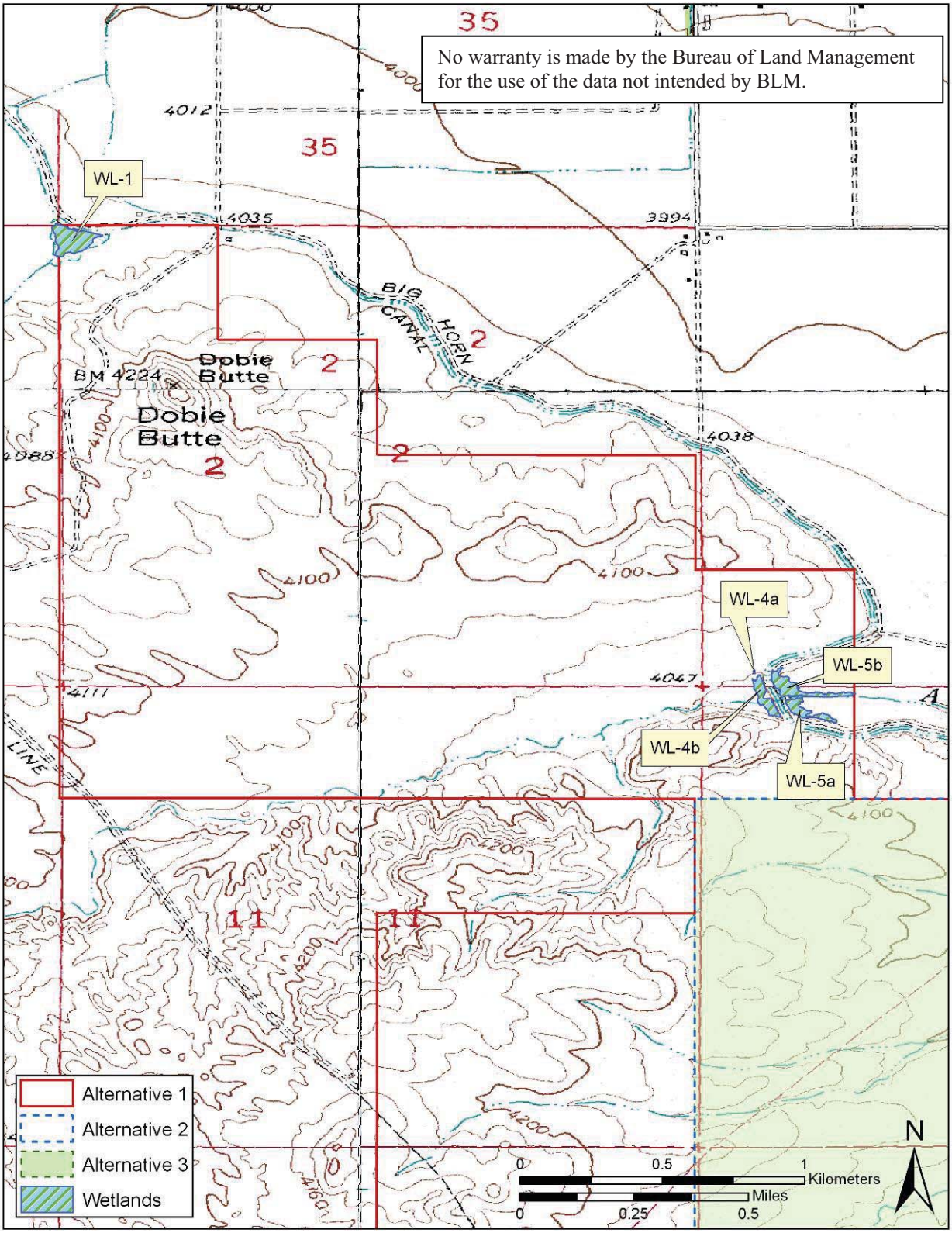
A survey of vegetation and wetland habitats was conducted September 12-15, 2005 throughout the project area and the drainage immediately south of the project area and resulted in the identification and delineation of 7.57 acres of wetlands (Table 3-9, Maps 3-9, 3-10, 3-11, and 3-12) (Appendix F, WEST 2005). All but one of the wetlands identified within the project area were in the immediate vicinity of, and associated with, the Big Horn Canal. An isolated shrub-scrub wetland, dominated by small plains cottonwoods (*Populus deltoides*), whiplash willow (*Salix lasiandra*), and broadleaf cattail (*Typha latifolia*), occurred within an impoundment on a tributary to Tenmile Creek, along the southern boundary of the project area (WL-3d), and is outside of the project area. This area was surveyed as the map of the project area utilized during the wetland survey contained an additional piece that extended past the current southern boundary. Wetland number WL-2d is located on the boundary of the project area and is being counted as being within the project area, based on its close proximity. Therefore, only 6.16 acres of wetlands are considered within the project area. The diversion points were not delineated for wetlands as exact location and access were not available, but generally both diversion points have narrow fringe wetlands along the river's edge.

Table 3-9. Wetlands Identified in the Project Area.

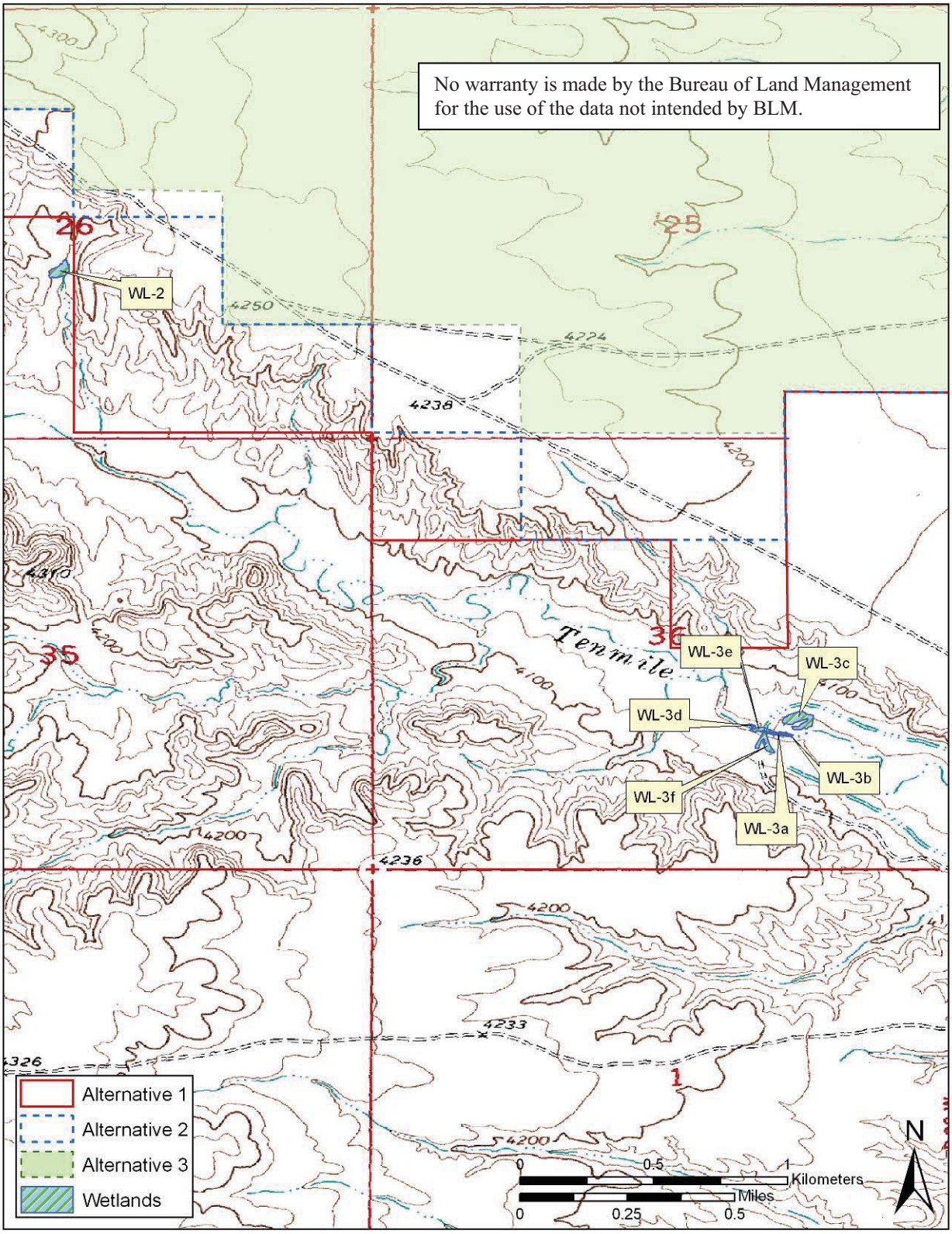
Wetland Type	Vegetation	Hydrology	Wetland Number	Size (acres)
Palustrine forested	Tree-dominated (forested) wetland: Russian olive, whiplash willow; features emergent vegetation in understory and in small, open patches	Associated with: seepage from levee, high water table, and/or located along drainage channel	4b	0.85
Palustrine scrub-shrub	Shrub-dominated wetland: plains cottonwood (saplings), whiplash willow, sandbar willow, tamarisk, prickly rose; features emergent vegetation in understory and in small, open patches	Associated with: seepage from levee, high water table, and/or located along drainage channel	2 3a 3b 3e 5a 5b	0.52 0.06 0.06 0.1 0.81 1.36 Total = 2.91
Palustrine emergent	Wetland dominated by emergent herbaceous vegetation (includes wet meadow, fringe wetland, and shallow marsh): slender wheatgrass, creeping bentgrass, meadow foxtail, beaked sedge, foxtail barley, Baltic rush, reed canarygrass, curly dock, common threesquare, sofstem bulrush, broadleaf cattail	Associated with: seepage from levee, high water table, and/or located along drainage channel	1 3c 3d 3f 4a 6	1.94 0.82 0.02 0.35 0.01 0.67 Total = 3.81



