Sage Creek Watershed Assessment Report

Dillon Field Office

December 16, 2015

Sage Creek Watershed from Armstead Mountain Allotment July, 2015

Table of Contents

Assessment Process 1

Background 3

Authorized Uses 12

Format for Standards 15

Uplands 16
- Affected Environment 16
- Findings and Analysis 25
- Recommendations 27

Riparian and Wetland Areas 28
- Affected Environment 28
- Findings and Analysis 31
- Recommendations 37

Water Quality 37
- Affected Environment 37
- Findings and Analysis 38
- Recommendations 39

Air Quality 40
- Affected Environment 40
- Findings and Analysis 41
- Recommendations 41

Biodiversity 41
- Affected Environment and Findings and Analysis 42
- Recommendations 66

Additional Programs, Issues and/or Concerns 67

Interdisciplinary Team Composition 68

Glossary of Terms 69

References 74

Tables

Table 1. Livestock Grazing Allocations and Management....13
Table 2. Average Monthly Precipitation....17
Table 3. Summary of Soil Susceptibility to Disturbance....18
Table 4. General Cover Types....18
Table 5. Upland Qualitative Assessment Summary of Grazing Allotments....23
Table 6. Functional Status of Lotic and Lentic Reaches....32
Table 7. Developed Springs....36
Table 8. Primary Game Species and Habitat Use Within the SCW....46
Table 9. USFWS Birds of Conservation Concern, BCR 10....47
Table 10. Sage Creek Watershed Fish Streams and Species....48
Table 11. Sage Creek Stream Temperature Data....52
Table 12. Special Status Species....52
Table 13. Pool Frequency, Depth and Stream Bed Particle Size....57
Table 14. Recent Weed Inventories and Treatments....59
Table 15. Distribution of Dominant BpS (All Ownerships)....63
Table 16. Natural Fire Regimes and Descriptions....64
Table 17. FRCC Summary (all ownerships) in the SCW....66

Figures

Figure 1. Geology of the Sage Creek Assessment Area....11
Figure 2. Gallagher Mountain AMP Photo Plot 10S09W2301....20
Figure 3. Armstead Mountain Allotment Photo Point 10S08W3102....21
Figure 4. Sage Creek Lotic Reaches....35
Figure 5. Sage Creek Lentic Reaches....35

Maps

Map 1. Sage Creek Assessment Area Boundary and Allotments
Map 2. Sage Creek Assessment Area- Lands with Wilderness Characteristics
Map 3. Sage Grouse Habitat Management Areas and Past Vegetative Spraying Units
Map 4. Sage Creek North Half Riparian Reaches
Map 5. Sage Creek South Half Riparian Reaches

Appendices

Appendix A. A List of Known Plants Found On or Near BLM Lands Within the Sage Creek Watershed and Wildlife Species List
Appendix B. Livestock Grazing Tools Available to Improve Resource Conditions

Assessment Process

This document reports the land health assessment of the public lands administered by the Bureau of Land Management (BLM) in the Sage Creek Watershed (SCW).

This is the first in a series of documents: the Watershed Assessment Report, the Authorized Officer's Determination of Standards, and the appropriate National Environmental Policy Act (NEPA) documentation and subsequent Decision(s).

The Watershed Assessment reports the condition and/or function of BLM administered land and resources within the SCW to the Authorized Officer. The Authorized Officer considers the report to determine if the five Standards for Rangeland Health (Standards) are currently being met, and then signs a Determination of Standards documenting where land health standards are, or are not, in compliance.

This assessment will report condition and/or function for the following five Standards:

- Standard #1 Upland Health
- Standard #2 Riparian /Wetland Health
- Standard #3 Water Quality
- Standard #4 Air Quality
- Standard #5 Biodiversity

The Standards are assessed on an allotment scale, with the exception of Air Quality, which is made at the watershed level.

This assessment will also report condition and/or function of forest and woodland health. Forest and woodland health can affect each of the five standards, but in this assessment will be reflected under Standard #5 Biodiversity, along with other factors pertinent to biodiversity including Special Status Species and invasive species.

Condition/function declarations regarding the Standards are made as either:

- Proper Functioning Condition (PFC),
- Functioning At Risk (FAR); which is assigned a trend of up, down, static, or not apparent, or
- Nonfunctioning (NF).

Land Health Standards are met when conditions across an allotment as a whole are at PFC or FAR with an upward trend. This is dependent on scope and scale and determined by the Authorized Officer.

Reporting the conditions of the Standards will follow the following format:

- 1) Affected Environment - This section briefly describes the area and resources that were assessed.
- 2) Analysis and Recommendations - This section outlines the procedures the interdisciplinary team (IDT) used to determine conformance with the various standards,

lists the findings, and includes recommendations suggested by the IDT during the field assessments.

The Standards are described in detail in the Record of Decision (ROD) Standards for Rangeland Health and Guidelines for Livestock Grazing Management (S&Gs) for Montana, North Dakota, and South Dakota-Western Montana Standards. The preamble of the Western Montana Standards states: "The purpose of the S&Gs are to facilitate the achievement and maintenance of healthy, properly functioning ecosystems within the historic and natural range of variability for long-term sustainable use." Standards are statements of physical and biological condition or degree of function required for healthy sustainable lands. Achieving or making significant progress towards these functions and conditions is required of all uses of BLM administered lands as stated in 43 CFR 4180.1.

This assessment is being done in accordance with the BLM regulations regarding Rangeland Health Standards.

- BLM Manual H-4180-1, Rangeland Health Standards Handbook and Guidance for Conducting Watershed-Based Land Health Assessments.
- Code of Federal Regulation 43 CFR, Subpart 4180
- Record of Decision - Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Montana, North Dakota and South Dakota.

Available trend monitoring data, existing inventories, historical photographs and standardized methodology are used by the IDT to assess condition and function of BLM administered lands. This information, including technical references, BLM policy and procedure handbooks, and monitoring guidelines and methodologies are available for review at the Dillon Field Office. Technical references and BLM procedural handbooks are also available on the BLM library website at www.blm.gov/nstc/library/library.html.

The initial recommendations developed by the IDT during field assessments contained in this report focus primarily on livestock management, forest and woodland treatments, and wildlife and fisheries habitat. Other BLM administered public land resources, concerns, uses and designations addressed in the SCW include recreation and travel management, noxious weeds and invasive species, cultural resources, and special status species.

The assessed land health conditions and/or functionality are the basis for the IDT's management recommendations in this report and the Determination of Standards. As required by NEPA regulations, an Environmental Assessment (EA) will be completed to address resource concerns identified within the 22 allotments within the SCW.

Alternative management will be analyzed wherever it is determined that:

- specific grazing allotments are not meeting the Standards
- allotments are meeting the Standards but have site specific concerns
- there are unhealthy forest or woodland conditions in the watershed
- vegetation composition and/or structure are outside the natural range of variability
- there are other documented resources concerns

Also, if existing grazing management practices or levels of grazing use on BLM administered lands are determined to be significant factors in failing to achieve one or more of the five Standards, the BLM is required by regulation (43 CFR 4180.1) to make grazing management adjustments. Alternative management may also be analyzed where permittees or BLM staff have recommended changes to better facilitate current livestock management.

Implementation of new plans will begin in 2017, but it may take several years to fully implement revised grazing management plans, range improvement projects, forest and woodland treatments. The new plans will be developed in consultation and coordination with the affected lessees, the agencies having lands or managing resources within the area and other interested parties.

As with all similar BLM decisions, affected parties will have an opportunity to protest and/or appeal these decisions.

Background

The Sage Creek Watershed is located in southeastern Beaverhead County, Montana on the eastern slopes of the Rocky Mountains. The watershed lies in Townships 10-13 South, Ranges 6-10 West Montana Principal Meridian (M.P.M). The assessment area covers public lands administered by the BLM from approximately I-15 on the west side of the watershed to the top of the Blacktail Range on the east and from Clover Divide on the south to the Blacktail Range on the north. The SCW roughly corresponds to the 5th level Hydrologic Unit (HU) also known as Sage Creek (1002000106) used by Montana Department of Environmental Quality (DEQ). A portion of Armstead Mountain allotment is located west of I-15. While the majority of the assessment area includes public lands within the Sage Creek HU, portions of other HUs are also included. The assessment area boundary shown on Map 1 follows grazing allotment boundaries and includes some allotments that are partially outside the watershed.

The Gallagher Mountain AMP grazing allotment is located in the Beaverhead West Watershed which borders the Sage Creek Watershed on its northern boundary (See Map 1). Due to the rugged topography of the Gallagher Mountain AMP allotment, the three southern most pastures (Sheep Canyon, Sage Creek and Divide Creek), which have a combined total of 4,756 acres of BLM administered lands, are geographically separated from the other Gallagher Mountain AMP pastures and are conveniently located near grazing pastures in the Armstead Mountain-allotment. The Armstead Mountain allotment is located in the SCW. The Gallagher Mountain AMP and the Armstead Mountain allotments have the same BLM grazing permittee and the permittee and the BLM would like to insert the three pastures in the Gallagher Mountain AMP allotment (Sheep Canyon, Sage Creek and Divide Creek) into the Armstead Mountain allotment to improve the administration of both allotments. As a result, this Assessment Report will document the rangeland health conditions found by the BLM IDT in the three mentioned pastures in the Gallagher Mountain allotment. The associated Sage Creek Watershed Environmental Assessment will then propose to include the three pastures in the Armstead Mountain allotment on a permanent basis.

Within the Sage Creek Watershed Assessment area boundary, there are approximately 203,628 acres of which the BLM administers 114,475 acres. This report addresses only public lands administered by the BLM within the watershed. However, approximately 41,312 acres

administered by the State of Montana Department of Natural Resources (DNRC) and 47,842 acres of privately owned lands also occur within the watershed assessment area.

Elevations within the assessment area range from approximately 5,950' along Sage Creek in the southwestern portion of the area to over 9,400' along the top of Blacktail Ridge on the north end of the assessment area. Topography varies from flat valley bottoms to steep mountainous ravines. Upland vegetation varies from low-sage (*Artemisia arbuscula spp. arbuscula*) and western wheatgrass (*Pascopyrum smithii*) or black greasewood (*Sarcobatus vermiculatus*) and bottlebrush squirrel-tail (*Elymus elymoides*) in the valley bottom to mountain big sagebrush (*Artemisia tridentata spp. vaseyana*) and Idaho fescue (*Festuca idahoensis*) or subalpine fir (*Abies lasiocarpa*) and limber pine (*Pinus flexilus*) at higher elevations. Riparian stringer habitat is very important within the watershed and includes primarily aspen (*Populus tremuloides*), willow (*Salix spp*.) and sedges (*Carex spp*.). Annual precipitation within the watershed varies from <10" in the lower elevations to >25" in the higher country. Because of the diverse landscape and vegetation within the watershed assessment area, it provides habitat for an abundance of wildlife.

The Dillon Field Office's Resource Management Plan (RMP) approved in 2006 provides guidance for all programs in the Dillon Field Office.

All BLM administered land within the Dillon Field Office has been assessed for land health over the last 13 years. The Sage Creek Watershed was assessed in 2005 and was re-assessed during the 2015 field season. By working on a watershed basis, a broader landscape is considered and more consistent management can be applied. It is the BLM's intent to implement watershed management cooperatively. Any changes in livestock management will be implemented through grazing decisions that address allotments or groups of allotments with a common permittee. Forest management actions and any other management projects or changes will be implemented through Decisions appropriate for the respective programs.

Over the previous 13 years (2002 to 2014), BLM has been conducting watershed assessments on a 10 year adaptive management schedule. All 17 watersheds within the Dillon Field Office covering over 900,000 acres of BLM administered land have been assessed at least once and several have been assessed a second time. These watershed assessments evaluated all five standards for Rangeland Health including both upland and riparian systems. Uplands are defined as any part of the landscape beyond the non-streamside boundary of the riparian area (USDI, 1998). Riparian areas are the "green zones" which lie between channels of flowing water and uplands. For each watershed assessment, an interdisciplinary team of trained BLM resource professionals observed these systems and made an on-the-ground rating whether they were meeting BLM Standards for Healthy Rangelands following approved BLM protocols.

Cultural History and Paleontology

The Native American presence in the SCW probably spans the entire record of documented human occupation in North America. The abundant floral, faunal and lithic resources of this high mountain valley, coupled with the presence of natural travel corridors, have attracted native peoples to the area for the past 10-12,000 years. The uninterrupted use of the area by Native Americans is documented within the archaeological record, which to date consists of over 36

recorded prehistoric sites within the SCW Assessment area. Early fur trappers traversed the area where they encountered native peoples belonging to the Shoshone, Bannock, Flathead, and Blackfeet Tribes.

A.J. Oliver and Company established a stage road between Salt Lake and Virginia City in 1863, followed by Ben Holladay in 1864. The Overland Stage started the first coach in June of 1866. The route entered Beaverhead County at Monida Pass with stops or stations at Summit (Pine Butte), Junction/Williams Junction, Sage Creek (at confluence of Sage Creek and Little Sage Creek – this station is located at the old P-0 Sheds or what is now The Matador Sage Creek Headquarters), True Dell Station (at the head of Little Sage Creek), Price Creek Station (at the mouth of Price Creek and also operated as a Toll Gate through Price Canyon). Though the exact route of the stage road has not been found or recorded, the presumed route goes through the eastern portion of the SCW. Stage and freight traffic along this route declined in prominence after the Utah and Northern railroad came into Montana at Monida in 1880 and reached Butte by 1881.

In addition to the seasonal grazing by major livestock producers, homesteading in the SCW continued from the late1880's through the 1920's. Homesteading is also well represented in the archaeological record by the remnants of at least nine historic homesteads that have already been recorded.

The SCW contains 34% of the paleontological resources identified in the field office. These consist primarily of fossils dating from the beginning of the Paleocene (66 Ma) to the end of the Pliocene (2.58 Ma).

Agricultural History and Socioeconomics

Although mining was an impetus in the region's development, cattle ranching was already established when the first miners found their way into Montana. The Grants and Orrs in the Beaverhead region and the Kohrs in Deer Lodge were grazing cattle and providing beef to local miners as well as to consumers in other parts of the west and east. These early ranchers faced difficult circumstances fighting with Blackfeet and other tribes over territory and initially competing with bison for range. Yet, through the 1870s the cattle and sheep business as well as farming continued to expand. By the end of the 1870s, bison were on the brink of extinction. Public lands became more accessible, facilitated by an "open range" policy that made available public lands for grazing. Cattle ranching in Montana became another means to "strike it rich" and spurred another rush of settlers and speculators.

Before the boom of the 1880s, most Montana cattle operations were partnerships or family affairs, but many of the new outfits were full-fledged corporations with access to plenty of capital and livestock. Dozens of corporate ranches held Montana charters by 1886; and many others, such as the Texas-based XIT, and Continental Land and Cattle spreads, were incorporated in other states or territories. By 1886, at the peak of the open range boom, roughly 664,000 cattle and 986,000 sheep grazed Montana rangelands. A large percentage of the animals belonged to the new corporate ranchers, whose managers packed them onto limited ranges with no provisions of winter hay, in hope of quick profits from minimal investments (Malone, Roeder, and Lang, 1991: 157).

A severe drought and hard winter in 1886-87 combined with overgrazing on public lands resulted in severe impacts to Montana's cattle business, with some estimates that half or more of the cattle died (Fletcher, 1960:89-94). Small operators who put up hay adapted better than the "get rich quick" operators did, and after 1887, the cattle industry settled into a period of recuperation and ultimately further expansion as the value of hay for winter feed became apparent (Fletcher 1960).

The agricultural boom began to go bust in the post-war depression of the 1920s, and large numbers of Montana farmers moved out of state, leaving a demographic profile that is similar to that of present day Montana: larger numbers of older persons and younger persons with the middle-age demographic group showing sharp declines. Prior to World War II, ranching and farming continued under pressure, but various New Deal programs supported these industries into World War II, when once again there was a small boom. A combination of weather, world economics, and cultural changes in the United States have continued to influence boom and bust cycles in ranching and farming in southwest Montana. Today these activities remain important to the overall economy and culture of the region, but the face of agriculture and ranching are changing. Ranchers or their family members may also work as fishing guides or outfitters or in town to supplement their income. Fluctuations in cattle prices, other market forces, and increasing equipment and operating costs require some diversification in order to ensure the fiscal viability of present-day ranching operations. Some choose to lease their lands, or access through them for hunting or fishing and thereby supplement ranch income. It is common for wives and children to work for the cash needed to keep family and ranching life viable. Unfortunately, for many ranchers, children are not staying on to ranch, either because the isolation and lifestyle demands are not appealing or because financial realities do not allow it.

The SCW is sparsely populated with Dillon being the largest town near the watershed. Recreation and tourism are important components of the economy of the SCW. Most of this recreation occurs during the big game hunting season which provides substantial contributions to the local economy.

Of Montana's 56 counties, Beaverhead County is the largest livestock producer. The USDA 2012 Census of Agriculture Inventory (http://www.agcensus.usda.gov/publications) indicated that there were 230,742 head of cattle and calves and beef cattle in the county. In Beaverhead County there were also 16,191 sheep and lambs inventoried. Very few grain-fed cattle were produced. The focus was on calves and feeder steers along with beef cows or breeding stock. This type of ranching requires large expanses of grazing land.

According to the National Agricultural Statistical Service (http://www.nass.usda.gov/mt/), overall cattle production in Montana has been relatively stable since 1986. The January inventories in 1986 and 2002 reported 2.45 million head with a peak of 2.75 million during 1996. Sheep production, on the other hand, showed a general decline across the state, reflecting a broader national pattern. The data from 2012 reports that, of Montana's 56 counties, Beaverhead county ranked 1st in total hay production, 1st in total cattle numbers; and 3rd in sheep and lamb numbers.

Several economic factors have changed since the early 1980s which might have affected ranching operations in southwest Montana, including rising real estate values, volatile commodity price fluctuations and rising overhead costs for agriculture. These factors along with state and national politics and changing livestock market conditions have affected the livestock industry over the last twenty years. Social factors include the rising popularity of southwest Montana as a place to live, work and play accompanied by related population growth and change.

BLM grazing fees are calculated using the formula required by 43 CFR 4130.8 and are considerably less than those charged by private landowners. In 2004, the average fee in Montana for grazing on private land was $16 per AUM based on Montana Agricultural Statistics Service, National Agricultural Statistics Service figures, and the minimum fee charged on Montana State Lands was $5.48 per AUM. In 2015, these same fees rose as the average fee in Montana for grazing on private land was $23.00 per AUM, and the minimum fee charge on Montana State Lands is $11.41 per AUM. The BLM and Forest Service used the same formula to derive a $1.69 per AUM fee in 2015, which makes federal land the least expensive grazing available to area ranchers. Federal grazing permits are desirable for area cattle producers as a source of inexpensive forage, even though additional management costs are usually incurred.

On page 252 of the Dillon RMP/Final EIS, Table 48, Employment and Labor Earnings by Major Type and Sector in 2000, reports that private on-farm employment accounted for 17 % of total employment in Beaverhead County. Refer to Table 56 on page 286 of the Proposed Dillon RMP and Final EIS, which shows employment and labor income response coefficients related to livestock grazing, timber management and recreation use for the area influenced by the Dillon Field Office. In addition, page 251 of the EIS presents personal income statistics from 2000 that indicate that labor earnings are the largest source of income in Beaverhead County. The Proposed Dillon RMP/Final EIS is available at http://www.blm.gov/mt/st/en/fo/dillon_field_office/rmp/Final.html.

Wilderness Study Areas

Roughly 2,900 acres on the northwest portion of the 17,479 acre Blacktail Mountains Wilderness Study Area (WSA) lies within the Sage Creek watershed boundary (Map 1). This portion of the WSA contains the only route within the WSA that is designated open to wheeled motorized vehicles since it was an inventoried 2-track vehicle route at the time of the wilderness inventory in 1980. This route accesses the top of the Blacktail Ridge, but is not open to the public across the private land below, and should therefore not be open to the adjacent landowner for recreational use according to the travel management policies in the RMP.

The Blacktail Mountains WSA contains 10,586 acres that were recommended by the BLM as suitable for wilderness designation (essentially the northern 60%), including that portion within the SCW. The entire WSA was determined to be in primarily natural condition with outstanding opportunities for solitude and primitive and unconfined recreation. Identified special features included outstanding panoramic views and scenic quality and features within the WSA.

Lands with Wilderness Characteristics
The planning area was inventoried for lands with wilderness characteristics in accordance with BLM Manual 6310 – Conducting Wilderness Characteristics Inventory on BLM Lands, published in March, 2012. The purpose of an inventory is to determine the presence or absence of wilderness characteristics. The BLM must document existing conditions as opposed to potential future conditions. The inventory will evaluate wilderness characteristics as defined in Section 2(c) of the Wilderness Act and incorporated in FLPMA. In order for an area to qualify as lands with wilderness characteristics, it must possess sufficient size, naturalness, and outstanding opportunities for either solitude or primitive and unconfined recreation. In addition, it may also possess supplemental values. Seven units within the planning area were inventoried from 2012 through 2015 (see Map 2 for a couple of unit locations). All of these units were part of the original inventory from 1979. Each unit has a unique identifier in a number and name. These seven units are #MT-076-004, Big Spring Gulch, 20,178 acres; #MT-050-004N, Maurer Mountain, 11,913 acres, this unit was originally part of the Big Spring Gulch unit but was separated out as the two units are divided by a road; #MT-076-005, Heifer Creek, 5,260 acres; #MT-076-006, White Hills South, 8,850 acres; #MT-076-008, Basin Creek North, 10,255 acres; #MT-076-009, Antelope Flats, 18,037 acres; and #MT-076-010, Basin Creek South, 8,355 acres.

Three of these units were found to possess wilderness characteristics, they are; Big Spring Gulch, Maurer Mountain and Antelope Flats. These areas are of sufficient size, appear to retain their natural character, and provide outstanding opportunities for solitude or primitive and unconfined recreation.

Big Springs Gulch, #MT-076-004, is 20,178 acres in size and appears to be in its natural condition. This unit provides outstanding opportunities for solitude and for primitive and unconfined recreation.

Maurer Mountain, #MT-050-004N is 11,913 acres, and appears to be primarily in its natural condition. As described above, this unit was originally part of the Big Springs Gulch unit, but they are divided by a constructed and maintained road. There are outstanding opportunities for solitude in the side drainages of the unit. The unit has some recreation opportunities, primarily in the form of hunting, but they are not considered outstanding.

Antelope Flats, #MT-076-009, is 18,037 acres, so it is of sufficient size, and it appears to be natural. The unit offers outstanding opportunities for solitude, but not for primitive or unconfined recreation. Portions of the unit provide enough screening that one can find solitude within the unit. The remote location of the unit makes it easier to find solitude.

The remaining four units were determined to not qualify as possessing wilderness characteristics. These four units, and why they were determined to not possess wilderness characteristics, are briefly described below.

The Heifer Creek unit, #MT-076-005, was determined to be of sufficient size and is predominantly natural, although the inventory noted that OHV routes are noticeable throughout the unit. Heifer Creek unit lacks outstanding opportunities for solitude and unconfined and

primitive recreation; this is primarily due to the topography, overall size and land configuration of the unit.

White Hills South, #MT-076-006, is of sufficient size, but this unit lacks naturalness, as well as outstanding opportunities for solitude and unconfined recreation. The Montana Initial Wilderness Inventory Final Decision, August 1979 (MIWIFD, August 1979) stated "Moderate amounts of development combined with small size and lack of vegetative and topographic screening contribute to a lack of naturalness." This statement still holds true. There are opportunities for solitude and primitive and unconfined recreation but they are not outstanding, and due to the lack of naturalness this unit doesn't meet the requirement for wilderness characteristics.

Basin Creek North, #MT-076-008, is of sufficient size, and is predominantly natural although there are roughly 28 miles of vehicle ways within the unit. The lack of vegetative screening does not allow one to avoid the sight and or sounds of others in the area, there are not outstanding opportunities for solitude available within this unit. There are primitive and unconfined recreation opportunities, but they are not outstanding.

Basin Creek South, #MT-076-010, is of adequate size and appears to be natural, although the impacts of cattle grazing are substantially noticeable within the unit. There are limited opportunities for solitude within the unit due to the lack of vegetative and topographical screening and uniform nature of the landscape. These opportunities for solitude are limited and are not considered outstanding. There are additional limits on the primitive or unconfined recreation in the frequency of fences and vehicle ways that crisscross the landscape. The uniform nature of the landscape would also impact the recreation opportunities. The opportunities exist for primitive and unconfined recreation but they are limited and not considered to be outstanding. In addition, the irregular configuration of this parcel of property does not lend itself to be managed for wilderness characteristics.

The documented presence of wilderness characteristics within this area does not mean that it requires these areas to be managed consistent with the policy for wilderness study areas. It simply means that any proposed activities that will impact these wilderness characteristics must be analyzed within the context of the upcoming EA. Future land use planning may consider a longer term objective for the future management of this area, and may or may not identify it for long term protection of these characteristics.

Visual Resource Management

The Blacktail Mountains Wilderness Study Area (2,895 acres), on the north end of SCW, will be managed as Class I. Preservation of the landscape is the primary management goal in Class I areas. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Another 885 acres adjacent to the WSA will be managed as Class II. The objective of this class is to retain the existing character of the landscape. Activities or modifications of the environment should not be evident or attract the attention of the casual observer. Changes should repeat the

basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.

The remaining 110,776 acres will be managed under Class III guidelines. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape may be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes caused by management activities may be evident but should not detract from the existing landscape.

The visual resource contrast rating system will be used during project level planning to determine whether or not proposed activities will meet VRM objectives. Projects will identify mitigation measures to reduce visual contrasts and prepare rehabilitation plans to address landscape modifications on a case-by-case basis.

Geology

The Sage Creek Assessment Area is dominated by outcrops of Paleogene sedimentary rocks. Other sedimentary units crop out in smaller volumes at the north and south ends of the Assessment Area. Paleogene volcanic rocks also occur in the Assessment Area.

