INTRODUCTION

The analysis area considered in this document includes the Great Divide Basin and portions of the North Platte River Basin that constitute the Ferris-Seminoe Mountains Ecosystem Planning area. The analysis area occupies 2,038,675 acres within the Rawlins Field Office in Carbon and Sweetwater counties of south-central Wyoming. Land ownership consists of 65% federal lands, 31% private lands, and 4% state lands. Federal ownership includes 1,300,881 acres administered by the Bureau of Land Management, 18,429 acres of withdrawn lands administered by the Bureau of Reclamation, and 1,689 acres of Pathfinder National Wildlife Refuge lands. (Map #1).

Land ownership patterns vary from blocked public lands, checkerboard along the railroad right-of-way, to various mixtures of public and non-public lands. Management has been initiated over the last twenty years to improve livestock management and address issues such as riparian health, erosion problems, and wildlife/fisheries habitat. Private individuals, livestock operators, non-profit groups, and agency personnel have all contributed to these efforts. In project planning and implementation, monitoring, education, and cost-sharing, these groups and their employees have been a tremendous help in improving the resource conditions on public and private/state lands.

The 1995 rangeland reform process modified the grazing regulations to address the fundamentals of rangeland health. In August 1997, the *Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for the Public Lands Administered by the Bureau of Land Management in the State of Wyoming* were approved by the Wyoming State Director. The objectives of the rangeland health regulations are to "promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions… and to provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands." The fundamentals of rangeland health combine the basic precepts or physical function and biological health with elements of law relating to water quality and plant and animal populations and communities. Initially the standards focused on livestock grazing on BLM-administered lands, but the standards were developed to apply to all uses and resources.

In the Rawlins Field Office, rangeland standards were assessed on an allotment basis from 1998 through 2000. Some of the allotments contained within this watershed assessment were already evaluated, and that information and determination has been incorporated into this document. However, allotment assessments tend to emphasize management and impacts from livestock grazing, rather than on all uses which occur to and potentially impact public lands. In addition, assessing watersheds, water quality, and habitat for wildlife, fisheries, and threatened and endangered species, often does not correspond to allotment boundaries and is more logically evaluated at a larger scale. In January 2001, Instruction Memorandum No. 2001-079, Guidance for Conducting Watershed-Based Land Health Assessments, was sent to Field Offices from the Director of the BLM. This IM transmitted the 4180 Manual Section and 4180-1 Rangeland Health Standards Handbook and provides guidance for conducting assessments and evaluations for ascertaining rangeland health on a watershed basis. Under Policy/Action it states: "The Field Offices are to consider all assessment requirements for the watershed being assessed and select methods which will provide information needed to fulfill those requirements. When a field office invests its resources in an assessment, the end product should substantially meet all assessment needs to avoid conducting multiple assessments for multiple needs. For example, a well-planned, watershed-based assessment can provide the information needed for allotment evaluations, biological assessments for Section 7 Endangered Species Act consultation, and developing habitat management plans, Water Quality Improvement Plans for Total Maximum Daily Loads on impaired waters, and watershed restoration actions." In order to complete all Standard

Assessments within the original 10-year timeframe, watersheds have been divided into seven units with the upper Colorado River watershed report the first to be completed and the Great Divide Basin being the second watershed report (see Map #2).

The standards are the basis for assessing and monitoring rangeland conditions and trend. The assessments evaluate the standards and are conducted by an interdisciplinary team with participation from permittees and other interested parties. Assessments are only conducted on BLM-administered public land, however, interpretation of watershed health and water quality may reflect on all land ownerships within the area of analysis. The six standards are as follows:

Standard 1- Watershed Health: Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.

The standard is considered met if upland soil cover generally exceeds 30% and obvious signs of soil erosion are not apparent, and stream channels are stable and improving in morphology.

Standard 2 – Riparian/Wetland Health: Riparian and wetland vegetation have structural, age, and species diversity characteristic of the state of channel succession and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.

The standard is considered met if riparian/wetland habitat is rated in Proper Functioning Condition (PFC) and existing management will lead to maintaining or improving resource conditions.

Standard 3 – Upland Vegetation Health: Upland vegetation on each ecological site consists of plant communities appropriate to the site, which are resilient, diverse, and able to recover from natural and human disturbance.

The standard is considered met if plant communities are sustaining themselves under existing conditions and management.

Standard 4 – Wildlife/Threatened and Endangered Species Habitat Health, Fisheries, Weeds: Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.

The standard is considered met if habitat needed to support wildlife species is being sustained under existing conditions and management.

Standard 5 – Water Quality: Water quality meets State standards.

The standard is considered unknown unless information provided by the State of Wyoming determines the status of a water body as impaired (not meeting) or is meeting its beneficial uses.

Standard 6 – Air Quality: Air quality meets State standards.

The standard is considered met or impaired based on information provided by the State of Wyoming.

If an assessment shows that a standard(s) is not being met, factors contributing to the non-attainment are identified and management recommendations developed so the standard may be attained. If livestock are contributing to the nonattainment of a standard, as soon as practical but no later than the start of the next grazing season, management practices will be implemented to ensure that progress is being made toward attainment of the standard(s). The rangeland standards establish a threshold, however, the desired resource condition will usually be at a higher level than the threshold.

The desired range of conditions portrays the land or resource values that would exist in the future if management goals are achieved. The length of time to achieve the desired range of conditions would vary depending on the resources involved, the management actions required, and the speed at which different resources can effectively change. For instance, improving plant cover and litter, or changing species composition with treatments may be achieved relatively quickly in 5 to 10 years. However, developing a mixed age structure of willows along a stream by changing livestock management may take 20 to 30 years, even though it may be properly functioning. Other actions, such as restoring aspen woodlands within lodgepole pine communities by using prescribed or natural fire, may take 50 years or more.

The following regulatory constraints or special management considerations govern some of the resource values in the area:

- State of Wyoming water quality classifications and regulations on water rights, reservoir permitting, well permitting, and stormwater discharge permitting.
- Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 USC 1531 et. seq.) and the Interagency Cooperation Regulation (50 CFR 402), concerning water depletions in the Platte River System.
- Army Corp of Engineer permitting for dredged and fill materials in wetland areas located in the North Platte River Basin authorized under Section 404 of the Clean Water Act.
- Ferris Mountain Wilderness Study Area.
- Lost Creek and Stewart Creek Wild Horse Herd Management Areas.
- Lands managed by the Bureau of Reclamation, with grazing managed by BLM.
- Lands within the Pathfinder National Wildlife Refuge, with grazing managed by BLM.

The framework for this report will be an introduction and background information, followed by discussion of each rangeland standard in the order described earlier in this document. Within the discussion for each standard will be a map and description of how the standard will be addressed. The outline of discussion for each standard will follow the six-step process for ecosystem analysis at the watershed scale. The six steps are: 1) Characterization of the watershed, 2) Identification of issues and key questions, 3) Description of current conditions, 4) Description of reference conditions, 5) Synthesis and interpretation of information, and 6) Recommendations. Core topics will be discussed under the appropriate standard, with erosion processes, hydrology, and stream channels under Standard 1; vegetation split into wetland/riparian or upland under Standards 2 and 3; species and habitats under Standard 4; water quality under Standard 5, and air quality under Standard 6. Human uses would be discussed under each Standard where appropriate. Standard 1 – Watershed Health has been split into four descriptions for different hydrologic units, while the Standards 2 through 6 are each described as one unit for the entire Great Divide Basin report area.

Where discussion items are similar between watersheds, previous sections will be referenced and only additional, specific information will be noted.

BACKGROUND

Topography of the Great Divide Basin is dominated by gentle to moderately-sloping flats and rolling hills. Moderately steep to steep slopes are associated with geologic uplifts, which are found primarily around the border of the basin. These include Cyclone Rim, Delaney Rim, Atlantic Rim, Lost Soldier Rim, the Haystacks, and the Rawlins Uplift area. Elevation ranges from 6,500 feet at the Chain Lakes to highs of 8,800 feet at Atlantic Rim, 7,800 feet at Rawlins Peak, and around 7,400 feet at Delaney and Cyclone Rims. The Ferris and Seminoe Mountains are the principle geologic landmark on the northeast border of the Great Divide Basin. However, other features include Bradley Peak, Bear Mountain, and granitic rock piles scattered along the northern border, the largest and tallest being the Sentinel Rocks. Gentle slopes and valleys occur leading up to these mountains, changing to moderately steep to very steep within them. Elevations range from 5,860 feet at Pathfinder Reservoir and 6,500 feet south of Lamont, to highs of 10,037 feet at Ferris Mountain, 8948 feet at Bradley Peak, and 8,350 feet at Seminoe Mountain.

Other landscape features include:

- Seminoe and Pathfinder Reservoirs – The North Platter River forms the border on the eastern edge. These reservoirs are critical for irrigation and municipal waters supplies downstream and recreational opportunities.
- Red Desert Basin – This is a unique desert feature in the Great Divide Basin and contains essential water sources for wildlife and livestock.
- Sand Dunes South of the Ferris and Seminoe Mountain Ranges – Vegetated and unvegetated dunes west of Seminoe Reservoir.

Climate varies from arid to semi-arid depending mostly on changes in elevation. The Ferris and Seminoe Mountain ranges are the highest points and in general accumulate more snow then the lower elevation regions. Snow distribution at lower elevations is driven by wind with drifts forming in topographic features. The elevation at the Rawlins weather station is 6,736 ft., where the average annual precipitation was 9.7 inches from 1971-2000. The elevation at the Seminoe Dam weather station is 6838 feet (located at the east end of the Seminoe Mountains), which recorded an average of 14.0 inches of annual precipitation for the same period. For both of the stations April and May were the wettest months on average. Other long-term weather stations in the assessment area are located at Wamsutter and Muddy Gap, which average 6.9 inches and 10.3 inches of annual precipitation, respectively. Precipitation occurs in the form of both snow and rain, with April, May, and June being the wettest months, but with significant moisture coming anytime between March and October. The mean summer temperature for this region is 56 degrees and the mean winter temperature is 30 degrees.

The North Platte River on the Eastern border of the area is fed by snowmelt from the Medicine Bow Mountain Range to the South. The State of Wyoming has classified most of the main stem of the North Platte as Class 1 waters, which is the designation with the highest standards. In the assessment area, these reaches include between Kortes Dam and Pathfinder Reservoir. Seminoe Reservoir is classified as 2AB, meaning the waters support native and game fisheries and are protected for all categories. Tributaries in the area that flow into the North Platte are mostly designated as 2AB or 3AB, depending if the tributary has perennial, intermittent, or ephemeral surface waters. Waters that are designated as 3AB are mostly ephemeral and protected for

aquatic life, but not fish. The majority of the Great Divide basin is designated 3A, B, or C with isolated portions of 4C for ephemeral areas that support few to no aquatic species.

Soils in the basin formed in residuum or alluvium derived dominantly from shales or sandstones. Layers of both these types are often found together in alternating bands of varying thickness. Soils in the Ferris and Seminoe Mountains have a granitic base overlaid with fractured and pushed aside uplifts of sandstone and limestone. The white cliffs that stand out on the south slopes of the Ferris Mountains are part of the Madison formation, while the dark red hills bordering Seminoe Reservoir represent the Chugwater formation. Textures range from clays to loams to sands and from very shallow to deep. Clay and silt-dominated soils are often saline or alkaline, while sandy and loamy soils have had enough precipitation to leach salts sufficiently to allow them to function (effective rooting depth) as moderate to deep soils. Fine-textured soils have lower infiltration rates and higher rates of runoff with high to severe potential for soil erosion, while loam to sandy soils have moderate to high rates of infiltration and produce low to moderate runoff with low to medium potential for soil erosion. Finer-textured soils will usually have lower amounts of vegetative cover and litter.

Vegetation is predominantly either sagebrush-grass or saline-influenced communities in this region. Wyoming big sagebrush is the most common species amongst the nine species or subspecies of sagebrush shrubs commonly occurring together or in site-specific habitats. Nuttall's saltbush and black greasewood are the distinctive species of saline-influenced communities. Mountain shrubs, which include bitterbrush, snowberry, serviceberry, chokecherry, and mountain mahogany, occur in 10-inch or higher precipitation zones and are usually intermixed themselves or with sagebrush and aspen. Aspen woodland is usually found above 7,000 feet in small pockets on north and east-facing slopes where snow accumulates or there is some other source of additional moisture. Conifer woodlands occur above 7,500 feet, with limber pine and juniper on drier sites and lodgepole pine, subalpine fir, and spruce on wetter sites. Riparian and wetland habitats occur on less than one percent of public lands. Herbaceous and shrub-dominated riparian communities are the most common, with tree-dominated habitat such as cottonwood being the least common in occurrence.

Wildlife is abundant and diverse. Antelope, mule deer and elk are common big game species, with small populations of bighorn sheep in the Ferris and Seminoe Mountains. Greater sage-grouse and mountain plover are important species of interest. Raptors include golden and bald eagles; ferruginous, red-tailed and Swainson's hawks; burrowing owls; and other hawks, harriers, and owls. Other commonly observed wildlife are coyotes, badger, beaver, muskrat, cottontail and jackrabbits, prairie dogs, ground squirrels, waterfowl, and songbirds. Fisheries are most recognized for various species of trout, which have all been introduced into streams and ponds for recreational use. Increasing attention is being directed at non-game fish species found in the North Platte River drainage.

The Lost Creek and Stewart Creek Wild Horse Herd Management Areas (HMA) are located in the blocked public lands in the northwest portion of the watershed, west of highway 287 and south of the Green Mountain and Crooks Mountain wild horse herd areas. The Lost Creek herd's appropriate management level (AML) is between 55 and 85 wild horses spread over 250,000 acres. The Stewart Creek AML is between 120 and 180 wild horses that roam over 230,000 acres. Both HMAs have limited water sources and few fences. The Lost Creek HMA is not fenced separate from checkerboard lands to the south or from the wild horse herd area to the north.

The Ferris Mountains Wilderness Study Area (WSA) includes most of Ferris Mountain, and consists of 22,245 acres of public lands. A small mountain range, its ruggedness leads to the perception of a larger size than it actually is. Along portions of its length, deep canyons prevail, while steep slopes are common throughout making for extreme local relief. These features have preserved a natural state and condition, essentially roadless and undisturbed. Numerous streams flow out of the mountain, but with limited areas of meadowland. Fire scars are common and various densities and age-classes of conifers dominate the landscape. Wildflowers are abundant and diverse, creating a colorful splendor during the spring. There is a register for ambitious hikers at the top of Ferris Peak.

Human population levels are low, with approximately 9,000 people living in Rawlins, the county seat, with other small populations of people living in Wamsutter, Bairoil and Muddy Gap. Improved roads are limited to the paved state highways and dirt and graveled roads maintained by the county, federal agencies, and, more recently, by mineral development companies. Human use on public lands within the Great Divide Basin is generally related to oil and gas development, livestock grazing, and recreation.

Natural gas development is extensive in the area around Wamsutter and is expanding to the north and east, while oil fields occur in a small zone around Bairoil. Extensive, undeveloped coalfields have led to the recent exploratory development of coalbed methane on the west sides of both Seminoe Reservoir and Atlantic Rim. Recent infield development of natural gas fields around Wamsutter is reaching the density of one well per 80 acres, with lower density development ranging from one to four wells per 640 acres.

There are 48 allotments permitted for grazing use on public lands in the watershed analysis area. Grazing use is approximately 90 percent cattle and 10 percent sheep, with winter or seasonal use at lower elevations and only summer or fall use at higher elevations. Historical use in this area developed as both cattle and sheep use, depending on the location. Cattle numbers have slowly risen through the years, with most conversions to cattle happening in the 1960s through the 1980s. The Taylor Grazing Act in 1934 began a process of creating allotments, which has led to greater stewardship and on-the-ground management. Fencing of allotments has been an ongoing, long-term process, with pasture fencing becoming more common in recent times. Table #1 lists the allotment name, number, and the factors for each allotment, which were used to prioritize monitoring in the standards assessment, and corresponds to Map #3 depicting allotments within the watershed. This table was created using monitoring data, PFC assessments, and professional knowledge, as well as information or knowledge about these allotments from other agencies. Typically, the allotments with the most boxes checked will be the areas needing the most attention. Best Management Practices (BMPs) describe various actions which have or can be implemented to change impacts from grazing management. They include altering the season, duration, or type of livestock use, as well as the use of herding, fencing, water developments, vegetation treatments, or other tools where appropriate.

Recreation use includes hunting, fishing, camping, wildlife-viewing, ORV use, and traveling the Continental Divide National Scenic Trail. The numbers of people involved in these activities are generally low except during the fall hunting seasons.

STANDARD 1 – WATERSHED HEALTH

> *Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.*

The analysis area contains all the Great Divide Basin and portions of the North Platte River Basin within the RFO boundary(Maps #4 & #5). Table #2 depicts the 4th Order HUCs, acreages, and groupings of these watersheds that will be discussed for Standard 1.

Table # 2 –Sub-Area Acreage Included in the Analysis Area

Sub-Area (report sections)	Acreage	4th Level HUCs*
Great Divide Basin (without Upper/Lower Separation Creek/Boggy Meadows)	1,032,272	14040200 - Great Divide Closed Basin
Upper/Lower Separation Creek/Boggy Meadows (portion of Great Divide Basin)	619,352	
Sweetwater River (RFO)	144,946	1018006 - Sweetwater
North Platte River Basin other than Sweetwater River	246,105	10180002 – Upper North Platte 10180003 – Pathfinder – Seminoe Reservoir
Total	2,042,675	

***** HUCs – United States Geological Survey Hydrologic Unit Codes.

Great Divide Basin (without Upper/Lower Separation Creek, Boggy Meadows)

1) Characterization:

This discussion includes the following fifth order watersheds: Battle Springs Flat, Buck Draw, Cyclone Draw, Latham Draw, Lost Creek, Red Creek, Red Desert Basin, Red Wash Draw, and Salt Sage Draw. These watersheds are all very similar in terms of an arid (< 10 inches of rain annually) environment, predominantly shale and sandy clay-loam soils, and ephemeral drainages. Rapid snowmelt or thunderstorms can produce moderate to high runoff with medium to high erosion potential. Topography is flat to gently rolling landscape for the most part, becoming moderately steep to steep close to rims (picture 10-1). The range in elevation is only 900 feet between the highest and lowest points in the watershed, so gradient changes within drainages are low. Wind redeposits snow on the leeward side of vegetation and topographic features, typically the north and east sides. This can alter vegetation and soils, as well as runoff occurrence and duration (picture 10-2). At the terminus of creek systems are playas or water sources such as Hay Reservoir for Red Creek and Lost Creek Lake for Lost Creek. In wet years these lakes will last from one season to the next, but they will dry up during years with normal to below normal precipitation. The rest of the water sources have been developed around wells or on natural

springs. These areas can be important for livestock and wildlife and may support wetland vegetation as discussed in Standard 2. Groundwater resources are critical for these areas and will be discussed in Standard 5.

Due to low topographic relief and infrequent flow events, channel formation is generally weak on smaller drainages and more pronounced on a few larger stream systems. Both types have wide floodplains. However, smaller drainages have channels that range from a few feet across by one to two feet deep to just slight depressions that are hardly recognizable. Larger systems like Lost Creek have very defined channels that are wide and shallow. Erosion sources include both uplands and in-channel. Peak flows usually occur in February through April when temperatures rise and snow melts across the whole watershed in a short period of time. Flows are erratic and short-term, with no recording of perennial flows.

The only sites where channel classification was determined, was along portions of Lost Creek, which is a D5 stream type. The D5 stream type is described as a braided stream, found within broad alluvial valleys, with predominantly sand channel bed material, interspersed with silts and clays (picture 11-1). The braided system consists of interconnected distribution channels formed in depositional environments. Channel gradients are generally less than 2% with very high width/depth ratios of 40 to 50 up to 400 or larger. The braided channel system is characterized by high bank erosion rates, excessive deposition occurring as both longitudinal and transverse bars, and annual shifts of the bed location (Rosgen 1996).

Principal human uses in this watershed are natural gas development, livestock grazing, and recreation. Natural gas development has occurred in the area for many years. However, it has expanded in scope of area as well as in-field drilling over the last 10 years (picture 11-2). Around Wamsutter, well density is reaching an 80-acre spacing, whereas in most areas 160-acre spacing is more common. Livestock use is primarily cattle, both cow/calf and yearling operations. Sheep use also still occurs on a few allotments. Seasons of use for livestock vary by allotment. Winter use is somewhat dependent on annual climate conditions. Recreation is largely related to hunting, primarily during the fall (September through October).

2) Issues and Key Questions:

Water and wind erosion, as well as gully formation, are important indicators of watershed health, which are influenced by vegetation health and groundcover. Erosion can result in the loss of topsoil and reductions in site productivity in the uplands and horizontal adjustments of stream channels. Management factors that affect these processes are described below.

1. Livestock Grazing: Livestock grazing has been and continues to be the principal factor affecting watershed values in terms of vegetative cover and litter (picture 11-3). Since channels and flow regimes are ephemeral, the focus is primarily on uplands. Management issues relate to the season, duration, and distribution of use rather than stocking rates. The key question is in what locations do further refinements in BMPs or other actions still need to be made to improve watershed health and meet desired resource conditions?

2. Erosion: Erosion from roads, both improved and unimproved, is the second most important factor relating to watershed health. The BLM, Sweetwater County, and various oil and gas companies all maintain improved roads within the watershed. The principal problem with improved roads is inadequate water control features, such as culverts, wing-ditches, and water-bars, to mitigate the effects of roads on upland runoff hydrology. Road standards are based on how to build and maintain a safe road, rather than what effect the road has on altering the natural

hydrology of the landscape. As a result, roads tend to collect water off a broad area and then release it in a more concentrated volume, in a draw or flared onto a hillside undeveloped for this flow, causing accelerated erosion. Since the Great Divide Basin has no external outlets, this erosion is localized and is not necessarily affecting values outside this watershed (except by wind erosion). For each mile of improved road there are probably ten miles of unimproved roads or two-tracks. Many of these two-tracks do not cause increased erosion, but where it does occur there is usually no mitigation to correct the problem. Use of road systems by all users, particularly in bad weather or when roads are wet, leads to increased erosion from roads. The increasing use of this country for recreation, and the increasing use of 4-wheel drives and off-highway vehicles, is creating new roads and new sources of erosion. The key questions here are: How do we improve the adequacy of water control features on improved roads? How can erosion sources from two-track roads best be addressed? How can we develop a long term strategy to address erosional issues from these roads? What educational and management tools should be employed to reduce erosion impacts from recreation and other users of public lands?

3. Oil and Gas: Oil and gas field development is increasing in this watershed and across the region. Short and long-term sources of erosion are increasing with this development, but can often be mitigated with good reclamation practices. This is especially true for pipelines and more recently for active and reclaimed natural gas well pads (picture 12-1). However, most other companies are not performing this level quality of pad reclamation to reduce impacts of mineral development on soil erosion. The key question is how to elevate the attention to reclamation by all mineral development companies?

4. Wild Horses: Wild horse populations in both Herd Management Areas (HMA) are currently at the Appropriate Management Level (AML) following gathers in 2001 and 2002. Prior to this, horse populations were two to three times the AML and contributing to impacts upon riparian resources. In a low precipitation desert watershed, with below normal moisture, it is critical for the BLM to keep wild horse populations at the proper level that natural resources can support (picture 12-2). What monitoring must be completed to determine if the current AMLs are the proper population level for each of the two HMAs? Wild horse use becomes concentrated around a small number of reliable water sources in dry years and the horses move out of the HMA into allotments with developed water for livestock. Why isn't adequate funding provided to develop adequate water for wild horses, manage and resolve distribution of use problems, and properly monitor and resolve impacts caused by wild horses? Wild horses occur in the northern half of this watershed area, and in the Boggy Meadows unit west of Highway 287 that is described next.

3) Current Conditions:

Quantifiable data about current erosion levels, ephemeral stream flows, and range condition and trend for the entire area, are not available. Information is available for specific locations from photo-points, upland cover transects, and personal observations.

Stream channels are ephemeral and are moderately vegetated with rhizomatous wheatgrass, basin wildrye, big sagebrush, and other upland species. Most erosion occurs from confined, in-channel sites and from rill and gully erosion from uplands. Much of this is considered background or natural rates of erosion, compared to accelerated rates of erosion caused by impacts from roads or poor grazing practices.

Vegetative cover and litter on uplands varies with the soils, slope, aspect, elevation and precipitation. Research conducted in Wyoming indicated that upland plant communities often

can be maintained with ground cover of 30 percent, while sediment yield increased dramatically when cover declined to less than 30 percent (Linse, Smith and Trlica, 1992). Ground cover ranges from 50 to 75 percent on big sagebrush plant communities and from 40 to 60 percent on saltbush steppe plant communities, the two most common vegetation types in this watershed. Plant cover and litter on one saltbush steppe site south of Wamsutter has improved from 48% to 55% over the past seven years with a rotational grazing system. Greasewood flats and playas are in the 20 to 30 percent range. While this would appear to meet the conditions listed above for accelerated sediment yield, this is not the case, since these sites are on flats and are often the endpoints for water flow off adjacent slopes. The water will pond on these sites with nearly a sealed soil surface due to salts and clays, resulting in most of the water leaving the site as evaporation. This is particularly true for the greasewood flats north of Tipton and adjacent to the Chain Lakes area (picture 13-1). In general, the overall ground cover appears good, but in many locations can still be improved with the use of BMPs.

4) Reference Conditions:

There are no known accounts which describe the watershed conditions for the Great Divide Basin prior to settlement by white men. The lack of water led early explorers to follow the Sweetwater River to the north or the Overland Trail route to the south.

5) Synthesis and Interpretation:

Lack of water in this region also protected it to some degree by the impacts of settlement once the transcontinental railroad was built in 1867. The abundance of saltbush and the ability of sheep to survive on snow, led to winter sheep being the principle use of this country for many years. Too much snow or lack of snow would limit the annual amount of sheep use. Although high levels of utilization probably occurred, the dormant season of use would still have helped maintain the native plant species. For the majority of the area, current species composition and levels of plant cover appear to be in good condition. The gentle terrain with low gradients across many miles also probably helped reduce the impacts that livestock use may have had upon watershed values. In other watersheds, head-cuts and gullies are more pronounced in areas with greater relief and differences in gradient.

The principal changes observed today in this watershed are the roads, gas wells, and fences relating to the existing land uses. Road improvements are probably the most visible recent change seen in this part of the Great Divide Basin. This includes graveling some of the more-frequently used roads used by industry, and using additional culverts and wing-ditching. There is still a large need for further work on nearly all improved roads to reach an adequate level of these types of practices to minimize or eliminate overland flow alterations and erosion caused by roads . This issue is getting larger rather than smaller, with the creation of more roads associated with expanding development of natural gas fields.

The other visible change has been the reclamation efforts around operating wellheads, particularly by BP America, to reduce bare ground that is exposed to wind and water erosion. Other oil and gas companies involved in the same type of work and resource impacts have not reached the same level in their reclamation. Reclamation of pipelines and dry hole locations is generally good.

Management changes relating to livestock grazing include: pasture grazing systems to manipulate duration and season of use to provide some growing season rest in each pasture and development of upland water sources to improve livestock distribution. These practices have been occurring

over the last 50 years as sheep permits were converted to cattle. Although most allotments now have some type of pasture management system, there are a few allotments without a management system. Areas of historic impact, still observable today, are old sheep bed-grounds along trail routes, adjacent to water sources, and on ridgetops. Plant cover and species composition were negatively affected by the trampling and soil compaction, with site recovery still occurring.

Current management systems are being modified where needed to improve plant vigor and vegetative cover by ensuring at least partial rest during the growing season. New water developments are used to improve livestock distribution and to create more reliable water sources, in order to get through periods of drought. Oil and gas field development has also contributed significantly to creating new sources of water, which are usually made available for livestock and wildlife use. Control of livestock is also complicated by mineral development activities, which can involve lack of maintenance on cattleguards and leaving gates open.

Horses were brought into North America by the Spanish in the 1500s. Early historical accounts from adjacent watersheds never mention wild horses, but do discuss buffalo, antelope, and other big game species. Most wild horses are the result of domestic horses getting away and becoming wild, or older horses being turned loose. A market for horses developed during World War I and many current-day livestock producers made their start by capturing and selling wild horses. It was a source of extra money to supplement the living made with livestock. The ranches tried to manage wild horses along with their livestock (in a general sense) according to what the land could support. With the advent of the Wild Horse and Burro Act in 1971, responsibility for managing wild horses was given to the BLM. However, adequate funding for roundups, management, and monitoring has been lacking. The current actions being taken has been to protect critical habitats being impacted by wild horses and shift distribution of use patterns by providing additional water sources, both by the BLM and when ranchers pump water for livestock (picture 14-1).

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands, the existing condition of primarily ephemeral channels, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, and the generally small number of management issues that need to be dealt with, it is determined that the Great Divide Basin watershed is meeting Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Identify and correct problems with improved roads, which affect water flows and soil erosion. Two-track roads are too numerous to deal with as a whole, however, problem areas should identified and fixed or the road should be closed and reclaimed. All oil and gas companies should implement reclamation practices on active and dry hole locations, which minimize the amount of bare ground exposed to wind and water erosion.

Continue to implement or manage using BMPs for livestock grazing. This primarily means controlling the season, duration, and distribution of livestock use to meet desired resource objectives for both riparian and upland habitats. Specific dates or times must be decided on a case-by-case basis. Methods to achieve this include, but are not limited to, herding, pasture fencing, water developments, and vegetation treatments.

Implement vegetation treatments where needed to restore plant communities with diverse species, age classes, and cover types. Promote composition of communities to maximize herbaceous cover and litter, and therefore, minimize surface runoff and soil erosion.

Maintain wild horse populations in the Lost Creek and Stewart Creek HMA's at the current AML for each herd area. Ensure adequate monitoring to determine if this AML is the appropriate level to manage for with regard to watershed values and other multiple uses of public lands. Develop additional water sources and improve distribution of wild horse use away from historic areas of concentrated use due to lack of adequate sources of water.

Expand public education about its role in public land management, particularly regarding impacts from roads and off-highway vehicular activities.

Upper/Lower Separation Creek/Boggy Meadows in the Great Divide Basin

1)Characterization:

This discussion includes three fifth order watersheds: Upper and Lower Separation Creek and Boggy Meadows. They were separated in discussion from the rest of the Great Divide Basin since they each have more defined stream channels, Separation Creek and Lost Soldier Creek, with perennial headwaters derived from Atlantic Rim and Green Mountain, respectively. These watersheds are also similar in terms of originating in 14 to 17 inch precipitation zones and ending in 7 to 9 inch precipitation zones. Soils are predominantly shale and sandy clay-loam soils, with short portions of perennial and intermittent stream segments turning into ephemeral drainages. Rapid snowmelt or thunderstorms can produce moderate to high runoff with medium to high erosion potential. Topography is flat to gently rolling landscape at lower elevations, becoming moderately steep to steep close to rims and headwater locations. The range in elevation is much greater than the rest of the Great Divide Basin, changing 2400 feet in both the Lost Soldier Creek and Separation Creek drainages (picture15-1). This creates high gradient changes near headwater areas, increasing the potential for head-cuts and gullies. The lower two-thirds of both drainages have low gradients with lower potential for gullies. At the terminus of each stream system are intermittent lakes or playas such as Separation Lake, Lost Soldier Lake, and other unnamed locations. In wet years these lakes will last from one season to the next, but they will dry up during years with normal to below normal precipitation.

Due to low topographic relief and infrequent flow events, channel formation is generally weak on smaller drainages and more pronounced on a few larger stream systems. Both types have wide floodplains. However, smaller drainages have channels that range from a few feet across by one to two feet deep to just slight depressions that are hardly recognizable. Main stream channels have very defined channels that are wide and shallow in low gradients, and more confined to even incised where higher gradients occur. Erosion sources include both uplands and in-channel. Peak flows usually occur in February through April when temperatures rise and snow melts across the whole watershed in a short period of time. Flows are erratic and short-term, with no recording of perennial flows. The main channels are mostly fine substrate and only support aquatic life in isolated portions that receive groundwater recharge. The health of the watershed outputs therefore should be evaluated based on the ability to support wetland areas and the water quality in shallow groundwater aquifers.

The only areas where stream flow is perennial and channel classification was determined, were Lost Soldier Creek and Separation Creek, both C6 type streams except for the lower portion of Separation Creek which is an E6 type stream. The C6 stream type is a slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). It occurs in broad valleys with gentle gradients of less than two percent. Rates of lateral adjustment are influenced by the presence and condition of riparian condition (picture 16-1). The E6 stream type is found where incisement has occurred. Here it is laterally contained in an entrenched valley and evolves to a channel inside a previous channel (Rosgen 1996). This stream type is also a silt-clay dominated, riffle-pool system, with gradients less than two percent creating high meander width ratios, high sinuosities, and low width/depth ratios (picture 16-2). Streambanks are stabilized with riparian vegetation similar to C6 stream types.

Principal human uses in this watershed are oil and gas development, livestock grazing, and recreation. Oil field development has occurred primarily around Bairoil. In addition, there is ongoing coal bed methane drilling just below the headwaters of Separation Creek. Livestock use is primarily cattle, both cow/calf and yearling operations. Sheep use also still occurs on a few allotments. Seasons of use for livestock vary by allotment. Winter use is somewhat dependent on annual climate conditions. Recreation is largely related to hunting, primarily during the fall (September through October).

2) Issues and Key Questions:

1. Livestock Grazing – (please refer to issues identified for the Great Divide Basin)

2. Erosion- (please refer to issues identified for the Great Divide Basin)

3. Wild Horses- (please refer to issues identified for the Great Divide Basin)

4. Oil and Gas: Oil field development has occurred around Bairoil (and later Ferris) for nearly 80 years (picture 16-3). However, most of this watershed has had only exploratory drilling for oil and gas development with no further activities. Preliminary pod drilling for Coal Bed Methane development is currently underway in the Separation Creek drainage on the west slope of Atlantic Rim. This will likely result in surface discharge of the water being pumped out of the coal seams to release the gas. This water could be used to better manage livestock, however since the water is temporary more permanent water sources may need to be developed to maintain this infrastructure. Continuous flows in systems formed in response to periodic floods from storm events may cause channel adjustments resulting in erosion in the stream channels. Impacts on wildlife from providing temporary water sources need to be assessed for potential changes in migration patterns.

5. Woody Plant Health: The age and canopy cover of big sagebrush, mountain shrub, and aspen woodland plant communities is increasing, leading to lower herbaceous ground cover and water yield. Older shrub and tree communities use more water, have lower infiltration rates and greater surface erosion, all leading to reduced late-season stream flows. Prescribed burns conducted in this and adjacent watersheds have shown improvements in ground cover, reduced surface erosion, and improved late season stream flows. The key question is: How do we as an agency decide on what amounts of treatments should occur to promote higher stream flows and lower soil erosion levels and still address all of the resource values that we are obligated to manage?

3) Current Conditions:

Quantifiable data about current erosion levels, ephemeral stream flows, and range condition and trend for the entire area, are not available. Information is available for specific locations from photo-points, upland cover transects, coal bed development studies, and personal observations.

Perennial and intermittent stream channels that support riparian vegetation are narrowing, with banks becoming more stable with perennial, deep-rooted sedges, rushes, grasses, and in some areas with willows. As the channels narrow, the active floodplain width expands, including within incised banks where the upper slopes continue to widen and become more stable with vegetative cover. In-channel bank sloughing on outer corners and gradient adjustment of ephemeral side drainages are the primary sources of erosion. In a few locations, this includes gully movement through the dams or spillways of old beaver ponds. Hydrologic function is improving due to the above-mentioned changes in stream channels and floodplains. However, the general lack of beaver ponds that were historically present in these system results in faster movement of flow events and reduced water storage for late-season stream flow. The majority of these watersheds have ephemeral stream channels that are moderately vegetated with rhizomatous wheatgrass, basin wildrye, big sagebrush, and other upland species. Erosion occurs from confined, in-channel sites and from rill and gully erosion from uplands. Much of this is considered background or natural rates of erosion, compared to accelerated rates of erosion caused by impacts from roads or poor grazing practices.

Vegetative cover and litter on uplands varies with the soils, slope, aspect, elevation and precipitation. Research conducted in Wyoming indicated that upland plant communities often can be maintained with ground cover above 30%, while sediment yield increased dramatically when cover declined to less than 30% (Linse, Smith and Trlica, 1992). Ground cover ranges from 50% to 85% on big sagebrush plant communities and from 45% to 70% on saltbush steppe plant communities, the two most common vegetation types in this watershed. At upper elevations, plant cover is usually higher, for instance the average cover values in upper Separation Creek drainage were 86%. Trend data shows increases in plant cover and litter, as well as plant densities, which occur primarily as grasses fill in the spaces between shrubs. Plant cover and litter on saltbush steppe sites along Lower Separation Creek has improved from an average of 47% to 61% over the past nine years with a rotational grazing system. One transect established in 1980 south of Lamont showed an increase in cover and litter from 52% to 80% when reread in 1998. Greasewood flats and playas are in the 20% to 30% range. While this would appear to meet the conditions listed above for accelerated sediment yield, this is not the case, since these sites are on flats and are often the endpoints for water flow off adjacent slopes. The water will pond on these sites with nearly a sealed soil surface due to salts and clays, resulting in most of the water leaving the site as evaporation. This is particularly true for the greasewood flats north of Tipton and adjacent to the Chain Lakes area. In general, the overall ground cover appears good, but in many locations can still be improved with the use of BMPs.

4) Reference Conditions:

There are no known accounts which describe the watershed conditions for this portion of the Great Divide Basin prior to settlement by white men. The lack of water led early explorers to follow the Sweetwater River to the north or the Overland Trail route to the south.

5) Synthesis and Interpretation:

Lack of water in this region also protected it to some degree by the impacts of settlement. However, these watersheds were closer to perennial water sources, and therefore, saw earlier and more permanent use and development. They were also along freight lines and travel routes leading away from the railroad, including the Chief Washakie trail north to the Wind River Indian Reservation and the freight road south to Meeker, Colorado and the Ute Indian Reservation. Homesteads sprang up with fenced hay meadows for horses and winter hay. Although sheep were still dominant in these areas, some cattle were run and others drifted in from neighboring ranches (such as the Sweetwater River area) that were solely cattle operations. In the lower and drier locations of the watersheds, the abundance of saltbush still led to winter sheep being the principle use of this country for many years. Too much snow or lack of snow would limit the annual amount of use made by sheep or cattle. Higher levels of forage utilization probably occurred due to both sheep and cattle use (plus wild horses) and being closer to more reliable water sources. Some dormant season of use and seasonal use would still have helped maintain the native plant species. Current species composition and levels of plant cover appear to be in good condition. There are small head-cuts and gullying present on steeper gradients, but current management and plant cover are helping to stabilize these locations. The gentle terrain with low gradients across most of this area has probably helped reduce the impacts that livestock use may have had upon watershed values.

The principal changes observed today in this watershed are the roads and fences relating to the existing land uses. There is still a large need for further work on nearly all improved roads to reach an adequate level of development (primarily additional culverts and wing-ditching) to minimize or eliminate overland flow alterations and erosion caused by roads. This issue is getting larger rather than smaller, with the creation of more roads associated with expanding development of coalbed methane gas fields and recreational users. Evidence of oil and gas development is only apparent around Bairoil, Lamont, Ferris, and the current development for coalbed methane gas. Reclamation of older facilities, as well as pipelines and dry hole locations are generally good.

Management changes relating to livestock grazing include: pasture grazing systems to manipulate duration and season of use to provide some growing season rest in each pasture and development of upland water sources to improve livestock distribution. These practices have been occurring over the last 50 years as sheep permits were converted to cattle. Areas of historic impact, still observable today, are old sheep bed-grounds along trail routes and adjacent to water sources. Plant cover and species composition were negatively affected by the trampling and soil compaction, with site recovery still occurring. Current management systems are being modified where needed to improve plant vigor and vegetative cover by ensuring at least partial rest during the growing season. New water developments are used to improve livestock distribution and to create more reliable water sources, in order to get through periods of drought.

The history of wild horses in this area was described for the Great Divide Basin. Watershed impacts attributable to wild horses has usually not been differentiated from livestock. The principle impacts from wild horses in this area are in the Lost Soldier Creek portion of the watershed. The current actions being taken has been to protect critical habitats being impacted by wild horses and shift distribution of use patterns by providing additional water sources, both by the BLM and when ranchers pump water for livestock.