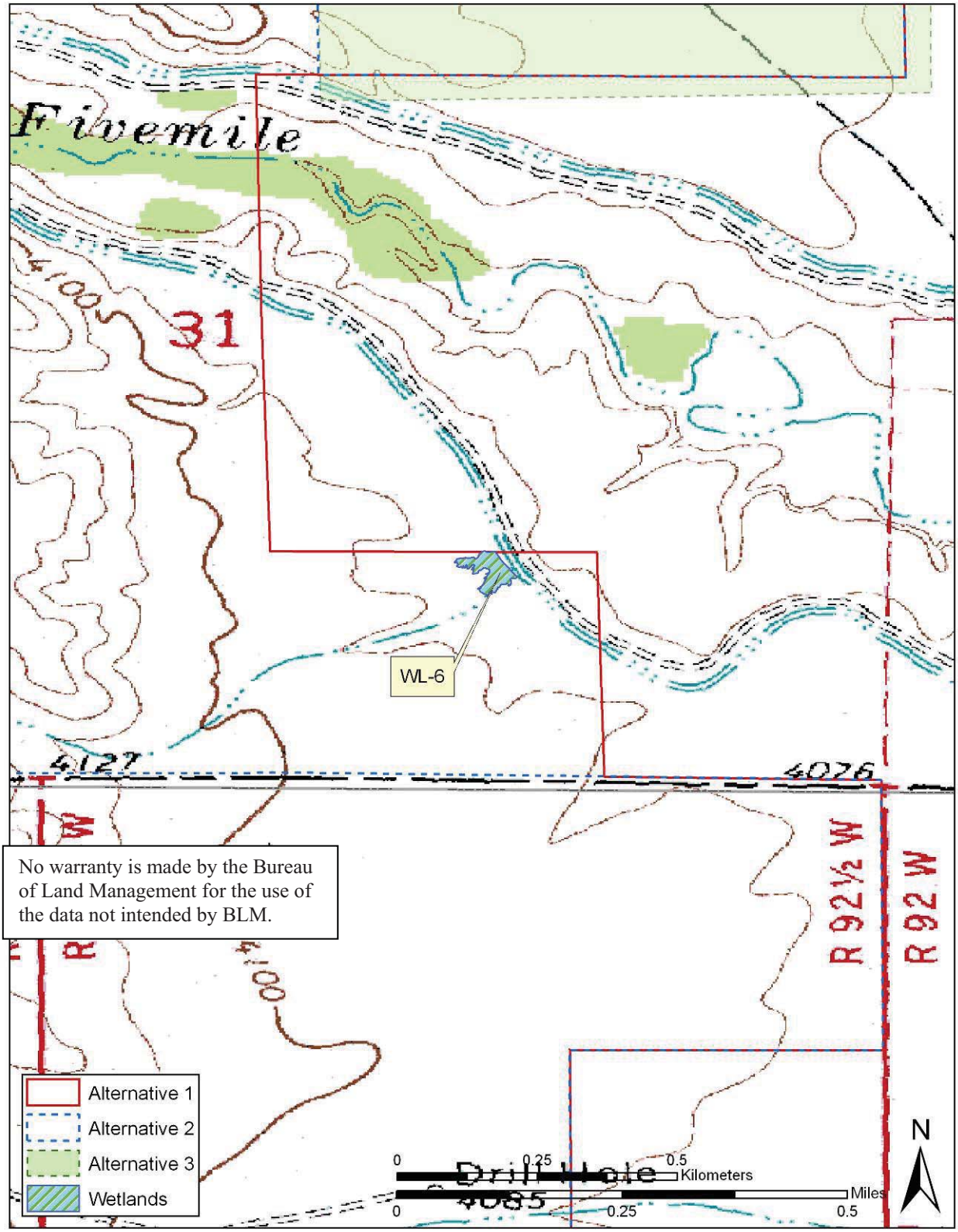
Map 3-9. Wetlands Identified during Survey Efforts.



Map 3-10. Location of Wetlands 1, 4, and 5.



Map 3-11. Location of Wetlands 2 and 3.



Map 3-12. Location of Wetland 6.

3.6.5 Special Status Species

Based on the results of the scoping process special status species determined important for analysis in the EIS process included federally protected species listed under the Endangered Species Act (ESA), migratory birds protected under the Migratory Bird Treaty Act (MBTA), and BLM sensitive species.

3.6.5.1 USFWS Threatened, Endangered, Species

The United States Fish and Wildlife Service (USFWS) provided a list of species that are provided protection through the ESA and are potentially occurring in the project area, including two threatened and one endangered species (Table 3-10). The greater sage-grouse was also included in this category because the USFWS considers this species as sensitive and has received several petitions to list the greater sage-grouse under the ESA.

Table 3-10. Federally Protected Species Potentially Occurring in the Project Area.

Species	Status
Black-footed ferret *(Mustela nigripes)*	Endangered
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	Threatened
Greater sage-grouse (*Centrocerrcus urophasianus*)	Sensitive

3.6.5.1.1 Black-Footed Ferret

The black-footed ferret is a federally listed endangered species that was historically distributed across the western plains of North America wherever prairie dogs occurred (Anderson et al. 1986). Black-footed ferrets are very specialized in their habitat requirements and are dependent on prairie dog colonies for survival (Biggins et al. 1985). Prairie dogs compose more than 90 percent of black-footed ferret diets (Campbell et al. 1987). Because of large-scale reductions in prairie dog populations, black-footed ferrets were nearly extirpated by the 1980s. Recovery and reintroduction programs have established at least six experimental populations in seven states throughout the west.

White-tailed prairie dogs have been reported in the WOS database and WYNDD. Even though the project area falls within an area that has been block-cleared of the need for black-footed ferret surveys, the EIS Team conducted surveys on February 23, May 18, and June 3 and 15, 2005 to locate prairie dog colonies. Four relatively small white-tailed prairie dog colonies were located in or near the project area (Map 3-13). These colonies qualify as a complex based on guidelines set forth by the USFWS (USFWS 1989) as they are within 7 km of each other.

