APPENDIX III

RIPARIAN ECOSYSTEM REPORT
FOR
ENVIRONMENTAL ASSESSMENT

EAST ROSEBUD, WEST ROSEBUD, BUTCHER CREEK, RED LODGE CREEK ALLOTMENTS & BLACK BUTTE WILDLIFE HABITAT AREA

RANGELAND PROJECT

Mark P. Nienow
Hydrologist
Custer National Forest

March 2008

INTRODUCTION

This report focuses on the characteristics, condition of and effects on riparian areas. Associated issues include channel morphology, streamflow and water quality. The analysis area includes all surface waters within the Forest boundary of the allotments covered in this analysis.

The Report is organized as follows:

APPLICABLE LAWS, REGULATION AND POLICY

- **a. Federal**
  - ***-Clean Water Act***
  - ***-Forest and Rangeland Renewable Resource Planning Act of 1974 and National Forest Management Act of 1976***
  - ***-Multiple Use Sustained Yield Act of 1960***
- **b. State - Montana Water Quality Law**
  - ***-Surface Water Classification***
  - ***Surface Water Quality Standards***
  - ***-Total Maximum Daily Load Waterbody List***
- **c. Forest Service**
  - ***-National Direction***
  - ***-Custer National Forest Land and Resources Management Plan***
- **d. Best Management Practices**
  - ***-R1/R4 Soil and Water Conservation Practices Handbook***
  - ***-Cooperative Direction Letter from the Governor of Montana, U.S. Forest Service Regional Forester – Northern Region, and the State Director of the Bureau of Land Management (USDI Bureau of Land Management, USDA Forest Service, State of Montana 1996).***
  - ***-The Montana Conservation Practice Specification for Prescribed Grazing Code 528 (USDA Natural Resources Conservation Service 2002)***

ASSUMPTIONS, METHODOLOGY AND SCIENTIFIC ACCURACY OF INFORMATION USED

AFFECTED ENVIRONMENT

- **Introduction**
- **a. Natural Characteristics and Processes**
- **b. Human Influences**
  - ***-General Grazing Influences***
- **c. Riparian Condition**
  - ***-Proper Functioning Condition Methodology***
  - ***-Existing Condition***
  - ***-Stream Classification***
  - ***-Desired Future Condition***

ENVIRONMENTAL EFFECTS

- **a. Background**
  - ***-Research Recommendations for Livestock grazing in Riparian Areas***
- **b. Effects Common to All Alternatives**
  - ***-Direct Effects***
  - ***-Short-term vs. Long-term Productivity***
  - ***-Irreversible/IrretrievableCommitments***
  - ***-Unavoidable Adverse Impacts***
- **c. Effects Common to All Action Alternatives**
  - ***-Indirect Effects***
- **d. Mitigation Included Under All Alternatives**
- **e. Effects By Alternative**
  - ***-Alternative 1 – No Grazing***
    - <u>Indirect Effects</u>

Cumulative Effects
Forest Plan Consistency and Other Required Disclosures
Conclusions for Environmental Consequences
-Alternative 2 – Current Management
Indirect Effects
Cumulative Effects
Forest Plan Consistency and Other Required Disclosures
Conclusions for Environmental Consequences
-Alternative 3 - Proposed Management
Indirect Effects- Summary Across Analysis Area
Indirect Effects by Allotment
Cumulative Effects
Forest Plan Consistency and Other Required Disclosures
Conclusions for Environmental Consequences
-Effects by Alternative Summary

MONITORING

REFERENCES

APPLICABLE LAWS, REGULATION AND POLICY

a. Federal

Clean Water Act

This Act requires federal agencies to comply with all federal, state, and local requirements, administrative authority, process and sanctions related to the control and abatement of water pollution (CWA, Sections 313(a) and 319(k)). The Act gives authority to individual states to develop, review, and enforce water quality standards under Section 303. This section also requires the states to identify existing water bodies that do not meet water quality standards, and develop plans to meet them. These plans are commonly called TMDLs, or total maximum daily load.

Forest and Rangeland Renewable Resource Planning Act of 1974 and National Forest Management Act of 1976

In response to requirements set forth in these two Acts, final rules on National Forest System Land and Resource Management Planning established specific minimum management requirements to be met in accomplishing the goals and objectives for National Forest System lands. These requirements were intended to guide the development, analysis, approval, implementation, monitoring, and evaluation of forest plans. Requirements specific to soils, water and fish habitat are found in 36 CFR 219.27, volume 47, #190, 09/30/82 (Federal Register 1982) as follows:

(a) Resource protection. “All management prescriptions shall: (1) Conserve soil and water resources and not allow significant or permanent impairment of the productivity of the land; (2) Consistent with the relative resource values involved, minimize serious or long-lasting hazards from flood, wind, wildfire, erosion. (4) Protect streams, streambanks, shorelines, lakes, wetlands, and other bodies of water...; (6) Provide for adequate fish and wildlife habitat to maintain viable populations of existing native vertebrate species....”

(e) Riparian areas. “Special attention shall be given to land and vegetation for approximately 100 feet from the edges of all perennial streams, lakes, and other bodies of water. This area shall correspond to at least the recognizable area dominated by the riparian vegetation. No management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment shall be permitted within these areas that seriously and adversely affect water conditions or fish habitat. Topography, vegetation type, soil, climate conditions, management objectives, and other factors shall be considered in

determining what management practices may be performed within these areas or the constraints to be placed upon their performance."

(f) Soil and Water Conservation. "Conservation of soil and water resources involves the analysis, protection, enhancement, treatment, and evaluation of soil and water resources and their responses under management and shall be guided by instructions in official technical handbooks. These handbooks must show specific ways to avoid or mitigate damage, and maintain or enhance productivity on specific sites. These handbooks may be regional in scope or, where feasible, specific to physiographic or climatic provinces." Refer to the section below, Best Management Practices for a discussion of the Forest Service Soil and Water Conservation Practices Handbook."

