3.3.6 Groundwater Use

Water rights registered with IDWR are listed in **Table 3.3-16** and are shown in **Figure 3.3-4**. The project is located in State Water District 27.

TABLE 3.3-16
WATER RIGHTS FOR WELLS AND SPRINGS IN THE VICINITY OF NORTH RASMUSSEN RIDGE MINE

Water Right Number	Owner Name	Point of Diversion	Source	Diversion Rate (cfs)	Water Uses	Distance from Proposed Action (miles)
27-11279	Taylor, Ray N	T6S R43E Sec. 17 SWSENW	Groundwater	0.03	S	2.0
27-11285	Nuffer, Phyllis and Tod	T6S R43E Sec. 17 SWSENW	Groundwater	0.03	S	2.0
27-11255	Thompson, Cheryl H and Sidney G	T6S R43E Sec. 08 SESWSW	Groundwater	0.07	D, S	2.0
27-11256	Thompson, Cheryl H and Sidney G	T6S R43E Sec. 08 SESWSW	Groundwater	0.09	S	2.0
27-7540	Nu-West Industries Inc	T6S R43E Sec. 26 NWSW	Groundwater	0.89	I	1.75
27-7452	P4 Production LLC (Current); Monsanto Co (Original)	T6S R43E Sec. 21 SWNE	Groundwater	0.3	M	1.0
27-7451	P4 Production LLC (Current); Monsanto Co (Original)	T6S R43E Sec. 21 SWSE	Groundwater	0.1	D, I	1.25
27-11412	US Dept of Agriculture; USFS	T6S R43E Sec. 35 SWSW	Spring	0.02	S	2.75
27-11277	Idaho Citizens Grazing Assoc (Current)	T6S R43E Sec. 28 SWSESW	Spring	0.05	S	1.75
27-4036	Us Dept Of Agriculture	T6S R43E Sec. 13 NWNW	Midnight Spring	0.02	S	2.25
27-11551	US Dept of Agriculture; USFS	T6S R43E Sec. 25 NESW	Spring	0.02	S	2.25

Notes:
T = Township, R = Range, Sec = Section, N = North, E = East, S = South, W = West, cfs = cubic feet per second
The following sections are included in the water rights database search: T6S, R43E, Sections 3,4,5,8,9,10,11,13,14,15,16,17,21,22,23,25,26,27,28
Water use categories are: D = Domestic, S = Stockwater, C = Commercial, I = Industrial, M = Mining

3.3.7 Seeps and Springs

Ten seeps and springs have been identified in Reese Canyon, West Fork of Sheep Creek, and along the Central Rasmussen Mine access road (**Figure 3.3-3**). Flow rates were measured at these seeps and springs in June 2002 and August 2002 (**Table 3.3-17**). Water quality parameters (temperature, pH, and electrical conductivity) were also measured in the field in August 2002 (**Table 3.3-17**).

Spring CMR is located on the southwest side of the Central Rasmussen Mine access road in the No Name Creek Drainage at an elevation of 7,020 feet above mean sea level (amsl) (170 feet above the local bedrock groundwater level). Spring CMR flows throughout the year and issues from colluvium on the northeast flank of a ridge that contains outcrops of Rex Chert. Based on the spring's location above the local bedrock groundwater level and the low electrical conductivity of the spring water (92 microsiemens per centimeter [µS/cm]), the origin of the spring is believed to be shallow infiltration of precipitation into alluvium and colluvium and the outcropping Rex Chert bedrock located directly above the spring (Whetstone 2002).

TABLE 3.3-17
FLOW RATES AND FIELD WATER QUALITY PARAMETERS FOR SPRING AND SEEPS IN THE VICINITY OF NORTH RASMUSSEN RIDGE MINE

Station	Location	Occurrence	Flow Rate June 10-11 & July 15, 2002	Flow Rate August 13, 2002	Temp	PH	EC
			(gpm)	(gpm)	(°F)	(su)	(µS/cm)
CMR	Haul Road	Flowing Seep	<1	<0.10	55.0	6.10	92.0
WSCE	West Sheep Creek	Seep associated with wetland area	1	Diffuse flow/not measurable	54.3	6.46	677
WSCW	West Sheep Creek	Seep associated with wetland area	<1	Damp/no open water	--	--	--
RCTS	Upper Reese Canyon	Seep associated with wetland area	<1	No outflow/not measurable	52.9	6.33	239
URCN	Upper Reese Canyon	Seep associated with wetland area	<1	≈0.5	51.3	7.68	336
URCS	Upper Reese Canyon	Seep associated with wetland area	<1	No outflow/not measurable	52.6	7.12	204
MP	Lower Reese Canyon	Spring pond with associated wetland	<1	No outflow/not measurable	61.2	7.05	387
LLP	Lower Reese Canyon	Spring pond with associated wetland	<1	≈0.75 at pond outflow	56.5	6.81	437
BLLP	Lower Reese Canyon	Spring pond with associated wetland	<1	Diffuse outflow/not measurable	66.6	9.85	138
BLLP2	Lower Reese Canyon	Spring pond with associated wetland	<1	Not observed	61.1	7.73	288

Notes: EC = electrical conductivity
gpm = gallons per minute
SU = standard units
µS/cm = microsiemens per centimeter

Springs WSCE and WSCW are located in the West Fork of Sheep Creek on the margins of a wetland area in the center of the drainage. WSCE and WSCW flow or are damp throughout the year and issue from alluvium and colluvium in the drainage.

Seven springs occur in Reese Canyon Creek, where the bedrock strikes northwest parallel to the canyon and dips steeply to the northeast. The geologic section, moving from east to west, includes Rex Chert, Meade Peak, and Wells Limestone. A fault has also been mapped in Reese Canyon that extends from the divide between the West Fork of Sheep Creek to the Little Blackfoot River. Alluvial cover in the drainage can be several tens of feet thick. Near the springs in Reese Canyon, the elevation of the regional groundwater flow system is estimated at 6,260 feet amsl (about 300 to 500 feet below the ultimate pit floor) (Whetstone 2002).

Spring RCTS is located near the head of Reese Canyon and is associated with two small wetland areas in the bottom of the drainage. The spring is located in a depression in alluvium and colluvium along the valley floor and is wet throughout the year. Probable sources of water for the spring flow include the alluvium and colluvium associated with drainage in Reese Canyon and possibly water from the local bedrock groundwater flow system on the east side of the canyon.

Springs URCN and URCS are located in the upper reach of Reese Canyon near the center of the drainage and are associated with a small wetland area. The two springs issue from alluvium and colluvium in the valley floor bottom and are near each other. The springs are perennial and remain wet throughout the year. Probable sources of water for the spring flows include the alluvium and colluvium associated with drainage in Reese Canyon, perched shallow groundwater, and water from the local bedrock groundwater flow system on the east side of the canyon (Whetstone 2002).

Stations MP, LLP, BLP, and BLP2 are located in the lower portion of Reese Canyon and consist of a series of shallow spring ponds that were constructed along the valley floor. Pond MP occurs within an enclosed depression. Ponds LLP, BLP, and BLP2 are associated with an extensive wetland area common to the three stations. The spring ponds contain water throughout the year and are probably supplied by the alluvium and colluvium associated with drainage in Reese Canyon and water from the local bedrock groundwater flow system on the east side of the canyon (Whetstone 2002).

3.4 WATERSHED AND SOILS

Marine sedimentary rocks characterize the study area, which includes the Phosphoria Formation, one of the world's largest known reserves of phosphate and the target formation for the mine. The region lies within the middle Rock Mountain Basin and Range physiographic provinces. Topographic and structural features resulted from folding and thrusting of sediments during the Laramide Orogeny.

3.4.1 Soil Resources

Agrium conducted an Order II baseline soil inventory on 250 acres within the project area (Maxim 2001c). This area has also been mapped on the Order III level by the Soil Survey of the Caribou National Forest, Idaho (USFS 1990). Soil classifications and other data used for this analysis were extracted from these two reports. Soil units are mapped in **Figure 3.4-1**. **Table 3.4-1** contains a summary of characteristics of the soil, including two categories for describing current areas of concern for soils, and constraints on reclamation and construction. The **Reason Soil is Marginal** category explains the chemical or physical characteristics of a soil that might affect soil productivity currently and during reclamation. **Table 3.4-2** explains the process for rating suitability of topsoil for reclamation (Maxim 2001c).

Soil on ridges and plateaus in the project area has developed from residuum from sandstone, shale, and siltstone. Soil on slopes has developed from colluvium from the same parent material, while alluvial materials form soil in the drainages and swales. Depth of soils in the project area ranges from very deep (> 60 inches) in valleys and sideslopes to shallow (< 11 inches) on ridgetops, and all soils are well-drained.

Figure 3.4-1 Soil Map

Figure 3.4-1 Back.

TABLE 3.4-1
MAJOR SOIL MAP UNIT CHARACTERISTICS

Map Unit	Texture	Physiographic Location	Parent Material	Area (acres)	Average Depth of Soil	Permeability[1]	Depth of Recommended Soil Salvage (inches)	Reason Soil is Marginal
A complex	Gravelly Silty Loam	Colluvial Valley Sideslopes	Sandstone Siltstone Shale	73.1	>60	S-M	40	Organic Matter Content
B complex	Gravelly Loam	Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	10.8	< 54	S-MS	50	Coarse Fragment Content
C complex	Silty Clay Loam	Stream Terrace	Alluvium	1.2	>60	S-M	60	Coarse Fragment Content
D complex	Wetlands	Flood Plain	Alluvium	NA	These soils are located on wetlands and have been avoided.	---	---	---
E complex	Silty Loam	Alluvial Flat	Alluvium	NA	>60	MS	60	---
F complex	Gravelly, Cobbly, Variable Loam	Ridgetop	Sandstone Siltstone Shale	10.5	<11	M	6-9	---
G complex	Gravelly, Variable Loam	Colluvial Valley Sideslopes	Sandstone Siltstone Shale	16.9	>60	S-M	40	Coarse Fragment Content
H complex	Gravelly Silty Loam	Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	--	> 60	S-M	50	Coarse Fragment Content
I complex	Gravelly Silty Loam	Mountain Valley Fan and Stream Terrace	Alluvium	NA	>60	M	17	Coarse Fragment Content
J complex	Gravelly Silty Loam	Colluvial Valley Sideslopes	Sandstone Siltstone Shale	25.2	> 60	S-M	24	Coarse Fragment Content

TABLE 3.4-1 (CONT.)
MAJOR SOIL MAP UNIT CHARACTERISTICS

K complex	Gravelly Loam	Colluvial Valley Sideslopes	Sandstone Siltstone Shale	34.1	35-60	S-M	34	Coarse Fragment Content
L complex	Gravelly Silty Loam	Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	46.2	43-60	S-M	55	Coarse Fragment Content
M complex	Gravelly Silty Loam	Benches, Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	1.3	>60	S-M	60	Coarse Fragment Content
N complex	Gravelly Loam	Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	18.4	40-60	S-M	33	Coarse Fragment Content
O complex	Gravelly Silty Loam	Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	--	60	S-M	28	Coarse Fragment Content
P complex	Gravelly Silty Loam	Colluvial Valley Sideslopes and Toe Slopes	Sandstone Siltstone Shale	--	60	S-M	36	Coarse Fragment Content

Note: [1] Permeability: S-M = Slow to moderately slow, MS = Moderately slow, M = Moderate.

Source: Maxim 2001c

TABLE 3.4-2
TOPSOIL SUITABILITY RATING GUIDE

Property	Good	Fair	Poor	Unsuitable
Texture (<3% organic matter)	---	loamy coarse sand, loamy sand, loamy fine sand, loamy very fine sand, sandy clay loam, clay loam, silty clay loam	Coarse sand, sand, fine sand, very fine sand, silty clay, clay, sandy clay	>60% Clay content
Texture (>3% organic matter and <35% clay)	Clay Loam, Silty Clay Loam, Sandy Clay Loam	---	---	---
Stoniness	1	2	3	4, 5
Rock Fragments (%) Volume	<15	15 to 25	25 to 35	>35
Salinity (mmhos/cm)	<4	4 to 8	8 to 15	>15
Depth to High Water Table (ft)	---	---	<1	Perennial Wetness
Sodium Adsorption Ratio (%)	0 to 4	4 to 8	8 to 16	>16
pH (su)	6 to 8	5 to 6, 8 to 8.5	4.5 to 5, 8.5 to 9.0	<4.5, >9.0
Slope (%)	<8	8 to 25	25 to 40	>40
Calcium Carbonate (%)	---	---	>15 to 40	>40
Total selenium (mg/kg)	---	<10	10-15[1]	>15

Note: [1] Soils with selenium in this range recommended for potted soil study for reclamation plantings.
Source: Maxim 2001c.

Silty clay and sandy loams dominate the soil texture with varying percentages of coarse materials and slope steepness. Generally, location dictates slope and the percentage of coarse material. Detailed information on soils is presented in the baseline study report (Maxim 2001c).

3.4.1.1 Physical Characteristics

Soil complex types F, I, J, L, and N have been identified as shallow soils. Excessive coarse fragments occur in nearly all complexes. Shallowness and coarseness are two major factors in evaluating the suitability of topsoil for reclamation (**Table 3.4-2**). Complexes D, E, F, and I are the only complexes that are not affected by low organic content. Soils also have biological surface layers that include bacteria, rhizomes and seeds, and at higher elevations, mosses and lichens. Organic matter supplies many factors, such as tilth, fertility, and permeability that are beneficial to soil productivity. Complex D is listed as frequently flooded, and Complexes C and I are only intermittently flooded. Complex D, which occurs in wetland areas, can be described as a wet soil. Slope steepness is an important component of soil suitability, as it can alter the potential for water erosion and soil movement. Complex A, located on top of Rasmussen Ridge in the southern half of the disturbed area, occurs on excessive slopes, defined as more than 40 percent (Maxim 2001c).

The stability of overburden fill slopes is attributed to a combination of factors, including water-erodibility potential (K-factor) and percent slope range of the overburden fill material and growth media soil, the reclamation slope contour of the overburden fill, the topography, seismic characteristics of the underlying excavated area, and stress resulting from shock loading or overloading. Soil Complex type A, located on top of Rasmussen Ridge in the southern half of the disturbed area, is the only soil type that occurs on excessibe slopes, defined as over 40 percent (Maxim 2001c). Introduction of excess water, snow, mud or ice can weaken overburden material strength, increasing the potential for slope instability and failure. A total of 22 sample sites contained K-factors above 0.40, which is considered high water erosion potential; however, these high K-factors occur in the subsoil, which underlies the reclamation surface growth media soil. Soils within the project area are relatively coarse, but permeability is rated slow to medium, so water infiltration through the reclamation surface into the underlying overburden would be slowed. Slopes left at the initial angle of backfill for extended periods of time are more likely to experience instability than those that are regraded immediately after construction. The Rasmussen Ridge study area lies within a Zone III seismic region and approximately 20 earthquakes capable of damaging structures (rating of 5 or greater on the Richter Scale) have occurred in the area from 1880 to 1994. Similar future earthquake activity would be expected in the study area (Section 3.1.3 Geology/Geologic Hazards). In the even of an earthquake of 5 or greater rating on the Richter Scale, the majority of any soil movement would be expected at the top of Rasmussen Ridge in the southern half of the disturbed area, in the location of Soil Complex A. Shock loading occurs when heavily loaded trucks roll to the crest of the overburden fill, while overloading occurs when too much backfill is placed on a given area of the backfill; therefore, avoiding both loading situations would decrease the potential for slope failure.

Physical characteristics of soil that may limit its use for reclamation include excessive coarse fragments (numerous large fragments impair handling soils with equipment), wetland soils, fractured rock, and location on steep slopes. No landslides or slope failures have been reported by Agrium on Rasmussen Ridge. No slope failures in existing waste rock dumps have been reported by Agrium.

3.4.1.2 Chemical Characteristics

Numerous soils samples were collected for chemical analysis. The pH of soil ranges from very acidic to mildly alkaline but does not drop below the acceptable suitability limit of 4.5 (**Table 3.4-2**). Soil samples SS-1 (Complex G), SS-3 (Complex J), SS-7 (Complex K), and SS-1 (Complex M) all contained horizons with a pH lower than 5.0. Although these samples were collected within complexes that extend throughout the disturbance area, higher acidity seems to be confined to the higher elevations.

Sodium adsorption ratio (SAR) and electrical conductivity (EC) are signs of sodicity and salinity and indicate the production ability of a soil. High values of either can negatively affect soil productivity. Soil throughout the project area was shown to be generally non-saline and non-sodic (**Table 3.4-2**). Calcium carbonate, which can also affect productivity of soil at high concentrations, was not found in any appreciable amount in soils in the project area. Effervescence indicating the presence of calcium carbonate after hydrochloric acid had been applied was noted at sites SS-22 (G Complex) and SS-25 (H Complex).

3.4.1.3 Selenium in Soil

Due to the potentially toxic effect and presence of selenium in the geologic strata of the region, it has been identified as a constituent of concern. Selenium is found in the highest concentration in sedimentary materials or rocks, especially shales, such as the marine shales of the Meade Peak Member, where unweathered rock generally contains approximately 165 parts per million (ppm). Within these shales, selenium exists as selenide or native selenium, but exposure of the shale to surface conditions can oxidize these compounds to the more soluble and mobile selenite and selenate. The total selenium content of soil reflects the concentration in the parent materials and rock from which the soil is derived, secondary deposition or redistribution of selenium within parent materials and rocks, accumulation or deposition by plants that accumulate selenium (Williams and Schuman 1987). Because of the levels of selenium in geologic formations, soils in the project area have the potential to reach concentrations that could produce forage considered hazardous to livestock.