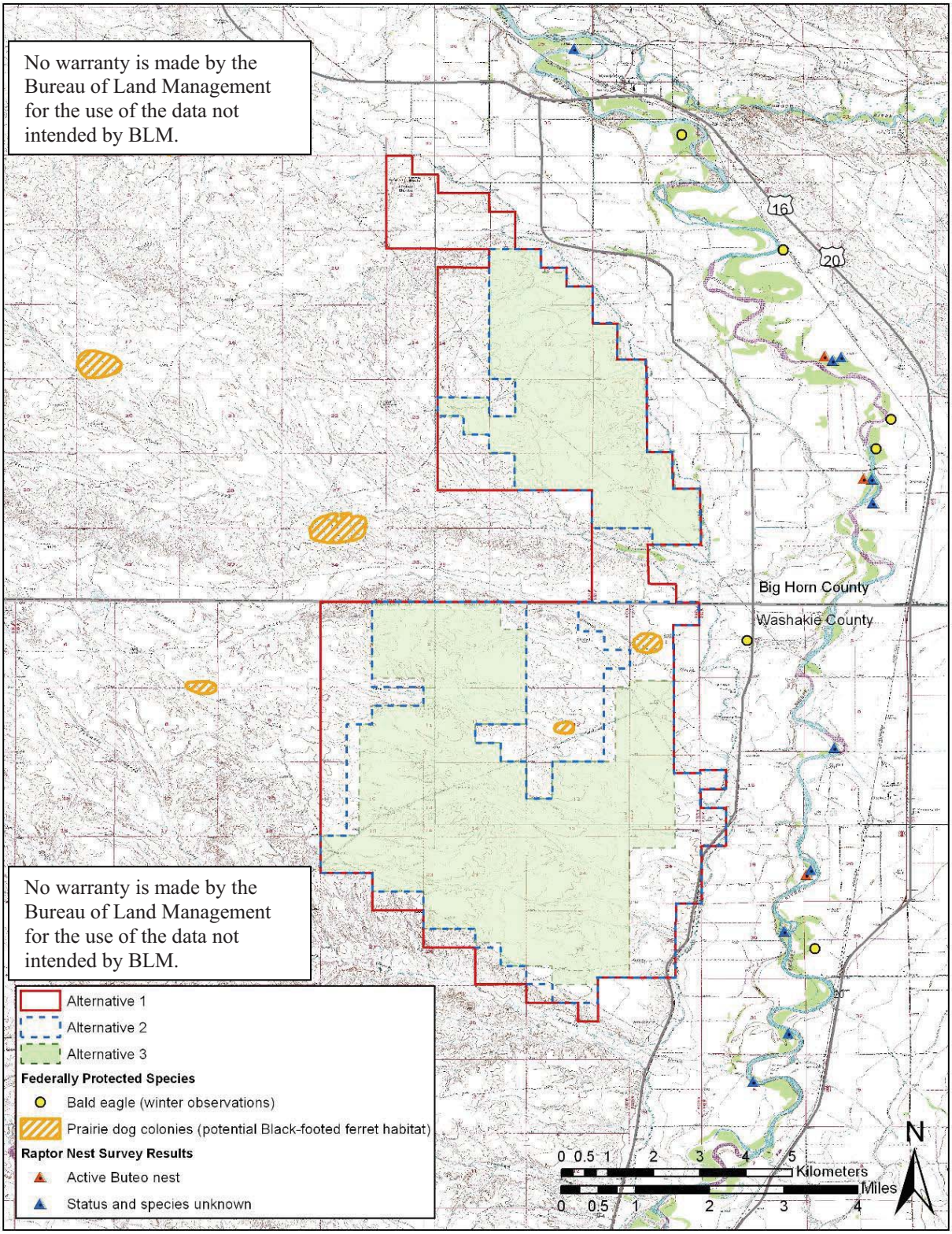
3.6.5.1.2 Ute Ladies'-Tresses

The Ute ladies'-tresses is a perennial orchid that is a wetland obligate. Flowering season is from early August to early September (Fertig 2000), although individual plants may not flower every year with only the underground parts persisting in association with micorhizal fungi (Fertig 2000). Ute ladies'-tresses are found in the Intermountain and Rocky Mountain west in the elevation range of 4300-7000 ft (USFWS 1995). In Wyoming, the orchid has been documented in Converse, Goshen, Laramie, and Niobrara Counties. Threats to Ute ladies'-tresses include

competition with exotic species, trampling and soil compaction by livestock and recreation, herbicides and pesticides, and loss of habitat due to urbanization and anthropogenic changes in wetland hydrology (USFWS 1995, Fertig 2000).

In Wyoming, Ute ladies'-tresses grow in wet meadows, open marshes, and early successional riparian habitats associated with perennial streams. Some individuals have been found in agricultural landscapes, typically wet areas used for grazing or haying. This orchid grows in association with low grasses and forbs and does not tolerate tall surrounding vegetation or shade (USFWS 1995).

The EIS Team conducted surveys on September 12-15, 2005 for Ute ladies'-tresses within or near the project area (WEST 2005). No individuals were located and the wetlands identified provide marginal habitat for Ute ladies'-tresses as they are 1,000 feet below the known elevation range of the species.



Map 3-13. Black-Footed Ferret Habitat and Raptor Nest Locations Identified during Survey Efforts.

3.6.5.2 Migratory Birds

The Bighorn River corridor may be important for some migrants such as waterfowl, shorebirds, or other waterbirds, or migrating passerines. The number of avian species in the area is expected to be greatest during spring and fall migration periods. Several species are likely to spend the winter in the project areas, having moved from higher elevations in the mountains or more northern latitudes.

Migratory birds are protected under the MBTA, which prohibits the taking of any migratory birds, their parts, nests, or eggs, except as permitted by regulations. With the exception of sage-grouse, the BLM sensitive species of birds (Table 3-11) are protected under the MBTA.

Table 3-11. WYNDD and WOS Database Records for BLM Sensitive Species.

Species	Habitat	Database Search Results*		
		WYNDD	WOS	Project Area
Mammals				
Long-eared myotis *Myotis evotis*	Conifer and deciduous forests, caves and mines	X		Potential Resident
Townsend's Big-eared Bat *Corynorhinus townsendii*	Forests, basin-prairie shrub, caves and mines			Potential Resident
Spotted Bat *Euderma maculatum*	Low deserts to coniferous forests; cliffs over perennial water			Potential Resident
White-tailed prairie dog *Cynomys leucurus*	Basin-prairie shrub, grasslands	X	X	Potential Resident
Birds				
White-faced ibis *Plegadis chihi*	Marshes, wet meadows			Potential Migrant
Trumpeter swan *Cygnus buccinator*	Lakes, ponds, rivers			Potential Migrant
Northern goshawk *Accipiter gentilis*	Conifer and deciduous forests			Potential Migrant
Ferruginous hawk *Buteo regalis*	Basin-prairie shrub, grassland, rock outcrops	X		Potential Resident
Peregrine falcon *Falco peregrinus*	Tall cliffs			Potential Migrant
Greater sage-grouse *Centrocercus urophasianus*	Basin-prairie shrub, mountain-foothill shrub	X	X	Potential Resident
Long-billed curlew *Numenius americanus*	Grasslands, plains, foothills, wet meadows		X	Potential Migrant
Yellow-billed cuckoo *Coccyzus americanus*	Open woodlands, streamside willow and alder groves	X		Potential Migrant
Burrowing owl *Athene cunicularia*	Grasslands, basin-prairie shrub	X		Potential Resident
Sage thrasher *Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothill shrub	X	X	Potential Resident

Table 3-11. WYNDD and WOS Database Records for BLM Sensitive Species.

Species	Habitat	Database Search Results*		
		WYNDD	WOS	Project Area
Loggerhead shrike *Lanius ludovicianus*	Basin-prairie shrub, mountain-foothill shrub	X	X	Potential Resident
Brewer's sparrow *Spizella breweri*	Basin-prairie shrub	X	X	Potential Resident
Sage sparrow *Amphispiza belli*	Basin-prairie shrub, mountain-foothill shrub	X	X	Potential Resident
Baird's sparrow *Ammodramus bairdii*	Grasslands, weedy fields			Potential Migrant
Amphibians				
Northern leopard frog *Rana pipiens*	Beaver ponds, permanent water in plains and foothills			Potential Resident
Fish				
Yellowstone cutthroat trout *Oncorhynchus clarki bouvieri*	Yellowstone drainage, small mountain streams and large rivers			Does not occur in Project Area

* Request area for WOS and WYNDD data was T48-49N R92-93W in Big Horn and Washakie Counties, Wyoming. WYNDD included results in this area plus a 4-mi buffer; WOS included this area plus a buffer of varying widths up to 5.7 mi.

Another migratory bird of concern, mountain plover (*Charadrius montanus*) was previously proposed for listing under the ESA; however, the USFWS found that the threats to the species were not as great as previously believed and withdrew the species from consideration. Mountain plovers utilize sparsely vegetated flat habitat types for nesting including; sparsely vegetated grasslands or shortgrass prairie, mixed grassland shrub-steppe plains, alkali flats, agricultural or cultivated lands, and prairie dog towns. The project area may be considered suitable habitat and during field investigations conducted by WEST, Inc. one individual was sighted northwest of the project area.