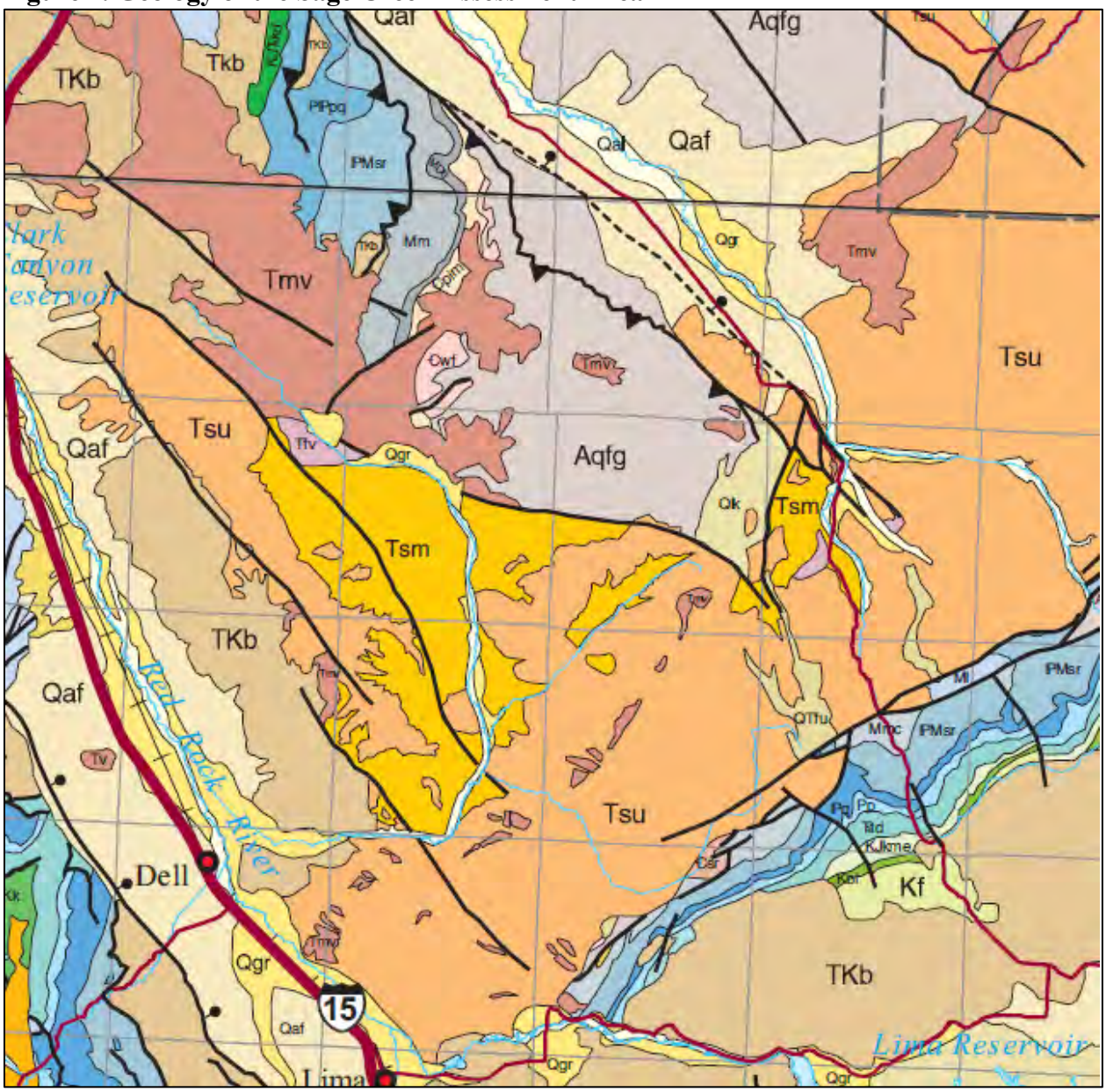
The oldest rocks in the area, and some of the oldest rocks in Montana, are the Precambrian Archean schists and gneisses that form the core of the Blacktail Range. These schists and gneisses also occur at the very southernmost portion of the area just north of the Red Rock River. The Archean rocks date to over 2 billion years ago and are overlain by Paleozoic sedimentary rocks in both areas. The Paleozoic sedimentary rocks at the southern end of the Assessment Area include the entire Paleozoic section from the Cambrian Flathead Sandstone, the basal unit of the Paleozoic rocks, up through the Permian Phosphoria Formation. The Paleozoic rocks at the north end of the area only extend through the Mississippian Madison Formation.

Conformably overlying the Paleozoic rocks are Mesozoic rocks including the Triassic Thaynes, Woodside and Dinwoody Formations. The Dinwoody is overlain conformably by the Jurassic Ellis Formation and the Lower Cretaceous Kootenai, Blackleaf and Frontier Formations. These relatively limited areas of Precambrian through Mesozoic age rocks have then been unconformably overlain with extensive Paleogene deposits ranging from various lithologies of the Beaverhead Formation up through younger Paleogene units including the Renova, Timber Hill and Sixmile Creek Formations. The sedimentary units are overlain by Paleogene extrusive igneous volcanic rocks including rhyolitic, pyroclastic and basaltic units of the Dillon Volcanics in the northern reaches of the area.

The small part of the Assessment Area that extends to the west side of the Red Rock River consists almost entirely of Quaternary Alluvial fan deposits.

Perhaps the most notable feature of the Paleogene sedimentary units is a strong tendency for mass wasting/landslide features which can be a critical factor in land use decisions.

Figure 1. Geology of the Sage Creek Assessment Area



Sedimentary and Metamorphic Rocks			
QUATERNARY		**MISSISSIPPIAN**	
Qlk	Lake deposit	Mmc	**Mission Canyon Formation:** Locally includes Big Snowy Formation in south-central Montana
QTtu	Tufa	Ml	Lodgepole Formation
Qgr	Gravel	**MISSISSIPPIAN AND DEVONIAN**	
Qaf	Alluvial fan deposit	MDj	Three Forks and Jefferson Formations

Paleogene	**CAMBRIAN**
	Csrf — **Snowy Range through Flathead Formation:** Snowy Range, Pilgrim, Park, Meagher, Wolsey, and Flathead Formations; or Snowy Range, Hasmark, Silver Hill, and Flathead Formations
TKb — Beaverhead Group	Cpim — **Pilgrim through Meagher Formation:** Pilgrim, Park, and Meagher Formations
Tsm — Middle Tertiary sediment or sedimentary rock	**ARCHEAN**
Tsu — Upper Tertiary sediment or sedimentary rock	Aqfg — Quartzofeldspathic gneiss
CRETACEOUS THROUGH TRIASSIC	**Igneous Rocks**
KJTkd — **Kootenai through Dinwoody Formation:** Kootenai, Morrison, Thaynes, Woodside, and Dinwoody Formations	Tfv — Felsic volcanic rock
Kf — Frontier Formation	Tmv — Mafic volcanic rock
Kbl — Blackleaf Formation	
KJkme — **Kootenai Formation through Ellis Group:** Kootenai and Morrison Formations, and Ellis Group	
Ttd — **Thaynes through Dinwoody Formation:** Thaynes, Woodside, and Dinwoody Formations	
PERMIAN AND PENNSYLVANIAN	
Pq — Quadrant Formation	
Pp — Phosphoria Formation	
PMsr — **Snowcrest Range Group:** Conover Ranch, Lombard, and Kibbey Formations	

Fire History

The presence or absence of fire plays an integral role in the composition and structure of the vegetation that occurs in the SCW. Fire has shaped western landscapes for the past 10,000 years, but more than a century of settlement activities have seriously disrupted that crucial role in most areas. Since the mid-1800s, the frequency of wildland fires occurring in southwestern Montana and the western United States in general have been reduced by domestic livestock grazing, land use practices, and aggressive fire suppression. Some fire scarred trees and charred wood are found in the mountainous terrain and foothills of the SCW. The sagebrush/grassland communities that dominate the majority of the SCW BLM-administered land typically retain evidence of past wildfires for a relatively short amount of time.

Spruce seedling growing from 1980s salvage harvest stump

Authorized Uses

Forest Products

The BLM completed a commercial harvest to salvage timber blown down during a high wind event near the head of Sheep Creek in the early 1980s. A small portion of this salvage project was on BLM within the SCW; the

remainder was on adjacent private land within the Beaverhead West Watershed. Prior to this salvage sale, records of commercial timber harvest within the SCW are unavailable, but timber was certainly harvested to supply local building materials, fencing materials, and firewood. Old stumps, many with the marks of axe-felling, are present within the widely scattered patches of timber.

The BLM sells permits authorizing firewood removal and Christmas tree cutting.

Livestock Grazing

There are 114,475 acres of BLM administered land in the Sage Creek Watershed located within 22 different grazing allotments. There are 11 different business entities or individuals currently authorized to graze livestock on the 114,475 acres of BLM administered lands. Those grazing permittees are authorized to harvest about 15,705 public land AUMs annually in the SCW. The allotments are shown on Map 1. Qualified individuals and business enterprises are authorized to graze livestock through a ten-year term grazing permit (43 CFR 4110). Many allotments have a mixed ownership pattern of public and private land pastures but there is a cooperative, comprehensive management plan that directs livestock grazing management on public lands. In most cases, private land owned by the permittees is adjacent to, or intermingled with, BLM administered land. Public lands, administered by BLM, provide a large proportion of the late spring, summer and fall forage base in the watershed. Changes in numbers of livestock, seasons of use, and/or increased labor inputs may have a considerable economic impact on individual operators.

Table 1. Livestock Grazing Allocations and Management Within the Sage Creek Watershed

Allotment Name, Number, and Category	Livestock Kind	Season of Use	Grazing System[2]	BLM Stocking Rate	BLM Acres	BLM AUMS	Acres in Other Ownership[3]	Total Acres
Armstead Mountain 30008, (I)	Cattle	7/11-12/10 6/1-7/10	RR	12.3	25,729	1,514 580	8,805 PVT 6,819 St	41,353
Big Springs Gulch, 10129 , (M)	Cattle	5/1-6/25	RR	12.4	4,607	370	758 PVT 890 St	6,255
Bull Heifer Creek, 10137, (M)	Cattle	6/1-9/30	RR	14.5	1,134	78	601 St	1,735
Crooked Creek AMP, 30010, (M)	Cattle	5/6-6/30 8/15-9/14	RR	11.8	2,346	200	106 PVT 640 St	3,092
Dell, 20620, (C)	Cattle	5/1-11/30	CU	2.8	40	14	21 PVT	61
Gallagher Mtn AMP, 30013, (I)	Cattle	5/1-11/20	RR	5.0	4,755	950	2,440 PVT 84 St	7,279
Huntsman , 10123 (M)	Cattle	5/6-7/15	STG	5.0	1,650	331	692 PVT	2,342
Kent-Price Canyon, 10138, (I)	Cattle	7/1-7/31 9/1-10/31	RR	5.2	1,031	200	None	1,031
Knox, 10136, (I)	Cattle	6/1-6/30 10/1-11/30	RR	7.4	6,710	901	3,736 PVT 1,633 St	12,107
Knox Non-AMP, 10624, (C)	Cattle	3/1-11/30	STG	5.0	45	9	1,820 PVT 153 St	2,018
Little Spring SGC, 20604, (M)	Cattle	5/15-6/30	STG	5.7	1,603	283	4,372 PVT 203 St	6,178
Long Creek, 20178, (C)	Cattle	9/1-10/30	DG	34	1,194	35	629 PVT 2,462 St	4,285

Allotment Name, Number, and Category	Livestock Kind	Season of Use	Grazing System[2]	BLM Stocking Rate	BLM Acres	BLM AUMS	Acres in Other Ownership[3]	Total Acres
Mayberry, 10143, (I)	Cattle	7/1-11/30	DG	4.6	10,886	2,372	2,539 PVT 3,830 St	17,255
Mosman AMP, 30011, (M)	Cattle	11/10-01/19	DG	6.9	3,530	514	1,239 PVT 579 St	5,348
Railroad, 20175, (c)	Cattle	11/1-12/01	DG	3	902	296	874 PVT	1,776
Red Butte, 20030, (C)	Cattle	4/1-10/31	CU	2.9	40	14	None	40
Red Butte SE, 30615, (C)	Cattle	6/1-10/30	STG	2.5	275	110	266	541
Sage Creek AMP, 30012, (I)	Cattle	5/15-12/10	RR	7.1	42,268	5,933	13,362 PVT 23,137 St	78,767
Stanford, 20717, (C)	Cattle	10/15-11/30	STG	3.7	320	87	160 PVT	480
Tallent AMP, 20027, (M)	Cattle	5/15-12/10	RR	6.8	3,223	473	4,774 PVT	7,997
Welborn Dell, 20714, (M)	Cattle	5/15-6/1	RR	5.7	1,516	266	174 PVT	1,690
Wolfe, 10703, (M)	Cattle	5/15-10/15	RR	3.7	640	175	82 PVT 860 St	1,582
BLM Totals				**7.3**	**114,444**	**15705**	**88,768**	**203,212**

[1]Livestock Kind: C=cattle
[2]Grazing System: RR=rest rotation, DR=deferred rotation, STG= short term grazing system, CU=custodial use
[3]Other Ownerships: ST=Montana DNRC, PVT=Private
[3]Total Acres is an estimate. The total acres in the allotment may not be completely accurate because BLM doesn't have authority to map allotment boundary fences on private lands.

All allotments in the Dillon Field Office have been categorized as *Improve* (I), *Maintain* (M), or *Custodial* (C), based on resource values and opportunities for improvement. Allotment category refers to BLM's level of management for a given grazing allotment and is used to establish priorities for distributing available funds and personnel during plan implementation to achieve cost-effective improvement of rangeland resources. Categorization is also used to organize allotments into similar groups for purposes of developing multiple use prescriptions, analyzing site-specific and cumulative impacts, and determining trade-offs. Allotments in the I-category are managed more intensively and are monitored more frequently. Allotments in the M-category are usually at a desired condition and are managed to maintain or improve that condition. Allotments in the C-category are usually isolated parcels with few resource concerns and/or limited management control that are fenced in with larger parcels of deeded land, are managed in conjunction with the permittee/lessee's normal livestock operation, and are usually monitored less frequently.

The BLM has worked cooperatively with individual livestock permittees/lessees in the watershed for many years to develop Allotment Management Plans (AMPs) that prescribe grazing management to maintain or improve natural resource conditions. Of the BLM-administered lands in the watershed that are available for livestock grazing (114,475), about 90% of the acres are managed under formal AMPs, or have agreed upon grazing systems, that prescribe a grazing system, such as rest rotation or deferred rotation (Table 1). About 5% of the BLM-administered acres that are available for livestock grazing are in custodial allotments, where BLM management inputs are minimal because of the small proportion of public land in the allotments (Map 1).

The stocking rate on BLM lands within the watershed averages 7.3 acres/AUM and varies from 2.5 to 34 acres/AUM. This wide variation is influenced by soils, vegetation, topography (aspect, elevation, and slope), distance from water and local weather. Cattle (mature individuals or cow/calf pairs) are the primary type of livestock authorized on the allotments; however, several allotments allow the flexibility to graze yearling cattle.

Recreation
One big game outfitter is permitted to operate within the Blacktail Mountains/Sage Creek Outfitter Permit Area. The authorized permit area covers only the southern portion of the watershed. Three other big game outfitters were permitted to operate on BLM lands within this watershed when this assessment was last done ten years ago, but they are no longer operating here.

Dispersed recreational use is dominated by big game hunting. Hunting District 325 typically receives over 3,500 hunters and more than 18,000 "hunter days" annually. All other recreational uses in the area are light, but may include snowmobiling, wildlife viewing and pleasure driving, hiking, horseback riding, and OHV use.

Mining, Mineral and Abandoned Mine Lands
The Sage Creek Assessment Area lies mostly within the ill-defined Blacktail Mining District. There is little evidence of locatable mineral activity in the assessment area. While the Archean schists and gneisses do host valuable mineral deposits elsewhere in Montana, that is not the case for the exposures of Archean rocks in the Blacktail Range and north of Lima Reservoir.

There has been some minor exploration and small scale activity along the range-front fault which forms the north end of the Blacktail Range, but there is little other activity in the assessment area. The Permian Phosphoria Formation, which has been mined for phosphate near Melrose, Montana and along the crest of the Centennial Mountains to the southeast of the area, occurs north of Lima reservoir. There has been no activity associated with these outcrops of the Phosphoria Formation.

There are no known abandoned mine properties in the assessment area.

Format for Standards

The Upland, Riparian, Air Quality, and Water Quality Standards will follow the following format:

- **Affected Environment** - This section briefly describes the area and resources that were assessed.
- **Findings and Analysis** - This section describes the findings of the IDT during the field assessment.
- **Recommendations** - This section presents initial recommendations developed by the IDT during the field assessment.

Because of the complexities involved with addressing the Biodiversity Standard, the Affected Environment and Findings and Analysis are presented together and Recommendations are presented at the end of the section.

Uplands

Western Montana Standard #1: *"Uplands are in Proper Functioning Condition."*

Uplands in Gallagher Mountain AMP allotment, photo point 10S09W2301; chemically sprayed in 1968

Affected Environment

Sagebrush and grassland areas are considered uplands for purposes of this report. According to our satellite imagery of vegetation, approximately 87 percent of the watershed is sagebrush and 2 percent is grasslands. The variety and distribution of plant communities and seral stages in the watershed area is a function of climate, geology, and soil combined with:

- historic uses (grazing and timber harvest)
- short term weather patterns
- disturbance regimes (drought, fire, floods and herbivory)

Soils

Soil development, formation, and stability are influenced by parent material, topography, local climate, plant cover and species composition, as well as historic and current uses. Information for the soils within the Sage Creek watershed was obtained from the Horse Prairie – South Valley, Part of Beaverhead County, Montana (NRCS 2015) and the Red Rocks Lake Area, Part of Beaverhead County, Montana (NRCS 2014) soil surveys. Soils on BLM managed public lands in the SCW are formed primarily from colluvium, alluvium, or slope alluvium. The soils within the SCW occur on mountain slopes, ridge tops, hill slopes, and drainage bottoms. Slopes generally range from 5-30%, though there are smaller areas, generally in valley bottoms that are relatively flat (0-5%) and areas with slopes ranging from 30-45%. As a result of the underlying geology, parent material and topography soils within the SCW range from shallow to very deep. Surface texture of the soil map units are predominantly gravelly loam, gravelly sandy loam, cobbly loam, and loam.

Climatic conditions within the Sage Creek watershed have been generalized based upon the National Oceanic and Atmospheric Administration (NOAA) Climate Data Online, Grant 5, Montana, climate station (NOAA 2015). The Grant 5 climate station is located just west of the SCW at 1,762 m, and is the closest climate station to the project area. Table 2 summarizes the

monthly precipitation data for the Grant 5, MT (NOAA, 2015) climate station from 1985-2014 (30-year average). There is no temperature data available for this site. Climatic conditions on BLM-administered land within the SCW vary from conditions recorded at the Grant 5 climate station; however the information provides general information about conditions and seasonal variation. These climatic conditions have resulted in soils that generally have a cryic or frigid temperature regime; the moisture regime varies greatly depending on proximity to groundwater and can vary from aquic to aridic.

Table 2: Average Monthly Precipitation (inches)

Month	Precipitation (in.)
January	0.35
February	0.30
March	0.63
April	1.02
May	1.76
June	1.70
July	0.99
August	0.94
September	0.77
October	0.87
November	0.51
December	0.36
Total	**10.20**

Soils on BLM-adminitered land within the Sage Creek watershed generally support forested, grassland, and shrubland ecological sites, including: Shallow Limy Droughty, Loamy Steep, Droughty Steep, Limy Droughty, Limy, Loamy, Thin Clay pan, Droughty, Shallow to Gravel, Shallow to Droughty, Saline Upland, Sub-irrigated, Riparian Meadow, Clayey, Wet Meadow, Loamy Steep, Meadow, and Saline Sub-irrigated (NRCS 2014, NRCS 2015).

As a result of parent material, topographic position and slope, local climate, and ecological communities, the soils within the SCW have developed distinct characteristics that affect what uses the soils can support and how the soils will respond to disturbances. One important use is for farmland, and Prime and Unique Farmlands or Farmland of state or local importance should be protected to the extent possible. Within the SCW there are approximately 1,732 acres of farmland designated as Farmland of Statewide Importance, which accounts for approximately 1.5% of BLM-administered land within the watershed. There is also approximately 3,830 acres designated as Prime Farmland if Irrigated, which accounts for approximately 3.3% of BLM-administered land within the SCW.

Soils within the SCW may also be impacted by recreational activities, livestock grazing, and timber harvest. These uses can result in disturbances to the soil surface to varying degrees, including erosion, compaction and damage by fire. Table 3 summarizes the vulnerability of soils within the SCW to various disturbances.

Table 3: Summary of Soil Susceptibility to Disturbance

Erosion Hazard (off-road)		Soil Compaction Resistance		Fire Damage Susceptibility	
Slight	34.6%	Low Resistance	91.8%	Slightly susceptible	4.7%
Moderate	62.5%	Moderate Resistance	7.4%	Moderately Susceptible	82.0%
Severe	1.9%	High Resistance	0.0%	Highly Susceptible	12.5%
Very Severe	0.2%				
Not Rated	0.8%	Not Rated	0.8%	Not Rated	0.8%

Vegetation

Current vegetative cover was calculated using LANDFIRE (2013) existing vegetation type. Some acreage will be under or over estimated, but generally follow the amounts shown in Table 4.

Table 4. General Cover Types

Description	All Land Acres	% of Total	BLM Land Acres	%BLM	% BLM of Total
Agriculture	5853	3	531	<1	<1
Grassland	4327	2	1578	1	1
Sagebrush/shrub/steppe	190,200	87	106,428	93	49
Riparian	11,670	5	4062	4	2
Aspen-mix	208	<1	45	<1	<1
Forested	5288	2	1912	2	1
Water	8	0	0	0	0
Totals	**217,554**	**100**	**114,556**	**100**	**53**

% of Total = Percent of acreage for each land type for all land.
% BLM = Percent of acreage for each land type that BLM manages
% BLM of Total = percentage of acreage for each land type occurring on BLM land as compared to all lands in the watershed.

Most upland habitats on BLM lands within the SCW are dominated by sagebrush including three subspecies of big sagebrush; mountain big sagebrush, basin big sagebrush (*Artemisia tridentata ssp. tridentata*), and Wyoming big sagebrush (*Artemisia tridentata spp. wyomingensis*), also included is low sagebrush, black sagebrush (*Artemisia nova)*, three-tipped sagebrush (*Artemisia tripartita*) and silver sagebrush (*Artemisia cana*). The highest elevation shrub types support mountain big sagebrush/Idaho fescue.

Low sagebrush is present along lower benchland or valley bottom areas that receive less rain and have drier soils (silty-limey). Grasses commonly associated with the low sage and three-tip sage (*Artemesia tripartita* subsp. *tripartita*) sites include bluebunch wheatgrass (*Pseudoroegneria spicatum*), western wheatgrass, Sandberg's bluegrass (*Poa sandbergii*), and needle-and-thread grass (*Hesperostipa comata*). Three-tip sagebrush is found primarily along the southern and southeastern edge of the analysis area. It is also found intermixed with mountain sagebrush in upper Little Sage Creek and other small patches, but generally is not common in the SCW.

Black greasewood and Gardner's saltbush (*Atriplex gardnerii*) are found in salt affected and limey soils along some valley bottoms within the watershed. Grasses commonly associated with these shrubs are bottlebrush squirrel tail, Indian ricegrass (*Achnatherum hymenoides*), western wheatgrass and needle-and-thread grass.

Winterfat (*Krascheninnikovia lanata*) and gray horsebrush (*Tetradymia canescens*) are found in the limey soils along with Indian ricegrass, western wheatgrass and needle-and-thread grass.

Rubber rabbitbrush (*Chrysothamnus nauseosus*), green rabbitbrush (*Chrysothamnus viscidiflorus*), fringed sagewort (*Artemisia frigida*) and broom snakeweed (*Gutierrezia sarothrae*) are common native shrubs found on numerous ecological sites throughout the watershed. If any of these shrubs have greater than 5% canopy cover on a site, it usually indicates that site has been subject to some kind of past disturbance.

Special status plants, noxious weeds, and invasive species are discussed under Standard #5 Biodiversity.

Vegetative Treatments

In 1981 or 1982, the Bull Heifer prescribed burn was ignited with intentions to burn about 200 acres within the Bull Heifer allotment. However, the fire escaped and burned approximately 720 acres, most of which was east of the originally planned burn and within the Sage Creek AMP allotment. In 2015, the IDT found the burned area to have fully revegetated with native grasses and shrubs.

According to BLM records, there have been five vegetative treatments in the sagebrush steppe areas on public lands in the assessment area during the past 40 years (Map 3). Between 1968 and 1970, approximately 4,300 acres were sprayed with 2,4-D to control sagebrush within the Armstead Mountain allotment in four separate spray projects. The mountain big sagebrush canopy cover has steadily increased since it was treated over 35 years ago. Figures 2 and 3 show comparison photos from 1972 and 2014/2015 of two areas that were chemically sprayed in 1969.

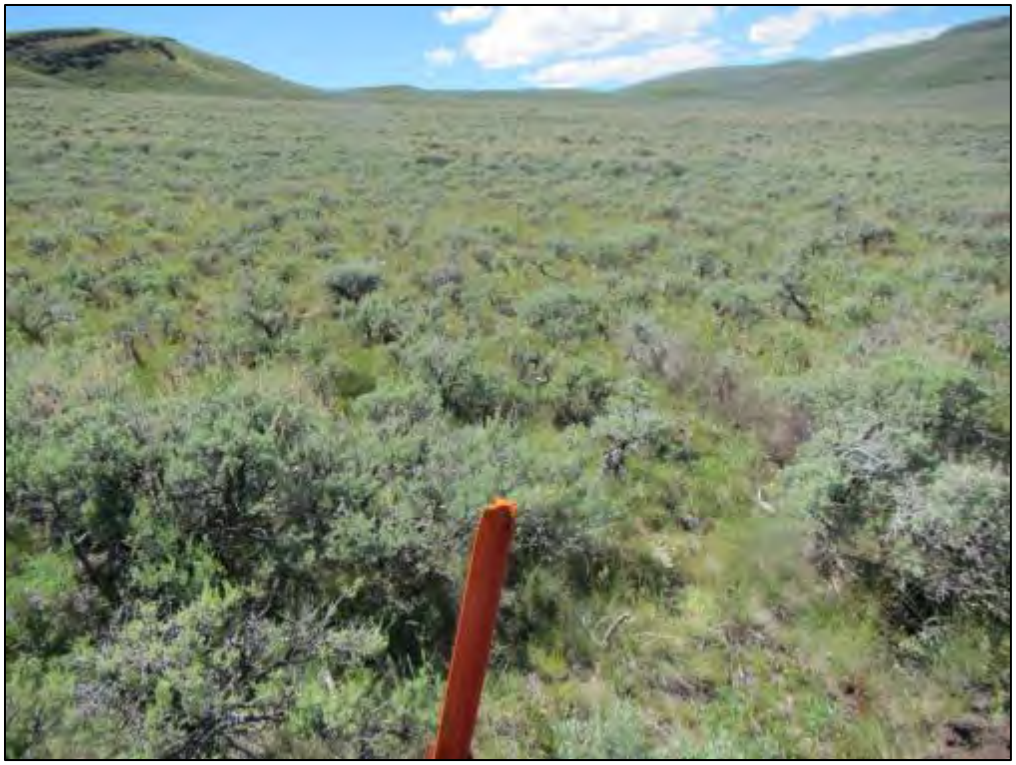
Figure 2. Gallagher Mountain AMP Photo Plot 10S09W2301, Chemically Sprayed in 1969.

8/29/1972

6/03/2015

Figure 3. Armstead Mountain Allotment Photo Point 10S08W3102, Chemically Sprayed in 1969.

8/29/1972



6/30/2014

Findings, Analysis and Recommendations

Procedure to determine conformance with Standard

The uplands were assessed on an allotment basis according to Interagency Technical Reference 1734-6 *Interpreting Indicators of Rangeland Health*. This technical reference is available to the public to read at the Dillon Field Office or download on the BLM Library webpage, http://www.blm.gov/nstc/library/techref.htm. This qualitative process evaluates 17 "indicators" (e.g., soil compaction, water flow patterns, plant community composition) to assess three interrelated components or "attributes" of rangeland health: soil/site stability, hydrological function, and biotic integrity. The IDT visits specific ecological sites and rates each indicator on the degree of departure, if any, from what is expected for the site. The rating for each indicator is then weighed to determine the degree of departure of the three attributes of rangeland health. The Natural Resources Conservation Service (NRCS) has developed Ecological Site Descriptions based on specific soil types, precipitation zones and location. They describe various characteristics and attributes including what vegetative species, and relative percentage of each, are expected to be present on the site. The IDT refers to these site descriptions while completing the upland evaluation matrix.

As part of the procedure to determine conformance with the Upland standard, the 2015 Sage Creek Watershed IDT reviewed the long term trend study data, including photographic records, conducted extensive field surveys, and used the Indicators of Rangeland Health assessment process while visiting each allotment to assess the functionality of the uplands in the SCW. The SCW was also evaluated for weed infestations using treatment records and inventories from the Dillon Field Office, the Beaverhead County Weed Coordinator, and the IDT's collective observations during the field assessments.