Total selenium levels were measured at all sample sites in the study area. Most levels in soil were found to contain concentrations of selenium above detection limits, although levels varied considerably between horizons in each soil. Concentrations of selenium are listed by sample site for the 39 samples containing selenium in **Table 3.4-3**. The BLM and USFS have created specific guidelines to simplify identification of possibly hazardous soils. USFS and BLM consider a soil or growth media that contains less than 3 ppm total selenium and 0.1 ppm extractable selenium as suitable for use in reclamation. A soil or growth media that contains between 5 ppm and 13 ppm should have vegetation growth studies conducted, and concentrations greater than 13 ppm total selenium are unsuitable for use in reclamation. Concentrations of selenium greater that 5 ppm occur at higher elevations and are primarily located in the southern portion of the proposed disturbance area. All soil samples but one in **Table 3.4-3** indicate the soil is suitable for reclamation use. Soil sample SS-62 had selenium concentrations greater than 22 ppm at depths from 23 to 60 inches. Data collected from topsoil in Central Rasmussen indicate that concentrations of extractable selenium never exceeded 0.02 ppm, even on soils with a total selenium concentration of more than 20 ppm. The amount of extractable selenium is more important in evaluating plant bioaccumulation than the amount of total selenium, but total selenium can oxidize into mobile selenium and other ionic states (Schoumacher 1999).

TABLE 3.4-3
SELENIUM VALUES PRESENTED BY SAMPLE SITE

Less Than 1 mg/kg	Between 1 and 5 mg/kg	Between 5 and 13 mg/kg	Greater Than 13 mg/kg
SS-4	SS-2	SS-1	SS-62
SS-5	SS-3	SS-7	
SS-28	SS-6	SS-14	
SS-29	SS-8	SS-15	
SS-33	SS-9	SS-17	
SS-43	SS-11	SS-21	
SS-48	SS-16	SS-41	
SS-50	SS-22		
SS-51	SS-23		
SS-56	SS-26		
SS-57	SS-32		
SS-66	SS-34		
SS-75	SS-59		
SS-77	SS-68		
	SS-71		
	SS-72		
	SS-73		

Note: mg/kg = milligrams per kilogram

By definition, toxic seleniferous soils produce forage that could be toxic to livestock. Of the numerous possible forms of selenium in soil, the selenates are the most soluble form of the element and thus, the form most readily taken up by plants. The relatively soluble selenate ion would be most stable under high oxidation potential and alkaline conditions characteristic of arid soils (Williams and Schuman 1987). In acid soils, selenium would be found in ferric selenite precipitates. The solubility and availability to plants would be quite low. The local climate and relatively low pH of the soil would indicate that selenium in soils is more likely to be in the form of selenite, and thus explain why concentrations of extractable selenium are low. In a study of selenium in soils at Smoky Canyon Mine, column tests were used to evaluate the effects of microbial populations on selenium speciation and association with the shale and organics present in the shale (Crawford, Knotek-Smith, Moller and Henson 2002). It was found that selenium was reduced due to the presence of the specific, enriched microbial populations, but reduction was mostly due to microbial reduction of the environment followed by abiotic reduction of selenium.

However, the discontinuous nature of seleniferous materials and the ability of plants that accumulate selenium to absorb from sources deep within the soil profile indicate that the analysis of constituents in surface soil has serious limitations as a means of forecasting problems with toxicity in potential mine spoils (Williams and Schuman 1987). Thus, seleniferous soils have traditionally been identified by the presence or abundance of the selenium accumulator plant species and not the total or available selenium in soils. Plant species of the *Astragalus* and *Stanleya* genera thrive in seleniferous environments and an abundance of these plant species in an area could indicate the presence of seleniferous soils. Also, the fourwing saltbush (*Atriplex canescens*), which has been used successfully for reclamation of surface mines in the western United States, is a secondary accumulator species. Unfortunately, while these plants grow well in the presence of selenium, they also tend to concentrate selenium much faster than other plants. According to the baseline report on vegetation and wildlife, none of the plant species above exists within the project area and no vegetative samples within the project area contain concentrations of selenium above the detection limit of 1 ppm (Maxim 2001c).

A separate soil study was conducted to evaluate post-reclamation concentrations of selenium and trace metals in soils and vegetation (Greystone 2002). Soil and vegetation samples were collected from the North Dump located southwest of the Central Rasmussen Ridge pit that covers approximately 17 acres. The dump was reclaimed in 1998 and 1999 and is comprised of chert and limestone material that has been covered with two to three feet of topsoil or alluvium. The dump was re-seeded using a mixture of perennial grasses and was fertilized. The results of this study indicate that the total selenium concentrations in soils are within the range considered questionable for use in reclamation. However, extractable selenium concentrations in soil samples are considered acceptable. Concentrations of selenium in vegetation samples collected from the North Dump are also considered acceptable. The results of trace metal analyses indicate that detected concentrations fall within the ranges published in the baseline soil study. With the exception of cadmium, total concentrations of trace metals in soil samples were also within the ranges for western U.S. soils. Average concentrations of manganese, nickel, vanadium, and zinc were above averages reported for western U.S. soils.

While cadmium and zinc concentrations in soils in Greystone (2002) exceeded some ecological soil screening guidelines, they fall within the range of background concentrations published in the baseline soil survey for the North Rasmussen Ridge area (Maxim 2001c). Although Greystone (2002) did not quantify the reclamation success, vegetation appears to be well established on the North Dump. A USFS survey conducted in August 2002 estimated vegetation cover to be approximately 85 percent after the three-year growth period. Questions remain on the rate of selenium oxidation in disturbed soils.

3.4.1.4 Erosion and Permeability

Based in the relatively low levels of selenium available for plant uptake, selenium in groundwater and surface water could be more of a concern for livestock and wildlife than seleniferous plants. For this reason, erosion of soil that leads to sedimentation and leaching to groundwater is a concern. Erosion is the process of soil particles being dislodged and carried away by wind or water.

K-factor and wind erodability group (WEG) were used to evaluate the potential for wind and water erosion. K is the soil erodability factor and is a measure of how susceptible (low, medium, or high) soil particles are to being entrained in moving water and is determined by using the Universal Soil Loss Equation (Soil and Water Conservation Society 1993). The WEG is a classification in the National Soils Handbook (SCS 1999) that ranks soils from 1 to 8, with 1 and 2 representing extremely severe erosion by wind and 7 and 8 being very slightly or not subject to wind erosion. While K-factor and WEG may not affect soil suitability for reclamation, they indicate possible difficulties in handling soil to prevent erosion during mining. Erosion of soil resources, especially seleniferous soil, has the potential to affect water quality if sediment reaches local drainages.

This analysis considered K-factors greater than 0.40 as having high erosion susceptibility (Maxim 2001c). There were 19 samples above 0.40, and of those, six contained selenium concentrations considered marginal for salvaged soils. However, these high K-factors occur in the subsoil and the surface textures of all these soils, except SS-23 (F Complex), which contains coarse fragments. Coarser materials at the surface may lower the potential for erosion by water.

Soils with WEG factors of 1 to 3 show a high susceptibility to wind erosion (SCS 1994). Complexes C and D, alluvial soils found on stream terraces and flood plains in all three creeks in the project area, are the only soil types to have a high wind erosion potential, with a WEG value of 3.

Although soils within the project area are relatively coarse, they are poorly sorted and permeability is rated slow to moderate. Leaching of chemicals from the soil to subsurface strata or groundwater would be slowed, but by no means halted, by the low permeability of the soil. Currently, there is relatively little erosion from the undistributed lands on Rasmussen Ridge.

3.4.1.5 Biological Characteristics

The surface layer (0 to several inches) of most soils supports a biological community of living organisms that support soil productivity such as bacteria, fungi, microrhizae, plant seeds, etc. These organisms only exist with sufficient water, oxygen, and food sources. The presence of these organisms maintains the productivity of soils by contributing to the soil as a fertile substrate for plants. When topsoils are buried for long periods of time, they lose their biological activity due to lack of oxygen and organic matter, and become sterilized. Sterile soils are less suitable for germination of plants than are biologically active soils.

3.4.2 Watersheds

As directed by BLM for the Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis, Version 2.2 and the Inland Native Fish Strategy (INFISH), Agrium conducted a Level 1 watershed analysis on all or part of six sixth-code watersheds that comprise the portion of the fifth-code watershed above the Blackfoot Narrows (Maxim 2002e). These sixth-code watershed analysis units (WAUs) - Angus Creek, Sheep Creek, Chippy Creek, Upper Lanes Creek, Middle Lanes Creek and Lower Lanes Creek - are located within the Blackfoot River basin (**Figure 3.4-2**). The project area extends into the Reese Canyon subwatershed, but based on the minimal disturbance in this subwatershed, Reese Canyon was not analyzed. Within these subwatersheds, IDEQ has listed Angus Creek, Lanes Creek, Bacon Creek, Sheep Creek, Timothy Creek, and the Blackfoot River as water quality limited streams as a result of mainly to sediment loading. Yellowstone cutthroat trout and several non-native game fish are present in streams in the watershed.

Landforms in the area have been formed by faulting, erosion, deposition, and intrusions, and represent a variety of ages (Maxim 2002e). Faulting occurs throughout the subwatersheds, and the phosphate-bearing rock has been exposed by faults in the Angus Creek and Sheep Creek subwatersheds.

The project area receives 27 inches of precipitation annually. Perennial streams and their tributaries drain the subwatersheds, and flow consists primarily of snowmelt, rainfall, and groundwater recharge (Maxim 2002e). Peak flows usually occur in May with the snowmelt, but also can occur during summer storms. The springs and seeps that maintain flow in the dry, late summer months stem from Triassic formations in the upper elevations, but loss of surface flow is greatest in these coarse upland areas. Water quality is affected by sedimentation from erosion of soil in uplands areas and by streambank erosion. Groundwater influence is limited, except in the Lower Lanes Creek subwatershed where the Blackfoot River begins, so sediment is mostly transported by overland flow. Ponds or basins associated with mining operations, beaver ponds, and wetland areas make up most of the sediment traps in the area. These impoundments and diversions have altered streamflow in the study area. Beaver dams are found within the upper portions of the study area where there is a supply of wood, while major man-made impoundments are concentrated in areas where mining and agricultural land use are prominent.

Evergreen and aspen stands, sagebrush/grassland, and wetlands constitute the bulk of the vegetative communities in the subwatersheds (Maxim 2002e). Evergreen stands and forested riparian areas occur in the higher elevations, while aspen grow in the transition to the grasslands in the lower regions. Vegetation in the lower riparian areas is dominated by willows, sagebrush, and sedges (Maxim 2002e). Highly functional riparian areas could occur in the Lower Lanes Creek and Angus Creek subwatersheds (Maxim 2002e). Two riparian and wetland communities were found in the area near the proposed project, and will subsequently designated as Category III wetlands. Category III wetlands are common, small, and isolated and support low species diversity.

Topography, limited access, the availability of water, and diverse habitat types makes Rasmussen Ridge ideal for big game, of which elk, mule deer, and moose are the most common.

Figure 3.4-2 Watershed Analysis Units

The primary predators include mountain lion, black bear, coyote, badger, and bobcat, which feed mostly on small mammals and birds. Numerous species of bats and birds occur in the area, including nine special status raptors and two upland game birds. Non-game fish, including sculpin and minnow, and game fish (primarily trout), occur in the local streams. Overall, five federally listed or candidate species as well as 18 special status species have the potential to occur in the area.

Land use within the subwatersheds primarily includes timber harvesting, open pit mining, grazing, recreation, and associated roads. Public land administered by the USFS makes up almost two-thirds of the area and nearly the entire Sheep Creek subwatershed. Evidence of all uses has been seen on public land, while livestock operations dominate private land use in the lower elevations (Maxim 2002e).

Table 3.4-4 lists causes of change in the subwatersheds. Hillslope erosion, fluctuating annual precipitation, and wildland fire have historically been the dominant causes of change in the area (Maxim 2002e). Increased risk of catastrophic fire caused by fire suppression practices (road and fire breaks) has raised the potential for sedimentation and runoff, altering water quality in the region. Along with this change in water quality, angler harvest and fish eradication are the major concerns in the decline of the native cutthroat trout. Other human activity, primarily sheep and cattle grazing, mining operations, timber harvesting and road construction, has led to the loss of vegetation and increased erosion and sedimentation that has caused degradation of habitat.

Based on **Table 3.4-4**, Angus Creek is the most influenced subwatershed of the six subwatersheds, because of grazing, mining, road construction, and timber harvest. High instream levels of sediment, limited riparian vegetation, unstable banks, higher stream temperatures, and low macroinvertebrate populations and declining densities of cutthroat trout all indicate some changes are taking place (Maxim 2002e). The Lower Lanes Creek subwatershed exhibits the same characteristics, mostly as a result of grazing, although on a slightly smaller scale than in the Angus Creek subwatershed. Compared with the two subwatersheds discussed above, Chippy Creek, Upper Lanes Creek, and Middle Lanes Creek show moderate influences to subwatershed resources, related mostly to cattle grazing and road construction. Sheep Creek is the least affected of all six subwatersheds (Maxim 2002e). Road construction presents the most immediate threat to Sheep Creek. However, sedimentation and runoff would greatly increase in the event of a large wildfire as a result of fire suppression in the subwatershed.

3.5 VEGETATION, RIPARIAN AREAS AND WETLANDS

A vegetation study was performed in the study area in August 2001 (Maxim 2001d). The study included a survey of vegetation and mapping of dominant plant communities; a survey for threatened, endangered, and special status plants; field verification of previous wetland delineations; and collection and analysis of vegetation samples to document background concentrations of metals. The results of the vegetation study are presented in this section.

TABLE 3.4-4
DOMINANT CAUSES OF CHANGE AND INFLUENCE IN THE SUBWATERSHEDS

Causes of Change	Direct Impacts	Indirect Impacts	Period	Subwatersheds					
				Angus Creek	Sheep Creek	Lower Lanes Creek	Middle Lanes Creek	Upper Lanes Creek	Chippy Creek
Natural Causes									
Hillslope Erosion	Erosion Processes	Stream Channel Water Quality	On-going	M	L	H	M	M	M
Climate Fluctuation	Hydrology	Aquatic Habitat	On-going	H	M	L	M	H	H
Wildland Fire	Vegetation	Hydrology Erosion Processes	On-going	L	H	M	H	H	L
Human Causes									
Fish Eradication	Aquatic Species	-	1960s	U	U	U	U	U	U
Angler Harvest	Aquatic Species	-	Post-Settlement	U	U	U	U	U	U
Cattle Grazing	Vegetation Erosion Processes	Stream Channel Water Quality	Post-Settlement	H	L	H	M	M	H
Mining Operations	Vegetation Hydrology Erosion Processes Water Quality	Stream Channel Water Quality	1969-Present	H	L	M	N	N	N
Road Construction	Vegetation Erosion Processes	Stream Channel Water Quality	Associated Action	H	M	L	M	H	M
Timber Harvests	Vegetation Hydrology Erosion Processes	Stream Channel Water Quality	1974-1994	H	M	M	H	L	L
Sheep Grazing	Vegetation Erosion Processes	Stream Channel Water Quality	Post-Settlement	L	H	M	M	M	L
Fire Suppression	Vegetation	Hydrology Erosion Processes	Post-Settlement	L	H	M	H	H	L

H=High relative influence on trout-bearing streams; M=Moderate relative influence on trout-bearing streams; L=Low relative influence on trout-bearing streams; U=Undistinguishable influences on trout-bearing streams; N=No relative influences on trout-bearing streams

3.5.1 Forest, Upland, and Riparian Communities

Five plant community types were observed in the study area. Plant communities identified included mixed aspen/conifer forest, conifer, sagebrush/grassland, aspen forest, and riparian/wetlands (**Figure 3.5-1**). The mixed aspen/conifer forest was the most common community, making up 40 percent of the total cover in the study area. Conifer forest represented 30 percent of the total cover in the study area. The sagebrush/grassland community constituted approximately 28 percent of the study area. Aspen forest represented approximately 7 percent of the study area. Riparian/wetland communities represented less than 1 percent of the study area. Dominant species of each plant community are summarized in **Table 3.5-1**.

Mixed aspen and conifer forest predominates the study area, making up almost 564 acres of the 1,375 acres surveyed. This community can be found on all aspects and overlaps both conifer and sagebrush/grassland communities. The community is characterized by open stands of aspen and conifer, with occasional areas of dense aspen or snowberry. Conifers are of intermediate age, and most aspen are either saplings or young trees.

Conifer forest is the second most common plant community, totaling 420 acres of the study area. Conifer forest occurs at higher elevations along ridgetops and on west-facing slopes. Dominant species in conifer forest include lodgepole pine, Douglas fir, and subalpine fir. Understory in the conifer forest includes a variety of shrubs as well as pinegrass and elk sedge. Canopy cover in conifer forest is relatively open, with numerous downed trees. Most trees are young to intermediate in age. The abundance of downed trees, coupled with the relatively young age of standing trees, provides evidence of the previous logging of the USFS lands in the early 1980s.

Approximately 282 acres of sagebrush/grassland communities occur in the study area. Sagebrush/grassland occurs mainly on gently west- and south-facing slopes on dry soils or rocky outcrops. Common species include mountain big sagebrush, silver sagebrush, mountain snowberry, Oregon grape, and several forbs and grasses (**Table 3.5-1**).

Aspen forest occupies 100 acres of the study area. This forest type is found throughout the study area, primarily on mesic sites. Aspen forests are interspersed with sagebrush/grassland at lower elevations and with conifer forest at higher elevations. The majority of aspen are young, which is typical of forests in early successional stages. Aspen forests include a diverse understory of shrubs, forbs, and grasses (**Table 3.5-1**).

Riparian/wetland communities are found along No Name Creek, Sheep Creek, and Reese Canyon Creek. Riparian/wetland communities occupy approximately 9.14 acres of the study area. In general, riparian/wetland communities are small and are located near areas of human activity.