Golden eagles (*Aquila chrysaetos*) and bald eagles are provided protection under the Bald and Golden Eagle Protection Act (BGEPA). Bald eagles are discussed in Section 3.6.5.1.1 as they are listed by the USFWS as a threatened species. Golden eagles are considered year round residents in Wyoming and occur in most habitats throughout the state (WFGD 2004b). Golden eagles forage for small and medium sized mammals in open areas and nest in trees or cliffs and are considered common in Wyoming (WGFD 2004b). The project area may be considered suitable habitat, however no individuals were located during field investigations. Bald eagles historically occurred over most of North America in a variety of landscapes. Generally, they require areas in proximity to water for nesting, and during winter, areas with readily available, abundant food sources (fish, carrion, or waterfowl) and secure roost sites. Roosts are generally old, large trees with good visibility and little human disturbance. In Wyoming, bald eagles are listed as an uncommon resident, and usually occur in coniferous forests and cottonwood/riparian plant communities in the northwestern portion of the state. In the winter, the population of bald eagles

in Wyoming increases due to an influx of migrants from the north. Currently, it is estimated that more than 100 pairs of bald eagles nest in Wyoming, with the majority of these occurring in Yellowstone and Grand Teton National Parks and along the major river drainages in the state.

Records of wintering bald eagles are common in the project area (WGFD 2004a). Of 43 bald eagle observations recorded by WOS (2004a), 37 of those were during December and January. BLM personnel confirm that bald eagles use the Bighorn River near the project area for winter roosting, and numerous roosting birds were observed during a site visit in February 2005. No bald eagle nests were found along the Bighorn River during a raptor nest survey conducted on March 22 and April 26, 2005 (Map 3-13).

3.6.5.3 BLM Sensitive Species

The BLM monitors a list of sensitive species with the goals of maintaining the components of functional ecosystems, ensuring sensitive species consideration in land management decisions, preventing species from needing to be listed under the ESA, and emphasizing habitat conservation. The EIS Team conducted a database search of the WYDD, which is part of the Natural Heritage Program, and the WOS, maintained by the WGFD, to identify BLM monitored species that potentially may occur in the project area. The requested area used for the database searches was T48 to 49N R92 to R93W; however each database provides a buffer to a requested area. The WYNDD placed a 4-mile buffer around the requested area, while the WOS provided a varying buffer up to approximately 5.7 miles. The database searches located twenty BLM sensitive species that potentially occur within the requested area of which eleven species have been documented within the requested area. During field investigations, four of the twenty species were documented, including white-tailed prairie dog, sage thrasher, Brewer's sparrow and sage sparrow. Additionally, one species, the burrowing owl, was observed approximately 2 miles west of the project area during field investigations. Based on the high mobility of birds and bats it is likely that these species utilize the project area.

The USFWS has received several petitions to list the greater sage-grouse (*Centrocerrcus urophasianus*) under the ESA and considers it a sensitive species. The causes of the range-wide decline in sage-grouse are not completely understood and may be influenced by local conditions. However, habitat loss and degradation, disease and loss of population connectively are considered important factors (Schroeder et al. 1999). Greater sage-grouse are dependent on sagebrush habitats year-round.

On March 23, 2010, the USFWS listed the greater sage-grouse as candidate pursuant to the ESA (50 Code of Federal Regulations Part 17). The sage-grouse will remain a candidate species until it is either removed from candidate status because listing is no longer warranted or when a proposed listing regulation is published (USFWS et al. 2010).

In June 2010 Governor Dave Freudenthal's Wyoming Sage-grouse Implementation Team (with assistance from local working groups) released a report on the following tasks: (1) reassess the Core Population Area maps in light of the most current biological and development information, (2) address the issue of connectivity between populations of geographic importance, (3) recommend a procedure and guidelines for development within Core Population Areas and non-Core Population Areas, and (4) consider needs for research, inventory, and habitat

protection. The Westside project area is not within the Core area, and is approximately 10 miles north of the closest Core area polygon.

The Bighorn Basin Sage-grouse Local Working Group (BHBLWG) (established by Wyoming Game and Fish) is currently using a collaborative *Sage-grouse Conservation Plan for the Bighorn Basin, Wyoming,* which was developed to provide direction for conserving sage-grouse populations and habitats in Wyoming's Bighorn Basin, while including socioeconomic and human use of sage-grouse habitat.

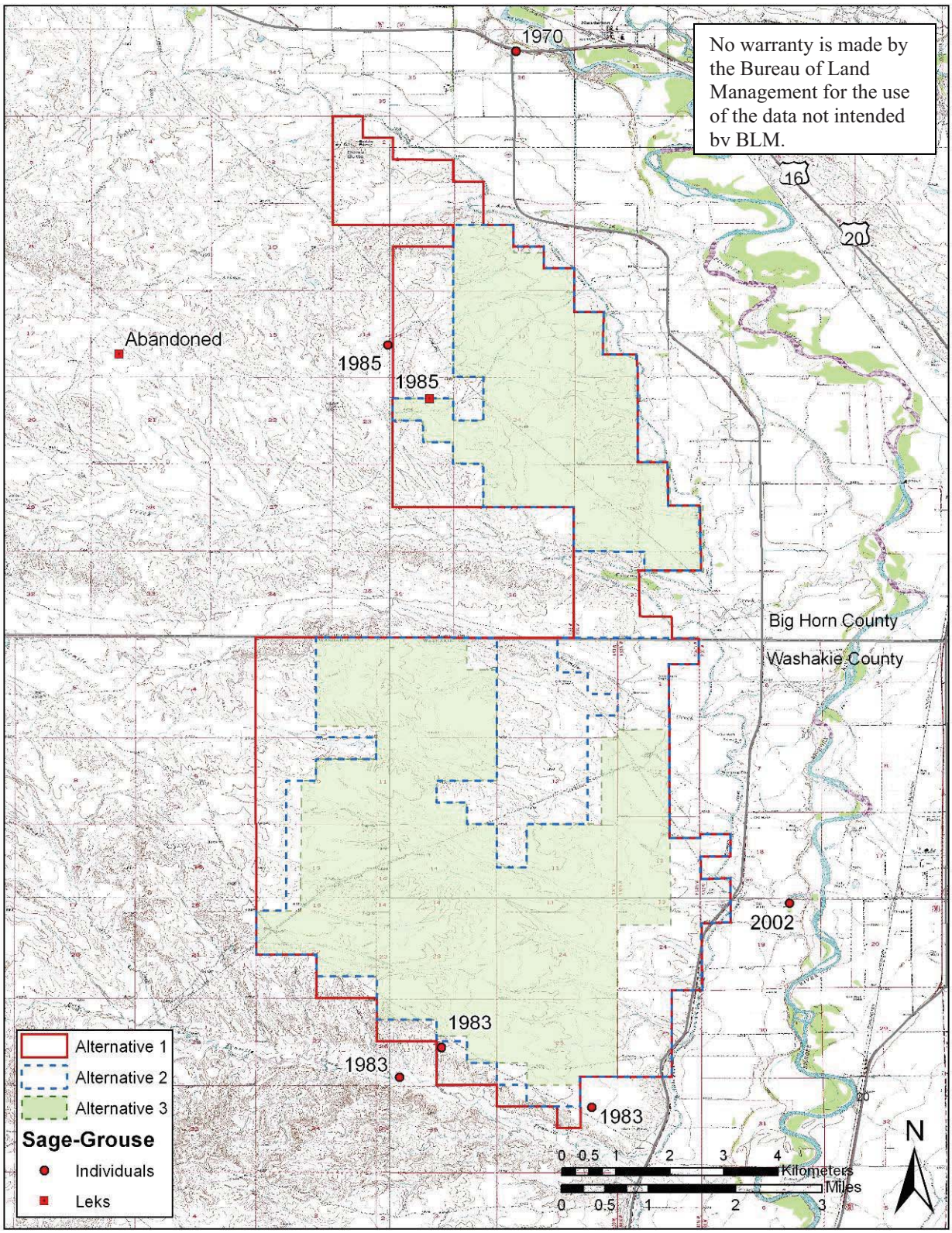
The EIS Team conducted aerial surveys for sage-grouse leks on March 22 and April 26, 2005 with no individuals or leks located during survey efforts. The BLM have conducted aerial and ground surveys for both winter sage-grouse concentrations and breeding habitat (leks) periodically since the late 1970s and more intensively within the last 5 years. There have been no significant findings. The sagebrush vegetation within the project area is generally sparse with little herbaceous ground cover, and sagebrush canopy cover generally less than 10%. Typically, wintering sage-grouse prefer a canopy cover of sagebrush greater than 10%, and greater than 15% for nesting habitat. Some studies have shown that the majority of sage-grouse generally nest within 2-3 miles of a lek, although this is variable depending on migratory status of a sage-grouse population. Therefore, it is possible that sage-grouse may nest within the project area if a lek occurs within a few miles to the west. Due to the poor nesting habitat available, it is expected that sage-grouse would not utilize the project area because the sagebrush is too sparse. A historic abandoned lek has been recorded by the WGFD to the northwest of the project area. There are three WOS records from 1983 of individual birds on the southern end of the project area, one of which is within the Alternative 1 boundary. Additionally, there are two records from 1985, one of an individual bird along the northwestern edge of the project area, which is on the boundary of Alternative 1 and the other of a lek within Alternative 2 and 3 (Map 3-14). The most recent sighting of sage-grouse recorded in this area was east of the project area in 2002.