Members of the IDT visited all the grazing allotments in the SCW during 2015 and completed 25 *Rangeland Health Indicator Evaluation Matrices* on various ecological sites and plant associations. In addition, 24 Daubenmire trend studies and over 50 permanent photo plots, which were established in the 1960s, 1970s and early 1980s, were duplicated in 2014 to help determine vegetative trends. The data collected were summarized and compared with baseline and interim data providing supporting information, along with the photographic record, for interpreting the upland indicators (see Table 5, Upland Qualitative Assessment Summary). Descriptions of these upland monitoring methodologies are found in Interagency Technical Reference 1734-4, *Sampling Vegetation Attributes*, which is available at the Dillon Field Office or online at http://www.blm.gov/nstc/library/techref.htm.

Table 5 outlines the findings at sites throughout the watershed where the IDT completed the Indicators of Rangeland Health evaluation matrix. A moderate departure from expected conditions is analogous to a FAR rating (USDI 2005). Upland sites that were found to be in the none-to-slight or slight-to-moderate departure from expected conditions category are generally considered to be in PFC.

Table 5. Upland Qualitative Assessment Summary of Grazing Allotments within the SCW

ALLOTMENT NAME, NUMBER & CATEGORY	ECOLOGICAL SITE	DOMINANT PLANT SPECIES	DEGREE OF DEPARTURE FROM EXPECTED		
			SOIL SITE STABILITY	HYDROLOGIC FUNCTION	BIOTIC INTEGRITY
Armstead Mountain, 30008, (I)	Loamy 15-19" Precipitation Zone	Bluebunch wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Armstead Mountain, 30008, (I)	Loamy-Droughty 15-19" Precipitation Zone	Bluebunch wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Armstead Mountain, 30008, (I)	Limy 10-14" Precipitation Zone	Bluebunch wheatgrass/Idaho Fescue / Mountain Big Sagebrush	Slight	Slight	Slight
Armstead Mountain, 30008, (I)	Limy 10-14" Precipitation Zone	Bluebunch wheatgrass/Idaho Fescue / Mountain Big Sagebrush	Slight	Slight	Slight
Big Springs Gulch, 10129 , (M)	Limy 10-14" Precipitation Zone	Needleandthread, Wyoming Sagebrush,	Slight to Moderate	Slight to Moderate	Slight to Moderate
Bull Heifer Creek, 10137, (M)	Loamy 15-19" Precipitation Zone	Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Crooked Creek AMP, 30010, (M)	Limy 10-14" Precipitation Zone	NeedleandThread	Slight	Slight	Slight
Dell, 20620, (C)	Limy 10-14" Precipitation Zone	NeedleandThread	Slight to Moderate	Moderate	Moderate
Gallagher Mtn AMP, 30013, (I)	Droughty 15-19" Precipitation Zone	Bluebunch wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Huntsman , 10123 (M)	Limy Droughty, 10-14 Precipitation Zone	NeedleandThread	None-Slight	None-Slight	None-Slight
Kent-Price Canyon, 10138 (I)	Droughty 15-19" Precipitation Zone	Bluebunch wheatgrass, Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Knox, 10136, (I)	Droughty-Clayey 10-14" Precipitation Zone	Bluebunch wheatgrass, Mountain Big Sagebrush	Slight-Moderate	Slight-Moderate	Slight-Moderate

ALLOTMENT NAME, NUMBER & CATEGORY	ECOLOGICAL SITE	DOMINANT PLANT SPECIES	DEGREE OF DEPARTURE FROM EXPECTED		
			SOIL SITE STABILITY	HYDROLOGIC FUNCTION	BIOTIC INTEGRITY
Knox, 10136, (I)	Limy Droughty, 10-14 Precipitation Zone	Bluebunch wheatgrass , Mountain Big Sagebrush	Slight	Slight	Slight
Little Spring SGC, 20604, (M)	Loamy steep 15-19" Precipitation Zone	Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Little Spring SGC, 20604, (M)	Limy Droughty, 10-14 Precipitation Zone	Bluebunch wheatgrass, Mountain Big Sagebrush	Slight-Moderate	Slight-Moderate	Slight-Moderate
Mayberry, 10143, (I)	Loamy 11-14" Precipitation Zone	Bluebunch wheatgrass, NeedleandThread	None to Slight	None to Slight	None to Slight
Mayberry, 10143, (I)	Droughty 11-15" Precipitation Zone	Bluebunch wheatgrass, NeedleandThread, Sagebrush	None to Slight	None to Slight	None to Slight
Mosman AMP, 30011, (M)	Limy Droughty, 10-14" Precipitation Zone	Bluebunch wheatgrass, NeedleandThread	None to Slight	None to Slight	None to Slight
Railroad, 20175, (C)	Shallow Droughty 10-14" Precipitation Zone	NeedleandThread, Bluebunch wheatgrass	None to Slight	None to Slight	None to Slight
Red Butte, 20030, (C)	Limy Droughty, 10-14" Precipitation Zone	NeedleandThread	Slight-Moderate	Slight-Moderate	Slight-Moderate
Red Butte SE, 30615, (C)	Limy Droughty, 10-14" Precipitation Zone	NeedleandThread	Slight-Moderate	Slight-Moderate	Moderate
Red Butte SE, 30615, (C)	Limy, 10-14	NeedleandThread	Slight-Moderate	Slight-Moderate	Slight-Moderate
Sage Creek AMP, 30012, (I)	Limy, 10-14" Precipitation Zone	Bluebunch wheatgrass, Mountain Big Sagebrush	None to Slight	None to Slight	None to Slight
Sage Creek AMP, 30012, (I)	Limy Droughty, 10-14" Precipitation Zone	Bluebunch Wheatgrass, NeedleandThread	None to Slight	None to Slight	None to Slight
Stanford, 20717, (C)	Limy Droughty, 10-14" Precipitation Zone	NeedleandThread	None to Slight	None to Slight	None to Slight
Tallent AMP, 20027, (M)	Droughty, 15-19	Bluebunch wheatgrass, Mountain Big Sagebrush	Slight-Moderate	Slight-Moderate	Slight-Moderate

ALLOTMENT NAME, NUMBER & CATEGORY	ECOLOGICAL SITE	DOMINANT PLANT SPECIES	DEGREE OF DEPARTURE FROM EXPECTED		
			SOIL SITE STABILITY	HYDROLOGIC FUNCTION	BIOTIC INTEGRITY
Welborn Dell, 20714, (M)	Limy Droughty, 10-14" Precipitation Zone	Bluebunch wheatgrass, NeedleandThread, Mountain Mahogany	None to Slight	None to Slight	None to Slight
Welborn Dell, 20714, (M)	Limy, 10-14" Precipitation Zone	Bluebunch wheatgrass	None to Slight	Slight-Moderate	Slight-Moderate
Wolfe, 10703, (M)	Limy Droughty, 10-14" Precipitation Zone	Bluebunch wheatgrass	None to Slight	None to Slight	None to Slight

Findings and Analysis

Sites with none to slight departures from what is expected, the quantitative monitoring data supports the findings of the IDT. The ecological condition at these upland sites is stable or improving. Where erosion is present, it is scarce and usually a remnant of historical grazing. Tall cool-season bunchgrasses, specifically bluebunch wheatgrass and other palatable native grasses and forbs, match what is expected for the site.

The sites with moderate departures, it is likely due to past and occasionally current, repeated spring and summer cattle grazing with little or no rest periods during the growing season. It can also be from a properly stocked allotment that has poor grazing distribution due to lack of available water across the pasture or difficult topography. Moderate departures denote a poorly functioning upland.

Uplands in Gallagher Mountain AMP, July 2015

The uplands on 20 allotments comprising over 98% of the BLM-administered uplands in the SCW assessment area were found to be functioning properly under existing management. One allotment (Big Springs Gulch) had some localized site specific concerns but when considering scope and scale, was rated as low PFC by the BLM IDT. The IDT found several resource indicators with moderate departures from what is expected in similar sites in properly functioning condition on three allotments. These three allotments, comprising less than 2% of the public uplands in the SCW, were not properly functioning. The uplands on Red Butte, Red Butte SE and Dell allotments were rated as FAR by the IDT. More information about each allotment's upland health is listed below.

Big Spring Gulch- In 2005, the BLM IDT determined that this allotment was not meeting BLM standards for a healthy rangeland and gave the allotment's uplands a FAR rating. As a result of the failed upland rating, the management plan for the allotment was changed by dividing the allotment into two separate pastures and then resting each pasture every other year and reducing the grazing period in each pasture to < 25 days when grazed. The every other year rest coupled with the shorter grazing period greatly improved the uplands on the allotment during the last 10 years. The IDT noted improvements in the reduced amount of bare ground and water flow patterns. However, the IDT noted that the allotment was still improving, noting that vigor was still lower than expected and bare ground was still slightly higher than expected. Overall, the allotment's uplands have improved greatly since 2005 with more improvements to come during the next decade with the continued management.

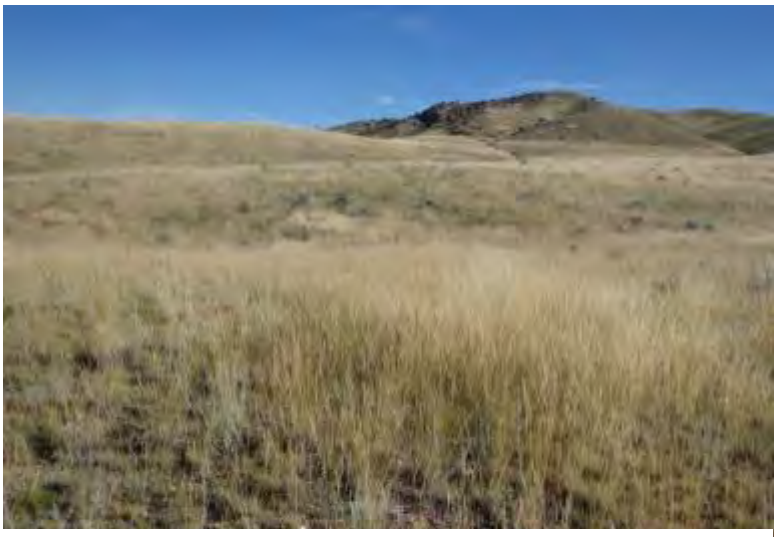
Red Butte- The allotment consists of an isolated 40 acre BLM tract intermixed with private lands. This land tract in potentially good rangeland health would have consisted of dominant grass species such as bluebunch wheatgrass, needle-and-thread grass with various native forbs. The IDT noted the lack of bluebunch wheatgrass, needle-and-thread grass and native forbs. Instead, non-palatable increaser plants such as fringed sage, broom snakeweed and rabbitbrush dominated the site. Bare ground was also found to be excessive coupled with numerous water flow patterns and pedestals which signal historic and recent erosion.

Red Butte Southeast– The allotment consists of several separated BLM tracts of land intermixed with mostly private lands. The combined total for all tracts of BLM administered lands is 275 acres. The 120 acre tract on the west side was determined to be in FAR condition by the IDT. In excellent condition the lands should have a dominance of bluebunch wheatgrass, but bluebunch was rarely found only under the protective cover of sagebrush plants. Unpalatable forbs such as fringed sage, broom snakeweed and annual grasses were the dominant vegetation in the pasture. Bare ground was much higher than expected and water flow patterns were more common and extensive than expected for this site. The 155 acres on the east side of the allotment was in better condition than lands on the west side. Bluebunch wheatgrass was found in the open but still was under-represented in the community and had low vigor. The amount of bare ground and water flow patterns found on the east tract was much less than the western tracts. The lands on the eastern portion of the allotment were rated as low PFC.

Red Butte Allotment Uplands, July 16, 2015

The IDT noted that there was an isolated, small historical landfill on BLM lands that needs to be addressed.

Dell – The Dell allotment consists of a 40 acre tract of BLM administered land. The vegetation on most of the 40 acres consisted of annual weeds such as kochia and few desirable range plants. Bare ground was higher than expected on most of the 40 acres. The IDT found evidence of hay bales and baling twine at this site. It was apparent that livestock have been fed hay at this site. This may have been inadvertent since these 40 acres is intermixed with private land. BLM regulations do not allow feeding of livestock on public lands.



Uplands in the Welborn-Dell Allotment- July 16, 2015

Some of the upland sites, especially in higher elevations, are in very high PFC or near pristine condition. The following allotments may have had some small localized areas of concern for various reasons, but overall the upland health standard was found to be in properly functioning condition: Armstead Mountain, Big Spring Gulch, Bull Heifer Creek, Crooked Creek AMP, Gallagher Mountain AMP, Huntsman, Kent-Price Canyon, Knox, Knox Non-AMP, Little Spring SGC, Long Creek, Mayberry, Mosman AMP, Railroad, Sage Creek AMP, Stanford, Tallent AMP, Welborn Dell and Wolfe.

Recommendations for Uplands

1. Continue to maintain or improve upland health in all 19 allotments that exhibit healthy or improving upland conditions.
2. On the Red Butte allotment adjust the grazing management to incorporate deferment and/or rest or adjust the season of use.
3. On Red Butte SE allotment, adjust grazing management to incorporate deferment and/or rest, or reduce the season of use or number of livestock authorized to graze.
4. On Red Butte SE, address the historical landfill site on BLM administered lands.
5. In the Dell allotment, make appropriate changes in management to include rest, additional deferment or other revisions. Further investigate if any feeding of livestock has occurred on BLM administered lands, which is prohibited.
6. Consider adjusting the Huntsman allotment boundary to include the Dell allotment within the Huntsman allotment boundary. The Dell allotment would then be eliminated and those BLM acres would be included in the Huntsman allotment.
7. Establish Daubenmire trend studies within the Sage Creek allotment.

Riparian and Wetland Areas

Western Montana Standard #2: *"Riparian and wetland areas are in proper functioning condition."*

Affected Environment

Riparian vegetation in the SCW includes sedge species such as beaked sedge (*Carex utriculata*) and Nebraska sedge (*C. nebrascensis*), rushes (*Juncus spp.*), aspen, currant (*Ribes spp.*), birch (*Betula spp.*), and alder (*Alnus spp.*). Willow species include bebb (*Salix bebbiana*), geyer (*S. geyeriana*), booth (*S. boothii*), yellow (*S. lutea*), planeleafed (*S. planifolia*), wolf (*S. wolfii*), and coyote (*S. exigua*). See the Uplands section for soils information. Refer to Maps 4 and 5 for riparian reaches in SCW.

Streams

Stream flow in the SCW fluctuates annually and seasonally in response to precipitation in the form of rain and snow. The major streams (creeks) within the assessment area are Basin, Little Basin, East, Divide, Long and Sage Creek. The major streams (creeks) are fed by numerous small perennial and intermittent tributaries, springs and seeps. Basin, Little Basin, Sage Creek and many other streams within the watershed flow through extensive wetlands in the form of wet meadows.

Springs and Wetlands

Numerous isolated springs and wetlands exist within the assessment area. The Dillon Field Office has not developed nor does it plan to develop a comprehensive wetland inventory, but rather supports the Montana Natural Heritage Program wetland mapping program. Nevertheless some wetlands have been mapped and inventoried. See discussion below under National Wetland Inventory (NWI).

Developed springs within the SCW were inventoried and assessed. All the developed springs in the watershed are listed and described in the Findings, Analysis and Recommendations section.

National Wetland Inventory

The National Wetland Inventory (NWI) was developed by the US Fish and Wildlife Service to conduct a nationwide inventory of wetlands. The Inventory was developed to facilitate conservation efforts by identifying various wetland types and their distribution throughout the United States. To do this a wetland classification system (Cowardin et al. 1979) was developed that is now the Federal Standard (see glossary). The Montana Natural Heritage Program (MNHP), with financial assistance from the BLM, is in the process of mapping riparian and wetland resources to NWI standards. Wetland and riparian mapping within the SCW is progressing, but has not been completed. Current wetland mapping status is available on the MNHP webpage at: http://mtnhp.org/nwi/NWI_Status_map.asp. The Cowardian wetland classification system is accessible at: http://mtnhp.org/nwi/Cowardin.pdf

Findings, Analysis and Recommendations

East Creek, in the Knox Allotment

Procedure to determine conformance with Standard

BLM policy specifies using several complimentary monitoring and evaluation methodologies to determine conformance with the Riparian Health Standard regarding riparian (lotic) and wetland (lentic) areas. The IDT used the Lotic and Lentic Riparian Area Management Assessment Methodologies TR 1737-15 and TR 1737-16 (USDI 1998, 1999), also known as Proper Functioning Condition (PFC) Assessment Methodologies as well as Interpreting Indicators of Rangeland Health TR 1734-6 (USDI 2000), to evaluate riparian wetland systems including streams, riparian meadows and riparian wet meadows. The lotic methodology is used for flowing water systems and their associated riparian areas. The lentic methodology is used for ponds and still water systems. Wetlands are transitional areas between terrestrial and aquatic systems. Sensitivity to grazing impacts varies along a gradient from wet to dry. The wettest and the driest sites are often more resilient than intermediate sites where pugging frequently occurs. Applicable portions of the lentic methodology are used to assess springs and wet meadows. A Guide to Managing, Restoring, and Conserving Springs in the Western United States TR 1737-17 (USDI 2001) is also used for springs. These technical references are available online at www.blm.gov/nstc/library/library.html.

Proper Functioning Condition (PFC) is a range of conditions (continuum), not a single point. A high PFC rating may be analogous to Desired Future Condition (DFC), however a low PFC rating, while meeting the Riparian Health Standard, may not meet site specific objectives. "Riparian-wetland areas can function properly before they achieve their potential."(Ibid). The lotic PFC assessment utilizes attributes and processes that can be judged visually to evaluate riparian wetland areas with flowing water against their capability and potential. Some of these attributes and processes include the stream channel's physical characteristics or stream geometry (dimension, pattern and profile). To function properly, adequate vegetation, landform or woody debris should be present to dissipate energy associated with relatively frequent high flow events and to filter sediment, capture bed load and aid floodplain development so the stream does not excessively aggrade or degrade (down-cut). The IDT uses the Rosgen Stream Classification System as a tool to help determine stream potential (Rosgen 1994). This system has gained wide recognition throughout the United States and abroad and its use is recommended in the Second Edition of the BLM Technical Reference 1737-15 (2015). A major benefit of the system is the ability to determine stream sensitivity and to predict channel evolution with some level of accuracy (Rosgen 1996). The classification system is available online at http://www.wildlandhydrology.com/assets/A_Classification_of_Natural_Rivers-Catena_Paper.pdf.

The Dillon Field Office used its riparian database, which has been developed over the course of 20 years, as a starting point for the SCW. Many of the riparian areas in the assessment area were originally described and mapped based on aerial photos and U.S. Geological Survey (USGS) topographical maps. This information was the basis for GIS mapping. In recent years, springs and wetlands have been added to the GIS inventory and mapping effort. Subsequent ground-truthing has verified that a number of drainages previously mapped as riparian habitat are actually ephemeral drainages which lack riparian characteristics. These reaches have been removed from the stream/wetland inventory. Conversely, several stream reaches, springs and wetlands not previously categorized were identified during the watershed assessment process. These new streams, springs and wetlands were assessed by the BLM and added to the BLM riparian-wetland database.

Data were collected on all the streams in the SCW area using a modified version of the Montana Riparian Wetland Assessment (MRWA) methodology (Hansen et al. 1995) during the 2014 field season prior to the IDT's PFC assessments. In accordance with the Dillon Resource Management Plan, the MRWA methodology has been adapted and modified by the Dillon Field Office to include channel morphology parameters. The MRWA methodology includes inventories of physical and vegetative characteristics and streambed materials, and measurements of channel dimensions (bank full width, mean bank full depth, flood prone width). Physical measurements are utilized to assess channel morphology and stability and tentatively classify streams at Rosgen Level II (Rosgen 1994, 1996). The MRWA also includes inventories and observations of the composition, cover, vigor and the amount of recruitment, regeneration and utilization of vegetative species within the riparian zone. The data gathered were used by the IDT in conjunction with the PFC assessment process to ascertain riparian health and trends on a reach by reach basis.

Riparian coverboards, greenline, woody browse and cumulative width/depth transects, pebble counts and Rosgen Methodology monitoring were also used to measure various riparian attributes in the SCW. Riparian coverboards were established in the SCW in the 1980's. Coverboard data measures relative change in canopy cover of woody species in the riparian zone. Greenline transects are also used to measure changes in the relative abundance of different plant community types in the riparian area. Greenline data track changes in vegetative composition and cover within the narrow green vegetation ribbon adjacent to the channel. Woody browse, short for woody browse regeneration, is used to monitor age classes and recruitment of deciduous woody shrubs. Pebble counts are utilized to determine changes in substrate.

Divide Creek (lotic reach), in the Gallagher Mountain AMP

Cumulative width/depth is used to monitor changes in stream geometry. Rosgen monitoring, similar to cumulative width/depth, is conducted to track changes in channel morphology. Photographs are also taken at the various monitoring sites to record current conditions and relative changes over time. All the monitoring data used to aid the IDT in its assessment are included in the SCW project file and are available for review at the Dillon Field Office.

Findings and Analysis

Streams

Eighty one stream reaches, totaling 46 miles, were assessed for functional condition. Sixty two reaches, totaling 36.3 miles, were rated PFC. Six reaches, totaling 3.7 miles, were rated FAR with an upward trend. Ten reaches, totaling 4.7 miles, were rated FAR with a static or no apparent trend. Two reaches, totaling 0.7 miles, rated FAR with a downward trend. One reach, totaling 0.5 miles was rated NF. See Maps 4 and 5 for riparian reach locations and calls.

Where streams were not PFC, some of the concerns included: alteration of stream morphology, reduced access to floodplains, down cutting, reduction in species diversity and composition, reduced vegetative cover, limited vegetative species recruitment and regeneration, reduced structural diversity, and/or decreased vigor of streamside vegetation. Generally, ungulate grazing and browsing, roads and road crossings, irrigation ditches and diversions were the most frequently observed causal factors.

Stream morphology (channel shape and dimensions, including width and depth, and gradient) and bed materials provide important information to determine a stream's function. Critical shear stress must be achieved before a stream channel is capable of reshaping and maintaining itself. Stream power is reduced as a channel becomes wider. With reductions in critical shear stress and stream power, the ability of a stream to maintain riffles and pools and move channel materials is diminished. As these reductions continue, sediments often accumulate which force the stream to widen even more (TR1737-15 2015). The BLM's regulations require streams to have the ability to maintain stable dimensions, patterns and profiles.

Wetlands

Eleven lentic (wetland) reaches totaling 56 acres were also assessed in the SCW. Of the 11 lentic reaches assessed, 9 reaches, totaling roughly 48 acres, were rated PFC. One reach, totaling 5.4 acres, rated FAR with a static or no apparent trend and one reach, totaling 2.9 acres, rated FAR with a downward trend. Approximately 85% of the lentic acres were PFC.

Wetland #1180 (lentic reach), Armstead Allotment, July 2015

Frequently observed wetland impacts which resulted in departures from PFC, included: hummocking and soil compaction which lead to drying and alterations to hydrology as well as loss of the 'sponge.' Reduction in species diversity and composition, reduced vegetative cover, limited vegetative species recruitment and regeneration, reduced structural diversity, and/or decreased vigor of wetland vegetation were also observed. Generally, ungulate grazing and browsing were the most frequently observed causal factors. Table 6 summarizes the functional status of all the stream reaches and wetlands in the SCW that were evaluated.

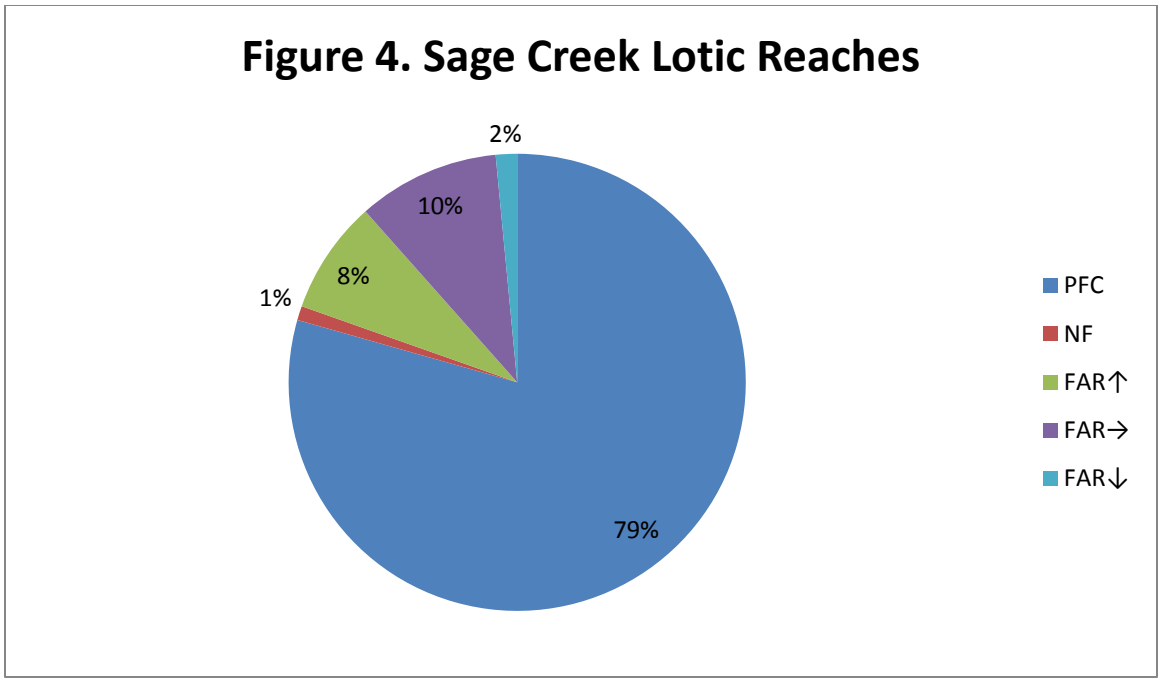
Table 6. Functional Status of Lotic and Lentic Reaches within the Sage Creek Watershed