Multiple Use Sustained Yield Act of 1960

It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes (16 USC 2 (I); Sec 528). The terms multiple use and sustained yield are defined as:

"The management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output." (multiple use)

"The achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land." (sustained yield)

b. State - Montana Water Quality Law

As directed by the Clean Water Act, the State of Montana developed a water quality classification system, developed water quality standards to be applied to various water classes, and identified water bodies that do not meet standards.

Surface Water Classification

The Montana Department of Environmental Quality has classified all waters within the project area as B-1 waters. The beneficial uses associated with this classification include; drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply (Administrative Rules of Montana (ARM) 16.20.607/618).

Surface Water Quality Standards

The Montana Water Quality Act, Surface Water Quality Standards require that land management activities must not generate pollutants in excess of those that are naturally occurring, regardless of the stream's classification. Under ARM 17.30.623 (2) (f) "No increases are allowed above naturally occurring concentrations of sediment, settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife." Naturally occurring is defined in ARM 16.20.602 (19) as: "the water quality condition resulting from runoff or percolation, over which man has no control, or from developed lands where all reasonable land, soil and water conservation practices have been applied". Reasonable land, soil and water conservation practices are similar to Best Management Practices (BMPs). BMPs are considered reasonable only if beneficial uses are fully supported. BMPs are further discussed in a following section.

Total Maximum Daily Load Waterbody List

Riparian and stream conditions are assessed by the Montana Department of Environmental Quality (MTDEQ) to determine the level of beneficial uses support. Streams that do not fully support their uses do not fully meet water quality standards. The status of water quality assessment and TMDL development of streams are identified in a biennial report from MTDEQ. The 2006 Montana 305(b)/303(d) Water Quality Report lists five streams within or immediately adjacent to the analysis area: Butcher, Red Lodge, West Red Lodge, and East and West Rosebud Creeks (MTDEQ 2006). Butcher and West Rosebud Creeks have known pollutant related sources and require a TMDL (Category 5 streams). Red Lodge Creek has no known pollutant related sources, is still considered impaired, but does not require a TMDL (Category 4C streams). Category 1 streams have been assessed and found to fully support all beneficial uses. A summary of streams identified on the 2006 303(d) List are provided in Table 1.

Impaired uses for all Category 5 streams include aquatic life and cold water fisheries, although primary contact-recreation is also impaired in Butcher Creek. Probable causes for aquatic life and fisheries impairment vary from alteration of streamside vegetation to benthic macro-invertebrates, sedimentation/siltation, solids and fish passage barriers. Probable sources are identified as livestock grazing, crop production, hydro structures and natural sources. In some cases sources are unknown at this time. Livestock grazing on National Forest System land has the potential to influence aquatic life and cold water fisheries in all of these watersheds.

Table 1 - Streams listed on the 2006 Montana Integrated Water Quality Report

Stream/TMDL Category	Probable Impaired Use[1]	Probable Cause of Impairment	Probable Source of Impairment	Location
Butcher Creek Category 5	Aquatic Life Support (P), Cold Water Fishery (P), Primary Contact - Recreation(P)	Chlorophyll-a, Phosphorous, Sedimentation/Siltation, Fish-Passage Barrier, Solids (suspended/bedload)	Source Unknown, Hydrostructure Impacts on Fish Passage, Natural sources.	Headwaters to Hwy 78.
Red Lodge Creek Category 4C	Aquatic Life Support (P), Cold Water Fishery (P)	Alteration in stream-side or littoral vegetative covers	Grazing in Riparian or Shoreline Zones, Crop Production (Crop Land or Dry Land)	West Fork to Cooney Reservoir.
West Red Lodge Creek Category 1	All uses fully supported	na	na	Wilderness boundary to mouth.
East Rosebud Creek Category 1	All uses fully supported	na	na	Wilderness boundary to Morris Cr.
West Rosebud Creek Category 5	Aquatic Life Support (P), Cold Water Fishery (P)	Benthic-Macroinvertebrate Bioassessments (Streams)	Source Unknown.	Headwaters to mouth.

[1] N = Not supporting, P = partial support, na = not applicable

The State of Montana has the authority to develop TMDLs. On streams with multiple ownership, the Forest Service cooperates with the State and other adjacent landowners in the development process. Additionally, the fact that a particular stream is listed does not preclude management activities from taking place. Montana Code Annotated (MCA) 75-5-703(10)(c), states: (10) Pending completion of a TMDL on a water body listed pursuant to 75-5-702: (c) new or expanded non-point source activities affecting a listed water body may commence and continue their activities provided those activities are conducted in accordance with reasonable land, soil, and water conservation practices.

c. Forest Service

National Direction

On March 20, 1996, the Chief of the Forest Service, Jack Ward Thomas and the Director of the Bureau of Land Management, Mike Dombeck issued a letter to Regional Foresters and State Directors concerning Accelerating Cooperative Riparian Restoration and Management. They state: "This undertaking is important to us. It represents an opportunity to work together on one of the most significant resources charged to our care, and to involve communities connected by the riparian zone. The USDA Natural Resource Conservation Service will be a principal partner as we begin to implement riparian restoration on a watershed scale in cooperation with all landowners. It is time to fix the creeks! We will work collaboratively to implement this program. This approach requires the integration of ecological, economic, social factors, and participation of affected interests. These are the elements proven effective in successful demonstration areas throughout the West." (USDA Forest Service, 1996a).

Custer National Forest Land and Resources Management Plan

Management goals for soil, water and riparian resources are identified in the Forest Plan under Chapter II - Forest Wide Management Direction and Chapter III – Management Area Direction.