One BLM sensitive plant species, persistent sepal yellowcress, potentially occurs in the project area along wetlands or the Bighorn River corridor. Persistent sepal yellowcress formerly had Federal Status as a Category 2 (C2) species, defined as taxa for which current information indicates that proposing to list as endangered or threatened is possible, but more biological information is needed. Persistent sepal yellowcress is currently considered a sensitive species by the BLM in Wyoming (Worland and Rawlins Field offices). Survey efforts by the EIS Team (Appendix G) to determine the presence of this species did not result in locating any individuals.

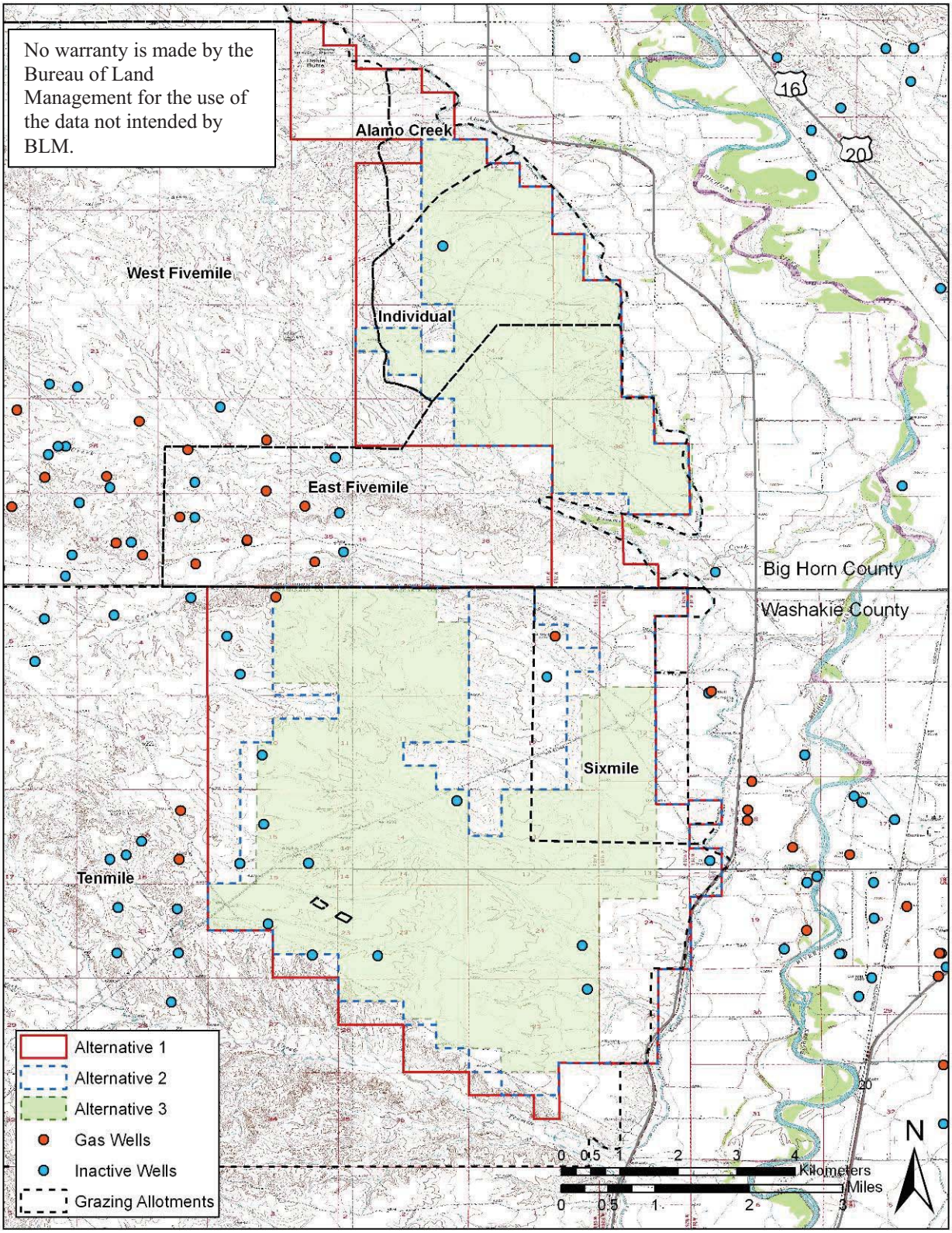
3.7 LAND USE

The project area is located primarily in the Grass Creek Resource Planning Area (GCRPA) of the Worland office of the BLM, which encompasses 968,000 acres of public land surface. The Wyoming BLM manages these lands in adherence to their mission statement; which is to sustain the health, diversity and productivity of public lands for use and enjoyment of present and future generations. The primary use by the public of the lands in the project area is pronghorn antelope, deer, and upland bird hunting, and off road vehicle use. Refer to Section 3.10 for additional information regarding recreational use.

Economic uses of the parcel include grazing and oil and gas production (Map 3-15). Currently, there are six grazing allotments that extend onto the land proposed for conveyance: Alamo Creek, Buchanan, West Fivemile, East Fivemile, Sixmile, and Tenmile. These grazing allotments represent 1099 animal units per month (AUM) potentially affected. Additionally, there are three producing wells and associated pipeline rights-of-ways (ROW) on the land proposed for sale.



Map 3-14. WGFD and WOS Records of Sage-Grouse in Relation to the Project Area.



Map 3-15. Economic Uses of the Project Area.

3.8 SOCIOECONOMICS

The project area, for purposes of describing socioeconomic conditions, is assumed to be Big Horn and Washakie Counties. Socioeconomic issues of importance identified during scoping deal primarily with the financial viability of the project and its impact on the local economy. The description of the affected socioeconomic environment was developed using these issues as guidelines. There is no meaningful distinction among the alternatives with respect to the affected socioeconomic environment, and the descriptions that follow are not distinguished by project alternative.

3.8.1 Population

The project is located in Big Horn and Washakie Counties in Wyoming. This two-county area is sparsely populated, even by Wyoming standards. Big Horn County has an estimated population of 11,333, or an average of 3.6 persons per square mile. Washakie County has an estimated population of 7,933, or an average of 3.5 persons per square mile. The equivalent figures for the State of Wyoming are 509,300 persons and 5.2 persons per square mile. Only four communities in the area have populations over 1,000 persons. The largest community is Worland, with population of about 5,000. The other larger communities are Lovell (2,300), Greybull (1,800), and Basin (1,200). (State of Wyoming 2006a, website)

Historical population data show that the area has experienced only modest population growth over the past 35 years, with Big Horn County's population increasing 11.1 percent during that period and Washakie County's population increasing 4.8 percent (Table 3-12). This small amount of growth has occurred primarily in smaller communities and rural areas. Basin is the only community of 1,000 or more that experienced population growth over the past 35 years. The other larger communities in the area experienced modest population declines during that period. (State of Wyoming 2006a, website)

Table 3-12. Historic Population Data.