Figure 3.5-1 Vegetation Map with Wetland Locations

TABLE 3.5-1
VEGETATION COVER TYPES AND ASSOCIATED SPECIES

Common Name	Scientific Name	Aspen	Conifer	Mixed Aspen/ Conifer	Sagebrush
Grasses/Sedges					
Elk sedge	*Carex geyeri*		X		
Kentucky bluegrass	*Poa pratensis*			X	
Pinegrass	*Calamagrostis rubescens*	X	X		
Prairie junegrass	*Koeleria cristata*				X
Timothy	*Phleum pratense*	X			
Forbs					
Bastard toadflax	*Comandra umbellate*				X
Black-headed coneflower	*Rudbeckia occidentalis*			X	
Capitate sandwort	*Arenaria congesta*				X
Meadow rue	*Thalictrum occidentalis*	X			
Mule's ear	*Wyethia amplexicaulis*				X
Nettle-leaf horsemint	*Agastache urticifolia*	X			
One-sided wintergreen	*Pyrola secunda*		X		
Silvery lupine	*Lupinus argenteus* Var. *parviflorus*			X	
Sticky geranium	*Geranium viscossimum*	X			
Wild strawberry	*Fragaria virginiana*			X	
Trees/Shrubs					
Aspen	*Populus tremuloides*	X		X	
Cascade mountainash	*Sorbus scopulina*		X		
Douglas fir	*Pseudotsuga menzeizii*		X	X	
Lodgepole pine	*Pinus contorta*		X	X	
Mountain big sagebrush	*Artemisia tridentata* ssp. *vaseyana*			X	
Mountain lover	*Pachistema myrsinites*		X		
Mountain snowberry	*Symphoricarpos oreophilus*	X		X	X
Oregon grape	*Mahonia repens*				X
Scouler's willow	*Salix scouleriana*			X	
Serviceberry	*Amelanchier alnifolia*		X		
Silver sagebrush	*Artemisia cana*				X
Sub-alpine fir	*Abies lasiocarpa*		X	X	

Source: Maxim 2001d.

3.5.2 Wetlands

Two wetland surveys have been completed for the study area. The first survey (TRC 2000) delineated jurisdictional wetlands located on the Rasmussen Mine property (see Figure 3.5.1). A follow-up survey (Maxim 2001e) verified the results of the previous effort and assessed the functions and values of wetlands located within the boundary of the study area. The assessment of functions and values was conducted in accordance with Montana Department of Transportation methodology (Berglund 1996).

3.5.2.1 Wetland Areas (Riparian and Springs/Seeps)

TRC Mariah Associates, Inc. (TRC) completed a wetland delineation for the study area in January 2000. The study identified four jurisdictional wetlands along No Name Creek, Sheep Creek and Reese Canyon Creek. Three wetlands are located in the eastern portion of the survey area along No Name Creek. The southern most wetland is 1.07 acres in size and is dominated by Booth's willow (*Salix boothii*), Colorado rush (*Juncus confusus*), and Kentucky bluegrass (*Poa pratensis*). The central wetland (3.03 acres) is described as a wet meadow that surrounds a man-made pond. Beaked water sedge (*Carex utriculata*) is dominant in the immediate vicinity of the pond. The northern most wetland in No Name Creek is 0.40 acres in size and is characterized by Kentucky bluegrass, tufted hairgrass (*Deschampsia caespitosa*), Colorado rush, and American false-helleborne (*Veratrum viride*).

Wetlands were also identified in Sheep Creek and Reese Canyon Creek. One wetland was identified in Sheep Creek that is 1.06 acres and is located near a small spring. Kentucky bluegrass, meadow barley (*Hordeum brachyantherum*), Colorado rush, and beaked sedge characterize the Sheep Creek wetland. The Reese Canyon wetlands cover 3.58 acres and include a small meadow located at the top of the drainage and five other wetland areas downstream. Dominant vegetation in the Reese Canyon wetlands include Colorado rush, Kentucky bluegrass, tufted hairgrass, and American false-helleborne.

3.5.2.2 Wetland Functions and Values Assessment

The results of the assessment of functions and values indicated that wetlands in the study area are classified as Category III (TRC 2000). Category III wetlands are relatively common, have lower species diversity, and are smaller and more isolated than are Category I or II wetlands. Wetlands located in the study area ranked high for sediment, nutrient, and toxicant removal. These wetlands were not considered potential habitat for threatened, endangered, or other special status species. This determination was based on the small size of wetlands in the study area and the high level of human activity near them. Most wetlands in the study area also received low rankings for flood attenuation and surface water storage. However, slope wetlands (for example in Sheep Creek and Upper Reese Canyon) ranked high for groundwater discharge and recharge. Slope wetlands received this ranking because their well-developed root systems help reduce erosion and trap sediment during periods of high flow. Most wetlands ranked low for recreation and education potential because of their small size and proximity to human activity.

3.5.3 Background Metal Concentrations in Vegetation and Soil

An Order II soil study was conducted during September 2000 and August 2001 to document background concentrations of metals in vegetation and soil (Maxim 2001c). Sites were sampled in upland plant communities within the study area (**Figure 3.5-1**). No riparian or wetland sites were sampled. Samples were analyzed for cadmium, copper, manganese, molybdenum, nickel, selenium, vanadium, and zinc. The results for nine representative soil samples are summarized in **Table 3.5-2,** and results for vegetation are summarized in **Table 3.5-3**.

TABLE 3.5-2
CONCENTRATIONS OF TRACE ELEMENTS IN REPRESENTATIVE SOIL SAMPLES NORTH RASMUSSEN RIDGE MINE

Site	Depth (inches)	Element (MG/KG)							
		Cd	Cu	Mn	Mo	Ni	Se	V	Zn
SS-1	0-6	23	11	365	<1	40	1	27	426
	6-16	10	20	102	2	28	2	48	114
	16-34	7	35	21	6	54	9	93	149
	39-60	61	139	36	2	38	2	332	230
SS-2	0-6	10	12	1850	<1	44	<1	20	255
	6-17	2	13	376	2	34	2	37	88
SS-3	0-12	12	17	1460	1	34	<1	23	317
	12-24	3	17	440	2	36	2	44	165
	24-40	1	30	237	3	42	1	43	108
SS-4	0-5	7	18	1280	1	32	<1	60	230
	5-24	6	16	1280	1	37	<1	58	215
SS-5	0-9	<1	12	2480	<1	16	<1	22	69
	9-18	<1	11	2390	16	<1	<1	22	68
	18-38	<1	19	1070	<1	18	<1	22	52
	38-60	<1	21	3440	<1	23	<1	23	58
SS-6	0-7	2	33	1240	3	64	2	45	175
SS-7	0-10	21	27	633	3	49	2	68	291
	10-24	20	30	365	3	55	2	83	275
	24-35	8	60	272	2	64	<10?	74	276
SS-8	0-17	16	22	1190	2	60	1	27	457
	17-39	2	31	181	3	103	2	32	300
	39-60	2	41	44	2	62	4	22	201
SS-9	0-6	6	18	744	2	35	2	54	160
	6-12	4	16	429	2	36	1	43	132
	12-25	3	22	280	3	44	3	75	127
	25-31	2	26	296	3	49	3	58	121
Background Levels in Western Soils (mg/kg) [1]		<3	21[2]	40 - 900	1 – 2 up to 40	4 – 80	<0.1 – 4.3	70[2]	<150
Mean		8.85	27.58	865.42	2.56	42.21	1.92	55.96	194.58
Standard Deviation		12.56	25.23	877.16	3.00	19.75	1.85	60.17	108.09

Notes: [1] Adapted from Shacklette and Borengen (1984).
[2] Value is mean concentration in western soils.
"<" indicates that element was not detected above the given quantity.
mg/kg = milligrams per kilogram
Source: Maxim 2001c.

TABLE 3.5-3
CONCENTRATIONS OF TRACE ELEMENTS IN REPRESENTATIVE VEGETATION SAMPLES NORTH RASMUSSEN RIDGE MINE

Site	Forb OR Grass (F OR G)	Element (MG/KG)							
		Cd	Cu	Mn	Mo	Ni	Se	V	Zn
SS-1	G	2	4	107	<1	2	<1	<1	61
	F	<1	2	71	1	3	<1	<1	58
SS-2	G	<1	4	123	<1	3	<1	<1	39
	F	3	8	259	<1	10	<1	<1	106
SS-3	G	<1	5	154	<1	2	<1	<1	48
	F	4	13	70	1	4	<1	<1	51
SS-4	G	<1	4	55	<1	2	<1	<1	19
	F	6	6	58	<1	5	<1	<1	60
SS-5	G	<1	4	326	<1	6	<1	<1	22
	F	<1	3	53	1	4	<1	<1	12
SS-6	G	2	8	124	6	8	<1	4	43
	F	<1	10	93	<1	4	<1	<1	43
SS-7	G	2	5	37	2	3	<1	2	26
	F	<1	4	24	<1	3	<1	<1	104
SS-8	G	<1	2	33	<1	2	<1	<1	26
	F	13	9	59	2	2	<1	<1	164
SS-9	G	<1	2	60	3	2	<1	<1	14
	F	<1	5	28	2	88	<1	<1	15
Mean		2.08	5.44	96.33	1.28	8.5	0.5	0.78	50.61
Standard Deviation		3.13	3.03	80.69	1.4	19.97	0	0.88	39.42

Notes: “<” indicates that element was not detected above the given quantity.
mg/kg = milligrams per kilogram
Source: Maxim 2001c.

The results of the analyses of soil indicated that concentrations of cadmium, copper, manganese, and zinc were frequently higher than typical concentrations found in soils of the western U.S. Concentrations of molybdenum, nickel, selenium, and vanadium also exceeded typical levels in western U.S. soils in several samples. Concentrations of cadmium exceeded typical background levels of 3 mg/kg at seven locations (in 14 samples). Concentrations of copper exceeded the mean level background of 21 mg/kg in sample collected at seven locations (in 13 samples). Concentrations of manganese exceeded typical background concentrations in western soils (40 to 900 mg/kg) in samples collected at six locations (in 10 samples). Concentrations of zinc exceeded typical background concentration at all nine sample locations (in 14 samples). Although selenium is known to occur at elevated concentration in this area the concentration of selenium in only one sample exceeded the range typically found in western U.S. soils.

Concentrations of trace metals in vegetation appeared to be loosely correlated to concentrations in companion soil samples. In general, concentrations of metals in vegetation were lower than concentrations of metals in companion soil samples, and metals do not appear to be concentrating in grass or forb samples.

3.5.4 Potential for Selenium Bioaccumulation

Selenium can be absorbed by plants to concentrations that are toxic to birds, fish, and mammals. Plants capable of accumulating selenium to high concentrations are known as seleniferous. Examples of seleniferous plants that occur in the western U.S. include fourwing saltbush (*Atriplex canescens*) and some species of milkvetch (*Astragalus* spp.).

Selenium toxicosis has been documented in horses in southeastern Idaho. In January 1997, the USFS received a report of six ill horses. The horses had been grazing a pasture located near a source of water located downgradient of a phosphate mine. The horses were later diagnosed with selenium toxicosis. A larger study was subsequently conducted to document concentrations of selenium in waterways on the Caribou National Forest. The study found concentrations of selenium at 17 locations in excess of Idaho's maximum contaminant level (MCL) for livestock drinking water consumption (USFS 1997). Idaho's MCL for selenium in drinking water is 0.05 mg/L.

Selenium was detected in soil samples collected from the study area; however, selenium was not detected in any vegetation samples. Concentrations of selenium in soil samples collected from the study site ranged from less than 1 ppm to 9 ppm.

A separate study conducted by Montgomery Watson concluded that regional background concentrations of selenium in southeast Idaho range from 0.61 ppm to 16.0 ppm. Typical concentrations of selenium in western U.S. soils range from less than 0.1 ppm to 4.3 ppm. Soils that contain concentrations of selenium above 2 ppm are considered seleniferous (CSU 2001).

A soil survey was also conducted for the Central Rasmussen Ridge area on August 25 and 26, 1999 (TRC 1999). Although the purpose of the study was to evaluate the suitability of topsoil for use in reclamation, it also documents baseline levels of selenium in the topsoil. Eight soil survey stations were sampled at 25 centimeter intervals to a total depth of 1.0 meter. Total concentrations of selenium in topsoil ranged from 0.5 mg/kg to 2.3 mg/kg dry weight, with a mean concentration of 1.0 mg/kg. Extractable concentrations of selenium were all below the detection limit of 0.02 mg/kg. Selenium was not detected in any vegetation samples collected near the of soil samples. As a result, there does not appear to be any evidence of natural bioaccumulation of selenium in vegetation samples collected from the baseline study area.

In one study in the Southeastern Idaho mining area (Mackowiak, Amacher and Herring 2002), wetland vegetation had mean tissue selenium above 10 mg/kg, whereas tissue selenium from a reference wetland outside of this area had a mean value of 1 mg/kg. Vegetation sampled near a seep contained 10 times more selenium than vegetation sampled 160 meters from the seep, suggesting some selenium immobilization may have occurred along the flow path. The mean selenium concentration in vegetation in Wooley Valley (unit 4) was approximately 30 mg/kg, while reference locations (excluding Maybe Canyon) were below 2 mg/kg. Legumes tended to contain the most selenium of all sampled lifeforms.

3.5.5 Timber Sales

In the early 1980s, commercial timber was removed from most of the Rasmussen Ridge leasehold. The North Rasmussen Ridge Mine site therefore would not require any Special Use Permits within timber sale areas.

The lease area falls partially or fully in one or two prescription units: a forest management unit and a phosphate lands unit that defaults to the forest-wide management prescription. Prescription 5.1 (b, c, d) - Timber Management, emphasizes scheduled wood-fiber production and use and other compatible commodity outputs, with consideration for long-term forest resilience. Alternative 7 of the Forest Plan DEIS is the preferred alternative and that states the timber resources in the lease area will be managed by one of two management prescriptions, depending on their exact location.

The forest restoration prescription emphasizes maintaining and restoring forest ecosystem processes and functions, and any volume that results from harvest is an outcome of restoration. Lands in this prescription are included in the suitable timber base and contribute to the allowable sale quantity. Firewood is available, as designated on fuelwood maps, from dead trees, designated aspen areas, and from slash and logs decked for that purpose. A timber management prescription also is in place for lands similar in structure to the lease area. The timber management prescription manages land to emphasize the cost-effective production of timber and is applied only to areas that have the highest potential to produce wood-fiber. The lease area does not fall into this category.

The elk and deer winter range prescription emphasizes vegetation management to maintain or improve cover or forage conditions needed for wintering deer and elk. These areas are not part of the suitable timber base and do not contribute to the allowable sale quantity.

3.5.6 Noxious Weeds

A review of Idaho Department of Agriculture records indicated that eight noxious weeds are well established or are becoming well established in Caribou County. Weeds with documented infestations that range from 50 acres to 1,000 acres in Caribou County include hoary cress (*Cardaria draba*), leafy spurge (*Euphorbia esula*), musk thistle (*Carduus nutans*), Russian knapweed (*Centaurea repens*), spotted knapweed (*C. maculosa*), Dyers woad (*Isatis tinctoria*), and yellow toadflax (*Linaria vulgaris*). Canada thistle (*Cirsium arvense*) affects the largest total surface area with a total infested area of between 1,000 and 10,000 acres.

Canada thistle, musk thistle, and yellow toadflax occur in some disturbed areas of the Rasmussen Mine. The mine has implemented a weed management program to control Canada thistle and yellow toadflax. Known occurrences of noxious weeds are monitored and chemically treated, as required, on an annual basis.

The USFS also has obtained data on management of noxious weeds in the Soda Springs Ranger District for the year 2000. Noxious weeds currently present in the Soda Springs Ranger District in Idaho and their areas of infestation include the following:

- Musk thistle – 100,000 acres
- Canada thistle – 20,000 acres
- Yellow toadflax – 3,900 acres
- Dyers woad (*Isatis tinctoria*) – 3,000 acres
- Mayweed – 300 acres
- Spotted knapweed (*Centaurea maculosa*) – 135 acres
- Black henbane (*Hyoscyamus niger*) – 100 acres
- Leafy spurge – 30 acres

Other noxious weeds with total infested acreages in the Soda Springs District that are less than 10 acres include whitetop, poison hemlock, and Russian knapweed.

3.5.7 Fire Management

Fire management guidelines are described in each of the Caribou National Forest management prescriptions that apply to the lease area. The lands in the project area include both Phosphate Mine Areas (Prescription 8.2.2) and Elk and Deer Winter Range (Prescription 2.7.2), both of which follow the forest-wide guidance. For lands in a forest management prescription, wildfire will be suppressed using control strategies during the fire season. Pre- and post-fire season strategies may include containment, confinement, or control. Prescribed fire may be used to reduce fuel loading, obtain natural regeneration, improve livestock forage, improve wildlife habitat, and for other purposes that meet the needs of this prescription. Prescribed fire may be allowed to maintain or improve winter habitat and enhance ecological conditions for lands in an elk and deer winter range prescription.

3.6 TERRESTRIAL WILDLIFE

Wildlife habitat on Rasmussen Ridge includes aspen, aspen/conifer mixed, conifer, sagebrush, disturbed, wetland, and riparian areas (Maxim 2001d). The study area for wildlife is shown on **Figure 3.6-1**. Aspen stands occur in a small area on the southwest-facing slopes of the ridge in the southwest corner of the study area. Aspen/conifer mixed habitat (aspen, Douglas-fir, lodgepole pine, and occasionally sub-alpine fir) occurs along the east side below the conifer habitat and above the sagebrush habitat. This habitat is located on all aspects and has wide zones of overlap with sagebrush and conifer habitats. Conifer habitat (Douglas-fir, lodgepole pine, and occasionally sub-alpine fir) occurs along the west side, typically at higher elevations on Rasmussen Ridge. Sagebrush habitat occurs in several small, isolated patches on dry, rocky outcrops and slopes along the ridge, and at lower elevations adjacent to riparian zones. A small area of disturbance occurs within and adjacent to the area of the proposed mine expansion in the southwest corner. The disturbed area is mostly associated with old mining activity, existing roads, and drill pad access roads (Maxim 2001d). Past logging activity has also reduced old growth habitat, which is used by species such as the northern goshawk. As a result, the quantity of old growth habitat has been reduced by removal of large trees. Wetlands and riparian areas occur along Sheep Creek, No Name Creek, and Reese Canyon Creek. These habitats provide important nesting, resting, and feeding habitats for several wildlife species.