The Forest Plan goal for watershed management is to: "[E]nsure that soil productivity is maintained and that water quality is maintained at a level which meets or exceeds state water quality standards", while the goal for riparian areas include: "[M]anage for water quality, provide diverse vegetation, and protect key wildlife habitat in these areas from conflicting uses and uses and activities that adversely impact these areas will be mitigated." (pages 3 and 4)

Forest Plan objectives for soil and water resources are: "Continue to produce water that meets State water quality standards. National Forest System lands will be managed so that the soil and watershed conditions are in a desirable condition and will remain in that condition for the foreseeable future. Soil and water quality objectives are designed to assure that these resources meet State water quality objectives and BMP's (Best Management Practices) are incorporated to assure this." Objectives for riparian areas include recognition of their unique values, and management direction is to be designed to protect these key wildlife habitats and improve water quality: "[T]hese areas will be managed in relation to various legally mandated requirements including, but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, and cultural resources." (page 5)

Goals for Management Area M (Riparian) are: "Manage to protect from conflicting uses in order to provide healthy, self-perpetuating plant and water communities that will have optimum diversity and density of understory and overstory vegetation." (page 80)

Forest Wide Management Standards for wildlife and fisheries state: "Management activities, including prescribed fire, will be conducted to maintain or enhance the unique value associated within woody draws and riparian zones, as well as a variety of successional vegetative stages." Additionally, "Shorelines along reservoirs and lakes that support cold or warm water fisheries will be managed to encourage the establishment of bank vegetation, and maintenance [or] improvement of water quality." (page 18 and 19)

d. Best Management Practices

As identified above under Surface Water Quality Standards, soil and water conservation practices (or BMPs) are the primary mechanism to minimize water quality impacts from non-point source pollution and still allow dispersed land management activities to occur on National Forest land. To reach these objectives the Forest Service developed a soil and water conservation practice handbook.

R1/R4 Forest Service Soil and Water Conservation Practices (SWCP) Handbook (USDA Forest Service 1995)

Practices specific to range management include:

17.01 - Range Analysis, Allotment Management Plan, Grazing Permit System and Permittee Operating Plan
17.02 - Controlling Livestock Numbers and Season of Use
17.03 - Controlling Livestock Distribution
17.04 - Rangeland Improvements
17.05 - Riparian Planning Considerations for Grazing

These practices were refined, based on site-specific conditions, to arrive at the desired grazing management system (including range improvements and allowable use standards) for the preferred alternative. They incorporate all of the objectives and guidelines identified below in the Montana Conservation Practice Specification for Prescribed Grazing CODE 528. The SWCP Handbook is planned for revision at the national level in 2008.

Cooperative Direction Letter from the Governor of Montana, U.S. Forest Service Regional Forester – Northern Region, and the State Director of the Bureau of Land Management (USDI Bureau of Land Management, USDA Forest Service, State of Montana 1996).

In reference to the Montana Conservation Practice Specification for Prescribed Grazing, signatories state "we have jointly prepared this rather unprecedented letter to you, our respective field office managers, to encourage the use of this Prescribed Grazing Standard, in a voluntary manner, to achieve our agencies' management objectives and meet the provisions of the Montana Water Quality Act and other state and federal laws as they relate to livestock grazing."

The Montana Conservation Practice Specification for Prescribed Grazing Code 528 (USDA Natural Resources Conservation Service 2005)

This conservation practice has the following purposes related to water resources:

- Improve or maintain the health and vigor of plant communities.
- Improve or maintain water quality and quantity.
- Reduce accelerated soil erosion and maintain or improve soil condition.
- Improve or maintain the quantity and quality of food and/or cover available for wildlife [including riparian dependant species].

Other recommendations relevant to riparian areas include:

<u>Streambank Stability</u>: Streambank stability is critical for maintaining or improving riparian condition and function. Riparian functions of a stream include sediment filtering and transport, bank building, water storage, aquifer recharge, and energy dissipation. These and other stream functions are necessary to provide for beneficial uses of water and are dependant on stable streambanks. Streambank disturbance from grazing must be managed according to the stream type, planned resource conditions, and management objectives for the stream. Areas that should be considered of high concern are those with actively eroding banks, or high erosion potential; those that contain sensitive fish or plant species habitat; and those in poor functioning condition.

<u>Livestock Grazing Patterns and Distribution in Riparian Areas</u>: Facilitating practices are often needed to control grazing use of riparian areas due to their high grazing preference. Some of these practices include: riding or herding, salt placement in uplands, fencing, off-stream development of high quality water, renovating and seeding uplands, prescribed burning of uplands, and placement of rock or vegetative obstacles on streambanks.

<u>Planned Grazing Systems</u>: Management should allow for flexibility of timing that livestock are turned onto or removed from a grazing unit, based on yearly variations in climate. For example, during years of below normal precipitation, livestock may tend to graze riparian areas earlier in the season and more intensely than during

times of normal precipitation. The management strategy should allow for livestock to enter the range unit earlier in the season to make better use of all available forage, and then be taken out of the unit sooner. If this is not practical due to breeding or calving cycles, the livestock should be put into an alternative “dry year” pasture when utilization target levels are met earlier than usual.

Herbaceous Forage Utilization: Adequate vegetative stubble height on the greenline at the end of the growing season is important to provide streambank stability, protect streambanks from runoff events, and trap and filter potential sediment deposits. Desired vegetation that can meet these criteria are deep rooted water loving species. Grazing management should allow for a minimum of 3 to 5 inches of stubble height to remain on the riparian areas at the time of year protection is needed for peak runoff events, such as springtime flows or summer storms. Some sites may require more stubble height to protect beneficial uses. In certain stream types, when riparian areas are of high concern, herbaceous utilization levels approaching 50 percent use may also be associated with other resource impacts such as overbrowsing of desirable woody species, and causing streambank shearing or trampling. The type of soil material, amount of rock on streambanks, type and amount of vegetation, length of grazing and rest periods, and season of use all dictate how these resources are affected and to what degree.