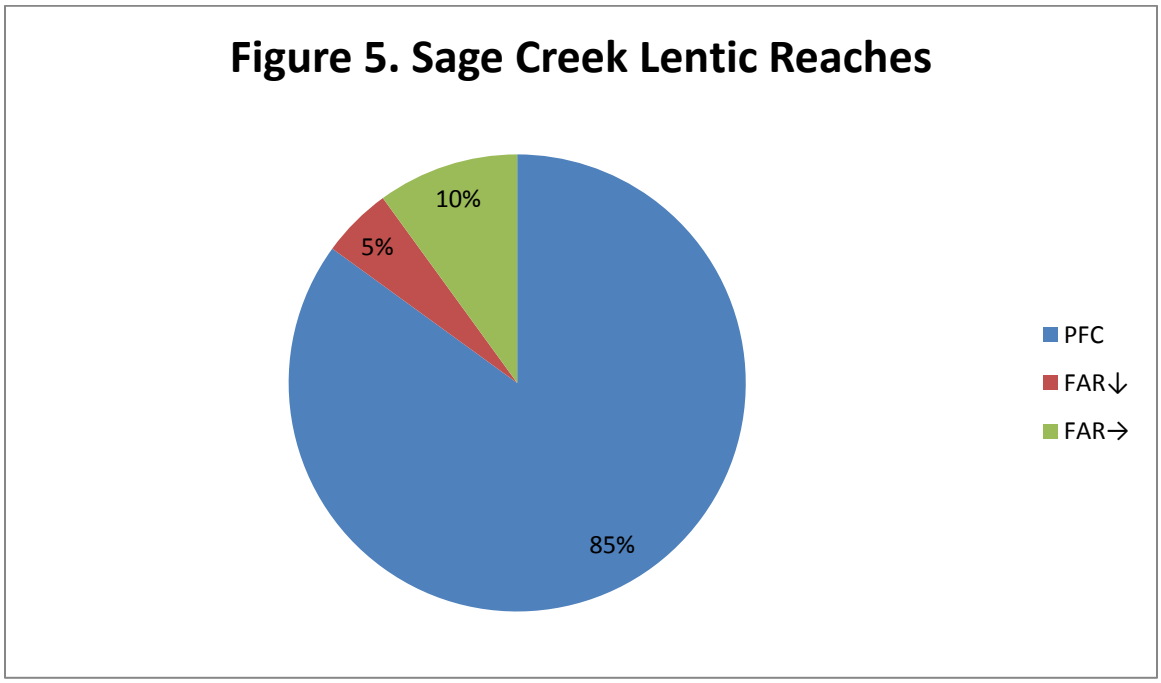
StreamWetland Name	Allotment	BLM Reach ID	Vegetative Community Type	Functional Rating & Trend	Miles/ Acres
Sage Creek trib	Armstead Mountain	1180	Shrubby cinquefoil/Tufted hairgrass	PFC	21.7 acres
Crooked Creek	Armstead Mountain	1153	Geyer willow/Beaked sedge	FAR-Up	0.5
Red Rock trib	Armstead Mountain	1107	Beaked sedge	PFC	0.43
Red Rock trib	Armstead Mountain	1111	Beaked sedge	PFC	0.3
Red Rock trib	Armstead Mountain	1127	Geyer willow/Beaked sedge	PFC	0.51
Red Rock trib	Armstead Mountain	1128	Geyer willow/Beaked sedge	PFC	0.33
Red Rock trib	Armstead Mountain	1168	Geyer willow/Beaked sedge	PFC	0.18
Red Rock trib	Armstead Mountain	1169	Geyer willow/Beaked sedge	FAR-Static	0.72
Red Rock trib	Armstead Mountain	1171	Kentucky bluegrass	PFC	0.29
Red Rock trib	Armstead Mountain	1172	Beaked sedge	PFC	0.06
Red Rock trib	Armstead Mountain	1173	Nebraska sedge	PFC	0.46
Sage Creek Upper	Armstead Mountain	1126	Geyer willow/Beaked sedge	PFC	3.1 acres
Sage Creek Upper	Armstead Mountain	1182	Geyer willow/Beaked sedge	PFC	2.4 acres
Sheep Creek trib	Gallagher Mountain AMP	8	Carex	FAR-Static	0.2
Sheep Creek trib	Gallagher Mountain AMP	9	Carex	FAR-Static	0.51
Sheep Creek, WF	Gallagher Mountain AMP	31	Douglas fir	FAR-Static	0.57
Divide Creek	Gallagher Mountain AMP	42	Beaked sedge	PFC	1.3
Divide Creek trib	Gallagher Mountain AMP	0042	Beaked sedge	PFC	0.56
Sheep Creek trib.	Gallagher Mountain AMP	86	Carex	FAR-Static	0.45
Divide Creek trib	Gallagher Mountain AMP	87	Geyer willow/Beaked sedge	PFC	0.31
Heifer Creek	Bull Heifer	1118	Geyer willow/Beaked sedge	PFC	1.45
Heifer Creek	Bull Heifer	1147	Quaking aspen/Red-osier dogwood	PFC	0.36
Heifer Creek	Bull Heifer	1164	Geyer willow/Beaked sedge	PFC	0.29

StreamWetland Name	Allotment	BLM Reach ID	Vegetative Community Type	Functional Rating & Trend	Miles/ Acres
Heifer Creek	Kent-Price	1119	Geyer willow/Beaked sedge	PFC	0.29
East Creek	Knox	1163	Geyer willow/Beaked sedge	PFC	4.5 acres
Heifer Creek bog	Knox	1187	Bog birch/Geyer willow/Beaked Sedge	PFC	10.4 acres
Beech Creek, WF	Knox	1103	Quaking aspen/Booth willow/Beaked sedge	PFC	1.55
Beech Creek	Knox	1104	Quaking aspen/sedge	PFC	0.08
Long Creek trib	Knox	1105	Geyer willow/Beaked sedge	PFC	.63
Beech Creek	Knox	1106	Geyer willow/Beaked sedge	PFC	1.13
Cattle Creek	Knox	1108	Booth willow/Beaked sedge	PFC	0.68
Cattle Creek	Knox	1109	Booth willow/Beaked sedge	PFC	0.37
Divide Creek	Knox	1112	Geyer willow/Beaked sedge	FAR Up	0.31
East Creek	Knox	1114	Geyer willow/Beaked sedge	PFC	0.97
East Creek	Knox	1115	Geyer willow/Beaked sedge	PFC	0.32
East Creek	Knox	1116	Quaking aspen/Red-osier dogwood	PFC	0.97
Heifer Creek	Knox	1117	Geyer willow/Beaked sedge	FAR-Up	0.93
Pistol Creek	Knox	1125	Quaking aspen/sedge	PFC	1.75
Bull Creek	Knox	1148	Shrubby cinquefoil/Tufted hairgrass	NF	0.55
Burnt Willow	Knox	1152	Geyer willow/Beaked sedge	FAR-Dn	2.9 acres
East Creek	Knox	1161	Quaking aspen/Red-osier dogwood	PFC	0.27
East Creek trib	Knox	1162	Quaking aspen/Red-osier dogwood	PFC	.0.29
Beech Creek	Knox	1184	Geyer willow/Beaked sedge	PFC	0.16
East Creek	Knox	1185	Quaking aspen/Red-osier dogwood	PFC	0.32
East Creek	Knox	1186	Quaking aspen/Red-osier dogwood	PFC	0.37
Long Creek	Knox non-AMP	1155	Geyer willow/Beaked sedge	PFC	0.29
Crooked Creek	Little Spring Gulch	1110	Geyer willow/Beaked sedge	PFC	0.64
Sage Creek	Little Spring Gulch	1134	Beaked sedge	PFC	0.14
Long Creek	Long Creek	2100	Douglas fir	FAR-Up	0.49
Little Basin Creek trib	Mayberry	1140	Geyer willow/Beaked sedge	PFC	1.1 acres
Red Rock trib	Mayberry	1197	Geyer willow/Beaked sedge	FAR-Static	0.25
Little Basin Creek trib	Mayberry	1501	Geyer willow/Beaked sedge	FAR-Dn	0.54
Little Basin Creek	Sage Creek	1102	Geyer willow/Beaked sedge	PFC	0.25
East Creek	Sage Creek	1113	Geyer willow/Beaked sedge	FAR-Up	0.46
Little Sage Creek	Sage Creek	1120	Shrub cinquefoil/Tufted hairgrass	PFC	0.31
Little Sage Creek, trib	Sage Creek	1121	Geyer willow/Beaked sedge	PFC	0.75
Little Sage Creek	Sage Creek	1122	Geyer willow/Beaked sedge	PFC	0.34
Little Sage Creek	Sage Creek	1122B	Geyer willow/Beaked sedge	PFC	0.29
Little Sage Creek	Sage Creek	1123	Geyer willow/Beaked sedge	PFC	0.87

StreamWetland Name	Allotment	BLM Reach ID	Vegetative Community Type	Functional Rating & Trend	Miles/ Acres
Little Sage Creek trib	Sage Creek	1124 (3 parts)	Geyer willow/Beaked sedge	PFC/FAR/ FAR-DN	0.52
Clover Creek	Sage Creek	1129	Shrubby cinquefoil/Tufted hairgrass	FAR-Static	0.68
Clover Creek	Sage Creek	1130	Geyer willow/Beaked sedge	PFC	0.29
Clover Creek	Sage Creek	1131	Shrubby cinquefoil/Tufted hairgrass	PFC	0.32
Clover Creek trib	Sage Creek	1132	Shrubby cinquefoil/Tufted hairgrass	PFC	0.55
Little Sage Creek, trib	Sage Creek	1133	Geyer willow/Beaked sedge	FAR-Static	0.3
Little Sage Creek	Sage Creek	1135	Kentucky bluegrass	FAR-Static	0.83
Little Basin Creek	Sage Creek	1136	SALPLA/CARAQU	PFC	0.23
Little Basin Creek	Sage Creek	1138	Shrubby cinquefoil/Tufted hairgrass	PFC	0.42
Little Basin Creek	Sage Creek	1139	Shrubby cinquefoil/Tufted hairgrass	PFC	0.51
Little Basin Creek	Sage Creek	1142	Beaked sedge	PFC	1.3 acres
Little Basin Creek	Sage Creek	1143	Geyer willow/Beaked sedge	PFC	0.64
Basin Creek	Sage Creek	1144	Beaked sedge	PFC	0.34
Basin Creek	Sage Creek	1145	Shrubby cinquefoil/Tufted hairgrass	PFC	1.36
Basin Creek	Sage Creek	1146	Kentucky bluegrass	PFC	0.23
Price Creek	Sage Creek	1149	Geyer willow/Beaked sedge	PFC	0.62
Price Creek	Sage Creek	1150	Geyer willow/Beaked sedge	PFC	0.32
Little sage Creek	Sage Creek	1159	Beaked sedge	PFC	0.91
Little sage Creek	Sage Creek	1160	Beaked sedge	PFC	1.44
Teddy Creek	Sage Creek	1165	SALPLA/CARAQU	PFC	1.08
Teddy Creek	Sage Creek	1166	Shrubby cinquefoil/Tufted hairgrass	PFC	0.36
Heifer Creek	Sage Creek	1188	Geyer willow/Beaked sedge	PFC	0.73
Price Creek	Sage Creek	1189	Geyer willow/Beaked sedge	PFC	0.84
Price Creek	Sage Creek	1190	Geyer willow/Beaked sedge	PFC	0.82
Clover Creek	Sage Creek	1502	Beaked sedge	PFC	0.36
Clover Creek	Sage Creek	1503	Geyer willow/Beaked sedge	PFC	0.55
Sage Creek Upper	Tallent AMP	1157	Geyer willow/Beaked sedge	PFC	.47

The percentage of the total lotic and lentic stream miles and lentic acres in each functional class are illustrated in Figures 4 and 5. The locations and functional class ratings for streams in the Sage Creek Assessment are also shown on Maps 4-5.





Allotments in which the riparian and wetland resources rated as PFC or FAR with and upward trend and had few site specific concerns are not discussed in this section, but information on these resources is available upon request. Additional stream reach specific data for any of the riparian/wetland areas in the SCW is available at the Dillon Field Office. Two allotments, Gallagher Mountain AMP and Mayberry, had several streams that rated as FAR-Static or FAR down and are discussed in more detail below.

Gallagher Mountain AMP
There are five stream miles in the portion of Gallagher Creek AMP that was included in the Sage Creek Assessment. Fifty-five percent of the stream miles (Divide Creek) rated PFC, however 45 percent (Sheep Creek tributaries) rated FAR-static. Sheep Creek tributaries were over-widened resulting in reduced shear stress and a reduction in the stream's ability to transport its bedload and maintain dimensions, patterns and profiles within natural ranges of variability. Livestock impacts were a causal factor resulting in the FAR-static ratings.

Mayberry
There are four wetland resources in the Mayberry Allotment. A one acre wetland associated with Nineteen Spring, a developed spring, was rated as properly functioning. A spring and tributary of Little Basin Creek were rated NF and FAR with a downward trend. A tributary to Red Rock River was FAR with a static trend. Livestock impacts have caused excessive hummocking and drying of these resources.

Developed Springs
The BLM's Rangeland Improvement Project System (RIPS) database shows 15 spring developments in the SCW. BLM staff visited most of these developments to determine resource condition, condition of infrastructure, and water production (flow). Table 7 lists the spring developments on BLM land in the watershed.

Table 7: Developed Springs

Spring Name	Project Number	Allotment
HUNTSMAN 1 SPRING	476410	Huntsman
NINETEEN SPRING	470346	Mayberry
TWENTY FOUR SPRING	470347	Mayberry
ASHBOUGH LOWER SPRING	009613	Armstead MTN
DULCE AGUA SPRING	470462	Armstead MTN
HORSESHOE SPRING 1	476384	Armstead MTN
TWO DRIP SPRING	470349	Armstead MTN
MIDDLE CANYON SPRING	004806	Armstead MTN
ASHBOUGH UPPER SPRING	004779	Armstead MTN
BOG HOLE SPRING	004802	Sage Creek
LITTLE SAGE CREEK SPRING	475013	Sage Creek
NORTH SPRING	475015	Sage Creek
PASTURE 2A NW SPRING	004811	Sage Creek
SADDLE SPRINGS	004714	Sage Creek
SEDGE MEADOW SPRING	004524	Sage Creek

Maintenance of water developments was a noted concern on several developments in the watershed. Maintenance problems include lines not being drained, sediment in troughs, plumbing not properly working, lack of float valves and/or shutoff valves, and leaking troughs. These maintenance issues can negatively impact wetland hydrology and do not help attain the objective(s) that the development was originally intended to achieve (i.e., livestock distribution

or mitigation of impacts to perennial streams). They may also impact water rights since water right holders are expected to conserve water. Though not related to maintenance per se, troughs may present wildlife hazards and escape ramps help mitigate the hazard. Properly maintained water developments are considered Best Management Practices for riparian resources. The BLM must report on BMP effectiveness as part of our participation in Montana's Nonpoint Source Management Strategy. Permittee partnership and cooperation is critical to achieve these goals.

Recommendations for Riparian

1. Revise livestock management in the Gallagher Mountain AMP and Mayberry allotments to mitigate impacts to riparian/wetland habitat. Also, revise management where site specific streams rated FAR-Static, FAR down or NF. Revisions to allotment management plans, pastures or site specific areas may include changes in timing, duration, frequency (resting pastures or allotments) and/or intensity of use as well as number of livestock authorized.
2. Maintenance of dysfunctional rangeland improvement projects and/or new construction of water developments, pasture division fences and riparian corridor fences may also be considered.
3. Verify that routine maintenance is conducted by the permittees on all spring developments on an annual basis as agreed to in the Cooperative Agreements for the projects. If spring developments are dry and dysfunctional, they should be abandoned and infrastructure cleaned up. Exclosures should be constructed, maintained, reconstructed or removed depending on resource needs.
4. Consider mechanical treatment to reduce hummocking on Clover Creek.

Water Quality

Western Montana Standard #3: *"Water quality meets State standards."*

Affected Environment

The affected environment is described in the introduction and the sections addressing the Upland and Riparian Health Standard. Sage Creek falls within the Red Rock TMDL Planning Area which DEQ has not fully assessed.

Findings, Analysis and Recommendations

Procedure to determine conformance with Standard

The Bureau of Land Management defers to the State of Montana with respect to this standard. The Bureau of Land Management and the State of Montana work together to implement the objectives of the Clean Water Act "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" and Article IX of the Montana Constitution "…maintain and improve a clean and healthful environment in Montana for present and future generations." Restoring and maintaining the Nations Waters and a clean and healthful environment require assessment and problem identification. In Montana water quality impairment is more often the result of nonpoint source pollution. "Nonpoint source pollution generally results from land

runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act. Unlike pollution from industrial and sewage treatment plants, nonpoint source (NPS) pollution comes from many diffuse sources." (http://water.epa.gov/polwaste/nps/whatis.cfm). Montana has developed a nonpoint source management plan for the State and the Montana-Dakotas BLM, through a Memorandum of Understanding, works with the State of Montana to implement this plan on public land. http://deq.mt.gov/wqinfo/nonpoint/NonpointSourceProgram.mcpx

The following is an excerpt from the 2012 Plan, "The goal of Montana's Nonpoint Source Management Program is to provide a clean and healthy environment by protecting and restoring water quality from the harmful effects of nonpoint source pollution. We believe this can best be achieved through the voluntary implementation of best management practices identified in science-based, community-supported watershed plans. The goals of this plan are to:
• Inform Montana citizens about the causes and effects of NPS pollution on water quality.
• Set priorities for controlling NPS pollution on a statewide basis.
• Identify strategies for restoring water quality affected by NPS pollution.
• Describe a set of focused, short-term activities (5-year action plan) for attaining the statewide NPS pollution control program goals." One way that the Dillon Field Office works to implement provisions of the nonpoint source management plan is through the watershed assessment process and implementation of management and projects.

Findings and Analysis

Section 319 of the Clean Water Act addresses non-point source pollution through the application of Best Management Practices (BMPs). The BLM uses a variety of BMPs to address nonpoint source pollution resulting from silviculture, livestock grazing, road construction and maintenance and mining. Allotment Management Plans (AMPs) are recognized as grazing BMPs to the extent that they address non-point pollution (EPA2003). The BLM uses AMPs developed to improve riparian and upland conditions as an effective BMP to improve water quality. Western Montana Guideline #10 states "Livestock management should utilize BMPs for livestock grazing that meet or exceed those approved by the State of Montana in order to maintain, restore or enhance water quality." Other grazing BMPs used by the BLM include off-stream water, exclosures, and riparian fences.

The BLM's responsibilities under the 1987 amendments of the Clean Water Act include evaluation of the effectiveness of implemented BMPs. The watershed assessment is an evaluation of BMP effectiveness as well as an evaluation of land health. For the SCW assessment, the IDT used a combination of methodologies to evaluate the watershed characteristics, as well as condition and function of floodplains, springs, streams, and wetlands.

In conducting watershed assessments with respect to nonpoint source water pollution, upland, forest, wetland and riparian assessments are used to determine how BLM management is affecting water quality. The BLM evaluates uplands for land cover condition (ability of plants, rocks, and litter to protect soil from erosion, promote infiltration and reduce runoff). Wetlands are assessed to determine their extent and condition and their ability to recharge ground water, cycle nutrients, filter sediments, promote infiltration and mitigate flooding. Streams and their

adjacent riparian areas are evaluated to determine channel morphology and stability, access to floodplains, species composition and condition of riparian vegetation. Wells, pipelines and spring developments are recognized as BMPs, and are evaluated to determine condition and effectiveness. Due to the extent of stream miles in the Dillon Field Office, temperature monitoring is limited to high priority streams. PFC assessments also provide clues to stream temperature. Shallow, over-widened streams with limited vegetation receive more solar radiation and are more at risk for thermal impacts than deep narrow well vegetated streams. Improvements in channel condition and riparian cover directly correlate to reductions in thermal impacts.

The assessment team also looks at current and historic mining, timber harvests, abandoned beaver dams, erosion from roads, concentrated livestock waste and other disturbances that may contribute to non-point source pollution. Road maintenance including stream crossings, culvert sizing and installations are also evaluated.

There are 22 allotments in the SCW. Of the 22 allotments, 11 have streams and wetlands. Allotment Management Plans/BMPs have been developed for ten allotments. A Final Decision was issued and new management was authorized for fourteen allotments: Armstead Mountain, Big Spring Gulch, Buck Creek AMP, Bull-Heifer Creek, Kent-Price, Knox, Little Spring SGC, Long Creek, Mayberry, Orphan, Sage Creek AMP, Stanford, Tallent AMP, and Welborn-Dell in 2006. As part of the Decision Armstead Mountain and Buck Creek and were combined into one allotment as were Wellborn-Dell and Orphan reducing the number of allotments from fourteen to twelve.

The 2015 field based land health assessments indicated that BMP effectiveness was achieved for eleven of the twelve allotments. Four allotments that were found in PFC during the previous assessment, had either FAR condition streams or uplands in 2015. Gallagher Mountain AMP, Dell, Red Butte and Red Butte SE. The Best Management Plans associated with the Mayberry Allotment were not fully implemented and several streams were rated as FAR.

In addition to the Allotment Management Plans, there are numerous water developments in the watershed assessment area. Some of these were well designed and working effectively, others were in need of repair or were not providing sufficient water.

Refer to sections on upland and riparian health above for, PFC determinations and information that helps indicate where BLM resource conditions and/or authorized uses may be either contributing to or mitigating water quality impairment. The State makes Beneficial Use Determinations. The BLM shares their findings to assist DEQ in making Beneficial Use Determinations.

Recommendations for Water Quality

Please refer to the recommendations under Upland and Riparian Health, and additionally:

1. Work with Montana DEQ as they develop TMDLs and Water Quality Restoration Plans.
2. Continue BMP implementation and effectiveness monitoring to address NPS pollution.
3. Continue to share Watershed Assessment findings with DEQ.

4. Continue implementation of Water Quality MOU (BLM-MOU-MT923-1030) between Montana DEQ and BLM, including submission of biannual reports.
5. Continue to implement the Montana Nonpoint Source Management Plan and strategies for Agriculture, Forestry, Mining and Road Maintenance.
6. Continue temperature monitoring on high priority streams.

Air Quality

Western Montana Standard #4: "*Air quality meets State standards.*"

Affected Environment

The United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) that limit air pollutant concentrations of six principal pollutants (particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead). The EPA also regulates additional pollutants such as hazardous air pollutants and greenhouse gases (GHGs), although these pollutants have no regulatory thresholds for ambient concentrations. Emissions of GHGs, including primarily carbon dioxide and methane, contribute to climate change.

Under the Clean Air Act Amendments of 1990, the EPA must regularly review and revise the NAAQS, ensure that the standards are attained (in cooperation with States), require control of hazardous air pollutant emissions, and set standards for air quality monitoring. Installation and operation of monitors is primarily carried out by State and local agencies and the monitors are typically located in population centers or near certain industrial sites. Monitors are rare in rural areas, unless air quality agencies have reason to believe that pollutant concentrations may approach or exceed ambient air standards in rural locations.

For most of the year, air quality in rural southwestern Montana is excellent. Air quality issues in the SCW develop predominantly during wildfires and are limited to $PM_{2.5}$ emissions, which can travel hundreds and even thousands of miles. Consequently, air quality in the SCW can be affected by fires located far from the SCW. Because pollutant emissions associated with wildfires are largely beyond human control, exceedances of air quality standards that are associated with large wildfires are considered to be natural events and are typically exempted from consideration when determining NAAQS compliance.

The closest population to the SCW is Dillon, Montana. The 2010 U.S. Census population estimate for Dillon Census County Division was 7,880. Beaverhead County's population estimate, also for 2010, was 9,246 (http://epa.gov/airquality/qa/monprog.html).

Findings, Analysis and Recommendations

Procedure to determine conformance with Standard

The Clean Air Act (CAA) of 1990, as amended (42 U.S.C. 7401 et seq), and Executive Order 12088 require the BLM to work with appropriate agencies to protect air quality, maintain Federal and State designated air quality standards, and abide by the requirements of State Implementation Plans.

The EPA delegated the authority to implement the provisions of the CAA to the State of Montana. Determination of compliance with air quality standards is the responsibility of the State of Montana. To address the issue of wildland fire, the EPA developed the 1998 Interim Air Quality Policy for Wildland and Prescribed Fires which required states to develop smoke management plans. Montana and Idaho responded by forming the Montana/Idaho Airshed Group and by developing the Montana/Idaho Smoke Management Program.

Findings and Analysis

Air quality concerns in the planning area are primarily related to smoke. Smoke contributors in the planning area include wildfire, prescribed fires, private debris burning, agricultural burning, slash burning, and wood burning stoves and fireplaces. Wildfire can produce short-term adverse effects on air quality. Air quality and visibility can deteriorate due to temporary air stagnation during wildfire events, which are most common during the months of July, August, and September. Smoke from wildland and prescribed fires are the primary concerns affecting human health.

Prescribed burning is conducted in accordance with the Montana/Dakotas Fire Management Plan and is coordinated with MT DEQ and the Montana/Idaho Airshed Group. During prescribed fire season, the Smoke Monitoring Unit supports the Montana/Idaho Airshed Group to prevent or reduce the impact of smoke on area communities, especially when that smoke could contribute to a violation of national air quality standards. During the summer wildfire season, the Smoke Monitoring Unit assists state and local governments in monitoring smoke levels and providing information about smoke to the public, firefighters, and land managers.

Recommendations for Air Quality

1. Continue to follow burn plans and to coordinate with the Smoke Monitoring Unit.

Biodiversity

Western Montana Standard #5:

"Provide habitat as necessary, to maintain a viable and diverse population of native plant and animal species, including special status species."

Procedure to Determine Conformance with the Standard

This Standard is an overall assessment of biodiversity and plant and wildlife habitat. The present state of each allotment and habitat type was

Western Toad

compared to the natural and historic condition. The indicators described under the definition of Standard #5, as well as condition/function of the other standards, specifically uplands and riparian, were considered to determine whether or not the Biodiversity Standard was met. The IDT considered the range of natural variation within this ecosystem as well as the species composition, condition of available habitat, and forest health to determine the condition/function of biodiversity.

Affected Environment and Findings and Analysis

The Sage Creek watershed provides a large, relatively contiguous, area of dry sage steppe habitat. It represents the largest sagebrush basin in southwestern Montana that has not been subject to human development although irrigated hay lands have replaced some basin big sagebrush communities on private lands. The area provides seasonal habitats for a wide variety of sagebrush dependent species and other wildlife uses that are enhanced by the interspersion and diversity of sagebrush species, grasslands, riparian habitat, rocky outcrops and small forested areas. Major seasonal wildlife movements occur within and in/out of the basin. The Biodiversity Standard was rated as FAR in two allotments, Dell and Red Butte, due to a moderate departure in the biotic integrity of these sites. Watershed-wide biodiversity concerns include loss of aspen habitat, heavy browsing of available mountain mahogany leading to a reduction in regeneration and expansion, and rampant ORV use during the big game hunting season which contributes to noxious and invasive weed spread, soil erosion and sediment input into streams, habitat fragmentation and wildlife security issues.

Sagebrush Habitats and Sagebrush Dependent Species

Sagebrush habitat makes up 93% of BLM administered lands in the SCW. The watershed provides a wide diversity of sagebrush communities with most of the sagebrush species and habitat types found in southwestern Montana present in SCW. The variety of sagebrush provides habitat for pronghorn, mule deer, elk, sage grouse, pygmy rabbits, and a suite of bird species. Bats also forage for insects in sagebrush habitat. Areas that were chemically sprayed to reduce sagebrush in 1968 -1969 in Armstead Mountain allotment and Gallagher Mountain AMP presently have vigorous sagebrush cover with a diverse herbaceous understory of grasses and forbs.

BLM administered lands in the SCW provide year-round sage grouse habitat. The majority of the SCW is within a sage grouse priority habitat management area (PHMA) (see Map 3). Sagebrush is an important habitat component for sage grouse. It comprises nearly 100% of sage grouse winter diets and provides thermal, hiding, and nesting cover. Broods require a high protein diet of forbs and insects, usually found in riparian habitats. At least five active leks occur within the watershed. Numbers of male sage grouse attending leks is relatively stable in the Basin Creek and Little Sage Creek areas, with higher than average counts on a couple of the leks. Other leks have not shown persistent attendance over the years, with some leks moving locations. An effort to locate new leks is ongoing in the watershed and throughout the DFO. The DFO radio-collared sage grouse throughout the Field Office from 1999-2012. Based on the telemetry data gathered, sage grouse captured from leks within the SCW, Centennial Valley, and Sweetwater winter in the watershed, mainly in the Sage Creek allotment as well as the Armstead Mountain and Mayberry allotments.

Habitat plots completed during the 2015 nesting and brood rearing seasons, within three miles of leks in the watershed, averaged 59.5 cm shrub height, 28 cm herbaceous height, 32% shrub cover, and 71% herbaceous cover. All of these indicators, except shrub cover, are within the "suitable" habitat range for sage grouse breeding habitat outlined in the Sage-Grouse Habitat Assessment Framework (June 2015), which is BLM's guidance for sage grouse habitat. Suitable habitat guidelines include: 15-25% shrub cover (marginal includes >25%), 40-80 cm sagebrush height in mesic areas and 30-80 cm in arid sites, ≥18 cm perennial grass and forb height, ≥15% perennial grass cover at a mesic site and ≥10% perennial grass cover at an arid site. It is important to remember that the SCW provides year-round sage grouse habitat and sagebrush cover ≥10% and sagebrush height ≥ 25 cm is considered "suitable" winter habitat.