Figure 3.6-1 Wildlife Study Area, Survey Locations and Elk and Deer Critical Winter Range

3.6.1 Mammals

Several mammalian species are known or expected to occur within the study area in the Caribou National Forest. These species include several members of the rodent family; various bats; intermediately sized species such as coyotes (*Canis latrans*); badgers (*Taxidea taxus*); bobcats (*Lynx rufus*); and mountain cottontails (*Sylvilagus nuttalli*); and large mammals including mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus*), moose (*Alces alces*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*).

3.6.1.1 Big Game

Rasmussen Ridge is an important area for big game because of the diverse, interspersed habitat types, availability of water, gentle topography, and limited access. However, past and current mining have reduced the amount and quality of foraging habitat by reducing acres of habitat and increasing human disturbance. Elk and mule deer are the two most common large mammals that occur within the study area. Moose are known to use habitats in the study area, but to a lesser degree. All three species can be found within and around the immediate study area during spring, summer, and fall. During the winter, these species generally migrate to areas with less snow accumulation and greater availability of forage; however, some winter habitat is located in the vicinity of the study area.

The DEIS for the Caribou National Forest draft revised forest plan identifies critical elk and deer winter range located immediately east of the boundary of proposed disturbance within the Caribou National Forest (USFS 2001). No critical winter elk or deer habitat is located within the study area (**Figure 3.6-1**). No critical moose winter range occurs within the Caribou National Forest.

In the Rasmussen Ridge area, elk prefer sagebrush-grass and mountain brush habitats during winter, sagebrush-grass and aspen habitats in spring, aspen habitats in summer, and conifer habitats during fall. These habitats all occur within the study area. Accordingly, Rasmussen Ridge has been identified as an important elk summer range and calving area, and has also been used as winter range. There are no defined elk migration corridors in the Rasmussen Ridge area (Collins 1981). Regional studies conducted by the Idaho Department of Fish and Game (IDFG) (Kuck 1984) indicate that most elk in southeast Idaho tend to be nomadic but do not migrate long distances between summer and winter ranges. The mean year-round home range for elk was reported as 26 square miles, with a mean migration distance between summer and winter ranges of 4.1 miles.

Although the bottomlands of Angus Creek and Sheep Creek provide excellent forage for elk, portions of the unforested areas south of the proposed mine expansion are occupied by active mining-related facilities and are not optimal for foraging. In addition, the valley bottomland to the west has a relatively high density of roads and agricultural fields. Many studies (Thomas et al 1979; Lyon 1983) have shown that increased densities of open roads and levels of human activity reduce the effectiveness of elk habitat. Elk calving typically takes place between May 25 and June 5 in forested habitat, where levels of human activity and livestock grazing are low. Aspen stands in the southeastern portion of the study area may be used as calving areas, but they are small and are not likely important. In terms of population numbers, IDFG periodically completes big game population surveys throughout the state. The proposed study area is located in IDFG Management Unit 76 that is bounded to the east by the Wyoming state line, to the south by the Utah state line, to the north by Highway 34, and approximately by the city of Soda Springs to the west. The most recent elk population surveys conducted in Management Unit 76 were completed in 1992, 1995 (IDFG 1999), and 1999 (IDFG 2000b). IDFG reported elk numbers equaling 2,654 in 1992, 3,213 in 1995, and 3,301 in 1999. The population of elk in the area appears to be increasing and is within the objectives defined by the IDFG (1999).

Mule deer prefer mountain brush and riparian vegetation during winter; mountain brush, riparian, aspen, and aspen/conifer habitats during spring and summer; and aspen and conifer during the fall. Mule deer use Rasmussen Ridge as summer range, but apparently do not use it as winter range. Mule deer exhibit a well-patterned migratory behavior, moving to areas of low elevation in the late fall and early winter and returning to the higher-elevation summer range in May (Collins 1981). Unlike elk, mule deer migrate longer distances from winter and summer ranges and do not show specificity to particular ranges. Deer migrate through the study area during the fall en route to winter range and during the spring en route to summer range. However, no specific migratory corridors have been identified within the area. The most recent population surveys for deer within Management Area 76 were conducted in 1991 and 1994. Surveys identified 4,405 mule deer during 1991 and 2,428 mule deer in 1994. This decline was attributed to the severe winter of 1991/1992. The population is currently considered stable (IDFG 1999).

Moose prefer aspen and conifer types during the winter, summer, and fall, and aspen in spring. Moose activity was also documented within riparian areas on the Rasmussen Ridge lease sites in November 1980 (Collins 1981).

Moose can also be found throughout the study area at any time of the year. Moose in the area do not concentrate in specific wintering areas, but are widely dispersed in aspen and conifer communities year-round (Kuck 1984). They tend to stay within a small home range and are well adapted for foraging in deep snow. The most recent survey for moose populations in the area was conducted by IDFG in 1999 for Management Unit 76. A total of 140 moose were observed; population estimates for the Management Unit are between 437 and 729 individuals (IDFG 2000b).

3.6.1.2 Carnivores

Carnivore track surveys were conducted during winter 2000 and 2001 within the study area (Maxim 2001d). In addition to these track surveys, carnivores were observed in the forest while other wildlife surveys were conducted during the spring and summer 2000. During these surveys, the following carnivores were observed: black bear, coyote, badger, and bobcat. The majority of the carnivores found in the area feed on small mammals and birds and use most of the habitat types in the area. Although mountain lions were not recorded, they are known to inhabit surrounding areas and typically occur in areas with high populations of elk and deer. Evidence of black bears in the area (claw markings on aspen trees) was also noted, primarily in the Reese Canyon drainage. No studies have been completed within the area that concern the uptake of selenium by carnivores as a result of feeding on prey species that were exposed to elevated levels of selenium in vegetation. Evidence of badger was common in the No Name and Sheep Creek drainages.

A winter survey was also conducted in 2001 for forest carnivores (Maxim 2001d). No lynx or wolverine tracks were recorded. Bobcat tracks were observed that entered the No Name road from the west. Old tracks were also recorded just east of a cattle guard on Sheep Creek Road. Other carnivore tracks observed included weasel and coyote.

3.6.1.3 Bats

Two surveys for bats were conducted in the study area during July and August 2000 (Maxim 2001d). Riparian areas and ponds were surveyed using mist nets and a tunable broadband ultra-sonic bat detector. Seven species of bats were either captured or detected during the surveys: big brown bat *(Eptesicus fuscus),* silver-haired bat *(Lasionycteris noctivagans),* western long-eared myotis *(Myotis evotis),* long-legged myotis *(Myotis volans),* Yuma myotis (*Myotis yumanensis*), California myotis (*Myotis californicus*), and little brown bat (*Myotis lucifugus*). An eighth species, hoary bat (*Lasiurus cinereus*), was detected but not confirmed. Of the bats that were captured, several individuals were lactating females and juveniles, suggesting the presence of active maternity roosts in the area (Maxim 2001d).

Two of the three survey sites (Sites B and C in Reese Canyon) were very active, and the third site (Site A near Sheep Creek) was moderately active, indicating that the study area is very good bat habitat (Maxim 2001d) (**Figure 3.6-1**). There are no known caves, abandoned mines, or fractured rock outcrops in the vicinity of the proposed North Rasmussen Mine, but there are numerous large-diameter snags and live trees that are likely suitable roosting habitat for bats.

3.6.1.4 Other Mammals

Several other small mammals were either directly observed or evidence of their presence (scat or tracks) was documented as part of baseline studies. Other mammals documented during the survey included beaver (*Castor Canadensis*), porcupine (*Erethizon dorsatum*), snowshoe hare (*Lepus americanus*), northern pocket gopher (*Thomomys armatus*), yellow pine chipmunk (*Eutamius amoenus*), and least chipmunk (*Eutamius minimus*).

3.6.2 Birds

A variety of vegetation types occur within the study area that provide a diversity of habitats for many bird species. Although each vegetation type offers important components of the habitat, the riparian areas that occur along the creeks are the most heavily used habitat by the birds in the area. The riparian areas are important during migration as these are often the only habitats within the arid west that are similar to the more mesic habitats found outside the intermountain region. The abundance of insects make riparian areas important foraging habitats for species that nest in the grass or shrublands adjacent to the riparian areas. Maxim (2001d) conducted two surveys for three-toed woodpeckers, two surveys for northern goshawk, two surveys for flammulated owl, and two surveys for boreal owl and great gray owl between May and July 2000. All incidental observations of non-target bird species were recorded during these surveys for special status and migratory species.

3.6.2.1 Raptors

The forested and riparian areas provide numerous nesting opportunities for raptors. Foraging opportunities for raptors are also plentiful and occur throughout the various habitat types found within the area. Mature forest communities of both aspen and conifer, with large trees and snags, are especially important areas for raptor nesting.

Surveys for special status raptor species were performed in the spring of 2000 (Maxim 2001d) and included: northern goshawk (*Accipter gentiles*), boreal owl *(Aegolius funereus),* flammulated owl *(Otus flammeolus),* and great gray owl (*Strix nebulosa).* Raptors observed during the survey included American kestrel (*Falco sparverius*), flammulated owl, great-horned owl (*Bubo virgianus*), northern goshawk, and red-tailed hawk (*Buteo jamaicensis*). Other raptors, such as golden eagle (*Aquila chrysaetos*)*,* Cooper's hawk (*Accipiter cooperii*), and sharp-shinned hawk *(Accipiter striatus*) may nest in the aspen or conifer stands or forage within the various vegetation types throughout the study area but were not observed during the survey. Northern harriers (*Circus cyaneus)* typically nest in grassland habitat (to the west in Enoch Valley) and may also be found foraging in the study area but were not observed during the survey.

Winter surveys for owls were conducted in 2001 (Maxim 2001d). Calling stations were established at several locations, where the surveyor played pre-recorded calls of a boreal owl and a great gray owl. Flammulated owls were heard calling from two distinct locations on both nights before and after dusk.

3.6.2.2 Upland Game Birds

Blue grouse *(Dendragapus obscurus)* and ruffed grouse *(Bonasa umbellus)* are often present in forest communities on toeslopes and ridges and are commonly found in dense conifer and aspen stands in the area. Maxim (2001d) identified both species in the study area during surveys in 2000.

Sage grouse and Columbian sharp-tailed grouse were not observed during the survey. Sage grouse and Columbian sharp-tailed grouse habitat is very limited on Rasmussen Ridge and is marginal to non-existent in the study area (Maxim 2001d); however, Rasmussen Valley west of Rasmussen Ridge has historically supported strutting grounds for sage grouse (Collins 1981). Columbian sharp-tailed grouse are not expected to occur within the project area due to the lack of extensive grasslands and shrublands. Columbian sharp-tailed grouse have been observed 7 miles south of the project area. The study area may provide some winter foraging habitat for Columbian sharp-tailed grouse.

3.6.2.3 Waterfowl

Wet valleys in the Rasmussen Ridge area are known as areas for waterfowl nesting and brood rearing. Waterfowl nest on upland sites and rear broods on natural and man-made ponds in

Enoch Valley, Rasmussen Valley, Lanes Creek, and to a lesser extent in Sheep Creek and the Little Blackfoot River drainages (Collins 1981).

Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), teal (*Anas* spp.), greater sandhill cranes (*Grus canadensis*), curlews (*Numenius* spp.), and other waterfowl nest in areas surrounding but not within the study area. Sandhill cranes likely do not nest within the study area. Shorebirds such as sandpipers (*Calidris* spp.), avocets (*Recurvirostra* spp.), and willets (*Catoptrophorus semipalmatus*) may visit Lower Dry Valley and Rasmussen Valley during migration, but there is limited suitable foraging habitat (mud flats and shorelines) for these species, and they likely do not use the study area.

3.6.2.4 Migratory Birds

Of the 46 birds observed in the study area, 44 species are protected under the Migratory Bird Treaty Act (16 U.S.C. §§ 703-712, July 3, 1918, as amended in 1936, 1960, 1968, 1969, 1974, 1978, 1986, and 1989). A summary of migratory birds observed in the study area and their associated habitat types is provided in **Table 3.6-1**.

3.6.3 Amphibians and Reptiles

The study area supports three streams that provide suitable habitat for amphibians. These streams include the No Name Creek, Sheep Creek, and Reese Canyon Creek. Maxim (2001d) conducted call surveys for frogs and searched for amphibian egg masses, larvae, and adults within these drainages in May and June 2000. These areas provide habitat that could be used as breeding sites for adults and rearing areas for the young to develop. The surveys revealed boreal chorus frogs (*Pseudacris triseriata maculata*) in the West Fork of Sheep Creek. Tiger salamander larvae (*Ambystoma tigrinum*) were recorded in both small ponds in No Name Creek and the upper beaver ponds in Reese Canyon. Northern leopard frogs (*Rana pipiens*) were recorded in beaver ponds in Reese Canyon and in No Name Creek on several occasions (Maxim 2001d). The western toad (*Bufo boreas*) and tiger salamander (*Ambystoma tigrinum*) occur in southeastern Idaho (Digital Atlas of Idaho 2003); however, none were recorded during baseline studies.

Several common garter snakes (*Thamnophis sirtalis*) were recorded in the study area incidental to other surveys of wildlife, fisheries, and wetlands. Five young of the year were observed in Reese Canyon and an adult was seen in the middle reach of Sheep Creek (Maxim 2001d). The western terrestrial garter snake (*Thamnophis elegans*) and rubber boa (*Charina bottae*) occur in southeastern Idaho (Digital Atlas of Idaho 2003), but were not observed during surveys.

TABLE 3.6-1
MIGRATORY BIRDS OBSERVED IN STUDY AREA

Common Name/Species	Habitat	Common Name/Species	Habitat
American kestrel *Falco sparverius*	Sagebrush, riparian	Mallard *Anas platyhynchos*	Wetland
American robin *Turdus migratorius*	Riparian, conifer, mixed aspen/conifer	Mountain bluebird *Sialia currucoides*	Sagebrush, mixed aspen/conifer
Black-billed magpie *Pica pica*	Riparian, sagebrush, conifer	Mountain chickadee *Parus gambeli*	Mixed aspen/conifer, conifer, aspen
Brewer's blackbird *Euphagus cyanocephalus*	Sagebrush, riparian	Mourning dove *Zenaida macroura*	Sagebrush
Brown-headed cowbird *Molothrus ater*	Sagebrush, mixed aspen/conifer, wetland	Northern flicker *Colaptes auratus*	Mixed aspen/conifer, conifer, aspen, riparian
Cassin's finch *Carpodacus cassinii*	Mixed aspen/conifer, conifer	Northern goshawk *Accipiter gentilis*	Mixed aspen/conifer, aspen, riparian
Chipping sparrow *Spizella passerine*	Mixed aspen/conifer	Pine siskin *Carduelis pinus*	Mixed aspen/conifer, Conifer
Cinnamon teal *Anas cyanoptera*	Wetland	Red crossbill *Loxia curvirostra*	Mixed aspen/conifer, Conifer
Common nighthawk *Chordeiles minor*	Sagebrush	Red-breasted nuthatch *Sitta canadensis*	Sagebrush
Common raven *Corvus corax*	Mixed aspen/conifer, conifer	Red-naped sapsucker *Sphyrapicus nuchalis*	Aspen, mixed aspen/conifer, riparian
Common snipe *Gallinago gallinago*	Wetland	Red-tailed hawk *Buteo jamaicensis*	Riparian, sagebrush, mixed aspen/conifer, aspen
Dark-eyed junco *Junco hyemalis*	Mixed aspen/conifer	Sandhill crane *Grus canadensis*	Wetland, riparian
Downy woodpecker *Picoides pubescens*	Riparian, mixed aspen/conifer, aspen, conifer	Song sparrow *Melospiza melodia*	Riparian, wetland
Flammulated owl *Otus flammeolus*	Conifer, mixed aspen/conifer, aspen	Townsend's solitaire *Myadestes townsendi*	Mixed aspen/conifer
Franklin's gull *Larus pipixcan*	Wetland	Turkey vulture *Cathatres aura*	Sagebrush, mixed aspen/conifer
Gray jay *Perisoreus Canadensis*	Conifer, mixed aspen/conifer	Vesper sparrow *Pooecetes gramineus*	Sagebrush
Great-horned owl *Bubo virginianus*	Mixed aspen/conifer, conifer, aspen, riparian	Western tanager *Piranga ludoviciana*	Mixed aspen/conifer, conifer, aspen, riparian
Green-tailed towhee *Pipilo chlororus*	Mountain brush	Western wood-pewee *Contopus sordidulus*	Riparian, aspen, conifer, mixed aspen/conifer
Hairy woodpecker *Picoides villosus*	Mixed aspen/conifer, conifer, riparian	White-breasted nuthatch *Sitta carolinensis*	Mixed aspen/conifer, conifer, aspen
House wren *Troglodytes aedon*	Riparian, mixed aspen/conifer, aspen	Williamson's sapsucker *Sphyapicus thyroideus*	Mixed aspen/conifer, conifer, aspen
Lincoln's sparrow *Melospiza lincolnii*	Riparian	Yellow warbler *Dendroica petechia*	Riparian
MacGillivray's warbler *Oporornis tolmiei*	Riparian, mixed aspen/conifer	Yellow-rumped warbler *Dendroica coronata*	Mixed aspen/conifer, aspen, riparian

Source: Maxim 2001d

3.6.4 Selenium

A number of studies have been conducted to determine the effects of selenium on terrestrial wildlife such as birds and amphibians in southeastern Idaho. A recent study (Montgomery Watson 2000) demonstrated that seven of 20 species of small birds had egg concentrations of selenium greater than the recommended toxicity threshold concentration of ten milligrams selenium per kilogram of dry weight tissue. In 1999, Montgomery Watson (2000) collected 98 eggs in non-mining areas and 117 eggs from mining areas from several bird species. The study was designed to identify whether any regional trends exist between selenium concentrations in eggs and proximity to mining activity in southeastern Idaho. Their work revealed that levels of selenium in egg tissues on mining sites were significantly higher than on non-mining sites. Of the eggs from mining sites, 12.8 percent contained selenium concentrations that exceeded 10 ppm, a level considered potentially problematic for development of bird embryos. Species with concentrations of selenium in eggs greater than 10 ppm included yellow-headed blackbird, common snipe, European starling, mountain songbird, red-winged blackbird, American kestrel, and song sparrow.