Woody Riparian Species: Trees and/or shrubs are essential for stabilizing certain stream types, and certain riparian plant communities. Where present, woody species act as a barrier to livestock and wildlife, provide fish cover and help prevent streambanks from being trampled or eroded by animals trailing along the banks. Maintaining woody species for streambank protection is often the most efficient way to protect streams from degradation. Trees and shrubs can be managed to reduce animal access to streambanks. Relatively dense stands of willow, alder, or other species along the stream channel will protect the streambanks from animal trampling, and also provide winter and summer shelter and cover. Wildlife use of woody browse can be a significant factor when trying to maintain or restore woody vegetation. Wildlife use should be documented in the grazing unit so that it is not attributed to livestock.

ASSUMPTIONS, METHODOLOGY AND SCIENTIFIC ACCURACY OF INFORMATION USED

The methodology used to assess existing riparian condition is described under section **c. Riparian Condition-*Proper Functioning Condition Assessment.*** It is a subjective evaluation by an interdisciplinary team, but the assessment protocol has scientific basis as described in USDI Bureau of Land Management (1998, 2003).

The effects of the proposed changes in grazing management on riparian systems, are based on a number of key factors and how they differ from current management. These factors include 1) construction of new range improvements, i.e., fencing, 2) implementation of active management tools, e.g., herding, salting and the use of mid-season triggers to move livestock within or from the pasture, 3) existing condition and resiliency of the riparian areas, and 4) monitoring and adaptive management. Comparing changes in allotment management variables, i.e., number of livestock, grazing duration and AUMs was not useful for determining effects as discussed under ***Alternative 3 – Proposed Action***.

It is important to understand that predicting the effects of livestock grazing management on future riparian conditions is a highly uncertain task. This is due to the variability of natural processes and characteristics, the uncertainty of implementation and administration of past and proposed management, and the variability of the effectiveness of proposed management assuming adequate implementation. Relevant research supporting the effects discussion is provided under sections ***General Grazing Influences and Background- Research Recommendations for Livestock grazing in Riparian Areas***.

AFFECTED ENVIRONMENT

Introduction

Both natural events and human activities have the potential to impact soil, water and riparian resources on both forest and range lands. Significant natural events include wildfire and floods, while the most significant human activities include mining, livestock grazing, roads, floodplain development, timber harvest and recreation. The degree of impact depends upon the soil and hydrologic characteristics of the watershed and how sensitive and

resilient they are to these disturbances. Soil and hydrologic characteristics vary extensively across landscapes and thus are dictated by local landform, geologic material and climate.

a. Natural Characteristics and Processes

Elevations within the project area range from 5,400 feet near the forest boundary to 7400 feet near the upper most areas of most allotments. Based on a 30 year period of record, the average annual precipitation associated with these elevations range from 24 to 32 inches (Montana State Library - Natural Resource Information System (http://nris.state.mt.us/gis/gisdatalib/downloads/precip_Stillwater.pdf).

The underlying geology within the project area is glacial outwash over granite bedrock. These structures have produced steep mountain side slopes, wide and relatively flat valley bottoms, and moderately sloping prairie foothills. Soils are generally deep unconsolidated alluvium, which results in relatively sinuous lower mainstem channels that are prone to further lateral adjustment during peak runoff events. Rotational slumps have occurred along slopes adjacent to the prairie, while recent debris flows have occurred in tributary channels of East and West Rosebud. Perennial flow occurs in both tributary and mainstem channels thoughout the analysis area. Springs and small ponds are also relatively common.

Vegetation is generally robust throughout the area. It is largely defined by climate and soils, but other natural agents including fire, wind and insects or disease can drastically alter vegetative structure. Within the project area, the most recent fire occurred in the East Rosebud drainage; the 1996 Shepard Mountain Fire. Insect or disease mortality has occurred across the Beartooth Front, but has not been quantified for this analysis area. The wind events of this past winter have mostly affected areas outside of the analysis area.

Under vegetated conditions, natural stream sediment load and transport processes are generally limited to instream erosion. Disturbance events that significantly reduce vegetative cover can result in significant surface erosion, and the slumps and debris flows mentioned previously, especially when followed by high intensity precipitation events. Subsequent sediment delivery to stream systems can be significant, but generally short lived, after these events.

b. Human Influences

Human influences on water resources in the analysis area include travel routes, recreation, timber harvest, fire suppression, hydroelectric operations, redistribution of wildlife, and livestock grazing.

The 2007 Beartooth Travel Manangement DEIS identified a couple of road spurs in the West Red Lodge Creek watershed that are impacting water quality. Other roads are generally located on mid slopes, which provide adequate filter distance for trapping sediment. No roads constrict natural stream meandering or reduce floodwater access to floodplains within the project area. Impacts of roads across private land that access Forest Service land were not assessed.

The most recent timber harvest activities occurred in the Red Lodge Creek watershed about 20 years ago. These activities were limited in extent and generally not located along streamside zones. Although not fully documented, these activities have likely recovered and are not currently influencing riparian systems.

Fire suppression efforts since the early 1900s have reduced the frequency and size of wildfires from historic levels. These suppression efforts have likely resulted in excessive fuel accumulations that may allow for more wide spread stand replacement fires in the future, thereby increasing the risk of higher than normal peakflows and associated flood impacts. Except for the East Rosebud Allotment, fuel loads are high throughout the analysis area.

The Mystic Lake hydro-electric operations began in 1922. A recent re-licensing effort involved substantial monitoring of water and fisheries resources. This monitoring suggests that, in general, these resources have not been significantly influenced by the operations. Although the operations are not expected to change, monitoring will continue under the new license to determine if trends in resource conditions occur, including trends in riparian condition along the mainstem of West Rosebud.