Area Name	1970	1980	1990	2000	2005	Percentage Change (1970-2005)
Big Horn County	**10,202**	**11,896**	**10,525**	**11,461**	**11,333**	**11.1%**
Basin	1,145	1,349	1,180	1,238	1,224	6.9%
Burlington	--	--	184	250	248	--
Byron	397	633	470	557	548	38.0%
Cowley	366	455	500	560	582	45.9%
Deaver	112	178	199	177	177	58.0%
Frannie	103	121	142	180	182	76.7%
Greybull	1,953	2,277	1,789	1,831	1,752	(9.0%)
Lovell	2,371	2,447	2,131	2,361	2,277	(4.0%)
Manderson	117	174	83	104	101	(13.7%)
Washakie County	**7,569**	**9,496**	**8,388**	**8,292**	**7,933**	**4.8%**
Ten Sleep	320	407	311	304	315	(1.6%)
Worland	5,055	6,391	5,742	5,250	4,967	(1.7%)

Source: State of Wyoming (2006a, website)

Area residents tend to be older, on average, than other Wyoming residents. The median in the two-county area is 40, contrasted to a statewide median age of 36. Residents over 64 years of age comprise 16.8 percent of the area's population, contrasted with 12.1 percent for all Wyoming residents. Although area residents constitute 3.8 percent of Wyoming's population, public school enrollments are only 1.7 percent of the state total. (State of Wyoming 2006a, website)

3.8.2 Employment and Income

The area economy is partially dictated by land ownership patterns. Both Big Horn and Washakie Counties are classified as Federal Land Counties by the U.S. Department of Agriculture's Economic Research Service (ERS). This designation refers to the extensive federal land holdings in the two counties, which account for 72 percent of their land area (State of Wyoming 2006b). This federal ownership pattern is reflected in local employment statistics, with government and government enterprises constituting the largest source of employment with almost 2,400 jobs (Table 3-13). Other large employment categories include retail trade, mining (including oil and gas production), and agriculture, each with about 1,000 employees (including sole proprietors).

Table 3-13. Local Full- and Part-Time Employment by Industry (2003).

Employment Category	Number of Employees and Proprietors	Percentage of Total
Farming	950	7.8
Mining	1,027	8.4
Construction	824	6.7
Manufacturing	697	5.7
Retail Trade	1,014	8.3
Transportation and Warehousing	388	3.2
Finance, Insurance, and Real Estate	654	5.4
Professional and Technical Services	392	3.2
Accommodation and Food Services	754	6.2
Other Services	674	5.5
Government and Government Enterprises	2,389	19.6
All Other Categories	2,445	20.0
Totals	**12,208**	**100.0**

Wages and incomes in the two-county area are somewhat below state averages. Average annual wages in the year 2004 were $28,756 in Big Horn County and $28,301 in Washakie County. The statewide average that year was $31,210 (State of Wyoming 2006b). In the year 2000, 11.4 percent of Wyoming households had incomes below the poverty level. That same year 14.1 percent of all households in the two-county area had incomes below the poverty level. Unemployment rates in the area are also somewhat higher than statewide averages. In 2004, the unemployment rate was 4.7 percent in Big Horn County and 4.1 percent in Washakie County. The Wyoming unemployment rate was 3.9 percent during that year.

3.8.3 Irrigated Agriculture

Irrigated agriculture is an important component of the area economy. According to the 2002 Census of Agriculture, there were 583 irrigated farms covering approximately 140,000 acres in the two-county area (U.S. Department of Commerce 2002). The 950 persons employed directly in agriculture constitute almost eight percent of the local workforce. The corresponding figure for the State of Wyoming is only 3.6 percent. (State of Wyoming 2006b)

Most irrigated land in the area is located along the Bighorn River and its tributaries, such as Owl Creek, and relies upon surface water diversions for irrigation. Traditional irrigation techniques involve flood or gated pipe applications, but some center pivot sprinklers have been installed in recent years. A description of current surface water diversions in the Upper Bighorn River Basin shows that an average of more than 475,000 acre-feet of surface water is diverted annually in the basin (Table 3-14). A large portion of that total is diverted into the Big Horn and Upper Hanover Canals that serve numerous irrigators along the upper Bighorn River.

Table 3-14. Average Annual Irrigation Water Diversions in the Upper Bighorn River Basin.

Diversion Name	Average Annual Diversion (Acre-feet)
Ackerman	1,516
Baylor-Purvis-Thompson-Farmer	1,521
Big Horn Canal	148,437
Bluff Canal	33,375
Brassington	2,166
Caledonia	1,944
Chessington-Wilson	1,514
Hale	1,185
Highland Ditch	9,484
Highland Hanover	30,409
Kirby Canal	18,416
Lower Hanover Canal	48,810
Lower Lucerne Canal	11,183
Padlock	1,781
Sliney and Mikkleson #1	3,268
Tenderfoot	2.023
Upper Hanover Canal	151,046
Upper Lucerne Canal	10,177
Woodward-Johnson	1,454
Total	**477,688**

Source: MWH Americas, Inc. (2003).

The primary irrigated crops grown in the area are alfalfa, corn, dry beans, malting barley, sugar beets, and grass hay mixtures. Much of the irrigated crop production is sold for cash, but some of the alfalfa and grass hay is fed to irrigator's livestock and marketed in that manner. According to 2002 Census of Agriculture, the annual value of all agricultural products (crops and livestock) sold in the two-county area is approximately $62.5 million (U.S. Department of Commerce 2002). Estimated returns to irrigated crop production for a modern irrigated farm with above-average management indicate a modest positive return (Table 3-15). The data is based upon crop enterprise budgets published by the University of Wyoming and updated to reflect current crop prices and yields. (Watts & Associates 2006).

Table 3-15. Estimated Gross Returns for Irrigated Crop Production (Above Average Management).

Crop	Cropping Percentage	Estimated Per Acre Yield	Average Price ($)	Estimated Gross Return Per Acre ($)
Alfalfa	12.6	5.5 tons	92.10/ton	506.55
Alfalfa Establishment	4.2	NA	NA	0.00
Corn for Grain	10.8	160 bu.	2.36/bu.	337.60
Corn Silage	10.8	25 tons	25.00/ton	625.00
Malting Barley	31.7	130 bu.	3.81/bu.	495.30
Sugar Beets	29.9	25 tons	43.00/ton	1075.00
Total/Weighted Average	**100.0**			**$646.22**

3.8.4 Local Infrastructure

3.8.4.1 Housing

Housing in the project area is affordable relative to statewide averages. In 2004 there were 8,873 housing units in the project area, with a median value of $76,700. This figure contrasts the statewide median housing of $96,600 in the same year. Only 7.7 percent of the area's housing units are in multi-unit structures, while 15.2 percent of Wyoming's housing units are in such structures. Home ownership rates in the area are somewhat higher than statewide averages. The area's home ownership rate is 74 percent, compared to a 70 statewide average ownership rate. (U.S. Department of Commerce 2004)

3.8.4.2 Transportation

The area is served by a relatively extensive system of U.S. and state highways and county roads. The primary north-south route through the area is U.S. Highway 20, also designated Wyoming Highway 789. This highway connects the community closest to the affected lands, Worland, with Shoshoni and Thermopolis to the south, and Basin and Greybull to the north. The area proposed for irrigation is served by Wyoming Highway 433, which is located on a bench above the west bank of the Bighorn River northwest of Worland.

The Burlington Northern Railroad also serves the two-county area. A rail line runs along the Bighorn River from north to south through the area.

3.8.4.3 Local Public Services

Local public services in the area are provided by Big Horn and Washakie County governments and by incorporated communities in the two-county area. The county governments are responsible for law enforcement and rural road maintenance in the immediate area that is proposed for irrigation. The nearby City of Worland, school districts, and other special districts provide the other public services needed in the area. The fact that Worland's population has declined from a high of almost 6,400 in 1980 to fewer than 5,000 today is an indication that public services in the area have not been strained by rapid growth.

3.8.5 Public Revenues

The two largest sources of revenue for local governments in Wyoming are sales and use taxes and ad valorem (property) taxes. In fiscal year 2003, Wyoming counties, municipalities, schools, and special districts levied a total of $669 million in ad valorem taxes. Of this amount, $124.1 million went into the state school foundation fund, while the rest was spent locally. Local governments in Big Horn and Washakie counties levied a total of about $17.1 million in property taxes in 2003, or about 2.6 percent of all property taxes levied statewide. Of that amount, $14.3 million was kept locally and $2.8 million went to the school foundation fund. (State of Wyoming 2003)

In fiscal year 2003, a total of 158,900 irrigated acres were listed on the local ad valorem tax roles in the area. The total valuation of this acreage for tax purposes was $13.5 million, or an average valuation of $85 per acre. Another 625,200 acres were assessed as rangeland, with a total valuation of $2.4 million, or about $4 per acre. (State of Wyoming 2003)
Sales and use tax collections form the second largest source of revenue to local governments. The base four percent sales tax is collected locally and divided between the State and local governmental units according to formulas established by the legislature. Counties may levy up to two percent in additional sales taxes upon voter approval. In fiscal 2003, local sales and use tax distributions in the two-county area totaled $4.2 million. During that year, the sales tax rate was five percent in Big Horn County and four percent in Washakie County. (State of Wyoming 2003)

There are a number of other sources of revenue for local governments, including state distributions of mineral severance taxes, lodging taxes, grazing lease revenues and federal payments in lieu of taxes. Local revenues from each of these other sources are small relative to that generated by ad valorem, sales, and use taxes.