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands, the existing condition of primarily ephemeral channels, the management responsibility by industry and agencies to design

and mitigate impacts from roads on hydrologic flow events and soil erosion, and the generally small number of management issues that need to be dealt with, it is determined that the Upper/Lower Separation Creek/Boggy Meadows watersheds are meeting Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Identify and correct problems with improved roads, which affect water flows and soil erosion. Two-track roads are too numerous to deal with as a whole, however, problem areas should be identified and fixed or the road should be closed and reclaimed. All oil and gas companies should implement reclamation practices on active and dry hole locations, which minimize the amount of bare ground exposed to wind and water erosion.

Continue to implement or manage using BMPs for livestock grazing. This primarily means controlling the season, duration, and distribution of livestock use to meet desired resource objectives for both riparian and upland habitats. Specific dates or times must be decided on a case-by-case basis. Methods to achieve this include, but are not limited to, herding, pasture fencing, water developments, and vegetation treatments.

Implement vegetation treatments where needed to restore plant communities with diverse species, age classes, and cover types. Promote composition of communities to maximize herbaceous cover and litter, and therefore, minimize surface runoff and soil erosion.

Maintain wild horse populations in the Stewart Creek HMA at the current AML for the herd area. Ensure adequate monitoring to determine if this AML is the appropriate level to manage for with regard to watershed values and other multiple uses of public lands. Develop additional water sources and improve distribution of wild horse use away from historic areas of concentrated use due to lack of adequate sources of water.

Expand public education about its role in public land management, particularly regarding impacts from roads and off-highway vehicular activities.

Sweetwater River in the North Platte River Basin

1) Characterization:

The portion of the Sweetwater River basin within the report area includes the drainages that originate from the west half of the Ferris Mountains, including Rush, Pete, Cherry, Whiskey, and Muddy Creeks and their tributaries. The lower elevations are in a 10 to 14 inch precipitation zone, while the mountains may reach up to 20 inches of precipitation annually. Soils are generally sandy loams and sandy clay-loams, with gravel and rocks becoming more numerous closer to the mountains and along higher gradient streams. Mountain terrain is steep, with elevation rising 2400 feet in the one mile leading up to the very top (picture 19-1). Slopes get more gentle on the adjacent foothill and plains, with a total elevation change of 3800 feet between the Ferris Mountains and the Sweetwater River.

Cherry Creek and Muddy Creek flow continuously off the mountain, while Pete, Rush and Whiskey Creeks are more intermittent (picture 19-2). Stream flows in the flatter terrain are generally the result of a line of seeps and springs that erupt from geologic faults. Early homesteads were developed in the wider valleys and gentler terrain below these spring and seep locations. Irrigation for hay meadows is reliable here, but is more variable due to climate at lower elevations in the drainages. The majority of the watershed has either a gravel or rocky base

which promotes more lateral stream movement with disturbance, rather than down-cutting. Stream channels are generally stable with rocks and perennial vegetation cover, including willows, waterbirch and other shrubs, and in some locations cottonwood and aspen. There has been no annual flow monitoring for any of the streams in this area. Flows are highest in May and lowest during August or September.

The majority of stream channels in this watershed are C6 and B4 stream types. The C6 stream type is a slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). It occurs in broad valleys with gentle gradients of less than two percent (picture 20-1). Rates of lateral adjustment are influenced by the presence and condition of riparian condition. Headwater streams on steeper gradients are B4 stream types. This stream type is found in narrow, moderately steep colluvial valleys, with gradients of two to four percent and channel materials composed predominantly of gravel with lesser amounts of boulders, cobble, and sand (picture 20-2). The B4 stream type is considered relatively stable and is not a high sediment supply stream channel (Rosgen 1996). In some areas there may also be B3 stream types with a greater amount of cobble found in the stream channel.

Principal human uses in this watershed are livestock grazing, hay production and recreation. Livestock use is with cattle, employing both cow/calf and yearling operations. Seasons of use are primarily winter and spring at lower elevations and summer and fall at higher elevations. Hay production includes both alfalfa and grass hay, with ground preparation and fertilization in the spring, summer irrigation, putting up hay in during the summer and fall. Recreation is primarily related to hunting, fishing, camping, or using the Continental Divide National Scenic Trail. The highest use period is during the fall hunting season (September through October).

2) Issues and Key Questions:

1. Livestock Grazing: Livestock impacts relate primarily to stream channels, which affect bank stability and width/depth ratios. In some areas there is also a need to address grazing impacts to woody shrubs and aspen vigor and regeneration. The key question is how to expand the use of BMPs from areas that have been successful to the remainder of the watershed?

2. Woody Plant Health: In addition to the discussion about sagebrush, mountain shrubs, and aspen in the Upper Separation Creek section, the Ferris Mountains contain large stands of conifers. Disease and decadence in these communities will lead to large wildfires with potentially severe consequences to watershed values. The use of prescribed burns would lessen these impacts by promoting smaller projects in 'cooler' times of the year. How can the risks of prescribed burning be mitigated and public support raised to implement man-made prescriptions instead of wildfires?

3. Erosion: (please refer to issues identified for the Great Divide Basin)

3) Current Conditions:

Quantifiable data about current erosion levels and stream flows, as well as condition and trend are not available. However, information is available from photo-points, channel cross-sections, and personal observations show that the trend for watershed values is upward. Specific management implemented along with range improvements and vegetative treatments, at least indirectly, should also relate to improved resource conditions in most areas.

The stream channels along Muddy Creek already have a good width-to-depth ratio, while channels along Pete Creek are narrowing, with banks becoming more stable with perennial, deep-rooted vegetation. As the channels narrow, the active floodplain width expands, including both lateral expansion on cobble, gravel, and silt-bottomed streams. In-channel bank sloughing on outer corners and gradient adjustment of ephemeral side drainages are the primary sources of erosion. Rush Creek stream flows tend to be the most intermittent, leading to weaker channel formation. Sedges and rushes provide good bank cover and stability. Whiskey Creek, and to a lesser extent Cherry Creek, exhibit a high amount of bank shear from cattle hooves, reduced bank cover, and wide/shallow stream channels (picture 21-1). This is due to the duration and season of cattle use. Although an Allotment Management Plan has been implemented, further effort is needed to improve channel values. Cherry Creek is starting to show some improvement, but Whiskey Creek is not. Beaver were once present on most of these streams, but are now largely absent.

Vegetative cover and litter on uplands varies with the soils, slope, aspect, elevation and precipitation. Research conducted in Wyoming indicated that upland plant communities often can be maintained with ground cover above 30%, while sediment yield increased dramatically when cover declined to less than 30% (Linse, Smith and Trlica, 1992). Ground cover ranges from 50% to 100% on big sagebrush plant communities, the most common vegetation types in this watershed. At higher elevations, plant cover is usually higher due to increased moisture and density of plants. Trend data shows increases in plant cover and litter, as well as plant densities, which occur primarily as grasses fill in the spaces between shrubs. Plant cover and litter on six pastures monitored in the Bar Eleven allotment has improved from an average of 58% to 82% over the past nine years with a rotational grazing system (picture 21-2). Much of the shallow sandy soils on the north side of the Ferris Mountains is dominated by threadleaf sedge. Although not as productive as the needleandthread grass it grows with, this species and others provide an excellent ground cover that maintains watershed values. In general, the overall ground cover appears good, but in many locations can still be improved with the use of BMPs.

4) Reference Conditions:

John C. Fremont, an army topographer, recorded the earliest documented conditions of the Sweetwater River in 1842. However, he did not actually travel across the watershed written about in this report. The next year marked the start of emigrants moving west across the Oregon Trail following Fremont's route, and the beginning of white men's impacts upon the landscape.

5) Synthesis and Interpretation:

The Sweetwater River received the earliest impacts from white men within the assessment area due to emigrant travel along the Oregon Trail, lasting from the 1840s through the 1870s. This use would most likely be concentrated along the river and not affecting most of the watershed. Tom Sun established the first cattle ranch in the valley in 1872, with other homesteads and settlement occurring thereafter. This area was primarily used with cattle. Small, fenced irrigated meadows provided winter forage, but otherwise the range was open and ranchers worked together to brand, manage, and roundup their livestock. Sheep and horses would also have their influences. In Wentworth's "American Sheep Trails" he describes how sheep were trailed from Oregon and California to Wyoming and other states from the 1880s to the early 1900s. The Sweetwater River drainage was a principle route used to cross Wyoming. A Lander newspaper on August 20, 1882 reported 100,000 sheep on trail along the Sweetwater River. Another reference was about a Dr. Wilson, who in 1898, brought 36,000 sheep across Wyoming at one time to stock the range by selling them to local sheepmen. Horses became more of a factor in the early 1900's as they were

rounded up to sell to the Army as cavalry mounts. Bill Grieve related the fact that all the wild horses were removed from the north side of the Ferris and Seminoe Mountains in the late 1920s, numbering around 3,000 head. The end of the open range and advent of fenced allotments began in the 1940s. The allotments in this area were all single operators and in most cases received better management than under open range conditions.

Vegetation health and ground cover are the primary factors that will reduce fluvial and alluvial erosion in the uplands. Erosion can result in the loss of topsoil and reductions in site productivity in the uplands and horizontal adjustments of stream channels. The primary influences upon these factors that may impact watershed health are current livestock use, wildfire suppression, and roads/off-highway vehicle activities.

Best management practices for livestock grazing that have been implemented in this watershed include: pasture grazing systems to control duration of use, deferment of riparian pastures to late summer or fall use when possible, and development of upland water sources to reduce dependence on streams as water sources. The effects from these changes in management and range improvements are documented with the change in upland cover and litter discussed for the Bar Eleven allotment under current conditions. Changes have also been documented in channel morphology on Pete Creek over the last 15 years. Photo-point and cross-section monitoring has shown tremendous improvement in bank cover and stability, which has led to surface stream width (at base flows) reductions of 50 percent or more in many locations. Changes in stream channel morphology between 1985 and 2002 are shown from one photo-point along Pete Creek (pictures 22-1, 22-2, 22-3). The pictures demonstrate reduced width/depth of the channel, interior bank building and stabilization with perennial riparian vegetation, to the point that willows now screen the stream channel from the photo-point only six feet away. Vegetative bank cover has increased significantly, starting at 25 percent or less and currently exceeding 90 percent. These sites have stabilized with vegetation and, therefore, reduced the unprotected bank area vulnerable to in-channel erosion. The bank building and expansion of riparian habitat (due to narrowing of stream channels), have led to increased late season flows in all perennial streams. These practices are currently being implemented to improve channel conditions along Whiskey and Cherry Creeks.

Fluvial erosional processes dominate this area due to the higher precipitation and higher ground cover. Flood events due to summer rainstorms are the most likely cause of changes in watershed health if vegetation is degraded. Forested systems on the Ferris Mountains are in poor health in some areas and have high fuel loading since there have not been any major fires on the Ferris Mountains since the 1940s (picture 22-4). Promoting forest health in the headwaters by mechanical thinning in diseased stands can be an effective method to improve the sustainability of headwater vegetation. There are many pockets of diseased trees in the Ferris and Seminoe Mountain Ranges, and these areas are less able to withstand and recover from a wildfire. Prescribed fire is needed as a management tool in this area to lower fuel loads and provide a mosaic of vegetation and increased diversity in species and age classes for both woodlands and shrublands.

As roads are upgraded and improved, problems associated with them are generally reduced. Main roads have been graveled or a harder surface developed to reduce long-term maintenance. Simple practices such as wing-ditching have become the standard operating procedure. Water flows are flared out into the vegetation where it benefits plant growth and infiltrates the soil instead of running down the middle or side of the road until it reaches a stream. Greater use of culverts prevents water from running along the road and creating gullies. Improved or closed off stream crossings have reduced vehicular disturbance to channels and banks (pictures 22-5, 22-6).

Off-road vehicle use, particularly four-wheelers, continue to be a problem where people drive them off existing roads and are creating new roads. These are often in an attempt to get higher on the mountain, in steeper terrain, that is more susceptible to erosion once the ground cover is removed.

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands, the existing and improving trend in stream vegetation and channel morphology, and the small number of remaining management issues, it is determined that the majority of the Sweetwater River watershed within the report area is meeting Standard #1. The area failing this standard is Whiskey Creek in the Cherry Creek allotment due to livestock management practices. This constitutes about ½ mile of stream channel on public lands. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to implement or manage using BMPs for livestock grazing. This primarily means controlling the season, duration, and distribution of livestock use to meet desired resource objectives for both riparian and upland habitats. Specific dates or times must be decided on a case-by-case basis. Methods to achieve this include, but are not limited to, herding, pasture fencing, water developments, and vegetation treatments.

Identify and correct any problems with improved and two-track roads, with erosional areas identified and fixed or the road should be closed and reclaimed.

Implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Promote composition of communities to maximize herbaceous cover and litter, and therefore, minimize surface runoff and soil erosion, and promote reliable, late-season stream flows.

Reintroduce beaver into suitable habitats whenever possible.

Expand public education about its role in public land management, particularly regarding impacts from road and off-highway vehicular activities.

North Platte River Basin other than Sweetwater River

1) Characterization:

The portion of the North Platte River basin within the report area is the west side of Pathfinder and Seminoe Reservoirs. This includes the drainages that originate from the east half of the Ferris Mountains, Arkansas and Sand Creeks, and all of the drainages that start in the Seminoe Mountains, namely Long, Wood, Deweese, Tincup, Sunday Morning, Indian, Hurt, Bothwell and Douglas Creeks. The lower elevations are in a 10 to 14 inch precipitation zone while the mountains may reach 16 to 18 inches of precipitation annually. Soils are generally sands and sandy clay-loams, with gravel and rocks becoming more numerous closer to the mountains and along higher gradient streams. Mountain terrain is moderate to steep, with elevation rising around 1000 feet in the one to 1½ miles separating the edge from the very top. Slopes get more gentle on the adjacent foothill and plains, with a total elevation change of 2500 feet between the Seminoe Mountains and the Pathfinder Reservoir (picture 23.1).

Stream flow is generally intermittent on lower reaches away from the mountains, with flows only reaching the reservoirs during high flow events. Early homesteads were developed in the wider valleys and gentler terrain along the larger streams, such as Sand, Deweese, Wood, Long and Hurt Creeks. Irrigation for hay meadows is reliable here, but is more variable due to climate at lower elevations in the drainages. The majority of the watershed has either a gravel or rocky base which promotes more lateral stream movement with disturbance, rather than down-cutting. Stream channels are generally stable with rocks and perennial vegetation cover, including willows, waterbirch and other shrubs, and in some locations cottonwood and aspen. There has been no annual flow monitoring for any of the streams in this area. Flows are highest in May and lowest during August or September.

The majority of stream channels in this watershed are C6 and B4 stream types. The C6 stream type is a slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). It occurs in broad valleys with gentle gradients of less than two percent (picture 24-1). Rates of lateral adjustment are influenced by the presence and condition of riparian condition. Headwater streams on steeper gradients are B4 stream types. This stream type is found in narrow, moderately steep colluvial valleys, with gradients of two to four percent and channel materials composed predominantly of gravel with lesser amounts of boulders, cobble, and sand (picture 24-2). The B4 stream type is considered relatively stable and is not a high sediment supply stream channel (Rosgen 1996).

Principal human uses in this watershed are livestock grazing, hay production and recreation. Livestock use is with cattle, employing both cow/calf and yearling operations. Seasons of use are primarily winter and spring at lower elevations and summer and fall at higher elevations. Hay production includes both alfalfa and grass hay, with ground preparation and fertilization in the spring, summer irrigation, putting up hay in during the summer and fall. Recreation is primarily related to hunting, fishing, and camping, and the Seminoe-Alcova Scenic Biway crosses this watershed. The highest use period is during the fall hunting season (September through October).

2) Issues and Key Questions:

Livestock Grazing: (please refer to issues identified for the Sweetwater River)

2. Woody Plant Health: (please refer to issues identified for the Sweetwater River and Upper Separation Creek)

3. Erosion: (please refer to issues identified for the Great Divide Basin)

3. Oil and Gas: The Seminoe Road Coalbed Methane Project is located in this area and will involve the discharge of treated water into ephemeral draws that drain into the North Platte and Seminoe Reservoir (picture 24-3). This water has Total Dissolved Solids concentrations of 600 to 1,200 mg/L and is being treated with aeration to remove iron. The current project is a pilot project, and an Environmental Impact Statement (EIS) is being prepared for the full project build-out. Although scoping has not been completed water disposal methods that may be considered include discharging into ephemeral draws (current practice), piping the water to discharge points in Seminoe reservoir, land applications, different treatment options, and/or injection into a deeper aquifer. Of the disposal methods discharging into ephemeral draws and land applications have the most potential for impacting watershed health. The key question is what method in the long-term picture with large scale development will have the least impact on watershed health? The

disturbance and compaction associated with road and pad construction impacts watershed health by increasing runoff rates and reducing vegetation. Road construction should take place with adequate drainage and culvert systems, but there may be localized problems with drainage crossings. Other water disposal methods and background water quality for this area will be discussed as part of the discussion for Standard 5.

3) Current Conditions:

Quantifiable data about current erosion levels and stream flows, as well as condition and trend are not available. However, information is available from photo-points, channel cross-sections, and personal observations show that the trend for watershed values is upward. Specific management implemented along with range improvements and vegetative treatments, at least indirectly, should also relate to improved resource conditions in most areas.

Stream channels are generally stable, with good vegetative cover and/or rock for armoring, with good width-to-depth ratios. Some channel narrowing will still occur. As the channels narrow, the active floodplain width expands, including both lateral expansion on cobble, gravel, and silt-bottomed streams. In-channel bank sloughing on outer corners and gradient adjustment of ephemeral side drainages are the primary sources of erosion. Sand Creek, however, exhibits a high amount of bank shear from hoof action, reduced bank cover, and wide/shallow stream channels. This is due to the duration and season of cattle use. Although an Allotment Management Plan has been in place for about eight years, further effort is needed to improve channel values. This is in just one pasture out of fifteen, so adjustments in the timing of livestock use should not be a problem. Beaver were once present on most of these streams, but are now largely absent.

There are three locations, on Deweese, Tincup, and Sunday Morning Creek where headcuts presented some management concerns. The causes for all three sites appear to be natural gradient adjustment between the mountains and the reservoir. The site on Deweese Creek was stabilized in the mid-1990s by a fence to exclude livestock and construction of a steel-piling drop structure with rock riprap (picture 25-1). The site on Tincup Creek was stabilized by a gabion basket with rock structure, but washed out shortly thereafter in 1983. It has been moving slowly upstream since that time, primarily due to drier climates and lower flow events. Sunday Morning Creek was stabilized with rock in 2000. Livestock management is not a contributing factor in the movement of these last two headcuts that were described.

Vegetative cover and litter on uplands varies with the soils, slope, aspect, elevation and precipitation. Research conducted in Wyoming indicated that upland plant communities often can be maintained with ground cover above 30%, while sediment yield increased dramatically when cover declined to less than 30% (Linse, Smith and Trlica, 1992). Ground cover ranges from 50% to nearly 100% on big sagebrush plant communities, the most common vegetation types in this watershed. At higher elevations, plant cover is usually higher due to increased moisture and density of plants. Trend data shows increases in plant cover and litter, as well as plant densities, which occur primarily as grasses fill in the spaces between shrubs. Much of the shallow sandy soils on the north side of the Ferris and Seminoe Mountains is dominated by threadleaf sedge. Although not as productive as the needleandthread grass it grows with, this species and others provide an excellent ground cover that maintains watershed values. In general, the overall ground cover appears good, but in many locations can still be improved with the use of BMPs.

4) Reference Conditions:

There are no historic documents in or close to this area that would describe watershed conditions prior to settlement by white men in this area.

5) Synthesis and Interpretation:

The descriptions for the Sweetwater River and Upper Separation Creek sections generally document impacts and conditions through development similar to this watershed . Vegetation health and ground cover are the primary factors that will reduce fluvial and alluvial erosion in the uplands. Erosion can result in the loss of topsoil and reductions in site productivity in the uplands and horizontal adjustments of stream channels. The primary influences upon these factors that may impact watershed health are current livestock use, wildfire suppression, and roads/off-highway vehicle activities.

BMPs for livestock grazing that have been implemented in this watershed include: pasture grazing systems to control duration of use, deferment of riparian pastures to late summer or fall use when possible, and development of upland water sources to reduce dependence on streams as water sources. Changes have also been documented in channel morphology along Sand, Deweese, and Long Creeks over the last 10 years (picture 26-1). Monitoring has shown improvement in bank cover and stability, which has led to surface stream width (at base flows) reductions. Vegetative bank cover has increased significantly, and, therefore, reduced the unprotected bank area vulnerable to in-channel erosion. The bank building and expansion of riparian habitat (due to narrowing of stream channels), have led to increased late season flows in all perennial streams. In most cases there are adequate pastures for rotational grazing, the key is to control the duration and season of use on streams where improvement is still needed.

Fluvial erosional processes dominate this area due to the higher precipitation and higher ground cover. Flood events due to summer rainstorms are the most likely cause of changes in watershed health if vegetation is degraded. Forested systems on the Ferris Mountains are in poor health in some areas and have high fuel loading since there have not been any major fires on the Ferris Mountains since the 1950s. Promoting forest health in the headwaters by mechanical thinning in diseased stands can be an effective method to improve the sustainability of headwater vegetation. There are many pockets of diseased trees in the Ferris and Seminoe Mountain Ranges, and these areas are less able to withstand and recover from a wildfire. Prescribed fire is needed as a management tool in this area to lower fuel loads and provide a mosaic of vegetation and increased diversity of species and age classes for both woodlands and shrublands.

As roads are upgraded and improved, problems associated with them are generally reduced. Main roads have been graveled or a harder surface developed to reduce long-term maintenance. Simple practices such as wing-ditching have become a standard operating procedure on new roads but need to be added to older roads. Water flows are flared out into the vegetation where it benefits plant growth and infiltrates the soil instead of running down the middle or side of the road until it reaches a stream. Greater use of culverts prevents water from running along the road and creating gullies. Improved or closed off stream crossings have reduced vehicular disturbance to channels and banks. Off-road vehicle use, particularly four-wheelers, continue to be a problem where people drive them off existing roads and are creating new roads. These are often in an attempt to get higher on the mountain, in steeper terrain, that is more susceptible to erosion once the ground cover is removed.

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands, the existing and improving trend in stream vegetation and channel morphology, and the small number of remaining management issues, it is determined that the majority of the Sweetwater River watershed within the report area is meeting Standard #1. The area failing this standard is Sand Creek in the Buzzard allotment due to livestock management practices. This constitutes about 1½ mile of stream channel on public lands. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to implement or manage using BMPs for livestock grazing. This primarily means controlling the season, duration, and distribution of livestock use to meet desired resource objectives for both riparian and upland habitats. Specific dates or times must be decided on a case-by-case basis. Methods to achieve this include, but are not limited to, herding, pasture fencing, water developments, and vegetation treatments.

Identify and correct any problems with improved and two-track roads, with erosional areas identified and fixed or the road should be closed and reclaimed.

Implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Promote composition of communities to maximize herbaceous cover and litter, and therefore, minimize surface runoff and soil erosion, and promote reliable, late-season stream flows.

Reintroduce beaver into suitable habitats whenever possible.

Expand public education about its role in public land management, particularly regarding impacts from road and off-highway vehicular activities.

STANDARD 2-RIPARIAN/WETLAND HEALTH

Riparian and wetland vegetation have structural, age, and species diversity characteristic of the state of channel success and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.

Riparian/wetland habitat makes up less than one-half percent of the Great Divide Basin Report Area. Although this is a very small percentage, these areas are some of the most productive found on public lands. They are important for recreation, fish and wildlife habitat, water supply, cultural and historic values, as well as livestock production. The discussion of riparian/wetland habitat will be divided into two geographic regions, the Great Divide Basin and the Ferris-Seminoe Mountains with associated drainages.

1) Characterization:

Riparian-wetland habitat within the Great Divide Basin are described in the following groups: desert springs and seeps, and streams supported by them; snow supported seeps, springs and streams that flow out from the Atlantic Rim area on the southeast border of the basin; playa lakebeds; wetlands in the Chain Lakes area; man-made wetlands around artesian wells, and the Ferris/Seminoe systems. Streams in this area generally flow for short distances supporting riparian vegetation in these areas, before turning into dry ephemeral drainages that do not support riparian vegetation. Riparian grassland habitat types are the most common forms of vegetation found here. Less common systems include willow riparian shrublands and aspen riparian woodlands. Riparian grasslands are wetland, stream, or spring-associated grass and grass-like communities, which are maintained by water tables within rooting depth during most of the growing season. Willow riparian shrublands occur as scattered individuals or as denser communities, on wet sites that are somewhat thermally protected along drainages. Aspen riparian woodlands occur in deep, loamy soils on north and east aspects where snow drifts protect and support their moisture requirements.

Desert seeps and springs primarily support riparian grassland habitat types. Common species include Nebraska, beaked and Liddon' sedges, Baltic rush, spike-sedge, tufted hairgrass, basin wildrye, wheatgrass, saltgrass, Kentucky bluegrass, redtop, mat muhly, alkali sacaton, cinquefoil, horsetail, plantain, mint, aster and thistle. Streams may flow for short distances or for several miles from these sources. Examples within the assessment area include: Kinch-McKinney Spring, Battle Springs, Tipton Spring, Fillmore Creek, Stewart Creek, Lost Creek, and lower portions of Lost Soldier Creek. The upper portion of Lost Soldier Creek contains Geyer's and Booth willows, currant, rose, shrubby cinquefoil, and a few decadent aspen, in addition to the species already listed above. Some seeps have had reservoirs or pits constructed below them, described under the man-made wetlands section.

The seeps, springs and streams in the Atlantic Rim area of the Great Divide Basin support a mixture of riparian grassland and willow riparian shrubland habitat types. Riparian grassland species are generally the same as those listed above. The willow riparian shrubland is dominated by Geyer, Booth, sandbar, and yellow willows. Additional shrubs found here include dogwood, currant, snowberry, rose, and individual quaking aspen. The herbaceous understory generally includes Nebraska sedge, beaked sedge, tufted hairgrass, Kentucky bluegrass and redtop. The principle drainage that originates from Atlantic Rim into the Great Divide Basin is Separation Creek and associated tributaries. Adjacent to these habitats on Atlantic Rim are aspen riparian

woodlands. These sites occur on north to east facing slopes adjacent to springs, streams or ponds, typically at 6,000 to 8,100 ft. Soils are generally poorly-drained and water tables are within root depth during most of the growing season. Overstory species are aspen, willow, and limber pine. The shrub layer is more open than the willow riparian sites and is dominated by serviceberry, chokecherry, common juniper, currants, rose and big sagebrush. Other species associated with this habitat type are shrubby cinquefoil, tufted hairgrass, Columbia needlegrass, elk and other sedges, bluegrasses, wildrye, rushes, and various forbs in the herbaceous layer.

The remaining portion of the basin consists of ephemeral drainages, which flow only during spring runoff or in conjunction with intense thunderstorms. These areas do not meet the riparian standard in that they do not support wetland vegetation nor do they have hydric soils. Hydric soils are formed when there are at least two weeks of water saturation during an average year, which produces anaerobic conditions within the soil. Since all drainages within the Great Divide Basin have no external outlet, they end up at one or more playa lake-beds. During drier climatic cycles these depressional areas may lack hydrology and/or hydrophytic vegetation indicators that would identify them as wetlands. Dominant species are rhizomatous wheatgrass and annual forbs. During wet years, these sites may provide a productive and diverse composition, primarily of aquatic species and shoreline species of grasses, sedges, and rushes that can survive alternating wet and dry periods.

The most prominent natural wetland systems within the Great Divide Basin are the Chain Lakes, scattered in an east to west line about 20 miles north of Interstate 80 (picture 29-1). There are also other isolated water bodies like Stratton and Bush Lakes. These lakes and adjacent habitat support riparian grassland and open aquatic-emergent wetland habitat. Vegetation must be tolerant of salt and/or alkaline conditions. Common plant species include Nuttall's alkaligrass, alkali cordgrass, saltgrass, Baltic rush, tufted hairgrass, American bulrush, slim sedge, greasewood, arrowgrass, alkali plantain, sea milkwort, buttercup, cinquefoil, hairy goldaster, and Rocky Mountain glasswort.

Manmade wetlands occur primarily next to artesian wells and reservoirs or pits. Wetlands supported by artesian wells occur at Red Desert Well, Luman Well, and Jawbone Well (picture 29-2). Many reservoirs and pits in the basin do not hold water on a year-round basis. However, projects next to seeps such as Chicken Springs or Mud Springs do provide wetland habitat. Sedges, bulrushes and grasses are commonly occurring species, and additional species have been transplanted into these sites to increase species diversity and structure, and to speed recovery once they have been fenced for protection from grazing.

Riparian-wetland habitat in the Ferris-Seminoe Mountains area are described in the following groups: springs, seeps, and streams; natural lakes; and man-made wetlands. Riparian grassland and willow-waterbirch riparian shrublands are the most common habitat types. Less common habitat types include open aquatic-emergent wetlands and aspen and cottonwood riparian woodlands.

Springs, seeps and streams are abundant around both the Ferris and Seminoe Mountains. However, perennial water sources are more likely to be found at the edge of- and away from the mountains than in them. Larger streams include Muddy, Whiskey, Pete, Arkansas, Sand, Deweese, Tincup, Bothwell, Sunday Morning, Junk, Wood, Long, Hurt and Indian Creeks. Streams are diverse in both gradient and flow regimes, which creates greater diversity in vegetative communities and species composition. Riparian grassland is the most common type of riparian habitat, with common species consisting of Nebraska, beaked and Liddon' sedges, Baltic rush, spike-sedge, tufted hairgrass, basin wildrye, wheatgrass, Kentucky bluegrass, redtop, mat

muhly, alkali sacaton, cinquefoil, wild licorice, iris, horsetail, speedwell, mint, monkey-flower, aster and thistle. Aquatic species include pondweed, chara and buttercup species. There are also extensive areas supporting willow-waterbirch riparian shrubland habitat. In addition to the herbaceous species listed above, there is a variety of shrubs to small trees which include: Booth, Geyer, Bebb's, sandbar, and yellow willows, waterbirch, hawthorn, dogwood, currant, silverberry, rose and cinquefoil (picture 30-1). At middle and higher elevations quaking aspen can also be added to this listed, and where abundant, these sites are classified as aspen riparian woodlands. Cottonwood riparian woodlands are found on higher gradient and sometimes drier sites along Cherry, Pete, Arkansas, Sand and Morgan Creeks. Understory species include many of those already listed above, with a tendency towards those shrubs and herbaceous plants that like drier meadow habitats.

Natural lakes occur scattered through the sand dunes on the south side of the Ferris and Seminoe Mountains and along the lower end of Deweese Creek near Pathfinder Reservoir. These lakes vary from small potholes that dry up at times to perennial lakes up to 20 surface acres. They support wetland and aquatic-emergent vegetation that may include: bulrushes, cattails, sedges, rushes, grasses, sandbar willow, forbs listed above, and water milfoil and horned pondweed.

The principle man-made wetlands are small reservoirs built for livestock watering and irrigation. Bucklin Reservoir along Highway 220 just north of Muddy Gap is the largest such project and supports similar habitat types and species that occur in the natural lakes described above (picture 30-2).

Evaluation Method:

The primary method used in evaluating this standard is through a qualitative assessment procedure called Proper Functioning Condition (PFC). This process evaluates physical functioning of riparian/wetland areas through consideration of hydrology, vegetation, and soil/landform attributes. A properly functioning riparian /wetland area will provide the elements contained in the definition:

- Dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality
- Filter sediment, capture bedload and aid floodplain development
- Improve flood-water retention and ground water recharge
- Develop root masses that stabilize streambanks against cutting action (TR 1737-15 1998)

It is important to note that the PFC assessment provides information on whether an area is physically functioning in a manner that allows maintenance or recovery of desired values (e.g., fish habitat, neotropical birds, or forage) over time. PFC is not desired or future condition (TR 1737-15 1998). PFC assessments are used along with other existing information such as stream cross-sections, photo-points, and habitat assessments to evaluate this standard of rangeland health.

2) Issues and Key Questions:

The area has been in official drought status since 2000 and has had several years of the lowest precipitation on record (note record is only since 1971). How have these drier conditions have impacted many of the riparian/wetland areas in the S&G area?

Livestock and wild horse use of riparian habitats has been and continues to be the most important factor relating to riparian health within the Great Divide Basin. Livestock are the most important factor affecting riparian health in the Ferris-Seminoe Mountains.

Historic livestock grazing use that included trailing large numbers of livestock and much longer durations of use, herbicide spraying of riparian communities, trapping beaver out of the system, and the lack of upland water sources contributed to the decline in riparian conditions. Current livestock grazing use is negatively impacting establishment and/or production of woody riparian plant species such as willows, dogwood, waterbirch or cottonwood in some portions of the watershed. In wild horse herd management areas, year round grazing use on riparian areas by wild horses and seasonal use by livestock have negatively impacted riparian vegetation. Movement of animals through riparian areas can affect functionality by increasing bare ground, usually observed in the form of trails and crossings. Higher numbers or an increased duration of use will create a greater impact from bank shear and trampling, leading to more bare ground. Increased bare ground reduces the ability of the system to function properly in high flow events. In many cases, best management practices have been implemented which reduce the duration and/or change the season of grazing use for livestock. Continued refinement of these practices will address the current livestock grazing use aspect. If livestock use has been addressed, how will damaged riparian areas be improved without management or control of use by wild horses and/or wildlife?

There are certain areas within the assessment areas where hummock areas occur adjacent to riparian areas. Many of these are a factor of the soil involved and the historic long duration of livestock use that has occurred within the area. Will implementation of best management grazing practices address these areas at risk?

Vertical instability is a problem in some areas. Some of these headcuts have been stabilized within the watershed; however, there are still areas that need to be addressed or maintained. Manmade structures such as reservoirs also have instability problems due to naturally fine sediments and lack of pipes on older projects. Cutting of the spillways on reservoirs or around or through dikes are ongoing problems affecting functionality. What is practical to address these instability issues?

Another factor affecting riparian health is roads and their associated impacts on these areas. Roads that are directly adjacent to riparian systems in many cases channel sediments directly into creeks and reservoirs. In addition, improperly placed sized culverts can increase erosion directly into riparian systems. If the amount of sediment is high enough, it can reduce vegetation, reduce functionality, decrease water quality, and change the channel dynamics. Roads can also interrupt surface and subsurface flow, which can effectively change the type of riparian system from one side to the other. Can road related concerns be addressed through culverts, improved crossings, rerouting, water bars, and roadside pits or are there additional solutions that can be implemented?

Given the potential for coal bed methane development in both the Seminoe Road Project and Atlantic Rim Project area, will the groundwater that feeds the springs and seeps in the area be affected? Will the change in channel features due to discharged water result in increased erosion? If wetlands/riparian areas are created by temporary water discharge, what will happen to these habitats after this discharge ceases?

3) Current Conditions

PFC assessments have been conducted in the watershed since the mid 1990s, with the most recent assessments occurring in 2002. Documentation of riparian condition may include photo-points, channel cross-sections, ground-water wells, habitat quality assessments, and woody plant studies.

Both the Great Divide Basin and the North Platte River Basin including the areas around the Ferris and Seminoe Mountain Ranges has been drier than normal since 1997. The area has been in official drought status since 2000 and has had several years of the lowest precipitation on record (note record is only since 1971). These drier conditions have impacted many of the riparian/wetland areas in the S&G area. Since many of the wetland areas in the Great Divide Basin are fed by groundwater and many with created water sources, impact to these features is generally delayed and can be expected in the following years. The riparian/wetland areas around the Ferris and Seminoe Mountain Ranges are generally fed by sandy soils with shallower water sources especially riparian areas supported by alluvium along stream channels. The drought has made a significant difference in some of these areas, with some normally perennial lakes in the dune areas south of the mountains drying up.

Livestock grazing over the last few years has been reduced by grazing permittees due to drought conditions. However, with less water available many of these wetland/riparian areas have been less productive and may show signs of drought stress. Assessments for PFC were mostly completed in the mid to late 1990s, which was in general a wetter time period than normal. Areas are re-assessed periodically, or if there is a change in livestock management or as new areas are discovered. Five sites selected for reassessment in 2002 on the south slopes of Ferris Mountain showed little change, and the overall rating has not changed since the 1997 assessment.

LENTIC SYSTEMS

The Great Divide Basin has few perennial water sources. They primarily consist of isolated springs and seeps, in upland locations or along drainages, and as alkali lakes. More recent man-made features include a number of wells that have artesian flows, many of these locations are fenced to protect wetland vegetation and provide water sources for livestock and wildlife using troughs outside the fencing. The natural water sources have been used seasonally by livestock and year-round by wild horses and wildlife, resulting in high amounts of trampling and utilization with changes or loss of species composition. Changes in species composition include increases in undesirable (from a forage point of view) species such as Baltic rush and arrowgrass; increased amounts of grazing resistant species like Kentucky bluegrass and mat muhly; greater amounts of early successional forbs like strawberry cinquefoil and dandelion; and total loss of vegetative cover. However, the isolated nature of some of these wetland habitats may mask impacts from management changes. For example, man-made habitat around an artesian well and highway borrow area were very slow to show increases in species composition after protection from use. Plantings were then made of root material from bulrushes, sedges, grasses and cattails, which quickly expanded (pictures 32-1, 32-2). It appears that establishment of new plants from natural seed dispersal via waterfowl or other bird species is very limited in this area.

The current condition of the alkali lakes in the Chain Lakes area is meeting proper functioning guidelines. Banks are generally stable and vegetated with native species already listed in the characterization section for this Standard. Other sites meeting this standard have been fenced in the past for protection from grazing use, and include Chicken Springs and the Luman, Red Desert and Jawbone artesian well wetland habitats. The patch of cattails at a seep on lower Separation Creek is boggy enough to prevent grazing impacts. Habitat along Lost Soldier Creek west of Bairoil has been fenced into a large pasture to control cattle use. This area of bogs and seeps did

not have a principle stream channel in most locations prior to 1990, and therefore, is described in this section. Since then, excess water pumped from water wells that is not needed for oil field injection at Bairoil, is released down this drainage and has formed a channel. Sedges, grasses, rushes, and in some locations willow dominate this drainage, with good vigor, cover and site stability. Both of these areas are in proper functioning condition.

In the Sandstone allotment there was an artesian well that had been fenced out and the water diverted to a pit. In a 2002 inspection the fence was down and the water was flooding a nearby road. The fence was replaced and the pipeline and pit reconstructed. The result of which has improved this important water source and its associated habitat greatly (pictures 33-1, 33-2).

Lentic sites in the Ferris-Seminoe Mountains area include the natural lakes in the sand dunes and along lower Deweese Creek, Bucklin reservoir, and at a few smaller man-made reservoirs. These sites have good species composition (already described) and bank cover, and are in proper functioning condition. Many of the smaller natural lakes in the sand dunes have dried up or the larger lakes have been reduced in size compared to the wetter periods in the early 1980s. However, but this is due to changes in the water table unrelated to livestock grazing.

Lentic areas not meeting PFC that are livestock related:

Stewart Creek allotment:
In the Stewart Creek allotment, the 1/8 mile of lower Stewart Creek located on public land was rated as Functional At Risk with a downward trend. Factors identified that were affecting this riparian area were seasonally cattle use and year-long wild horse use. In March 2002 a gather of 300 wild horses was completed that returned the wildhorse population to the appropriate management level (AML) of 150 head. During the winter of 2002-03, the lower Stewart Creek seeps located on both public and state lands were fenced by the BLM, permittee, and Cowboy 3-Shot Foundation, to protect the water source and adjacent habitat (pictures 33-3, 33-4). Nearby water wells are pumped by the BLM and livestock operator to provide the water necessary to support both cattle and wild horses.

Cyclone Rim allotment:
Springs and seeps within the Cyclone Rim allotment (10103) were inventoried in 2002. These springs and seeps rated as non-functional or Functioning-At-Risk include Kinch-McKinney spring, Olson and Olson Reservoir in the northwest portion of the allotment and some of the springs and seeps in Battle Springs Flat located in the south-central section of the allotment (picture 33-5). Improvement work is being planned for each of the springs not improving or at PFC.
Causes were estimated to include previous excessive use by wild horses during the growing season, and in some cases complicated by livestock grazing. Springs in the south-central portion of the allotment did not show excessive grazing throughout the vegetative resource, but was high on palatable species. Springs in the northwest portion of the allotment were heavily utilized, including all herbaceous vegetation. Even with proper grazing management and proper wild horse numbers, these riparian areas would likely show heavy use due to the unique and rare characteristics of the areas and the relatively higher palatability of the plants. Fences are being proposed with possible off-site water for wildlife, wild horses, and livestock.