Sage Creek Watershed also provides year-round pygmy rabbit habitat. Pygmy rabbits also require sagebrush for forage and cover, as well as deep alluvial soil to dig burrows. Sagebrush comprises nearly 100% of their winter diet and over half of their summer diet. Pygmy rabbits are endemic to sagebrush and are the only rabbit on the continent to dig their own burrows. Pygmy rabbits have been documented in Tallent AMP, Big Spring Gulch, Little Spring Gulch, Mayberry, and Sage Creek allotments. Active burrows were found in a variety of sagebrush communities. Where burrows can be dug and there is some patchy sagebrush structure, it is likely that pygmy rabbits have been present.

Large extensive Basin big sagebrush communities are present in many drainage bottoms. These provide important structure and cover for wildlife in otherwise open habitat, particularly for special status species that require tall dense sagebrush such as sage thrasher, Brewer's sparrow, sagebrush sparrow and loggerhead shrike. Gray flycatchers, golden eagles, prairie falcons, great horned owls, and ferruginous hawks also inhabit the sagebrush grassland habitat in the watershed. The Sage Creek watershed lies within the Lima/Sweetwater Breaks key raptor management area (see Dillon RMP Vol.1 p.174, ROD map 32). This area was designated because it had one of the highest concentrations of breeding ferruginous hawks in North America, along with prairie falcons, golden eagles and other raptors. Maintaining sagebrush steppe and mountain mahogany habitat and controlling disturbance of nest sites is important in this area.

Monitoring efforts during the 2014 and 2015 nesting seasons documented several active ferruginous hawk nests within the watershed, however the density of active nests has declined since survey efforts in the 1970s-1980s identified many of the nesting territories (although they were not all active at that time either). It has been noted throughout the DFO that ground nests are virtually never active, with active nests only found in trees and shrubs, including mountain mahogany and Rocky Mountain juniper, on rock outcrops, or cliffs. Active prairie falcon nest territories were documented near inactive ferruginous hawk territories during 2015 monitoring efforts. A couple of active golden eagle nests were also located during these monitoring efforts.

Sagebrush habitat in the watershed provides mule deer and antelope winter range. Portions of Sage Creek, Mayberry, Gallagher Mountain, and Armstead Mountain allotments are important elk winter range. The higher elevation mountain big sagebrush communities at the north end of the watershed provide elk calving habitat. Mountain mahogany is heavily browsed throughout the watershed, notably near Bull and Heifer Creeks, Little Ashbough Canyon, and Basin and

Little Basin Creeks. Most of the available mountain mahogany leaders were browsed with moose and mule deer pellet groups covering the ground in these mahogany stands.

Generalist or Widespread Species

Sage Creek provides seasonal habitat for migratory and resident elk. The Sage Creek Watershed is part of the Gravelly Elk Management Unit (EMU). The elk population in this EMU has been maintaining at around 10% above the objective range for a couple of years. There are around 4,000-4,500 elk that utilize SCW throughout different seasons of the year (pers. comm. Waltee, 2015). Several thousand elk winter in SCW, with elk winter range concentrated between Little Basin Creek and the White Hills on the Sage Creek AMP allotment, which supports up to 2500 elk that summer in the Gravelly/Snowcrest Range and the Centennial Mountains in both Montana and Idaho. Elk also winter in the Mayberry allotment between Basin Creek and the Red Rock River, as well as in Armstead Mountain allotment in the sagebrush grassland hills east of the Red Rock River, north of Ashbough Canyon. A small resident herd of 200-400 elk are found on the west side of the watershed between Buck Creek and Monument Hill. Fall hunting pressure, fall weather and winter snow depths throughout this larger area influence actual numbers using Sage Creek winter habitat. Calving habitat is present along the north side of the watershed between Price Canyon and upper Divide Creek, and supports several hundred elk from spring into summer months. Managing this elk population is complicated by elk moving onto alfalfa pivots north of the watershed in the Beaverhead Valley during the archery and rifle hunting seasons. Intense browse pressure on aspen and some willow communities are largely from elk pressure in the summer and early fall.

Brucellosis is an infectious disease caused by the bacteria *Brucella abortus* that infects cattle, bison, and elk. In these species, brucellosis typically results in an abortion during the first pregnancy after infection, although it can also cause abortions during subsequent pregnancies, or the birth of weak calves with high mortality. *B. abortus* is primarily transmitted through contact with infected birth tissues and fluids (MFWP, 2015a). Montana Fish, Wildlife and Parks (MFWP) is conducting a multi-year targeted elk brucellosis surveillance project to evaluate the prevalence and spatial extent of brucellosis exposure in southwest Montana elk populations, evaluate the extent of elk interchange between infected and adjacent elk herds, and evaluate the risk of seropositive elk shedding and potentially transmitting *Brucella abortus* (MFWP, 2015b). Annual work plans are put together with public input, research, and input from the Elk Management Guidelines in Areas with Brucellosis Work Group, which are used to reduce the risk of brucellosis transmission from elk to cattle in a manner that maintains elk on the landscape. Given the risk of transmission in areas where elk have tested positive for exposure to brucellosis (seropositive) is associated with proximity of elk to cattle, these actions are designed to adjust local elk distribution away from cattle at small geographic scales. In 2012, MFWP captured 93 elk from the Sage Creek watershed, 5 of which were seropositive, which equates to a 5.4% estimate of seroprevalence. Out of 13 live birth events, *Brucella abortus* was not detected at any of the birth sites. One abortion occurred and *Brucella abortus* was detected at the site. Elk from the Sage Creek herd interchange with the Blacktail elk herd yearlong. Individuals from the Blacktail herd also tested seropositive for *Brucella abortus*. Sage Creek elk also cross Interstate-15 into the Tendoy Mountains where elk have not been tested for *Brucella abortus* at this time.

Antelope are found throughout the Sage Creek watershed with greatest numbers (500-1000) present during the winter from the White Hills, throughout Little Sage Creek area, into Basin/Little Basin Creek and Antelope Flats. Antelope also winter along the entire western side of the watershed from Railroad allotment to the north watershed boundary in the Armstead Mountain allotment. Many of the antelope move into the Centennial Valley during the summer months. Small groups of antelope are resident within the analysis area yearlong usually associated with irrigated cropland.

Several hundred mule deer occur throughout Sage Creek seasonally. Mule deer winter range covers a large portion of SCW, with use focusing on sagebrush habitat. Mountain mahogany is heavily browsed by mule deer and moose during the winter. Heavy browse pressure over the past four decades is reducing mountain mahogany vigor, limiting winter browse availability. Similar to elk, many mule deer move between winter/spring habitat in Sage Creek, and summer habitat in the Gravelly/Snowcrest Ranges and the Centennial Mountains. White-tail deer are not common in the SCW, but are typically found along riparian areas, however the sagebrush grasslands of the Mayberry allotment above Sage Creek are also utilized during the spring and summer.

Moose are typically associated with riparian habitats, however the SCW provides yearlong habitat, including throughout sagebrush/grassland and mountain mahogany habitat. Moose were not as commonly seen during the 2015 field assessment, as they were during the 2005 assessment. Elk were observed more often this year than a decade ago. Heavy browse on mountain mahogany and aspen regeneration in areas throughout the watershed may be limiting mule deer and moose winter range quality. Browsing from livestock and wildlife including mule deer, moose, and elk are all contributing. Seventeen moose were observed along willow riparian habitats during a March 2014 MFWP trend survey, mainly toward the north end of the watershed (pers. comm. Waltee, 2015).

Wolves are present year-round in SCW, occasionally concentrating near large groups of wintering elk. Black bears also occur within the area, with more use at the north end of the watershed, especially during elk calving season. Although the level of use is not known, mountain lions also move through the watershed.

Net-wire and barbed-wire fences are found throughout SCW. These fences represent an entanglement hazard and travel barrier, especially for antelope, and deer, elk and moose calves. Barbed wire fences with more than four wires, wires spaced too closely, or wires higher than 40-inches or lower than 16-inches hinder wildlife movement between pastures and are also an entanglement hazard. Fences near sage grouse leks or in areas with low visibility can be a collision hazard for sage grouse. Fence markers can be placed on the top wire to increase visibility. Fences for marking, modification, removal, or rebuilding have been identified in several SCW allotments. Spring developments are an important water source for wildlife, but associated tanks can be fatal when escape ramps for birds and small mammals are not installed in them. Escape ramps will be installed in stock tanks that were lacking them.

Table 8. Primary Game Species and Habitat Use within the SCW

Species	Forested	Sagebrush	Riparian
Antelope		Y	
Black bear	Y	S	S
Dusky grouse	Y	S,B	Y
Elk	S,C	W,C	Y
Gray Wolf	Y	Y	Y
Hungarian Partridge		Y	
Moose	Y	Y	Y
Mountain lion	Y		Y
Mule deer	S,C	Y	W
Ruffed Grouse	Y		Y
Sage grouse		Y	B
White-tail deer		S	Y

Y = yearlong, S = summer, B = brood rearing, C = calving/fawning, W = winter

Riparian, Aquatic and Wetland Habitat and Associated Species

Riparian habitat is widely scattered within this large, dry watershed, making up 3.5% of the BLM administered lands in the SCW. There are few larger perennial streams, and most riparian habitat is associated with small tributary streams originating in springs, isolated springs with no downstream connections to other water sources, or intermittent drainages and wet meadows. Riparian areas provide important habitat for moose, elk, beaver, songbirds, and sage grouse. Columbia spotted frogs and western toads were observed at different sites within the watershed. Columbia spotted frogs are the most common frog in mountainous regions of Montana and frequent wetlands in both forested and non-forested habitat. Adults overwinter in larger ponds and in extremely dry conditions they become inactive and burrow in the mud or under rocks (Werner et al., 2004). Riparian, aquatic, and wetland habitat offers habitat diversity and are crucial water sources for wildlife. Succulent forbs, largely found in riparian areas, are a key component of sage grouse brood diets. Wildlife and livestock concentrate in riparian habitat, as it provides green vegetation later into the summer and fall, resulting in a disproportionate amount of use in these areas.

Heifer Creek, Reach 1118; mature aspen cut down by beavers in the past

Beavers have declined significantly region-wide, and the only active beaver dams found on BLM administered lands in the SCW were on Long Creek and East Creek. Private lands contain active beaver complexes in the SCW. Historic beaver activity was documented on BLM lands along East Creek, Bull Creek, Cattle Creek, Crooked Creek, Divide Creek, and a tributary to Little Sage Creek. The aspen is either no longer existent along

these reaches, with the beaver having cut them all down, or colonies of mature aspen remain with little regeneration or browse reducing the vigor of the regeneration. Existing beaver colonies could provide beaver recruitment elsewhere into vacant streams and into adjoining watersheds but suitable habitat to sustain long-term occupancy is generally lacking, with many aspen communities transitioned into willow dominated systems.

Aspen in the SCW is also an important forage, cover, and nesting component for various species including elk, moose, and ruffed grouse. Riparian woodlands support the highest diversity of landbird species of all habitats. Riparian corridors are crucial to several northern-breeding Neotropical migrants and breeding or wintering species, even though they may not carry water year-round (Rich et al., 2004). Most species are summer residents that use habitats ranging from lower elevation wetlands to high elevation forests for breeding and raising young. Some species are migratory, but small populations may stay yearlong depending on seasonal conditions. The USFWS has a list of 22 "Birds of Conservation Concern" for Bird Conservation Region (BCR) 10 (Northern Rockies U.S. portion only), many of which depend on riparian habitat for all or part of their lifecycle (U.S. Fish and Wildlife Service, 2008). Table 9 lists the 18 species that potentially occur within the SCW.

Table 9: USFWS Birds of Conservation Concern, BCR 10, Potentially Occurring in SCW

Bald Eagle	Williamson's Sapsucker
Swainson's Hawk	Olive-sided Flycatcher
Ferruginous Hawk	Willow Flycatcher
Peregrine Falcon	Loggerhead Shrike
Long-billed Curlew	Sage Thrasher
Flammulated Owl	Brewer's Sparrow
Calliope Hummingbird	Sage Sparrow
Lewis's Woodpecker	McCown's Longspur
Black Rosy-Finch	Cassin's Finch

Fish Streams

There are 10 streams on public land within the Sage Creek assessment area that currently support cold water fish species. The westslope cutthroat trout (WCT), mountain whitefish, longnose sucker, white sucker, longnose dace and mottled sculpin are native fishes in the Sage Creek watershed. Rainbow, brown, brook and Yellowstone cutthroat trout were introduced, probably about the turn of the century. As a result, populations of native WCT within the watershed have declined due to competition and/or hybridization with rainbow and Yellowstone cutthroat trout. Land use practices within the Sage Creek watershed over the last century have caused a decline in riparian areas, which have led to a loss of habitat for WCT and other native and nonnative fish species.

Fish streams within the assessment area do not generally support popular recreational fishing. Portions of Sage Creek support a limited sport fishery for hybrid cutthroat, rainbow, brown, brook trout and mountain whitefish. Sage Creek provides on average approximately 67 angler use days per year (MFWP 2013). Several other streams likely support light fishing use as well. Sage Creek itself, lies primarily on private land.

Fish habitat conditions on streams within the Sage Creek assessment area were generally found to be in good condition. Some streams exhibited localized impacts due to livestock or road use.

Table 10. Sage Creek Watershed Fish Streams and Species

Stream	BLM Stream reach(s)	Fish Species Present on BLM	BLM stream length
Sage Creek	1134,1157	Rainbow, brown and brook trout, cutthroat trout hybrids, long nose sucker, mottled sculpin, longnose dace and mountain whitefish	.61
Basin Creek	NA	WCT (99%), brook trout mottled sculpin	0
Little Basin Creek	1102,1138	WCT (92%), brook trout, mottled sculpin	.67
Little Sage Creek	1123,1159,1135	Brook trout, rainbow trout and mottled sculpin	2.53
Bull Heifer Creek	1117	Brook Trout	0.93
East Creek	1114,1113,1115, 1116,1185	WCT (97 %), brook trout	3.41
Beech Creek	1106	Hybrid trout, brook trout	1.13
Cattle Creek	1109	WCT (unknown %)	0.23
Long Creek	2100,1155	WCT (99%), sculpin, brook trout	0.78
Divide Creek	42	Cutthroat hybrids, brook trout	1.3

Overall, riparian habitat condition on streams surveyed was in good condition with stable banks and low levels of bank disturbance. Throughout the SCW area sediment levels in streams were found to be within the natural range expected with the exception of Little Basin Creek. The high levels of observed sediment within the reach located on BLM administered land likely originates from the parent material in the basin which contains high levels of fines and clay as well as the low gradient E type channel. Stream banks on this stream are heavily vegetated with sedge and rush making bank disturbance unlikely as a significant sediment source.

Additional riparian condition information can be found above under the Riparian and Wetland Areas section.

East Creek

The East Creek WCT population was discovered during the 2005 watershed assessment. Prior surveys in lower portions of the drainage had only indicated brook trout and mottled sculpin were present. East Creek was genetically tested in 2005 and found to be 98% WCT. In addition to the WCT, a large population of non-native brook trout was found to be present within the drainage. In 2010 a non-native removal was initiated with backpack electrofishing gear to suppress the brook trout population. To date, over 2,500 brook trout have been removed from the BLM reaches in the headwaters of the drainage. The WCT population has responded favorably.

In 2010 when suppression efforts began, the brook trout to WCT ratio was > 55:1, but it had improved to 12:1 by 2013. With no fish barrier within the drainage and limited suppression efforts only taking place on BLM lands, this ratio is probably about as low as can be expected.

Habitat conditions are in good condition overall. Most of the upper drainage consists of a long series of degrading beaver complexes which will continue to release sediment during high flows for some time. However, the old dams, lodges and downed aspen provide a large amount of cover for resident fish as well as providing debris jam tail-out spawning habitat.

In Section 6, T11S, R7W, there is a primitive road crossing located on a closed road. This unauthorized crossing incurs substantial use during big game season contributing additional sediment to East Creek.

A 2014 fishery habitat survey conducted upstream of most beaver activity found low sediment levels. Stream banks were heavily vegetated with sedges, willows and herbaceous plants. Ocular surveys in lower reaches noted higher levels of sediment which was expected with the number of degrading beaver dams. The stream channel was found to be laterally shifting in several areas. This was related to the degrading beaver complexes in the reach. The drained complexes were rapidly re-vegetating with sedges and other early colonizing riparian plants. Limited aspen re-generation was noted, however heavy sprouting of new willow was noted throughout the areas previously flooded by beaver activity. As these willows begin to mature they should begin to stabilize the stream channels.

Basin Creek

Basin Creek supports a very small population of hybridized cutthroat trout and a population of non-native brook trout. Occupied habitat is found primarily on state or private lands. There is no occupied habitat on BLM. Since Basin Creek occurs within a BLM-administered allotment, temperature and habitat data was collected as part of general allotment monitoring.

A 2015 habitat survey found conditions in the surveyed reach to be very good. Banks were found to be stable and well vegetated with sedges. Riffle habitat was dominated by small 2-5" cobble. Sediment levels were low (~20%). Spawning habitat was not present within the surveyed reach but was present in reaches upstream.

Little Basin Creek

Little Basin supports a small population of hybridized WCT and a large population of mottled sculpin. Non-native brook trout are also found at very low densities. Within the drainage there is approximately two miles of occupied habitat. Low summer flows and a high sediment load likely limit population size. A fish habitat survey was conducted in 2014. Stream habitat was primarily an E channel dominated by long meandering runs. Stream banks were found to be stable and heavily vegetated with rush and sedges.

With the exception of high sediment levels, habitat conditions were found to be good overall. The high level of sediment found in the drainage is primarily related to naturally occurring high levels of clay and fines in the parent material within the basin. There is one primitive road

crossing over an upstream reach located on state land that contributes some sediment. Spawning habitat was not present within the BLM reach but was noted in upstream reaches.

During a 2010 fish distribution survey, the intact shell of a Western Pearl Shell Mussel (*Margaritifera falcate*) was collected. Based on the level of calcification on the shell, it was judged that this shell was old and likely from many decades past. Several additional surveys specifically looking for a Pearl Shell population failed to turn up any live mussels or shells.

Divide Creek

This drainage supports a small population of hybrid trout, 88% WCT, 8% rainbow trout and 4% Yellowstone cutthroat trout as well as a population of brook trout and in the lower reaches of the stream, mottled sculpin are present. This drainage is not managed as WCT habitat but could potentially be considered for WCT restoration in the future. Within the drainage there are ~5 miles of good quality occupied fishery habitat. A 2015 fishery survey found ~ 3 trout per 100 feet in the extreme headwaters. Considering the quality of fishery habitat within this headwater portion, these numbers are better than expected and should be considered a minimum. Fish distribution surveys indicate that fish numbers increase in downstream stream reaches.

A thermograph was placed on BLM administered land at approximately stream mile 1.7 in 2015 to collect temperature data. However, 21 days after placement stream flows in this area took a precipitous drop and the data indicates that by early July the stream channel was likely dry indicated by daily temperature spikes into the mid 80's which corresponded with daily air temperatures. When the thermograph was retrieved in early Sept, there was no water present within the stream channel. As such, this portion of stream is likely intermittent and only flows in the spring and possibly later in the fall and is not fish habitat.

Sage Creek

A 2010 fishery survey was conducted to collect genetics from the headwater reach of Sage Creek. During the survey it was noted that fish distribution stopped well prior to the BLM-administered stream reach likely due to the high stream gradient and low flows. All genetic samples were collected downstream of BLM administered land on Montana DNRC land. Fish are present in reaches downstream, however to date, biological data has not been collected on BLM downstream.

Cattle Creek

In 2015, a fish habitat survey and a WCT genetic collection were conducted on Cattle Creek. Due to the lack of a fish barrier and close proximity between Long Creek and Cattle Creek, the genetics are very likely to be the same as Long Creek (~99%). Habitat conditions were found to be fair to good. This portion of the drainage is a higher gradient B channel that appears to have had historic heavy livestock use as well as experienced several high flow events in the past. Sediment levels were a little higher than expected based on channel type and gradient. Primary substrate was small to medium sized cobble (1"- 4"). Spawning gravel was noted throughout the reach. Stream banks were overall well vegetated with willow, aspen and sedges.

Long Creek
The BLM reach (#2100) located in upper Long Creek is at the upstream edge of seasonal WCT distribution. It provides limited spring/summer habitat. Periodic, low, late season flows through most of this reach probably limit WCT use. Over winter use is unlikely. Depending on the water year, this reach may or may not provide habitat for WCT. The lower reach (#1155) supports a fishery, primarily brook trout and mottled sculpin. WCT may be occasionally found in this portion of the drainage in low numbers.

This reach (#1155) periodically supports active beaver, which typically are removed by the county for road issues. The habitat in this reach is subjected to regular cycles of high and low water levels related to beaver presence. Stream bank vegetation is comprised of herbaceous, sedges and willows. Banks are overall well vegetated. With several beaver dams present and the variability in water levels, this reach carries higher sediment load than areas further upstream. This is offset by high quality pool habitat and security habitat the beaver dams provide. Spawning habitat is limited within this reach, but is present in areas upstream.

Throughout the west, the threat of increasing water temperatures on fisheries habitat due to climate change is a growing concern. Studies have linked water temperature with lower cutthroat performance in water temperatures >59F (DeStatso and Rahel 1994; Dunham et al. 1999; Novinger 2000). Water temperature monitoring within the assessment area was initiated in 2014 on Sage Creek Watershed streams to track potential changes in summer stream temperatures. Data collected to date shows that both average and summer peak temperatures have remained relatively consistent since temperature monitoring began (see Table 11 below). However, several streams experience a number of days where water temperatures exceeded 60 degrees. In most cases this can likely be attributed to variations in summer temperatures. With only a few years of temperature data, it's difficult to say whether this is normal climatic fluctuation or the beginnings of a long term trend. In most cases where temperatures exceeded 60 degrees F, it was for short periods of a few hours during the day with temperatures in most streams dropping back into the 40 or 50 degree range overnight. However in the case of Little Basin Creek, it would appear that the elevated stream temperatures within the drainage may be the norm rather than the exception. However, again with only two years of data it's difficult to determine.

Table 11. Sage Creek Stream Temperature Data

Stream/Year	Avg. temperature 6/1-9/1	Peak temperature 6/1-9/1
East creek 2014	53	66
East creek 2015	53	64
Running avg	*53*	***65***
Basin Creek 2014	52	64
Basin Creek 2015	54	64
Running avg	***53***	***64***
Little Basin Creek 2014	57	73
Little Basin Creek 2015	58	71
Running avg	***57.5***	***72***

SCW stream temperatures overall are within the expected range. All of these streams have more or less a south aspect and generally are not heavily vegetated with tall shade type stream bank vegetation (*Carex* habitat type). Without the shading affect, these streams receive long periods of direct sun which results in slightly elevated temperatures. Overall, stream temperatures are within the desired range for native cold water species.

Special Status Species

Special Status Species refers to both plants and animals and includes proposed species, listed species and candidate species under the Endangered Species Act. State-listed species and BLM State Director-designated sensitive species (USDI, 2014a) are also included in the Special Status category. Providing habitat for special status plant and animal species is integral to meeting the biodiversity standard. Table 12 lists the special status species that potentially occur within the SCW during all or part of the year.

Table 12. Special Status Species Potentially Occurring within the Sage Creek Watershed

Wildlife Species	Current Management Status	Occurrence*	Preferred habitat
Grizzly bear (*Ursus arctos*)	Threatened	T	All
Bald eagle (*Haliaeetus leucocephalus*)	Sensitive	R	Forest/Riparian/wetland
Black-backed woodpecker (*Picoides arcticus*)	Sensitive	T	Forest
Boreal/western toad (*Bufo boreas*)	Sensitive	R	Riparian/wetland/forest
Brewer's sparrow (*Spizella breweri*)	Sensitive	R	Sagebrush shrubland
Burrowing owl (*Athene cunicularia*)	Sensitive	T	Grassland
Ferruginous hawk (*Buteo regalis*)	Sensitive	R	Sagebrush shrubland
Flammulated owl (*Otus flammeolus*)	Sensitive	T	Forest

Wildlife Species	Current Management Status	Occurrence*	Preferred habitat
Fringed myotis (*Myotis thysanodes*)	Sensitive	T	All
Gray wolf (*Canis lupus*)	Sensitive	R	All
Great Basin pocket mouse (*Perognathus parvus*)	Sensitive	R	Sagebrush shrubland
Golden eagle (*Aquila chrysaetos*)	Sensitive	R	Riparian/wetland Sagebrush shrubland
Great gray owl (*Strix nebulosa*)	Sensitive	R	Forest
Greater sage grouse (*Centrocercus urophasianus*)	Sensitive	R	Sagebrush shrubland
Lewis' woodpecker (*Melanerpes lewis*)	Sensitive	T	Forest/woodland
Loggerhead shrike (*Lanius ludovicianus*)	Sensitive	R	Sagebrush shrubland
Long-billed curlew (*Numenius americanus*)	Sensitive	T	Grassland
McCown's longspur (*Calcarius mccownii*)	Sensitive	T	Grasslands
North American wolverine *(Gulo gulo luscus*)	Sensitive	T	Alpine Forest
Peregrine falcon (*Falco peregrinus*)	Sensitive	R	Grassland/shrubland/riparian
Pygmy rabbit (*Brachylagus idahoensis*)	Sensitive	R	Sagebrush shrubland
Sagebrush sparrow (*Artemisiospiza nevadensis*)	Sensitive	R	Sagebrush shrubland
Sage thrasher (*Oreoscoptes montanus*)	Sensitive	R	Sagebrush shrubland
Spotted Bat (*Euderma maculatum*)	Sensitive	T	All
Townsend's big-eared bat (*Corynorhinus townsendii*)	Sensitive	R	Forest/riparian
Veery (*Catharus fuscescens)*	Sensitive	R	Riparian/wetland/woodland
Fish Species	**Current Management Status**	**Known from BLM lands?**	**Preferred habitat**
Westslope cutthroat trout (*Oncorhynchus clarki lewisi*)	Sensitive	Yes	Aquatic
Plant Species	**Current Management Status**	**Known from BLM lands?**	**Preferred habitat**
Chicken sage (*Sphaeromeria argentea)*	Sensitive	Yes	Sagebrush steppe and grasslands
Idaho sedge (*Carex idahoa*)	Sensitive	Yes	Moist alkaline meadows
Tree Species	**Current Management Status**	**Known from BLM lands?**	**Preferred habitat**
Whitebark Pine (*Pinus albicaulis*)	Candidate	Yes	High elevation sub-alpine zone.

*Resident (R) = yearlong or main part of lifecycle including reproduction, Transient (T) = seasonal use or migratory, not expected to be found regularly.

Special Status Wildlife

In September, 2015 after reviewing petitions to list the greater sage grouse as Threatened on the Endangered Species List, the U.S. Fish and Wildlife Service (USFWS) announced that listing of the greater sage grouse was not warranted (USFWS, 2015). The BLM completed Resource Management Plan (RMP) amendments and revisions to demonstrate to the USFWS that protections for sage grouse have been improved. The Record of Decision and Approved Resource Management Plan Amendments for the Great Basin Region, Including the Greater Sage-Grouse Sub-Regions of Idaho and Southwestern Montana (September, 2015) and Sage-Grouse Habitat Assessment Framework (Stiver et al., 2015) are used as guidance for sage grouse habitat management. Sage grouse are also discussed above under "Sagebrush Habitats and Sagebrush Dependent Species".