A subsequent study was conducted in 2000 to evaluate the effects of selenium exposure on clutch size, hatchling success, fledgling success, and post-fledgling survival. Species studied included American coot, American robin, barn swallow, red-winged blackbird, and yellow-headed blackbird. These species were selected because they are common in the study area, their nests are easily found and observed, they rarely desert nests because of human disturbance, and they are rarely parasitized by brown cowbirds (Montgomery Watson 2000). The impact of selenium levels in eggs on the nesting success and fledgling success of individual blackbird and robin nests indicate that reproductive success consistently increased with increasing levels of selenium of 30 ppm selenium in eggs. A population-level assessment of the impact of selenium on blackbirds and robins also demonstrated no substantial negative impact of selenium contamination from phosphate mining (Garten, Vasterling, and Ratti 2002).

Selenium poisoning has been confirmed in many salamanders at the Gay Mine at the Ft. Hall Indian Reservation (Idaho) and the nearby Smoky Canyon Mine, with concentrations in some individuals that are 10 to 100 times the normal level in animal tissue (USGS 2001a, 2001b). Viral infections found in salamanders at both sites in Idaho may also be linked to high selenium body burdens (USGS 2001a, 2001b).

Laboratory studies have documented that selenium is potentially toxic to other terrestrial wildlife. Concentrations of 12 milligrams selenium per kilogram of food proved toxic to screech owls and caused near total reproductive failure (Wiemeyer and Hoffman 1996 in Sample et al. 1996). The maximum selenium tolerance level for large mammals such as cattle, sheep, horses, and pigs is estimated to be two milligrams selenium per kilogram of food (NRC 1980). Levels greater than the maximum tolerance level can cause chronic selenium toxicity. Concentrations of 0.5 milligrams selenium per liter of drinking water are considered toxic to large mammals such as cattle (Ganje 1966 in Gough et al. 1979). Severe reproductive effects were seen in a study of rats provided a concentration of 2.5 milligrams of selenium per liter of drinking water (Rosenfeld and Beath 1954).

3.6.5 Management Indicator Species

The Caribou National Forest has established three management indicator species (USFS 2001). Management indicator species include Columbian sharp-tailed grouse, sage grouse, and northern goshawk. These species were selected because of general public interest or because the habitat requirements for the species are similar to other species, enabling it to serve as a barometer for habitat health. The Caribou National Forest identified the Rocky Mountain elk and the mule deer as Management Indicator Species in the 1985 Forest Plan. However, they did not meet the criteria and are not considered a Management Indicator Species in the draft revised forest plan (USFS 2001). A summary of management indicator species considered in the study area and their habitats at risk are summarized in **Table 3.6-2**.

TABLE 3.6-2
MANAGEMENT INDICATOR SPECIES
CARIBOU-TARGHEE NATIONAL FOREST

Management Indicator Species	Habitat	Rationale
Columbian sharp-tailed grouse	Grassland and open canopy sagebrush	Only species at risk that is a year-round resident of this habitat.
Sage grouse	Sagebrush	Currently a management indicator species for the Caribou National Forest and USFS.
Northern goshawk	Mature and old forest structure, conifer	Sensitive species with a large range, uses a variety of forest types, and is feasible to monitor for structural changes within foraging areas.

Source: USFS 2001.

3.7 FISHERIES AND AQUATIC RESOURCES

The Blackfoot River drainage historically supported a high-quality Yellowstone cutthroat fishery. The Blackfoot River and tributaries were chemically treated in 1961 to eradicate non-game fish species.

As a result, spawning populations of native cutthroat trout were severely depleted. Introduction of non-native strains of cutthroat and rainbow trout began in 1962 and was widespread in the Blackfoot River drainage. Stocking of trout in the drainage has not returned the fishery to pre-1961 trout populations.

A baseline study of aquatic resources was conducted and included sampling of fish populations, descriptions of fish habitat, and sampling of benthic macroinvertebrates within Sheep Creek (Maxim 2001f).

3.7.1 Aquatic Habitat

Fish populations, fish habitat, fish genetics, substrate heavy metals, and macroinvertebrates were sampled in the study area in August 2000 (Maxim 2001f). These studies provided baseline data on biological and physical characteristics of the streams that might be influenced by the Proposed Action. The following subsections are a summary of results. **Figure 3.7-1** shows the study area and aquatic sampling locations.

3.7.1.1 Sheep Creek

Sheep Creek drains upland areas that are composed of a mixture of forest, shrub, and grass vegetation types. The streambanks primarily support willows (*Salix* spp.) and are bordered by grass and sedge (*Carex* spp.) meadows. Sheep Creek meanders through the length of the drainage and contains numerous beaver dams and short stretches of riffles, runs, and pools (Maxim 2001f).

3.7.1.2 Reese Canyon Creek

Reese Canyon Creek is a seep-fed stream with one seep that emerges in its upper portion, creating stream flow that is augmented by other small seeps throughout its length. During the August 2000 survey, the stream was dry in some reaches and had low flow in others. Beaver ponds are present in the middle reaches and contained water during August 2000. Riparian vegetation appears to be impaired by livestock grazing. A mix of willows, sedges, Douglas-fir, and subalpine fir predominate in the uplands (Maxim 2001f). Flow limits the availability of suitable spawning and rearing habitats for cutthroat trout. This stream was dry and was not sampled for fish or macroinvertebrates.

3.7.1.3 No Name Creek

No Name Creek is an intermittent stream that originates near the headwaters of Sheep Creek east of the existing mine. It flows south and eventually west through a narrow fault-block canyon and into the Angus Creek drainage. Willows, sedges, and shrubby species are the dominant vegetation along the stream. Gradient in the stream varies from 2 to 3 percent in the headwaters to more than 4 percent in the canyon. This stream is commonly dry during summer, fall, and winter (Maxim 2001f). This stream was dry and was not sampled for fish or macroinvertebrates.

Angus Creek provides spawning and rearing areas for cutthroat trout and has been known to support cutthroat trout. No Name Creek may provide suitable spawning habitat, but it seems to be limited by the lack of flow during many years (Collins 1981).

3.7.2 Fisheries and Macroinvertebrates

Streams in and adjacent to the study area have a low gradient, flow through lands grazed by livestock, and are often affected by beavers (Mariah 1992). These factors generally tend to increase the amount of fine materials in the substrate, therefore reducing the diversity of benthic

Figure 3.7-1 Aquatic Resource Data Collection Sheep Creek

macroinvertebrates. Long periods of below-normal surface water flows, such as the drought that occurred in 1991 and 1992, can also contribute to increased fine materials in substrate. These factors not only affect macroinvertebrate communities but also tend to reduce the quality of the streams for cutthroat trout (Mariah 1992).

Yellowstone cutthroat trout and introduced strains of cutthroat trout live as both migratory and resident populations in the Blackfoot River and tributary streams. Migratory fish move upstream from Blackfoot Reservoir starting in March and spawn in the tributary streams to the Blackfoot River. Resident populations of trout may also live and spawn in tributary streams year round. Spawning occurs from mid-May through early July (Collins 1981). Young cutthroat trout emerge from eggs from July through September (BLM et al 2000). Some young fish migrate downstream in the Blackfoot River to Blackfoot Reservoir, and others remain in tributary streams as resident, non-migratory fish. Brook trout *(Salvelinus fontinalis),* a non-native char, may also be found in the Blackfoot River drainage. Brook trout spawn in fall (October to December) and fry emerge from spawning gravel (known as redds) in April and May (BLM et al 2000). Rainbow trout *(Oncorhyncus mykiss)*, a non-native species, spawn in spring (March to June), usually in small tributaries with abundant gravel riffles. Eggs hatch within 4 to 7 weeks, and young fish move downstream into deeper pools (BLM et al 2000). Rainbow trout may also be present in the watershed but were not captured during surveys completed in August 2000. German brown trout *(Salmo trutta)*, also an introduced species, are also present in tributaries of the Blackfoot River but were not captured during surveys completed in August 2000. Numerous non-game fish may be found in the tributaries to the Blackfoot River, including sculpin *(Cottus* sp*.),* minnow (*Cyprinidae*), and dace. These non-native trout and other non-native fishes often contribute to the reduction or elimination of native trout populations such as Yellowstone cutthroat trout.

3.7.2.1 Sheep Creek

Sheep Creek was divided into 11 sub-reaches. Two reaches were sampled for fish populations in accordance with R1/R4 procedures, and one of these reaches was also sampled for presence and absence (spot shocked) (Figure 3.7-1). The USFS also conducted presence and absence sampling on a fourth reach (Lower Sheep Creek, not shown on Figure 3.7-1) in 2000. Four reaches were sampled along Sheep Creek for fish. These reaches include Upper Sheep Creek, Upper Sheep Creek Tributary, Middle Sheep Creek, and Lower Sheep Creek (reaches 1 through 11 are included within Upper Sheep Creek, Upper Sheep Creek Tributary, and Middle Sheep Creek).

A study conducted in 1997 concluded that Sheep Creek was in good condition when compared with other streams in the area (JBR 1997). The 1997 survey found a good complement of sensitive taxa in the orders of Ephemeroptera and Plecoptera. The 1997 survey also reported high index values for community tolerance and biotic condition for Sheep Creek. The authors concluded that these results indicate that Sheep Creek likely has good water quality, a diverse substrate, and good riffles.

Maxim (2001f) also conducted a survey of macroinvertebrates for Sheep Creek. Species recorded in the upper reaches of Sheep Creek included Ephemeroptera (62 percent), Coleoptera (10 percent), Diptera (7 percent), Plecoptera (5 percent), and Trichoptera (3 percent). The abundance of Ephemeroptera indicates that water quality is likely high since members of this order are generally intolerant of pollution. Middle Sheep Creek was also sampled as part of this survey. Ephemeroptera and Diptera were the most abundant orders recorded in the middle reaches of Sheep Creek. Plecoptera and Trichoptera represented a larger portion of the catch compared with the upper reaches of Sheep Creek. These orders are considered indicative of cold, fast-flowing streams with good oxygen content and water quality. Maxim did not sample the lower reaches of Sheep Creek, but previous surveys conducted by the USGS reported that the most abundant order was Trichoptera, with Plecoptera and Ephemeroptera also found. The lower reaches of Sheep Creek were also considered of good quality based on the results of the USGS study.

Yellowstone cutthroat trout was the most abundant fish species captured in Sheep Creek and was present at all sampling locations. Mottled sculpin (*Cottus bairdi*) and longnose dace (*Rhinichthys cataractae*) were less common. Longnose dace were captured in the Lower Sheep Creek reach only, and mottled sculpin were captured in all sampling locations except the Upper Sheep Creek sampling location.

Fish habitat within Sheep Creek is variable depending on location although overall structural diversity is sufficient throughout the creek to provide high quality year round habitat for both resident and migratory Yellowstone cutthroat trout. The presence and distribution of beaver dams within the stream currently limit the presence of migratory fish to the lower stream reaches. Maxim (2001f) concluded that fish captures indicated a healthy resident fish population dominated by Yellowstone cutthroat trout. No invasive or exotic species were captured, and the trout that were captured appeared healthy. Genetic results indicate that the cutthroat trout in the stream are pure strain Yellowstone, with no evidence of hybridization with rainbow trout. Results from the population sampling indicate that spawning and survival of young have been successful, at least in the recent past. Results for fish tissue indicate that concentrations of selenium are well below unhealthy levels. The high numbers of fish indicate that populations may be resident but the sizes recorded suggest that the fish are limited in growth by food and habitat restrictions.

Sheep Creek was identified as an important spawning and rearing area for wild Yellowstone cutthroat trout in the early 1980s. Sheep Creek and other valley tributaries produced the majority of wild cutthroat trout in the Blackfoot River system (Collins 1981). Livestock use has been heavy in the past, but cutthroat trout have persisted, and spawning and rearing habitats have not been excessively degraded.

3.7.2.2 No Name Creek

A survey conducted by JBR (1997) reported that the upper reaches of No Name Creek were of higher quality compared with lower reaches. However, although the upper station yielded more stoneflies than the lower reaches, only one mayfly and relatively few stonefly and caddisfly species were recorded. The lower reaches of No Name Creek were considered more lentic, or slow moving, as evidenced by the presence of several aquatic beetle taxa. A higher number of caddisflies and mayflies were observed at the lower monitoring station (JBR 1997).

No Name Creek was surveyed in 1992 (Mariah 1992). The survey described the substrate of No Name Creek as primarily gravel immersed in sand and other fine sediments. Leeches, black fly larvae (Diptera), and the amphipod *Gammarus lacustris* primarily dominated benthic populations at No Name Creek. Diptera, mayflies, aquatic earthworms, and leaches dominated the middle reaches of No Name Creek. The lower reaches of No Name Creek were dominated by mayflies (Cinygmula) and stoneflies (*Zapata* spp.). Both Cinygmula and Zapata are considered indicative of good water quality (Mariah 1992). The lowest reaches of No Name Creek were dominated by true flies (Diptera).

3.7.3 Bioaccumulation of Selenium and Trace Metals

The bioaccumulation of selenium in fish and other aquatic organisms depends on the amount of selenium present in water and sediment and the chemical form in which selenium is present, as well as other factors. Selenium exists in five forms; the three most studied in terms of toxicological effects are the two inorganic forms (selenite and selenate) and the more toxic organic form, the amino acid called selenomethionine. Water temperature, age of the organism, mode of administration, and organ/tissue specificity also modify the rate of selenium accumulation (Eisler 1985). In aquatic habitats, higher animals show a generally marked increase in selenium residues as compared with waterborne concentrations which indicates that bioaccumulation of selenium occurs primarily through diet.

Field studies have demonstrated that selenium can enter the food chain through plants, become bioavailable, and subsequently bioaccumulate in animals. Although measured concentrations of selenium are often low in surface water, selenium can be present at elevated levels in sediment and thus become available for uptake by aquatic life through algal and planktonic food chains (Lemly 1996). A variety of toxic effects have been associated with exposure of fish to elevated levels of selenium in water and diet. The endpoints that can result from high exposure to selenium may be impairment of reproductive functioning and death.

Reproductive toxicity is reported to be one of the most sensitive endpoints for vertebrates exposed to selenium (Lemly 1997; Skorupa 1998). Teratogenic (malformations in embryo or fetus) deformities in fish or congenital malformations that occur as a result of excessive selenium in eggs are a permanent pathological marker of selenium poisoning (Lemly 1997). Selenium is efficiently transferred from parents to offspring through the eggs (Lemly 1993). Levels of selenium that cause teratogenic effects do not generally affect the health or survival of parent fish; the teratogenic process is an egg-larvae phenomenon. Data indicate that mortality of adult fish, even in sensitive species, occurs at exposure levels much higher than concentrations that may result in reproductive impairment (Skorupa 1998). Teratogenesis is a direct expression of selenium toxicity and is considered an important cause of reproductive failure in fish (Lemly 1997).

The EPA national water quality criterion for selenium for chronic aquatic habitat exposure is currently 0.005 mg/L. The EPA national water quality criterion for selenium for acute exposure is 0.020 mg/L. Lemly and Smith (1987), who reviewed much of the available literature on selenium effects, reported that concentrations of selenium in water greater than 0.002 to 0.005 mg/L may bioaccumulate in food chains and result in adverse reproductive effects in fish. Baseline studies show that concentrations of selenium in Sheep Creek are much less than this level (Maxim 2001f). The concentrations measured in Sheep Creek are below the aquatic life standard (0.005 mg/L) for chronic exposure to selenium (Hardy and Moller 2002).

Montgomery Watson (2000) conducted three studies on the effects of selenium on the reproductive success of cutthroat trout. The study area for all three studies included the Blackfoot River and Henry's Lake. The three studies examined the following:

- Egg viability study to evaluate whether selenium is causing birth defects in cutthroat trout;
- Feeding study to assess the effects of selenium consumption on growth rates, survivorship, or breeding success of cutthroat trout;
- Genetic analysis to evaluate whether survivorship is present when comparing experimental results for two geographically isolated populations.

The preliminary results of the egg viability studies indicated that eggs collected from the Blackfoot River cutthroat trout contained two to three times more selenium than did control eggs collected from Henry's Lake (Montgomery Watson 2000). Although concentrations of selenium were higher in the Blackfoot River samples, they were still below the toxicity benchmark for selenium in fish eggs for increased birth defects of 10 mg/kg (dry weight). However, there was no discernable difference in the percent of deformed fry between the two populations. A feeding study was also conducted to evaluate the effects of selenium consumption on growth and reproductive performance of cutthroat trout. The results of the genetic study indicated that both populations were Yellowstone cutthroat trout, but were genetically distinct. The authors concluded, however, that bias in survivorship was not expected because both populations were the same subspecies.

A study on cutthroat trout given varying diets of seleno-methionine (SE-Met) found that average weight was unaffected by diet for the first year, but thereafter, fish fed the control diet weighed less than those fed diets containing SE-Met (Hardy and Moller 2002). Whole body selenium levels increased to 10 to 12 ug/g dry weight over the first 26 weeks of the feeding, but did not increase further with prolonged feeding. Mortality was 20 percent in fish fed the control diet and less than 10 percent in fish fed diets containing 4 ug/g dry weight selenium or higher. No clinical signs of selenium toxicity were observed nor were differences in reproductive performance (such as fecundity and egg hatchability) although in all dietary groups, egg fertility and hatchability were lower than that observed in eggs from wild cutthroat trout. Whole body and egg selenium levels reflected dietary intake in all treatment groups. Groups of fish fed the control diet for 32 weeks after having been fed diets containing various levels of Se-Met for 48 weeks returned to near baseline levels, indicating depuration of whole body levels of selenium over this time.

Lemly (1993) suggested a risk threshold of 12 micrograms per gram (µg/g) in concentrations of selenium in the liver of fish based on experimental results that linked exposure to selenite with perturbations of blood chemistry. However, the fish component for a hazard assessment protocol for selenium presented by Lemly (1993; 1996) relies on data for fish eggs or whole-body residues (as a surrogate for eggs) but not on data for hepatic tissues. As Lemly recognized, only a weak basis exists for assessing ecological risk in nature based on hepatic concentrations of selenium and, therefore, they have little interpretive value.