Jawbone allotment:
In the Jawbone allotment, there is one permanent water source called Mud Springs, which had a pit developed next to it many years ago (picture 33-6). This site is the principle water source in a

23,000 acre allotment, in addition to one well and ten small semi-reliable reservoirs. Factors identified that were affecting this wetland habitat was summer cattle use. The BLM, Wyoming Game and Fish Department, Cowboy 3-Shot Foundation, and the Rocky Mountain Elk Foundation are cooperating on exclosure fencing with off-site water development in 2003 to protect this water source and the habitat around it.

LOTIC SYSTEMS:

The only perennial stream in the Great Divide Basin is the upper portion of Separation Creek in the Atlantic Rim area. Aspen and willow riparian communities still exist which support beaver populations in some locations (picture 34-1). This area was rated as Functioning-At-Risk with an upward trend in 1998 and continues to improve. Factors identified that contributed to this rating were historic livestock trailing and gradient adjustments due to loss of beaver ponds. In the higher elevation portion of Separation Creek there have been three instream structures installed that has stabilized the stream. Beaver have used these structures to build their dams on, and continue to improve the system (picture 34-2). Healthy, vigorous sedge and rush communities stabilize the majority of this drainage. Most streambanks are lined with both obligate and facultative riparian plants that are capable of holding together the riparian area even in high flows. These plants have deep and extensive root systems that stabilize the channels and also play an important part in channel roughness during high flows and filtration of sediments. Regeneration of woody shrubs and trees is occurring with a mixed age class and vertical structure of plants. Little to no bare ground, channel sloughing, or instability in these systems is present today, with the exception of the area of Separation Creek that is to the west of the Twentymile Road. This area has a significant headcut (10-12 feet deep), however it has not been identified as a concern due to the fact that it hasn't moved upstream, vegetative stabilization is occurring, and there is a road crossing and culvert just upstream that would prevent the head-cut from moving any further.

There are numerous creeks that originate in the Ferris-Seminoe Mountains, supporting grassland, shrubland and woodland riparian plant communities. Beaver were once very common and active in this region, with remnants of old dams and gnawed off aspen trees still visible reminders of their presence. The loss of aspen habitat to conifer succession will be discussed in Standard #3 – Upland Plant Communities. A few beaver can still be found, but often in private land irrigated meadow areas. Most of the gradient readjustment and revegetation of dams and ponds that comes after the beaver have gone has occurred. However, in a few locations this process can still be observed. Most streams have good species composition and stability, due to the deep-rooted sedges, grasses and willows, which dominate these sites. Woody plant communities are diverse in species composition and vertical structure, with good regeneration of young plants where good management is in place. Near the edge of the mountains the amount of hedging on young shrubs and trees is higher, and may be attributable to more frequent use by big game species. Some encroachment into these habitats by subalpine fir can be seen, particularly along Pole Canyon Creek. Cottonwood riparian woodlands are found along portions of Pete Creek and Cherry Creek. They used to have a wider range, which may in part be due to the recent lack of high runoff events to establish new trees. Past grazing practices would also have inhibited the growth of young cottonwood trees. However, there is recruitment in the existing communities and these stands appear to be maintaining themselves. Some spring sources of streams have been fenced to protect the water source, which has also enhanced the woody plant community. In some cases where woody plants did not exist there have been plantings within these exclosures. In general, many of these streams meet proper functioning condition. However, we do want to see some

changes in a desired future condition, such as greater cover or age class structure of a particular grass, shrub or tree.

Intermittent and Ephemeral drainages
In the lower elevations of this watershed, riparian communities consist of mainly intermittent and ephemeral drainages, in addition to playa lake-beds. These communities vary from riparian herbaceous-dominated to coyote willow- dominated to an absence of riparian vegetation of any kind. In many cases, these systems are higher in alkalinity, and plant communities must be adaptive to that condition.

Along the intermittent portion of Separation Creek, significant improvement has occurred. Willows have expanded greatly along the length of this stretch as have the sedges, rushes and cattails (pictures 35-1, 35-2, 35-3). In addition, improvements along all of upper Separation Creek have greatly extended groundwater availability over a longer time period.

There are limited intermittent systems throughout the rest of the basin; , however, where there are longer periods of water availability these systems tend to have facultative wetland plants such as Nebraska sedge, bulrushes, and cattails. Those areas that are small locations around a seep-type water source are described under "Lentic" areas. The majority of the drainages in the Great Divide Basin are ephemeral with no riparian vegetation.

Lotic areas not meeting PFC that are livestock related:

All locations within this category are in the Ferris-Seminoe Mountains area.

Cherry Creek allotment
The riparian areas within the Cherry Creek allotment are not meeting the minimum standard for riparian health due to season and duration of cattle use. Located on the northwest side of Ferris Mountain, this allotment contains Whiskey, Cherry, and the lower end of Muddy Creek. Bank shear, change in species composition, heavy hedging and lack of mixed age classes in woody plants, and wide, shallow channels were factors observed in evaluating this standard. An allotment management plan (AMP) was initiated in 2000 with the permittee to address these issues and is currently being revised. The development of pasture fencing and water developments along with adjustments in the livestock grazing operation have led to more controlled season and duration of use (picture 35-1, 35-2). Several projects are still necessary to make the grazing system fully functional (ie – reliable water sources). However, duration of livestock use along Cherry Creek, the most extensive area of riparian habitat on public land, has been changed from summer-long (about four months) to a month or less in the late spring or fall.

Ferris Mountain allotment
The Ferris Mountain allotment is used by one permittee with cattle, employing a rotational grazing system across fifteen pastures for many years that has resulted in generally good range conditions. Located on the southwest side of Ferris Mountain, this allotment is primarily drained by Muddy Creek and its tributaries. However, portions of the riparian areas within the principle summer pastures are not meeting the minimum standard for riparian health due to season and duration of livestock use. Factors observed include change in species composition, bank cover, and head-cutting, which in addition to livestock use is affected by system changes to plant succession and loss of beaver in this area (and the entire mountain). Adjustments over the last several years have been made, including an AMP currently being developed to address riparian management concerns. A short cross-fence was completed by the permittee several years ago to

create a deferred-rotation grazing system on the two principle summer pastures where health issues with riparian condition exist. Several other range improvements have been developed or are planned, including another pasture fence and water developments. Numerous photopoints have demonstrated improvements in riparian condition in many areas of the allotment (picture 36-1).

Buzzard allotment
The Buzzard allotment is also used by cattle with one permittee, with multiple pastures in a grazing rotation. Located on the east end of the Ferris Mountains, this allotment includes Sand, Arkansas, and a portion of Deweese Creeks. Portions of the riparian areas within the principle summer pastures are not meeting the minimum standard for riparian health due to season and duration of livestock use. Factors observed include bank shear, change in species composition, lack of mixed age classes in woody plants, and wide, shallow channels with high amounts of sediment (picture 36-2). An AMP was implemented in the 1990s and the permittee has developed numerous water sources to support the grazing system. The AMP will be revised in the coming year in order to meet riparian proper functioning conditions.

Seminoe allotment
The Seminoe allotment was one of the earliest allotments with an AMP, developed in 1969, and converted from primarily sheep to all cattle in 1973. It is used by one permittee, has seventeen pastures, and is located on the south side of the Seminoe Mountains. Portions of Bothwell, Hurt, Rankin and Indian Springs Creeks are not meeting the minimum standard for riparian health due to season and duration of livestock use. Factors observed were bank shear, change in species composition, hummocks, and widening channels with high amounts of sediment (picture 36-3). The AMP will be revised in the coming year in order to meet riparian proper functioning conditions.

Long Creek allotment
The Long Creek allotment was inventoried for PFC in the middle nineties and all riparian areas in the allotment were found to be functioning at risk. Riparian areas within the Long Creek allotment are Sunday Morning Creek, Tincup Creek, Long Creek, Steep Creek, Meadow Creek, and the North Platte River. Since that assessment the ranch has changed hands and new management has been implemented. Two new fences have been constructed and this has created two additional pastures. Animals are now rotated though the pastures for shorter periods of time and with fewer numbers. Since the implementation of the new grazing system, reassessment of the riparian areas has indicated a marked improvement of the condition of riparian areas. Trend of all the riparian areas is upward (picture 36-4). Within the next couple of years riparian areas should reach proper functioning condition and this will happen sooner if moisture regimes return to normal. If and when that happens the allotment will be meeting standards.

Wood Creek allotment
The Wood Creek allotment is a small allotment used by one permittee, and is located on the north side of the Seminoe Mountains. Wood Creek and Sunday Morning Creek that flow through the allotment are not meeting the minimum standard for riparian health due to season and duration of livestock use. Factors observed include bank shear, change in species composition, and wide, shallow channels. Adjustments in the timing of use by livestock will be made in order to meet proper functioning condition of the riparian habitat.

4) Reference Conditions:

Reference conditions for the North Platte River Basin are taken from the historic accounts by Col. John Charles Fremont from *The Life of col. John Charles Fremont, and his narrative of exploration and adventures, in Kansas, Nebraska, Oregon and California*. His narrative includes portions of the North Platte and Sweetwater River as traveled in July and August of 1842. As Fremont travels up the Sweetwater He mentions sections of the river with willows and bright flowers near the creek. As he moves up into the foothills he notes the presence of aspen, beech and willow and the remnants of beaver dams. These conditions may have been similar to the areas around the Ferris and Seminoe Mountain Ranges.

Clarence King described the Red Desert portion of the Great Divide Basin in a *Geological Exploration of the Fortieth Parallel in 1869*, he says of this area:

"This region, and that to the north of the railroad between Washakie Station and Bitter Creek Ridges, constitutes the Red Desert, from which the railroad station takes its name. The northern portion is an almost unknown region, barren of vegetation, and almost without water, but said to contain several alkaline ponds."

5) Synthesis and Interpretation:

Although little documentation of historic reference conditions exist, there are accounts, both written and those passed down through families, that help describe the uses and impacts upon the resources currently being evaluated.

The Great Divide Basin, due to the lack of water, was not of much use to the large cattle ranches that sprang up following the railroad until the severe winter of 1886-87. However, the sheep bands that began using this country in the mid 1870s could get by on snow during the winter and moved to the forest during the summer. Dormant season use by sheep on uplands would typically have low impacts on vegetation, but during dry times the impacts on desert water holes was probably severe. The Niland Family began running sheep in this area around 1900 until the 1970s. The first account passed on to John from his father, probably from the 1930s, was about counting 31 sheep wagons in the vicinity of Hadsell's Crossing on Lost Creek, using the water here for their sheep to drink during a dry period. At 2-3,000 sheep per band of sheep, there must have been between 60,000 and 90,000 sheep watering at this site at the time. The second account was from Circle Bar Lake in the Chain Lakes region. Again, during dry times, John recalled having to water their sheep every third day at the lake and then taking them out on the rangeland to avoid mixing with other bands of sheep also coming in to water. Although not used extensively by cattlemen, there would be cattle that drifted into the basin, as well as year-round use by wild horses that would use and have some impacts on isolated, desert water sources.

For much of the Great Divide Basin, lack of water precluded homesteading and year-round use. This led to incommon use by many different sheep outfits, both local and regional, that ranged into Wyoming from Utah, Idaho and Colorado. In contrast to this, areas with water like the Separation Creek drainage could be homesteaded and developed. In the early 1900s, irrigation from Separation Creek was used extensively for hay production in the higher elevations, and even provided adequate water for growing wheat in the flats of the Red Desert.

Areas within the checkerboard allowed livestock operators to purchase the private land grazing rights from the Union Pacific railroad and essentially control the grazing on the vacant public lands intermingled with their private lands. These areas came under the management of a single livestock operator far earlier than the land used by multiple stockmen, resulting in better condition and management of the land they could treat as their own.

In the Ferris-Seminoe Mountains country, the types of livestock use were split. On the south side adjacent to the Great Divide Basin, livestock were primarily sheep run by Mahoney, Miller and other families. In the Sweetwater River valley, use was a mixture of sheep and cattle run by Grieve, McIntosh, Sun and other families. This is important to note, particularly in the years following the Taylor Grazing Act in 1934, when private allotments were established and fenced. Whereas cattle prefer riparian habitat to feed, water and lounge in, sheep prefer uplands and spend little time in riparian habitat except to water. These trends are very apparent when evaluating long-term cattle allotments, compared to long-term sheep allotments. The riparian habitat is generally in much better condition in the sheep allotments. Allotments that just recently converted from sheep to cattle will not necessarily be in lower condition if best management practices are implemented to control the season and duration of use by cattle.

An important natural element in riparian and wetland habitats that is seen very seldom described are beaver. Beaver are considered hydrologic modifiers in the PFC process. This means they can directly affect stability of those systems that have a woody component. Their dams often provide gradient control on steeper slopes, extend the streamflow period later into the year, and create more diverse vegetation and wildlife habitat. Loss of aspen habitat, trapping, and browsing of aspen and willow by cattle and elk has contributed to the reduction in beaver. There is more than adequate willow-waterbirch riparian habitat along some streams to support beavers. However, they seem to prefer irrigated hay meadows where they have to be removed. Along Lost Soldier Creek, beaver were reintroduced and are still holding on in the willow communities found there. Long-term changes in the aspen communities, which is discussed in Standard #3, would have the most benefit in expanding beaver populations and the positive impacts they can have on riparian and wetland systems.

Following the Taylor Grazing Act, grazing districts were established and priority rights for grazing determined. In addition to fencing of private allotments, it also led to adjustments in stocking rates and AUMs available for livestock use to maintain or improve range conditions. When addressing livestock management issues over the last twenty years, it has not been necessary to reduce livestock numbers to achieve resource (primarily riparian) objectives. Depending on the specific situation, best management practices for livestock grazing have been implemented on a case-by-case basis in the majority of the watershed. In some cases, many practices and improvements needed to be implemented. In others, just a slight adjustment was needed.

In addition to adjusting duration and season of use by livestock in riparian areas, additional water sources have helped to greatly improve riparian areas. Upland water developments such as spring developments, reservoirs, and pipelines reduce the dependence of livestock on riparian habitats and result in better distribution of the animals in a pasture. Specifically, spring developments protect the water source, improve water quality and flow, and provide greater flexibility in grazing rotations (picture 38-1). In some cases, pastures with riparian habitat are deferred to late summer or fall use. Pastures with primarily reservoirs and seeps are used first, saving the more reliable pastures with streams for late-season use. This has worked particularly well during drought.

Vegetation treatments, prescribed burning and herbicide applications, also improve distribution of both livestock and wildlife, while diversifying upland shrub communities and age classes. These treatments also increase water recharge into the overall riparian system resulting in higher and longer duration of flows. In some cases springs may start to flow that hadn’t prior to treatment.

To date, use of treatments within the Great Divide Basin report area has primarily occurred in the Fillmore allotment on Atlantic Rim, with one other treatment being completed in the Seminoe allotment on the east edge of the Great Divide Basin.

Fencing has been used to reduce duration of grazing on riparian habitats within most allotments. For the most part, there are few exclosures (besides spring/seep developments) within the basin (picture 39-1). Managing livestock use across the watershed by strategic placement of fences and other improvements has resulted in decreased grazing duration on riparian communities overall without the need for exclusion, complete rest, or decreasing AUMs.

The principle impacts of livestock management upon the health of riparian-wetland habitats, are long duration of use (two months up to all summer) and hot-season use (primarily late June through early September). Historic (long-term) livestock use in this manner has led to many of these areas being dominated by upland grass species such as Kentucky bluegrass, redtop, and mat muhly that are adapted to heavier grazing use. Upland forbs and grass species resistant to grazing consequently increased along stream channels. These species may endure overgrazing but provide very little riparian stability. They have shallow roots that are not capable of stabilizing soils adjacent to riparian areas especially in high flows. With only upland species protecting the streambank, bank sloughing, bare ground, and vertical cutting were commonly observed results. Platts et al. (1987) states that the highest rating for streambank alteration is when less than 25 percent of the streambank is false, broken down, or eroding. Where BMPs for livestock grazing have been implemented, riparian herbaceous communities have responded quickly. Early successional plants such as spike-sedge, brookgrass and creeping potentilla respond initially by increasing in bank cover and encroaching into the stream channel. Then sedges, rushes and desired grasses begin to expand and later dominate the riparian community. Shortening duration of use, frequency of use, and timing of use has resulted in a vigorous, productive and, most importantly, stable vegetative communities (pictures 39-2, 39-3).

Examples of two allotments where more intensive management has been implemented are described below:

The Bar Eleven allotment is located on the north side of the Ferris Mountains and contains portions of Pete, Rush, and the east fork of Cherry Creek. Historically used by the Sun Family from the late 1800s until 1996, it is now controlled by Handcart Ranch Corporation. Prior to 1985, all three of these creeks were in one summer pasture used by cattle from June through September. Streambanks were dominated by Kentucky bluegrass and other shallow-rooted grasses that led to sloughing of banks and widening of channels. Regeneration of willows, waterbirch, cottonwood and aspen were slow or not occurring due to heavy browsing by cattle. By implementing management tools such as pasture fencing, upland water development, and instream structures, the riparian area has greatly improved while maintaining livestock use. Willows, waterbirch, dogwood and silverberry are examples of woody shrubs that have expanded in height, area and age class as a result of management changes (pictures 39-4, 39-5). Pasture fencing is just one of many tools used to improve riparian areas(picture 39-6). This stream system and others throughout the region are often dominated by sedges, with Nebraska sedge the most common and important species. It is a deep-rooted, rhizomatous plant that helps to stabilize banks, is productive, and very nutritious (39-7). Another species of interest is American mannagrass. Severely reduced by season-long cattle use, this plant species is observed along most streams where rotation and deferred rotation grazing systems have been implemented. It is similar to Nebraska sedge in terms of helping stabilize banks, being nutritious, and is easily observed with its big flowering head waving three to four feet in the air along creeks.

The Fillmore allotment is grazed by one permittee, PH Livestock Company, and contains most of the headwaters of Separation Creek along Atlantic Rim. Originally, this allotment was basically just one large pasture that was used by cattle, sheep and horses. It was also a heavily used trailing area, which impacted certain areas of the allotment greatly. In 1987, PH initiated a rotational grazing system and associated range improvements. There are now eight pastures, spring developments and cleaned-out reservoirs, and vegetation treatments. By shortening duration of use, especially along riparian areas, both woody and herbaceous species have responded tremendously (40-1, 40-2). PH Livestock, in conjunction with the Cooperative Extension Service County Agent, has established a monitoring program that has helped to provide BLM the necessary information to evaluate and confirm these achievements in healthy rangeland management. Documented improvement in plant vigor, plant density, and species composition has not only benefitted wildlife as can be seen, in part, by increased elk numbers in the Sierra Madre herd, but it also afforded a permanent increase in AUMs of 25% on the Fillmore allotment. This was the first increase in permitted AUMs in the Rawlins Field Office for fifteen years.

In the wild horse herd areas, the issues are much more problematic. Expansion of horse numbers to several times the AML and no control of their use results in the degradation of important riparian areas. Livestock use is being addressed; however, until wild horse management becomes more than just periodic gathers, the condition of riparian and wetland habitats will continue to suffer. Chicken Springs is one example of a project requiring protective fencing with alternative water development within the Stewart Creek wild horse HMA (pictures 40-3, 40-4). The maintenance of wild horse numbers at appropriate management levels is a vitally important step.

Drought conditions may result in lower groundwater tables in the years ahead and may impact the water available to maintain lentic areas. This has been observed in shallow aquifers, especially the unconsolidated sand aquifers along the southern portion of the Seminoe and Ferris Mountains. Aquifers with less transmissivity (the ability of water to move through a system) may show more long term or delayed impacts from the drought.

The development of natural gas from coalbeds (CBM) produces water of varied quality and may be discharged year around. Surface discharges into ephemeral systems change the physical hydrology and will result in channel adjustments. Channel adjustments result in erosion and increases in sediment yields. This potential erosion as well as the increased availability of water could change lotic areas by eroding bank sides and possibly creating headcuts, while at the same time creating the hydrologic conditions necessary for wetland plant establishment. The availability of water in some allotments may be used as a tool to improve the use of water sources for livestock management. There may be opportunities to create additional water sources in the uplands and improve uses in riparian/wetland areas. With CBM development it will be important to restore channels and reservoirs that cannot be sustained with natural water levels, or create water sources to feed the infrastructure developed. There is the potential for both positive and negative impacts to riparian/wetland areas, and these impacts will be addressed through the planning process for each CBM project.

6) Recommendations:

There has been a tremendous improvement in riparian/wetland condition within the assessment area over the last 15 to 20 years, however, there are still some specific areas that need attention. Allotments containing riparian/wetland habitat that do not meet this standard have been described previously and include: Stewart Creek, Cyclone Rim, Jawbone, Cherry Creek, Ferris Mountain, Buzzard, Seminoe, Long Creek, and Wood Creek allotments. For lotic systems that are not meeting the minimum standard, there are 62 miles out of a total 128 miles. In lentic sites, there

are 196 acres of a total 2,161 acres, that do not meet the minimum standard. For riparian systems along streams and creeks, lotic systems, only those portions of streams and creeks that have riparian on BLM land were included. The non-riparian lengths and portions of streams and creeks not on BLM land were not assessed. For the Lentic values, the total acres of waterbodies and wetland features were calculated. For example a lake with a portion of the shore line as wetland was talleyed for the entire portion of the lake that could exhibit open water or wetland characteristics.

Most of the lentic and lotic sites not meeting the standard have been, or are in the process of being addressed in management plans or as range improvement projects. Continued progress in grazing management of livestock and wild horses (where they are present) will ensure further improvement of all riparian areas within this area. Although there are areas where desired future condition is yet to be reached in woody species dominance and composition in the upper watersheds, these areas still meet the minimum standard of rangeland health. Other than the specific allotments listed previously, the remainder of the allotments within this assessment area are meeting Standard #2 – Riparian/Wetland Health.

Specific recommendations are:
Continue to implement or manage using BMPs for livestock grazing. This primarily means controlling the season, duration, and distribution of livestock use to meet desired resource objectives for riparian habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, additional fencing, water developments, and vegetation treatments. Address trespass livestock problems where needed.

The numbers of wild horses in the assessment area must be maintained at AML. This will allow the proper assessment and evaluation of whether this AML is a reasonable number of wild horses to manage for in conjunction with other users while still meeting rangeland health standards and vegetative objectives.

Continue existing projects to protect riparian habitat and provide off-site water for wild horses and livestock.

Identify and correct impacts from improved roads, including water flows and erosion into riparian systems. Two-tracks that are negatively impacting riparian areas should be identified and addressed.

In areas where produced water from CBM development occurs, manage the placement of new water sources to meet livestock and wildlife management objectives. Where possible, create new water sources to maintain beneficial uses from CBM discharged water. Plan for reclamation of reservoirs and channels that receive CBM resources when discharge ceases. Make sure CBM water management plans meet the livestock and wildlife management goals for individual areas.

Continue plantings where needed within the watershed. Species diversity and vertical structure of wetland and riparian communities can be easily enhanced through vegetative plantings. When just a few individuals are planted, they establish exceedingly well.

Continue to expand the beneficial practices that improve riparian health and maximize public involvement and education regarding resource issues.

STANDARD 3 – UPLAND VEGETATION HEALTH

> *Upland vegetation on each ecological site consists of plant communities appropriate to the site, which are resilient, diverse, and able to recover from natural and human disturbance.*

Vegetation in the Great Divide Basin report area varies from ordinary mixes of saline and sage-grass habitats to complexes of forest, mountain shrubs, sage-grass and riparian habitats around Ferris and Seminoe Mountains. An assortment of environmental factors influence the location(s), extent, seral stage(s), and/or types of vegetation found throughout the area. Elevation, precipitation zone, topography, soils and underlying parent materials, slopes, and exposures all contribute to the general vegetation composition and diversity throughout the assessment area. Various combinations of communities and limited inclusions within specific community types are common. The discussion of upland vegetation will be divided into two geographic regions, the Great Divide Basin and the Ferris-Seminoe Mountains with associated drainages.

1) Characterization:

The Great Divide Basin was once an inland sea, where layers of clays and sands were deposited through erosional processes that became the shale and sandstone derived soils we have currently. Mixed with these soil particles were salts, which with snowmelt and rainfall were leached down to varying depths depending on soil textures and the amount of moisture received. On clay soils, vegetative communities observed today tend to be more saline influenced and dominated by saltbush steppe or greasewood shrubland habitats. On sandy soils, where salts have been washed down into the soil profile, vegetative communities are dominated by big sagebrush/mixed grass habitats. Although most soils are deep, the depth to which salts have been leached in non-saline habitats is known as the effective rooting depth, and has a significant influence on the species and composition of plants found in various communities.

Big sagebrush/mixed grass communities are the most common vegetative communities found in the Great Divide Basin and the Rawlins Field Office. Wyoming big sagebrush is the principle variety, growing from six inches up to two feet in height at low to mid-elevations (picture 42-1). Above 6,500 feet (along Atlantic Rim) it is replaced by mountain big sagebrush, which has more of a flat-topped appearance and similar height. On deeper soils and often along drainages the dominant sagebrush is basin big sagebrush, which may grow from three to eight feet in height. Species commonly occurring with Wyoming big sagebrush are Douglas' rabbitbrush, winterfat, prickly-pear cactus, western and bluebunch wheatgrass, little and mutton bluegrass, bottlebrush squirreltail, Indian ricegrass, needleandthread, phlox, buckwheat, wild onion, Indian paintbrush, sego lily, groundsel, locoweed, and penstemon. Also found with mountain big sagebrush are snowberry, bitterbrush, serviceberry, mahogany, rubber rabbitbrush, Idaho and king-spike fescue, green and Columbia needlegrass, elk sedge, Kentucky and big bluegrass, lupine, larkspur, yarrow, sandwort, geranium and Oregon grape (picture 42-2). Basin big sagebrush is usually observed with Douglas' and rubber rabbitbrush, rose, snowberry, basin wildrye, green needlegrass, bottlebrush squirreltail, rhizamotous wheatgrass, and forbs listed with Wyoming big sagebrush.

Saltbush steppe habitat is found on flats and gentle slopes in upland positions. The dominant plant species is Nuttall's saltbush, that may grow in dense communities almost by itself or as a mixture with other species (picture 42-3). Plants found in these mixtures include birdsfoot sagebrush, bud sagewort, winterfat, Indian ricegrass, bottlebrush squirreltail, little bluegrass, thickspike wheatgrass, springparsley, biscuitroot, phlox, and mustards. In locations northwest of

Wamsutter, four-wing saltbush is common. Shadscale, another saltbush species, is found in low amounts in many areas. Black greasewood shrublands are found in lowland positions of the landscape where there is additional water, such as along drainages and playa and alkali lakes. Around playa lakes it is nearly a monoculture, otherwise it may be mixed with saltbush steppe species or with basin big sagebrush along drainages (picture 43-1). Understory species include those already listed for the two habitat types just mentioned.

Other plant communites found in this area are generally small in size and occur due to unique, localized conditions. On wind-blown rims, uplifts and ridgetops, vegetative communities are dominated by bluebunch wheatgrass or a mixture of grasses, mat-forbs, and sometimes birdsfoot sagebrush. These are classified as Very Shallow range sites in terms of effective rooting depth, that is limited by either bedrock or depth to higher soil pH. Other common species in addition to the two already mentioned are Indian ricegrass, little bluegrass, rhizamotous wheatgrass, phlox, buckwheat, sandwort, locoweed and penstemon.

Along Atlantic Rim are mountain shrub and aspen woodland plant communities. Aspen require deep, loamy soils and additional moisture. Because the wind direction in this area is primarily out of the west and southwest, snow is deposited on north to east slopes, providing habitats with extra moisture that can support aspen. Understory species include serviceberry, snowberry, creeping juniper, rose, Oregon grape, elk sedge, Columbia needlegrass, mountain brome, blue wildrye, elkweed, columbine, bluebells, geranium, arnica, licorice, bedstraw, and other forbs. Adjacent to aspen stands and still requiring extra moisture are stands of chokecherry and serviceberry, with many of the same understory species already listed for aspen sites. On the other side of the moisture spectrum are mountain shrub communities dominated by mountain mahogany. This species can grow in almost pure stands with primarily bluebunch wheatgrass, Indian ricegrass, balsamroot, buckwheat, groundsel, skyrockets and other forbs in the understory.

Plant communities in the Ferris-Seminoe Mountains area are much more diverse than the Great Divide Basin, with more influence by sands and limestone soils. On the south side of these mountains and extending northeast along Sand Creek are extensive sand dunes, both stabilized with vegetation and open, moving dunes. The vegetated areas are dominated by silver sagebrush with occasional pockets of basin big sagebrush, with shrub heights averaging two to four feet and taller along drainages (picture 43-2). Understory species include Douglas' and rubber rabbitbrush, needleandthread, prairie sandreed, Indian ricegrass, sand dropseed, scurfpea, dock, lupine, cryptantha, groundsel and buckwheat. In the open dunes about half of the surface area is occupied by blowout grass, an early successional species in the stablization process. A rare and unique plant, blowout penstemon, is found south of Bear Mountain on the north aspects of steeply sloping sand dunes. Smaller pockets of stabilized sands with similar species described above are also found on the north side of the mountain on deeper soils along drainages and south of the Sentinel Rocks.

On the benches and slopes on the north side of the Ferris-Seminoe Mountains are sandy to gravelly soils with shallow effective rooting depth that support low growing sagebrush/mixed grass communities (picture 43-3). Below 7,500 feet these sites are dominated by a mixture of Wyoming big sagebrush and black sagebrush, with shrub heights ranging from six to twelve inches. On some sites near Junk Creek there are nearly solid stands of black sagebrush. Understory species are primarily needleandthread, threadleaf sedge, and Junegrass, with lesser amounts of little bluegrass, bluebunch and thickspike wheatgrass, blue grama, phlox, locoweed, bitterroot, Indian paintbrush, sandwort and buckwheat. On the west end of the Ferris Mountain this site has increased amounts of mat forbs on shallow, wind-blown ridges. Above 7,500 feet near the edge of the mountain and reaching up the lower edge of the steeper slopes on the shallow

soils, the sagebrush dominant changes to Wyoming three-tip sagebrush. Understory species shift to Idaho and king-spike fescue, mutton bluegrass, Columbia needlegrass, buckwheat, balsamroot, bitterroot, shooting star, sandwort, locoweed, Indian paintbrush, phlox and mountain pea (picture 44-1).

Vegetation on deeper soils close to and on the mountains are dominated by big sagebrush, including all three varieties of Wyoming, basin and mountain. Description of heights, soils, and species are similar to that already described above. Sites supporting basin and mountain big sagebrush commonly have bitterbrush, snowberry and rabbitbrush as subdominants, but not as much serviceberry or chokecherry. One species found here and not seen further south is oceanspray. Varying amounts of limber pine and Rocky Mountain juniper are also found intermixed with the sagebrush communities on both Ferris and Seminoe Mountains. Extensive stands of mountain mahogany are located on the west end of Ferris Mountain (picture 44-2). In the same areas with mountain big sagebrush are small patches and stringers of aspen plant communities. Species found with aspen are similar to those described for Atlantic Rim, with the addition of Rocky Mountain maple. Encroaching into aspen woodlands are Rocky Mountain juniper, lodgepole pine and subalpine fir.

The stands of trees which cover most of Ferris Mountain are primarily lodgepole pine, and to a lesser extent subalpine fir at higher altitudes (picture 44-4). Douglas' fir and Engelmann spruce occur intermixed with subalpine fir along drainages. Lodgepole pine stands tend to have higher densities of trees than the other conifers, and therefore, have less diversity and lower production of understory species. Those commonly seen include grouse whortleberry, buffaloberry, pine reedgrass, arnica, wintergreen, prince's pine, dogbane, hawkweed and pine-drops. Subalpine fir grows in more open communities with sagebrush, creeping juniper, and a variety of grasses, sedges and forbs in the understory. Common species include elk and Ross' sedge, timothy, needlegrass, bluegrass, spike trisetum, pearly everlasting, pussytoes, sandwort, columbine, balsamroot, harebell, bluebells, violet, buttercup, groundsel, cinquefoil, fireweed, strawberry and yarrow. The Seminoe Mountains have more rocky and shallow soils that support mixtures of sagebrush and limber pine communities rather than denser forests (picture 44-3).

The granite formations found north of the Ferris-Seminoe Mountains are part of what's known as the Sweetwater Rocks, some of the oldest geologic formations in Wyoming. They appear as huge granite rockpiles, comprised of steep rock slopes, cliffs, and boulder fields, laced with cracks and canyons in various stages of fracturing and erosion. This results in an interspersion of small disjunct pockets, basins, slopes, and stringer drainages that support a mixture of vegetation types and species, some unique to these rocks. Species found here include limber pine, juniper, aspen, big sagebrush, black sagebrush, rabbitbrush, oceanspray, bitterbrush, currant, rose, snowberry, chokecherry, prickly-pear cactus, basin wildrye, bluebunch wheatgrass, needleandthread, Junegrass, Idaho fescue, little bluegrass, cheatgrass, sedges, pussytoes, cinquefoil, penstemon, larkspur, lupine, buckwheat, hairy goldaster, sandwort, cudweed sagewort, and various aster family species.

2) Issues and Key Questions:

Removal of vegetation and trends in species composition as a result of large ungulate grazers has been and continues to be the principal factor affecting vegetation. Domestic livestock grazing tends to provide the most impacts to the vegetation, primarily cattle currently and both sheep and cattle historically. This also includes trampling of vegetation along trails, fencelines and around watering facilities. Although localized portions of the assessment area (or specific vegetation

communities and/or species) may by more influenced by grazing or browsing of wild horses and wildlife.

Through varied management processes, including rangeland inventories, management agreements and grazing plans, and implementation of various "best management practices," stocking rates have been adjusted to fit available livestock forage on public lands throughout the Rawlins Field Office since the inception of the Taylor Grazing Act. Because of these adjustments, livestock management issues relate primarily to the season, duration, and distribution of use rather than stocking rates. The upland vegetative communities most often affected by livestock management are sagebrush/grassland and sagebrush-mountain shrub/grassland habitats in the form of the following impacts:

- Uneven use patterns (higher levels of grazing use close to reliable water sources or on gentle slopes as opposed to light grazing use when further from water or on steep slopes). Long duration and repeated livestock use adjacent to Bulls' Creek probably led to an expansion of prickly-pear cactus.

- Shifts in vegetation species types that favor increaser forage species (e.g., western wheatgrass) and aggressive warm-season annuals over cool-season, perennial vegetation types (such as bunchgrasses) where uninterrupted, season-long livestock grazing occurs.

- Variations in the availability of more desirable forage species due to season-long and/or growing season livestock use. Repeated, high use of these more favored species leads to their reduction or total removal from open, "easily accessible" locations (spaces between shrubs) to more protected, "sheltered" spots (e.g., under and within sagebrush and other shrubs.) This allows less desirable species such as rhizomotous, single-stalked grasses (e.g., western wheatgrass) to colonize and spread, thus lowering overall ground cover and forage value.

- Impacts to microbiotic soil crusts occur from grazing, roads, oil and gas development, and off-road vehicle use. The extent of these impacts and the ecology of species that occur in this region needs to be further monitored.

The key question that arises from these impacts focuses on implementation and refinement of best management practices for livestock grazing. What tools can be used or actions taken to implement or refine best management practices for livestock grazing that will maintain and/or improve the overall health and value of upland vegetation? What mix of grazing or browsing impacts can occur under the Bureau's multiple use mandate and still meet desired resource conditions? In country better suited to support winter sheep use (than summer cattle), what options are available for maintaining this type of use when the industry is currently depressed (picture 45-1)?

Vegetation use by wild horses occurs in the Great Divide Basin in the block public lands north of the checkerboard and west of Highway 287, and is managed only to the extent that the population of horses should be maintained at AML. In areas where wild horse populations exist within the watershed, impacts to vegetation from their grazing can be considered as important as those from livestock grazing to the health of the resource (picture 45-2). Because wild horse populations are restricted to only a portion of the analysis area, they could be considered to have less impact than the livestock grazing which occurs throughout the entire field office. Impacts to vegetation from wild horses are similar to those from livestock grazing in that they relate to

season, duration, and distribution of use, but also include stocking rates. The Lost Creek HMA was rounded up to reach AML in 2001 and the Stewart Creek HMA was rounded up to reach AML in 2002. Impacts from horse use are primarily to sagebrush/grassland habitats, and can result in heavy utilization levels, uneven distribution patterns, shifts in species types, and trampling and tearing up the ground. The key questions isto what extent should wild horses be managed to manipulate their distribution and seasonal use of vegetation? Asecond question concerns the established AMLs for both herd management areas; are the current AMLs the correct number of wild horses to manage for?

Policies that govern the use of vegetation treatments and the suppression of such vegetative community alterations, have played and continue to play an important role in the existing make-up and continual alteration of vegetation in the assessment area. Aggressive wildfire suppression, public perception over treating forest areas, and increasing concern of the risk levels to maintain control of treatments, has led to a predominance of late successional and lower productive shrub and woodlands, particularly in the Ferris-Seminoe Mountains area (picture 46-1). Additionally, aspen woodlands have declined in health and abundance, and conifer/juniper encroachment into these and other shrub stands appears to be increasing with time. A large percentage of sagebrush and mixed sagebrush/mountain shrub stands have reached a level of overly mature to decadent, leading to lower herbaceous ground cover, species diversity, plant vigor, forage, and nutritional value (for livestock and many big game wildlife species). Additionally, large, uninterrupted expanses of vegetation allow for large-scale losses of key habitat types if and when natural disturbances occur. The key question is how should the BLM and other natural resource management agencies/partners determine the level of vegetation treatment which should occur in order to promote better overall vegetation health while balancing the need for diversified habitat requirements of many user species? To what extent should portions of important vegetation communities be modified with treatments in order to improve the overall health of the larger ecosystem? At what level of vegetation alteration does temporary habitat loss outweigh long-term vegetation health maintenance and/or improvement?

The next most important factor relating to upland vegetation health throughout the watershed is use of varied vegetation resources by native wildlife, in particular, ungulate big game species. The principal issues that should be addressed regarding big game management relate to seasonal habitat forage requirements for mule deer, elk, and pronghorn antelope. Transitional, winter/yearlong, and crucial winter ranges for all species have traditionally been the habitats of concern (limiting the populations). Recent research has elevated the importance of quality spring/summer/fall habitat to healthy individual and population conditions. Key questions to be addressed include how to manage vegetation resources on key seasonal habitats to provide adequate quality forage for wildlife species, yet continue to provide forage for seasonal, managed livestock use. How can the mix of uses of the vegetation resource in the assessment area be managed so that vegetative health is maintained or enhanced?

Another influence on vegetation health is the presence and expansion of oil and gas field development, which is primarily in the checkerboard area around Wamsutter and pockets of activity around Hay Reservoir and Bairoil. Natural gas activity is expanding northward into the Red Desert and pilot projects for developing coalbed methane were initiated in 2000 on the west sides of both Seminoe Reservoir and Atlantic Rim. Short-term vegetation losses occur with every pad and access road that is constructed, but can be mitigated comparatively quickly with adequate reclamation after the initial activity subsides, sometimes to the point of increasing vegetative production over predisturbance levels. This can also be an opportunity to beneficially impact species composition and age class diversity. Good reclamation practices are generally the norm, but examples of poor, or unsuccessful reclamation attempts also exist. When reclamation is

unsuccessful or not attempted, impacts to vegetation are not limited only to direct changes (loss of vegetation on pad and road locations), but can expand to indirect impacts, including shifts in species composition and community diversity which appear in the form of increaser and/or invader species such as annual cheatgrass along road and pipeline right-of-ways and the spreading of halogeton, Russian thistle, and other weeds in oilfield road complexes. Additionally, seismic exploration has increased dramatically in the region. Although this exploration is supposed to be low impact, these activities do create new roads, which are then used and made more permanent by recreationists. The key question that should be addressed in regards to these impacts is how to elevate enforcement of reclamation standards in order to mitigate long-term impacts to the vegetation.