According to the Interagency Grizzly Bear Study Team (IGBST), the current Greater Yellowstone Ecosystem (GYE) grizzly bear population is roughly 757 individuals (Haroldson et al, 2014). SCW is within the Distinct Population Segment (DPS) boundary which distinguishes the population of grizzly bears in the GYE as distinct from the remaining populations in the lower 48 states. The DPS boundary includes all landscapes where genetically distinct Yellowstone grizzly bear occur and may occur given future range expansion, delineated along easily identifiable boundary features (i.e. Interstate 15 to the west). The Dillon Field Office is outside the Grizzly Bear Recovery Zone, which depicts an area surrounding Yellowstone National Park where inter-agency grizzly bear recovery efforts are concentrated for the long-term conservation of the distinct Yellowstone grizzly bear population (IGBST, 2014). Grizzly bear observations have occurred over the past two years within and surrounding the SCW.

In 2014 the United States Fish and Wildlife Service withdrew a proposal to list the North American wolverine in the contiguous United States as a threatened species under the ESA (USDI, 2014b). Wolverines occur in coniferous montane forest types, preferring rugged, roadless, isolated habitats. Home range size in western Montana averages 150 mi^2 for females and 163 mi^2 for males (Foresman, 2012). Transient wolverines are more likely to occur at higher elevation forested habitat on the north side of Blacktail Ridge but limited suitable habitat is present within the analysis area and is not a sufficient size for supporting a female wolverine's natal territory.

The Northern Rocky Mountain population of gray wolves, including Montana wolves, was delisted from the list of Endangered and Threatened Wildlife in 2011 as part of the Appropriations Act. To avoid relisting, Montana will comply with federal regulations to manage wolves in a manner that will guarantee that the state maintains at least a minimum of 150 wolves and 15 breeding pairs (MFWP, 2013). Since delisting, a hunting season for wolves has been implemented in Montana. The combined maximum hunting and trapping bag limit is five wolves per person during the 2015 season. In 2014, a minimum estimate of 122 wolves in 23 verified packs were documented in southwestern Montana in the Montana Portion of the Greater Yellowstone Experimental Area (GYA), 11 of which qualified as a breeding pair. This number of breeding pairs increased from five last year. This represents a 33% increase in the minimum count compared with 2013, which had 92 wolves. Five new packs were documented in 2014 (Bradley et al., 2015). Conflicts between wolves and livestock are an issue.

Fringed myotis occurs in a variety of habitats, from low- to mid-elevation grass, woodland, and desert regions (Foresman, 2012). Fringed myotis is found primarily in desert shrublands, sagebrush-grassland, and woodland habitats. They roost in caves, mines, rock crevices, buildings, and other protected sites (MNHP, 2015a). Townsend's big-eared bats are found in a variety of habitats from western mesic Douglas-fir forests to more arid Rocky Mountain juniper-limber pine-curlleaf mountain mahogany vegetative types (Foresman, 2012).

The Brewer's sparrow, sage sparrow, and sage thrasher utilize sagebrush habitats. McCown's longspur and long-billed curlew nest in dry, shortgrass prairies. Great gray owl habitat consists of mature forests with clearings such as bogs, meadows, and wetlands for foraging. Loggerhead shrikes are associated with open woodlands, and have also been documented nesting in sagebrush, bitterbrush, and greasewood. Black-backed woodpeckers inhabit early successional, burned forest of mixed conifer, lodgepole pine, Douglas-fir, and spruce-fir. Western toads breed in any clean standing water and may wander miles from their breeding sites through coniferous forests and subalpine meadows, lakes, ponds, and shoreline (Werner et al., 2004).

Overall, throughout the SCW sensitive wildlife species habitat is adequate. In allotments that didn't meet riparian/wetland or upland standards, an improvement in this habitat will enhance conditions for cover, forage, and nesting. Where noxious weeds are a concern, controlling these invasives will reduce the likelihood that they outcompete native herbaceous and forb species, retaining it for wildlife forage and cover. Since aspen provides food, cover, and nesting habitat for various special status species, the reduction in aspen documented in SCW is a concern for these species and other wildlife and birds.

Special Status Fish

The native WCT (*Oncorhynchus clarki lewisi*) historically was wide spread throughout streams in western Montana. Genetically pure WCT are primarily restricted to limited habitats within headwaters of tributary streams where they occur in the Missouri River basin. It is estimated that WCT are genetically unaltered in only 2.5% (McIntyre and Reiman 1995) to 10% (Shepard et al. 2002) of their historical range. Many of these small populations have a high risk of extinction due to isolation and threats from hybridization.

As of 2010, the headwater reaches of Sage Creek still supported a 100% pure WCT population. However, during a 2010 survey, no fish were found with the BLM headwater reach. This is the only currently known pure population of WCT left within the Sage Creek basin.
There are four streams, Basin, Little Basin, East and Long Creek, which support hybridized WCT populations and one stream, Cattle Creek which supports WCT with unknown genetic purity. Genetic samples were collected from Cattle Creek in 2015. Since there is no fish passage barrier between Long Creek and Cattle Creek, genetic purity is very likely to be the same between these two creeks.

WCT are a designated Sensitive species for the BLM and USFS, and have been listed as a Class A State Species of Special Concern by the Montana Department of Fish, Wildlife and Parks (MFWP) and the Montana Chapter of the American Fisheries Society since 1972. Class A designation indicates limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species or subspecies. WCT were petitioned for listing under the Endangered Species Act (ESA)

and found “not warranted” by the USFWS in 2002. A court ordered review of that decision in 2003 again found them “not warranted”. In Oct 2004, the USFWS received a 60 day notice of intent to sue based on hybridization levels and current status of WCT in its native range.

In May of 1999, the BLM entered into a Memorandum of Understanding (MOU) and Conservation Agreement (Agreement) with the MFWP, USFWS and the USFS. The purpose of the MOU and Agreement is to expedite conservation measures for WCT in Montana through a collaborative and cooperative effort among resource agencies, conservation and industry organizations, resource users, and private land owners. Threats to the WCT and its habitat continue to be reduced through implementation of this Agreement.

The management goal for WCT in Montana is to ensure the long-term self-sustaining persistence of the subspecies within each of the five major river drainages they historically inhabited in Montana (Clark Fork, Kootenai, Flathead, upper Missouri, and Saskatchewan), and to maintain the genetic diversity and life history strategies represented by the remaining local populations.

WCT streams within the Sage Creek Watershed are shown above in Table 10.

Fish habitat surveys were conducted on BLM administered lands during the 2012, 2013 and 2014 field seasons. Surveys were conducted on random 500 foot reaches in selected streams. In-stream habitat was identified to type (pool, riffle, run) with habitat length, width and residual pool depth measurements taken. Stream substrate data was collected using a 500 point “zig zag” pebble count method in riffle habitats within each reach.

Several studies have indicated that cutthroat trout reproduction can be impacted by low levels of fine sediment (Ringler and Hall 1975; Irving and Bjornn 1984; Weaver and Fraley 1991; Horan et al. 2000; Ireland 1993). Bjornn et. Al (1977) found that as the percentage of fine sediment exceeds 20% to 30% in spawning riffles, salmonid reproduction begins to decline. Bryce, et al. (2010) evaluated fine sediment impacts on fish and macro-invertebrates and found that sediment impacts begin at 13% for fish and 10% for macro-invertebrates. As indicated in Table 13 below, sediment levels in surveyed streams are higher than optimum. With the sediment levels observed, it is probable that salmonid spawning success and pool quality is being impacted to some extent.

Using baselines identified in the “Beaverhead Sediment Total Maximum Daily Loads and Framework Water Quality Protection Plan” (Montana DEQ. 2012), streams < 15 foot wetted width would be expected to have a minimum of ≥ 90 pools per stream mile while streams 15-30 feet bankfull width would be expected to have ≥ 52. Residual pool depth would be expected to be approximately 10 inches and % fines (<6mm) would be expected to be between 10% and 30% depending on stream gradient and channel type. Steeper gradient “B” channels would be expected to have slightly more or less than 10% fines < 6mm while lower gradient “E” type channels are expected to have up to 30% fines < 6mm. Stream size and gradient will affect pool number, residual depth and the percentage of fine sediment present. Generally, as stream size decreases pool frequency increases and pool depth decreases. Using the data in Table 13 below, the surveyed streams are likely within the natural range of variability expected based on stream

size with the exception of elevated sediment levels. These elevated sediment levels are likely inhibiting pool frequency and quality to some extent.

Table 13: Pool Frequency, Depth and Stream Bed Particle Size

Stream	Primary Channel Type	Average Stream Width (feet)	Pool Frequency (per mile)	Residual Pool Depth (inches)	% Fines (<6mm)	Riparian Habitat Condition 2015
East Creek	B	3.5	208	6.4	23	PFC
Little Basin Creek	E	3.4	87	9.4	90	PFC
Basin Creek	E	3	53	9	20	PFC
Pistol Creek	A	1.4	313	8.5	21	PFC
Cattle Creek	B	4	157	8.2	16	PFC
Long Creek	C	8	52	9.8	17	PFC
Divide Creek	B	4	87	10.8	9	PFC

Special Status Plants

Chicken sage (*Sphaeromeria argentea*) prefers sparsely vegetated habitats with low competition. The known populations of this plant species, in the SCW, face no anthropogenic threats. They appear to tolerate and may benefit from disturbances that reduce competition such as livestock grazing.

Chicken sage (*Sphaeromeria argentea)*

Idaho sedge (*Carex idahoa*) is found in a few different riparian habitat locations throughout the SCW. It is found in wet to moist alkaline meadows, is palatable, and sensitive to intensive grazing, especially during spring and early summer. Repeated herbivory, particularly between mid-May and mid-July may lead to population declines. Rest-rotation grazing regimes may allow enough recruitment to maintain stable populations of these palatable sensitive plants. Kentucky bluegrass and common dandelion are

present in most wet meadow habitat and along many stream reaches. Kentucky bluegrass may compete with Idaho sedge. Canada thistle and houndstongue are scattered throughout the SCW and were observed in many riparian and wetland habitats, especially along intermittent stream reaches. These noxious weeds may also compete with Idaho sedge which prefers these streamside and meadow habitats.

Noxious Weeds and Invasive Species

Noxious weeds are defined in the Montana Weed Management Plan as "plants of foreign origin that can directly or indirectly injure agriculture, navigation, fish or wildlife, or public health." Currently there are 38 weeds on the statewide noxious weed list that infest about 7.6 million acres in Montana. Of these 38, there are only two of major concerns in the SCW: spotted knapweed and houndstongue. Canada thistle (*Cirsium arvense*), another state declared noxious weed, is also found in the SCW. It is widespread throughout the Dillon Field Office and mostly found in riparian areas making treatment difficult.

Spotted knapweed (*Centaura maculosa*) is one of the more aggressive noxious weeds in the area administered by the Dillon Field Office. It is found scattered in small infestations throughout the watershed primarily along roads and in other disturbance areas. Because of where it is found, the potential is high for knapweed to be spread by vehicles, livestock, wildlife, recreation and other activities.

Houndstongue (*Cynoglossum officinale*), a noxious weed that is toxic to animals due to high levels of alkaloids contained in the plant, is found scattered throughout the SCW in moderate sized infestations along roads, trails, and streams. Because of its seeds ability to cling to hair and clothing, the potential is high for it to be spread rapidly within the watershed.

There have been two infestations of leafy spurge (*Euphorbia esula*) found in the Sage Creek Watershed. Both were reported in 2010, one in the Mayberry and the other in the Sage Creek allotment. The infestation in the Mayberry allotment was made up of scattered plants over a 50 foot square area when first discovered. It has been treated every year by the BLM and in 2015 only four plants were found. The Sage Creek allotment infestation, which is about a quarter of an acre in size, is mostly located on private ground with a few plants on BLM managed land. This infestation is treated yearly by the landowner and the BLM and in 2015 only a few scattered plants were found.

Other noxious or invasive weeds present in isolated locations are cheatgrass (*Bromus tectorum*) hoary cress (Whitetop) (*Cardaria draba*),and black henbane (*Hyoscyamus nigar*).

Since 1989, BLM has been involved in cooperative control efforts with Beaverhead County. Throughout this period, the goal has been to prevent new noxious weed infestations and control or eradicate existing infestations in Beaverhead County using Integrated Pest Management. Due to the small size of the weed infestation, no biological controls have been released.

The ID team noted substantially more weeds along roads accessible to the public and an increase in the amount of off road travel. This off road travel is contributing to the spread of noxious weeds throughout the watershed, especially during hunting season.

Table 14: Recent Weed Inventories and Treatments

Year	Acres Treated	Acres Inventoried
2011	20	1000
2012	30	1200
2013	40	2000
2014	35	1000
2015	35	1200

Invasive Aquatic Species
There are no known populations of aquatic invasive species found within the Sage Creek Watershed.

Forest and Woodland Habitats and Associated Species
Forest and woodland habitats comprise approximately 3% of all ownerships, and approximately 2% of BLM-administered lands within the SCW. Effective precipitation, aspect, and soils influence the establishment and composition of forests and woodlands. The widely scattered patches of mixed conifer forest and aspen woodlands adjacent sagebrush and riparian habitats support a broad array of wildlife species. This habitat provides important thermal and hiding cover, including security habitat for big game. Forest and woodland habitat offers high protein browse species in the fall and winter, as well as year-round, for deer, elk, and moose. Forests in the SCW provide habitat for a large variety of species including mountain lions, dusky grouse, ruffed grouse, northern goshawk, black bear, and bobcat. This habitat provides important linkage corridors for large carnivores. Forest-dwelling bird species require suitable nesting and foraging habitat. Several bird species help protect forests by eating millions of damaging insects, such as the western spruce budworm.

Conifer Forests
Mid-elevation conifer forest stands are dominated by Douglas-fir and are primarily found on moist, north-facing aspects. Limber pine is more tolerant of warm, dry conditions and is found extending on to south-facing slopes, often mixed with Douglas-fir. Above about 7,500 feet in elevation, forest stands are comprised of a mix of conifer species, including lodgepole pine, spruce, and subalpine fir.

Mixed conifer forest, Gallagher Mountain AMP, July 2015

Many Douglas-fir stands have been influenced by past non-commercial timber harvest due to the relative scarcity of wood in the area, and the demand for building materials and firewood. Past wildfires in the adjacent sagebrush and grasslands have burned into some timber patches, evidenced today by charred

wood and fire scars on some relic Douglas-fir trees. Density and structure of these stands has shifted, in part due to more recent fire exclusion, resulting in slightly higher than historic stocking levels and some conifer expansion into sagebrush and grasslands. Douglas-fir expansion is evidenced by sagebrush remnants found beneath closed tree canopies and by comparing historic photos to current conditions. The relatively old age of the small diameter expanding trees suggests the conversion of shrubland to forested cover is occurring slowly and generally only on the most productive sites. Conifer expansion within the SCW is minimal compared to other areas within the Field Office due to climate, elevation, and soils. Currently, very few forested areas in the analysis area display the structure associated with periodic fire, though fire scars found on Douglas-fir indicate that some stands may have been maintained as savannah-like in structure by natural and /or anthropogenic fire.

Douglas-fir bark beetle has been active in Douglas-fir stands throughout southwest Montana at varying levels over the past 10-15 years, killing many relic, large-diameter Douglas-fir trees as well as co-dominant trees stressed by drought and repeated spruce budworm defoliation. Douglas-fir bark beetle is usually present at endemic levels within stands dominated by Douglas-fir, though recent beetle-caused mortality was not noted during the 2015 assessment. Spruce budworm, a defoliator that affects Douglas-fir and spruce trees, is also present within forest stands but is currently not causing heavy defoliation.

Dusky grouse forage on Douglas-fir needles and buds in the winter and, along with other birds, rely on Douglas-fir communities for cover. Several bird species extract seeds from Douglas-fir cones or forage for seeds on the ground (Steinberg, 2002). Douglas-fir habitat types provide excellent hiding and thermal cover for deer and elk. It also provides nesting and/or roosting habitat for numerous bird species including great-horned owls, sharp-shinned hawks, great gray owls, and northern goshawks.

Limber pine occurs on the harshest sites capable of supporting conifers. Much of the limber pine population has been killed by mountain pine beetle and/or white pine blister in the past 10-20 years. In 2005, the IDT noted limber pine stands dominated by red-needled trees; in 2015 the IDT found those stands are now in the grey-phase (standing dead) with a select few healthy limber pine trees that appear to have resisted the recent insect and disease outbreaks. Typically limber pine plant associations would consist of widely spaced limber pine dominating the canopy, with Douglas-fir and juniper co-dominant or in the understory. The coexistence of limber pine and Douglas-fir is common though soils, exposure, and other undetermined factors seem to limit which species dominates the other. The establishment of Douglas-fir beneath mature limber pine stands was noted in several areas, and a species conversion will likely occur as mature limber pine die and resources become available to young Douglas-fir trees. Whitebark pine may occur within the SCW, but it is not common and was not positively identified during the 2005 or 2015 watershed assessments.

The cones and seeds of five needle pines are a primary food source for several wildlife species due to their high caloric and fat content. They are important resources for wildlife food, snowpack retention, and watershed protection. Limber pine and whitebark pine seeds provide critical food for rodents and birds, including squirrels and Clark's nutcrackers, which also cache the seeds for later use. Other birds, small mammals, and bears benefit from these caches.

Live and dead limber pine above Little Basin Creek

Within higher elevation mixed conifer stands, up to 80% of the mature lodgepole pine has been killed by recent mountain pine beetle activity. Beetle-caused lodgepole pine mortality appears to have increased greatly in the late 2000s, and the insect is still active where mature lodgepole pine trees are present. As suitable host trees decline, the beetle population also returns to endemic levels. Engelmann spruce is found on moist sites, particularly on cool, shady aspects and in stream bottoms. Subalpine fir becomes more common within mixed conifer stands at higher elevations. Historically, fire played a role in shaping these forest stands, though with less frequency and higher severity than within the lower elevation, drier Douglas-fir/limber pine stands. Consequently, many of the dense, multi-storied forest stands with heavy downed fuel accumulations are within the historic range of variation, but also subject to stand replacing wildfire.

Curl-leaf Mountain Mahogany Woodlands

Mountain mahogany plant associations are found throughout the analysis area in small scattered patches. Curl-leaf mountain mahogany is exhibiting declined vigor due to repeated, heavy wildlife browsing. Generally, conifer expansion into these sites, and the subsequent shading of mahogany plants, was not determined to be a factor in reduced vigor. During the 2005 and 2015 land health assessments, the IDT found very few curl-leaf mountain mahogany seedlings within the SCW.

Heavily browsed mountain mahogany

Quaking Aspen Woodlands

Aspen stands within the SCW are found as isolated stands primarily near springs or seeps, and within the riparian corridors of some streams. Though aspen woodlands comprise a very small portion of watershed, aspen habitat contributes greatly to biological diversity. The high value of aspen to wildlife and the positive influences aspen stands have on hydrologic functions are just several reasons aspen is considered the most important deciduous forest type in western North America (Long and Mock 2012).

Declining aspen along Heifer Creek reach 1118, June 2015

The IDT found all aspen stands in the SCW to be declining in vigor and extent, and most were not successfully regenerating past browse height. Dead or dying mature aspen trees with an absence of nearby regeneration suggests some stands are at risk of being eliminated in several areas of the watershed. Current beaver activity on BLM was noted on East Creek and Long Creek drainages, but evidence of past beaver activity is common in many stream systems. Currently, most stream systems do not have enough woody deciduous vegetation to support a viable beaver population. Where aspen regeneration is occurring, repeated ungulate browsing, primarily by elk, is preventing a young age-class of trees from replacing the mature age-class of trees as they die of old age, insects/disease, and/or lack of available water. Most aspen clones are responding to stressors by producing suckers, but very few are taller than knee-height and all show evidence of repeated browsing. How long the interconnected, clonal root system of an aspen stand will remain viable while under constant stress of browse, shading, and/or reduced groundwater availability is the subject of current research.

Aspen at wetland 1182, Armstead Mountain allotment June 29, 2015

Many animals browse aspen year-round, but it is especially valuable during fall and winter when protein levels are high relative to other browse species (Howard, 1996). Aspen is an important browse species for ungulates including deer, elk, and moose. It also provides hiding cover, summer shade and some thermal cover for ungulates in the winter, as well as hiding and thermal cover for many small mammals. Aspen also provides nesting and foraging habitat for a variety of bird species including dusky grouse, dark-eyed junco, house

wren, chipping sparrow, and pine siskin. Aspen buds, flowers, and seeds are palatable to many bird species. Ruffed grouse depend on aspen for foraging, courting, breeding, and nesting throughout most of its range. Aspen buds, catkins, and leaves provide year-round food for ruffed grouse. The decline of aspen in the watershed is a concern.

Fire Ecology and Fire Regimes of the Sage Creek Watershed

As a prominent disturbance process in southwestern Montana, fire is directly tied to land health by affecting seral stage diversity, age classes, and landscape vegetation structures. Understanding the historic role of fire helps inform decisions on ecological status, trend and treatment needs. Recently, fire regimes for most terrestrial communities have been mapped and textually described for vegetation types across the entire U.S. (LANDFIRE, 2013). These descriptions give context for assessing land health, reference conditions, and functioning ecosystems.

Biophysical Settings (BpS) are most simply defined as the native vegetation communities present in the pre-Euro-American era, and therefore developed under the influence of natural disturbances such as fire. BpS's describe vegetation communities at a larger scale than Ecological Sites, and as such can be applied to characterize broad areas such as watersheds. Each BpS description describes the historic composition and dominance of seral stages for that type, as well as the historic fire frequency and severity. Together, this information describes a reference condition, or a standard against which current conditions may be compared. Comparing Biophysical Settings to current conditions is useful for identifying trends in forest and non-forest vegetation communities. Based upon field reconnaissance and LANDFIRE National data, the dominant BpS's found in the entire Sage Creek watershed include mostly big sagebrush species. Many other individual BpS's are present within this watershed that are isolated or comprise a small percentage of the total area; these BpS's are grouped in the "other" category in the table below.

Successional processes, seral stage descriptions, and historic fire regimes for these types are described in the LANDFIRE BpS description documents for Map Zone 19 & 21 (LANDFIRE 2013). These descriptions of historic conditions were compared with current conditions to depict landscape trends in vegetation and fire regime departure. The approximate distribution of the dominant BpS(s) in the watershed, are presented in Table 15.

Table 15: Distribution of Dominant BpS (All Ownerships)

Biophysical Setting	Acres in SCW	% of SCW
Inter-Mountain Basins Montane Sagebrush Steppe	148313	68%
Rocky Mountain Subalpine/Upper Montane Riparian Systems	16198	7.5%
Inter-Mountain Basins Big Sagebrush Steppe	14277	6.5%
Rocky Mountain Alpine Fell-Field	3984	2%
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	2800	1%
Middle Rocky Mountain Montane Douglas-fir	2435	1%

Biophysical Setting	Acres in SCW	% of SCW
Columbia Plateau Low Sagebrush Steppe	1566	>1%
Rocky Mountain Poor-Site Lodgepole Pine	1523	>1%
Other	26458	10%

Fire Regimes in the Sage Creek Watershed

The fire regime concept is used to describe the fire frequency, behavior, ecological effects, seasonality, pattern, and type for a given ecosystem or vegetation type. Based upon the most current fire regime classification system, each BpS corresponds to a unique fire regime (Schmidt et al. 2002). Table 16 outlines fire regime and descriptions.

Table 16: Natural Fire Regimes and Descriptions

Regime	Frequency	Severity	Severity Description
I	0-35 years	Low/Mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory.
II	0-35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation.
III	35-200 years	Mixed/Low	Generally mixed-severity; can also include low-severity fires.
IV	35-200 years	Replacement	High-severity fires.
V	200+ years	Replacement/ Any severity	Generally replacement-severity; can include any severity type in this frequency range.

Mountain Big Sagebrush (BpS 1911250 & Bps 1911260)

Fire Regime:

Mountain big sagebrush dominated communities are found above about 7000 feet in elevation, and on sites that annually receive 12-20 inches of effective precipitation. This vegetative community is characterized by fire regime Group I. Fire is a major disturbance factor for mountain big sagebrush and likely played a large role in maintaining this habitat as a sagebrush/grassland. Periodic fire restricted conifer establishment on sites capable of supporting trees, and held in check the conversion of sagebrush habitat to forest habitat. Mountain big sagebrush has the fastest recovery rate of the three subspecies of big sagebrush. Fire size for this type is larger than other big sagebrush species because of greater fine fuel load, but some unburned pockets remain after fires, often resulting in a patchy mosaic. The fire return intervals vary from 10-200 years. However, estimating historic fire regimes for sagebrush ecosystems is tenuous at best and often based on fire scar and age structure data from adjacent forest types, shrub age structure and fuel characteristics. Fire regimes also vary considerably across the range of mountain big sagebrush, based on factors like elevation, soil depth, slope, aspect, adjacent vegetation, frequency of lightning and climate. While the majority of fires were likely stand-replacing, some mixed severity fire may have occurred. Mixed severity fires were likely small in area, but ignitions may have occurred as frequently as 5-20 years. There were probably also portions of this system that never carried fire because of sparse fuel. Historic fires likely occurred during the summer months and were wind driven events. Lightning ignitions are variable and affect fire frequency on regional landscapes in the Northern Rockies. Fire may

spread from adjacent forested communities. Mountain big sagebrush does not re-sprout following fire and re-colonization of burned areas must come from either a short-lived seed bank or seed dispersed by plants in unburned patches or adjacent stands.

Current Conditions:
The mountain big sagebrush stratum is moderately departed from reference conditions due to fire exclusion and the effects of some conifer expansion. Three-tip sagebrush is found in localized areas throughout the watershed. Three-tip sagebrush re-sprouts after fire. The proportions of mid- to late-development mountain big sagebrush are near reference conditions, however the early development sagebrush component is lacking throughout the watershed. Douglas-fir trees are establishing in a few limited areas where conditions are suitable for conifers and are converting former sagebrush habitat into closed canopy forest habitat.

Rocky Mountain Subalpine/Upper Montane Riparian Systems (BpS 1911600)
Fire Regime: The highest elevation forest types in this watershed are dominated by five-needle pines, subalpine fir, Engelmann spruce and lodgepole pine. This forest type is characterized by Fire Regime Groups III and IV, primarily long-interval (100-200+ year) mixed severity (25-75% top kill) and stand replacement fires. Ignitions are frequent due to lightning, though fires seldom carry due to lack of fuel from the slow-growing vegetation. Nonlethal surface fires may be possible where short grasses provide a continuous ground fuel; individual tree torching is more common. Climate variability and slow fuel loading could extend the stand-replacing fire interval to many hundreds of years.

Current Conditions: The subalpine forest stratum is within the range of variation for its natural fire regime. Fire has not recently affected large portions of this forest type in this area, which has led to predominantly mid to late-development stands. However, most of the limber pine is being affected by both white pine blister rust and mountain pine beetle. White pine blister rust is not a native disease agent; therefore the current limber pine die-off is creating an uncharacteristic condition. Mortality caused by these agents will increase fuel loading and will lead to more open stands dominated by tree species not susceptible to blister rust or pine beetle. Even with increased fuel loading, many fires that start in these high elevation stands will continue to be inhibited from spreading by rock, scree and green and/or sparse vegetation. Fires that start in lower elevation, drier forest types may affect the fringes of the subalpine forest.

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is a general index providing two pieces of information: the historic fire regime group, and the condition class. Fire Regime Groups are described in the previous section and summarized in Table 17 below. Condition class reflects the degree of ecological departure when current conditions are compared against modeled reference conditions in terms of two main ecosystem components: fire regime and associated vegetation. This departure is from changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and disease mortality, grazing, and drought).