Samples of trout tissue from Sheep Creek were obtained from fish collected during the sampling in September 2000. Ten whole body tissues were sampled and analyzed for concentration of selenium and cadmium. Whole-body values for selenium ranged from 1.2 to 5.6 µg/g dry weight. These values are below the risk threshold for bioaccumulation in fish as suggested by Lemly and others. Whole-body concentrations of cadmium ranged from 0.05 µg/g to 0.27 µg/g. These tissue concentrations are less than whole body tissue concentrations of 0.54 µg/g and 0.96 µg/g that produced no effect on growth and survival of young rainbow trout in the laboratory (BLM et al 2000).

Samples of fish tissue were also collected from Sheep Creek and analyzed as part of the North Rasmussen Ridge baseline aquatic study. Samples, which included both cutthroat trout and sculpin, were collected from upper and middle Sheep Creek. Concentrations of selenium in fish tissue ranged from 0.6 µg/g to 1.1 µg/g (wet weight). Concentrations of selenium in all fish tissue samples were below the 12 µg/g risk threshold. Concentrations of cadmium ranged from 0.07 µg/g to 0.26 µg/g (wet weight) (Maxim 2001f).

3.7.4 Stream Standards

In addition to human health standards, water quality standards for surface waters in Idaho include aquatic life standards that are based on the use classification of the stream.

Sheep Creek is identified as a "class 5 – highly critical" stream. A highly critical stream contains a fishery that is of value on a statewide basis. A continued high level of production is essential to sustain the current condition of the fisheries. The designation as a class 5 – highly critical stream includes Sheep Creek and all of its tributaries (USFS 1998).

No Name Creek is considered an Inland Native Fish Strategy (INFISH) category 4 stream – has perennial sections. INFISH is designed to protect riparian areas and fisheries from degradation caused by new or existing activities. To protect the riparian areas and fisheries, Riparian Habitat Conservation Areas have been established adjacent to designated fisheries or streams. The RHCA for No Name Creek is 50 feet wide on either side of the stream (USFS 1998).

3.8 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

The list of threatened, endangered, and special status species that could occur within the study area was developed from two sources. The USFWS (Mignogno 2003) and the USFS (Hamann 2001b) were contacted and each agency provided a list of species (**Table 3.8-1**). The USFWS identified three federally listed and one candidate species: bald eagle (*Haliaeetus leucocephalus*), gray wolf (*Canis lupus*), Canada lynx (*Lynx canadensis*), and yellow-billed cuckoo (*Coccyzus americanus*). The USFS identified 18 other sensitive species of interest because of concern about their population status or threats to their long-term viability. The USFWS and USFS identified

TABLE 3.8-1
USFWS AND USFS SPECIES OF INTEREST

Common Name	Scientific Name	USFS Status	USFWS Status	In Study Area
Bald eagle	*Haliaeetus leucocephalus*	NA	Threatened	No[1]
Canada lynx	*Lynx canadensis*	NA	Threatened	No
Gray wolf	*Canis lupus*	NA	Experimental Population, Non-Essential	Transients
Yellow-billed cuckoo	*Coccyzus americanus*	NA	Candidate	No
Cache's beardtongue	*Penstemon compactus*	Sensitive	Special Concern	No
Payson's bladderpod	*Lesquerella paysonii*	Sensitive	Candidate	No
Starveling milkvetch	*Astragalus jejunus* spp. *Jejunus*	Sensitive	NA	No
Spotted bat	*Euderma maculatum*	Sensitive	NA	No
Townsend's big-eared bat	*Plecotus townsendii*	Sensitive	NA	No
Wolverine	*Gulo gulo*	Sensitive	NA	No
Trumpeter swan	*Olor buccinator*	Sensitive	NA	No
Harlequin duck	*Histrionicus histrionicus*	Sensitive	NA	No
Boreal owl	*Aegolius funereus*	Sensitive	NA	No
Flammulated owl	*Otus flammeolus*	Sensitive	NA	Yes
Great gray owl	*Strix nebulosa*	Sensitive	NA	Likely
Three-toed woodpecker	*Picoides tridactylus*	Sensitive	NA	No
Spotted frog	*Rana pretiosa*	Sensitive	NA	No
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	Sensitive	NA	No
Bonneville cutthroat trout	*Oncorhynchus clarki utah*	Sensitive	NA	No
Northern goshawk	*Accipiter gentilis*	MIS	NA	Yes
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	MIS	NA	No
Sage grouse	*Centrocercus urophasianus*	MIS	NA	No

Notes: [1]Bald eagles may use wintering area east of study area and the Blackfoot River watershed.
NA = Not Applicable
MIS = Management indicator species
Source: Mignogno 2003, Hamann 2001b.

species were considered in planning this project, and are addressed in a Biological Assessment (Greystone 2003a) and Biological Evaluation (Greystone 2003b).

The USFS identified three species of plants and 15 species of animals with special status. This analysis is summarized in **Table 3.8-1**. Detailed information on these species has been compiled in either a Biological Assessment for the USFWS available from BLM or a Biological Evaluation for the USFS that is available from USFS.

Two surveys were conducted for threatened, endangered, or special-status plants. Before field surveys began, the Idaho Conservation Data Center was contacted for a record search. The search did not identify any special status populations of plants within the study area. None of the plant species were observed within the study area during surveys, but potentially suitable habitat is present for all except slick-spot peppergrass.

The bald eagle is a periodic migrant in the area, but no known winter roost sites or breeding areas occur near the study area. Breeding wolves are not known to occur in or around the study area, but may travel through the area periodically. No evidence of Canada lynx was identified during surveys and it is unlikely to occur in the study area. However, the study area is located within a linkage corridor between lynx habitat in the Bridger-Teton National Forest (Greater Yellowstone Ecosystem) and the Ashley National Forest (Uintah Mountains) (Keyser 2002). The spotted bat was not observed during surveys, and suitable roosting habitat does not occur in the study area. Townsend's big-eared bat was not observed, and no known suitable day or night roosting areas occur in the study area.

The yellow-billed cuckoo (*Coccyzus americanus*) was listed as a candidate species by the USFWS on July 25, 2001 (66 FDR 38611 [USFWS 2001]). Habitat includes open and riparian woodlands and deciduous riparian habitat up to elevations of 6,600 feet. In southwestern Idaho, the yellow-billed cuckoo is considered a rare and erratic summer resident and breeder in mainly the Snake River valley (USFWS 2001). Yellow-billed cuckoos have not been detected during breeding surveys conducted in Idaho between 1966 and 2000 (Sauer, et al. 2000). According to USFWS data, the only documented occurrence of yellow-billed cuckoo and only known suitable habitat within the Caribou-Targhee National Forest is located on the Palisades Ranger District.

No evidence of wolverine was observed during surveys. However, the study area provides foraging habitat for wolverine. Wolverine may travel through the study area periodically, and are known to occur near Caribou Mountain in the Caribou-Targhee National Forest. No suitable habitat for the Trumpeter swan is present in the study area, as is also the case for the Harlequin duck. Neither the swan nor the duck was observed during surveys. Several Northern goshawks were observed in the study area during surveys, although suitable habitat does not occur in the area and no nests were located. Prior to past logging activities, the study area may have provided nesting habitat for northern goshawks. However, the study area is likely only used now as foraging habitat because most large trees have been removed by past logging. Surveys have not documented the presence of Columbian sharp-tailed grouse in the study area (Section 3.6.2.2). The study area may provide limited winter foraging habitat for Columbian sharp-tailed grouse due to the presence of aspen and serviceberry.

No boreal owls were heard or observed during surveys, but may occur because potentially suitable habitat is available in the area. The flammulated owl is expected to occur in the study area based on audible detections of the owls during surveys. The great gray owl was not seen or heard during surveys, but is considered likely to occur in the study area because suitable habitat is available. Although potential habitat exists in the study area, no evidence of three-toed woodpecker was observed during surveys. The spotted frog was not observed during surveys. Yellowstone cutthroat trout have not been observed in the study area, but suitable habitat is present and populations exist in lower Sheep Creek. Bonneville cutthroat trout do not exist in the study area because the study area is outside the Bonneville Basin.

3.9 GRAZING MANAGEMENT

The study area is currently used to graze livestock during the summer, however, the Rasmussen Ridge Mine site has been excluded from grazing. Three USFS grazing allotments are located within the study area: Rasmussen Valley Cattle Allotment, Sheep Creek Sheep Allotment, and the Henry-Olsen Sheep Allotment (**Figure 3.9-1**). State and private lands located west of the project site are also leased for grazing. Forage production on these lands ranges from 400 pounds to 800 pounds air dry weight per acre (BLM and USFS 1997b). The vegetation communities in the grazing allotments include grassland/sagebrush, aspen forest, and mixed aspen/conifer forest. The species composition of these communities is presented in Section 3.5.1.

Cattle graze the Rasmussen Valley Cattle Allotment between June 11 and September 30. The allotment is leased by two permittees and is permitted for 378 cow/calf pairs, for a total of 1,399 head months. Of the 6,495 acres located within the Rasmussen Valley Cattle Allotment, 4,200 acres are considered suitable for grazing. Unit 1A of the Rasmussen Valley Cattle Allotment is currently closed to grazing due to mining activity. This unit did support 205 cattle for 48 days before mining began in the area. This unit contains about 2000 acres and supported 23 percent of the grazing use on this allotment.

The Sheep Creek and Henry-Olsen Sheep Allotments are held by a single permittee. Sheep graze these allotments between July 1 and September 5. The combined allotments are permitted for 1,000 ewe/lamb pairs, for a total of 2,203 head months.

According to the Caribou National Forest Plan, all lands except for talus slopes, water and rocks are considered suitable for grazing. Approximately 20,304 cattle (71,707 HMs) and 79,235 sheep (187,206 HMs) currently graze the Caribou National Forest. Within the Caribou National Forest, approximately 65 percent of grazing lands are currently meeting the Forest Plan objectives and another 27 percent of grazing lands are moving towards those objectives. In those areas where grazing is currently not meeting Forest Plan objectives, conditions are expected to improve under planned objectives. The Forest Plan includes a prescribed burning plan that involves treatment of sagebrush and mountain shrub vegetation annually. Treated areas are not available for livestock grazing for one year prior to treatment and for two-years following treatment. Prescribed burning effectively reduces the number of acres available for grazing because treatment areas are not available to livestock. Under Alternative 2 – Proposed Action of the Forest Plan DEIS, approximately 7,750 acres of sagebrush or mountain shrub would be treated using prescribed burning. Using a three year rotation, about 23,250 acres, producing 4,650 HMs of forage, would

Figure 3.9-1 Grazing Allotments

be unavailable for grazing on an annual basis. Under Alternative 2, restriction of cattle grazing in riparian areas would also result in the loss of 2,203 cattle HMs.

State and private lands located on the western portion of the study area are leased by the Idaho Citizen's Grazing Association. This association is almost 100 years old and includes a number of operators. The allotment located immediately to the west of the study area is the Henry Use Area. Sheep are grazed every other year on this allotment from May 15 until the end of June. At the end of June, the sheep are moved to adjacent Forest Service leases. In some years, the sheep may return to graze the Henry Use Area after September 15.

3.10 RECREATION

Outdoor recreation is one of the primary uses of federal lands in Caribou County, the Soda Springs Ranger District of the Caribou National Forest, and to a limited extent in the analysis area by providing scenic or historic attractions and a wild lands environment. Tourism is an important factor in the increasing diversity of the Caribou County economy because of these and other recreational opportunities provided by numerous private operators in the area. Destinations for recreation in the county include the Blackfoot Reservoir, Gray's Lake Wildlife Refuge, and the Soda Springs Geyser. Demand for recreation originates from resident and non-resident populations.

The analysis includes all areas where access to National Forest system lands is affected by the Proposed Action at the North Rasmussen Ridge Mine. Forest system roads that access the mine site or are directly connected to roads that access the mine site define the analysis area, which is bounded on the north by Sheep Creek, on the east and west by the National Forest Boundary, and on the south by Blackfoot River Road. The cumulative analysis area extends farther to the south to the Soda Springs/Montpelier Ranger District boundary to include other past and current phosphate mining operations on the Caribou National Forest in the Soda Springs District.

3.10.1 Recreation Use and Management

The Caribou National Forest in the Soda Springs Ranger District provides a wide variety of year-round dispersed recreational opportunities. Dispersed activities account for the largest amount of recreation use on the forest. Currently, more dispersed recreation facilities are needed to meet demand and reduce the impacts of recreation to forest resources.

There is little developed recreation in the analysis area, which is located on Rasmussen Ridge. The developed site nearest to the mine is the Mill Canyon campground, located about 5 miles south of the mine near the Blackfoot River. There are no other developed recreation sites on the forest within the analysis area. The Gravel Creek campground is north of Grays Range outside of the analysis area. Other developed recreation in the general vicinity of the analysis area includes state-managed facilities at the Blackfoot River State Recreation Management Area.

A broad spectrum of dispersed recreation occurs year-round on the forest. The Blackfoot River Management Area, which encompasses the analysis area, receives moderate to heavy use for activities such as hunting big game, waterfowl, and upland birds, hiking, fishing, snowmobiling, Nordic skiing, pleasure driving, and gathering forest products. Numerous 4-wheel drive roads traverse the area and provide opportunities for dispersed activities. Recreation uses in Rasmussen Valley on the south side of Rasmussen Ridge consist of sightseeing, dispersed camping, and hunting. Livestock permittees and private property owners also use this area and appreciate the visual and remote qualities of this valley. Recreation use is light until the hunting season.

Hunting is a major recreation use of the area. The general big game hunting seasons occur between late August through mid-December, depending on the method. Elk, deer, moose, and game birds occur in suitable habitat throughout the analysis area. The IDGF manages big game populations in hunt units. The analysis area is within hunt unit 76. Hunters generally enter the area near the existing mine from FDR 195, although some hunters hike from Lane's Creek County Road into the more inaccessible and remote portions of the area. **Table 3.10-1** summarizes the number of participating hunters and recreation days for each hunt unit.

There are a great variety of year-round fishing opportunities in southeast Idaho. Currently, the supply meets the demand. Most fishing within or near to the analysis area occurs on the nearby Blackfoot River and the Blackfoot Reservoir. Some limited fishing may occur in the lower segments of Sheep Creek east of the mine site.

TABLE 3.10-1
BIG GAME HUNTING DATA IN UNIT 76 IN 1999

	Total Hunters	Total Harvest	Percent Success	Total Recreation Days
Deer 1999	3,426	786	23.0	24,307
Deer 2000	NA	1,236	NA	NA
Deer 2001	3,057	1,493	49.0	14,205
Elk 1999	1,340	285	21.3	13,492
Elk 2000	NA	298	NA	NA
Elk 2001[1]	843	220	26.0	8,003

Source: Idaho Department of Fish and Game 2001.
NA = Not available
[1] = Archery only reported. Archery usually comprises 17 percent of the total elk harvest.

State Highway 34 north of Soda Springs is part of the Bear Lake-Caribou Scenic Byway. This route is shared by the Pioneer Historic Byway. Both were designated as Idaho State Scenic Byways by the Idaho Department of Transportation.

3.10.2 Caribou National Forest Recreation Management

Forest-wide general direction for developed recreation is to construct, reconstruct, and maintain developed sites in accordance with existing Recreation Opportunity Spectrum (ROS) class for the management area. The general direction for dispersed recreation is to provide a broad spectrum of dispersed recreation opportunities based on the existing ROS class for the management area.

The analysis area is located in the Blackfoot River Management Area. Management prescriptions for the management area are defined under Preferred Alternative 7 of the Draft EIS for Caribou National Forest Draft Revised Forest Plan. The management prescriptions identify the specific activities that are to be emphasized or permitted in each management area.

There are seven management prescriptions for the portion of the Blackfoot River Management Area that is within the analysis area. These are 8.2.2 – Concentrated Development – Mines, which includes the mine site; 2.7.2 – Elk and Deer Winter Range; 3.2 – Semi-Primitive Motorized; 3.3 – Semi-Primitive Motorized – restoration; 5.1 Timber Management; 5.3 – Forest Management – restoration; and 6.3 Range Management. Small areas of land managed with a semi-primitive motorized prescription are located adjacent to the west side of the mine site and throughout the analysis area. The largest area managed with a semi-primitive motorized prescription is more than 8 miles south of the mine site and the south end of the analysis area in the vicinity of Dry Ridge.

The goal for Semi-Primitive Recreation is to emphasize the prescription's uses while optimizing wildlife and fish habitat, water yield, and livestock grazing. Timber harvest prescriptions are limited to three stage shelterwood or partial cut methods. Recreation facilities will be to enhance the visitor's experience or protect the environment, but not to increase visitor comfort. Structural and nonstructural improvements associated with range, wildlife and fish, and water yield are permitted. Existing visual quality objectives must be maintained or improved. The standards and guidelines for dispersed and developed recreation are to manage to enhance the goal statement objectives.

Standards and guidelines for recreation resources in management prescriptions 6.3 and 5.1 emphasize Roaded Natural and Semi-Primitive Motorized within the Blackfoot River Management Area. Recreation management is not compatible with management prescription 8.2.2 – Concentrated Development – Mines.

3.10.3 Recreation Opportunity Spectrum Management

USFS lands are inventoried by ROS class to define the types of outdoor recreation opportunities the public desires and to identify the opportunities the forest can provide. The ROS system categorizes forest lands in six classes, each defined by its setting and by the possible recreation experiences and activities it affords. The analysis area has been inventoried with two ROS classes: Semi-Primitive Motorized and Roaded Natural.

The Semi-Primitive Motorized classification is characterized by moderately dominant alterations by people. It also is characterized a moderate probability of isolation from the sights and sounds of people, except for evidence of primitive roads and trails. Small areas of USFS land managed with Semi-Primitive Motorized prescriptions are located adjacent to the west side of the mine site and scattered throughout the analysis area. The analysis area includes primitive roads and trails.