Finally, there is an increase in the expansion of unimproved roads and trails, and in the amount of off-highway vehicle (OHV) use throughout the field office area. This use is primarily associated with general recreational activities by the public rather than with development actions described previously (although those actions may alter the landscape in ways that encourage further OHV expansion.) The popularity and affordability of small, all-terrain vehicles leads to their use farther and farther into previously remote and roadless areas. This creats or "pioneers" unauthorized and illegal trails through the vegetation wherever possible. These routes are repeatedly traveled until vegetation is lost along the route, and it becomes a road for all practical purposes. The only barriers to this travel are terrain and hard to enforce rules governing off-highway travel. Only vegetation in the roughest topography is currently or potentially free from this disturbance. This disturbance leads to vegetation shifts and losses similar to those associated with the expansion of oil and gas exploration and extraction. However, the impacts extend into much longer-term time frames as there is no reclamation of the disturbance unless a pioneered road or trail is left to naturally revegetate through a lack of use. With ever-increasing recreational use of these lands, this rarely happens. Additionally, recreational OHVs are not subject to minerals management stipulations designed to mitigate the spread of weed seeds, and so have the potential to add weed infestation to their impacts. The key questions which should be addressed center around the need for the Bureau to decide if limits should be set which regulate off-highway vehicle use, what they should be, and how to effectively enforce these limits? Additionally, what educational tools should be employed to reduce impacts from recreational uses of public lands?

3) Current Conditions:

Quantifiable data about current vegetation conditions, health, and trends throughout the watershed varies as to availability, content, and quality. Upland monitoring information is available for varied grazing allotments and sub-basins within the watershed in the form of photo-points, aerial and basal cover transects, utilization studies, and other, more species and/or impact-specific studies. Studies vary by amount, type, and content throughout the assessment area in relation to the relative priority of the area/allotment, the level of management, and/or the urgency of determining specific impacts. Much of the monitoring efforts in the past focused on the collection of utilization information (what animals do to the plant), rather than on trend information (what the plant response is to animal use).

Vegetation and forage inventories of the assessment area occurred originally in the 1940s through the 1960s that led to stocking rate changes reflected in the current grazing permits. The most recent inventories were conducted in the mid- 1970s (Seven Lakes EIS) and in 1980-81 (Divide Grazing EIS). Seven Lakes was conducted using an order four soil survey and broader vegetative community classes, while Divide Grazing used an order three soil survey (smaller scale with greater definition) and the Soil Vegetation Inventory Method (SVIM) procedures. Data from these one-time inventories, based solely on species composition, suggested that rangeland health

conditions throughout the assessment area fell into the acceptable range, mostly rated as "good" condition, but including "excellent" and "fair" condition rangelands. The occurrence of "poor" condition rangeland was limited to small areas highly impacted by livestock such as historic sheep bedgrounds. Habitats such as aspen and conifer woodlands, greasewood playas, and mixed saline/non-saline ecotypes were not rated due to the lack of range site guide descriptions. Most of these habitats are believed to in good condition based on professional judgement, except for some of the woodland types. It should be noted that these inventories and associated conditional assessments were one-time snapshots of the vegetation communities and did not and/or have not been altered or updated to take into account trends in ecological vegetation conditions. In addition, use of 'range site guide descriptions' usually dropped the 'guide' part in rating communities. Since the guides tended to favor early to mid-successional (more grasses and forbs) plant communities, late successional communities dominated by shrubs received lower (fair) condition ratings. The following discussion is based on vegetative attributes, such as species composition, age class, cover and diversity of structure.

Species composition within the assessment area is comprised of 99+ percent native plants. Non-native plants are found in scattered spots where there was historic or recent disturbance. The most common species, cheatgrass, occurs on old sheep bedgrounds, salting areas, along roads, in and around the Sweetwater Rocks, and as a minor component in a number of plant communities. Other than in severely disturbed locations the perennial species appear to maintaining themselves without the expansion of cheatgrass, which is an annual. Other species like Russian knapweed and halogeton are found along roads or in isolated spots with recent disturbance, and are more thoroughly discussed in the weeds section of Standard #4. Crested wheatgrass has generally not been introduced on public lands in this area, except by the State of Wyoming Highway Department along highway right-of-ways and by oilfield companies around Bairoil for older road, pad, and pipeline reclamation. The crested wheatgrass found in these sites does not appear to be encroaching into adjacent native rangelands.

The most important concerns about species composition have to do with diversity and abundance of specific native plant species, namely aspen. Aspen is an early successional species. Due to the lack of fire, encroachment by conifers and sagebrush, and impacts of disease, decadence, and grazing, the acreage and health of aspen communities is declining. In the Ferris-Seminoe Mountains area, there are about 500 acres of aspen woodland habitat remaining, approximately 10 percent of what should be there. In the Atlantic Rim area, overall health of aspen communities is better. Although health trends are similar to the Ferris-Seminoe area, current acreage of these sites is still good. In addition, a recent prescribed burn in Jep Canyon has removed competing sagebrush and stimulated regeneration of aspen suckers (pictures 48-1, 48-2). Aspen growth on this prescribed burn is also being promoted by the rotational grazing system used on the Fillmore allotment. Disease is also widespread among the conifer species found on Ferris Mountain. White pine blister rust, mistletoe, and bark beetle infestations have killed many trees and are spreading across the mountain (pictures 48-3, 48-4).

Other concerns over species composition and cover relate to plant succession and grazing. In big sagebrush/mixed grass and mountain shrub communities, these two factors lead to increased cover of shrubs and reduced cover and composition of grasses and forbs. Due to the general lack of wildfires or prescribed burns in this area, most shrub communities are mature to old-aged. Historic grazing practices also led to shifts in plant species, with 'desirable' plants overused and reduced in abundance, while 'less desirable' or 'grazing tolerant' species increased in abundance. This is observed in the proportions of bunchgrasses (desirable) compared to plants like rhizamotous wheatgrass and little bluegrass (less desirable). Although less desirable increaser

species are present in varying degrees throughout the assessment area, in most cases, their presence does not indicate poor health or nonfunctional vegetation communities.

4) Reference Conditions:

Due to the lack of potable water or drainages to follow, the Great Divide Basin was essentially ignored by early explorers, so there is little written about this area in terms of the conditions that existed prior to settlement by white men.

5) Synthesis and Interpretation:

The vegetative resource in the Great Divide Basin and Ferris-Seminoe Mountains formed over thousands of years due to its geographic setting, climate, and animal use. Although there is not a lot written about the vegetation prior to impacts from settlement, much can be gleaned from analyzing the basic factors just listed. The Great Divide Basin lies between the Wind River Mountain range to the north and the Colorado Rocky Mountains to the south. It also straddles the Continental Divide with drainages to the west flowing to the Pacific Ocean and drainages to the east flowing into the Gulf of Mexico and the Atlantic Ocean. This gap in the mountains, where the Intermountain West meets the Great Plains, is reflected in a mixture of both climates and therefore, vegetation. The ecotone of vegetation produced by the overlap in these two zones, nearly two hundred miles across, is also influenced by the moderate, sustained winds that move through the gap in the mountain ranges. Peak moisture months are April through June, but with substantial amounts from March through October. This promotes a mixture of cool and warm season species, particularly in grasses. Although cool season grasses dominate, such as wheatgrasses, bluegrasses, and needlegrasses, there are increasing amounts from Rawlins eastward of blue grama, threeawn, prairie sandreed, sand dropseed and little bluestem. Yucca and sumac, more common to the plains, also show up in this area.

This mixture of plants was also modified by historic bison grazing. In the Reference conditions under Standard #4- Wildlife, there are journal entries by Fremont in 1842 about the bison herds in the Sweetwater River valley. Stansbury in 1850 also described the sign of bison in the Muddy Creek drainage south of the Great Divide Basin. And bison kill sites used by the Native Americans in this area also reflect their occurrence, and therefore, influence on native vegetation. The gap in the two mountain ranges obviously allowed bison to easily move from the Great Plains into the basin and further west. Bison may have contributed to the abundance of particular species. Threadleaf sedge, a low upland plant found on shallow, sandy soils, is common throughout central Wyoming. More adaptive to drought and close grazing, this species could have out-competed other species in habitats used by bison. Believed to be an 'increaser' species with cattle grazing, threadleaf sedge is as common in historic winter use pastures as those which have historically received growing season use by cattle.

The history of settlement by white men for this region followed that of the railroad, which arrived in 1867. The Sun Ranch on the Sweetwater River by Devils Gate was the first ranch established in the valley in 1872 and the Miller Ranch on the south side of the Seminoe Mountains began in 1873. Bison were killed for their hides and virtually eliminated from most locations by the late 1870s. In much of the West, early dominance of the livestock industry was by large cattle operators until the severe winter of 1886-87. This was not so much the case for the Great Divide Basin due to the lack of water. Sheep were trailed into Wyoming from the 1870s through 1905 to stock the range and were the principle use in the basin since sheep could get by on snow. Their use was generally late fall until early spring, when herds would be moved to the railroad for shearing so the wool could be easily shipped east to mills. Shearing corrals were located at short

distances along the line, such as Rawlins, Daley, Riner, Creston, and Wamsutter. John Niland spoke about how segregated it was even in those years, with separate corrals and shearing facilities based on the origin or religion of each outfit. Sheep were then moved to where there was good water and forage to lamb in the foothills before moving to forest lands (south) or Green Mountain (north) for the summer. Lambing areas in this report area would have been at Atlantic Rim, along Bulls and Lost Soldier Creeks in the Stewart Creek allotment, and in places around the Seminoes. The Ferris-Seminoe Mountains area tended to be a mixture of both sheep and cattle in the early years, and as allotments were fenced after the Taylor Grazing Act, became more dominated by cattle use. This transition to cattle use has continued through the years, with the Miller Ranch (Seminoe allotment) changing to all cattle in 1973 and the Moore Family (Stone allotment) changing in 2003.

Impacts from historic livestock use are most obvious where concentrated, repeated use took place, such as corrals, shearing areas, and bedgrounds. Bare ground, cheatgrass, and annual forbs are indicators of these sites. Locations are isolated and small in size. Change in rangeland condition on a broader scale include localized impacts with changes in species composition. Uplands adjacent to Bulls Creek have extensive patches of cactus, probably due to spring lambing and long duration use by wild horses and cattle next to a perennial water source. John Niland mentioned seeing more evidence of cactus in the Great Divide Basin in spots near water following years of livestock use near these sites. In a few locations at lower elevations where historic winter use pastures exist, desirable warm-season grasses like sand dropseed and green needlegrass still exist. However, in most areas that have received long duration of use by livestock during the growing season, these desirable grasses are not present. In many areas within the assessment area, low effective rooting depth and precipitation limit the potential for sagebrush or other shrubs to increase in cover and density if livestock use of grasses would promote expansion of shrubs. However, on deeper soils with ten inches or more precipitation, through both natural succession and livestock use of competing grasses, sagebrush can increase and dominate communities. In some sites, shrub cover may reach 60 to 70 percent cover. Some type of vegetative treatment is required at this point to reestablish a mixed community of grasses, forbs and shrubs. There were probably other historic impacts from livestock that are hard to recognize without any reference conditions, or where time has allowed rangelands to heal. However, dormant season-of-use in the Great Divide Basin and stable family ranches in the same locations for the past 50 to 120 years have lead to lower impacts and maintenance of natural plant communities over a majority of the area under evaluation.

Grazing use of vegetation is currently made by livestock, wildlife and wild horses. The majority of the assessment area is allotted to some form of livestock grazing use during various periods of the year (except the Morgan Creek watershed in the Seminoe Mountains). The vegetative resource is also utilized by wildlife use in its entirety, most notably by big game species (although in most cases, significant wildlife use is seasonal). Additionally, grazing use from wild horse herds occurs in the northern third of the Great Divide Basin. Impacts to vegetation from grazing can be expected to occur to measurable extents throughout the analysis area. Vegetation around Wamsutter and Bairoil are also impacted by extensive oil and gas field development, and an ongoing exploratory development for coalbed methane extraction is located on the west sides of Seminoe Reservoir and Atlantic Rim. Associated with this mineral extraction are networks of (mostly) improved roads.

Additional human uses of the watershed include commercial seed collection, off-highway vehicle use not associated with the previously-mentioned activities, the collection of moss-rock for commercial decorative purposes, and removal of wood products (pine, aspen and juniper) for firewood, fenceposts, and furniture. All of these activities influence the vegetative component of

the watershed where they occur, either indirectly via associated changes, or directly by contact with and/or removal of vegetation. Additionally, vegetation in the watershed is directly influenced by human activity through the application or repression of intentional and/or naturally occurring "vegetation treatments," including wildfire, prescribed fire, chemical, and mechanical vegetation removal.

As described and discussed previously, upland vegetative species within the Great Divide Basin and Ferris-Seminoe Mountains are likely very similar at present to that which would have been encountered prior to settlement of the area. The principal changes are in the type of animals, which utilize the resource, and the amount of disturbance (or lack thereof) that is levied towards the vegetation from other human activities. Sagebrush, sagebrush-grasslands, saltbush steppe, greasewood flats, and conifer woodlands continue to dominate the landscape throughout the watershed. The most obvious changes in vegetation on the landscape are evident where all or a portion of an existing community has been removed or "converted" to some other type. Examples of this include roads, well pads, mines, buildings, and agricultural conversion to irrigated hay meadows. Less obvious are changes within vegetation communities that have occurred naturally as communities evolve or have gradually been altered through the addition, subtraction, or manipulation of additional influences (e.g., a shift in vegetation consumed as traditional livestock uses are supplanted by animals with different dietary preferences and the suppression of wildfires).

Shifts in vegetation communities from historical conditions are to a large extent the result of use by grazing ungulates. Generally, grazing use throughout the watershed has placed pressure on developing vegetation through various portions of its seasonal life cycle. Winter use areas at lower elevations, where herded bands of sheep moved throughout the terrain in a nomadic fashion, tend to retain most of the desirable increaser forage species in a more available fashion, due to the timing and duration of use. Late spring and early summer grazing by cattle, sheep, horses, and/or big game wildlife species places the majority of grazing pressure on growing herbaceous material. As the summer 'hot season' progresses, cattle and wild horse use continues to primarily remove grasses, while sheep (where still present) and wildlife use tends to shift towards browse species on uplands. Fall and winter use by cattle, wild horses, and wintering elk herds, although still focused on grasses, removes mostly dead and dormant material, and sheep, pronghorn, and winter mule deer use removes portions of the summer's growth mostly on shrub species mixed with dried and desiccated forbs. More recent changes in composition that have occurred internally in various upland vegetation communities in the watershed (due to grazing pressure by ungulates) have been primarily the result of cattle use. Cattle grazing may cause shifts in composition due to continuous, repeated, and sustained grazing use on selected, preferred herbaceous species through their peak growth periods (primarily on cool-season bunchgrasses during late spring and early-to-mid-summer). The principle example of this are areas where desirable bunchgrass species have been reduced and allowed expansion of less desirable species like rhizamotous wheatgrass.

The majority of the assessment area has undergone the implementation of various BMPs, to some extent, which promote the maintenance or enhancement of natural plant communities. The results can be readily observed in the form of higher density of native plants, higher ground cover, greater plant diversity, and higher vigor and nutritional value of individual plants. In some cases, multiple practices and improvements were necessary, while in others, only minor adjustments to grazing management have been or are required. Direct changes to grazing timeframes, including adjustments to duration, intensity, and season of use, have been implemented to remove constant, repetitive pressure on key forage communities during the heart of their growth period. Rotational grazing schedules that include deferment and recovery periods

allow for preferred vegetation species to concentrate energy reserves towards vegetative growth. Upland water developments, including small stockponds and reservoirs, water wells, spring developments, and pipeline systems have led to better overall distribution of livestock use and facilitate grazing rotations and pasture systems. Fencing has been implemented to control livestock movement, allowing rotational grazing systems, and better distributing livestock use. Finally, vegetation treatments have been applied to limited areas within the watershed in order to introduce, or in some cases accelerate, the rate at which vegetation communities evolve and develop towards different seral stages. Very seldom (if ever) are vegetation treatment projects initiated with the objective of *converting* vegetation permanently to another type, but instead are intended to set the existing community back to an earlier seral stage and stratify the overall age class and structural variation. Treatment of (mostly) shrub stands can also be used to improve livestock distribution by removing impediments to animal movement and making the forage more accessible, and through increased forage quality and herbaceous content (through the removal of competition for nutrients and moisture). Overall, livestock management has been improved through the use of rangeland improvements and more intensive management without resorting to grazing exclusion, complete rest, or reducing permitted use. Although further refinements in grazing management may be necessary, these are primarily directed at achieving riparian/wetland objectives, rather than upland plant objectives.

Wildlife use in the assessment area varies with season, and tends to impact different components of the vegetation communities than does domestic livestock use. Pronghorn antelope primarily affect low elevation sagebrush and saltbush steppe habitats across the majority of the region, with studies showing winter diets comprised of up to 97 percent Wyoming big sagebrush. They usually congregate in larger herds during the fall and winter, which can lead to higher concentrations of use on crucial winter habitat. During the spring and summer they move around in smaller groups with few, concentrated impacts to vegetation. Mule deer also primarily use shrubs during the fall and winter, but require a more mixed diet of sagebrush and mountain shrubs, including bitterbrush, snowberry, serviceberry, chokecherry and mountain mahogany. During the spring and summer, deer eat more forbs with some grass and shrubs, and generally stay in small groups throughout the year. They are primarily found around the Atlantic Rim and Ferris-Seminoe Mountains with small, isolated populations in the Great Divide Basin. Impacts from mule deer use are most visible on mountain shrubs, particularly bitterbrush. Elk may impact through their use both the herbaceous and browse components of the communities, usually at higher elevations throughout the year (dependent on the severity of winter weather). Their areas of use have shifted over the last twenty years following changes in grazing management and vegetative treatments. Elk use north of the Ferris Mountains during the winter is more concentrated along lower Rush Creek and the south side of the Sentinel Rocks, compared to greater use in the past closer to the mountains near the Arkansas and Cherry Creek drainages, following changes in cattle management. Use by elk is expanding west from Atlantic Rim following both prescribed burn treatments and cattle management changes. In this area, burns have treated enough aspen acreage, so that the elk have not negatively impacted the resprouting plants. Although big game herd numbers are at or near objective, the numbers of animals utilizing the habitat probably has less effect on the vegetation than does the overall age class uniformity and maturity of the stands. However, animal use is an important factor in the health and ecology of important stands of shrubs, particularly mountain shrubs and basin and mountain big sagebrush. As the individual plants reach a stage of over-maturity and decadence, annual vegetative production decreases, and as the current and/or portions of the previous years' growth is removed, the plants become more and more hedged, further deteriorating overall stand health. New, juvenile plants are removed quickly if they are available, due to the higher palatability and/or nutritional content, leading to an overall loss of productivity and further aging of the stand. Additionally, as stands age, rival vegetation surrounding the shrubs, such as junipers, tends to

spread into the shrubs, out-competing them and shifting the overall community composition. Management changes that would focus on stratifying shrub stands and diversifying overall community composition, stand age and structural class, and habitat production would focus on achieving a mixture of seral stages, benefiting all species of wildlife. Impacts by other wildlife species on vegetation are light to moderate and inconspicuous to the casual observer. At the current time, existing numbers of wildlife are not having negative impacts upon the vegetation resource.

Within the Stewart Creek and Lost Creek HMAs in the Great Divide Basin, wild horses become a third user of the vegetation resource in addition to livestock and wildlife. Historically, most wild horses in this area originated from horses that were turned loose or escaped from local ranchers. These wild horses would thrive and occasionally be rounded up by ranchers or townspeople for extra cash. Populations must have reached high numbers at times, based on different accounts. Bill Grieve spoke about when all the wild horses were rounded up on the north side of the Ferris and Seminoe Mountains, around 1926-28, totaling between 2,000 to 3,000 head. With few water holes and no wells yet developed in the Great Divide Basin, impacts from wild horses would have been concentrated around the existing sources of water. However, differentiating these from livestock use is not possible.

Actions and tools, which are specified for the management of wild horses are limited to the use of gathers and removals of a portion of the horse population on a continuing basis in order to sustain the population at the Appropriate Management Level (AML). The AML is determined to be a population level that can be supported by the available forage in conjunction with amounts removed by other uses, including livestock and wildlife. Since both of these wild horse herd areas were just reduced to the AML level in the last two years, it will be important to monitor vegetative trends to determine if current levels of use by livestock, wildlife and wild horses can be sustained. Besides the total amount of vegetation that wild horses use, there are other factors to consider. Similar to unmanaged cattle, wild horse distribution is uneven and concentrated around limited water sources. It takes place throughout the year, and more importantly, throughout the growing season, regulated only by availability of forage and water sources. As population levels rise above the AML level, as they did in recent years, impacts to forage, particularly bunchgrasses on sites with higher productivity, have risen. Utilization has been observed at moderate to high amounts in areas where little use was made previously due to the relatively remote location and longer distance to water sources. Vegetation surrounding limited water sources is grazed more intensively by both livestock and wild horses. Where livestock operators pump water wells for their livestock, some use by wild horses is also drawn away from the natural water holes. The BLM also moves a solar pumping system between three wells located west, north and east of Stewart Creek to help better distribute the use made by wild horses. Some of the effects observed within the HMA include disturbance of the ground surface and increased bare ground, more annual forbs, and lower vigor, production, and density of grasses in upland plant communities. Due to the combined grazing effects from domestic livestock and unrestricted wild horse use, it is difficult to determine which use most impacts the vegetation. Actual use by wild horses within the Stewart Creek HMA in 2000-2001 was equal to that made by livestock in the same area.

The at-risk aspect of upland vegetation communities in the assessment area, particularly around the Ferris-Seminoe Mountains, centers on the late seral stage of development that the vast majority of sagebrush and mountain shrub stands and woodlands have reached without disturbance or stratification. This can be observed in the predominance of even-aged and structural classes of the dominant shrub species that are mature to decadent. As noted previously, the predominant overstory shrub or woodland community can be considered

monotypic, with few, if any, instances of early or mid-seral communities interspersed within the landscape. Although a portion of any vegetation community should be expected to exist in a mature to decadent (or late seral) stage in order to be considered healthy and properly functional, there also must be a mixture of early to mid seral components mixed throughout, on a community or landscape scale. As dominant shrub and/or woodland vegetation continues to age and decline, individual plants or portions of them die and are not replaced by juvenile seedlings or tillers, and understory vegetation decrease in density, abundance, and diversity. As the production and vigor of these grasses and forbs decreases, less vegetation remains after growth resulting in less litter above and below ground and reduced overall nutrient cycling. Less desirable species such as coniferous trees in aspen stands and limber pine or junipers in sagebrush and mountain shrub stands continue to encroach and out-compete the more desirable plants. Vegetation values for ground cover, big game habitat, and livestock forage, decrease, putting the entire community into an "at risk" category. Additionally, the communities can be considered at risk due to the homogeneous and continuous nature of these dense, mature shrub stands, because the potential exists to lose large blocks of vegetation to catastrophic wildfire events, as few vegetation transition-type fuel breaks are located (or placed) within landscape vegetation communities.

Where portions of sub-basins have been treated with prescribed burns (Separation Creek drainage in the Fillmore allotment), monitoring has shown that with managed post-treatment use the overall health of herbaceous vegetation is higher, with higher plant densities and increased species and cover diversity (pictures 54-1, 54-2, 54-3, 54-4). Existing grasses and forbs are the most obvious species to benefit, and uncommon, early seral species like cotton horsebrush, Oregon grape, and wild hollyhock appear and increase on treated sites. Desired grazing species like green needlegrass and oniongrass are released to expand in abundance following the removal of the shrub canopy through burning and proper post-treatment grazing management. Because most treatments are conducted to obtain a mosaic pattern, shrub age classes are diversified between older, mature-to-decadent shrub stands interspersed within and around areas set back to an early seral stage, which include many juvenile to young plants. Although aerial canopy cover from older shrubs can be quite high, the nutritional value and production drops, and overall ground cover percentages remain low and continue to decline over time as understory species are shaded by the larger shrubs and out-competed for nutrients and water. These areas when compared to treated sites exhibit lower species diversity and lower herbaceous cover, production, and nutritional value for livestock and wildlife forage.

The lack of treatments and aggressive suppression of all natural fire around the Ferris-Seminoe Mountains has also affected the health of aspen stands by allowing them to over-mature and become decadent and diseased, with total loss of stands to encroachment of coniferous vegetation (subalpine fir, limber and lodgepole pine, and Rocky Mountain juniper) and sagebrush (picture 54-5). Bleeding rust is present in most stands, primarily affecting larger trees, but spreads through the root systems to younger trees in the same clone (picture 54-6). Removing these larger, diseased trees can prevent the bleeding rust from spreading to young trees. It is estimated that less than ten percent of the aspen stands that were present during the early half of the 20th century continue to exist today. As the older trees die or fall to wind events, they are not replaced by juveniles or suckers, and eventually, the stand dies or is reduced to a few remnants, dominated by conifers and big sagebrush. Of course, historical season-long livestock grazing and elk use has concentrated grazing on the seedlings in the past, but relatively recent implementation of rotational use and other upland grazing management tools currently mitigates these impacts, leaving a lack of stand replacement events as the missing element to enhanced aspen health. Prescribed burns are being planned to restore aspen health by stimulating sucker regeneration and removing other plant species that compete with aspen.

Wildfires do not play a large role in the region of this assessment. A limited number of natural ignitions occur annually and are aggressively suppressed. In the last twenty years there have been two wildfires between 500 and 1000 acres in size, one in the Haystacks and one in the Seminoe Mountains. Small 'tree' fires up to twenty or thirty acres are the average size. The last large fire in the area was on Ferris Mountain in the late 1940s, and it burned several thousand acres. In the area around the Ferris-Seminoe Mountains there has only been one prescribed burn in 1994 that covered about 300 acres. There have been no other significant vegetation treatments undertaken in this area, although an ecosystem plan for the Ferris' with multiple vegetative treatments over the next few years is currently being developed. The lack of periodic stand-replacement type events has allowed sagebrush and mountain shrub species to reach a level of over-maturity and decadence, and limber pine/juniper woodland communities threaten to encroach on and overwhelm portions of the shrub lands. In many cases, understory grasses and forbs (and in the case of juniper woodlands, the understory shrubs as well) have been suppressed by the large, mature shrubs resulting in lower vigor, density, and diversity of these species.

Recreation primarily takes place during the late-summer and fall months as hunting (mid-August through November). Springtime recreational uses such as shed-antler hunting continue to increase at an accelerated pace, while limited summer use occurs throughout the area.. Associated with these uses are an ever-increasing number of roads, trails, and tracks, which wind through all of the vegetation types and are restricted only by topographical impediments. However, in the flat to gently sloping land common to the Great Divide Basin, there are few effective topographical impediments. Even in the Ferris Mountain WSA, people attempt to drive ATVs as far up steep slopes and lookout points within the WSA wherever they can. Commercial moss rock collector's are also creating similar impacts to those just described.

Loss of vegetation that occurs due to the proliferation of roads and trails, although proportionally smaller than other impacts, tends to be more evident and can be equally severe on a small scale because all vegetation is totally removed along the entire area of impact. Even improved roads, if not adequately designed and/or drained, lead to vegetation loss/community conversion on adjoining lands through increased erosion/sedimentation immediately along the route and introduction of less desirable species from disturbance along the route. As noted in the watershed health section, there is a need for further work on many improved roads to reach an adequate level of improvement practices (gravelling, additional culverts, wing-ditching, water-bars) to minimize or eliminate overland flow alterations and vegetation species movement/colonization. Equipment used to sustain or improve highly traveled routes should be maintained in a weed-free status, as noxious weed and non-native invasive species infestations have arisen in areas of recent maintenance. Recreational use of roads and trails, and particularly the pioneering of new trails by illegal off-highway driving is increasing, including problems stemming from hunting, joy-riding and the increasing popularity of antler hunting in the late winter and spring (picture 55-1). Greater availability of disposable wealth has led to greater availability of all terrain vehicles (particularly 4-wheelers) and pickup trucks, which have exacerbated this impact, particularly in areas with easy access and proximity to towns, but also in remote portions of the watershed.

Reclamation standards, and their application (or lack thereof) directly affect the vegetation through the watershed by allowing or precluding an unoccupied niche, which less desirable increasers or invader species attempt to fill. Poor reclamation practices, found in various portions of the watershed, mostly on developed and/or capped well pads, lead to an increase in weedy species, mostly halogeton and cheatgrass, which thrive and spread to surrounding rangelands. Good or even adequate vegetation reclamation, most notably on pipeline routes and BP America well pads, results in little unoccupied space for infestation, high forage production, and the

proliferation of desirable introduced or annual species which tend to remain within the project's right-or-way area and only affect the surrounding rangeland in a limited manner.

6) Recommendations:

At the present, the review of upland vegetation conditions in the Great Divide Basin reveals generally good overall community health. Natural ecological and biological processes appear to be functioning adequately overall, although concerns about current, and especially near-future, functionality of certain community types remain. Specifically, the review group has determined that the majority of upland vegetation communities are properly functioning in relation to the seral stage to which they have evolved. Several specific communities, however, are becoming rare (aspen) or elicit concerns due to their uniformity of age and structural class, and the imminent onset of over-maturity to decadence (big sagebrush and mountain shrub stands).

Aspen stands in the Ferris-Seminoe Mountains area do not meet the standard for upland vegetation health due to decadence, disease, and decreasing occurrence and acreage due to encroachment by conifers. They occur next to seeps and drainages at lower elevations, as separate stands along the base of the mountain, and intermixed with conifers up on the mountain. The current acreage of aspen habitat in this area is about 500 acres. Livestock grazing is a component in the management scenario of these plant communities, but it is not the principle factor in non-attainment of this Standard.

The health of big sagebrush and mountain shrub stands are a management issue to resolve, as is the disease and decadence found in conifer woodlands on the Ferris and Seminoe Mountains. However, these communities are not at the brink of being lost within this ecosystem. Implementation of treatments, improved grazing management, or implementation of other BMPs can address the problems identified in these shrublands and woodlands.

In spite of these concerns, the diversity, vigor, productivity, and overall amount of upland vegetation within the watershed, as well as the cooperation exhibited by the majority of livestock permittees towards grazing management, suggest that no insurmountable vegetation health problems are evident on a significant scale in most vegetation communities. Due to the existing conditions and general vegetation community heath on uplands, and the generally small number of management issues that need to be dealt with, it is determined that the remainder of the Great Divide Basin Report Area is meeting Standard #3 – Upland Plant Health. The following recommendations would expand upon the successes already achieved and help to meet desired resource conditions in the future.

Continue to implement or manage using BMPs for livestock grazing. These practices utilize, but are not limited to, the control of season, duration, intensity, and distribution of livestock use to meet desired resource objectives for upland vegetation as well as riparian habitat. Specific dates or timing of use must be decided on a case-by-case basis specific to the management unit and/or site limitations. Methods that can be used to achieve resource conditions include, but are not limited to, livestock control by pasture fencing or herding, water developments, vegetation treatments, and/or the manipulation of livestock turn-out/removal dates.

Vegetation treatments designed to modify the age and structural composition of predominant shrub stands and stratify the seral stage mix within stands should be expanded throughout the assessment area. The ecosystem plan for the Ferris-Seminoe Mountains areas should be completed and implemented as soon as possible (in the next year). Where treatments are utilized to improve the health and productivity of sagebrush and sagebrush/mountain shrub communities,

they should attempt to promote juvenile, palatable shrub seedlings within the community in addition to increasing the herbaceous component. Where management units include decadent or dying (shrinking) aspen stands, treatments can incorporate design features to remove old, decadent, and diseased trees (stand replacement), or at a minimum, remove understory vegetation and litter (with low-intensity, creeping flame fronts) in order to promote suckering of new clones and turnover of the stand(s). The use of wildland fire for resource benefits should be promoted on Ferris Mountain where controlling a prescribed burn may be nearly impossible. Removal of encroaching species (limber pine and juniper in shrub stands and mixed conifers within aspen stands) in manageable vegetation communities can be accomplished through the use of traditional, controlled-intensity prescribed burns removing vegetation in a mosaic pattern. Treatment methods and post-treatment management of burns designed to improve watershed health should (at least initially) maximize herbaceous vegetation and litter in order to provide healthy, productive forage and habitat for livestock and wildlife. Treatment and management objectives should strive to focus on and address changes and improvements to the predominant vegetative community rather than expected secondary effects (positive and negative) to narrowly-defined rangeland "users" (e.g., wildlife vs. livestock burns). Polarization from user groups and single resource advocates can be more effectively avoided if objectives specifically address rangeland vegetation health issues, rather than focus on what can be construed as single species or single use management. On a long-term basis, treatments and pre/post-treatment management should be designed to promote healthy, diverse, natural rangeland conditions rather than the creation of homogeneous monotypical communities covering large tracts of land.

Wild horse populations in the Lost Creek and Stewart Creek HMAs should be maintained at the AML. Bands of wild horses occupying rangelands outside the HMA should be removed or herded into the HMA. Monitoring of impacts to the vegetation within the HMA should attempt to determine what effects wild horses have on their habitat when maintained at the desired population level and to what extent these effects are compatible with other multiple use activities occurring in the area. Additional water sources should be developed to reduce the dependence on existing water sources and the long duration use by wild horses around these sites to improve vegetative vigor, cover, and diversity.

Identify and correct problems with improved roads which affect vegetation community health and/or composition, including the implementation of mitigation and/or improvements to improved travel routes that will modify overland flow regimes and erosion/deposition patterns which influence the surrounding and adjacent vegetation communities. Pioneered and/or illegally located two-tracks or trails should be dealt with on a more location-specific basis for key problem areas. There is a need throughout the watershed to remove duplicate/redundant motorized vehicle travel routes, as well as unimproved routes creating vegetation or watershed-damaging disturbance. The scale of such management should be dependent on the issues involved. Enforcement of travel regulations, including ticketing of illegal off-highway use and increasing reparations for violations should be implemented throughout the watershed. Enforce existing stipulations on commercial activities like moss rock collecting which do not allow off-road vehicular travel as a part of the permit.

Oil and gas extraction companies should be held to established reclamation standards on active and abandoned (dry hole) well pad sites in order to mitigate construction impacts to the disturbance site and to surrounding rangelands. Additionally, reclamation of former well-site access roads should be stringently inspected and enforced. Seed mixtures should promote a mix of desired species, including a balance of grasses, forbs, and shrubs. Construction and reclamation equipment should be thoroughly cleaned and inspected prior to movement between

work sites to ensure that undesirable vegetation species are not carried and spread throughout the watershed.

STANDARD 4 – Wildlife/Threatened and Endangered Species/Fisheries Habitat Health and Weeds

> *Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.*

Wildlife/Threatened and Endangered Species

1) Characterization

The plant communities/habitat types that occur within this watershed have been described under the Characterization section of Standard 2 (Wetland/Riparian Health) and Standard 3 (Upland Plant Health). These habitat types vary greatly in their ability to support wildlife, depending on species composition, age classes, single-species dominance, horizontal and vertical structure, type abundance, mosaic mix with other habitats, and proximately to features such as migration corridors and winter concentration areas. Over 374 species of wildlife, including birds, mammals, reptiles, and amphibians, are known or expected to occur within the Rawlins Field Office (RFO). Graph #1 lists the number of wildlife vertebrate species by standard habitat types that are found within the RFO and have the potential to be located within this watershed. In general, aquatic habitats support the greatest diversity of species (up to 165) and are the least common types of habitat, comprising about oneperecnt of the landscape. Aspen woodlands are next in terms of supporting the greatest diversity of species, followed by big sagebrush, conifer, mountain shrub, and juniper woodland habitat types. The woodland plant communities are also uncommon in occurrence, comprising about four percent of the landscape. Big sagebrush and sagebrush/mixed grass are the most common plant communities in this watershed. Habitats with the lowest diversity of plants, cover, and structure, such as sand dunes, badlands, and rock outcrops, correspondingly support the lowest number of wildlife species (USDI-BLM, 2002).

The RFO Resource Management Plan (RMP) management objectives for wildlife species are to provide habitat quality (food, cover, space, and water) adequate to support a natural diversity of wildlife and fisheries, including big game, upland game, waterfowl, non-game species, game fish, sensitive, threatened, and endangered species, species of special management interest in Wyoming, as well as to assist in meeting goals of recovery plans. The RMP has an objective to maintain or improve vegetation condition and/or avoid long-term disturbance in high priority standard habitat sites and fisheries areas. In addition, there is an objective to also maintain or improve overall ecological quality, thus providing good wildlife habitat, within the constraints of multiple-use management in moderate and low priority standard habitat sites (USDI-BLM 1990). Although the RMP gives direction to manage the higher priority habitats first, there are circumstances when managing moderate and low priority habitats will take priority. Management of all three of these habitat types to obtain a diversity of vegetative species, cover, age classes, and structure is essential to maintain healthy wildlife populations and their associated habitat types.

The most commonly observed wildlife are big game, particularly antelope and mule deer in open habitat, and elk in shrub and woodland habitat. A small population of bighorn sheep still exists in the Ferris and Seminoe Mountains. Raptors are also very abundant and include golden and bald eagles; ferruginous, red-tailed and Swainson's hawks; burrowing owls; and other hawks, harriers, and owls. Other commonly observed mammals are coyotes, red fox, badger, beaver, muskrat, cottontail and jackrabbits, prairie dogs, ground squirrels, voles and mice. Shorebirds and

waterfowl include great-blue herons, avocet, stilt, phalarope, sandpipers, coots, Canada geese, white pelicans, coots, and various ducks (primarily dabblers). Songbirds vary by habitat type, with sparrows, meadowlark and horned lark most often seen in sagebrush and saltbush areas, and warblers, swallows and flycatcher species observed in riparian habitats. Greater sage-grouse and mountain plover are numerous and important species of interest. Horned lizards and prairie rattlesnakes are the most common reptiles, while tiger salamanders are the most abundant amphibian species (picture 60-1, 60-2).

Species of Interest or Concern:

There are numerous species of special interest and or concern that inhabit the watershed area, or use parts of the watershed area for migration, transitional zones and/or other corridors. There are five antelope herds, five elk herds, five mule deer herds, and one bighorn sheep herd – all managed by the Wyoming Game and Fish Department (WGFD) - that are located, or are partially located, within this watershed. In addition, other species of special interest and or concern within this watershed include threatened, endangered, candidate, and proposed species (T&E species), BLM-State Sensitive Species, greater sage-grouse and raptors. An account of these are described in the following paragraphs. Crucial winter range for big game species are shown on Map #6. In addition, there is parturition habitat for bighorn sheep located within the Ferris Mountains.

Antelope

Pronghorn antelope are the most visible and numerous form of big game species in the Great Divide Basin (picture 60-3). Antelope rely heavily on Wyoming big sagebrush habitat, in addition to other 'open' communities like saltbush steppe, greasewood, and short grasslands. During the winter, antelope diets consist of primarily Wyoming big sagebrush. However, spring and summer diets include higher amounts of forbs, grasses, and other shrubs. There are five antelope herd units that are located within, or are partially located within, the watershed area. These herd unit areas are identified as the: (1) Baggs Herd Unit; (2) Bitter Creek Herd Unit; (3) Red Desert Herd Unit; (4) South Ferris Herd Unit; and (5) North Ferris Herd Unit.

Baggs Antelope Herd Unit: This herd unit extends from Rawlins southwest to Baggs, with only WGFD Hunt Area 55 lying within this watershed. Hunt Area 55 lies south of I-80 and east of Hwy 789. The majority of this habitat is used from spring through fall, with antelope moving to crucial winter range on Red Rim or further south on Muddy Creek or east on the Iron Springs Unit. Densities of antelope are higher during the summer along Atlantic Rim and Red Rim due to the species composition and production of forbs where higher precipitation occurs.

Bitter Creek Antelope Herd Unit: The Bitter Creek antelope herd unit is bounded by Interstate 80 to the north, the Colorado state line to the south, Highway 789 to the east, and Highway 430 to the west. This herd unit contains WGFD Hunt Areas 57 and 58; whereas only the north ¼ of Hunt Area 57 is located within this watershed. This portion of Hunt Area 57 is classified as winter yearlong habitat for antelope. However, the higher elevations along Highway 789 are used from spring through fall, with lower elevations used on a yearlong basis.

Red Desert Antelope Herd Unit: This herd unit is located northwest from Rawlins, with I-80 the southern boundary the Highway 287 forming the east border. It contains WGFD Areas 60,

61, and 64; whereas the east half of Hunt Area 60 and most of Hunt Area 61 is located within this watershed (WGFD 2002a). The majority of this herd unit is also classified as winter-yearlong habitat. However, summer antelope densities are higher at higher elevations where forb diversity and production is greater. Antelope congregate at lower elevations during the winter, particularly south and east of Bairoil, along Separation Creek, the Chain Lakes and Horseshoe Bend. An extensive research project was conducted in this area in the early 1980s. During the severe winter of 1983-84, antelope moved as far west as Green River and north to the Sweetwater River.