3.9 CULTURAL AND PALEONTOLOGICAL RESOURCES

3.9.1 Prehistoric Periods

The Bighorn Basin and surrounding mountains contain many prehistoric archaeological sites that have been the focus of archaeological research for many years. Most of the work has occurred in the Bighorn Mountains on the east side of the basin. The Medicine Lodge Creek site near Ten Sleep (Frison 1991) and the Mummy Cave on the Shoshone River (McCracken et al. 1978) contain stratified deposits ranging as far back as the Paleo-Indian Stage. These sites and others in the region, demonstrate that the Big Horn Basin and surrounding mountains have been occupied for at least 11,500 years (Appendix H).

3.9.2 Protohistoric to Historic Periods

Though Euro-American groups did not reach the region of what is now known as Wyoming and the Bighorn Basin until the nineteenth century, their arrival in the Americas and their subsequent expansion westward affected the Native American cultures significantly earlier. The introduction of the horse via the Spanish in the southwest and intervening tribes (Ewers 1955), the northwest

fur trade, the subsequent diffusion of European manufactured goods, and the introduction of guns and foreign diseases were all factors in changing and disrupting Native cultures long before any Euro-American group set foot in Wyoming.

Late prehistoric/early Protohistoric groups that may have occupied the Bighorn Basin included Shoshone, Crow, Athapaskans, and Kiowa (McNees et al. 1999). The Crow were in the Powder River Basin and Bighorn Mountains as early as A.D. 1400 (McNees et al. 1999). The uppermost levels of the Medicine Lodge Creek site (48BH499) yielded European glass trade beads in association with tri-notched projectile points (Frison 1991) illustrating the Euro-American influence prior to the 19th century.

3.9.3 Historic Stage

Beginning in the early 1800s, Euro-American fur traders entered the region. This event spelled the end of Native American domination of the western United States and eventually resulted in the Native Americans in the region being placed on reservations and the settlement of the Bighorn Basin by people immigrating to the area from the east (Table 3-16, Appendix I).

Table 3-16. Summary of Historic Stages in the Bighorn Basin Region.

Industry	Date	Comment
French Fur Traders	18th century	Entered the western side of Powder River Basin
Explorers	Circa 1804	Coulter leaves Lewis and Clark and explores mountains, valleys, and basins of northwestern Wyoming
Emigrants	1864	Bridger emigrant trail established through Bighorn Basin
Gold Exploration	1864	First attempts at gold mining in Bighorn Basin
Transportation		
Railroad	1907	Chicago, Burlington, & Quincy Railroad branched south and reached Worland
Automobile	1924	Modern highways penetrated Bighorn Basin
Agriculture		
Cattle	1879-1883	First large cattle herds enter basin
Sheep	1876	Sheep utilize basin
Irrigated crops	1890's	Beginning of irrigation for crop production in basin
Carey Act	1894	Federal aid to irrigation projects
Newlands Act	1902	Federal aid to reclamation projects – Shoshone Project in Basin to cultivate sugar beets
Fossil Fuel		
Coal mining	1890's	Small scale until railroad extended
Oil and gas development	Mid 1880's	Began; the area's prolific deposits of natural gas were tapped for industrial and domestic use beginning in 1916

3.9.4 Previous Archaeological Investigations

A number of previous archaeological investigations have been undertaken in and around the project area. Most have been small well pad and pipeline cultural resource inventories. The Office of the Wyoming State Archaeologist (OWSA) conducted a Class III cultural survey of the WID between June 23 and November 16, 1985 (Eckles and Scott 1986). The area investigated consisted of 11,072 acres, and included 10,642 acres of BLM land and 430 acres of private land. About 600 acres of the project area was under agricultural production at the time and were not surveyed. The survey resulted in the documentation of 253 sites, including 243 newly recorded sites and 11 previously recorded sites. Of this total, OWSA recommended 55 sites as eligible for inclusion in the National Register of Historic Places (NRHP). The remaining sites were determined not to be eligible. This project area was followed up in 2005 by a Class I report (Eckles 2005). This Class I cultural resource survey covered 16,050 acres proposed for conveyance and three buffer areas comprising approximately 3,330 acres.

The previous inventories recorded small prehistoric lithic scatters and lithic scatters associated with fire-cracked rock. A few of these sites contained cultural features, primarily the remains of fire-hearths. These sites are thought to have functioned as root processing sites (M. Bies, BLM, pers. comm.), but this hypothesis has yet to be tested. Two lithic landscapes have been recorded in the project area, the Fifteen Mile Creek lithic landscape (48WA1289/48BH1820) and the Five Mile Creek lithic landscape (48BH1762). Historic sites included small trash scatters and the Big Horn Canal.

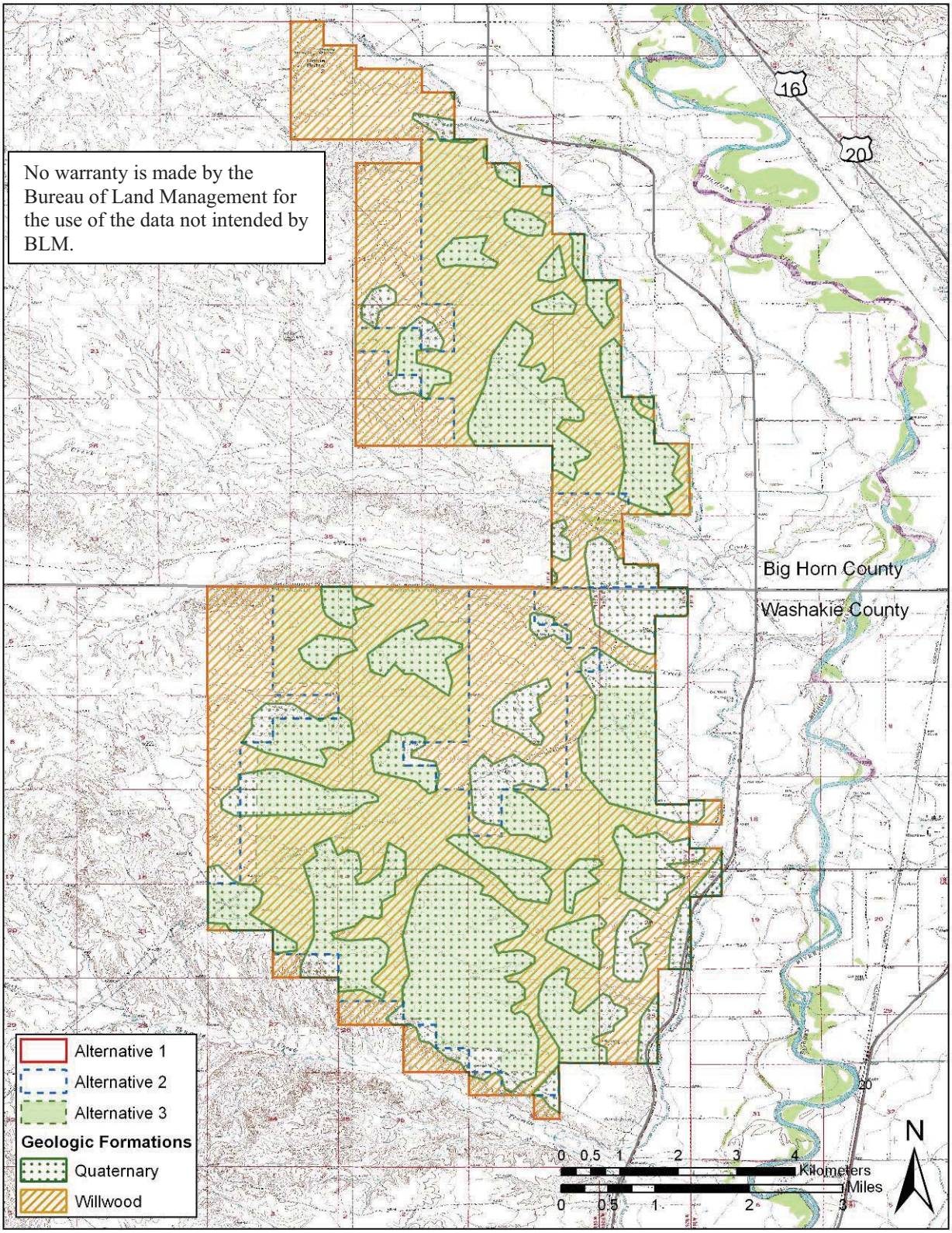
In 2005 and 2006, crews from Cultural Resource Analysts, Inc. (CRAI) resurveyed the 16,050 acre area originally surveyed by OWSA. This inventory located 322 prehistoric and historic sites, 22 of which were recommended as eligible for nomination to the NRHP, or were considered important by the Northern Arapaho tribe, and 300 were recommended as not eligible for nomination to the NRHP (Hall et al, 2007). CRAI found the same site types as had been recorded by OWSA. In order to determine if the project area held soils and sediments that may contain buried archaeological sites, a geoarchaeological study was conducted to model archaeological sensitivity (Eckerle, in prep). The model divided the project area in five sensitivity levels that indicated if soils or sediments, suitable in age and location to contain intact buried archaeological deposits, occurred in the project area. Low and Very Low areas accounted for approximately 51 percent of the project area, Moderate areas included approximately 23 percent of the area, and High and Very High accounted for approximately 26 percent of the project area. Limited testing in each of the sensitivity areas failed to locate any buried cultural deposits (Hall et al. 2007).