The Roaded Natural class characterizes a predominantly natural environment with evidence of moderate permanent alternative resources and resource utilization. Evidence of the sights and sounds of man is moderate but in harmony with the natural environment. Opportunities exist for both social interaction and moderate isolation from the sights and sounds of man.

3.10.4 Roadless Areas

There are 34 inventoried roadless areas in Caribou National Forest. The nearest roadless area is 5 miles east of the mine site and is separated from the analysis area by private lands in the Upper Valley.

3.11 VISUAL RESOURCES

Scenic resources vary by location and existing natural features, including vegetation, water features, landforms and geology, and human-made elements. Scenic forest settings contribute to all recreation experiences.

3.11.1 Forest Service Scenery Management

The Caribou-Targhee National Forest has been directed to use the revised system, called the Scenery Management System (SMS), for project planning (USFS 2001). The USFS uses the SMS to establish the relative value and importance of scenery on USFS lands. The system is used in the context of ecosystem management to inventory and analyze scenery, assist in developing natural resource goals and objectives, monitor scenic resource, and ensure attractive landscapes are sustained in the future. The five components of Scenery Management System implementation are:

- Landscape character description
- Existing scenic integrity
- Scenic attractiveness
- Constituent analysis and visibility analysis
- Scenic classes

For the purposes of this analysis, the section on General Visual Characteristics will describe these components, and the section on key observation points will analyze these components for the existing condition. Visual resources analyses will incorporate the SMS, using the former Visual Management System (VMS) inventory data. Additionally, the scenery inventory, landscape character goals, and Scenic Integrity Objective (SIO) for the forest landscapes will be identified by the project or area-level analysis (USFS 2001). Scenery will be managed using the Forest Plan Visual Quality Objectives (VQOs), or translated SIOs.

The VMS was developed to inventory and manage the visual resources of National Forest lands. The visual management inventory consists of three steps:

- Landscape character type
- Variety class
- Sensitivity levels

These steps are combined and interpreted to develop VQOs. The VQOs guide the amount of visual impact that management activities may have on the appearance of the landscape. The SMS evolved from and replaces the VMS. The system is used in the context of ecosystem management to inventory and analyze scenery in a national forest, to assist in the establishment of overall resource goals and objectives, and to monitor the scenic resource.

3.11.2 Landscape Character Description

Landscape character creates a "sense of place" and describes the image of an area. Rasmussen Ridge is located on the east side of the Rasmussen Valley Basin, which is enclosed on the east by Grays Range and on the west by the Wooley Range. The study area is along the eastern portion of the Rasmussen Ridge, an area of hilly terrain that ranges from 6,400 feet amsl at the valley floor to more than 8,300 feet amsl on nearby peaks. Reese Canyon is adjacent to the northwest portion of the study area. There are no naturally occurring distinguishable exposed soils and rock outcrops within the study area.

The area is characterized by rolling ridges, with a mixture of vegetation. The northern aspects, along higher ridges, are vegetated with conifer-aspen, and the foothills are vegetated with sagebrush interspersed with aspen. The valley bottoms are a mix of sagebrush and grass. The Sheep Creek drainage, east of the study area, has dense vegetation that consists of riparian in the drainage bottom to coniferous vegetation on the top of Rasmussen Ridge.

Views of the study area are limited. Henry Cutoff Road, Olsen Creek Road, Little Long Valley Road, and Sheep Creek Road are travel routes in the vicinity. The existing mine is visible from Upper Sheep Creek Road. Henry Cutoff Road, an improved road, is 1 mile north of the study area and is 800 feet lower in elevation. Olsen Creek Road, an unimproved road, is 1½ mile southeast of and is at a similar elevation as the study area. Little Long Valley Road, an unimproved road, is 2 miles south of the study area and is 600 feet lower in elevation.

The surrounding area is primarily used for summer grazing, logging, and mining. Some man-made features, such as corrals, fences, roads, and stock watering ponds, have been added to the area.

3.11.3 Existing Scenic Integrity

The landscape character description is used as a reference for the Existing Scenic Integrity (ESI) of all lands. ESI indicates the degree of "intactness" and "wholeness" of landscape character and helps locate and rank areas that need scenic rehabilitation. Conversely, ESI is a measure of the degree of visible disruption of landscape character. Six terms are used to describe the levels of existing and proposed scenic integrity as well as Scenic Integrity Objectives.

New System SIO	Old System VQO
Very High	Preservation
High	Retention
Moderate	Partial Retention
Low	Modification
Very Low	Maximum Modification
Unacceptably Low	Maximum Modification

Several man-made surface disturbances already exist within and around the study area. The Enoch Valley Mine is located in the north end of the Rasmussen Valley, about 1/3 mile west of the existing Central and South Rasmussen Ridge mines. The South and Central Rasmussen Ridge mines constitute an area with a VQO of Modification or a Low SIO. More than 488 acres have been disturbed by activities at Agrium's South and Central Rasmussen Ridge mines and more than 450 acres at Enoch Valley Mine. As of the end of 2000, more than 125 acres have been reclaimed at the Rasmussen Ridge mines. More than 310 acres have been reclaimed in the Enoch Valley Mine (USFS 1998). In 2001, additional disturbance associated with construction of a haulroad and stripping of topsoil occurred at Monsanto's South Rasmussen Ridge Mine. Ore and overburden removal was scheduled to begin in 2002.

VQOs of Modification (M) and Maximum Modification (MM) occur in generally "unseen areas" of potential phosphate mining areas (USFS 2001). Under the visual quality objective of M, management activities may dominate the original characteristic landscape. Class MM allows the greatest modification of the landscape. These VQOs translate into SIOs of Low and Very Low.

3.11.4 Scenic Attractiveness

Scenic attractiveness is the primary indicator of the scenic beauty of a landscape and of the positive responses it generates for people. It helps identify the landscapes that are valued for scenic beauty based on commonly held perceptions of the beauty of landform vegetation patterns and composition, water characteristics, land-use patterns, and cultural features. Scenic attractiveness indicates varying levels of long-term beauty of the landscape character. Two scenic attractiveness classifications are:

> Class A – Distinctive, which consists of landforms, vegetation patterns, water characteristics, and cultural features that combine to provide unusual, unique, or outstanding scenic quality. These areas have strong positive attributes of variety, unity, vividness, intactness, harmony, uniqueness, pattern, and balance.

Class B – Typical, which consists of landforms, vegetation patterns, water characteristics, and cultural features that combine to provide ordinary or common scenic quality.

The existing surface disturbance associated with the mine is located within an area considered Class B - Typical. The landforms in the study area, which consist of foothill lands, are not unique to the region. The vegetation patterns, which consist of conifer-aspen, sage, and grasses, are common to the region. There are no outstanding water characteristics or cultural features within the study area. As a result, these characteristics combine to provide common scenic quality.

3.11.5 Constituent Analysis/ Visibility Analysis

Landscape visibility consists of human values as they relate to their relative importance to the public and the relative sensitivity of scene base on distance from the observer. Human values that affect perception of landscapes are derived from constituent analysis. Constituent analysis serves as a guide to perceptions of attractiveness, helps identify special places, and helps to define the meaning people give to the landscape.

The public importance and the scenic attributes of the landscape are expressed as a concern level. Areas are assigned a concern level of 1, 2, or 3 to reflect the relative high, medium, and low visual importance of the area. Seen areas and distance zones are considered from these concern level areas to establish the sensitivity of scenes based on their distance from an observer.

In light of its location, the study area is generally not visible to the average observer. The study area is in the background from Little Long Valley Road and would, generally, be considered concern level 3, or of low visual importance. The proposed disturbance area is not visible from the other roads in the area.

3.11.6 Scenic Classes

A numerical class value is assigned to forest lands using the data gathered for scenic attractiveness and landscape visibility. The ratings 1 through 5 indicate the scenic importance of the landscape areas. Generally, scenic classes 1 and 2 have high public value, classes 3 through 5 have moderate value, and classes 6 and 7 have low value.

The scenic attractiveness of the study area, which consists of the existing mine disturbance, is considered typical. Coupled with the visual analysis or concern level of 3, the scenic class of the study area ranges from 5 to 6.

3.12 LAND USE AND ACCESS

3.12.1 Ownership

The Rasmussen Ridge leased area (North, Central, and South areas) encompasses 1,357 acres of land, as shown on **Figure 2.1-1**. Approximately 1,120 acres of the leased area is federally administered and is within the Caribou-Targhee National Forest. The remaining 237 acres of the leased area are state-administered lands. Of the 269 acres proposed for disturbance at North Rasmussen Ridge, approximately 249 acres would be on Federal leases and 20 acres on State leases.

The mineral estate (mineral ownership) for the phosphate resources within the study area is primarily federally administered. The BLM Pocatello Field Office administers the federal mineral leases within the Caribou-Targhee National Forest. A total of 237 acres of the mineral ownership within the study area consists of state-administered lands with mineral leases managed by the Idaho Department of Land (**Figure 2.1-1**).

3.12.2 Existing Land Uses

The existing land uses within the study area include commercial mining, timber, domestic livestock grazing, and dispersed recreation. The current and historical land use for both the federal and state lands within the proposed mine area is primarily rangeland used for livestock grazing.

Previous disturbances in the project area include extensive exploration and logging (BLM and USFS 1990). A total of 220 exploratory holes were drilled in the North Rasmussen area (Agrium 2001). Mining began in the Central Rasmussen Ridge Mine in 1997. The South Rasmussen Ridge Mine was in operation from 1990 to 1997 (USFS 1998) and disturbed 257 acres. The Central Rasmussen Ridge Mine is estimated to disturbed 231 acres (USFS 1998). Within the Rasmussen Ridge area and Enoch Valley, 1,000 acres have previously been disturbed by mining, and about 440 acres have been reclaimed (USFS 1998).

The commercial timber resources were previously logged in the early 1980s for most of the Rasmussen Ridge area.

The federal lands within the study area are currently used for livestock grazing under the grazing allotments. Approximately 97 percent of the Caribou-Targhee National Forest is designated into grazing allotments and is open to grazing by either cattle or sheep (USFS 2001). The state and private lands within the study area are also leased for grazing.

3.12.3 Land Use Planning and Controls

The USFS Soda Springs Ranger District administers surface activities on federal lands within the Caribou-Targhee National Forest. The management standards and guidelines for development within the national forest are provided in the Caribou-Targhee National Forest Land and Resource Management Plan (Revised Forest Plan, USFS 2001). The management plans for the national forest support mining of phosphate resources under the Multiple-Use Sustained-Yield Act of 1960. The forest plan classifies the land within the national forest into various prescription categories, each with management practices selected to accomplish specific land and resource management objectives. The study area is categorized as both an existing and proposed concentrated mine development prescription area (USFS 2001).

The BLM Pocatello Resource Area Office administers the federal phosphate leases within the Caribou-Targhee National Forest. The USFS provides BLM with recommendations for lease issuance and development proposals, but the BLM has final authority for the leases on National Forest System lands. Conditions for approval and mitigation measures may be applied to federal phosphate leases.

State-owned lands in the study area are available for mineral and agricultural leasing, timber leasing and sales, and public recreation. Land use goals for most of the state lands within this area includes mine development. Under the State of Idaho Surface Mining Act, a reclamation plan with bonding must be approved before mining begins.

3.12.4 Access and Transportation

The study area is served by a well-developed regional road system that provides ready access from Soda Springs, which is located about 30 road-miles southwest of the existing mine site. The primary route to access the study area is State Highway 34, which connects to Soda Springs and U.S. Highway 30 to the south. The highway north of Soda Springs is a two-lane paved road that connects to Blackfoot River Road. Blackfoot River Road connects to forest system roads that access the study area. The study area can be also be accessed from the west from Enoch Valley Road and FDR 121. State Highway 34 also provides access to the Blackfoot Reservoir west of the study area and to Gray’s Lake National Wildlife Refuge, north of the study area. Blackfoot River Road provides access to the forest south of the study area, in the Dry Ridge area. There are about 100 employees at the Central Rasmussen Ridge Mine, who currently use the local roads to commute. Employees commute from Soda Springs, Montpelier, and other communities via U.S. Highway 30 and State Highway 34.

Internal access to the mine site from Blackfoot River Road is on Forest Development Roads (FDR) 346, 872, 121, 195, and 243 (**Figure 3.1-2**). These forest system roads connect with several smaller roads to form a network that provides access to most of the study area. FDR 243 provides direct access to the mine site as well as forest lands on the north side of Sheep Creek. There are no traffic data for USFS roads in the study area. A few roads are gravel-surfaced and will accommodate passenger cars during snow-free months. Some roads within the study area are completely or partially closed during the winter because the Forest Service does not plow them.

Phosphate ore is hauled via 85-ton truck down the haulroad (FDR 999) to the tipple and railroad loadout area. From here, the ore is transported by rail to Agrium’s processing plant located 5 miles north of Soda Springs.

3.13 CULTURAL RESOURCES AND NATIVE AMERICAN RELIGIOUS CONCERNS

Cultural resources include archaeological and historical manifestations of past human activity and traditional cultural concerns. These resources may be significant for their associations with events or persons important in cultural tradition or history, may be important manifestations of art, architecture, or typical traditional patterns, or may be likely to yield important information regarding past technologies, settlement patterns, subsistence strategies, or other research questions important in history or prehistory. Primarily under the mandates of the National Environmental Policy Act (NEPA, P.L. 91-190; 40 U.S.C. 1500-17.7; 42 U.S.C. 4321-61) and the National Historic Preservation Act (NHPA, P.L. 95-515; P.L. 102-575; 16 U.S.C. 470-470t), as amended, and their principal implementing regulations (40 CFR §1 and 36 CFR §800), federal agencies are required to consider the effects of actions that they undertake, fund, or sanction on significant cultural resources. Significant cultural resources are defined as sites, objects, or districts that are eligible for or listed on the National Register of Historic Places under the Criteria for Eligibility (36 CFR §60.4). Additional laws and regulations including, but not limited to the Archaeological and Historic Preservation Act (P.L. 93-291; 16 U.S.C. 469-469c), the Federal Land Policy and Management Act (PL 94-579), the American Indian Religious Freedom Act (P.L. 95-341; 42 USC 1996 and 1996a; 43 CFR §7), the Archaeological Resources Protection Act (P.L. 96-95; 16 U.S.C 470aa-470mm; P.L. 100-555; P.L. 100-588), and the Native American Graves Protection and Repatriation Act (P.L. 101-601; 104 Stat. 3048; 25 U.S.C. 3001; 43 CFR §10) may apply to the consideration of certain resources. In general the preferred alternative for treatment of significant cultural resources is avoidance and protection.

3.13.1 Prehistoric Context

Southeastern Idaho is in the northeastern Great Basin culture area. The prehistory of the region is typically divided into three broad periods: (1) Paleoindian; (2) Archaic; and (3) Protohistoric. Each of these periods is characterized by distinct artifact types and by different settlement and subsistence patterns. The distinguishing characteristics of each of these periods are discussed below.

Paleoindian Period (ca. 12,000 to 7,800 years ago). The Paleoindian Period is divided into two subperiods based on hafted biface technologies and evidence of subsistence patterns. These periods are the Llano or Fluted Point (ca. 12,000 to 10,500 years ago) and the Plano (ca. 10,500 to 7,800 years ago). The best-known hafted bifaces or point types of the Llano subperiod are the Clovis and Folsom fluted points. Clovis and Clovis-like points have been found at a number of sites in southeastern Idaho but not in securely radiocarbon dated contexts. Clovis points predate Folsom and in other areas, including the Big Horn Basin of Wyoming, have been found in association with late Pleistocene mammoth remains. Folsom points are often associated with late Pleistocene forms of bison, somewhat later than the mammoth remains. They have been found in well-dated deposits at Owl Cave in southeastern Idaho, as well as a number of surface sites. The Plano Period, which spanned nearly three millennia, is comparatively well represented in southeastern Idaho. This period is represented by a wide range of large point styles that are distinct from the earlier fluted points. The fauna associated with these sites are more diverse than is typical of Llano sites, but includes modern and early Holocene forms of bison.

Archaic Period (ca. 7,800 to 300 years ago). The Archaic Period is distinguished from the Paleoindian Period by distinctive stemmed (Pinto series) and notched (Bitterroot Side-notched and Elko series) point types and evidence of a broader resource base. The shift from the larger lanceolate-shaped points of the Paleoindian to smaller stemmed and notched points is believed to be related to a change in hafting technology. Ground stone artifacts and small animal remains are also found at many sites, suggesting use of a wider range of resources. The Archaic Period is subdivided into three subperiods: (1) Early Archaic (7,800 to 4,500 years ago); (2) Middle

Archaic (ca. 4,500 to 1,300 years ago); and (3) Late Archaic (ca. 1,300 to 300 years ago). These cultural periods are characterized by biface technologies and shifts in patterns of settlement and subsistence. The Early Archaic is marked by the appearance of distinctive large side-notched and bifurcate stemmed points. The typical point types include Bitterroot Side-notched, Pinto series, and Elko series. There is no evidence of a substantial shift in subsistence practices. Groups remain highly mobile and retain a focus on hunting large game, similar to the earlier Paleoindian Period. The Middle Archaic is marked by an increase in the frequency of bifurcate-stemmed (Pinto and Gatecliff series), large corner-notched (Elko series), and lanceolate (Humboldt series) points, and a decrease in the frequency of Bitterroot Side-notched. Earth oven features are also commonly associated with sites of this period. Later in the Middle Archaic large corner-notched points and small point types become more abundant. The Late Archaic Period is marked by ceramics and small triangular and side-notched points. At least two cultural groups, the Fremont and the Shoshonean, are represented by these remains. Many contemporary Fremont groups in Utah are horticulturalists, and ceramics are often thought of as a marker of sedentary horticulturalists. However, current evidence indicates that the northern Fremont were hunter-gatherers. Shoshonean occupation is marked by brown-ware ceramics, Desert Side-notched points, and Cottonwood triangular points. These Numic cultural groups were also mobile hunter-gatherers with ceramics.