Three fire regime condition classes have been defined (Schmidt et al. 2002) based on the following criteria: FRCC 1 represents ecosystems with low (<33 percent) departure and that are still within an estimated historical range of variation as determined by modeling for the pre-Euro-American era; FRCC 2 indicates ecosystems with moderate (33 to 66 percent) departure; and FRCC 3 indicates ecosystems with high (>66 percent) departure (Hann and Bunnell 2001; Hardy et al. 2001, and Schmidt et al. 2002). A low departure indicates current conditions are characteristic of those occurring in the natural fire regime and associated vegetation. A high departure indicates uncharacteristic conditions that did not occur within the natural fire regime. The following table represents the two most dominant Bps by existing FRCC as well as the FRCC rating for the watershed as a whole. Condition classes were assessed using Landfire (2013) data.

Table 17: FRCC Summary (all ownerships) in the SCW

Biophysical Setting	Fire Regime I-V	Condition Class 1 (acres)	Condition Class 2 (acres)	Condition Class 3 (acres)	Total Acres
Mountain Sagebrush (11250 &11260)	IV	5054	123,375	51,260	179,689
Rocky Mountain Subapline/Upper Montane Riparian System (11600)	III & IV	521	10,873	2,593	13,987
Total Acres		6680	150,111	56,024	212,815
Percent of Watershed in each condition class		3%	71%	26%	

Recommendations for Biodiversity

1. Modify old net-wire fence, dilapidated fences, and fences with improper wire spacing to meet wildlife-friendly specifications and ensure that new fences are built to BLM specifications. Remove any unnecessary fences and work with private landowners to improve BLM-private boundary fences.
2. Continue to maintain wildlife escape ramps in all stock tanks in the watershed.
3. Identify fences that pose a collision hazard with sage grouse or other wildlife and install fence markers to improve visibility and reduce the risk of collision.
4. Explore opportunities to enhance/improve/protect "Priority Habitats" such as aspen, mahogany, and five needle pine (prescribed fire, mechanical, herbicide, planting and /or seeding).
5. Work with MT Fish, Wildlife and Parks to expand and/or re-establish genetically pure WCT populations within the SCW.
6. Consider options to decommission the primitive road crossing East Creek in Section 6, T11S, R7W to reduce impacts to WCT habitat related to road use.
7. Continue to address localized weed infestations cooperatively with Beaverhead County, other landowners, and partners as appropriate. Continue the existing education effort on weed identification with permittees and other public land users.

8. Limit any ground disturbance activities that may increase the risk of noxious weed invasion. Where disturbance does occur, use BMPs to mitigate the chance of noxious weed establishment.

Additional Programs, Issues and/or Concerns

Recreation and Travel Management

An overview of recreational use within the SCW is provided on page 15. As a result of the 2006 Dillon Field Office RMP, public motorized wheeled vehicle use is limited to those routes designated as open. All other routes are considered closed, with few exceptions to accommodate administration of permits, to access private lands, or other limited circumstances. Travel management will continue be implemented as prescribed in the Dillon RMP. Roads identified as open to public use will be signed with a white arrow symbol on a flexible sign post. Roads not identified as open to public use would be:

- Left unsigned unless there is evidence of regular use.
- Signed closed if there is evidence of regular use.
- If signing is ineffective at discouraging use, roads would be obliterated to the extent possible (made unnoticeable), at least at the intersection with an open route, or physically closed when continued use is causing significant unacceptable resource impacts or user conflicts.

Corrections of mapping errors in the original route designations in the RMP, and other minor adjustments to route designations will be made through this watershed assessment process and specified in the environmental assessment and decision record. Travel management issues are a concern in SCW. In cooperation with DNRC and MFWP, the DFO has made SCW a priority area for enforcing travel management, particularly during the hunting season, including increased patrolling of the area and signing roads as closed, as well as barricading, blocking, or obliterating closed roads where possible. Improving adherence to travel management restrictions will facilitate ethical hunting and wildlife security, which would increase big game distribution across public lands and enhance hunter opportunity. The spread of noxious weeds would also be reduced.

Recreation and Travel Management Recommendations

1. Analyze, and make necessary adjustments to route designations where concerns were documented.
2. Consider installing culverts or other appropriate structures where frequently traveled roads intersect perennial streams within the SCW.
3. Consider options to increase compliance with travel management and reduce off-road or closed road motorized vehicle use. Consider and/or analyze the following actions: press releases prior to big game hunting, more accurate and accessible maps, more visible and effective patrols, increased law enforcement, more durable signs, blocking or obliterating roads where signing is not working, citizens watch groups, interpretive signs/education at access points.
4. Discuss and analyze where to physically close or obliterate roads due to noncompliance with signing.
5. Consider adding travel management limitations for snowmobiles, tracked OHVs, or over-snow machines to designated routes only, between May 15 – December 2.

Interdisciplinary Team Composition

Core IDT members for the SCW Assessment:

Katie Benzel, Wildlife Biologist and ID Team Leader
Pat Fosse, Assistant Field Manager-Renewable Resources
Ryan Martin, Rangeland Management Specialist
Paul Hutchinson, Fisheries Biologist
Stephen Armiger, Hydrologist (Soil, Water & Air)

Support IDT members:

Michael Mooney, Weeds Specialist
Kipper Blotkamp, Forester
Joe Sampson, Fuels Specialist
Jason Strahl, Archaeologist
Laurie Blinn, GIS Specialist
Rick Waldrup, Outdoor Recreation Planner
Kelly Savage, Rangeland Management Specialist (Special Status Plants)
Keith Johnson, Assistant Field Manager-Non-renewable Resources

Other resource members involved:

Dave Williams, Geologist, Butte Field Office
Joan Gabelman, Geologist, Butte Field Office
Brandy Janzen, Soil Scientist, Butte Field Office
LeeAnn Pallett, Soil Science Technician, Butte Field Office
Jennifer McAdoo, Hydrologic Technician, Butte Field Office
Berett Erb, Range Technician
Leea Anderson, Range Technician
Haleigh Stott, Range Technician
Cari Forsgren, Range Technician
Melanie Finch, Wildlife Technician
Tempe Regan, Wildlife Technician
Jed Berry, Fisheries Technician
Chris Carparelli, Beaverhead Conservation District

GLOSSARY OF TERMS

Animal Unit- A 1000-pound cow, with or without an un-weaned calf, with such a cow consuming 26 pounds of forage dry matter per day.

Animal Unit Month- The amount of forage needed by an "**animal unit**" (AU) grazing for one month**.**

Anticline: In structural geology, an anticline is a fold that is convex up and has its oldest beds at its core.

Anthropogenic: Caused or influenced by humans.

Bankfull stage: "The bankfull stage corresponds to the discharge at which channel maintenance is most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing the work that results in the average morphologic characteristics of channels." Dunne and Leopold (1978).

Census County Division: Census county divisions (CCDs) are geographic statistical subdivisions of counties established cooperatively by the Census Bureau and officials of state and local governments in states where minor civil divisions (MCDs) either do not exist or are unsatisfactory for census purposes.

Channel stability: the ability of the stream, over time, to transport the flows and sediment of its watershed in such a manner that the dimension, pattern and profile of the river is maintained without either aggrading nor degrading.

Critical Shear Stress: For a fluid to begin transporting sediment that is currently at rest on a surface, the boundary (or bed) shear stress τ_b exerted by the fluid must exceed the critical shear stress τ_c for the initiation of motion of grains at the bed. This is typically represented by a comparison between a dimensionless shear stress (τ_b*) and a dimensionless critical shear stress (τ_c*). The nondimensionalization is in order to compare the driving forces of particle motion (shear stress) to the resisting forces that would make it stationary (particle density and size). This dimensionless shear stress, $\tau*$, is called the Shields parameter. Critical shear stress: the Shields diagram empirically shows how the dimensionless critical shear stress required for the initiation of motion is a function of a particular form of the particle Reynolds number, Re_p or Reynolds number related to the particle.

Desired Condition: A desired condition is a description of specific social, economic, and/or ecological characteristics of the plan area, or a portion of the plan area, toward which management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined, but do not include completion dates (36 CFR 219.7(e)(1)(i)).

Diatreme: A diatreme, sometimes known as a maar-diatreme volcano, is a volcanic pipe formed by a gaseous explosion. When magma rises up through a crack in the Earth's crust and makes

contact with a shallow body of ground water, rapid expansion of heated water vapor and volcanic gases can cause a series of explosions.

Ecological Sites: a distinctive kind of land with specific characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. (USDA Definition).

Entrenchment: the vertical containment of river and the degree to which it is incised in the valley floor.

Entrenchment ratio: a quantitative expression of the ratio of the flood prone width to the bankfull width.

Flood prone width: width measured at an elevation which is determined at twice the bankfull depth.

Forest land: land that is now, or has the potential of being, at least 10 percent stocked by forest trees (based on crown closures) or 16.7 percent stocked (based on tree stocking).

Functional at risk (FAR): riparian wetland areas that are functional, but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Greenline: that specific area where a more or less continuous cover of vegetation is encountered when moving away from the center of an observable channel. The greenline is often, but not necessarily, located at the water's edge.

Hummocking: a form of micro-topographic relief characterized by raised pedicels of vegetated soil as much as 0.6 m (2ft) higher than the surrounding ground which results from long term large animal trampling and tracking in soft soil. Vegetation on the pedicels usually differs from that on the surrounding lower area due to moisture difference between the two levels. Hummocking is also caused by abnormal hydrologic heaving.

Hydric soil: soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrophyte: Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Hydrologic Unit: The USGS has developed a system of geographic units based upon watersheds. These units were originally subdivided to four levels. Subsequently two additional subdivisions have been developed. Currently there are six levels, with the sixth being the smallest unit.

Kerogen: Kerogen is a complex waxy mixture of hydrocarbon compounds that is the primary organic component of oil shale. Kerogen is thought to have originated from compacted organic

material, such as algae and various forms of plant life, that accumulated at the bottom of ancient lakes and seas and was buried at great depths over long periods of geologic time.

Lacustrine: from the French "lacustre" or lake. Permanently flooded lakes and reservoirs, generally over 20 acres, exhibiting wave-formed or bedrock shoreline features. (Cowardin *et al*., 1979).

Lands with Wilderness Characteristics: those lands that have been inventoried and determined by the BLM to contain wilderness characteristics as defined in Section 2 (c) of the Wilderness Act. These are separate from lands already designated as Wilderness or wilderness study areas.

Lentic: standing or still water such as lakes and ponds.

Lotic: flowing or actively moving water such as rivers and streams.

Nonpoint source pollution: pollution originating from diffuse sources (land surface or atmosphere) having no well-defined source.

Palustrine: from the Latin "palus" or marsh. All non-tidal wetlands dominated by trees, shrubs, persistent emergent plants, emergent mosses or lichens. (Cowardin *et al.*, 1979)

Preliminary General Sage-grouse Management Areas (PGMA): Is occupied (seasonal or year-round) habitat outside of priority habitat. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Preliminary Priority Sage-grouse Management Areas (PPMA): Areas that have been identified as having the highest conservation value to maintaining sustainable sage-grouse populations. These areas would include breeding, late brood-rearing, and winter concentration areas. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Proper functioning condition (PFC): Lotic riparian-wetland areas are considered to be in proper functioning condition when adequate vegetation, landform, or large woody debris is present to:

- Dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid floodplain development;
- Improve flood-water retention and ground-water recharge;
- Develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses;
- Support greater biodiversity

Riparian –wetland areas can function properly before they achieve their potential. The PFC definition does not mean potential or optimal conditions have been achieved.

Pugging: the small depressions and areas of compaction in saturated soils caused by the hoof action of animals.

Resource Reserve Allotment: A unit of public land that will not have term grazing permits issued. Such an allotment would only be grazed on a temporary nonrenewable basis. The use of this allotment would be to provide temporary grazing to rest other areas following wildfire, habitat treatments, or to allow for more rapid attainment of rangeland health.

Riparian zone: the banks and adjacent areas of water bodies, water coursed, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a moister habitat than that of contiguous flood plains and uplands.

Rosgen Classification System: A classification system for natural rivers in which a morphological arrangement of stream characteristics is organized into relatively homogeneous stream types. Morphologically similar stream reaches are divided into 7 major stream type categories that differ in entrenchment, gradient, width/depth ratio, and sinuosity in various landforms. Within each major category are six additional types delineated by dominant channel materials from bedrock to silt/clay along a continuum of gradient ranges.

Spring brook: a channel that carries water from a spring. Where there is sufficient flow, the channel forms a perennial stream. Frequently in arid environments, the flow is insufficient to create a perennial stream. Groundwater emerges at the springhead, flows a short distance within the spring brook, and then submerges.

Spring province: a group of springs in close geographical proximity.

Stream power: Stream power is the rate of energy dissipation against the bed and banks of a river or stream per unit downstream length. It is given by the equation: $\Omega = \rho g Q S$ where Ω is the stream power, ρ is the density of water (1000 kg/m^3), g is acceleration due to gravity (9.8 m/s^2), Q is discharge (m^3/s), and S is the channel slope. **Unit stream power** is stream power per unit channel width, and is given by the equation: $\omega = \frac{\rho g Q S}{b}$ where ω is the unit stream power, and b is the width of the channel. Stream power is used extensively in models of landscape evolution and river incision.

Total Maximum Daily Load (TMDL): The goal of the Clean Water Act (CWA) is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Under section 303(d) of the CWA, states are required to develop lists of impaired waters. The law requires that states establish priority rankings for waters on the lists and develop TMDLs for these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards.

TMDL Planning Areas: Montana DEQ is using a watershed approach to address TMDLs based on the premise that water quality restoration and protection are best addressed through

integrated efforts within a defined geographic area. DEQ has divided the state into 91 watershed planning areas to facilitate development of TMDL/water quality restoration plans.

Wilderness Characteristics: These attributes include the area's size, its apparent naturalness, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. They may also include supplemental values.

Woodland: forest communities occupied primarily by noncommercial species such as juniper, mountain mahogany, or quaking aspen groves. All western juniper forest lands are classified as woodlands, since juniper is classified as a noncommercial species. Woodland tree and shrub canopy cover varies, but generally individual plant crowns do not overlap.

References – Literature and Materials Reviewed and/or Cited During the Preparation of this Document

Bjornn, T.C., M.A. Brusven, M.P. Molnau, and J.H. Milligan 1977. Transport of granitic sediment in streams and its effects on insects and fish. University of Idaho, College of Forestry, Wildlife and Range Sciences, Bulletin Number 17. Moscow, Idaho).

Bradley, L., J. Gude, N. Lance, K. Laudon, A. Messer, A. Nelson, G. Pauley, M. Ross, T. Smucker, J. Steuber, and J. Vore. 2015. Montana Gray Wolf Conservation and Management. 2014 Annual Report. Montana Fish, Wildlife & Parks. Helena, Montana. 60pp.

Bryce, S. A., G. A. Lomnicky, and P. R. Kaufmann. 2010. Protecting sediment-sensitive aquatic species in mountain streams through the application of biologically based streambed sediment criteria. Journal of the North American Benthological Society 29:657–672).

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Home Available: http://www.npwrc.usgs.gov

De Staso, J., and F. J. Rahel. 1994. Influence of water temperature on interactions between juvenile Colorado River cutthroat trout and brook trout in a laboratory stream. Transactions of the American Fisheries Society 123:289-297. Dunham et al. 1999; Novinger 2000

Dunne, T., and L.B. Leopold. 1978. Water in Environmental Planning. San Francisco, CA, 818p.

Fletcher, Robert H. 1960. *Free Grass to Fences*. University Publishers Inc.

Foresman, K.R. 2012. Mammals of Montana. Mountain Press Publishing Company, Missoula, Montana.

Hansen, P.L., R.D. Pfister, K. Boggs, B.J. Cook, J. Joy, and D.K. Hinckley. 1995. Classification and Management of Montana's Riparian and Wetland Sites. Misc. Publication No. 54. Montana Forest and Conservation Experiment Station, Missoula, MT.

Haroldson, M.A., F.T. van Manen, and D.D. Bjornlie. 2014. Estimating Number of Females with Cubs. Pages 11-20 *in* F.T. van Manen, M.A. Haroldson, and S.C. Soileau, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2014. U.S. Geological Survey, Bozeman, Montana, USA.

Horan, D.L., Kershner, J.L., Hawkins, C.P., Crowl, T.A., 2000. Effects of habitat area and complexity on Colorado River cutthroat trout density in Uinta Mountain streams. Transactions of the American Fisheries Society 129 (6), 1250–1263.

Howard, J.L. 1996. Populus tremuloides. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2009, November 6].

Interagency Grizzly Bear Study Team. 2014. Grizzly Bear Recovery Zone (*alias Primary Conservation Area*). Found at: http://www.nrmsc.usgs.gov/files/norock/IGBST/Web_Map_Files/Grizzly_Bear_Recovery_Zone.pdf. *Accessed November 16, 2015*.

Interagency Lynx Biology Team. 2013. Canada lynx conservation assessment and strategy. 3rd edition. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication R1-13-19, Missoula, MT. 128 pp.

Irving, J. S. and Bjorn, T. C. 1984. Effects of Substrate Size Composition on Survival of Kokanee Salmon and Cutthroat Trout and Rainbow Trout Embryos. Technical Report 84-6. Moscow, ID, University of Idaho.

LANDFIRE (2013): LANDFIRE Existing Vegetation Type layer. U.S. Department of Interior, Geological Survey. [Online]. Available: http://landfire.cr.usgs.gov/viewer/ [2013, May 8].

Long J.N. and K. Mock. 2012. Changing perspectives on regeneration ecology and genetic diversity in western quaking aspen: implications for silviculture. Canadian Journal of Forest Research 42(12); 2011-2021.

Lonn, J.D., Skipp, B., Ruppel, E.T., Janecke, S.U., Perry Jr., W.J., Sears, J.W., Bartholomew, M.J., Stickney, M.C., Fritz, W.J., Hurlow, H.A., and Thomas, R.C., 2000, Geologic map of the Lima 30' x 60' quadrangle, southwest Montana: Montana Bureau of Mines and Geology Open-File Report 408, 42 p.

Malone, Michael P., Richard B. Roeder, and William L. Lang. 1976. Montana A History of Two Centuries. University of Washington Press, Seattle Washington.

Montana Department of Environmental Quality, Water Quality Planning Section, Watershed Protection Bureau. 2012. Montana Nonpoint Source Management Plan. Helena, Montana http://www.deq.mt.gov/wqinfo/nonpoint/NonpointSourceProgram.mcpx

Montana Fish, Wildlife, and Parks. 2013. FWP Fact Sheet: Congress Delists Montana Wolf Population. Available at http://fwp.mt.gov/fishAndWildlife/management/wolf/ . [Accessed 12 December, 2013].

Montana Fish, Wildlife and Parks. 2015a. Brucellosis. Available at http://fwp.mt.gov/fishAndWildlife/management/elk/brucellosis/default.html. [November, 2015].

Montana Fish, Wildlife and Parks. 2015b. Targeted Elk Brucellosis Surveillance Project, 2011 – 2015 Comprehensive Report. 20 pp.

Montana Natural Heritage Program. 2015a. Montana Field Guide. Available at http://fielduide.mt.gov. [2015, November].

Montana Natural Heritage Program. 2015b. Natural Heritage Map Viewer. Available at http://mtnhp.org/mapviewer/. [2015, November].

National Oceanic and Atmospheric Administration, Climate Data Online, Grant 5, Montana (January 1961 – October 2015). Available online at: https://www.ncdc.noaa.gov/cdoweb/. Accessed: 11/19/2015.

Neil H. Ringler & James D. Hall (1975) Effects of Logging on Water Temperature, and Dissolved Oxygen in Spawning Beds, Transactions of the American Fisheries Society, 104:1, 111-121.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Inigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, and T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY.

Rosgen, D.L. 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199 Elsevier Science, B.V. Amsterdam.

Rosgen, D.L. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO. pp.352

Rosgen D. and L. Silvey. 1998. Field Guide for Stream Classification. Wildland Hydrology. Pagosa Springs, CO. Second edition ISBN 0-9653289-1-0.

Steinberg, P.D. 2002. Psuedotsuga menziesii var. glauca. In: Fire Effects Information System [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2009, November
6].

Stiver, S.J., E.T. Rinkes, D.E. Naugle, P.D. Makela, D.A. Nance, and J.W. Karl, eds. 2015. Sage-Grouse Habitat Assessment Framework: A Multiscale Assessment Tool. Technical Reference 6710-1. Bureau of Land Management and Western Association of Fish and Wildlife Agencies, Denver, Colorado.

Tilton, M. E., and E. E. Willard. 1982. Winter habitat selection by mountain sheep. J. Wildl. Manage. 46:359-366.

Tysdal, R.G., Lee, G.K., Haddemer, J.H., and Hanna, W.F., Mineral Resources of the Blacktail Mountains Wilderness Study Area, Beaverhead County, Montana, 1987, U.G.S. Bulletin 1724-B.

USDA. 2006. Natural Resources Conservation Service. Field Indicators of Hydric Soils in the United States, A Guide for Identifying and Delineating Hydric Soils, V 6.0 G.W. Hurt and L.M. Vasilas (eds.), in cooperation with the National Technical Committee for Hydric Soils. Available: http://landcare.sc.egov.usda.gov/images/pdf/HydricFieldIndicators_v6_0.pdf

USDA. 2011. The National Agriculture Imagery Program (NAIP), administered by the USDA's Farm Service Agency (FSA), acquires aerial imagery during the agricultural growing seasons in the continental U.S. The imagery, digital ortho photography, is available to governmental agencies and the public. Available: http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prog&topic=nai

USDA. 2013. Natural Resources Conservation Service. Montana Rangeland Ecological Site Key. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/mt/technical/landuse/pasture/?cid=nrcs144p2_057025 [Accessed December 10, 2015].

USDA. 2014. Natural Resources Conservation Service. Red Rocks Lake Area Part of Beaverhead County, Montana, Natural Resources Conservation Service, United States Department of Agriculture, Soil Survey Geographic (SSURGO) Database. Available online at: http://sdmdataaccess.nrcs.usda.gov/. Survey Area Publication Date: 9/03/2014.

USDA. 2015. Natural Resources Conservation Service. Horse Prairie- South Valley Area- Part of Beaverhead County, Montana, Natural Resources Conservation Service, United States Department of Agriculture, Soil Survey Geographic (SSURGO) Database. Available online at: http://sdmdataaccess.nrcs.usda.gov/. Survey Area Publication Date: 09/29/2015.

USDI. 1998, 2015. Bureau of Land Management. A User Guide to Assessing Proper Functioning Condition and Supporting Science for Lotic Areas - TR 1737-15.

USDI. 1999. Bureau of Land Management. A User Guide to Assessing Proper Functioning Condition and Supporting Science for Lentic Areas - TR 1737-16.

USDI. 2000, 2005. Bureau of Land Management. Interpreting Indicators of Rangeland Health – TR 1734-6.

USDI. 2001. Bureau of Land Management. A Guide to Managing, Restoring, and Conserving Springs in the Western United States-TR 1737-17.

USDI. 2001. Bureau of Land Management. BLM manual 6840 - Special Status Species Management.

USDI. 2004. Bureau of Land Management. Dillon Resource Management Plan and Environmental Impact Statement (DRAFT), Volume 1. Dillon Field Office. Dillon, Montana. 389 pp.

USDI. 2006. Bureau of Land Management. Record of Decision and Approved Dillon Resource Management Plan. Dillon Field Office. Dillon, Montana. 227 pp.

USDI. 2008.U.S. Fish and Wildlife Service. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. Available: http://www.fws.gov/migratorybirds/. [2011, November 22].

USDI. 2010. Bureau of Land Management. Memorandum of Understanding Regarding Water Quality Management on Bureau of Land Management Lands in Montana Between the Montana Department of Environmental Quality and the United States Department of the Interior Bureau of Land Management BLM-MOU-MT923-1030.

USDI. 2013. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous U. S. Distinct Population Segment of the Canada Lynx and Revised Distinct Population Segment Boundary. Federal Register 50 CFR Part 17.

USDI. 2014a. Bureau of Land Management. 2014 Montana/Dakotas Special Status Species List. Instruction Memorandum No. MT-2014-067.

USDI. 2014b. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States; Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico; Proposed Rule. Federal Register 50 CFR Part 17.

USDI. 2015. U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List Greater Sage-grouse (*Centrocercus urophasianus*) as an Endangered or Threatened Species. Federal Register 50 CFR Part 17.

USEPA. 1998. Interim Air Quality Policy on Wildland and Prescribed Fires. Available: http://www.epa.gov/ttncaaa1/t1/memoranda/firefnl.pdf

USEPA. 2003. Office of Water. National Management Measures for the Control of Nonpoint Pollution from Agriculture. EPA-841-B-03-004. Washington, D.C. Available: http://www.epa.gov/nps/agmm/

USEPA. 2011. Office of Air and Radiation, Air Quality Planning and Standards, Ambient Air Monitoring Program. Available: http://epa.gov/airquality/qa/monprog.html

USEPA. 2012. The Clean Water Act: Protecting and Restoring our Nation's Waters. Available at: http://water.epa.gov/action/cleanwater40/cwa101.cfm (accessed March 4, 2014).

Vuke, S.M., K.W. Porter, J.D. Lonn, and D.A. Lopez. 2007. Geologic Map of Montana, Montana Bureau of Mines and Geology Geologic Map 62-D, 73 p.

Waltee, D. 2015. Personal Communication. Wildlife Biologist, Montana Fish Wildlife and Parks.

Weaver, T. and J. Fraley. 1991. Fisheries Habitat and Fish Populations. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program. Flathead Basin Commission. Kalispell, Montana.

Werner, J. K., B. A. Maxell, P. Hendricks, and D. L. Flath. 2004. Amphibians and reptiles of Montana. Mountain Press Publishing Company. Missoula, Montana. 262 pp.

Appendix A

A List of Known Plants
Found On or Near BLM Lands
Within the Sage Creek Watershed

And

Wildlife Species List

(Plant scientific names and alphanumeric codes presented in the following table correspond to those found in *The PLANTS Database*/http://plants.usda.gov; and the *Synthesis of the North American Flora*. Plant common names are generally those listed for the State of Montana in the above references unless BLM resource specialists are aware of a more frequently used locally accepted plant name.)