The CRAI investigation also included Native American consultations. These consultations were initiated and organized by the BLM and included the Northern Arapaho and Shoshone-Bannock tribes. The purpose of the consultations is to determine if any of the tribes have any concerns with conveyance of any of the sites.

3.9.5 Paleontological Resources

The project area contains the geological formation referred to as the Willwood formation which contains important fossil resources (Map 3-16). The Willwood formation consists of immature fluvial sandstones, conglomerates, and varicolored mudstones. The Willwood is primarily Eocene in age and vertebrate fossils commonly found in this formation include turtles, crocodilians, and mammals (Gingerich and Clyde, 2001). Mammalian fossils of the Willwood formation have been studied by paleontologists since the late nineteenth century and early twentieth century expeditions of Walter Granger and William J. Sinclair. These studies have made important contributions to our understanding of early mammal evolution, as well as the environmental changes that occurred within the Bighorn Basin. Additionally, the Willwood formation contains dense accumulations of fossil plant debris (Kraus and Sian Davies-Vollum 2004). Approximately, 9,735 surface acres of Willwood formation occur within Alternative 1, Alternative 2 contains approximately 6,105 surface acres of Willwood formation, and Alternative 3 encompasses 5,128 surface acres of the formation.

Research publications regarding these paleontological deposits begin in the early 1880's and continue to present. In 1896, J. L. Wortman published a paper on the Hyracotherium or first horse based in part on materials from this area. Current research focuses on documenting and understanding the climatic shifts that occur during this period. The Willwood formations' rich deposits of both plant and vertebrate fossils allow detailed analysis of the changes in the environment. Many researchers believe that this data will contribute to our understanding of current environmental factors.



Map 3-16. Location of the Willwood Formation within the Project Area.

3.10 RECREATIONAL RESOURCES

3.10.1 Non-Consumptive Use

The project area is located within the Extensive Special Recreation Management Area for GCRMP. Approximately half of the project area is considered "back country" with natural appearing landscape having modifications not readily noticeable. Recreation use of this area consists of site seeing, camping, driving for pleasure (off road vehicles and 4 wheel drive), destination travel for viewing the area, and general remote dispersed recreation. The GCRMP manages the travel in the area by directing visitors to remain on existing roads and trails. The typical group size is two to four people per group and encounters with other users may exceed three per day, but are usually less than five on motorized travel routes. Encounters off motorized routes are less. The BLM provides basic maps and minimal on site signing for the users.

3.10.2 Fishing

Wyoming has the highest per capita rate of fishing participation in the U.S. (over 50 percent), and fishing is an important recreational activity in Wyoming's Bighorn Basin. Approximately 2,300 miles of streams occur in the basin, of which an estimated 1,800 miles are classified as Class 1 (fisheries of national importance), Class 2 (fisheries of state importance), or Class 3 (fisheries of regional importance) by the WGFD (WGFD 1987). The basin also contains approximately 22,200 acres of natural lakes, reservoirs, and farm ponds which are productive fisheries. The Bighorn River and a few small lakes/ponds provide warm water fishing opportunities to anglers in the basin.

The WGFD is acquiring access the Bighorn River for walk-in hunting and fishing opportunities by the public. Currently, between Worland and Manderson there are five areas that provide approximately five miles of river bank open to public fishing. Additionally, the BLM has two tracts of land providing approximately 1.25 miles of river bank. There are three public boat ramps along this stretch of the Bighorn River; one in Worland, one in Manderson, and another in between the two towns on the BLM property. These boat ramps provide access for float fishing, which is increasingly popular in the basin.

In the year 2000, over 51,000 fishing licenses were sold in the five-county area comprising the Wind/Bighorn River Basin. According to WGFD estimates, these license sales correspond to approximately 445,000 angler days of fishing activity. About 71 percent of the angling activity is by Wyoming residents and the remainder by non-residents. Angling activity in the Basin is projected to grow to between 488,000 angler days (low-growth scenario) and 722,000 angler days (high-growth scenario) by the year 2030. (BRS Engineering 2003a)

About 8,300, or 16 percent, of the Basin-wide license sales occurred in the Big Horn/Washakie County project area. The WGFD does not routinely estimate angling activity for specific waters in the Bighorn Basin, but the Bighorn River between Worland and Manderson probably receives only very light angling pressure. One reason is that public access is limited by private ownership of the banks except for a few public access areas. Another reason is that the fishery in this stretch of the river is limited to warm water game fish such as catfish and perch. Viable trout fisheries

are available for anglers in the higher elevations of the Bighorn Mountains in both counties. The Bighorn River upstream of the project area in Hot Springs County is also a viable trout fishery.

3.10.3 Hunting

Big game, upland gamebirds, and waterfowl hunting opportunities are available in the project area along the Bighorn River and adjacent lands in Big Horn and Washakie counties (BRS Engineering 2003b). The project area is in Antelope Hunt Area 77, which covers a large area north and west of Worland, and is bounded by the Greybull River to the north. During the three-year period from 2003 through 2005, an average of 155 pronghorn antelope hunting days annually were estimated for this area by the WGFD. The number of hunting days specific to the project area is unknown, but probably quite small given its size relative to the entire hunt area. Hunter success rates for Area 77 are estimated to be about 93 percent. (WGFD 2003-2005, Harvest Reports, website)

The project area is located in Deer Hunt Area 125, which covers an even larger geographic area stretching generally north and west of the Gooseberry Creek drainage south of Worland. The WGFD estimates that an average of 620 deer hunting days of activity occurred in this area annually during the period from 2003 through 2005. Again, no site-specific estimates of hunting activity are available for the project area. The hunter success rate for Deer Hunt Area 125 is approximately 68 percent. (WGFD 2003-2005, Harvest Reports, website)

A lack of habitat for waterfowl and upland game birds in the project area suggests that bird-hunting opportunities are limited under present conditions. Although sage-grouse may occasionally occupy the area, habitat is marginal and no leks were found nearby, suggesting that few sage-grouse would occur in the project area. Hungarian partridge and ring-necked pheasant may also occur in the project area but are likely more commonly associated with nearby agricultural lands. It is unlikely that the project area receives many upland game bird hunters.

3.11 VISUAL/AESTHETICS

The project area consists of flat terraces separated by relatively short eroded slopes with nothing extraordinary for the area. Under the BLM Visual Resource Management (VRM) classification, the project area occurs in a Visual Resources Management Class III with some Class IV (D. Ogaard, BLM pers. comm.). Class III areas are those adjacent to the agricultural corridor, while Class IV areas are primarily the agricultural lands along the western edge of the entire parcel. Under the VRM plan, the objective for Class III areas is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. The objective for Class IV areas is to provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention.

3.12 HAZARDOUS MATERIAL

According to officials with Wyoming Department of Environmental Quality, there is no record of hazardous material or waste ever being stored or spilled on the land that is scheduled to be conveyed (C. Anderson, WDEQ, pers. comm.) Visual and olfactory inspections of the project area during visits revealed no stained soil, disturbed ground, debris, or odors which might indicate the presence of hazardous material or waste.