South Ferris Antelope Herd Unit: This herd unit lies northeast of Rawlins and is bordered by I-80 on the south, Highway 287 on the west, the Ferris and Seminoe Mountains on the north, and the North Platte River on the east. It contains WGFD Hunt Area 62, and all but the southeast corner is contained within this watershed. Crucial winter range is located at lower elevations along Highway 287 and Seminoe Reservoir, and along the windswept rims of the Rawlins uplift. The majority of this unit is used from spring through fall, with winter use dictated by annual climate conditions.

North Ferris Antelope Herd Unit: This herd unit is located north of the Ferris and Seminoe Mountains and south of Highway 220. It contains WGFD Hunt Area 63, with most of this hunt area within the watershed. This herd unit contains crucial winter range at lower elevations along Highway 220 and Pathfinder Reservoir, and the majority of the habitat used from spring through fall.

Elk

Elk are the largest of the big game wildlife species that are common in this watershed. Elk normally prefer staying close to hiding cover, so are most often associated with conifer and aspen woodlands or tall shrublands. These are found on Atlantic Rim and the Ferris and Seminoe Mountains (picture 61-1). However, elk have also become established in the tall sagebrush habitats on the Rawlins Uplift and the Continental Divide north of Creston. They prefer grasses and have a high diet overlap with cattle, but will include more forbs in their spring diets and more shrubs in their winter diets. There are three elk herd units that are located within, or are primarily located within, the watershed area. These herd unit areas are identified as the: (1) Ferris Herd Unit; (2) Shamrock Herd Unit; and (3) Sierra Madre Herd Unit.

Ferris Elk Herd Unit: This herd unit is located on and adjacent to the Ferris and Seminoe Mountains. It contains WGFD Hunt Areas 22 and 111. Elk avoid areas with human activity and stay close to hiding cover, and therefore, are primarily found on the mountains or along shrub and woodland dominated riparian habitat in the summer and fall. They generally move off the mountains during the winter to sites where adequate forage is available and/or where topography provides visible and thermal protection.

Shamrock Elk Herd Unit: This herd unit lies north of I-80 and from north of Rawlins westward to nearly Wamsutter. It contains WGFD Hunt Area 118. The elk move within this area based on forage availability and human activity, but do not have a defined crucial winter range.

Sierra Madre Elk Herd Unit: This herd unit includes the forest and rangelands south of Rawlins and between Saratoga and Baggs. It is comprised of the WGFD Hunt Areas 13, 14, 15, 21, and 108, of which only half of Hunt Areas 108 is located within this watershed. This unit includes Atlantic Rim and Miller Hill, where smaller numbers of elk (200-300) live year-round, augmented by elk from the National Forest which move to lower elevations during the winter.

Numbers of elk using the area around Atlantic Rim have increased significantly in the last few years, which may in part be due to the prescribed burns that have increased the herbaceous component for that area. In March of 2003, over 1600 wintering elk were seen in the sagebrush flats just west of Atlantic Rim.

Mule Deer

Mule deer are the second most abundant big game species following antelope in this watershed. However, mule deer are not found evenly distributed across the landscape. They prefer areas with hiding cover and higher precipitation sites with forbs, which tend to occur close to the mountains, rims, and along stream drainages and lakes. Mule deer select forbs and grasses when green and more nutritious, shifting to primarily shrubs in the fall and winter. Compared to antelope, mule deer prefer a mixture of sagebrush and other shrubs during the winter. There are three mule deer herd units that are located within, or are partially located within, the watershed area. These herd unit areas are identified as the: (1) Ferris Herd Unit; (2) Chain Lakes Herd Unit; and (3) Baggs Herd Unit.

Ferris Mule Deer Herd Unit: This herd unit lies northeast of Rawlins, bordered by I-80 on the south and Highways 287-220 on the west and north. It is comprised of the WGFD Hunt Area 87, all of which except the northern tip, is located within this watershed (WGFD 2002a). Mule deer primarily spend spring through fall on or near the mountains and uplifts and near shrub and woodland riparian habitats. Crucial winter ranges are found at mid and lower elevations where mixtures of sagebrush and mountain shrubs provide the desired/available forage.

Chain Lakes Mule Deer Herd Unit: This herd unit is located northwest of Rawlins with I-80 forming the south border and Highway 287 forming the east border. It is comprised of the WGFD Hunt Areas 98, of which the entire hunt area is located within this watershed. This herd unit contains a small population of mule deer found in marginal habitats in the eastern portion of the Great Divide Basin. They primarily use the rougher topography found on the Rawlins Uplift and Lost Soldier Rim. A significant portion of the herd resides in or near Rawlins, Wyoming (Picture 62-1)(WGFD 2002a).

Baggs Mule Deer Herd Unit: This herd unit includes that portion of the watershed located south of I-80. The herd unit is comprised of the WGFD Hunt Areas 82, 84, and 100, of which half of Hunt Area 84 and only the northeast corner of Hunt Area 100 are located within this watershed. The principle mule deer population lives in and adjacent to the rougher topography found along Atlantic, Red, and Delaney Rims. These areas contain more desirable mixtures of shrubs, forbs, and grasses. Small populations of deer are also found in the denser sagebrush habitats between Atlantic Rim and Echo Springs.

Bighorn Sheep

Ferris-Seminoe Bighorn Sheep Herd Unit: There are a handful of bighorn sheep that reside within the Ferris-Seminoe ecosystem (picture 62-2). These sheep have been known to cross landscapes between the Seminoe Mountains and may travel west from the Ferris Mountains into the Green Mountains. Sheep use habitat types that include mountain meadows, rocky outcrops, and riparian habitats located within the Ferris and Seminoe Mountains. They prefer grasses and forbs over shrubs, resulting in dietary overlap concerns with both cattle and elk depending on the location.

Raptors

There are several raptor species that have been observed within the watershed area, or their nests have been identified within the area. Raptors that have known nests within the area include the ferruginous hawk, golden eagle (picture 63-1), Swainson's hawk, great-horned owl, Cooper's hawk, prairie falcon, red-tailed hawk, burrowing owl, northern harrier, and kestrel. Although nests have not been identified for the northern goshawk, long-eared owl, short-eared owl, and sharp-shinned hawk , these species have the potential to nest within this watershed. The ferruginous hawk, burrowing owl, and northern goshawk have been identified as BLM-State Sensitive Species and are discussed in that section of the document as well.

Hawks

The sharp-shinned hawk summers in mixed deciduous and coniferous woods and winters in woods and near bird feeders. These hawks feed by catching small birds in midair and carrying them off to eat. They may hunt among bird feeders. The Cooper's hawk inhabits mixed forests and open woodlands. This hawk has regular feeding routes during the breeding season where it hunts for common medium-sized birds such as mourning doves, jays, and starlings. The northern goshawk inhabits deep woods with mostly conifers. These hawks feed on birds by catching them in the air, and feed on mammals by swooping down on them. They eat medium size birds and mammals such as grouse and squirrels. The Swainson's hawk inhabits prairies and open arid land. This hawk often feeds by hopping on the ground, eating insects such as grasshoppers and crickets. They soar and catch mice, rabbits, lizards, frogs, and birds. The red-tailed hawk inhabits a variety of open habitats. This hawk may perch, hover, or hold still into the wind when hunting. This hawk eats small mammals, birds, and reptiles. The ferruginous hawk inhabits arid open land and grasslands. This hawk feeds by swooping down on prey from the air. They eat mostly medium-sized mammals, reptiles, and insects.

Owls

The great-horned owl inhabits extremely varied areas including woods, deserts, and suburbs. This large fearsome hunter will capture a wide variety of prey, ranging from insects to prey the size of a great blue heron. They eat squirrels, mice, rabbits, snakes, skunks, weasels, porcupines, domestic cats, crows, ospreys, as well as other owls and hawks, including barred owls and red-tailed hawks. The burrowing owl inhabits open plains, grasslands, and desert scrub. These owls eat insects, scorpions, crayfish, mice, ground squirrels, young prairie dogs, rabbits, amphibians, snakes, and rarely birds. The long-eared owl inhabits woods and willow patches near open fields and marshes. This owl eats mostly voles and mice, but have been known to eat amphibians, reptiles, and insects. The short-eared owl inhabits open fields, marshes, dunes, and grasslands. This owl feeds mostly on voles, but will also hunt songbirds and some game birds. They hunt mainly at dawn and dusk.

Other Raptors

The golden eagle inhabits mountains, foothills, and adjacent grasslands. This bird hunts by soaring and then diving down on prey such as rabbits and rodents and some birds, and they also feed on road-killed animals as well. The prairie falcon inhabits the plains, grasslands, and other open country. This raptor catches birds in midair or on the ground, and mammals after a swift swoop. The northern harrier inhabits open fields, grasslands, prairies, and marshes. This raptor feeds by coursing close to the ground and quickly swooping down on its prey. They eat mice, rats, birds, snakes, frogs, and other small mammals. The kestrel inhabits a wide variety of open

habitats, including urban areas. This raptor hunts by perching or hovering, then diving to catch prey. They eat voles, mice, birds, and insects (Stokes 1996).

Threatened, Endangered, Proposed, and Candidate Species:

There are seven threatened, endangered, proposed, and candidate species (T&E species) that occur, or have the potential to occur, within the watershed, and six species – the North Platte River species – that do not physically occur within this watershed, but that may be affected by actions that occur within the watershed. These include the bald eagle, black-footed ferret, blowout penstemon, Canada lynx, North Platte River species (least tern, pallid sturgeon, piping plover, whooping crane, Eskimo curlew, and western prairie fringed orchid) mountain plover, Ute ladies' tresses, and Western boreal toad. T&E species that are located within the RFO, but that do not occur, or do not have the potential to occur and/or are not affected by actions within this watershed include the Colorado butterfly plant, Colorado River species (bonytail chub, Colorado pike-minnow, humpback chub, and razorback sucker) Preble's meadow jumping mouse, Wyoming toad, and yellow-billed cuckoo.

Bald Eagle

The current status of the bald eagle is threatened. Bald eagles are found in conifer, cottonwood-riparian, and river ecosystems and forage in adjacent upland rangelands (USDI-BLM 2002). There are known bald eagle nests located along the North Platte River drainage within both the RFO and the Casper Field Office (CFO). There is winter habitat located to the northeast of the watershed, along the North Platte River, in the CFO, just northeast of the Rawlins-Casper Field office lines.

Black-footed Ferret

The black-footed ferret is considered endangered and is the rarest and most endangered mammal in North America and receives full protection under the Endangered Species Act of 1973 (Act). This species lives in prairie dog towns and relies on prairie dogs for both food and shelter. The original range of the black-footed ferret corresponded closely with the prairie dog, extending over the Great Plains area from southern Canada to the west-Texas plains and from east of the 100th Meridian to Utah and Arizona (USDI-BLM 2002).

Blowout Penstemon

The blowout penstemon is considered an endangered species and receives full protection under the ESA of 1973. This plant is located in areas of sparsely vegetated shifting sand dunes or wind carved depressions (blowouts). Formerly only known to exist in Nebraska, it was discovered in the sand dunes on the south side of Bear Mountain in this watershed in 1996. The habitat it occupies is on sandy aprons or the lower half of steep sandy slopes deposited at the base of granitic or sedimentary mountains or ridges (USDI-BLM 2002).

Canada Lynx

The current status of the Canada lynx is threatened. Lynx occur in the boreal, sub-boreal, and western montane-forests of North America. Snowshoe hares are the primary food source of lynx, comprising 35-97 percent of their diet throughout the range. Other prey species include red

squirrels, ground squirrels, mice, voles, porcupine, beaver, and ungulates as carrion or occasionally as prey. Lynx prefer to move through continuous forests and use ridges, saddles and riparian areas. Lynx have been known to cross large rivers and lakes and have been documented in habitats such as shrub-steppe, juniper, and ponderosa pine (USDI-FWS, 1999a).

Mountain Plover

The U.S. Fish and Wildlife Service (Service) proposed listing the mountain plover as threatened in February 1999, without critical habitat, under the authority of the ESA of 1973. The mountain plover is a bird of short-grass prairie and shrub-steppe landscapes at both breeding and wintering locales. The birds winter in southern California. This species has declined by 2.7 percent annually from 1966 through 1996, the highest of all endemic species. Mountain plovers are rarely found near water and use both native rangelands and disturbed areas for nesting and for brood-rearing (USDI-BLM 2002).

North Platte River Species: Least Tern, Pallid Sturgeon, Piping Plover, Whooping Crane, Eskimo Curlew, and Western Prairie Fringed Orchid

The North Platte River species include the endangered Eskimo curlew, interior least tern, pallid sturgeon, whooping crane and the threatened piping plover, bald eagle, and Western prairie fringed orchid. The first five species are downstream residents of the Platte River, the whooping crane is a migrant along the central Platte River in Nebraska, and the bald eagle is a downstream winter resident of the Platte River (FWS July 2001). The bald eagle is also a winter resident of the North Platte River in the Casper Field office to the north-east of the watershed area and has the potential to nest along the North Platte River.

Ute Ladies' Tresses

The Ute ladies' tresses is considered a threatened species under the ESA of 1973. This plant is a perennial, terrestrial orchid. This plant blooms from late July through August; however, depending on location and climatic conditions, orchids may bloom in early July or still be in flower as late as early October. This orchid is endemic to moist soils in mesic or wet meadows near springs, lakes, seeps, and riparian areas within the 100-year flood plain of perennial streams ranging from 4,300-7,000 feet in elevation. It colonizes early successional riparian habitats such as point bars, sand bars, and low laying gravelly, sandy, or cobbly edges, persisting in those areas where the hydrology provides continual dampness in the root zone through the growing season (USDI-BLM 2002).

Western Boreal Toad

The Western boreal toad (boreal toad) is a candidate species under the ESA of 1973. This species is found in riparian areas above 7,500 feet in elevation adjacent to and within the Medicine Bow National Forest (USDI-BLM 2002).

BLM State Sensitive Species:

Many wildlife and plant species are experiencing population declines. The BLM developed a sensitive species list to better manage species and their habitats. There are 26 BLM-state sensitive species that have the potential to occur within this watershed. These species include

seven mammals, twelve birds, three amphibians, and four plants. The BLM state sensitive fish, reptiles, and amphibians that may occur within this watershed are discussed in the Fisheries section. The BLM state sensitive mammals that have the potential to occur in this watershed, or that may migrate and/or travel through the watershed area, include the dwarf shrew, long-eared myotis, fringed myotis, spotted bat, Townsend's big-eared bat, white-tailed prairie dog, Wyoming pocket gopher, Idaho pocket gopher, and swift fox. The BLM state sensitive birds that have the potential to use this area include the white-faced ibis, northern goshawk, ferruginous hawk, peregrine falcon, greater sage-grouse, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and Baird's sparrow. The BLM state sensitive plants that may occur in this watershed, or have the potential to occur in the watershed include the Nelson's milkvetch, cedar rim thistle, persistent sepal yellowcress , and pale blue-eyed grass. With the exception of persistent sepal yellowcress, there have not been any identified populations at this time. However, there is the possibility that these plants may occur in the area. A description of the habitat type that each species is associated with is shown in Graph 1.

Table 3 : BLM State Sensitive Species That May Occur In The Watershed

Mammals		
Common Name	**Scientific Name**	**Habitat Types**
Dwarf shrew	*Sorex nanus*	Mountain-foothill shrub, grasslands
Long-eared myotis	*Myotis evotis*	Conifer and deciduous forests, caves and mines
Fringed myotis	*Myotis thysanodes*	Conifer forest, woodland, caves and mines
Townsend's big-eared bat	*Corynorhinus townsendii*	Forests, basin-prairie shrub, caves and mines
White-tailed prairie dog	*Cynomys leucurus*	Basin-prairie shrub, grasslands
Wyoming pocket gopher	*Thomomys clusius*	Meadows with loose soil
Swift fox	*Vulpes velox*	Grasslands
Birds		
Common Name	**Scientific Name**	**Habitat Types**
White-faced ibis	*Plegadis chihi*	Marshes, wet meadows
Northern goshawk	*Accipiter gentilis*	Conifer and deciduous forests
Ferruginous hawk	*Buteo regalis*	Basin-prairie shrub, grassland, rock outcrops
Peregrine falcon	*Falco peregrinus*	Tall cliffs
Greater sage-grouse	*Centrocercus urophasianus*	Basin-prairie shrub, mountain-foothill shrub
Long-billed curlew	*Numenius americanus*	Grasslands, plains, foothills, wet meadows
Burrowing owl	*Athene cunicularia*	Grasslands, basin-prairie shrub
Sage thrasher	*Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothill shrub
Loggerhead shrike	*Lanius ludovicianus*	Basin-prairie shrub, mountain-foothill shrub
Brewer's sparrow	*Spizella breweri*	Basin-prairie shrub
Sage sparrow	*Amphispiza billineata*	Basin-prairie shrub, mountain-foothill shrub
Baird's sparrow	*Ammodramus bairdii*	Grasslands, weedy fields
Amphibians		
Northern leopard frog	*Rana pipiens*	Beaver ponds, permanent water in plains and foothills
Great basin spadefoot	*Spea intermontana*	Spring seeps, permanent and temporary waters
Boreal toad	*Bufo boreas boreas*	Pond margins, wet meadows, riparian areas
Plants		
Common Name	**Scientific Name**	**Habitat Types**
Nelson's milkvetch	*Astragalus nelsonianus – or- Astragalus pectinatus var. platyphyllus*	Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, cushion plant communities at 5200'-7600'
Cedar rim thistle	*Cirsium aridum*	Barren, chalky hills, gravelly slopes, & fine textured, sandy-shaley draws at 6,700'-7,200'
Persistent sepal yellowcress	*Rorippa calycina*	Riverbanks & shorelines, sandy soils near high water line
Pale blue-eyed grass	*Sisyrinchium pallidum*	Wet meadows, stream banks, roadside ditches, & irrigated meadows at 7,000-7,900'

The objective of the sensitive species designation is to ensure that the BLM considers the overall welfare of these species when undertaking actions on public lands, and do not contribute to the need to list the species under the provisions of the ESA. The lack of demographic, distribution, and habitat requirement information compounds the difficulty of taking management actions for many of these species. It is the intent of the sensitive species policy to emphasize the inventory, planning consideration, management implementation, monitoring, and information exchange for the sensitive species on the list in light of the statutory and administrative priorities (USDI-BLM 2001).

Greater Sage-Grouse

Greater sage-grouse (grouse) are common inhabitants within this watershed (picture 67-1, 67-2). Grouse populations have exhibited long-term declines throughout North America, with a 33% decline over the past 30 to 40 years. No one causal factor has been identified for these declines. Wyoming supports the largest populations of grouse, more than all the other states combined; however, there are population declines occurring in Wyoming as well. Grouse are a sagebrush obligate species and each aspect of their life cycle requires slightly different elements within the sagebrush communities. Grass height and cover play an important role in the nesting success of grouse. Early brood rearing habitats contain relatively open stands of sagebrush with greater than 15 percent canopy cover of grasses and forbs, and contains insects as well. During the summer months, grouse move to more mesic sites seeking succulent forbs. Movements to winter ranges are slow and meandering and occur from late August to December. During the winter months, grouse feed almost exclusively on sagebrush leaves (USDI-BLM 2002).

Winter habitat has been identified for parts of this watershed and will be finalized using GIS. Only certain areas were flown for winter habitat within this watershed for different projects; therefore, there is always the possibility that additional winter habitat areas for greater sage-grouse will be identified in other areas of the watershed unit. Winter habitat must be assessed during very specific time periods and under specific winter conditions.

2) Issues and Key Questions

There are several issues and key questions that have been identified for wildlife species. The major issues that concern wildlife species include the overall health of the ecosystem including both the quality and quantity of a diversity of habitat types that species depend on throughout their life cycles; the availability of these habitat types for wildlife species; and existing and potential disturbance of these habitat types to wildlife species. Priority wildlife habitats include riparian grassland, willow-waterbirch riparian, aspen and cottonwood woodlands, and wet forested meadow areas; in addition to open aquatic; sagebrush-grass communities, mountain shrub, saltbush steppe, conifer forest, and rockland areas (USDI-BLM 1990). Habitat diversity includes vegetation cover types and age distribution, as well as the need for disturbance-such as fire, disease, and/or climatic change. Factors that affect the availability of these habitat types for wildlife include livestock management, oil and gas development, and inter- and intra-species competition for available forage and associated diet overlap. Existing and potential disturbances to wildlife species include impacts to priority habitats from fencing, water development projects, vegetative treatments, and livestock/wild horse use; disturbance to individual life cycles from human activity, including oil and gas development and associated facilities - such as pipelines, utility corridors, roads, recreation activities, OHV use, and noise. The following describes issues and key questions that pertain to specific wildlife and impacts that may occur as a result of activities occurring.

Species of Interest and Concern

Antelope

Issues that relate to antelope across the watershed include fence impacts upon animal movement, and other livestock management practices relating to water developments and type/season of use by livestock. These will be discussed for all herd areas at one time. Issues that affect antelope which are more specific to particular herd areas (and will be discussed by herd area) include oil and gas development, vegetation treatments, wild horses, and the development of private land within checkerboard areas.

There are over 1,000 miles of fencing in the assessment area, most of which were constructed prior to standards being created to reduce impacts on wildlife. Since the predominant livestock use in this area was by sheep, approximately half of old style fences are woven wire with one or two strands of barbed wire on top. Antelope prefer to pass under or through a fence, however adult animals will jump over them at times. Woven wire fences prevent passage under or through them, forcing antelope (particularly young) to find low spots such as gully crossings where they can get under the fence. During severe winter conditions, antelope have to expend additional time and energy to get through fences while migrating which may reduce their chance for survival, or they may get stuck in fence corners where they are likely to die. During the 1983-1984 severe winter, almost all dead antelope immediately north of Interstate-80 were found within allotments where fences were constructed of woven-wire (Alldredge and Deblinger, 1988). Old fences built to control cattle were made with four to six strands of barbed wire. Although the bottom strands are lower than the height recommended in BLMs fencing standards, antelope can often pass through these fences or find low spots to go underneath them. Modifications need to be made to sheep style (woven wire) fences in particular to reduce the impacts to antelope migrating between spring/summer/fall and winter ranges (pictures 68-1, 68-2). Although a few spots have been modified to BLM fencing standards to assist antelope in moving through fences, much more needs to be done. In some cases, just installing gates in corners that would be left open during the winter would help a lot. Since not all of this work can be done at once, what locations should have the highest priority to be modified initially and in future years? How can we accomplish the modification of a significant amount of fence each year to resolve this issue in a reasonable amount of time?

Livestock management practices primarily relate to water, both in terms of new developments and their management, as well as protection of natural seeps and streams. When new water sources are developed, which are usually for summer cattle use, antelope and other wildlife will use them and depend upon them, especially during times of drought. However, if these water developments are wells, they may be turned off or the generator moved to a different location when the cattle are moved and the wildlife must look for water elsewhere. There have been incidents where antelope get stuck in certain pastures due to woven wire fences and can't move to new locations when the water they were using is no longer available. How can these situations be avoided? Are there certain times or locations when water should remain available, either through continuing to pump water or development of other sources? In other situations, water developments have been created for wildlife, such as guzzlers or other projects. These are often developed and maintained by individuals working for state for federal agencies, which often are not taken care of when these individuals retire or move to other jobs. How can this situation be rectified to maintain the use of these facilities for the long-term benefit of antelope and other wildlife? About 90% of all livestock use is made by cattle, which have a low overlap in diet similarities with antelope. However, cattle can have a significant impact on riparian habitat that is important to antelope. Through the use of riparian pastures or exclosures, these areas are

managed or protected from a livestock perspective, but from a wildlife viewpoint, what mix of vegetative species and structure should be promoted and what form of management will it take to achieve this?

Baggs Antelope Herd Unit: Coalbed methane development is proposed in the area from Atlantic Rim just south of Rawlins to Muddy Mountain just north of Baggs and Dixon, Wyoming. Initial efforts consist of 200 exploratory wells to gather information, with full field development reaching as many as 2,000 wells. In addition to the wells, ancillary facilities will include compressor stations, service roads, and pipelines which may affect antelope. Although the majority of this development would occur outside crucial winter ranges, these adjoining lands which are often referred to as transitional range, are very important in supporting animal use and taking pressure off of the crucial winter range. What affects will coalbed methane development have on antelope transitional ranges and what long-term indirect affects will occur to antelope crucial winter range?

There has been approximately 6,000-7,000 acres of prescribed burns that have occurred in the Fillmore allotment over the past ten years and 2,200 acres of chemical (tebuthiuron) thinning of sagebrush as well. Additional vegetative treatments in this allotment and adjoining allotments are being planned. The principle plant community being affected by prescribed burns have been mature to decadent stands of basin big sagebrush, with smaller areas of mountain and Wyoming big sagebrush, aspen and mountain shrubs. Chemical treatments are directed primarily at stands of Wyoming big sagebrush which have lower fuels to support burning and in an attempt to reduce the affect upon greater sage-grouse by thinning rather than removing all of the sagebrush. A ten year cooperative research study between the BLM and the WGFD on the nearby Grizzly allotment is almost completed that compares the impacts of both prescribed burning and chemical applications to sagebrush communities and the wildlife that use them. However, all shrub treatments should be monitored as closely as possible to document the change in habitat conditions and effect on antelope and other wildlife species. What are the cumulative impacts to antelope as a result of implementing vegetative treatments in addition to coal bed methane and natural gas development in these areas?

Bitter Creek Antelope Herd Unit: Deep gas well drilling continues to expand throughout the herd unit. In the Echo Springs area the spacing of gas wells is changing from 160 acre spacing down to 80 acre spacing, with increased disturbance due to roads, pads, pipelines and other facilities. Seismic projects are also occurring within the herd unit. These projects reduce the habitat available and cause temporary displacement of animals and may create disturbance within the herd unit. The road networks also increase the use of this area by recreationists and other people. Gas field development has led to additional water sources being created which change the distribution and seasonal use patterns of antelope in this area. In many cases the affect of these water sources may be beneficial, however, are antelope now staying longer in these areas and what impacts are there on the rangeland as a result? And what are the cumulative impacts to antelope as a result of the expanding natural gas development within this herd unit area?

Red Desert Antelope Herd Unit: A survey completed in 2001 found large numbers of antelope north of traditional winter range in Area 60, and it may be necessary to modify the crucial winter range boundaries in this area. Habitat losses have occurred due to oil and gas development. Increased drilling and development of hundreds of natural gas wells in the southwestern third of the herd unit could impact crucial winter habitat. Major portions of the southern part of this herd unit are underlain by coal seams that have the potential to be developed for coalbed methane. Impacts from the Amoco CO2 injection project in Bairoil, Wyoming in the crucial winter range

have been localized in already disturbed habitats and do not appear to have a significant impact. A proposal to haul ore from an underground uranium mine on the south side of Green Mountain to the inactive Union 76 mill would have a minor affect on antelope summer habitat, but could negatively affect antelope migrations if not properly mitigated. What are the impacts on this herd from natural gas development and associated roads, pipelines, and reserve pits? What effects will occur if and when coalbed methane development occurs within this watershed?

Nearly 100,000 acres of private land in the checkerboard area north and west of Rawlins has been sold in forty acre tracts, primarily to out of state owners who want to "own a piece of the West". Although development of these lands is slow, portions of crucial winter range are being affected as buildings and fences are constructed, access to water is changed, and domestic animals and pets are brought in to native environments. Increased development of these lands, particularly as more fencing is constructed, could seriously degrade the quality and utility of antelope crucial winter range, and can impact migration corridors. While Carbon County does have a land use plan, which promotes maintaining open range and habitat for wildlife, the other neighboring counties have no similar plans and the rights of private landowners to do as they please with their lands creates a real dilemma for public land managers in these checkerboard areas. How much further development will occur in the future and what types of mitigation, if any, will be effective and pursued? Could land exchanges or other methods be supported to block up private lands for development that would maintain open spaces on public lands and protect crucial wildlife habitats?

There is some concern with the wild horse management, including population levels, their impact on riparian habitat, and indirect competition between wild horses and antelope. Prior to 2001 wild horse populations had been two to three times higher than the appropriate management level (AML). The principle concern has been with the wild horse use and competition around scarce water sources and the condition of riparian habitat and wetlands that are important in supporting antelope does and fawns. Will wild horse populations be maintained at the AML? Is this AML the right number of wild horses to manage for in conjunction with wildlife, livestock use, and other resource values? What management changes will be made to reduce existing conflicts between antelope and wild horses?

South Ferris Antelope Herd Unit: The CBM development on the west side of Seminoe Reservoir will affect antelope through the loss of habitat due to road, well pad, facility, and pipeline construction in the eastern portion of this herd unit. Full development of methane wells along the coal beds could have serious impacts on crucial winter ranges from both habitat loss and disturbance. When development occurs, AUMs are removed for both wildlife and livestock, which could result in additional inter-specific competition. What short and long-term impacts will CBM development have on antelope herds within this unit area?

A conversion from sheep to cattle on the Stone Ranch should reduce forage competition for antelope on a year-round basis, and particularly during winter months. Without the need for woven wire fencing, modifications in key locations initially and across a large part of the ranch long-term will remove barriers to antelope movement and increase animal survival. Best management practices for cattle use will be implemented, but what vegetative objectives should be incorporated into the grazing plan that would most benefit wildlife?

North Ferris Antelope Herd Unit: This herd unit is primarily influenced by fencing and livestock management issues that are discussed under the general heading of antelope.

Elk

The major issues affecting elk are fence impacts on animal movement, competition with cattle for forage, reduced health and productivity of forest and shrublands due to the lack of natural fire, and increased human activities and disturbance to elk from oil and gas development and recreation. Fencing and competition with cattle are issues common to all three herd units and are discussed together. Topics of concern that are not common to all herd units are discussed for each individual herd unit.

Elk movement is affected by fences, and vice versa, much differently than with antelope. Elk, being considerably larger, will generally jump over fences. However, young elk will have to pass under or through fences for a time and can get stuck behind a fence they can't get through or get a leg caught while attempting to jump a fence. Woven wire fences constructed for sheep present problems for very young elk, but these fences were usually not over 40 inches tall and can be jumped over fairly easily. Old style fences built for cattle may be 50 to 55 inches tall and present considerable problems for both young and adult elk. Elk which summer on the national forest or the Ferris and Seminoe Mountains may not have many fences to pass over until they migrate in the spring and fall to and from the winter range. The Shamrock elk herd stays in sagebrush habitat year-round in country with more fences, but does not migrate or move around typically as far as the other two elk herds. Fence locations requiring annual maintenance due to big game movement are good indicators of where fence modifications should occur to reduce both the cost of maintenance and the impact to big game species. How can a program be implemented to modify fences where needed in the short-term, and correct all fences to meet BLM standards in the long-term?

Competition for forage between elk and cattle occurs to some degree. The percent diet overlap is around 80% for these two species. The fact that all three elk herds are above herd population objectives would indicate that current levels of livestock use is not affecting elk numbers. In terms of there being available forage for use by both types of animals, this is probably true, but distribution of livestock use will affect where forage is left and where elk have to move in order to find forage. Two cases of this happening are the Ferris elk herd using the Beef Acre area as well as private hay meadows and the Baggs elk herd using the Fillmore Creek drainage and Red Rim area. Water development and improved riparian and upland range conditions are also affecting elk distribution and how long they stay in a particular area. Should more attention be paid to these changes in elk distribution and use patterns, and how does this reflect back on the management of cattle or other activities in these areas?

Ferris Elk Herd Unit: The health of shrub and woodland communities on the Ferris and Seminoe Mountains is a key issue affecting the Ferris elk herd. Due to wildfire suppression and the lack of prescribed burns, there is increasing decadence, disease, insect infestations, and dominance by late successional species in these communities. They provide important cover as well as forage for elk and a large wildfire could have serious affects upon this elk herd. However, change is needed to provide elk and other wildlife with the diverse and productive habitat to support them. A plan to address these issues has been "in the works" for the past ten years, but is still not completed. What steps need to be taken, what support is needed, in order to restore healthy and diverse shrub and woodland communities in this herd unit?

Shamrock Elk Herd Unit: Conventional natural gas development has occurred for many years on the west side of this herd unit, and is expanding around Wamsutter and east to the Continental Divide. Elk have been using the undeveloped Five-mile Draw area, but development is occurring

here as well. Elk use areas with lower road density and human activity, and rapid increases in road densities are reducing the size of elk security areas. Elk may permanently migrate west out of this area. Although coalbed methane development has not occurred in the area, there are shallow coal seams that underlie much of the elk habitat. This area overlaps the portion of the Red Desert Antelope Herd Unit where development of private lands within the checkerboard area is increasing. With nearly 100,000 acres of private lands sold this will eventually affect elk using this area. Results will likely include an increase in density of roads, buildings, fences and human activity. What will be the cumulative affects on elk herds from natural gas development and will these affects decrease after full field development occurs? What future impacts will occur to elk as development of private lands occurs? What value will the intermingled sections of public land still retain as wildlife habitat?

Sierra Madre Elk Herd Unit: Coalbed methane is in the initial stages of development on the west side of Atlantic Rim. Compressor stations, service roads, and pipelines associated with this development will increase access and may create disturbance to wildlife. Elk, of all of the big game species, have the lowest tolerance for disturbance and studies show them staying a mile or more away from roads with frequent human activity. The level of disturbance to elk will depend on the number of wells developed, their location and associated roads. Winter and transitional ranges may be affected, since in the past most of this area is inaccessible due to drifting snow . The west side of this herd unit along highway 789 is also experiencing increased development for natural gas. The roads associated with this development increase the human presence in these areas, both by the commercial industry and by recreationists throughout the year. What will be the cumulative affect of developing coalbed methane and conventional natural gas resourceson elk within this herd unit? What mitigative measures can be implemented up front that will reduce the affect of this development upon this elk herd?

Mule Deer

The issues that relate to mule deer include fence impacts on animal movement, livestock management practices, health of shrub and woodland habitats, natural gas and coalbed methane field activities, and development of private lands in the checkerboard area. The affect of fences upon mule deer are similar to those described for elk. Mule deer will typically jump over fences, with concerns relating to fence height and the spacing of the top two wires. Young deer may have to pass under or through fences, so that woven wire fences raise the greatest concerns. The affect of development of natural gas resources and private lands are similar to those described for antelope.

Livestock management practices that have the greatest effect on mule deer are fencing (already discussed), type of livestock use (cattle versus sheep), and management impacts to mule deer habitat, particularly riparian plant communities. Sheep diets are very similar to mule deer and antelope, so competition for forage can be an important factor. However, current use levels by sheep only make up ten percent of all livestock use, compared to the inverse of that 100 years ago. Use by cattle and mule deer primarily overlap in riparian habitat. Spring through fall use of riparian habitat by cattle has degraded the value of these sites for mule deer use, especially the woody plants which are important as forage and cover. Use of best management practices for cattle has improved many of these areas. However, how can these BMPs become the standard operating procedure so that these kind of issues are no longer present?

Ferris Mule Deer Herd Unit: The species composition and decadence of the forest and shrub communities on and around Ferris and Seminoe Mountains are the principle management issues.

In using fire or other types of vegetative treatments to alter this condition, what mix of species and habitats would most benefit mule deer? Are these similar or different from what would benefit antelope, elk and bighorn sheep? Most of the coalbed methane wells currently proposed along the Coal Creek drainage lie outside of crucial winter habitats, but these same coal seams extend under winter range and may impact this herd in the future. There is the potential for future coalbed methane development to occur in this area. Increased traffic and construction of pipelines to transport methane may also have affects on crucial winter ranges along the North Platte River. How can the potential impacts of this development be mitigated to reduce the affect on mule deer?

Chain Lakes Mule Deer Herd Unit: Since the majority of mule deer inhabit the more rugged country along the Rawlins Uplift and Lost Soldier Rim, the principle impact to these areas would be by development of the private lands in the checkerboard area and recreational use. In this area there are currently no large impacts occurring. No crucial habitats have been identified in this herd unit, since observations have been sporadic due to the small herd size. Fences are not as big of a concern in this area because the mule deer are more localized and are located on yearlong range; therefore, movements are not as great, but it is still an issue. What type of education program to private landowners could be implemented to reduce impacts to mule deer as private lands are developed?

Baggs Mule Deer Herd Unit: Coalbed methane development is already described for this area under the Baggs Antelope Herd Area and the Sierra Madre Elk Herd Area. Mule deer are probably somewhere between antelope and elk in terms of their tolerance to disturbance.

Bighorn Sheep

Ferris-Seminoe Bighorn Sheep Herd Unit: The main issue affecting bighorn sheep are poor forage quality and lack of open habitat throughout their range. This is a result of natural forest succession, conifer encroachment into open spaces, and the suppression of wildfires. Studies conducted on Ferris Mountain have shown that ewes give birth to healthy lambs, but survival of these lambs beyond July is very low. Insufficient high quality forage, competition for forage with elk, and predation are believed to be the principle factors affecting lamb survival. Another issue is the potential for disease transmission between domestic and wild sheep. The conversion of the Stone Ranch livestock operation from sheep to cattle eliminates the chance of this occurring within the herd unit boundary. However, the sheep use still authorized in the Whiskey Peak allotment by the Lander BLM on the west border will continue to pose a health risk to this herd. Fences do cause some problems to bighorn sheep and there have been some deaths, specifically to rams, as a result of fences. Water availability next to summer forage areas is also a concern (personal interview with Greg Hiatt, Wyoming Game and Fish Department). When will the Ferris Mountains Ecosystem Management Plan be finalized and implemented? What type of schedule will the authorized actions follow to improve habitat for bighorn sheep?

Raptors:

Raptors are primarily affected by the abundance of their prey species, which will fluctuate annually as a result of habitat and climate conditions. Factors that influence habitat condition and availability include the impacts that may occur from oil and natural gas development, recreation (falconry practices), subdivision development, and livestock management (condition of habitat for food base). What types of impacts are affecting raptors and what types of mitigation can be implemented to reduce and or eliminate these impacts?

T& E Species:

The issues are closely associated with the health and diversity of habitat types. In general, the healthier an ecosystem is then the T&E species, and BLM-State Sensitive Species tend to thrive and do better.

The only issue relating to bald eagles in this watershed center around the health of riparian vegetation, specifically the health and vigor of cottonwood trees along the North Platte River system. Livestock may affect tree health and vigor along the river system if there is excessive rubbing and browsing that can damage young trees. Beaver will cut down cottonwood trees to eat and build dams with. Lack of high flow events, particularly in stretches of the river where flows are controlled through dam releases, reduces the regeneration of young cottonwood trees. What areas on public lands are being used by bald eagles, is there nesting activity and if so, how successful are they? What types of impacts are attributable to cattle and what actions can be implemented to reduce and or eliminate them?

The only issue relating to black-footed ferrets would be potential impacts to white-tailed prairie dog towns (the major food base and habitat for black-footed ferret) that may occur as a result of natural gas development, coalbed methane development, recreation activities and subdivision development. In general, livestock management should not impact potential black-footed ferret habitat. Where are impacts to white-tailed prairie dog towns occurring? What affects has plague had on prairie dog populations?

There are not any current issues that affect the blowout penstemon plant species since this species actually prefers disturbed areas. What further inventory is needed for this plant species and what monitoring is needed to determine the long-term population trends of the blowout penstemon?

There should not be any management issues with the Canada lynx since this species only use the riparian habitats between ranges during dispersal and it would be unlikely that this species would be traveling through the watershed, although this may occur. There should not be any impacts to this species as a result of implementing actions within the watershed.

There are not any major issues concerning mountain plovers that occur within the watershed area. Mountain plover prefer short-grass systems, where livestock grazing is actually advantageous for this species. Livestock have the potential to step on nests and/or eggs, but this would be by chance and plover are birds that may have double clutches. Where are the known mountain plover occupied habitat areas located, what are the vegetative (or other) criteria that define habitat used by these birds, and what is the reproductive success of these birds using this area?

The North Platte River threatened and endangered species utilize habitat located in Nebraska along the North Platte River. Factors which may affect these species relate to water depletions in the North Platte River system as a result of implementing proposed projects. A proposed project that may result in a water depletion, including evaporative losses, triggers a “may affect” situation and requires a biological assessment to be prepared. Formal consultation with the U.S. Fish and Wildlife Service is required. How many projects within this watershed that have been determined to cause a water depletion to the North Platte River system and have these depletions had any affect on local populations?