Common Name	**Scientific Name**	**USDA Symbol**
Agoseris	*Agoseris* spp	AGOSE
Alfalfa	*Medicago sativa*	MESA
Alkali primrose	*Primula alcalina*	PRAL6
Alkali Sagebrush	*Artemisia arbuscula ssp. longiloba*	ARARL
Alpine Forget-me-not	*Eritrichium spp.*	ERITR
Alpine Timothy	*Phleum alpinum*	PHAL2
Alumroot	*Heuchera spp.*	HEUCH
American Bistort	*Polygonum bistortoies*	POBI6
Baltic Rush	*Juncus arcticus ssp. littoralis*	JUARL
Basin Big Sagebrush	*Artemisia tridentata ssp. tridentata*	ARTRT
Basin Wildrye	*Leymus cinereus*	LECI4
Beaked Sedge	*Carex utriculata*	CAUT
Bearded wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	ELTRT
Bebb Willow	*Salix bebiana*	SABE2
Bitterroot	*Lewisia rediviva*	LERE7
Black Cottonwood	*Populus balsamifera ssp. trichocarpa*	POBAT
Black Henbane	*Hyoscyamus nigar*	HYNI
Bladderwort	*Utricularia spp.*	UTRIC
Blue Flax	*Linum perenne*	LIPE2
Blue Grama	*Bouteloua gracilis*	BOGR2
Bluebunch Wheatgrass	*Pseudoroegneria spicata*	PSSP6
Bluegrass	*Poa spp.*	POA
Bluejoint Reedgrass	*Calamagrostis canadensis*	CACA4
Booth's Willow	*Salix boothii*	SABO2
Broom Snakeweed	*Gutierrezia sarothrae*	GUSA2
Buckwheat	*Eriogonum spp.*	ERIOG
Bull Thistle	*Cirsium vulgare*	CIVU
Canada Thistle	*Cirsium arvense*	CIAR4
Chicken sage	*Sphaeromeria argentea*	SPAR2
Cheatgrass	*Bromus tectorum*	BRTE
Cinquefoil	*Potentilla spp.*	POTEN
Clustered Field Sedge	*Carex praegracilis*	CAPR5
Common Cattail	*Typha latifolia*	TYLA
Common Dandelion	*Taraxacum officinale*	TAOF
Common Juniper	*Juniperus communis*	JUCO6
Common Mullein	*Verbascum thapsus*	VETH
Common Snowberry	*Symphoricarpos albus*	SYAL

Common Name	Scientific Name	USDA Symbol
Common Yarrow	*Achillea millefolium*	ACMI2
Cow Parsnip	*Heracleum maximum*	HEMA80
Coyote Willow	*Salix exigua*	SAEX
Creeping Catchfly	*Silene repens*	SIRE
Creeping Juniper	*Juniperus horizontalis*	JUHO2
Curl-leaf Mountain Mahogany	*Cercoarpus ledifolius*	CELE3
Currant	*Ribes spp.*	RIBES
Cusick's horse-mint	*Agastache cusickii*	AGCU
Cutleaf daisy	*Erigeron compositus*	ERCO4
Deathcamas	*Zigadenus spp.*	ZIGAD
Douglas-fir	*Pseudotsuga menziesii*	PSME
Drummond's willow	*Salix drummondiana*	SADR
Elephanthead	*Pedicularis groenlandica*	PEGR2
Elk thistle	*Cirsium foliosum*	CIFO
Engelmann Spruce	*Picea engelmannii*	PIEN
Foxtail Barley	*Hordeum jubatum*	HOJU
Fringed Sagewort	*Artemisia frigida*	ARFR4
Gardner Saltbush	*Atriplex garneri*	ATGO
Geyer Willow	*Salix geyeriana*	SAGE2
Greasewood	*Sarcobatus vermiculatus*	SAVE4
Green Needlegrass	*Nassella viridula*	NAVI4
Green Rabbitbrush	*Chrysothamnus vividiflorus*	CHVI8
Grey Horsebrush	*Tetradymia canescens*	TECA2
Heartleaf Arnica	*Arnica cordifolia*	ARCO9
Hoary Phacelia	*Phacelia incana*	PHIN9
Houndstongue	*Cynoglossum officinale*	CYOF
Idaho Fescue	*Festuca idahoensis*	FEID
Indian Paintbrush	*Castilleja spp.*	CASTI2
Idaho Sedge	*Carex idahoa*	CAID
Inflated Sedge	*Carex vesicaria*	CAVE6
Indian Ricegrass	*Achnatherum hymenoides*	ACHY
Kentucky Bluegrass	*Poa pratensis*	POPR
Kinnikinnick	*Arctostaphylos uva-ursi*	ARUV
Lewis Flax	*Linum lewisii*	LILE3
Limber Pine	*Pinus flexilis*	PIFL2
Limestone Larkspur	*Delphinium bicolor ssp. calcicola*	DEBIC
Low Sagebrush	*Artemisia arbuscula ssp. arbuscula*	ARARA
Lupine	*Lupinus spp.*	LUPIN
Mealy primrose	*Primula incana*	PRIN
Meadow Barley	*Hordeum brachyantherum*	HORR2
Montana Sweet Pea	*Thermopsis montana*	THMO6
Mountain Big Sagebrush	*Artemisia tridentata ssp. vaseyana*	ARTRV
Mountain Brome	*Bromus carinatus*	BRCA5

Common Name	Scientific Name	USDA Symbol
Mountain Snowberry	*Symphoricarpos oreophilus*	SYOR2
Musk Thistle	*Carduus nutans*	CANU4
Narrowleaf Cottonwood	*Populus angustifolia*	POAN3
Nebraska Sedge	*Carex nebrascensis*	CANE2
Nodding Brome	*Bromus anomalus*	BRAN
Northwestern groundsel	*Packera conterminal*	PACO53
Oniongrass	*Melica bulbosa*	MEBU
Owl-clover	*Orthocarpus spp.*	ORTHO
Phlox	*Phlox spp.*	PHLOX
Pinegrass	*Calamagrostis rubescens*	CARU
Plains Pricklypear	*Opuntia polyacantha*	OPPO
Planeleaf willow	*Salix planifolia*	SAPL2
Planeleaf Willow	*Salix planifolia*	SAPL2
Prairie Junegrass	*Koeleria macrantha*	KOMA
Prairie smoke	*Geum triflorum*	GETR
Prostrate hutchinsia	*Hornungia procumbens*	HOPR
Pussy-toes	*Antennaria spp.*	ANTEN
Quaking Aspen	*Populus tremuloides*	POTR5
Redoiser Dogwood	*Cornus sericea ssp. sericea*	COSES
Redtop	*Agrostis gigantean*	AGGI2
Rocky Mountain Groundsel	*Packera streptanthifolia*	PAST10
Rocky Mountain Iris	*Iris missouriensis*	IRMI
Rocky Mountain Juniper	*Juniperus scopulorum*	JUSC2
Rubber Rabbitbrush	*Ericameria nauseosa*	ERNA10
Rush	*Juncus spp.*	JUNCU
Sandberg Bluegrass	*Poa secunda*	POSE
Sandwort	*Arenaria spp.*	ARENA
Scarlet Globe-mallow	*Sphaeralcea coccinea*	SPCO
Sedge	*Carex spp.*	CAREX
Shy Wallflower	*Erysimum inconspicuum*	ERIN7
Short-fruited Willow	*Salix brachycarpa*	SABR
Shrubby Cinquefoil	*Dasiphora fruticosa ssp. floribunda*	DAFRF
Silverweed Cinquefoil	*Argentina anserine*	ARAN7
Silver Sagebrush	*Artemisia cana*	ARCA13
Slender Sedge	*Carex lasiocarpa*	CALA11
Slender thelpody	*Thelypodium sagittatum ssp. sagittatum*	THSA
Slender Wheatgrass	*Elymus trachycaulus*	ELTR7
Small-flowered Pennycress	*Noccaea parviflora*	NOPA5
Smooth Brome	*Bromus inermis*	BRIN2
Spike Fescue	*Leucopoa kingii*	LEKI2
Spotted Knapweed	*Centaurea stoebe ssp. micranthos*	CESTM
Spruce	*Picea spp.*	PICEA
Stemless Mock Goldenweed	*Stenotus acaulis*	STAC

Common Name	Scientific Name	USDA Symbol
Sticky Geranium	*Geranium viscosissimum*	GEVI2
Stiffleaf Penstemon	*Penstemon aridus*	PEAR2
Stonecrop	*Sedum spp.*	SEDUM
Subalpine Fir	*Abies lasiocarpa*	ABLA
Suksdorf Monkey flower	*Mimulus suksdorfii*	MISU2
Sweetscented Bedstraw	*Galium triflorum*	GATR3
Taper-tip Desert-parsley	*Lomatium attenuatum*	LOAT
Thick-spike Wheatgrass	*Elymus lanceolatus*	ELLA3
Thinleaf Alder	*Alnus incana*	ALIN2
Three-tip Sagebrush	*Artemisia tripartita*	ARTR4
Threadleaf Sedge	*Carex folifolia*	CAFI
Timothy	*Phleum pratense*	PHPR3
Tufted Hairgrass	*Deschampsia cespitosa*	DECE18
Water Birch	*Betula occidentalis*	BEOC2
Water Sedge	*Carex aquatilis*	CAAQ
Water Smartweed	*Polygonum amphibium*	POAM8
Western Joepye-weed	*Eupatorium occidentale*	AGOC2
Western Meadow-rue	*Thalictrum occidentale*	THOC
Western Wheatgrass	*Pascopyrum smithii*	PASM
Western Yarrow	*Achillea millefolium var. occidentalis*	ACMIO
Wheeler's bluegrass	*Poa wheeleri*	POWH2
Whiplash Willow	*Salix lucida ssp. lasiandra*	SALUL
White Clover	*Trifolium repens*	TRRE3
White Sagebrush	*Artemisia ludoviciana*	ARLU
Whitebark Pine	*Pinus albicaulis*	PIAL
White-stemmed Globe-mallow	*Sphaeralcea munroana*	SPMU2
Winterfat	*Krascheninnikovia lanata*	KRLA2
Wolf's Willow	*Salix wolfii*	SAWO
Wyoming Big Sagebrush	*Artemisia tridentata ssp. wyomingensis*	ARTRW8
Yampa	*Perideridia gairdneri*	PEGA3
Yellow Sweetclover	*Melilotus officinalis*	MEOF
Yellow Willow	*Salix lutea*	SALU2

WILDLIFE SPECIES LIST

Birds

American kestrel (*Falco sparverius*)
Bald eagle (*Haliaeetus leucocephalus*)
Black rosy-finch (*Leucosticte atrata*)
Brewer's sparrow (*Spizella breweri*)
Burrowing owl (*Athene cunicularia*)
Calliope hummingbird (*Stellula calliope*)
Cassin's finch (*Carpodacus cassinii*)

Chipping sparrow (*Spizella passerina*)
Clark's nutcracker (*Nucifraga Columbiana*)
Cooper's hawk (*Accipiter cooperii*)
Dark-eyed junco (*Junco hyemalis*)
Downy woodpecker (*Picoides pubescens*)
Dusky grouse (*Dendragapus obscures*)
Ferruginous hawk (*Buteo regalis*)
Flammulated owl (*Otus flammeolus*)
Golden eagle (*Aquila chrysaetos*)
Great gray owl (*Strix nebulosa*)
Great horned owl (*Bubo virginianus*)
Greater sage grouse (*Centrocercus urophasianus*)
Green-tailed Towhee (*Pipilo chlorurus*)
Hairy woodpecker (*Picoides villosus*)
House wren (*Troglodytes aedon*)
Hungarian partridge/Gray partridge (*Perdix perdix*)
Lewis' woodpecker (*Melanerpes lewis*)
Loggerhead shrike (*Lanius ludovicianus*)
Long-billed curlew (*Numenius americanus*)
McCown's longspur (*Calcarius mccownii*)
Northern goshawk (*Accipiter gentilis*)
Olive-sided flycatcher (*Contopus cooperi*)
Peregrine falcon (*Falco peregrinus*)
Pine siskin (*Carduelis pinus*)
Ruffed grouse (*Bonasa umbellus*)
Sage sparrow (*Amphispiza belli*)
Sage thrasher (*Oreoscoptes montanus*)
Sharp-shinned hawk (*Accipiter striatus*)
Short-eared owl (*Asio flammeus*)
Swainson's hawk (*Buteo swainsoni*)
Williamson's sapsucker (*Sphyrapicus thyroideus*)
Willow flycatcher (*Empidonax traillii*)
Wilson's phalarope (*Phalaropus tricolor*)

Mammals
Badger (*Taxidea taxus*)
Beaver (*Castor canadensis*)
Big brown bat (*Eptesicus fuscus*)
Black bear (*Ursus americanus*)
Bobcat (*Lynx rufus*)
Coyote (*Canis latrans*)
Elk (*Cervus elaphus*)
Fringed myotis (*Myotis thysanodes*)
Gray wolf (*Canis lupus*)
Great Basin pocket mouse (*Perognathus parvus*)
Grizzly bear (*Ursus arctos*)

Hoary bat (*Lasiurus cinereus*)
Little brown myotis (*Myotis lucifugus*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Long-tailed weasel (*Mustela frenata*)
Moose (*Alces alces*)
Mountain lion (*Puma concolor*)
Mule deer (*Odocoileus hemionus*)
North American wolverine (*Gulo gulo*)
Pronghorn (*Antilocapra americana*)
Pygmy rabbit (*Brachylagus idahoensis*)
Red fox (*Vulpes vulpes*)
Silver-haired bat (*Lasionycteris noctivagans*)
Townsend's big-eared bat (*Corynorhinus townsendii*)
Western small-footed myotis (*Myotis ciliolabrum*)
White-tailed deer (*Odocoileus virginianus*)

Amphibians and Reptiles
Columbia spotted frog (*Rana luteiventris*)
Western toad (*Bufo boreas*)
Terrestrial gartersnake (*Thamnophis elegans*)
Common gartersnake (*Thamnophis sirtalis*)

Appendix B- Livestock Grazing Tools Available to Improve Resource Conditions

Rangeland health standards have been assessed on all 900,000 acres of BLM administered lands in the Dillon Field Office (DFO) on a ten year adaptive management schedule since 2002. Nearly all (>90%) of the uplands in the DFO met the BLM Upland standard signifying that AUMs authorized by BLM (stocking densities) are appropriate for most allotments across the field office. There are about 860 miles of streams and 854 separate stream reaches identified by BLM in the field office. Of these 854 reaches, about half met the BLM riparian health standard while about half failed to meet this standard. This failure to meet the BLM riparian health standard is typically due to the grazing period or length of time livestock are allowed access to the riparian area (Marlow 1991). Generally, livestock stocking density or AUMs authorized by BLM on an allotment is **not** the most important parameter affecting riparian health.

Upland health standards on BLM allotments are highly dependent on the stocking density or stocking rate for the allotment. A stocking density or rate that is not in concert with the carrying capacity of the allotment will result in the allotment not meeting the Upland Health Standard. This is true for all allotments across the DFO. However, riparian systems are usually much more dynamic than uplands (USDI, 1998). Riparian health is dependent on a variety of key grazing attributes including Duration, Timing, Intensity and Frequency. These four terms have corresponding terms that the Society for Range Management calls: **Grazing Period** (the length of time that livestock are grazed on a specific area), **Seasonal Grazing** (Grazing restricted to a specific season or time of year), **Stocking Density** (Number of animals per unit area expressed as AUM/ac), and **Frequency** (Number of repeat grazing events in a pasture). Three other important grazing factors are: **Palatability of Forage**, **Availability of Off-Stream Watering Sources** and **Class of Animal** (Age and/or sex-group of a kind of animal).

Grazing Period or Duration - The most critical aspect in any grazing plan for the protection of riparian areas is the Grazing Period or length of time cattle have access to a particular stream reach (Marlow 1991). Myers (1989) after reviewing 34 allotments in southwestern Montana, concluded, "Duration in grazing treatments becomes a key factor in determining the severity of damage". He added that cattle have a tendency to gather at riparian areas and spend a considerable amount of time in the riparian area even when they are not feeding. Cattle spend a disproportionate amount of time in the riparian area and tend to over-utilize the forage that grows there (Clary and Webster 1989). This attrition to riparian areas by a small herd or a large herd of cattle has an important bearing on riparian management and its connection to Grazing Period duration and Stocking Density. Due to social factors associated with cattle dominance around a riparian area and the limited availability of space in the riparian area, it is understood that doubling the number of livestock in a pasture with a riparian area does not equate to doubling the grazing use in the riparian area. A relatively smaller number of livestock will usually graze the riparian area close to the same degree as a large number of livestock during the same period of use. Therefore, decreasing the **Grazing Period** and increasing the **Stocking Density** in a pasture with riparian will generally benefit riparian conditions by reducing the use in the riparian area even when the same number of AUMs are grazed. This strategy of a reduced duration in a riparian pasture and an increased stocking density will improve the riparian system.

Frequency or Number of Grazing Events- Frequency is simply the number of occurrences of a grazing event during a specified period of time or incorporation of non-grazing (rest) of an area of grazing land ranging from a few days to a full year or more. To fully understand frequency, there must be a time frame associated with the frequency of the given event. Historically, the term "rest" referred to non-grazing for a full year along with foregoing grazing on that year's complete forage crop, but the term now is commonly used to include any period of non-grazing. Thus, rest must be carefully described and interpreted in order to be meaningful. The length of time of prescribed rest will be highly dependent on site specific conditions and objectives for each riparian system. Repeat grazing events during the year are important when dealing with plant health. Plants must have time to recover from a grazing event to properly replenish lost photosynthetic material and recharge energy reserves. The time it takes for this recovery is highly dependent on the growth stage the cool-season plant is in when defoliated and the season of defoliation. Defoliation during the early stages of plant growth in the spring was formerly presumed to be the most detrimental time to graze a cool-season plant (Stoddart 1946). Later research has shown that late growing season grazing is the most critical period to negatively impact perennial forage plants, and adequate time away from grazing during this period is necessary to replenish energy reserves and for bud development (Vallentine 1990). Furthermore, grazing during any time of the plants growing season and then repeat grazing during the same growing season without allowing adequate plant recovery away from grazing will reduce plant health. The greater the frequency of grazing events, the more damage to plants that will occur. Even more detrimental to riparian plant health is when frequency increases during a specific calendar year and this scenario is continued for multiple consecutive years. Recovery of channel morphology or browse species in a riparian system will generally require longer periods of rest within a specified timeframe than recovery of herbaceous riparian vegetation.

Seasonal Grazing – Another key attribute in meeting riparian health standards is **Seasonal Grazing** or grazing during a specific time of year. Clipping studies have indicated that timing can greatly affect plant productivity and vigor (Miller and Donart 1981). Seasonal Grazing is simply changing the time or season of the year when the riparian pasture is grazed. During periods of hotter temperatures, July to September, livestock will congregate considerably more around riparian areas to decrease body temperatures and to forage on green vegetation that is only available near the water. This could result in an over-used riparian. Continual grazing during the plant's growth period will eventually cause roots to die and the plant to lose vigor and reproductive capacity (USDI, BLM 1998). By simply changing nothing but the seasonal grazing period from summer to fall, spring or winter grazing, the riparian area can improve and may meet BLM standards for riparian areas. The grazing seasons are generally divided into three seasons (USDI, BLM 1998).

Early Season (spring) Use - Early Spring grazing (April 1 to July 15) in riparian areas may improve a riparian system for a variety of reasons as listed below.

1) Livestock may be attracted to succulent vegetation in the uplands and will not loiter in the riparian areas as much compared to other seasons of the year.

2) Cool temperatures may discourage cows from staying in the riparian or weather is not as harsh in the uplands. Hot temperatures experienced during the hottest months may force cattle into the riparian areas.

3) Soil in the riparian area may be wet as to discourage cows from entering.

4) Well drained soils reduce the possibility of compaction.

Late Season (fall) Grazing Use- Late Season (July 15 to October 31) grazing in riparian areas may improve a riparian system but livestock affinity for browse species later in fall may be a concern. Benefits of late season grazing are listed below.

1) Soils are drying during this period which reduces the probability of compaction and bank trampling.
2) Most plants have completed their life cycle and removing plant material by grazing will not adversely affect plant development and health compared to Grazing during April to July.
3) Ground nesting birds that nest in riparian areas are not negatively impacted.

Winter Use – Winter use (November 1 to March 31) usually has the least impact to the health of riparian systems.

1) Soil compaction is typically not an issue due to frozen soils.
2) Most plants have completed their life cycle and removing plant material by grazing will not adversely affect plant development and health compared to Grazing during April to July.
3) Livestock distribution should improve due animals need for water is lessoned.

Palatability- Livestock palatability is simply an animal's desire or ability to consume a particular plant species or plant part (Kothmann 2008). Palatability is tied closely with the life cycle of a particular grass plant species (Raleigh and Wallace 1965). Palatability becomes important to riparian and upland management when producers are determining a livestock rotation that will benefit a riparian or upland system. In general, livestock palatability or the closely tied digestibility of a cool-season perennial rangeland grass is high from growth initiation in spring (April/May) and continues being relatively high until the grass sets its seeds in mid to late summer (Raleigh and Wallace 1965). Palatability decreases after seed set and continues to decline into the dormancy period in late summer and into fall. This low palatability continues until the following spring when growth initiation begins.

In a similar timing scenario, negative impacts to cool-season rangeland plants caused by a grazing herbivore removing photosynthetic material are much more pronounced during a period when palatability is high. However, herbivory by livestock has little impact to plants when palatability is low. When determining a grazing plan that improves conditions in riparian or upland pastures, management should focus on grazing cattle in pastures that need improvement during periods when the plant growth cycle is completed and palatability is low.

The dates and terms used in the Seasonal Grazing heading listed above generally correspond to both palatability and the life cycle of a cool-season rangeland plant. Early spring grazing (April

1 to July 15) is when the plant is completing its life cycle and it is most palatable to livestock. During this period, plants are most vulnerable to excessive grazing by livestock (Laycock 1970). Late season grazing (July 16 to November 1) is after rangeland plant's life cycle is completed and when palatability is low. Grazing during this period has little impact on rangeland plant health if grazing is not extreme (Cook 1971, Laycock 1970). Winter grazing is also after the plant's life cycle is completed and when palatability is lowest. Grazing during this period has little impact on plant health but excessive grazing may lead to increased erosion and a loss of topsoil (Heady 1984).

Stocking Density –Stocking density is simply the number of animals in a given area. As Myers (1989) and Marlow (1991) stated, length of time is the most important factor when determining the amount of use a riparian area will receive. However, stocking density is important. It is fundamentally understood that if a given number of AUMs are be grazed in a riparian pasture, it is most beneficial for the riparian area to graze the largest number of animals for the shortest period of time to harvest the given number of AUMs. This assumption is valid only when strictly dealing with riparian resource health and does not factor important economic and logistical factors such as livestock performance, breeding performance, health of the livestock, logistics of moving livestock, etc.

Class of animal – Class of animal is an important consideration when trying to improve a riparian area that has failed standards. A livestock operation that grazes cows and their calves will typically have a livestock herd that travels less and has poorer grazing distribution in the pasture compared to a yearling cattle operation. Yearling or younger cattle will usually spend less time in the riparian area and more time exploring the entire pasture which has the potential to improve riparian conditions and get better use of your upland vegetation.

Off-Stream Watering Locations- Developing ways to influence the amount of time livestock spend in the riparian area is a critical part of proper riparian management (USDI, BLM 1998). The development of alternative clean water sources may lure livestock out of the riparian areas. Livestock usually prefer clean water provided in a livestock trough rather than a riparian area, especially during periods outside the hot summer months (July to September). By developing an alternative water system, livestock can improve distribution in the pastures with riparian present and lessen the impact of livestock in the riparian areas.

Other Tools to Improve Riparian Areas- There are other options that may be effective in improving a riparian system, yet each one by itself will not change a non-function riparian system into a health riparian.

Hardened crossings – Hardened crossings are graveled or rocked areas that allow cattle to cross creeks or streams without adding excessive sediment to the stream or compacting soils is this area. Cattle often prefer to use these areas if constructed properly and will travel less on the riparian area that isn't hardened.

Watering Access Point- Sometimes, riparian streams are fenced off from livestock use for protection. However, providing a watering location from the stream is still needed to water the remainder of the pasture. Creating a watering access point off the creek using rock or gravel can

allow livestock to water without negatively impacting riparian condition or increasing sediment in the stream. The goal is to construct an access point that allows livestock to water but encourages them to leave quickly and to avoid creating an area where livestock are able to loiter.

Riding Cattle Out of Riparian Areas- Riding is increasingly being used as a method to move livestock out of riparian areas (Storch 1979). Proper riding can be an effective tool to improve riparian areas but the quality and quantity of the riding will correspond to the benefits that area derived in improving the riparian area.

Drift Fences- In hilly topography, livestock are likely to use the riparian area and sometimes the stream bed itself as a corridor to travel to and from lower and higher elevations. A strategically placed drift fence can interrupt this habitual corridor and reduce pressure on the riparian area.

Riparian Pasture- As stated by Marlow and Myers above, length of time is the most critical factor when determining whether or not a riparian will meet BLM standards. Increasing the number of pastures by constructing a grazed riparian pasture may give an operator more flexibility to graze pastures with higher stocking densities but for shorter durations.

Pasture Divisions- In a similar fashion to Riparian pastures, dividing an existing pasture may provide more flexibility in the producers operation and result in grazing a pasture with riparian for a shorter period of time which will likely improve riparian condition.

Salt and Mineral Placement- Although these alone may not solve a riparian problem, they can improve livestock distribution and reduce the time cattle spend in the riparian area.

In conclusion, the length of time livestock are allowed access to a riparian area is the paramount grazing parameter that determines the health of the system. However, many other tools mentioned above may help to reach the goals for the livestock operation and to meet the desired natural resource condition. In summary, there is no single, let alone simple solution for how to graze livestock in riparian areas where both ecologic and economic goals are desired. Ultimately, what is required is an on-the-ground review of the site specific circumstances by resource professionals (livestock producers and land managers) and a carefully considered prescription developed to address the unique conditions and desired objectives of the parties involved (Anderson 1993, Buckhouse and Elmore 1993).

References – Literature and Materials Reviewed and/or Cited During the Preparation of Appendix B

Anderson, E. William. 1993. Prescription grazing to enhance rangeland watersheds. Rangelands 15(1):31-34.

Buckhouse, John C., and Wayne Elmore. 1991. {re-print 1993}. Grazing practice relations: Predicting riparian vegetation response from stream system. In" Watershed management guide for the Interior Northwest. Edited by Thomas Beell. Oregon State University Extension Service, Corvallis, OR. Pp. 47-52.

Clary, Warren P., and Bert F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. USDA Forest Service General Technical Report INT-263. Intermountain Research Station, Ogden, UT.

Cook, C. W. (1971). Effects of Season and Intensity of Use on Desert Vegetation. Utah Agrilc. Ept. Stat. Bul. 483. 57 pp.

Heady, H.F. (1984). Concepts and Principles Underlying Grazing Systems. In Natl. Res Council/Natl. Acad. Sci. "Developing Strategies for Rangeland Management. "Westview Pres. Boulder, CO . pp 885-902.

Kothmann, M. (Ed., Chair.). 1974. A Glossary of Terms Used in Range Management, 2nd Edition, published by the Society for Range Management.

Laycock W. A. (1970). The Effects of spring and Fall Grazing on Sagebrush-Grass Ranges in Eastern Idaho. Intern. Grassland Cong. Proc. 11:52-54.

Marlow, Clayton B., Douglas Allen, and Kathyrn Olson-Rutz. 1991. Making riparian zone protection a workable part of grazing management. In: Proceedings of the international beef symposium. January 15-17, Great Falls, MT. Animal Range Sciences Department, Montana State University, Bozeman, MT pp 256-266.

Miller R. F., and G. B. Donart. 1981. Response of *Muhlenbergia popteri Schibn*. to season of defoliation. J. Range Manage. 34:91-94.

Myers, Lewis H. 1989. Grazing and riparian management in southwestern Montana. In: Practical approaches to riparian resource management: An education workshop. Edited by Robert E. Gresswell, Bruce A. Barton and Jeffrey L. Kershner. May 8-11 Billings, MT BLM-MT-PT_89-001-4351. Bureau of Land Management, Washington, DC. Pp. 117-120.

Raleigh, R. J., and J. B. Wallace. (1965). Nutritive Value of Range Forage and its Effect on Animal Performance. Ore. Agric. Expt. Sta. Spec. Rep. 189. 6 pp.

Stoddart, L. A. 1946. Some physical and chemical responses of *Agropyron spicatum* to herbage removal at various seasons. Utah Agric. Exp. Sta. Bull. 324.

Storch, Robert L. 1979. Livestock/streamside management programs in eastern Oregon. In: Proceedings: Forum-on grazing and riparian/stream ecosystems. Trout Unlimited, Inc., Vienna, VA pp. 56-59.

United States Department of Interior Bureau of Land Management, Dillon, field Office. 2006. Record of Decision and Approved Dillon Resource Management Plan.

United States Department of Interior Bureau of Land Management, Montana State Office. 1998. Successful Strategies for Grazing Cattle in Riparian Zone. Riparian Technical Bulletin No. 4. Montana Forest and Conservation Experiment Station. Pp. 2-20.

Vallentine, John F. 1990. Grazing Management. Academic Press, San Diego, CA. 101-102.