Historically, beaver influenced many reaches within and below the Forest boundary through the development of dams and ponds. Excessive trapping over the years has reduced beaver populations and likely resulted in lower water tables, smaller willow communities and overall less wetland/riparian/aquatic habitat throughout the analysis area. For the most part, stream systems have reached a new level of equilibrium in form and function in the absence of beaver.

Big game distribution is likely influenced by human development, especially adjacent to the Forest boundary. Concentrated use by elk was observed in the Butcher Creek Allotment and localized impacts occur on streams and springs.

Livestock grazing has occurred within the project area since the early 1900s. Livestock numbers have decreased over the years; in some allotments quite substantially. For example, actual use in the West Rosebud Allotment averaged 467 AUMs in the '40's to 60's and dropped to 412 permitted AUM's in 1976, and 364 permitted AUM's in 1983. Current permitted AUM's is 226. Livestock grazing effects are discussed in site-specific terms under section

General Grazing Influences

The effects of livestock grazing on riparian resources in the western United States are well documented. Riparian zones are often grazed more heavily than upland zones because they have flatter terrain, water, shade, and more succulent vegetation (Platts 1991). The effects may best be summarized by Platts (1991) in his review of nine references. He states: "Livestock grazing can affect the riparian environment by changing, reducing, or eliminating vegetation, and by actually eliminating riparian areas through channel widening, channel aggradation, or lowering of the water table. Streams modified by improper livestock grazing are wider and shallower than they would have been normally. Generally, in grazed areas, stream channels contain more fine sediment, streambanks are more unstable, banks are less undercut, and summer water temperatures are higher than is the case for streams in ungrazed areas; therefore, salmonid populations are reduced."

Kauffman et al. (1983) also summarized their review of five references in similar fashion: "[They] found livestock grazing and excessive trampling caused a decrease in bank undercuts, increase in channel widths, and a general degradation of fish habitat." From their own research in Oregon, Kauffman, et al. (1983) found that significantly greater streambank erosion and disturbance occurred in grazed areas than in exclosed areas. Grazed portions of the streambank also had significantly fewer undercuts than exclosed areas. The grazing period was late season - early August to late September. During nongrazing periods (late September to early August the following year) erosion was not significantly different between grazed and exclosed areas. However, erosion related to livestock grazing and trampling was enough to create significantly greater annual streambank losses when compared to ungrazed areas.

Armour et al. (1994) indicate that livestock damage to riparian habitats is also amply addressed in the literature for which they reference nine documents. Their summary of these references suggest that: "[D]amage [to fish habitat] includes 1) loss of riparian vegetation by changing the composition and quantity of streamside vegetation and altering channel morphology, 2) lower groundwater tables and decreased summer streamflows, and 3) increased summer water temperatures and winter icing. The result is deteriorated conditions for wildlife, fish and other aquatic organisms. Vegetation is an extremely important influence on hydrologic conditions within a watershed, and any activity, including over grazing, that decreases [streamside] vegetation can adversely affect hydrologic conditions and diminish summer stream flows."

Monitoring grazed and ungrazed (exclosed) reaches along sensitive and resilient stream types in the Castle Mountains of central Montana supports the above statements related to channel width and depths, levels of fine sediments, and amount of unstable and undercut banks. The data suggests that channel geometry was wider and shallower, levels of fine sediment were higher, unstable banks were more frequent and undercut banks less frequent along a grazed reach verses an ungrazed reach (USDA Forest Service 2002).

From a watershed perspective, Blackburn (1983) states: "Livestock grazing affects watershed properties by altering plant cover and by the physical action of their hooves. Reductions in the vegetative cover may: (a)

increase the impact of raindrops, (b) decrease soil organic matter and soil aggregates, (c) increase surface soil crusts, and (d) decrease water infiltration rates. These effects may cause increased runoff, reduced soil water content, and increased erosion."

A similar watershed perspective, Ponce (1989), states: "Generally, livestock grazing affects watershed response by the removal of protective plant cover and by trampling. Removal of vegetation has the following effects: 1) It increases the impact energy of raindrops, encouraging splash erosion and dislodgement of soil particles from the surface. 2) It decreases soil organic matter, decreasing soil infiltrability. 3) It increases surface runoff, encouraging the entrainment and transport of fine suspended sediments and the eventual development of relatively impermeable surface crusts, further abetting surface runoff and sheet erosion. Livestock trampling has the following effects: 1) It destroys the protective cover of plant litter, decreasing infiltration and surface detention and increasing surface runoff. 2) It decreases the bulk density of the soil beneath the surface, decreasing soil infiltration and increasing surface runoff. The net effect of grazing is increased surface runoff and erosion and a decreased rate of subsurface moisture replenishment."

Elmore and Beschta (1987) suggest: "[P]art of the problem with riparian-area management is perception. Even an observant person living along a creek may not detect the subtle changes in stream character and vegetation composition that are occurring with time. Each generation may be aware only of seemingly small incremental changes, the cumulative effects of these changes over long periods of time can be substantial. Many people have never seen a healthy rangeland riparian area, since degradation was widespread before many of us were born. The whole picture may not be obvious even to old-timers, because many changes occurred before the turn of the century." They go on to suggest that many factors can result in adverse changes to riparian areas: changing climatic and precipitation patterns, more frequent flooding, altered beaver populations, heavy streamside grazing, improper use of upland watersheds, road construction, and others. "Yet, when we look at all the factors that can and do influence the present condition of riparian areas in the West, livestock grazing is unquestionably a significant factor. Since grazing is intrinsically associated with the problems, it is also fundamentally important in the solutions."

c. Riparian Condition

Proper Functioning Condition Assessment

Riparian systems were assessed during the 2005 field season following the Proper Functioning Condition (PFC) Assessment process (USDI Bureau of Land Management 1998, 2003). The process allows for independent evaluation of both lentic (standing water) and lotic (flowing water) systems. The PFC process categorizes riparian systems into one of three condition classes: Functioning, Functioning At-Risk and Nonfunctioning. Refer to Tables 2 through 5 for reach/site specific riparian issues identified through this PFC assessment. Refer to the PFC Plot Locations Map for the location of these reaches. Refer to the project file for PFC assessment forms.