Ute ladies' tresses is a plant that is located in riparian habitats. This plant is listed as a threatened species and may be impacted by livestock grazing, but grazing may not cause irreversible impacts to the species. It is considered a "take" only if the entire plant, roots and all, are removed, and grazing does not do this. What locations are most likely to support this plant in order to inventory and determine if it even exists in this watershed? If populations are found then further steps in analyzing current and future management practices would occur.

The Western boreal toad may occur in riparian habitats within the Ferris Mountain ecosystem, but to date the species has not actually been located in this area. Projects that occur in riparian habitats above 7,500 feet should be assessed for boreal toads. If the toad is found, what protection measures, if required, will be implemented to protect the species?

BLM State Sensitive Species:

There are seven mammals, twelve birds, three amphibians, and four plants that have been identified as BLM state sensitive species and may occur, or have the potential to occur, within this watershed area. The main key issues include the lack of information concerning exact locations of most of these species and the affects that authorized actions may have on these species. Monitoring has occurred, and will continue to occur, throughout the watershed area for the greater sage-grouse. There are numerous questions concerning this species - for example, what affects do vegetation treatments (prescribed burns, chemical treatments), grazing management, natural gas development, recreation activities, private land development and roads have on these species? What affects do management practices have on other sensitive species located within the watershed? How much information should be obtained concerning specific species before land management actions are implemented?

Greater Sage-Grouse

Approximate 133 greater sage-grouse leks and associated nesting habitat occurs within this watershed (picture 75-1). Habitat changes within portions of the watershed have been significant. Drought reduces the amount and height of vegetative cover, which may lead to lower nesting success and chick survival for the next year. Drought also affects the production of understory forbs, which may have negative impacts to early brood-rearing, specifically from April through June, which is their critical time period. Water sources placed in the uplands may increase cattle use in areas that grouse use for nesting (picture 75-2). This may affect grouse nesting success and survival of chicks by further reducing herbaceous cover. Wild horse population numbers have increased and are expected to shift their use into the uplands as well, further increasing forage use in sage grouse habitat. Livestock and wild horse use of riparian habitats has led to degradation of species, vigor and cover that is important to late season brood-rearing by sage grouse. What levels and seasons of use by livestock and wild horses in upland and riparian habitat are appropriate in conjunction with the needs of sage grouse and other wildlife? Natural gas activity continues to expand and although seasonal stipulations on BLM-administered land provides some protection to grouse strutting activities, there is no protection on private or state lands for protection during the strutting and nesting time periods. Habitat loss from mineral development and subdivision activities continues (WGFD 2002d). Large scale sagebrush treatments may cause negative impacts if located in nesting habitat, but smaller scale sagebrush habitat conversions (less than 200 acres in size) may actually cause beneficial impacts to nesting grouse. Fences constructed next to strutting grounds may also cause negative impacts to grouse by becoming perches for raptors or obstructions to fly into. What are the cumulative impacts to greater sage-grouse as a result of authorizing actions including natural gas development, livestock

management and associated projects (water development, fences, habitat treatments), recreation activities, and the wild horse management program? What educational programs can BLM become involved in with private landowners to reduce and or eliminate impacts to grouse within and adjacent to private parcels?

3) Current Conditions:

The following describes the current conditions of wildlife populations and their habitat for those species that inhabit the watershed, or have the potential to use habitats within the watershed.

Species of Interest or Concern:

Antelope

Baggs Antelope Herd Unit: The postseason population model estimates about 7,000 antelope, compared to the population objective of 9,000 antelope. This objective was raised from 7,100 animals in 1994, and has yet to reach the objective. The 2001-2002 winter and summer were drier and warmer in Baggs compared to the 1979-2000 20-year average. Although winter survival was good due to these conditions, forage production of shrubs and forbs, both important to antelope, was well below normal in low elevation areas. The 2001 fawn:doe ratio (45:100) is about the same as the five-year average, while the buck:doe ratio was well above the five-year average.

Bitter Creek Antelope Herd Unit: The population objective for this herd was raised from 11,000 to 25,000 antelope, established in 1994. The current population has remained static at about 12,000-14,000 antelope (WGFD 2002b). Climate conditions have been similar to the Baggs Herd Unit, but become even drier the further west you travel. While the Rock Springs area has experienced three to four years of drought, the Rawlins area has just been dry since 2002. The lack of precipitation results in both reduced forage production and quality, as well as water availability in natural seeps and reservoirs. This herd unit and the Red Desert Herd Unit have historically been used by livestock in the winter where they can subsist on snow, so there are fewer reliable water sources and no foothills or mountains with wetter conditions that animals can move to.

Red Desert Antelope Herd Unit: A population objective of 15,000 antelope was proposed and adopted for this herd following public review in 1994. The public is supportive of increasing antelope densities in this herd, except for landowner concerns over higher antelope densities in the checkerboard lands in the southeast corner of Area 61. In addition, this herd is managed to maintain buck:doe ratios above 60:100. The fawn production has declined to 50 fawns:100 does, the lowest in six years, and below the five-year average of 56:100. Fawn production was lowest in Area 60 (38:100), and was also poor in Area 61 (41:100) with the lowest fawn:doe ratio recorded in at least 30 years. Area 64 had the highest fawn:doe ratio (75:100). Poor fawn production is attributed to drought conditions and winter stress on pregnant does during the 2000-2001 winter. Buck:doe ratios declined in all three areas. Yearling buck:doe ratios also dropped in all three areas. Summer precipitation was well below average according to weather data from Muddy Gap and Wamsutter, Wyoming. Maximum temperatures during the summer were more than three-four degrees above average, average minimum temperatures were also above normal. The combination of low precipitation and high temperatures likely affected fawn survival. The

WGFD population model suggests that the antelope herd is about 10 percent below objective size (WGFD 2002a).

South Ferris Antelope Herd Unit: A post-hunt population objective of 6500 antelope was adopted in May 1984 and retained following public review in 1988 and 1994. The herd was near or above objective size prior to the severe 1992-1993 winter, when high losses reduced the herd below objective. Poor fawn production has hindered recovery. The WGFD model indicates losses during the 2000-2001 winter reduced the herd by about 10 percent, and predicts that these losses, combined with poor fawn production in 2001, left the population about 20 percent below objective. The fawn production has declined, and was likely due to summer drought and nutritional stresses on pregnant does during the 2000-2001 winter. The adult buck:doe ratio increased, but the yearling buck:doe ratio decreased. Precipitation in the area was 36 percent below the 30 year average. Maximum and minimum temperatures were above average as well. Low precipitation during the winter and spring months is expected to affect forage production, which may reduce fawn production (WGFD 2002a).

North Ferris Antelope Herd Unit: This herd has been well below the objective of 5,000 antelope since 1986 because of large harvests in 1987 and 1988, heavy losses during the 1992-1993 winter, and unusually poor fawn production in six of the past ten years. Fawn production has improved in the past four years, but the WGFD model estimates the population at just over half of the objective size. The WHGF models shows that the herd size has decreased steadily from 1993 through 1997 as a result of poor fawn production, and although there was some growth in 1998 and 1999, there were losses in the 2000 and 2001 winter. The fawn:doe ratio increased in 2001, the highest ratio recorded in he past 18 years. The yearling buck:doe ration declined, while the buck:doe ratio improved slightly. The 2001 weather conditions were severe compared to other years. Precipitation in the last several years has been below average. Maximum and minimum temperatures were higher than the norm for the past several summers. The fawn production did not drop in 2001, despite higher temperatures and drier weather patterns. The antelope in this herd are in fair to good physical condition. Low precipitation may affect fawn production in the area, especially since the drought is expected to occur (WGFD 2002a).

Elk

Ferris Elk Herd Unit: A population objective of 350 elk was adopted in 1977 and retained following three subsequent public reviews. This herd was designated for special management in 1988. There was a dramatic increase in 1995 and the herd was estimated at 80% above objective. The herd was almost 30% above objective in 2001. The present drought has had an effect on calf production (WGFD 2002a). However, forage production in most areas is still good, and the creeks and water developments allow elk to use habitat on and away from the mountains. The aging of shrub and woodland plant communities and loss of aspen habitat to conifers due to the lack of wildfires or vegetative treatments is the principle negative factor influencing this herd unit.

Shamrock Elk Herd Unit: The population objective of 75 elk was adopted in 1984 and retained in 1988 and 1994. It is difficult to estimate the numbers in this herd due to movement within three concentration areas of this herd unit and animal movement between adjacent herd units. A trend count in 1998 showed a count of 254 elk. Summer precipitation in 2001 was well below average, while minimum and maximum temperatures have been above normal. These temperatures along with low precipitation may affect calf survival (WGFD 2002a). This herd unit is primarily within a checkerboard land pattern and some landowners minimize hunting on

their lands. Coupled with the difficulty in finding elk in the gently rolling sagebrush terrain has led to growth in their population. Although this is a desert herd unit with the driest conditions, there has also been substantial nonuse by livestock operators in response to the drought that has benefited elk.

Sierra Madre Elk Herd Unit: The herd has been above population objective since the mid-1980s, with post-season populations of nearly 8,000 animals. Adjustments in annual harvests by hunters have lowered elk populations to around 6,500 animals and closer to the objective of 4,200 animals (WGFD 2002b). This herd unit is probably the most productive of the three described. The National Forest and surrounding foothills have been less affected by drought than areas to the west, north and east. There is generally good distribution of reliable water sources between streams and man-made developments. Over the last fifty years there have been many vegetation treatments on public, private and state lands to promote more grass and forbs for cattle, which also benefits elk. Removal of 600 head of wild horses in 1986 from this herd unit also benefited elk, particularly on their winter range, due to the high diet overlap between these two species. Improvements in livestock management with adoption of BMPs has improved range conditions that benefit elk. All of these factors are reflected in both the productivity of this herd and their expansion of use into areas further away from the forest.

Mule Deer

Ferris Mule Deer Herd Unit: This herd has not been near the objective size of 5,000 deer since 1990. Poor fawn production in 1991 and 1992, coupled with heavy losses in the 1992-1993 winter, reduced the herd to less than half of the objective size. Fawn production did not return to normal until 1998. The population is estimated at less than half the objective size, despite nine years of conservative harvests. Fawn production did improve in 2001 with 67 fawns:100 does. The drought has continued through 2001, and the increased fawn survival is probably from spring snowmelt. Low precipitation during the winter and spring months may reduce fawn survival (WGFD 2002a). Condition of riparian habitat and the aging of shrub and woodland communities are the principle factors affecting mule deer in this herd unit.

Chain Lakes Mule Deer Herd Unit: The population objective was increased to 500 deer in 1994, which was the estimated herd size prior to heavy losses during the 1992-1993 winter. The combination of low precipitation and high temperatures likely affected fawn survival, producing a smaller than normal fawn crop (WGFD 2002a). This herd unit is small in terms of deer population due to available habitat. Mule deer primarily inhabit those areas where forage and adequate cover occurs, which is along the uplifts that run from Rawlins north to Green Mountain. Water is also limiting in many locations. A high percentage of the deer in this herd unit are found in or adjacent to the city of Rawlins.

Baggs Mule Deer Herd Unit: The population objective for this herd unit is 17,800 mule deer, which has been one of the few herd units in the State of Wyoming to be at objective levels in recent years. The 2002 population model showed about 21,000 deer postseason, and it may have been as high as 27,000 in 1987. Winter conditions have been mild the last couple of years. However, these have been offset by dry summer conditions, which has lowered forage production and quality, especially at lower elevations. On the other hand, implementation of grazing BMPs has led to improvement of riparian habitat and condition that benefits mule deer. Water developments also aid deer in surviving dry periods. Vegetation treatments have increased grass and forb diversity and production. Mule deer seek out treated areas close to cover, particularly

during green-up. The condition of crucial winter range around Baggs is the principle limiting factor to this deer herd in terms of habitat.

Bighorn Sheep

*Ferris-Seminoe Bighorn Sheep Herd Unit:*There are approximately ten to twenty bighorn sheep that reside within the Ferris-Seminoe ecosystem. These sheep may be moving between this area and adjacent mountain ranges. At this time, there is no hunting permitted by the Wyoming Game and Fish Department

Raptors

The raptors previously listed all nest and forage within the watershed. Bald and golden eagles often stay year-long, while other species migrate to warmer climates. The rough-legged hawk spends the winter in the watershed and migrates further north to nest. Prey species are common, with their abundance varying year to year due to climate. Monitoring occurs in some areas of the watershed to determine nest activity and status where broad scale oil and gas activity occurs. In other locations, timing stipulations to avoid disturbance during nesting seasons are used on a project specific basis. Nest sites are for the most point natural, however, artificial nests are used to mitigate conflicts between human activities and nest locations by ferruginous hawks and golden eagles.

Threatened, Endangered, Proposed, and Candidate Species:

The following paragraphs describe the current status of threatened, endangered, proposed, and candidate species that may occur, or have the potential to occur within this watershed. Species may use portions of the watershed during their entire life cycle or portions of their life cycle.

Bald Eagle

Although there are known bald eagle nests located along the North Platte River drainage, at this time, the actual number of new nests that may occur within the watershed have not been updated. Most of the bald eagle nests are located further north in the Casper Field Office area. Winter habitat has not been identified in the RFO area.

Black-footed Ferret

There are white-tailed prairie dog towns located within this watershed and many of these towns are active. At this time, an actual map of all of these towns has not been completed and surveys would be needed to refine any map that is prepared. Although prairie dog towns are located within this watershed, and some have the potential to support black-footed ferrets, no known black-footed ferrets have been recently identified within the watershed area.

Blowout Penstemon

There are identified areas to the south-east and east of Ferris Mountains that contain populations of blowout penstemon. Continued monitoring of this plant species will occur to determine the extent of the populations.

Canada Lynx

Although it is highly unlikely that lynx will reside within this watershed, they may travel through the watershed, specifically using riparian habitats. Lynx are very secretive and are difficult to monitor; therefore, numbers of lynx are hard to obtain.

Mountain Plover

Mountain plovers occur in this watershed and have the tendency to return to the same areas each year. Known locations are around Wamsutter and on the north side of the Ferris Mountains. However, large amounts of suitable habitat are available across the watershed, and sightings have usually been associated with clearances for natural gas development or projects. Occupied habitat is defined as two or more observations of mountain plovers within two miles of each other during one breeding season of any of the following: territorial adults, nests, adult distraction displays, and/or broods. Mountain plover have been observed in this watershed during the reproductive period between mid-April through mid-July.

North Platte River Species: Least Tern, Pallid Sturgeon, Piping Plover, Whooping Crane, Eskimo Curlew, and Western Prairie Fringed Orchid

The North Platte River species include the endangered Eskimo curlew, interior least tern, pallid sturgeon, whooping crane and the threatened piping plover, bald eagle, and Western prairie fringed orchid. Although these other species are not located within the watershed, other than the bald eagle, any proposed projects leading to a water depletion within the North Platte River ecosystem must evaluate impacts to these downstream species.

Ute Ladies' Tresses

Although the Ute ladies' tresses has not been identified to exist in this watershed, it has the potential to occur and the Service has concluded that it may occur in this area.

Western Boreal Toad

Since the Medicine Bow Forest is located to the southeast of the watershed, there is potential for the boreal toad to be found in riparian areas on Ferris Mountain. After consulting informally with Dr. Baxter, an expert on the boreal toad, he stated that there is always the possibility that this toad could be found within the Ferris Mountains in riparian areas at or above 7,500 feet in elevation.

BLM State Sensitive Species:

All of the BLM-state sensitive species have the potential to occur within this watershed. There are known nests for ferruginous hawks, and burrowing owls have been observed with some nesting habitat identified. Greater sage-grouse leks are monitored throughout the watershed by the WGFD and the BLM wildlife biologists from March through mid-May each year to determine activity status of each lek. Populations of greater sage-grouse are declining across the West and in Wyoming, however, the actual cause(s) for this decline is unknown. Less is known of other BLM-sensitive state species; however, the habitats for these species is present and inventory or monitoring should occur to determine abundance and habitat use in the future.

4) Reference Conditions:

There are several historical accounts that have described wildlife species that were present within the watershed area during different eras. The following are descriptions that were recorded by homesteaders and explorers that traversed or lived in the watershed in historic times. Immediately following are historical descriptions of the area that were written by Ruth Beebe, whose father came from West Virginia and settled in the Sweetwater area in 1880. The people she talked about describe some of the wildlife that were present:

> This is about Morris Waln and Charles Strong in 1888. The two men were actually murdered while on a hunting trip. The party started to the Sweetwater Mountains in Wyoming, to hunt bear…when Mr. Waln shot an animal-antelope, wildcat, bear, or coyote, he would cut off the ears, tail, or paws, and nail them to the mess box.
>
> Mrs. Boney Earnest (Canzada Brantly, also known as Martha Earnest) lived with her husband on Pick Ranch, located on Canyon Creek, close to both the Sweetwater and Platte Rivers…one of the most interesting sights Mrs. Earnest told about in the early west, was seeing buffalo herds containing no less than 60,000 head, which took ten hours in passing. Mr. Earnest was with the party who shot the last wild buffalo ever seen in central Wyoming.
>
> Mr. Bothwell settled on a large, level plain at the mouth of Horse Creek…He had a large woven wire fence around a pen where he kept ferocious grey wolves, for pets…the neighbors said in hearing their howls, and carryings on, all the outside wolves would gather near his place.
>
> There was a bear hunt at Split Rock on Ed McKinney's and August Lankin's ranches.
>
> The Sun family, including Tom Sun, was one of the earliest families to settle in the area. They began to take up land in the form of desert claims and had a water wheel at Cherry Creek…they have added many more ranches to their vast holdings…Bar Eleven Ranch on Peet's Creek (Pete Creek)…Turkey Track Ranch…66 Ranch from N.D. Bucklin (Bucklin Reservoir)…they also added the mighty Separation Ranch, a part of the Mahoney spread. An excerpt from a diary of Edwin C. Johnson while he accompanied Tom Sun on a hunting trip in 1878 included the following descriptions - break camp and start on prairie covered with antelope and wild geese…Story kills fine buck antelope for camp…Head of Sage Creek at four p.m. Soon after camping, band of elk came within twenty rods of camp, several hundred, all cows and calves…Go out for ride. See thousands of elk…Go hunting in earnest. See bands of elk in hundreds, but big bulls scarce…Take pack horses and go with Tom for horns I killed last night…we see that a bear has dragged the carcass eight or ten rods and partially buried it…he proved to be a large male grizzly species…I killed a black tail deer…They report lots of buffalo…In about two miles see a bunch of sheep on the highest peak, about thirty…This old cabin is full of mountain rats, so I will set a trap for them, as they pack off all our provisions…numerous rattlesnakes. (Basically, these two hunters shot and killed mule deer, rattlesnake, antelope, bison, grizzly bear, bighorn sheep, pack rats, and elk in their hunting trip from August 27, 1878 to October 6, 1878).
>
> In 1893, Stuart Joseph Sharp (Ruth Beebe's father) married Virginia Clark. They had a ranch at the foot of the Ferris Mountain on Cherry Creek. Mrs. Sharp was delighted to see herds of antelope that would walk right past her door, flocks of sage chickens that dusted themselves in the woodpile, even the mountain lions that crashed through the willows on the creek, grey wolves…to say nothing of the coyotes she heard every night.
>
> In 1906, the Ute Indians ran away from their reservation at the White Agency, in Colorado. As they poured through Whiskey Gap with one thousand ponies, their dogs, and all their possessions…they set up their teepees there. They turned their horses loose, and invaded the valley, and when they left there wasn't an antelope, deer, rabbit, sage chicken, or prairie dog in the country…At every teepee was a campfire, and a prairie dog roasting.
>
> Albert A. Harper purchased the Hay's place in 1895. He was constantly trapping for wolves and mountain lions. He caught a golden eagle in a trap.
>
> According to Ruth, the worst winters were in 1919-1920 and 1949. In 1972, the plants in the valley include mountain pinks, cactus – the strawberry or pink variety, Grizzly Bear (has yellow blossoms), pink and white

> primrose, Sego (mariposa) lily, Yucca (Spanish Bayonet, Soap Weed or Candles of Heaven), coral pink gilia (or sky rocket), yellow and purple violets, shooting stars (or Baird's bills), wild iris, wild rose, columbine, wild tiger lilies (found along Whiskey Creek), lavender wild geranium, showy fleabane (Last Days of Summer), sunflowers, gaillardia, Indian paint brush, larkspur, loco (ivory and purple), caitail. The birds included the eagle, hawks, owls, cranes, Canada geese, ducks, sage grouse, blue grouse (both are prominent), prairie chicken (different kind of bird) – songbirds include robins, wild canaries (or golden finches), mourning doves, catbirds, mocking birds, phoebes, horned larks, blue birds, swallows, woodpeckers and flickers, juncos, the black capped chickadees, and meadow larks, killdeer, red winged blackbirds, ruby throated hummingbirds, whipporwill, magpie, crows, and common blackbirds. Big game species included antelope, deer, and elk (Beebe 1973).

John Charles Frémont was an explorer in the Sweetwater country in the early to mid-1800s. He wrote descriptions of the country as he traveled through and described some of the wildlife that he observed below:

> We saw here numerous herds of mountain sheep, and frequently heard the volley of rattling stones which accompanied their rapid descent down the steep hills…we gave the encampment the name of Goat Island…This morning we left the course of the Platte, to cross over to the Sweetwater…A long and gradual slope led from these hills to the Sweetwater, which we reached in fifteen miles from Goat Island…I made an early encampment here, in order to give the hunters an opportunity to procure a supply from several bands of buffalo, which made their appearance in the valley near by…The hunters went ahead this morning, as buffalo appeared tolerably abundant, and I was desirous to secure a small stock of provisions; and we moved about seven miles up the valley, and encamped one mile below Rock Independence (Independence Rock)…Several bands of buffalo made their appearance to-day, with herds of antelope; and a grizzly bear – the only one we encountered during the journey – was seen scrambling up among the rocks (Fremont 1856).

Jim Baker was a trapper and explorer that traveled through this watershed in the early to mid-1800s. Taylor Pennock, in an article entitled *Recollections of Taylor Pennock*, has related a couple of stories which help to describe the individuality of Jim Baker. This story refers to an area near Brown's Hill near Savery, Wyoming – to the south of this watershed – and to the Red Desert.. Pennock recalled:

> One day Jim Baker told us a story about his buffalo hunting. He was with a big party of Indians camped over near Brown's Hill on the Savery…There was a string of buffalo passing all the time and it took herds three weeks to pass, coming from the North Park country (Colorado) where they had their summer range and going to the Red Desert for the winter (USDI-Heritage Conservation and Recreation Services).

5) Synthesis and Interpretation:

From the accounts above, the detectable changes in wildlife are the disappearance of the buffalo, grizzly bears, and wolves within this watershed. Livestock impacts, although still present, have been reduced, and range conditions on upland and riparian habitats are improving in most areas (USDI-BLM 2002). Antelope, elk, and mule deer are generally thriving, and Wyoming has the largest population of greater sage-grouse in the country. Development in Wyoming has not occurred at the rate that it has in other states; thereby reducing the habitat loss and fragmentation. Native plant species are still present and weeds, although present in some areas, have not taken over large areas of the range. Wild horse numbers were recently above objective, and, along with the drought, may have been impacting wildlife species. Impacts from oil and natural gas development, off-highway vehicle use, and loss of or modification to habitats from developments on private land in checkerboard areas continues to increase. (USDI-BLM 2002). The lack of fire has led to a predominance of mature to decadent shrubs in some areas, and conifer encroachment has occurred along the Ferris Mountains. The following analysis specific habitat conditions within the watershed and the effects these may have on wildlife species.

Species of Interest or Concern

Antelope

The presence of antelope in Wyoming was noted by all of the early explorers and emigrants that moved to or across the state. Antelope are still the most visible and abundant big game species in this area, due to open expanses of sagebrush dominated rangelands with only limited habitat loss and fragmentation. The health of Wyoming big sagebrush communities that antelope depend upon is generally good. High cover and density of shrubs that limits understory species is only observed at higher elevations and precipitation. In this assessment area the crucial winter ranges do not receive enough concentrated animal use to show high utilization rates or severe hedge classes. There appears to be a good mix of winter, summer and transitional habitat to support existing populations and objective levels of antelope. Antelope, being the smallest of the big game species, is probably more susceptible to die-offs during severe winters. However, their reproductive capacity also allows them to respond more quickly after such events to repopulate their habitat.

The presence of many miles of woven wire fencing and its affect in hindering or altering antelope movement is the most important issue needing to be addressed. Most livestock use is made by cattle, and what sheep use is made employs the use of herders, so woven wire fencing is not needed for control of livestock. Outside of the Daley allotment (mid-1980's) and a few spots on the Jawbone allotment, very little fence modification has occurred over the last 20 years. Research conducted in the early 1980's in the Red Desert antelope herd unit showed that woven wire fences were a significant hindrance to antelope movement during severe winter weather. Modification of fence corners and other key locations should become part of the annual goals and accomplishments of the Rawlins Field Office to address this issue. In the 1970's, small cattleguards called antelope passes were installed in corners of some woven wire fences to improve antelope passage. Their small size, however, allowed cattle to move across them and it is unclear whether they actually helped antelope. Most have silted in and been fenced off. Private land that is sold to people as homesites, if developed with fencing and other facilities, could pose tremendous impacts on antelope habitat and movement in checkerboard areas. Informing people about the potential impact to wildlife of these actions may help address this situation, or on a broader scale, exchanging lands to block up public land to maintain wildlife habitat should be pursued.

Livestock management affects antelope in a number of ways in addition to fencing. Sheep compete with antelope for forage, however, sheep use only makes up about 10% of all livestock use currently occurring in the Rawlins Field Office, so this is not as important an issue as it would have been 50 years ago. Water development also can affect antelope. The creation of new sources of water has allowed antelope to expand their use into areas that formerly did not have reliable water. On summer range this is a benefit, but increasing seasonal use on winter range may have a negative affect on the vegetative resource. In these latter areas, the use of controllable facilities, like wells, is preferred in order to not encourage year-long use of winter range by antelope. The problem of livestock water being turned off when wildlife use is still needed should be addressed on a case by case basis. This may vary depending on the climate conditions experienced each year, what other water sources are available, and whether animals can move to water sources in other pastures or allotments. Agreements with some livestock producers, as well as voluntary efforts by ranchers and industry, are already in place where water is left on for wildlife for specific time periods or as needed. Water projects developed for wildlife that are in disrepair should be maintained or removed. Interest groups or individuals may be willing to voluntarily oversee and maintain these types of projects.

Oil and gas development is another significant influence upon antelope in the assessment area. Roads, well pads and other facilities result in a long-term loss of habitat, while pipelines that are reclaimed fairly quickly, only result in short-term loss of habitat. The dust off roads that drifts downwind and coats the vegetation may indirectly result in vegetation being unusable on a seasonal basis. Antelope appear to adapt to the increase in traffic and human activity, having a greater tolerance to this type of disturbance than mule deer or elk. Water sources developed in conjunction with natural gas wells provide additional sources of water and expand the range of country that antelope can utilize. Whether infield drilling with closer well spacing or expansion of natural gas and coalbed methane development into new habitat will alter the behavior and health of antelope from what is observed currently is unknown.

The Wyoming big sagebrush habitat that antelope depend upon as their principle habitat and forage source is stable and long-lived. While plant succession in this community type is relatively slow, it is occurring and changing over time. For antelope, greater sage-grouse, and other sagebrush obligate species, it is important to maintain healthy stands of big sagebrush, with a diverse mixture of grasses, forbs and shrubs. The type and amount of disturbance required for this to happen still needs to be determined. The use of prescribed fire, natural fire, or chemical treatments and their respective affects in this plant community are currently being studied in this watershed to try and answer some of the questions and improve future management. Natural gas pipelines and other reclamation areas also offers an opportunity to change or manipulate this community on a smaller scale.

Elk

Prior to the arrival of white men, elk were common but probably competed with bison for forage and space. At this time, elk are doing well across Wyoming and this watershed area follows a similar trend. All three herd units have current populations that exceed the population objectives and have for several years. This would indicate that elk are thriving, have good reproductive rates, and have the habitat to support them. In general, there are no significant problems with any winter or summer ranges that elk utilize. However, elk use has increased on private hay meadows along Muddy Creek. Drier conditions than average in 2002 may have lowered calf survival rates. Although diet overlap is high between elk and cattle, there appears to be enough forage to provide for the needs of both at current levels of use. Changes in elk distribution on the Cherry Creek and Buzzard allotments may change as allotment management plans are revised. As best management practices for cattle continue to be implemented or improved, forage production and availability for elk should be increased. Elk and wild horses also overlap in diet, however, only the Shamrock elk herd area has a small degree of overlap with the wild horse herd area.

The management issue which affects all three elk herd units are fences. Modifications to fences have occurred in a few areas, like on the Buzzard allotment, but much more work is needed. Priority spots for modification must be identified and a minimum of ten miles of fence modification annually should be achieved. New fences are being built to BLM standards to improve the ability of wildlife in general to get by them. The use of electric fencing is increasing and it appears to have lower impacts on wildlife than conventional barbed wire fencing. Elk, in particular, are not as likely to be injured and cause less damage to this type of fence, which also results in lower maintenance costs. It is being used as pasture fencing in the Fillmore and Cherry Creek allotments in order to improve livestock management while minimizing impacts to wildlife. The practice of leaving gates open in pasture fences when they are not needed should also be promoted more. In many cases this simple idea could help wildlife passage, especially during severe conditions.

In addition to fences and livestock management, the Ferris elk herd is affected by the increasing age and decadence of the shrub and woodland communities. As trees and shrubs increase in dominance, the cover and production of the grasses and forbs that elk rely upon decrease. The loss of aspen habitat for cover and forage, especially later in the summer when forage in other areas has dried up, has negative impacts on elk. Completion of an ecosystem management plan for this area, with vegetative treatments to provide a diverse mixture of plant communities, age classes, and structure, would benefit this elk population.

The Baggs elk herd has increased in both the local population that stays year-round on Atlantic Rim, as well as the migratory population that summers in the national forest and winters on Atlantic and Red Rim. The local population has benefited from improved livestock management practices and vegetative treatments, which have increased forage quality and production. Elk herds are pushing winter habitat boundaries farther to the north and west due to improved forage conditions and prescribed burning (USDI-BLM 2002). The concerns with this elk herd are with coalbed methane development and the amount of human activity that results from it. Since elk avoid roads and associated human disturbances, the placement of roads and the amount and timing of the use of roads will be a factor in the long-term use by elk in this area.

The Shamrock elk herd is likely to be the most affected elk herd in this watershed in terms of long-term impacts of development and disturbance. Natural gas field development on the west side of this herd unit will likely reduce habitat available to elk. Whether this activity will continue on the east side of the Continental Divide is unknown at this point, but if it does there could be significant impacts to this elk herd. Roads constructed for natural gas extraction are also used by recreationists, which can result in additional human activity resulting in elk avoiding these areas. Land sales and buildings, fences, or other activities in the checkerboard areas of this herd unit would also create more disturbance to elk. Even though habitat may not be changed, the avoidance by elk of areas with human activities occurring on a regular basis still results in a loss of habitat to these animals. On the other hand, water developments, improved livestock management, and vegetative treatments could all help improve the habitat for and distribution of elk in this herd unit.

Mule Deer

Mule deer were common in this watershed historically, based on the journals of explorers and early hunters like Tom Sun. Although still common today, their status varies in different areas of the state and even within this assessment area. The general belief is that trends in mule deer populations are following trends in the health of upland sagebrush and mountain shrub communities. The Baggs mule deer herd has been maintained at the population objective for a number of years, and until recently was one of very few herd units that was issuing doe/fawn permits. This would indicate that habitat conditions are generally good, compared to other herd units where mule deer populations are well below the population objective. The habitat within this herd unit has shown tremendous improvement following changes in livestock management, development of water sources, and vegetative treatments. Riparian and upland habitats, that are both important to mule deer, have improved in terms of cover and/or composition of forbs, grasses and young shrubs. The principle concern within this herd unit are the potential impacts from coalbed methane development. Mule deer are more tolerant of disturbance than elk, but depending on how and where CBM development occurs will determine the actual affect in this herd unit.

Mule deer populations in the Ferris herd unit are stable but below the population objective. Poor fawn crops and die-offs during severe winter weather are climate related factors that can't be altered. Habitat and forage for mule deer are the factors that can be manipulated by land managers. The descriptions for Standards 2 and 3 indicate where improvement could occur, primarily in riparian habitat and shrub and woodland communities on and adjacent to the mountains. Riparian habitat is primarily influenced by cattle grazing. Use of best management practices, like those implemented on the Bar Eleven and Long Creek allotments, would improve shrub and herbaceous species important to mule deer. The dominance of mature to decadent shrub and conifer communities is also affecting mule deer. The use of vegetative treatments or natural fire to promote a diverse mixture of species, age classes, and structure would also benefit mule deer populations. Competition for forage between mule deer and livestock is highest with sheep. The conversion of the Stone Ranch from sheep to cattle will reduce this direct competition. However, all other ten sheep permits have already been converted around the Ferris and Seminoe Mountains, so this last one will have some, but not necessarily significant benefits to mule deer. Modifications of fences in key locations would also assist mule deer movement and survival, similar to the description in the elk section above.

The Chain Lakes mule deer herd is relatively small, subsisting along the rougher terrain of the Rawlins Uplift and Lost Soldier Rim where hiding cover and scattered patches of aspen and mountain shrubs intermix with the sagebrush. Although the population within this herd unit will likely stay about what it is due to limited habitat, there is potential to improve the existing plant communities. Similar to other big game herd units, stands of shrubs and trees are mature to decadent. Treatments to create more diversity in these communities would benefit mule deer. The topographic relief of the uplifts form some natural deterrents to cattle movement that wildlife still pass over, so the overall miles and density of fences is less in this area than in other herd units. However, there are still locations that could be modified to help mule deer move across their habitat, particularly for young deer and woven wire fences.

Bighorn Sheep

Based on historical accounts, bighorn sheep were more abundant in the 1800s than they are at the current time. In the 1980s most of the sheep were observed using the Seminoe Mountains. A transplant of bighorn sheep from Whiskey Mountain by Dubois to the Ferris Mountains was completed in 1984. The sheep from this transplant along with the remaining sheep on the Seminoe Mountains have dwindled to the few observed today. The factors believed most likely to have contributed to this decline are conifer encroachment and decadence of vegetation in preferred habitats, forage competition with livestock and elk, and diseases transmitted from domestic sheep. The lack of fire within the high elevation ecosystem has altered the vegetation on mountain meadows. Sheep depend on forage and open habitat on the mountain meadows that are close to security areas. They must also move across the mountain and between security areas. As plant succession occurs and conifer cover increases, their susceptibility to predation increases and the sheep appear more nervous and stressed. If natural and prescribed fire can be implemented to reduce the amount of conifers and promote more composition and production of grasses and forbs, this would likely be the single most beneficial action to maintain bighorn sheep on the mountain. If the use of fire can not be achieved, it is unlikely that bighorn sheep will survive in this ecosystem. The diets of bighorn sheep are very similar to those of cattle and elk. Forage use by cattle (more on gentle slopes adjacent to the mountains) and elk use on the mountain reduces the quantity and quality of forage available to bighorn sheep. The implementation of livestock grazing systems to maintain or improve plant vigor, cover and production and maintaining elk populations at objective levels should provide adequate forage for bighorn sheep.

Bighorn sheep have been impacted from juxtaposed domestic sheep allotments. Domestic sheep have been known to transfer several diseases that can be fatal to wild sheep. Most ranches in this area have changed from sheep to cattle over the last forty years. The Stone Ranch is the last livestock operation within the watershed to complete a conversion from sheep to cattle, which should have a positive effect on bighorn sheep. However, the continuation of sheep use immediately to the west within the Lander office area of the BLM will still pose a threat for disease transmission as wild sheep move between the Ferris Mountains and Green Mountain.

Raptors

Raptors are primarily affected by climate (indirect affects on prey species) and human activities around nesting and perching areas. Ferruginous hawks and to a lesser extent golden eagles, will sometimes nest on man-made structures, such as gas well facilities, windmills, and old corrals and buildings. Artificial nests are used to draw the birds away from these sites so that human activities do not force the abandonment of active nest sites. These artificial nests have also been documented to be more productive in terms of the number of birds fledged per nest compared to natural sites. There are currently 101 artificial nest sites, with about 50% being actively used (picture 87-1). The BLM has a timing stipulation for raptors attached to any proposed project that is located within ¾ of a mile to one mile (depending on each species) from any nest that prohibits surface disturbing and other activities from occurring between February 1 and July 31. In addition, the Bald Eagle and Golden Eagle Protection Act, 16 U.S.C. 668, prohibits knowingly taking, or taking with wanton disregard for the consequences of an activity, any bald or golden eagles or their body parts, nests, or eggs, which includes collection, molestation, disturbance, or killing. The ferruginous hawk and burrowing owl are BLM-State Sensitive species that are found within this watershed, while the northern goshawk and peregrine falcon have the same status and have the potential to occur within this watershed (picture 87-2).

Threatened, Endangered, Proposed, and Candidate Species:

The threatened, endangered, candidate, and proposed species that have the potential to occur within this watershed include the bald eagle, Canada lynx, Ute ladies' tresses (threatened); black-footed ferret and blowout penstemon (endangered); Western boreal toad (candidate); and mountain plover (proposed). The North Platte River species (least tern, pallid sturgeon, piping plover, whooping crane, Eskimo curlew, and Western prairie fringed orchid) are not actually physically located within this watershed; however, water depletions that occur within the North Platte River system, and within this watershed, may cause an impact to these downriver species. The BLM wildlife biologists complete informal and/or formal conferencing and/or consultation with the Service for all proposed projects that may contain habitat, or the species themselves, to avoid adverse impacts to threatened, endangered, candidate, and proposed species.

Threatened Species

There are no known bald eagle nests located within this watershed area, but bald eagles have been observed and have the potential to nest along the North Platte River, which is the eastern border of the watershed. According to the Wyoming Game and Fish Department Bald Eagle Completion Report of 2002, the population of bald eagles statewide has continued to increase. In 2001, there were 89 pairs of bald eagles that produced 86 young in Wyoming (WGFD 2002c). Bald eagles are most commonly observed using cottonwood woodland habitat along major rivers. The majority of the habitat type within the RFO is located on private, state, and BOR administered

lands. Bald eagles observed using BLM administered public lands are usually found scavenging big game or other wildlife carcasses in wintering areas. The BLM has a timing stipulation attached to any proposed project that prohibits surface disturbing and other activities from occurring between February 1 and July 31. This stipulation is attached to any project or activity that is located within one mile of a bald eagle nest. Generally, projects are not located beneath or even close to bald eagle nests; therefore, there should not be any impacts to nesting bald eagles as a result of authorizing actions on BLM-administered lands. In addition, the BLM has a winter raptor timing stipulation that prohibits surface disturbing and other activities from occurring between November 15 and April 30 for the protection of winter concentration areas.

The Canada lynx may travel through the watershed and use woodland and adjacent riparian habitats. The closest known lynx populations occur in the Colorado Rocky Mountains to the south and in the Wind River Mountains to the northwest. In general, there should not be any impacts to dispersing Canada lynx as a result of authorizing actions on BLM-administered lands.

The Ute ladies' tresses has not been specifically identified within this watershed. The only known locations within the State of Wyoming are located in Converse, Goshen, Laramie, and Niobrara counties at elevations between 5,000 and 6,000 feet. However, since the plant has been located in adjacent states, the Service believes it may occur in more locations within Wyoming. Site specific field investigations occur for all projects; therefore, the Ute ladies' tresses will be surveyed on any project that may be located within or near riparian habitat.

Endangered Species

The black-footed ferret has the potential to occur within the watershed. Since ferrets inhabit prairie dog towns, these sites are identified and delineated over broad areas or on a site specific project basis. All proposed projects have a field site investigation completed prior to disturbance to determine if suitable habitat for the ferret exists. Projects are located outside of suitable habitat or black-footed ferret surveys are completed. The BLM biologists informally or formally consult with the Service when black-footed ferret surveys are completed. There have not been any black-footed ferrets found in any surveys that have been conducted within this assessment area. In general, there should not be any impacts to the black-footed ferret as a result of authorizing actions on BLM-administered lands.