<u>Protohistoric Period (ca. 300 years ago to historic).</u> The Protohistoric Period is marked by the influence of the European market system and the appearance of European artifacts. One of the most conspicuous influences on cultural change was the horse. The horse made new hunting techniques possible and increased the potential range of hunting forays. At the same time, the demands of horse herds for water and forage limited potential settlement locations. The Shoshonean horse cultures of the Protohistoric Period in this region were the predecessors of the historic Shoshone and Bannock. As in other regions, conflicts between encroaching Euroamericans and indigenous cultures led to displacement of the indigenous cultures and establishment of the reservation system. The Fort Hall and Wind River reservations were established in 1867 and 1868. Even though the native groups relinquished their claim to the lands outside the reservations, they retain traditions about the lands and connections with sacred sites. These sacred sites include burials, rock art, monumental rock features, natural features, rock structures or rings, sweat lodges, timber and brush structures, eagle traps, and prayer and offering localities. Much of the landscape itself figures prominently in the identity and traditions of the native groups, and sacred places are not necessarily defined by archaeological remains.

3.13.2 Historic Context

The earliest documented accounts of Euroamericans in southeastern Idaho are of fur trappers and explorers in the early 1800s. By the 1840s, emigrants to the West Coast were following the trails identified by the earlier explorers and fur trappers. The Hudspeth Cutoff of the Oregon and California Trail passed through Soda Springs. In the 1860s, Mormon pioneers established settlements in southeastern Idaho. The discovery of gold in the Idaho panhandle in 1861 brought an influx of miners, and a regional mining boom continued into the 1890s. From 1870 to 1920, Soda Springs was a major supply point for mining camps in the Caribou Mountains. With the building of the transcontinental railroad in the 1860s, railroad workers entered the region. Tie hack camps supplied ties for the transcontinental railroad, and the timber industry supplied the mines and the growing towns. Even though the timber resources of southeastern Idaho are not as abundant as in other parts of the state, they have played a key role in the development of the region. Cattlemen entered the region in the 1860s to supply the mines and eastern markets. Although sheep had been brought into the region along the emigrant trails, large herds were not established in Caribou County until the 1890s. The mining opportunities and railroad construction also attracted Chinese emigrants and later Japanese. Some homesteading took place in southeastern Idaho in the 1890s and early 1900s, but many of those homesteads failed in the 1920s and 1930s and reverted to federal control.

3.13.3 Previous Studies and Known Resources

A baseline cultural resource report was prepared for the North Rasmussen Ridge Mine Project (Maxim 2000). The study included a review of available information and a report of pedestrian surveys of the proposed area of impact. Pedestrian surveys located and recorded a single isolated historic artifact. Pre-field review identified four previous cultural resource investigations in the general area. No record was found of any known sites in the vicinity of the project. The baseline report states that the high elevation, rugged terrain, and distance from reliable sources of water made this area unattractive for sustained prehistoric or historic occupation. Early mining in the region was oriented to precious metals, and there are no precious metal deposits in the study area. There are also no indications that the area was used for ranching. No prehistoric or historic sites were anticipated in the study area.

Investigations of 150 acres in the previously unsurveyed portions of the study area were conducted by parallel pedestrian transects at 20-meter intervals (Maxim 2000). Two small areas of steep slopes were excluded from the investigation. A single historic isolated find was located and recorded. This isolated find, discovered at the edge of the study area, was described as a segment of riveted “smokestack.” Given the relatively rugged terrain and the absence of mining or industrial buildings or equipment in the vicinity, it is likely that this smokestack is a stovepipe dropped by a passing shepherd’s wagon. No areas were identified within the study area that exhibited the potential to contain undiscovered cultural resources.

3.13.4 Native American Traditional Concerns

The study area is within the traditional homeland of ancestors of the Northern Shoshone and Bannock Tribes. The study area is within the Shoshone Reservation broadly defined by the Fort Bridger Treaty as it was signed in 1863 and ratified in 1864. However, the Northern Shoshone and Bannock who now occupy the Fort Hall Reservation were not represented at those negotiations, and the western boundary of the reservation was not clearly defined. The subsequent Fort Bridger Treaty of 1868 refers to a reservation “which shall embrace reasonable portions of the ‘Port neuf’ and ‘Kansas Prairie’ [*sic* – Camas Prairie] countries.” This treaty confirmed the vague definition of the Fort Hall Reservation in a Presidential Executive Order in 1867. As with the earlier Eastern Shoshone or Wind River Reservation, safe passage of white men, emigrants, travelers, and overland stage lines along established routes through the reservation territories was guaranteed.

The first firmly defined boundaries of the Fort Hall Reservation were surveyed in 1872 and encompassed 1.2 million acres, and does not include the study area. The study area is not within the current boundaries of the Fort Hall Reservation. These tribes retain certain rights and privileges on public land administered by the BLM and USFS. Off-reservation treaty rights include hunting, fishing, plant gathering, and grazing livestock. Federal agencies have implicit trust responsibilities to maintain the habitat of traditional natural resources in a viable and sustainable condition.

3.14 SOCIAL AND ECONOMIC CONDITIONS

This section describes the existing socioeconomic structure of Caribou County and the Town of Soda Springs, including population, economy, housing, and community services. Available socioeconomic data were collected from local and state government sources. The primary sources of information were various Idaho Department of Commerce data.

Part of the neighboring Bear Lake County, including the City of Montpelier, provides approximately half of the current workforce at the Rasmussen Ridge Mine. Bear Lake County and Montpelier are included in the population analysis because the County is impacted by the addition of personal income to the County economy through the wages paid to County residents.

Caribou County, Bear Lake County, and the communities near the mine site that provide housing for mine employees comprise the analysis area for socioeconomic resources. Caribou and Bear Lake Counties are located in southeast Idaho. The City of Soda Springs is the Caribou County seat. The Town of Grace is located 8 miles southeast of Soda Springs. Phosphorus mining and related industries provide employment for workers residing in both communities. The two communities are the largest in Caribou County, and together account for nearly 60 percent of the population in the county. The City of Montpelier in Bear Lake County is nearly 30 miles southeast of Soda Springs on U.S. Highway 30.

3.14.1 Population

Historically and currently, population trends in Caribou and Bear Lake Counties have been tied to resource development, particularly mining and agriculture. The phosphate industry provides employment for a significant portion of the population.

Caribou County has lost and gained population in the last 20 years, reflecting the fluctuations of mining and agriculture in the local economy. In the years between 1980 and 1990, the population of the county decreased by 19.9 percent. The population grew to 7,304 people in 2000, an increase of 4.9 percent over the 1990 population (Idaho Department of Commerce 2001a). The total population in 2000 is still 16 percent less than the 1980 population, due to downturns in agriculture and mining industries since the 1980s. Population changes over time are shown in **Table 3.14-1**. Population fluctuations in Bear Lake County have followed a similar pattern.

Soda Springs is the largest community in the county, accounting for 46.3 percent of the county population in 2000 (Idaho Department of Commerce 2001a). The urban population in the county is 46.3 percent of the total population. Population density in the county is sparse at 4.1 persons per square mile. Caribou County had one of the lowest growth rates in Idaho between 1990 and 2000, ranking 41st out of Idaho's 44 counties (Idaho Department of Labor 2001a). The City of Montpelier accounted for 43.4 percent (2,785) of the Bear Lake County population in 2000.

TABLE 3.14-1
POPULATION GROWTH IN CARIBOU COUNTY AND SODA SPRINGS

	1980		1990		2000	
	Population	Growth (%)	Population	Growth (%)	Population	Growth (%)
State of Idaho	944,127	-	1,006,734	6.6	1,293,953	28.5
Caribou County	8,695	-	6,963	-19.9	7,304	4.9
Soda Springs	4,051	-	3,111	-23.2	3,381	8.7
Grace	1,216	-	973	-20.0	990	1.7
Bear Lake County	6,931	-	6,084	-12.2	6,411	5.4
Montpelier	3,107	-	2,656	-14.5	2,785	4.9

Source: Idaho Department of Commerce 2001c and 2001d; U.S. Census Bureau 2001a.

Caribou County's 2000 demographic estimate (U.S. Census Bureau 2001a) indicates that the majority of the residents are between the ages of 20 and 44 years. The median age is 53. In addition, residents of Caribou County comprise a fairly homogenous population, with a very low percentage of minorities. **Table 3.14-2** illustrates Caribou County's age distribution.

Table 3.14-3 illustrates the ethnic distribution in Caribou County. The population of Caribou County is predominantly white (96.1%), as shown in **Table 3.14-3** (U.S. Census Bureau 2001a). Other minority groups in the area constitute a small percentage of the total population. There were no areas identified in the analysis area that consisted of predominantly minority populations.

The U.S. Census Bureau (2001a) has estimated the number of people of all ages in poverty for Caribou County in 1997. Approximately 714 people, or 9.6 percent of the total population, had incomes below the poverty level in the county in 1997. There were no concentrations of residents below poverty level identified in the county, however, rural populations in southeast Idaho generally experience higher rates of poverty than urban areas.

TABLE 3.14-2
CARIBOU COUNTY AGE DISTRIBUTION (2000)

Age	Number	Percentage of Total
0-4	547	7.5
5-19	1,962	26.9
20-44	2,192	30.0
45-64	1,609	22.0
65+	994	13.6

Source: U.S. Census Bureau 2001a.

TABLE 3.14-3
CARIBOU COUNTY ETHNIC COMPOSITION (2000)

Race	Population	Percent
White	7,022	96.1
Black or African American	4	0.1
American Indian or Alaskan Native	15	0.2
Asian	6	0.1
Native Hawaiian or Other Pacific Islander	9	0.1
Other Race	161	2.3
Two or More Races	87	1.1
Totals	7,304	100.0
Hispanic Heritage*	289	4.0

Note: * Persons of Hispanic Heritage may be of any race.
Source: U.S. Census Bureau 2001a.

3.14.2 Economy and Employment

Historically and currently, the economies of Caribou and Bear Lake Counties have been dependent on the agricultural and mining sectors. The mining sector has been characterized by boom-bust cycles, which reflected the downturns and upswings of the mining industry. However, in recent years, there have been efforts to diversify the economy of the area. The area has seen growth in tourism and recreation, which in turn has stimulated the services and trade sectors. The largest employment sectors in 2000 were manufacturing, agriculture, services, government, and retail trade. The largest gains in employment between 1990 and 1999 were in the services, construction, and manufacturing sectors. The mining sector lost jobs during the same time period. In 1999, mining accounted for 9.2 percent of employment, which is a decline from 13.1 percent of employment in 1990. Manufacturing includes phosphate products manufactured within the county that are produced from phosphate ore mined in the county. The mining industry in Caribou County includes workers from the Bear Lake County labor force. However, employment and labor force characteristics do not reflect the number of workers from neighboring counties. **Table 3.14-4** summarizes employment by economic sector in Caribou and Bear Lake Counties.

Employment opportunities in the tourism and recreation industries are seasonal, consisting of employment related to hunting in late summer/early fall months and employment in other seasonal recreation industries. Employment in the agriculture industry, which has declined in the last decade, is also seasonal. In 1999, unemployment rates ranged from a low of 5.3 percent in October to a high of 7.7 percent in December. The unemployment rate has declined from a high of 7.5 percent in 1994 to the 1999 unemployment rate of 6.0 percent, a result of the increasing diversity of economic sectors providing employment in the county that offsets the fluctuations resulting from fluctuations in mining and agriculture industries. The 1999 employment is higher than the unemployment rate of 5.2 percent for the State of Idaho. **Table 3.14-5** summarizes labor force characteristics between 1990 and 1999.

The employment rates do not reflect economic conditions that have resulted in the loss of relatively high paying jobs in the mining industry. A general shift towards jobs that pay lower wages have led to an increasing number of workers holding more than one job to maintain an acceptable living standard (Idaho Housing and Financing Association 2001).

TABLE 3.14-4
EMPLOYMENT BY ECONOMIC SECTOR IN CARIBOU COUNTY

Economic Sector	1990		1999	
	Number of Employees	Percent	Number of Employees	Percent
Farm	636	15.8	705	15.4
Ag. Serv, Forest, Fish & Other	65	1.6	87	1.9
Manufacturing	681	16.9	808	17.7
Mining	526	13.1	422	9.2
Construction	161	4.0	306	6.7
Transport., Comm., & Pub. Utilities	136	3.4	174	3.8
Wholesale Trade	128	3.2	134	2.9
Retail Trade	459	11.4	535	11.7
Finance, Insur., & Real Estate	150	3.7	144	3.2
Services	446	11.1	597	13.1
Federal Civilian	54	1.3	46	1.0
Federal Military	45	1.1	31	0.7
State & Local Government	543	13.5	575	12.6
Total Employment	4,030		4,564	

Source: Idaho Department of Labor 2001.

TABLE 3.14-5
LABOR FORCE CHARACTERISTICS IN CARIBOU COUNTY

	1990		1994		1999	
	Caribou	Bear Lake	Caribou	Bear Lake	Caribou	Bear Lake
Total Labor Force	2,953	2,362	3,227	2,906	3,134	3,038
Employed	2,802	2,233	2,986	2,731	2,946	2,901
Unemployed	151	129	241	175	189	137
Unemployment Rate	5.1	5.6	7.5	6.0	6.0	4.5

Source: U.S. Census Bureau 2001b.

3.14.3 Housing

The 2000 U.S. Census of Population and Housing estimates a total of 3,188 housing units in Caribou County, of which 2,034 units, or 63.8 percent, are owner occupied. Of the total units, 1,505 housing units are in Soda Springs and 389 units are in Grace. The total vacancy rate for homeowners and rental in the county was 19.7 percent. The available housing stock was slightly greater in Bear Lake County, however, a greater percentage of available homes were seasonal homes, with a correspondingly higher rental vacancy rate. **Table 3.14-6** summarizes the housing characteristics in Caribou and Bear Lake Counties in the Census year 2000.

TABLE 3.14-6
HOUSING CHARACTERISTICS IN CARIBOU AND BEAR LAKE COUNTIES, 2000

	Caribou	Bear Lake
Total Housing Units	3,188	3,268
Occupied Housing Units	2,560	2,259
Owner Occupied Units	2,034	1,878
Renter Occupied Units	526	381
Vacant Housing Units	628	1,009
Seasonal, Recreational, or Occasional Use	257	729
Homeowner Vacancy Rate (percent)	2.2	2.8
Rental Vacancy Rate (percent)	28.9	12.8

Source: U.S. Census Bureau 2001c

The median home value in Soda Springs and Grace in 2000 was $97,300. The available housing data suggest that building activity is not keeping pace with current population growth. The units currently being built do not meet the housing demands at the low end of the price spectrum (Idaho Housing and Financing Association 2001).

3.14.4 Community Services

There are three school districts in Caribou County. Communities in the project area are served by two school districts: the Soda Springs District #150 and the Grace District #148. There are five schools in the Soda Springs District #150 with a 1999 fall enrollment of 1,120 students. In the Grace District #148, there are three schools with a 1999 fall enrollment of 569 students (Idaho Department of Education 2001). The nearest adult education is provided through the College of Southern Idaho, a community college in Twin Falls, or Idaho State University in Pocatello.

The Caribou County Sheriff's Department in Soda Springs, and the Idaho State Highway Patrol provide law enforcement for Caribou County. The Sheriff's Department also provides a volunteer group for search and rescue. Law enforcement in Soda Springs is provided by the Soda Springs Police Department, which employs a staff of seven full-time officers (Idaho Department of Commerce 2001b).

Fire protection services in Soda Springs are provided by the Soda Springs Fire Department, which is manned by a combination of paid and volunteer personnel (Idaho Department of Commerce 2001d). Fire protection in Grace is provided by a volunteer fire department (Grace Chamber of Commerce 2001b). Caribou County also has a volunteer fire department that services the areas outside of Soda Springs and Grace and will also assist either of the city fire departments.

The Caribou County Hospital and Nursing Home in Soda Springs provides comprehensive health care facilities, including a full-service hospital with 27 beds, emergency care, industrial testing, and 24-hour ambulance service. The hospital also provides a 43-bed skilled nursing home. There are also a variety of health practitioners and specialists in the area.

The Utah Power and Light Company provides residential electricity in Caribou County. Each community has a water transmission and distribution system. Water system service in rural Caribou County is supplied primarily by wells or other authorized suppliers.

A treatment plant is responsible for solid waste management in unincorporated Caribou County. Soda Springs is served by its own waste water treatment facility. The Town of Grace has a sewage disposal facility that is capable of providing treatment for a population of 2000, more than double the current population. The landfill nearest to the communities is the Caribou County Landfill located near Grace.

3.14.5 Fiscal

Public finance activities, lease fees, taxes, and other fees paid to the federal, state, and local entities, impact Caribou County, the State of Idaho, and the federal government. None of the proposed facilities are located within Bear Lake County.

The taxes and royalties assessed on mineral development and production are a significant source of revenue for the State of Idaho and local governments, including Caribou County. The mining industry pays rent, royalties, and bonuses on federal leases, mine license taxes to the State of Idaho, and local property taxes on production equipment.

A mine license tax of 2 percent is collected by the state for the value of ores mined or extracted. In fiscal year 2000, the state collected revenues of $1,038,288 from the mine license tax, a decrease of 53.67 percent from the 1999 revenues of $2,240,990.

Property taxes are levied by Caribou County on facilities and/or improvements constructed by companies. The average 2000 tax rate for rural areas in Caribou County was 1.3025 percent.

3.15 ENVIRONMENTAL JUSTICE

U.S. Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations) directs federal agencies to assess whether the Proposed Action or alternatives would have disproportionately high and adverse human health or environmental impacts on minority and low-income populations. Environmental issues can be identified through public involvement and the scoping process. After conducting a public scoping process and public involvement program (as described in Chapter 1) no responses were received that raised any concerns about environmental justice in minority or low-income populations.

The North Rasmussen Ridge Mine site is located in a sparsely populated rural area of Caribou County. No distinct population groups have been identified in proximity to the proposed mine expansion site. The Fort Hall Indian Reservation is more than 25 air miles west of the mine site. The nearest community is Soda Springs, 19 air miles southwest of the site.