The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation. "Systems are **Functioning** properly when adequate vegetation, landform, or large woody debris is present to 1) dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality, 2) filter sediment, capture bedload, and aid floodplain development, 3) improve flood-water retention and ground-water recharge, 4) develop root masses that stabilize streambanks against cutting action, 5) develop diverse ponding and channel characteristics to provide the habitat and water depth, duration and temperature necessary for fish production, waterfowl breeding, and other uses, and 6) support greater biodiversity. Systems that are **At-Risk** are in a functional condition but an existing soil, water, or vegetation attribute makes them susceptible to degradation. Systems that are **Non-Functioning**, clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows and thus are not reducing erosion, improving water quality or protecting beneficial uses. The absence of certain physical attributes, such as a floodplain, where one should be, is an indicator of nonfunctioning conditions." (USDI Bureau of Land Management 1998)

Some riparian systems in the analysis area have characteristics of both lentic and lotic environments. Lotic characteristics include linear gradients sufficient to produce flowing water, sinuosity (at least for the valley bottom), and potential for infrequent flash flood events. However, unlike higher elevation, snowmelt dominated

stream systems with large drainage areas, the low discharge, spring dominated flow regime of these systems do not produce a significant annual spike in the hydrograph and may be more representative of lentic systems. Due to the lack of significant annual bankfull flows, channel characteristics are not well defined along most or all of these reaches. Thus, the function of riparian vegetation in stabilizing streambanks under annual peakflow events is reduced, although still important for infrequent flash flood events. Lentic issues include surface/subsurface flow patterns and processes. Adequate assessment of PFC for these types of systems requires a combination of lotic and lentic criteria. A hybrid assessment process was developed by the National Riparian Service Team in cooperation with Custer National Forest personnel and incorporated into this analysis (Wiley 2006).

These PFC assessments are the first and only documented field reviews of riparian conditions within the project area. These one-time surveys are the basis for determining the existing channel conditions and sensitivity to grazing and floods. A one-time survey is sufficient to determine existing conditions and what the conditions are most likely due to. Where livestock grazing is determined to be a major factor in the current conditions, current year grazing effects are obvious where cattle hoof prints and cow excrement is observed. Cumulative grazing impacts over many years can be identified through changes in stream, soil, and vegetative features, i.e., gradual bank sloping, hummocks, soil compaction, lack of vegetative vigor and composition, stunted/hedged shrubs, etc.

Trends in riparian conditions are difficult to identify based on one site visit. Trends can generally be inferred, based on known changes in livestock management, or known disturbance events, but the certainty of the trend estimates is relatively low. In general, the trends for all reaches is up from a long-term perspective due to decreases in stocking rates over past decades, recent rest due to non-use, and natural recovery from past wildfire events. However, these long-term trends may have reached a new plateau and may now be considered static. The current trend for all reaches is considered *not apparent*.

It is important to understand that proper functioning condition, as defined by the PFC assessment process, is a minimum level condition that provides the necessary attributes to maintain riparian stability, but may not result in conditions that provide high quality waters which fully support all beneficial uses including habitat for riparian dependent species (USDI Bureau of Land Management 1998, Figure 3, page 16).

Properly functioning streams that provide high quality habitat for fisheries and other riparian dependent species including migratory birds, amphibians, and mammals comply with all applicable State and Federal laws, the direction in the Custer National Forest Land and Resources Management Plan, and are the objectives of this AMP revision process. Systems that are clearly functioning at-risk likely exhibit degraded habitat for riparian dependent species and therefore, likely do not comply with applicable State and Federal laws pertaining to water quality and associated beneficial uses.

Existing Condition

Fifteen reaches, or 7.38 miles of perennial stream were surveyed using the Lotic (flowing water) PFC methodology. Five reaches (1.16 miles) were determined to be less than properly functioning, in part due to grazing. Six ponds were surveyed using the Lentic (standing water) PFC methodology and one was determined to be less than properly functioning, in part due to grazing. Four sites were surveyed using the low flow, spring fed wetland water course checklist. Three of these sites (0.48 miles) were determined to be less than properly functioning, in part due to grazing. The individual components of riparian function causing these conditions are identified below in Tables 2 through 4 below. The location of individual riparian sites are provided on Maps 5-A, 5-B & 5-C, Riparian Functioning Condition Plot Inventory. Allotments that contain streams that are less than properly functioning include Butcher Creek, and East and West Rosebud. Changes in grazing management have the potential to improve the condition of these streams because grazing impacts are the most direct and significant of all the activities that influence them. Impact from other activities including existing roads and recreation may be addressed through travel management planning. Perennial streams are of limited extent in the Red Lodge Allotment and were not surveyed.