The blowout penstemon is located within shifting sand dunes or wind carved depressions on the south side of Bear Mountain, which is between the Ferris and Seminoe Mountains. Inventories have been conducted over the last three years, and additional surveys are being conducted by BLM wildlife biologists to determine the extent of these populations. The most current population count (2002) documented around 4,000 plants with a total estimated population of 4-5,000 plants. The blowout penstemon occur on north and east facing slopes and adjacent bottoms of steeper unstabilized sand dunes, which retain moisture longer during the summer (picture 88-1). Current utilization of these plants by livestock or wildlife is acceptable in amount and there does not appear to be any other potential impacts that may affect known populations. Generally, most authorized actions on BLM-administered lands are not implemented on shifting sand dunes due to the instability of these areas. Site specific field investigations occur for all projects; therefore, the blowout penstemon will be surveyed on any project that may be located in shifting sand dunes or wind carved depressions. In general, there should not be any impacts to the blowout penstemon as a result of authorizing actions on BLM-administered lands.

Candidate Species

The Western boreal toad has the potential to occur within riparian habitats above 7,500 feet in elevation. There is the possibility that this toad may be located in riparian/wetland habitat on Ferris Mountain. No surveys of this habitat have conducted. Site specific field investigations occur for all projects; therefore, the Western boreal toad will be surveyed on any project that may be located within or adjacent to riparian habitats above 7,500 feet in elevation. In general, there should not be any impacts to the Western boreal toad as a result of authorizing actions on BLM-administered lands.

Proposed Species

Mountain plover have been observed in short-grass prairie and shrub-steppe habitats that have sparse to moderate cover of vegetation on upland locations (picture 89-1). These sites can be quite variable, ranging from saltbush steppe with high amounts of bare ground to Wyoming big sagebrush, black sagebrush, or Wyoming three-tip sagebrush communities with good grass and forb cover. These birds are also known to inhabit prairie dog towns. There are vast amounts of suitable habitat for these birds within this watershed and throughout the entire Rawlins Field Office area, however, much of this habitat is currently not being used or has not been surveyed. Inventories for this species have primarily been conducted around Wamsutter due to oil and gas field activities, where several hundred mountain plover have been documented. Several sitings of these birds has also occurred on the gently sloping plateaus found on the the north side of the Ferris and Seminoe Mountains. Long-term monitoring of mountain plover to determine occupied habitat and concentration areas is a componet of the Greater Wamsutter/Continental Divide EIS for oil and gas development. Other studies are also ongoing to study diet and habitat selection in order to establish parameters for further definition of suitable habitat. The BLM has a timing stipulation attached to any proposed project that prohibits surface disturbing and other activities from occurring between April 10 and July 10. This stipulation is attached to any project or activity that is located within potential mountain plover habitat. The timing restriction protects the mountain plover during the critical nesting period; therefore, there should not be any impacts to nesting mountain plovers as a result of authorizing actions on BLM administered lands. In addition, the BLM has additional protection measures that may be applied to proposed projects and activities that occur within known mountain plover occupied habitat. Occupied habitat is an area where broods and/or adults have been found in at least two of the past five years.

BLM State Sensitive Species:

Protection measures for BLM-State Sensitive Species, other than those required for raptor and greater sage-grouse, have not been identified in the RFO area. The Migratory Bird Treaty Act, 16 U.S.C. 703, enacted in 1918, prohibits the taking of any migratory birds, their parts, nests, or eggs except as permitted by regulations and does not require intent to be proven. This Act and its regulations should protect the white-faced ibis, long-billed curlew, sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and Baird's sparrow from actual destruction of the nests and or the bird itself. Habitat loss and or degradation is more difficult to measure and mitigate for these species. The long-eared myotis, fringed myotis, spotted bat, and Townsend's big-eared bat usually inhabit caves, rocky outcrops, and abandoned buildings. Again, habitat loss and or degradation is more difficult to measure and mitigate for these species. Wildlife biologists monitor white-tailed prairie dog towns for potential black-footed ferret habitat and protect these habitats by moving projects 50 meters from existing towns. There are occasions when a project may be constructed within a white-tailed prairie dog town after the towns are surveyed for black-

footed ferrets and no ferrets or their parts are observed. In general, this does not happen very often and project proponents are encouraged to move the projects outside of existing white-tailed prairie dog towns for the protection of not only the prairie dogs themselves, but for other species such as the mountain plover and burrowing owl that depend on the prairie dog town ecosystem. The swift fox may travel through the watershed and should not be impacted by proposed projects that occur as a result of implementing BLM-authorized actions. Little information is known about the habitat locations of the dwarf shrew, Wyoming pocket gopher, and Idaho pocket gopher and the impacts to these species from authorized actions. A field site investigation is completed for all proposed projects and the BLM-State Sensitive plant species can be monitored at that time, and/or their likelihood of occurring should be noted in the event that additional field site investigations are required.

Greater Sage-Grouse

The greater sage-grouse is commonly found throughout the watershed area. Although Wyoming has healthy but declining populations of this species, there are opportunities to improve both upland and riparian habitats used by these birds. In many areas, existing grouse habitat contains too much big sagebrush, lack of species diversity and forb abundance, and not enough residual cover for high nesting success. Greater sage-grouse habitat recommendations developed for Wyoming, which are based on research conducted within Wyoming, can be used for assessments to determine current condition and where the need exists for vegetative treatments. Reclamation efforts should also receive more attention in terms of how it is completed that would most benefit grouse. In particular, the use of more forbs, including succulent species, should be considered in seed mixtures. Summer and fall brood-rearing habitat is especially dependent on riparian habitat, which is most influenced by livestock management. Stream segments that are not in proper functioning condition are also not likely providing high quality habitat for sage grouse. Implementation of livestock grazing BMPs would improve the use of both riparian and upland habitats for greater sage-grouse. For instance, the primary goals of the recently constructed exclosure on lower Stewart Creek is to protect the water sources and manage the habitat to benefit the grouse that utilize this area. Creating new water sources for wildlife use and operating livestock water sources for wildlife when livestock are not present are two other methods of improving habitat use by grouse. Manipulation of wild horse distribution and utilization where they overlap with grouse habitat would also benefit this species. Another tool the BLM uses is a timing stipulation attached to any proposed project that is located within two miles of a lek that prohibits surface disturbing and other activities from occurring between March 1 and June 30 for the protection of strutting and nesting greater sage-grouse. Generally, projects are not located within ¼ mile of an identified lek; and proposed projects should be moved as far away from an active lek as possible. The timing stipulation reduces impacts to breeding and strutting grouse; however, the two mile buffer has been debated by wildlife biologists. Recent research conducted within Wyoming indicates that only 40% of the hens nest within this two mile buffer. Suitable nesting habitat may be selected as far away as 20 miles from the lek. The BLM has a winter greater sage-grouse timing stipulation that prohibits surface disturbing and other activities from occurring between November 15 and April 30 for the protection of winter concentration areas.

6) Recommendations:

Habitat needed to support healthy wildlife populations and listed or proposed threatened and endangered species is generally in acceptable condition. This does not mean that there aren't problems or concerns about wildlife habitat. The discussion under Standard #2 – Wetland/Riparian Health and Standard #3 – Upland Plant Health outlines the current conditions and recommendations for improving management of these resources. In many cases we may be

meeting a standard but we fell short of our "desired or future" condition. On the other hand, our composition of native species is good, with just spot problems at this time with weeds. Due to the existing good condition of native vegetation and its ability to support the diverse wildlife populations we currently have, it is determined that the majority of Great Divide Basin assessment area is meeting Standard #4 with respect to wildlife. The principal area deemed not to be meeting Standard #4 for wildlife habitat is the Ferris Mountains, due to loss of aspen habitat and the disease, decadence, and encroachment of conifers into shrubland and riparian habitats. This area encompasses about 24,000 acres of public land. The following recommendations address action to help meet future desired resource conditions. Livestock grazing is not a principle factor in the non-attainment of this standard.

Implement recommendations described for Standards #2 and #3. Improving the health of riparian/wetland and upland plant communities will help meet the needs of all wildlife, which use this watershed.

Species of Interest or Concern

Antelope, elk, mule deer, and bighorn sheep

Modify existing sheep-type fences and older cattle-type fences to meet BLM standards. This should be accomplished in key locations in the short-term, while working towards all fences in the long-term. A specific number of miles should be accomplished each year, and cooperative efforts should be pursued with grazing permittees, WGFD, and conservation districts. When possible, relocate fences to reduce impacts to wildlife movements. Encourage livestock permittees to leave gates open when not needed and/or through as much of the fall through spring seasons to help wildlife move between seasonal ranges. Documentation of locations where fences are affecting big game movements should continue, particularly for the new fences such as the pasture fences in Cherry Creek allotment or the Seminoe Road highway fence. Impacts to big game species due to CBM development should be mitigated, possibly by modifying existing fences to improve access to less disturbed winter habitats (WGFD 2002a).

Management plans should consider other grazers, such as wildlife and wild horses, in making recommendations and to properly assess impacts. Water developments should benefit as many species as possible. This includes running projects in the summer even after livestock have left. In winter ranges, projects should be controllable, or small (ephemeral) in nature, to not encourage year-round wildlife use. Isolated desert water sources and associated riparian habitat should be protected and managed to meet the needs of wildlife. Encourage the Lander BLM to convert domestic sheep AUMs in the Whiskey Peak allotment to cattle to prevent disease transmission to bighorn sheep using Ferris Mountain. Monitoring information, particularly trend data for big game crucial winter range, should be coordinated with the WGFD for use in evaluating and changing herd objective levels.

Complete the Ferris-Seminoe Mountains ecosystem plan, including public input and review, to improve habitats to support wildlife. Implement vegetative treatments in shrub and woodland habitats to improve the diversity of cover, species, age-class, vertical structure, and mosaic mix of plant communities. Management efforts should also emphasize the use of naturally ignited fires to benefit resource values in accordance to preplanned conditions and objectives outlined in a Wildland Fire Implementation Plan. Monitor the effects for all treatment projects, to document and analyze results and improve future prescriptions to achieve management objectives. Utilize habitat recommendations for greater sage-grouse and other species where available in both

assessing and planning habitat treatments. Encourage the development of interagency long-term habitat treatment plans (WGD 2002b).

Maintain wild horse populations within established herd population levels. Monitor to evaluate the impacts on vegetative communities and wildlife habitat and whether these levels represent a proper long-term population of wild horses.

Evaluate the need and institute measures where necessary to reduce disturbance to big game species on crucial winter ranges, or other habitat areas where needed. This could involve seasonal closures of roads, seasonal closures of habitat for antler collecting, general off-highway vehicle use, transportation planning for oil and gas development, and other activities. Private landowners should be encouraged to leave their lands unfenced, or use fence designs that are compatible with big game movements (WGFD 2002a).

Raptors

The BLM should continue to use the seasonal restriction stipulation for breeding and nesting raptors which prohibits construction and other activities from occurring between February 1 and July 31. In addition, the BLM should continue to use the seasonal restriction stipulation for identified raptor winter habitat areas which prohibits construction and other activities from occurring between November 15 and April 30.

Threatened, Endangered, Proposed, and Candidate Species:

Bald Eagle:

The BLM should continue to use the seasonal restriction stipulation for breeding and nesting bald eagles which prohibits construction and other activities from occurring between February 1 and July 31. In addition, the BLM should continue to use the seasonal restriction stipulation for bald eagle winter habitat areas which prohibits construction and other activities from occurring between November 15 and April 30.

Black-footed Ferret, Blowout Penstemon, Canada Lynx, Ute Ladies' Tresses, and Western Boreal Toad:

The BLM should continue to complete informal and/or formal consultation with the Service for any proposed project that may be constructed within potential black-footed ferret habitat. Identified stipulations will be attached to all projects to avoid adverse impacts to the species.

Mountain Plover:

The BLM should continue to use the seasonal restriction stipulation for breeding and nesting mountain plover which prohibits construction and other activities from occurring between April 10 and July 10 of each year. In addition, the BLM should continue to use the additional protection measures to protect mountain plover located within known occupied habitat. Further inventories of potential mountain plover habitat would occur, with sighting of plovers documented and descriptions made of the habitats being used.

North Platte River Species: Least Tern, Pallid Sturgeon, Piping Plover, Whooping Crane, Eskimo Curlew, and Western Prairie Fringed Orchid: Recommendations

The BLM should continue to identify any proposed project that may cause a depletion within the North Platte River system and should initiate formal consultation with the Service for each proposed project. Projects should not be implemented until after formal consultation has been completed.

BLM State Sensitive Species:

Greater Sage-Grouse:

The BLM should continue to use the seasonal restriction stipulation for breeding and nesting greater sage-grouse which prohibits construction and other activities from occurring between March 1 and June 30 of each year. In addition, the BLM should continue to use the seasonal restriction stipulation for greater sage-grouse winter habitat areas which prohibits construction and other activities from occurring between November 15 and April 30 of each year. The WGFD should continue to delay the opening date of the grouse hunting season to the middle of September, which should reduce hunter numbers and harvest. This delay reduces the vulnerability of grouse, particularly productive hens, by delaying harvest until after broods have broken up flocks and moved from the easily hunted riparian habitats into the more difficult open sagebrush (WGFD 2002d). Implement (or continue) management and projects to improve greater sage-grouse habitat, including nesting cover and species diversity and age class structure in upland and riparian habitat (particularly forbs). Continue monitoring habitat trends and grouse use where possible before and after projects have been implemented - for example, vegetative treatments and mineral development projects. Additional mitigation should be applied to projects, if required, and this mitigation should be monitored to determine the effects on the grouse.

Fisheries

1) Characterization

Regionally or Nationally Important Recreational Fisheries:

Miracle Mile

This tailwater fishery begins at the outlet of Seminoe Reservoir and flows downstream into Pathfinder Reservoir. Hypolimnetic releases from Seminoe Reservoir produce relatively constant water temperatures in the North Platte River at this site that have created a highly productive trout fishery for brown trout, rainbow trout, and cutthroat trout. The reputation of this fishery is known nationally and represents the single most publicized fishery in the analysis area.

Pathfinder and Seminoe Reservoirs

Pathfinder and Seminoe Reservoirs are a major feature of the Kendrick Project, providing water storage on the North Platte River for use in irrigation. These reservoir fisheries offers anglers the opportunity to catch walleye, rainbow trout, brown trout, and cutthroat trout.

Dune Ponds

These ponds, located in close proximity to Seminoe Reservoir, once produced brown trout, rainbow trout, and brook trout of exceptional size, however, they do not presently sustain a fishery (picture 94-1).

Ferris Mountain Streams

The slopes of the Ferris Mountains contain several small streams, some of which harbor populations of coldwater and warmwater fishes. Pete Creek and Cherry Creek have both received prior management emphasis to increase their productivity as brook trout fisheries. Sand Creek, Muddy Creek, Whiskey Creek, Pole Canyon Creek, and Arkansas Creek also have existing or the potential to support small fishery populations. Their improvement as trout fisheries is contingent upon successful management of riparian vegetation and could benefit greatly from beaver activity.

Seminoe Mountain Streams

Similar to Ferris Mountain, the Seminoe Mountains are drained by several small streams that have existing fisheries or are thought to be able to support populations of trout. Deweese and Long Creeks are the largest streams with the most potential. Similar to the Ferris Mountain streams, their improvement as trout fisheries is contingent upon successful management of riparian vegetation and could benefit greatly from beaver activity.

Man-made Ponds

Bucklin Reservoir located north of Muddy Gap along Hwy 220 is stocked with game fish by the WGFD. A reservoir southwest of Bairoil is also stocked, with trout also moving up into Lost Soldier Creek. A&M reservoir west of Bairoil is having a new well developed next to it to ensure a reliable water source so fish stocking in this reservoir can resume(94-2).

Native Fishes

Table 4. Fish species known to occur or potentially occurring in the analysis area.

Common Name	Scientific Name	Drainage	Source	Management Status
Bigmouth shiner	*Notropis dorsalis*	SW	Patton et al. (1998)	
Creek chub	*Semotilus atromaculatus*	SW	Patton et al. (1998)	
Fathead minnow	*Pimephales promelas*	SW	Patton et al. (1998)	
Longnose dace	*Rhinichthys cataractae*	SW	Patton et al. (1998)	
Sand shiner	*Notropis stramineus*	SW	Patton et al. (1998)	
Longnose sucker	*Catostomus catostomus*	SW	Patton et al. (1998)	
White sucker	*Catostomus commersoni*	SW	Patton et al. (1998)	
Iowa darter	*Etheostoma exile*	SW	Patton et al. (1998)	
Brook trout	*Salvelinus fontinalis*	ALL	WGFD	
Rainbow trout	*Oncorhynchus mykiss*	PS	WGFD	
Cutthroat trout	*Oncorhynchus clarki*	PS	WGFD	
Brown trout	*Salmo trutta*	PS	WGFD	
Walleye	*Stizostedion vitreum*	PS	WGFD	

SW = Sweetwater, PS = Pathfinder-Seminoe, GD = Great Divide, ALL = Sweetwater, Pathfinder-Seminoe and Great Divide.

Amphibians

The southern Rocky Mountain population of the boreal toad occupies forest habitats between roughly 7,500 and 12,000 feet elevation in Colorado, southeaster Wyoming, and north-central New Mexico. Throughout this range, boreal toads have been documented within lodgepole pine or spruce-fir forest types. Boreal toads have rarely been documented in lower-elevation ponderosa pine forests or willow and sage communities (BTRT, 2001). Distribution is thought to be limited by available breeding locations including large lakes, kettle ponds, man-made ponds, beaver ponds, marshes, and roadside ditches (BTRT, 2001). Adult toads have been shown to utilize upland habitats outside of the breeding season, showing an affinity for areas in close proximity to spring seeps.

Table 5. Special status Amphibian species known to occur or potentially occurring in the analysis area.

Common Name	Scientific Name	Drainage	Management Status
Boreal Toad	*Bufo boreas boreas*	SW, PS	BLM sensitive
Northern Leopard Frog	*Rana pipiens*	ALL	BLM sensitive
Great Basin Spadefoot	*Spea intermontanus*	ALL	

SW = Sweetwater, PS = Pathfinder-Seminoe, GD = Great Divide, ALL = Sweetwater, Pathfinder-Seminoe and Great Divide

2) Issues and Key Questions

Vegetation Management

The potential impacts of livestock grazing on stream processes and fish habitats has been well documented (Armour et al. 1991, White 1996, Rinne 1999). They include the loss of stabilizing riparian vegetation which can lead to stream instability and an associated loss of habitat complexity, the loss of shading vegetation which can lead to elevated stream temperatures, increased sediment delivery, and loss of stream channel complexity provided by fluvial processes and woody debris.

The importance of landscape-scale disturbances resulting from either wildfire or prescribed fires to aquatic species and riparian ecosystems has recently received additional attention (Bisson et al. 2003). Natural disturbance regimes maintain the diversity of riparian ecosystems (Naiman et al. 1993). These disturbances can include fire and fire-related flooding, debris flows and landslides (Dwire and Kauffman in press). Additional riparian influences result from the vegetative responses to fires outside the riparian zone. A key example of this influence is the regeneration of quaking aspen that can result from the top-killing of aspen during a fire. The regenerated aspen are then available for instream uses by beaver.

Beaver Habitat

Beaver activity can have several benefits to aquatic ecosystems including elevated water tables that enhance riparian vegetation, reduction of stream water velocities that reduce erosional forces, stabilization of stream flows throughout the summer and droughts, improvement of fish habitats, improvement of terrestrial wildlife habitats (Olsen and Hubert 1994). Beaver historically occupied portions of the analysis area, found mainly in areas containing healthy communities of willow or aspen. Signs of historic beaver activity are widespread on Ferris Mountain and Atlantic Rim. The beaver population around Atlantic Rim seems to be doing well due to both willow and aspen adjacent to Separation Creek. Several different colonies are scattered along the main stem and in numerous side channels. The loss of beaver from the Ferris' is thought to be due to the reduced distribution and vigor of woody vegetative communities as well as trapping of beaver for commercial uses and in areas where they are in conflict with agricultural practices such as irrigation (picture 96-1, 96-2).

Limited availability of aspen and willow in the majority of the analysis area is thought to currently limit the suitability of the area for beaver colonization. This loss of woody vegetation can be related to many causes including livestock grazing, herbicide spraying, conifer encroachment, fire suppression, and wildlife grazing. A negative feedback mechanism often exists between the loss of woody vegetation and the water table of riparian systems. As woody vegetation is lost, the stream channel can become unstable and begin to actively incise. As this incision proceeds, the water table can be lowered and result in a reduction in the amount and area of woody vegetation available for beaver use.

Energy Development

The influence of coalbed methane (CBM) production operations on fisheries can be divided into impacts resulting from surface discharge of produced waters, impacts on groundwater aquifers, and impacts resulting from surface disturbing activities. Two CBM projects are currently underway in the analysis area, the Seminoe Road CBM Project and the Hanna Draw CBM Project. Additional CBM development projects are envisioned in the future in portions of the analysis area.

The impacts of surface discharge of produced waters on the habitats of fishes are variable. Both the quantity and quality of discharged waters can determine how fish habitats will be influenced. For example, the discharge of large volumes of water into ephemeral drainages can lead to stream channel adjustments such as incision that may simplify channel geometry and reduce the diversity of habitats required by each life stage of fishes (i.e. juvenile rearing habitat, spawning habitats, refuge habitats). If the discharged water is of poor quality, fish may be impacted either directly (e.g. increased water temperatures) or through the processes of bioaccumulation of metals. Fishes adapted to highly turbid rivers may be impacted by the discharge of waters with little turbidity. Additionally, decreasing the intermittence of flows may favor introduced fishes over native fishes that have evolved in the presence of a highly variable environment.

The impacts on surface water resources from groundwater extraction are also highly variable, depending on the connectivity of surface water resources to the target groundwater aquifer. If a connection occurs, there is potential to dewater both lentic and lotic systems that may be of importance to aquatic populations.

Road construction associated with CBM development can impact fish habitats by concentrating streamflow, which may cause stream channel adjustments, by adding sediment to the stream, or by fragmenting stream habitats at road crossings. Fragmentation of habitats has been shown to interfere with the metapopulation dynamics of many fish populations. When extirpations occur due to localized environmental variation, restrictions of fish passage eliminate the possibility of the area being recolonized from a neighboring population. Surface disturbing activities associated with well pad construction can increase sediment delivery to lotic and lentic systems which may interfere with the life history strategies of fishes. For example, clean gravels are required by some fishes for successful spawning. Increased sediment delivery can embed these gravels and render spawning efforts unsuccessful.

Conventional oil and gas development can also affect fish habitats. These impacts are largely associated with road construction and surface disturbing activities, similar to the impacts of coalbed methane development.

Transportation Planning

Roads can affect fish populations through fragmentation of habitats at road crossings, concentration of overland flow which can result in stream channel adjustments, and increased sediment delivery. Fragmentation of stream habitats can limit access to habitat features that are required by stream fishes. Stream fishes require habitats for spawning, rearing, feeding, and refuge from environmental extremes (Schlosser and Angermeier 1995). The spatial distribution of these required habitats can necessitate the seasonal movement of fishes among habitats. If barriers to movement are present, such as those caused by improperly designed road crossings, fish may not have access to all of the habitats necessary to fulfill their life history requirements. Additionally, barriers can interrupt metapopulation dynamics that allow for the recolonization of habitats that have experienced local extirpations.

Roads can also concentrate overland flow. This concentration of flow may generate greater water velocities that are foreign to the stream channel. The stream channel can, in turn, adjust to these increased velocities by changing its geometry through erosional processes such as channel incision.

Additional impacts of roads on fish communities are associated with increased sedimentation. The concentration of overland flow and increased rill and gully erosion associated with roads can affect required fish habitats. Increased sediment delivery to the stream can lead to the embedding of stream gravels. Some stream fishes require clean gravels for successful reproduction. Clean stream gravels are also necessary for the production of macroinvertebrates – a key food source for many stream fishes.

Invasive Species

On February 3, 1999, Executive Order 13112 on Invasive Species was signed. This order directed federal agencies to:

> "use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them…" as well as "…not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

Introduced pathogens of concern in the analysis area include *Myxobolus cerebralis,* which can causes whirling disease in salmonid fishes, and Chytrid fungus, which can impact amphibian populations. Whirling disease is a parasitic infection that attacks the nerves and cartilage of small trout, reducing their ability to feed and avoid predators. These infections can significantly impact wild trout populations. Chytrid fungus has been cited as a cause of major declines in amphibian populations. The parasite responsible for causing whirling disease is known to occur at locations in the North Platte River drainage within the analysis area. Chytrid fungus attacks keratin of metamorphosed amphibians and can lead to 90-100% mortality in some species. The Boreal Toad Recovery Team (BTRT) has cited Chytrid fungus as a major concern in the southern Rocky Mountain population (BTRT, 2001). The occurrence of Chytrid fungus has not been documented in the analysis area. Both of these pathogens can be transported via contaminated waders or other equipment.

Invasive species of concern in the analysis area include zebra mussel and New Zealand mud snail. Zebra mussels have become widely distributed in the United States, particularly east of the 100th meridian. These exotic mussels have recently been discovered as near as Colorado, likely the result of overland transport by trailered boats. These mussels can be found in large lakes, ponds, and river systems throughout their range in the U.S. A major transport mechanism of these mussels is through attachment to boats and trailers. New Zealand mud snails appear to prefer

flowing water habitats with stable flows. Springs, spring creeks, and river sections downstream from dams are all places that they thrive in. They are most typically found on larger cobble substrates or on pieces of wood. These snails are known to occur in the Great Lakes region, as well as in isolated regions of the west, including Yellowstone National Park. New Zealand mud snails can be transported with fishing waders or other equipment that has been exposed to infected waters. The dispersal of these snails has been associated with recreational fisheries exhibiting high angler use. Neither the zebra mussel nor the New Zealand mud snail are currently known to occur in the analysis area and preventing their spread into this region will be particularly challenging.

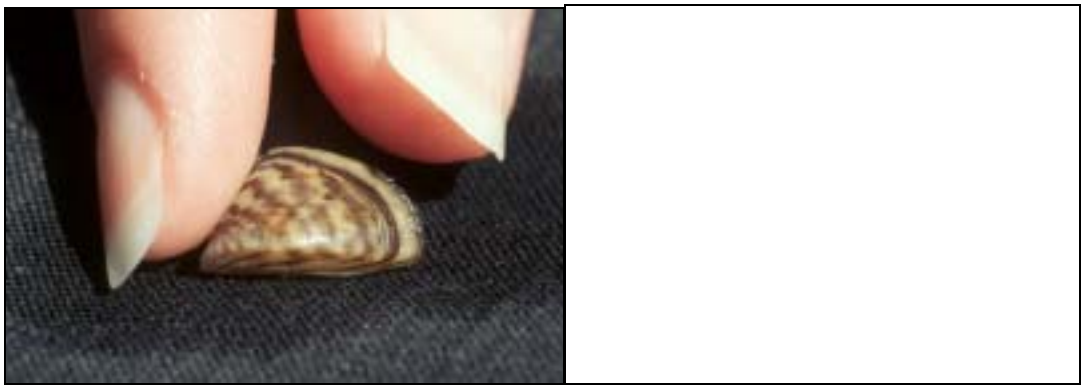

Figure 1. Zebra mussel. Actual size is approximately ¾ inch.

Figure 2. New Zealand mud snail.

Nonnative fishes have been introduced and become naturalized in much of the analysis area (Table 1). Their impact on native fishes is not fully described in this area. As in other areas of the West, the use of desirable nonnative fishes for their recreational and aesthetic values will need to be balanced with the needs of native fishes. Emphasis should be placed on managing habitats for a diversity of fishes, including providing habitats for native and desirable nonnative fishes.

3) Current Conditions

Regional or Nationally Important Recreational Fisheries

Sampling of aquatic environments within the analysis has included both fish population and habitat sampling by the WGFD and macroinvertebrate sampling by the BLM.

Miracle Mile, Pathfinder and Seminoe Reservoirs

Data unavailable at time of publication

Dune Ponds

Beginning in the mid-80s, the water level in these ponds began to drop, resulting in a gradual elimination of once exceptional trout fisheries. The specific cause of this declining water level is still a mater of debate. Potential causes proposed to date include the influence of declining water levels in Seminoe Reservoir, the construction of a drainage ditch below the ponds, channel incision along feeder streams, and climatic influences. Further investigations are needed to define the cause of the observed drop in water levels in these ponds.

Ferris Mountain Streams

The WGFD conducted fish populations sampling in this area during the 2002 field season. In addition to brook trout, Pete Creek contains longnose dace and white suckers. Miner's Canyon Creek and Sand Creek contain populations of brook trout. Both Whiskey Creek and Arkansas Creek appear to have some potential to support populations of coldwater game fish, but the WGFD found there to be no fish present at the time of sampling in 2002.

Seminoe Mountain Streams

Sampling by the WGFD in 2002 found only Deweese Creek and Long Creek to currently support trout populations, with Deweese Creek containing a small population of brown trout, and Long Creek containing a population of brook trout. No warmwater fishes were found during this sampling effort. Several additional streams are thought to have some potential to support trout populations in this area. These include Junk Creek, Sunday Morning Creek, Tin Cup Creek, and Wood Creek.

Man-made Ponds

These ponds are restocked as needed, usually every two or three years. The pond southwest of Bairoil is the only site that presently has fish in it.

Native Fishes

The distribution and status of native fishes within the analysis area is currently unknown.
Amphibians

The distribution of the southern Rocky Mountain population of boreal toad has witnessed dramatic reductions in its range (BTRT, 2001). Inventories for boreal toad have not been conducted within the analysis area (See Standard 4 – Wildlife and Threatened/Endangered Species).

4) Reference Conditions

References to historical stream conditions are limited. See Standards 2 and 5 for historical accounts of stream habitat conditions. Distributional changes of native fishes east of the Continental Divide were recently assessed by Patton et al. (1998). No trout species are native to the analysis area.

5) Synthesis and Interpretation

The analysis area contains many unique aquatic resources. These include notable recreational fisheries such as the Miracle Mile and Pathfinder and Seminoe Reservoirs. The importance of these fisheries to the local economy and to the quality of life of the citizens of the area is significant. Although BLM is not involved in reservoir and fishery management, managing adjacent upland habitat to minimize runoff and soil erosion into these sites is our responsibility. Several other waters have the potential to provide quality recreational opportunities.

The descriptions for Standard 2, Riparian/Wetland Health, also applies in most cases to fisheries. Livestock grazing is the principle factor affecting fisheries habitat. Changing the season of use and/or shortening the duration of use are the best methods for improving riparian habitat for fish. As streams improve in vegetative health, water flows improve and temperatures are kept lower. The second factor needing attention is the lack of beaver and the habitat to support them. Beaver also improve water retention and lower temperatures due to their dams and ponds.

Baseline inventory information is lacking for native species of fish and wildlife throughout much of the analysis area. Though some broad-scale inventories have been conducted to identify trends in populations of native fishes in Wyoming, site-specific information required for effective land management is presently lacking.

Given an insufficient temporal perspective, macroinvertebrate samples from Pete and Cherry Creeks will not be used to make a one-time assessment of stream health or function. Rather, continued sampling will be useful to monitor the effectiveness of land management activities and progress of riparian restoration for these two streams.

6) Recommendations

The improved management of riparian habitats through the use of grazing BMPs indicate both an upward trend and meeting Standard #4 for fisheries for some of the streams in the assessment area. However, many other sites that should support fisheries, currently do not. Standard #4 for fisheries is not being met on streams, which currently fail Standard #2 – Riparian/Wetland Health. There are also sites that are rated in proper functioning condition, but due to the lack of overhead cover (stream shading) exceed temperature requirements for some fish species and won't support them. However, these sites have not yet been defined. Due to the lack of credible data on the status of native fishes in the watershed, whether Standard #4 is being met for these species is unknown.

Completing inventories for native fishes and native amphibians, including boreal toad, should be a high priority for the fisheries program in coming years in order to identify site-specific land management opportunities.

Vegetation Management

In areas not meeting Standard 2, implement allotment management plans that will provide the amount of vegetation necessary to ensure adequate watershed protection under grazing use to perpetuate vegetation, enhance woody plant vigor, and assure soil stability. In allotments containing portions of the Miracle Mile, implement grazing management strategies that reflect the importance of this fishery both locally and nationally. Implement treatments including prescribed fires, in conjunction with grazing management, within forested areas that increase the regeneration of aspen stands.

Energy Development

Consideration of the viability of aquatic populations will be an important component of effective land use planning for energy development activities. These considerations should include obtaining baseline inventory information in proposed development areas, considering life history requirements of native species when designing transportation networks, and maintaining the integrity and diversity of stream and wetland habitats.

Transportation Planning

Designing road crossings that simulate natural stream processes would allow for the passage of aquatic organisms and allow access to habitats required by stream fishes. This can be accomplished by using a number of designs including bridges, bottomless culverts, and baffled culverts. Several references are available to help in this design process. Road designs should also consider appropriate energy dissipation in order to limit the concentration of overland flows and resulting sedimentation.

Invasive Species

Avoiding the transportation of invasive species to new habitats should be considered a high priority for the Rawlins Field Office. As the distribution of invasive species is not fully known, disinfecting equipment and materials that have been used in riparian or wetland environments should be considered standard precautions. All programs should use the chlorine bath maintained by the fisheries crew for disinfecting their equipment and materials before they are used in a new location. Instructional Memorandum No. WY-030-99-007 outlines required disinfection procedures for the Rawlins Field Office.

Weeds

1) Characterization:

Weeds, invasive non-native plants, ecologically threaten natural ecosystems and greatly impact natural plant communities throughout the West. The reduction of light, water, nutrients, and space available to native species can change the hydrological patterns, soil chemistry, erodibility, and may even change fire patterns on a localized basis (NPS ref). These invaders can reduce biodiversity, affect threatened and endangered species, change habitats and natural plant/animal associations, and prevent native species from remaining or encroaching upon a site. Weed infestations reduce forage availability for livestock and wildlife. Unlike many areas of the West, the Rawlins Field Office has a comparatively smaller weed problem than other areas in the Rocky Mountain region. The analysis area is relatively noxious weed free, with just small problem areas. The term ***noxious*** is a legal designation used specifically for plant species that have been determined to be a major threat to agricultural and/or natural ecosystems and are subject, by law, to certain restrictions. Invasive species include those that increase and invade disturbed areas and may or may not be able to invade native rangeland. Within the analysis area, noxious and invasive species are predominantly found along roadways and other disturbed areas associated with oil and gas development, recreational use, and livestock grazing activities. Road building, development, grazing, fire suppression, recreation, and other activities can directly increase weed establishment, introduction, and/or maintain their presence within the ecosystem.

The main noxious species present within the area are Dalmatian toadflax, spotted knapweed, Russian knapweed, and whitetop. Other noxious species include saltcedar, perennial pepperweed, Canada thistle, diffuse knapweed, and leafy spurge. There are also several invasive species present which are normally restricted to disturbed areas. These include halogeton, Russian thistle, begonia dock, henbane, gumweed, annual goosefoot, cheatgrass, cactus, and several annual mustards. Most invasive species are not treated unless they are interfering with reclamation of disturbances, or are a fire hazard around well locations.

2) Issues and Key Questions:

As new disturbances are continually being created, the area is seeing an expansion of some of these species. Current issues in the assessment area follow:

- Noxious weeds and invasive species are spreading into undisturbed rangeland from the initial sites of introduction along many roadsides, well pads, pipelines, livestock water developments, hunter camps, and other disturbed areas.
- Adequate mitigation measures are in place to address weed control on disturbed areas, however, enforcement of existing stipulations is spotty.
- The Bureau of Reclamation (BOR) is not conducting any weed treatments on lands withdrawn from the BLM.
- Some private landowners adjacent to BLM land have yet to implement noxious weed management programs, thereby negating some of the potential effectiveness of treatments on BLM lands.
- More direct action is needed in allotments where livestock movements are increasing weed presence.
- Historic high populations of wild horses, combined with ongoing conversions from sheep to cattle grazing have affected the condition of native rangelands, making them more susceptible to invasion by weed species.

- Where recreation is a factor in weed establishment and spread, measures frequently are not being taken to address this issue.
- There are no reasonable measures available to control wildlife movements that spread weeds.

3) Current Conditions:

Weed locations are primarily restricted to disturbed areas associated with oil and gas development, recreational use, and livestock grazing activities such as water developments. Some noxious weed locations associated with manmade disturbances are being treated either by lease/ROW holders, County Weed and Pest personnel, or the BLM. There are only a few areas where the noxious weeds are spread throughout native rangeland. Some of these areas are being treated to contain the weeds where they are. A goal is to avoid having them spread elsewhere by vehicle, equipment, or animal movements. Most Federal, State, and county improved roads are being treated for weeds. Some Oil and gas related disturbances, and most recreation areas (land administered by the BLM), are being treated for weeds and are the main source of weed introduction and spread. Continued oil and gas activity will result in the expansion of some of these species as development-related disturbance continues.

As stated earlier, the principle noxious species found within the analysis area include Dalmatian toadflax, spotted knapweed, Russian knapweed, and whitetop. The following weed descriptions and associated photographs were taken from *Weeds of the West*, the authorization for which is in Appendix E, and *Biology and Management of Noxious Rangeland Weed*.

Dalmatian toadflax is a mildly poisonous perennial up to three feet tall, which reproduces by seed and underground root stalks. It is very aggressive, with a deep root system and a waxy leaf, which render it very difficult to eradicate. It usually prefers well-drained, relatively coarse-textured soils with low precipitation or soil disturbance. Toadflax can establish in naturally occurring disturbances or small openings in pristine areas and on rangeland in excellent condition. Once growth begins, condition of the rangeland does little to slow expansion of the infestation.

Dalmatian toadflax occurs in two areas. One area is north of Rawlins (on private land abutting BLM) along Highway 287, which is being treated, but is still expanding. Ten acres here fail to meet the standard. The other is by Seminoe Reservoir on BLM lands, and withdrawn BLM lands managed by the BOR, which has had no chemical treatment. The University of Wyoming has released some biological control agents on an experimental basis in this area. The toadflax is rapidly expanding (picture 104-1). Five acres here are at risk of infestation, but still meet the standard currently. There are small spot infestations starting along the roads, from vehicles spreading the seed, and in undisturbed rangeland from animals redistributing seed.

Spotted knapweed is usually a biennial or short-lived perennial, one to three feet tall, reproducing by seeds. It grows early and is highly competitive. It usually starts in disturbed areas, and can readily spread into well-managed native vegetation. Sites dominated are subject to increased runoff rates (up to 60%) and stream sediment yield increases (up to 200%) compared to bunchgrass sites (Lacey et al 1989).

Spotted knapweed occurs above Seminoe and Kortes Reservoirs on BLM land, and withdrawn BLM lands managed by the BOR, and have had mechanical and some chemical treatment. It was introduced by construction of a high-voltage power line and is being spread mostly by vehicles

along roads in the area. It has also been found along the main road through the area in one spot (so far), which is being treated.

Russian knapweed is a poisonous perennial, which forms dense colonies. It is a native of Eurasia and is found throughout the West. It spreads by seeds and adventitious roots that can penetrate up to eight feet, it is allelopathic, and is toxic to horses.

Russian knapweed is found in many places throughout the assessment area. Hay Reservoir has a rather large infested area of about 1400 acres, which is spreading slowly, and not being treated as of yet (picture 105-1). There are nearly 100 acres on the southwest side of the Ferris Mountains, that is also expanding, and has received only limited treatment.There are several small, and one medium sized patch, north of Wamsutter and the Continental Divide exits along the oil and gas roads. These areas are being treated. A larger area in Bell Springs allotment, not presently being treated, is expanding, partly in response to a recent gravel pit and road. Eighty acres here are not meeting the standard. There are scattered small patches around Muddy Gap, which are being treated as found. There are also small areas all along the Seminoe Road, which are being treated with the exception of the Morgan Creek Drainage. The area along Miracle mile, upstream and down, is infested. It occurs below Kortes Reservoir on BLM land, and withdrawn BLM lands managed by the BOR, and is not being treated. This puts approximately 40 acres currently at risk from invasion. Total acres not meeting this standard are 1600.

Whitetop (hoary cress) is a deep-rooted perennial up to two feet tall, which reproduces from root segments and seeds. It occurs on alkaline, disturbed soils along roads and the edge of meadows and irrigation ditches, and is highly competitive with other species. It can be mildly toxic to cattle and is one of the more difficult to control weeds. Whitetop occurs along roads and other disturbed areas throughout the analysis area. Most areas are not treated.