Table 2 - Riparian Reach Attributes

REACH/ POND ID	NAME	ALLOTMENT/ PASTURE	LENGTH MILES	PFC RATING[1]	STREAM TYPE[2]	SENSITIVITY[3]
EB01	EF Rosebud - lower mainstem	East Rosebud	0.35	PFC	C3/4a	High
EB02	EF Rosebud - beaver pond	East Rosebud	na	PFC	na	Low
EB03	EF Rosebud - middle mainstem	East Rosebud	0.98	PFC	C4/5	High
EB04	EF Rosebud - beaver pond	East Rosebud	na	PFC	na	Moderate
EB05	EF Rosebud - upper mainstem	East Rosebud	0.28	**FAR**	B3/4a	Moderate
EB06	EF Rosebud - unnamed trib (lower)	East Rosebud	0.24	PFC	A2/3/4	Low
BB01	EF Rosebud - unnamed trib (upper)	Black Butte Admin	0.42	PFC	B4/A3	Moderate to Low
BB02	EF Rosebud - beaver pond	Black Butte Admin	na	PFC	na	High
WB01	WF Rosebud - pond	West Rosebud	na	**FAR**	na	Low
WB02	WF Rosebud - middle mainstem	West Rosebud	1.68	PFC	B/C3/4	Moderate to High
WB03	Morris Creek	West Rosebud	1.25	PFC	B3/4/5	Moderate
WB04	WF Rosebud - unnamed trib (south)	West Rosebud	0.38	PFC	B4/5	Moderate
WB05	WF Rosebud - unnamed trib (north)	West Rosebud	0.40	PFC	A2/B/D4/5	Low to High
WB06	WF Rosebud - pond	West Rosebud	na	PFC	na	High
WB06A	WF Rosebud - unnamed low-flow trib	West Rosebud	0.09	PFC	np	Moderate
WB07	WF Rosebud - unnamed trib (west)	West Rosebud	0.32	PFC	B2/3/4a	Moderate to Low
WB08	WF Rosebud - pond (southside)	West Rosebud	na	PFC	na	High
WB08A	WF Rosebud - unnamed low-flow trib	West Rosebud	0.31	**FAR**	np	High
WB09	WF Rosebud - unnamed trib	West Rosebud	0.16	**FAR**	np	High
WB10	WF Rosebud - unnamed trib	West Rosebud	0.19	PFC	B2/3/4/5a	Moderate to Low
BC01	Butcher Creek - unnamed low-flow trib (east)	Butcher Creek	0.08	**FAR**	np	Moderate
BC02	Butcher Creek - unnamed trib	Butcher Creek	0.18	**FAR**	B4/5	Moderate
BC02A	Butcher Creek - unnamed low-flow trib	Butcher Creek	na	**FAR**	G/B4/5	High
BC03	Butcher Creek - unnamed trib (middle)	Butcher Creek	0.19	**FAR**	B4/5	Moderate
BC04	Butcher Creek - unnamed trib (west)	Butcher Creek	0.35	**FAR**	G/F4/5	High

[1] PFC= Proper Functioning Condition, FAR= Functioning At-Risk, NF= Non-Functioning
[2] Refer to Rosgen (1996) Classification System. na= not applicable to pond sites, np= not possible to type stream due to lack of bankfull features.
[3] Sensitivity based on either stream type classification or visual observations.

Table 3 - Lotic Proper Functioning Condition Criteria[1] Indicating Potential Impairment of Riparian Function

Lotic PFC Evaluation Criteria[1]		BB 01	BC 02	BC 03	BC 04	EB 01	EB 03	EB 05	EB 06	WB02	WB03	WB04	WB05	WB07	WB09	WB10
1	FLOODPLAIN NOT INUNDATED			X	X			X								
2	BEAVER DAMS NOT STABLE															
3	CHANNEL GEOMETRY NOT IN BALANCE		X	X	X										X	
4	RIPARIAN ZONE NOT WIDENING		X	X											X	
5	UPLAND WATERSHED CONTRIBUTING TO DEGRADATION	X				X	X	X							X	
6	AGE-CLASS NOT DIVERSE				X			X							X	
7	VEG COMPOSITION NOT DIVERSE														X	
8	MAINTENANCE OF SOIL MOISTURE NOT OCCURRING				X										X	
9	ROOT MASSES NOT ABLE TO WITHSTAND STREAMFLOWS						X								X	
10	PLANTS DO NOT EXHIBIT HIGH VIGOR															
11	VEG COVER NOT PRESENT TO PROTECT BANKS															
12	INADEQUATE SOURCE OF WOODY DEBRIS															
13	CHARACTERISTICS NOT ADEQUATE TO DISSIPATE ENERGY											X			X	
14	POINT BARS NOT REVEGETATING															
15	LATERAL MOVEMENT NOT NATURAL				X										X	
16	VERTICALLY UNSTABLE															
17	STREAM NOT IN BALANCE WITH WATER AND SEDIMENT		X	X	X										X	
	CONDITION RATING[2]	**PFC**	**FAR**	**FAR**	**FAR**	**PFC**	**PFC**	**FAR**	**PFC**	**PFC**	**PFC**	**PFC**	**PFC**	**PFC**	**FAR**	**PFC**

[1] The 17 evaluation criteria as identified in the Lotic Proper Functioning Condition Assessment (USDI Bureau of Land Management 1998).
[2] PFC= Proper Functioning Condition, FAR= Functioning At-Risk, NF= Non-Functioning

Table 4 - Lentic PFC Criteria[1] Indicating Potential Impairment of Riparian Function

Lentic PFC Evaluation Criteria[1]		BB02	EB02	EB04	WB01	WB06	WB08
1	AREA NOT SATURATED OR INUNDATED						
2	WATER LEVEL FLUCTUATION EXCESSIVE						
3	RIPARIAN ZONE NOT AT POTENTIAL						
4	UPLAND WATERSHED CONTRIBUTING TO DEGRADATION						
5	WATER QUALITY NOT SUFFICIENT						
6	FLOW PATTERNS ALTERED						
7	STRUCTURE DOES NOT ACCOMMODATE SAFE PASSAGE OF FLOWS	X					
8	AGE-CLASS NOT DIVERSE				X		
9	VEG COMPOSITION NOT DIVERSE				X		
10	MAINTENANCE OF SOIL MOISTURE NOT OCCURRING						
11	VEGETATION NOT ABLE TO WITHSTAND WIND, WAVE, FLOW EVENTS						
12	PLANTS DO NOT EXHIBIT HIGH VIGOR						
13	VEG COVER NOT PRESENT TO PROTECT BANKS						
14	FROST/HEAVING PRESENT				X		
15	UNFAVORABLE MICROSITE CONDITIONS						
16	CHEMICALS AFFECTING PLANTS APPARENT						
17	SATURATION NOT SUFFICIENT TO MAINTAIN HYDRIC SOILS						
18	NOT CAPABLE OF RESTRICTING WATER PERCOLATION						
19	AREA NOT IN BALANCE WITH WATER AND SEDIMENT						
20	CHARACTERISTICS NOT ADEQUATE TO DISSIPATE ENERGY						
	CONDITION RATING[2]	**PFC**	**PFC**	**PFC**	**FAR**	**PFC**	**PFC**