Other noxious species present in the analysis area are:

Saltcedar is a deciduous shrub introduced from Eurasia as an ornamental. In many places it has become naturalized along streams and reservoirs and tends to form monocultures that limit biodiversity. Saltcedar can transpire up to 200 gallons of water per plant each day and can dry up ponds and streams. In addition, they bring large amounts of salt up from the soil and deposit it on the surface, thus rendering adjacent sites uninhabitable by native species. This shrub is difficult and expensive to control. It occurs in some borrow areas along the Interstate (five acres fail the standard) and isolated patches scattered throughout the analysis area. Isolated patches are treated as found. It also occurs all around Seminoe and Pathfinder Reservoirs on withdrawn BLM properties managed by the BOR, none of which is being treated. It has increased tremendously in these areas since the drought and associated low reservoir levels. Sites found along Hay Reservoir are mixed in with Russian knapweed, with acres failing this standard included in the acreage already listed for the knapweed.

Canada thistle occurs in and along riparian habitat, and in some cases along roads where runoff water accumulates. As long as the riparian habitat is being properly managed, Canada thistle is not expanding and occupies the niche between the riparian and upland habitats. Canada thistle occurs basically throughout the assessment area and is treated along most main roads.

Diffuse knapweed is an annual or short-lived perennial, up to three feet tall. It grows along roadsides, disturbed areas, and dry rangelands, especially liking bitterbrush/bunchgrass communities on light, well-drained soils. Diffuse knapweed occurs above Seminoe and Kortes Reservoirs on BLM lands, and BOR withdrawn lands, and has had mechanical and some

chemical treatment. It was introduced by construction of a high-voltage power line and is being spread mostly by vehicles along roads in the area.

Leafy Spurge is a perennial, up to three feet tall, which grows basically anywhere. It is highly competitive and extremely difficult to manage (picture 106-1). Spurge contains milky latex, an irritant that causes lesions around the mouth and eyes of cattle when ingested. Spurge is known to occur in the Muddy Gap area and is being treated as found. Wildlife appear to spread the spurge the most and are carrying it up and around the Wilderness Study Area. This is observed along draws and shrub patches in small amounts of an acre or less in size. Altogether there are an estimated 700 acres of leafy spurge scattered across 3,000 acres on the southwest side of the Ferris Mountains that do not meet this standard, most of which is not being treated.

The invasive species of concern are halogeton, black henbane, gumweed, and cheatgrass. Other invasive species include begonia dock, annual goosefoot, Russian thistle, cactus, and several annual mustards. Halogeton is widespread throughout the oil and gas areas, lining roadways and in some cases dominating inadequately reclaimed sites (picture 106-2). It is also invading into nearby native rangelands on shale and saline upland sites from untreated oil and gas roads. Halogeton is poisonous and has caused sheep losses (as recently as January, 2003) due to its prevalence in certain areas. Since the sheep numbers have declined, fewer losses due to halogeton poisoning have occurred. It often provides lush forage along roads due to the late summer flowering habit and added moisture from road runoff. Halogeton has also been known to kill cattle. Although it is a stipulation on oil and gas APDs (Applications for Permit to Drill) and ROWs (Right of Ways) to treat and control weed species, in many cases this is not occurring. Black henbane is also poisonous and can expand rapidly in disturbed areas, so it is targeted for treatment, primarily along disturbed roads. Gumweed is native but excels in disturbed areas, especially during dry times. It can form nearly pure stands along roadsides and is unpalatable forage for all animals. Cheatgrass occurs sporadically throughout the assessment area. Disturbed areas along roads, corrals and salt blocks are common locations. However, it can also be found on rangelands on well-drained, disturbed soils, particularly on south and west facing slopes. Cactus occurs in a few places which have received historic spring use or overuse. Annual mustards, goosefoot, Russian thistle, and begonia dock occur along disturbed roadsides throughout the area. These generally are not large-scale problems, but patchy ones. Most invasive species, including halogeton, are not treated unless they are interfering with reclamation of disturbances or are a fire hazard around well locations.

4) Reference Conditions:

"Early European settlers in North America inadvertently brought weed seeds with them, perhaps in the hay they brought for their animals or in the dirt they used as ballast for their ships, or even in their clothes or bedding. Some activities, such as clearing the land, opened up niches that created places for weeds to grow. Settlers also purposely brought plants from their 'home country' to reseed areas, make dye for clothing and use as ornamental plants. Some of these non-native plants became invasive, reducing the diversity and quantity of native plants. Weeds are continuing to spread rapidly in many areas across the country. Weeds spread to an estimated 4,000 acres each day on public lands managed by the BLM and Forest Service" (BLM Noxious Weed Webpage).

For the most part, this assessment area has been weed-free until relatively recent disturbances by man over the past 50 or 60 years. Petroleum development, especially in the western portion, has greatly increased noxious and invasive non-native species introduction. The advent of motorized travel and subsequent increasing miles of road have resulted in the spread of weedy species.

Settlers along riparian corridors have historically impacted these areas by clearing the land, irrigation, and overall human presence-associated disturbances. These areas also tended to have higher concentrations of livestock, especially historically, when riparian systems were "sacrifice areas" and did not receive the management attention that they receive today.

5) Syntheses and Interpretation:

The highest priorities for treatment are the aggressive noxious weed species, such as the knapweeds, musk thistle, toadflax, saltcedar, and leafy spurge, which are able to spread throughout stable native plant communities. These are promptly treated and monitored, and are not specifically related to livestock grazing. Where livestock grazing is contributing to the invasion or expansion of weed species, management must be adjusted.

Due to the BLM's multiple use philosophy, oil and gas development will continue to occur, providing increased disturbance areas for additional weed establishment. Mitigation practices to control these weeds will continue to be necessary. In addition, the presence of roads and their associated maintenance will also continue to provide additional infestation sites. Some annual weed species are initially beneficial in terms of providing cover on reclaimed pads and pipelines that trap snow, reduce runoff, and shade young perennial grasses. However, these species should not continue to be the dominant species several years after reclamation has occurred.

A significant portion of the watershed has not been inventoried for weeds, but it is generally assumed that unless there are disturbances, there probably are not any weedy species present. The exceptions are where noxious weeds are already established in an area, and buffer zone inventories around the patches are not complete. Most invasive species are not treated unless they are interfering with reclamation of disturbance. As native vegetation is reestablished, many of the invasive species will be crowded out. The species of long-term concern within the assessment area are the noxious species and halogeton.

6) Recommendations:

Due to the existing good condition of native vegetation and the weed treatment program in place to control and/or eradicate identified weed problem areas, it is determined that the majority of the watershed is meeting Standard #4 with respect to weeds. There are known areas of noxious weeds that are rapidly expanding and are not being treated. These areas affect approximately 2400 acres. The following recommendations, in addition to following the Rawlins Weed Prevention Plan (BLM, 1999), would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue inventory and treatment efforts in the area to identify and contain or eradicate noxious weeds. Continue to work with ROW/lease holders in their treatment of weedy species, as well as work with landowners on concurrent treatments with private lands. Enforcement of stipulations on APDs/ROWs to control weeds must occur.

Re-initiate contact with BOR personnel to encourage weed treatment on BOR withdrawn lands, especially where the weeds are putting BLM managed lands at direct risk of invasion.

Identify all weed species that need to be treated throughout the assessment area. Although some may not be a major focus for treatment, they can be a significant problem within localized areas.

STANDARD 5 – WATER QUALITY

Water quality meets state standards.

1) Characterization:

In 1972, the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act, was signed into law. Its purpose is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Act gave the Environmental Protection Agency the authority to implement pollution control programs through partnerships with each individual state. Provisions for establishing water quality standards were included in the Clean Water Act, as amended, and in the Wyoming Environmental Quality Act, as amended. Regulations are found in Part 40 of the Code of Federal Regulations and in Wyoming's Water Quality Rules and Regulations. The latter regulations contain Quality Standards for Wyoming Surface Waters.

The State of Wyoming has surface water quality standards in place for streams rated from class 1 to 4. Each rating class has specific numeric and narrative water quality standards. Class 1 waters of the State are waters where no additional water quality degradation will be allowed. Classes 2 through 4 waters are differentiated based on their ability to support aquatic life, fish and other human and wildlife uses. In general, Class 2 waters support fish populations, Class 3 waters are non-game fisheries protected for aquatic life, and Class 4 waters do not have the potential to support fish and maintain few areas that support aquatic life.

An additional classification scheme describes the multiple goals of a water body, for example supporting both drinking water and game fish (Class 2AB). The "A" refers to the ability to support drinking water and the "B" refers to its ability to support aquatic life. For example, a 3B classification would be non-game protected for aquatic life, but does not have the potential for drinking water.

The North Platte River is mostly designated Class 2AB due to the fisheries on the river and municipal drinking water sources in the basin and downstream. The Miracle Mile below Kortes Dam to Pathfinder Reservoir is Class 1 waters since this reach is designated a blue ribbon trout fishery. Seminoe and Pathfinder reservoirs also have the 2AB designation.

The Great Divide Basin is mostly designated Class 3B waters. The state of Wyoming is doing a Use Suitability Analysis on Red Creek to designate it as Class 4; the analysis must show that wetland/riparian areas are rare and not characteristic of the system. Most ephemeral systems in the basin will probably be reclassified as Class 4 waters, but each reach will have to have an individual analysis done before re-classification.

Water bodies that do not meet their designated beneficial uses are placed on the State 303(d) list for factors identified that contribute to the impairment. There are no water bodies on the State 303 (d) list in the analysis area.

2) Issues and Key Questions:

Non-point source impacts to water quality are the result of not maintaining healthy upland habitats and riparian/wetland systems. These impacts can result from surface disturbance, increased road density, and overuse by livestock, wild horses, and/or wildlife. Surface

disturbance and increased road density can result in erosion by altering the surface hydrology. Overuse of upland vegetation can result in increased eolian and fluvial erosion by reducing ground cover and exposing soil to erosional processes. Overuse of water sources in or near riparian/wetland areas can cause reductions in wetland vegetation from grazing and hoof action and in some cases a lowering of the water table.

Point source impacts include the potential for toxic spills along the I-80 corridor and other highway systems, industrial and municipal discharges and produced water or wastes from the oil and gas developments. Coalbed methane development in the resource area will include surface discharges in isolated portions of the Great Divide Basin including near Cyclone Rim and Separation Creek and in the North Platte by Seminoe Road (picture 109-1). In general this produced water has a higher salinity than background water quality and may contain trace metals that could evapoconcentrate in some cases.

3) Current Conditions:

In general the water quality is excellent in the North Platte watershed and poor in the Great Divide Basin. The excellent water quality in the North Platte is evident by the water quality classifications described in the characterization section. In most cases, water quality classifications are based on the beneficial uses the quality of the water can support. Some areas in both the North Platte River and the Great Divide Basins have naturally saline soils and contribute to high Total Dissolved Solids (TDS), locations where soils with high erosion potential predominate and there are localized impacts from erosion due to road construction and livestock grazing that contribute to sediment loads. The water quality is poor in the Great Divide Basin based mostly on the ephemeral nature of the surface water systems in this area. This is also evident by the water classification of Class 3 or 4 for most of the water bodies. Ephemeral systems generally flow only in response to precipitation events and therefore have typically high sediment loads when flowing, and since there are many areas with saline soils TDS values are generally high in this area. The USGS has collected water samples from stations located on the Sweetwater and North Platte Rivers and represents current water quality conditions. Very little water quality data is available for the Great Divide Basin, however there is some data available for Separation Creek that is characteristic of this area.

Sweetwater River Basin

The USGS Gage on the Sweetwater River near Alcova, Wyoming contains the most extensive water quality sampling (picture 109-2). For the Sweetwater the only parameters that exceeded standards are Iron on 4/5/78 and Turbidity on 5/6/81. Without a more detailed study it is difficult to say whether these values are anomalies or if they reflect true water quality conditions. Iron will typically be high in the first snow runoff event of the year as the system flushes through accumulated litter. The high Iron value on 4/5/78 corresponds a record snowfall year with cold temperatures.

North Platte River Basin

The excellent water quality in the North Platte River is evident by the water quality classifications described in the characterization section. In most cases, water quality classifications are based on the beneficial uses the quality of the water can support. However, the North Platte River has exceeded state standards for Turbidity. Since these high values do not seem to correlate with high flows or time of the year, it is more likely to come from side tributaries like Sage Creek,

which are dominated by shale soils and low vegetative cover, and during thunderstorm events can contribute high amounts of fine clays into the river.

Current conditions in the North Platte River basin include the consideration of Seminoe and Pathfinder reservoirs. These reservoirs provide important recreational opportunities and are protected for the game fisheries by a 2AB classification. Water quality in reservoirs is mostly driven be nutrients. Nutrients can cause Algal blooms that may lead to eutrophication and anaerobic (no available oxygen) conditions. Some metals are more likely to go into the dissolved state when oxygen in lacking, and therefore it is important to monitor the accumulation of nutrients in reservoirs. In general the annual emptying of these reservoirs in response to irrigation demands downstream allow for enough circulation to prevent euthrophic conditions. The most common source for nutrients is large confined animal operations such as feedlots and municipalities. There are no feedlots in the analysis area and a limited amount of municipal systems upstream.

Great Divide Basin Including Separation Creek

Most streams and creeks in the Great Divide Basin are dominated by groundwater and only contain surface water during spring snowmelt and storm events. In general, the Total Dissolved Solids (TDS or Salinity) are high with low flows and the Suspended Sediment concentrations are high with high flows. TDS is particularly high for Separation Creek, the highest value measured was 1970 mg/L and the average 860 mg/L. For comparison the highest value measured for TDS at the North Platte site was 463 mg/L and the average was 274 mg/L. Total Suspended Solids (TSS) were also relatively high with the highest value recorded being 2460 mg/L.

4) Reference Conditions:

Reference conditions are taken from the historic accounts by Col. John Charles Fremont from *The Life of col. John Charles Fremont, and his narrative of exploration and adventures, in Kansas, Nebraska, Oregon and California*. His narrative includes portions of the North Platte and Sweetwater River as traveled in July and August of 1842. There is no mention of fish, however he did not note that there weren't fish present. Fremont estimates the width of the North Platte to be 70 yards (210 ft) in one location, probably below or under Pathfinder Reservoir. He also described islands and most likely the channel was braided indicating sediment deposition. The USGS Gage at Orin, Wyoming has an average width of 284 ft and is located at least 100 miles downstream and in the backwater from Glendo Reservoir. Most of this stretch Fremont says is 200- 300 ft. wide. The year Fremont traveled was during a drought according to the Indians in the area and grass was sparse.

Fremont gives a description of the Sweetwater River on 31st of July. He says that it was about 30 feet wide, 18 inches deep and moderate current. A rough estimate of the discharge assuming a 1 ft./s velocity is 45 cfs. The average measurements at the USGS Gage near Alcova records the smallest width of 24 ft on 8/30/99 and a discharge of 42 cfs. The highest flow in July and August was 141 cfs on 7/24/86. Again, there is no mention of the presence or absence of fish. Since Fremont traveled in a drought year it can be inferred that the Sweetwater was similar in geomorphology to what it is today.

As Fremont travels up the Sweetwater, he notes the saline conditions of the soil and the lack of vegetation in the uplands and river sections with willows and bright flowers near the creek. He also comes across several bands of buffalo. After several days of rain the party observes a flood

event with depths of 4 –5 feet and 60 feet across with a strong current. As he moves up into the foothills he notes the presence of aspen, beech and willow and the remnants of beaver dams.

Clarence King described the Red Desert portion of the Great Divide Basin in a *Geological Exploration of the Fortieth Parallel in 1869*, he says of this area:

"This region, and that to the north of the railroad between Washakie Station and Bitter Creek Ridges, constitutes the Red Desert, from which the railroad station takes its name. The northern portion is an almost unknown region, barren of vegetation, and almost without water, but said to contain several alkaline ponds."

5) Synthesis and Interpretation:

Within the assessment area, water quality impairment has not been identified in any water bodies by the State of Wyoming by listing them on the State's 303d list. There are indications that water quality parameters may exceed state standards in some areas. These events are difficult to predict and in many cases are part of natural processes. Livestock grazing, road density and other human practices contribute to non-point pollution. These human influenced processes may be additive to natural processes that lead to exceedences, however separating human from natural sources is difficult at best. Managing livestock and evaluating road designs on a project and allotment basis is the best way to address human contributions and can be measured and evaluated on a case-by-case basis or in monitoring vegetation health.

There are a number of wellhead protection areas in the analysis area that are designed to protect shallow surface waters near the well or spring sites. In general, good grazing management, evaluation of wetlands in these protected areas, and in some cases limiting oil and gas development in these areas are the management approach used by the BLM. Watershed, riparian/wetland habitat, and upland vegetation (Standards 1-3) are the tools used to evaluate upland areas that may contribute to water quality impacts. If an allotment fails on one of these standards it may also fail Standard 5 for water quality.

<u>Non-Point Pollution Sources</u>

Livestock and wild horses can contribute to vegetation disturbances altering the developed soil profile by degrading protective vegetation, root channels, and the structure of the soil horizons. This disturbance reduces infiltration and increases runoff. Disturbances also disrupt the biological and chemical processes that contribute to soil fertility. Such disturbances expose soil materials to both wind and water erosion.

Soil compaction increases water runoff and thereby promotes sheet, rill and gully erosion on site and stream down cutting and gullying off site. The greatest compaction occurs when soils are moist or wet. Compacted soils are less accommodating to plant roots, and seed germination is difficult in such soils. This physically reduces soil productivity. Increases in water runoff increase peak flows in perennial and ephemeral drainages. Increased flows can upset stream equilibrium, causing streams to downcut and ephemeral tributaries and other drainages to gully. Water tables may drop, reducing moisture available for plant growth. When this happens, riparian areas become degraded.

Disturbance in or adjacent to riparian areas can increase sediment into channels and degrade water quality. The PFC analysis method is design to evaluate if a given riparian or wetland

system is sustainable during a typical disturbance such as flooding. Therefore, if a stream channel is not meeting PFC, it is an indication that the system will contribute to water quality problems by eroding during a storm event. Riparian and wetland systems can also be an effective buffer and trap suspended sediment during storm events, therefore if they are degraded the quality of the water downstream will generally be lower than if the system was healthy. Therefore, if allotments have areas that fail PFC it can be assumed to contribute to non-point pollution in downstream water bodies.

Point Source Pollution

Point sources of pollution are regulated by the State of Wyoming using the National Pollutant Discharge Elimination System (NPDES) Program. Industrial and municipal sources are generally a small factor due to the low population density. The development of natural gas from coal seams, however is mostly on Federal Leases and in many cases on BLM administered land. Coalbed Methane (CBM) removes water from coal seams saturated with natural gas. As the water is removed the hydrostatic pressure of the coal seam is reduced and the natural gas travels to the well casing via fractures in the coal produced in the drilling process. This water is generally of good quality with TDS values of 1000-2000 mg/L in this area. The water can include trace elements and metals that would not be present in the same concentrations in other sources of water, such as selenium, manganese and iron. However, regardless of the water quality, the release of this water into systems that are adapted to current climate conditions, in itself, may cause erosion and lead to increased sediment loads as the channel adjusted to different flow conditions.

CBM discharges in the Great Divide Basin are generally not of concern for water quality in the produced water itself. However, there is the potential of creating erosion problems, changing the availability of water sources for livestock and/or wildlife and therefore their resource use, or by temporally changing the physical hydrology of a drainage. This is because high TDS values are common in the great divide (Current Conditions Section).

Sub-Analysis Area Comparison and Summary

The Sweetwater and North Platte River Systems generally have higher water quality classifications than the Great Divide Basin. There is no reason to assume that current water quality conditions for beneficial use are different from reference conditions, with the exception of the reservoirs on the North Platte and the development of water resources in the uplands. Impacts from these water developments in general store more sediment in the headwaters were the reservoirs are located and produce localized changes in water quality, such as reducing the temperature of streams below major reservoir outfalls and reducing peak flows. This may actually improve water quality for the game fish, one of the beneficial uses designated.

Non-point impacts to water quality from increased road density and ungulate grazing need to be managed through good engineering designs and minimized when possible by good grazing management. Point sources could contribute to increased sediment and salt loading and potentially introduce trace elements and metals to systems downstream. These point source activities should be well planned when the BLM is involved and the impacts minimized, since each CBM project will be evaluated through the NEPA process.

6) Recommendations:

Within the assessment area, water quality impairment has not been identified by the State of Wyoming for any of the Great Divide Basin or the North Platte River drainage. The BLM will continue to implement or refine BMPs for livestock grazing, which promote perennial vegetation to stabilize stream banks and improve cover and litter on uplands. Season and duration of use are the principal factors in considering management changes to address this standard.

Identify and correct existing road problems that alter surface water flows and result in accelerated erosion. Incorporate measures into new projects and environmental assessments, which will mitigate alterations to surface water flows.

The numbers of wild horses in the assessment area must be maintained at AML.

Promote mixed-age shrub and woodland communities with higher proportions of young and middle-aged stands, which have greater amounts of herbaceous cover to reduce runoff and soil erosion and increase infiltration and ground water recharge.

Design and plan surface discharge facilities for CBM to reduce impacts on water quality, and minimize road development through transportation plans.

STANDARD 6- AIR QUALITY

Air Quality Meets State Standards.

1) Characterization:

Air quality within the field office cannot be easily documented, since monitoring data has not been gathered for the most part, except for site-specific projects. Air quality regulations consist of the National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) increments. The NAAQS limit the amount of specific pollutants allowed in the atmosphere. All BLM-administered lands are classified PSD Class II, which means that moderate, controlled growth can take place. However, adjacent to this field office is a high priority airshed for the Mt. Zirkel Wilderness Area.

In 1999, EPA issued regulations to address regional haze, which are visibility impaired areas caused by numerous sources located across a wide geographical range. Visibility impairment happens when light is scattered or absorbed by particles and gases in the atmosphere. It is most easily described as haze that obscures the clarity, color, texture, and form of what we see (NAQETR, 1999).

2) Issues and Key Questions:

Several different factors can greatly affect air quality within this analysis area, but most are unrelated to livestock grazing. Oil and gas development and coal mining produce the largest and most continuous amounts of pollutants in the air. The pollutants come directly from power plants and coal mine emissions, areas of production such as well heads in burn-off operations, and other associated activities. Vehicle traffic contributes pollutants through the combustion of fossil fuels. Where interstates or highways are present, more motor vehicle traffic will result in increased levels of these pollutants. In less developed areas, such as along two-tracks these levels of pollutants will be greatly reduced due to less traffic. Oil and gas (and other uses) traffic along these dirt roads also affects air quality over the short term, especially during dry conditions. How can we reduce pollutants that enter the air at their source, and also address associated air quality issues such as dust abatement from vehicular travel?

Prescribed burns and wildfires affect air quality in a localized area for a short period of time. Prescribed burns are implemented in coordination with and permitted by the Wyoming Department of Environmental Quality. Most are planned in a way to minimize impacts to more-populated areas. Large-scale fires are becoming much more common due to decades of fire suppression. If fuel breaks aren't created occasionally by prior burned areas, could we be looking at larger wildfires with associated air quality issues?

3) Current Conditions:

Overall air quality is good within the area, which is due in large part to the presence of reliable winds. According to a letter received from the Wyoming Department of Environmental Quality there are no air quality criteria pollutant non-attainment areas for either state or federal standards within the boundaries of the Rawlins Field Office. Lichens (an important air quality indicator) are prevalent throughout the assessment area and the field office.

Current annual average conditions range from 18-40 miles in the rural portions of the eastern United States to 35-90 miles in the rural western portions. On an average basis, they are estimated at approximately 80-90 miles in the east and up to 140 miles in the west (NAQETR, 1999). Three figures (1, 2, and 3) from this report document the clearest, middle, and haziest days across the country. On a local basis, visibility as reported from the Rawlins airport is on average 60 miles. On days that are hazy due to drift smoke this visibility can be less than 10 miles.

Oil and gas development and the associated roads and traffic have impacts on local air quality. Some roads have been surfaced to reduce dust levels, but there is still much that should be done. In high development areas, roadside vegetation is caked with dirt, and in the winter the snow shows the movement of dirt particles. Dry soil conditions exacerbate the problem, so in the summer dust is increased. This not only affects air quality but also public safety, as visibility when traveling by vehicle can be severely hindered. In many cases headlights must be turned on to alert others of vehicles within the area.

Short-term impacts from prescribed burning and/or wildfires can also impact air quality. There are usually only a few prescribed burns in this area conducted mainly in the fall. The burns usually only take a few days to implement and generally require winds in the burn plan prescription. If they are close to communities, the burn plan tries to mitigate short-term impacts to air quality.

No large wildfires have burned in the assessment area, the largest has been less than 3,000 acres. The majority of wildfires are less than 10 acres. Therefore, local wildfires have as minimal an impact on air quality as do prescribed burns. However, large-scale fires in the Intermountain West can affect air quality within the area as drift smoke. Recent photographs show the impacts on air quality from catastrophic wildfires in Colorado in 2002. Depending on the fire season, these impacts can be short or long-term. In the case of 2002, several days have been unusually smoky due to large wildfires throughout the West and the lack of reliable prevailing winds (pictures 115-1, 115-2).

Depending on the type of grazing management implemented, number of animals, and habitat type, pollution from livestock presence varies. Season-long use and/or heavy use levels can increase bare ground, thereby increasing dust. In periods of drier climate conditions, dust created by livestock trailing, herding, and day to day movements increases.

4) Reference Conditions:

Information gathered from longtime residents has alluded to the increased haziness in the area. Clear vistas were the norm, and being able to see over 100 miles from a high point was an everyday occurrence. At this time, most information is anecdotal since there is very little documentation. Possible causes of this long-term reduction in air quality could be the increased mineral development and associated powerplants to the west that contribute air pollutants. Days that have clear skies are relatively rare.

Historic livestock use tended to be much heavier and for longer periods of time that increased bare ground and decreased plant cover. Large bands of sheep trailed back and forth across the field office, and dust from their movements could be seen for miles.

5) Synthesis and Interpretation:

Current mitigation standards in oil and gas development address new road construction and adequate surfacing. However, many of the existing roads have not been addressed. Vehicular traffic related to increased development results in numerous trips through these areas by anything motorized ranging from ATVs, pickup trucks, semis, large seismic trucks, and miscellaneous heavy equipment. Vegetation along these roads has reduced vigor and production and is generally covered in dust particles. Although gravel on the new roads has reduced some dust problems, even they are not exempt. Winter snows observed from the air show telltale signs of particulate movement along the drift side.

Catastrophic wildfires throughout the West are a problem beyond the scope of this document. Forest fires both regionally and locally could continue to have a significant impact on the area's air quality. Continued efforts to address this widespread problem are being implemented on a national basis, however, in the short-term there will continue to be large-scale wildfires. On the local level, creating fuel breaks and diversifying vegetation communities will help to ensure that wildfires in this area do not become catastrophic in scope.

Best management practices for livestock grazing will continue to reduce particulate pollution caused by this use. Reducing the size of disturbed areas, reestablishing vegetation on disturbed sites, and managing livestock to reduce bare ground will reduce soils susceptible to wind erosion (dust).

6) Recommendations:

Within this assessment area there is no air quality criteria pollutant non-attainment areas for either state or federal standards as determined by the Wyoming DEQ. Due to prevailing winds, limited pollution within the general area, overall air quality meets this Standard.

Continue to implement mitigation measures on new oil and gas development operations, while attempting to resolve existing issues. Dust abatement due to vehicle traffic is an important concern, both on a resource basis and a public safety basis.

Continue prescribed burning and other vegetation treatment operations to provide for fuel breaks to ensure catastrophic wildfires do not occur. Treatments will greatly reduce the risk of large amounts of particulate matter in the air from local wildfires burning out of control.

SUMMARY

Standard 1 – Watershed Health

Due to the existing diversity and amount of vegetative cover on uplands, the existing condition of primarily ephemeral channels, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, and the generally small number of management issues that need to be dealt with, it is determined that the Great Divide Basin and Upper/Lower Separation Creek/Boggy Meadows watersheds are meeting Standard #1.

Due to the existing diversity and amount of vegetative cover on uplands, the existing and improving trend in stream vegetation and channel morphology, and the small number of remaining management issues, it is determined that the majority of the Sweetwater River watershed within the report area is meeting Standard #1. The area failing this standard is Whiskey Creek in the Cherry Creek allotment due to livestock management practices. This constitutes about ½ mile of stream channel on public lands.

Due to the existing diversity and amount of vegetative cover on uplands, the existing and improving trend in stream vegetation and channel morphology, and the small number of remaining management issues, it is determined that the majority of the Sweetwater River watershed within the report area is meeting Standard #1. The area failing this standard is Sand Creek in the Buzzard allotment due to livestock management practices. This constitutes about 1½ mile of stream channel on public lands.

Standard 2 – Riparian/Wetland Health

There has been a tremendous improvement in riparian/wetland condition within the assessment area over the last 15 to 20 years, however, there are still some specific areas that need attention. Allotments containing riparian/wetland habitat that do not meet this standard have been described previously and include: Stewart Creek, Cyclone Rim, Jawbone, Cherry Creek, Ferris Mountain, Buzzard, Seminoe, Long Creek, and Wood Creek allotments. For lotic systems that are not meeting the minimum standard, there are 62 miles out of a total 128 miles. In lentic sites, there are 196 acres of a total 2161 acres, that do not meet the minimum standard.

Most of the lentic and lotic sites not meeting the standard have been, or are in the process of being addressed in management plans or as range improvement projects. Continued progress in grazing management of livestock and wild horses (where they are present) will ensure further improvement of all riparian areas within this area. Although there are areas where desired future condition is yet to be reached in woody species dominance and composition in the upper watersheds, these areas still meet the minimum standard of rangeland health. Other than the specific allotments listed previously, the remainder of the allotments within this assessment area are meeting Standard #2 – Riparian/Wetland Health.

Standard 3 – Upland Vegetation Health

At the present, the review of upland vegetation conditions in the Great Divide Basin reveals generally good overall community health. Natural ecological and biological processes appear to be functioning adequately overall, although concerns about current, and especially near-future, functionality of certain community types remain. Specifically, the review group has determined

that the majority of upland vegetation communities are properly functioning in relation to the seral stage to which they have evolved. Several specific communities, however, are becoming rare (aspen) or elicit concerns due to their uniformity of age and structural class, and the imminent onset of over-maturity to decadence (big sagebrush and mountain shrub stands).

Aspen stands in the Ferris-Seminoe Mountains area do not meet the standard for upland vegetation health due to decadence, disease, and decreasing occurrence and acreage due to encroachment by conifers. They occur next to seeps and drainages at lower elevations, as separate stands along the base of the mountain, and intermixed with conifers up on the mountain. The current acreage of aspen habitat in this area is about 500 acres. Livestock grazing is a component in the management scenario of these plant communities, but it is not the principle factor in non-attainment of this Standard.

Standard 4 – Wildlife/Threatened and Endangered Species/Fisheries Habitat Health, Weeds

Habitat needed to support healthy wildlife populations and listed or proposed threatened and endangered species is generally in acceptable condition. This does not mean that there aren't problems or concerns about wildlife habitat. The discussion under Standard #2 – Wetland/Riparian Health and Standard #3 – Upland Plant Health outlines the current conditions and recommendations for improving management of these resources. In many cases we may be meeting a standard but we fell short of our "desired or future" condition. On the other hand, our composition of native species is good, with just spot problems at this time with weeds. Due to the existing good condition of native vegetation and its ability to support the diverse wildlife populations we currently have, it is determined that the majority of Great Divide Basin assessment area is meeting Standard #4 with respect to wildlife. The principal area deemed not to be meeting Standard #4 for wildlife habitat is the Ferris Mountains, due to loss of aspen habitat and the disease, decadence, and encroachment of conifers into shrubland and riparian habitats. This area encompasses about 24,000 acres of public land. The following recommendations address action to help meet future desired resource conditions. Livestock grazing is not a principle factor in the non-attainment of this standard.

The improved management of riparian habitats through the use of grazing BMPs indicate both an upward trend and meeting Standard #4 for fisheries for some of the streams in the assessment area. However, many other sites that should support fisheries, currently do not. Standard #4 for fisheries is not being met on streams, which currently fail Standard #2 – Riparian/Wetland Health. There are also sites that are rated in proper functioning condition, but due to the lack of overhead cover (stream shading) exceed temperature requirements for some fish species and won't support them. However, these sites have not yet been defined. Due to the lack of credible data on the status of native fishes in the watershed, whether Standard #4 is being met for these species is unknown.

Due to the existing good condition of native vegetation and the weed treatment program in place to control and/or eradicate identified weed problem areas, it is determined that the majority of the watershed is meeting Standard #4 with respect to weeds. There are known areas of noxious weeds that are rapidly expanding and are not being treated. These areas affect approximately 2400 acres. The following recommendations, in addition to following the Rawlins Weed Prevention Plan (BLM, 1999), would expand upon the success already achieved and help to meet desired resource conditions in the future.

Standard 5 – Water Quality

Within the assessment area, water quality impairment has not been identified by the State of Wyoming for any of the Great Divide Basin or the North Platte River drainage. Although specific compliance for some stream segments is unknown, nothing within available data indicates this Standard is not being met.

Standard 6 – Air Quality

Within this assessment area there is no air quality criteria pollutant non-attainment areas for either state or federal standards as determined by the Wyoming DEQ. Due to prevailing winds, limited pollution within the general area, overall air quality meets this Standard.

Allotments described in this report that do not meet Standards due to Livestock Grazing:

- Buzzard: Standard #1 – Watershed Health, Standard #2 - Riparian/Wetland Health
- Cherry Creek: Standard #1 – Watershed Health, Standard #2 – Riparian/Wetland Health
- Cyclone Rim: Standard #2 – Riparian/Wetland Health
- Ferris Mountain: Standard #2 – Riparian/Wetland Health
- Jawbone: Standard #2 – Riparian/Wetland Health
- Long Creek: Standard #2 – Riparian/Wetland Health
- Seminoe: Standard #2 –Riparian/Wetland Health
- Stewart Creek: Standard #2 – Riparian/Wetland Health
- Wood Creek: Standard #2 – Riparian/Wetland Health

Standards not being met due to causes other than livestock grazing:

- Standard #1 - None
- Standard #2 - Riparian/wetland health due to wild horses in the Lost Creek and Stewart Creek HMAs; responsibility – BLM.
- Standard #3 - Upland plant health in aspen plant communities in the Ferris-Seminoe Mountains, and spot locations elsewhere; responsibility – BLM.
- Standard #4 - Shrub and woodland habitat around the Ferris-Seminoe Mountains totaling 24,000 acres; responsibility – BLM. Streams on public land that do not meet Standard #2 and are capable of supporting fish populations; responsibility – BLM. Expansion of noxious weeds on 2400 acres, primarily Russian knapweed and leafy spurge, into native rangelands due to lack of control on public lands and spread from private lands; responsibility – BLM, BOR, oil and gas industry, private landowners, County Weed and Pest Districts.
- Standard #5 - None
- Standard #6 - None

Allotments within the Great Divide Basin/Ferris and Seminoe Mountains Standards and Guidelines assessment area that do meet the six Rangeland Standards:

- Bar Eleven
- Bell Springs
- Buzzard Ranch Meadows
- Chain Lakes
- Coal Bank Wash
- Daley Ranch
- Desert Claim
- Echo Springs
- Fillmore
- G.L.
- Haystack
- Junk Creek
- Larson Knolls
- Latham
- Lazy Y-S Ranch
- Little Camp Creek
- Monument Draw
- Monument Lake
- Muddy Creek Pasture
- North Creston-West
- North Tipton
- North Wamsutter
- Pole Canyon
- Red Desert
- Riner
- Ruby Knolls
- Sand Creek
- Sand Creek Ranch Pasture
- Sandstone
- Separation Flats
- Shamrock Hills
- Shamrock Pasture
- South Red Desert
- South Wamsutter
- Station 8
- Stone
- Tapers
- Tipton
- Wood Creek Ranch Pasture

References

Alldredge, A. William and Robert D. Deblinger. 1988. Great Divide Basin Pronghorn Antelope Study.

Armour, C.L., D.A. Duff, and W. Elmore. 1991. The effects of livestock grazing on riparian and stream ecosystems. Fisheries 16:7-11

Beebe, Ruth. 1973. *Reminiscing Along the Sweetwater*. Second Printing. Johnson Publishing Co., Boulder, Colorado.

Bisson, P.A., Rieman, B.E., Luce, C., Hessburg, P.F., Lee, D.C, Kershner, J.L., Reeves, G.H., and R.E. Gresswell. In press. Fire and aquatic ecosystems of the Western USA: current knowledge and key questions. Forest Ecology and Management. In Press.

BTRT. 2001. Boreal toad conservation plan and agreement for the southern Rocky Mountain population of the boreal toad (*Bufo boreas boreas*). Colorado Division of Wildlife, Denver, CO.

Dwire, K.A. and J.B. Kauffman. In Press. Fire and riparian ecosystems in landscapes of the western USA. Forest Ecology and Management. In Press.

Frémont, John Charles. 1813-1890. *The life of Col. John Charles Frémont, and his narrative of explorations and adventures, in Kansas, Nebraska, Oregon, and California*. The memoir by Samuel M. Smucker. New York, Auburn, Miller, Orton & Mulligan. 1856.

Lacey, J.R., C.B. Marlow, and J.R. Lane. 1989. Influence of spotted knapweed (*Centaurea maculosa*) on surface runoff and sediment yield. Weed Technol. 3:627-31.

Olsen, R. and W.A. Hubert. 1994. Beaver: water resources and riparian habitat manager. University of Wyoming, Laramie, WY. 48 pp.

Patton, T.M., Hubert, W.A., and F.J. Rahel. 1998. Ichthyofauna in streams of the Missouri River Drainage, Wyoming. The Prairie Naturalist 30(1):9-21.

Rinne, J.N. 1999. Fish and grazing relationships: the facts and some pleas. Fisheries 24:12-21

Schlosser, I. J., and P. L. Angermeier. 1995. Spatial variation in demographic processes of lotic fishes: conceptual models, empirical evidence, and implications for conservation. Pages 392-401 *in* J. L. Nielsen, editor. Evolution and the aquatic system: defining unique units in population conservation. American Fisheries Society, Symposium 17, Bethesda, Maryland

Sheley, R.L. and J. K. Petroff. 1999. Biology and Management of Noxious Rangeland Weeds. Oregon State University Press, Corvallis, Oregon.

Stokes, Donald and Lillian. 1996. *Field Guide to Birds*. Western Region. Little, Brown and Company. Boston, New York, London.

USDI-Bureau of Land Management. September 2002. *Upper Colorado River Basin Rawlins Field Office Standards and Guidelines Assessment 2001 Field Season*. Document for Agency, Permittee, and Interested Public Review.

USDI-BLM. April 9, 2001. *Issuance of BLM (Wyoming) Sensitive Species Policy and List*. Instruction Memorandum No. WY-2001-040. Expires 9/30/2002. 6840 (930)P.

USDI-BLM. November 1990. *Great Divide Resource Area Record of Decision and Approved Resource Management Plan*. United States Department of the Interior, Bureau of Land Management, Rawlins District Office, Great Divide Resource Area. BLM-WY-PT-91-010-4410

USDI-Heritage Conservation and Recreation Service. National Register of Historic Places Inventory – Nomination Form. Jim Baker Cabin. FHR-8-300 (11-78).

USDI-Fish and Wildlife Service. *Endangered, Threatened, Proposed, Petitioned and Candidate Species of Wyoming*. July 2001. Species List.

White, R.J. 1996. Growth and development of North American stream habitat management for fish. Canadian Journal of Fisheries and Aquatic Sciences 53:342-363

WGFD. 2002 (a*). Lander Region Annual Big Game Herd Unit Reports 2001*. Wyoming Game and Fish Department. Cheyenne, Wyoming.

WGFD. 2002 (b*) Green River Annual Big Game Herd Unit Reports 2001*. Wyoming Game and Fish Department, Cheyenne, Wyoming.

WGFD. 2002(c) *Threatened, Endangered, and Nongame Bird and Mammal Investigations*. Nongame Program. Biological Services Section. Wyoming Game and Fish Department. Annual Completion Report. Period Covered: 15 April 2001 to 14 April 2002. Edited by: Andrea O. Cervoski. 30 September 2002.

WGFD. 2002(d) *2001 Sage Grouse and Pheasant Job Completion Report Lander Region*. Wyoming Game and Fish Department.