[1] The 17 evaluation criteria as identified in the Lentic Proper Functioning Condition Assessment (USDI Bureau of Land Management 1998).
[2] PFC= Proper Functioning Condition, FAR= Functioning At-Risk, NF= NonFunctioning

Table 5 - Low Flow, Spring Fed PFC Criteria[1] Indicating Potential Impairment of Riparian Function

Low Flow, Spring Fed Wetland Water Course Evaluation Criteria[1]		BC01	BC02A	WB06A	WB08A
1(lentic)	AREA NOT SATURATED OR INUNDATED				
2	BEAVER DAMS NOT STABLE				
3	CHANNEL GEOMETRY NOT IN BALANCE	X	X		X
4	RIPARIAN ZONE NOT WIDENING	X	X		
5	UPLAND WATERSHED CONTRIBUTING TO DEGRADATION	X	X		X
6(lentic)	FLOW PATTERNS ALTERED	X	X		X
6	AGE-CLASS NOT DIVERSE		X		
7	VEG COMPOSITION NOT DIVERSE		X		
8	MAINTENANCE OF SOIL MOISTURE NOT OCCURRING				
9	ROOT MASSES NOT ABLE TO WITHSTAND STREAMFLOWS				
10	PLANTS DO NOT EXHIBIT HIGH VIGOR		X		
11	VEG COVER NOT PRESENT TO PROTECT BANKS		X		
12	INADEQUATE SOURCE OF WOODY DEBRIS				
14(lentic)	FROST/HEAVING PRESENT				
13	CHARACTERISTICS NOT ADEQUATE TO DISSIPATE ENERGY		X		
16	VERTICALLY UNSTABLE		X		
17(lentic)	SATURATION NOT SUFFICIENT TO MAINTAIN HYDRIC SOILS		X		
19(lentic)	AREA NOT IN BALANCE WITH WATER AND SEDIMENT				
	CONDITION RATING[2]	**FAR**	**FAR**	**PFC**	**FAR**

[1] These riparian systems have a mix of lotic and lentic characteristics. See discussion under PFC Assessment section above.
[2] PFC= Proper Functioning Condition, FAR= Functioning At-Risk, NF= NonFunctioning

Reaches found to be functioning at-risk have vegetative, hydrologic or soil attributes that are not adequately supported. In general, the concerns in these systems include 1) impairment of water storage and release processes, 2) reduced channel, bank and vertical stability, and 3) degraded habitat for riparian dependant wildlife and aquatic/semi-aquatic species. Refer to the aquatics and wildlife sections for discussion of riparian dependant species concerns.

Water Storage and Release

Long-term over-utilization of riparian vegetation and streamside trampling and trailing has likely affected water storage and release processes along two riparian sites (BC02A and WB08A). A reduction in vigor and density of deep-rooted riparian vegetation (i.e., root biomass) has likely decreased infiltration rates and increased surface runoff rates. Toledo and Kauffman (2001) documented these relationships in a study in northeast Oregon. Additionally, long-term trampling and trailing has likely compacted streamside soils. Overly compacted streamside soils can affect water movement into these soils in two ways. 1) Similar to the effects of reduced root biomass, compacted soils also generally have reduced infiltration rates. This again, increases the potential for overland flow and routing of precipitation (rain and snowmelt) directly to streams, thereby bypassing hill-slope recharge processes in localized areas (Ponce 1989). 2) Compacted soils reduce capillary action and movement of streamflow into adjacent soils along portions of the stream course, thereby bypassing recharge of adjacent soils by streamflow. Decreased infiltration, increased surface runoff, and reduced storage capacity of adjacent streamside soils means less water is held on the land for less time.

Livestock trampling and trailing has also widened portions of stream channels and reduced vegetative cover along portions of the stream course. This exposes more surface water to evaporation processes, which further reduces water available to recharge adjacent streamside soils and augment baseflow in reaches further down the valley.

As discussed below, entrenched channels occur along portions of these streams. Entrenched channels generally coincide with lower water tables, and narrow or absent riparian areas. These conditions further compound the effects to storage and release processes discussed above.

The combination of reduced riparian vegetation and increased soil compaction, evaporation, and channel entrenchment have likely affected water storage and release processes within these narrow and short riparian systems.

Channel, Bank and Vertical Stability

Entrenched channels occur along portions of some streams within the analysis area (BC02A and BC04). These conditions are partially due to natural characteristics, but the magnitude of the condition has likely been intensified by past grazing management.

Long-term over-utilization of riparian vegetation and continuous streamside trampling and trailing has likely increased the rate of channel entrenchment. A reduction in vigor and density of deep-rooted riparian vegetation has likely decreased bank stability and resistance to peak runoff events. This is compounded by annual livestock trampling and trailing that has exposed and destabilized streamside and adjacent side-slope soils along portions of the stream course. As discussed above, reduced vegetative cover and increased compaction can increase surface runoff and magnitude of peakflows.

Entrenched channels confine a higher proportion of peakflow water to the main channel thereby reducing floodwater access to, and floodwater energy dissipation in, the floodplain. More energy confined to the main channel provides more energy available for lateral (bank cutting) and vertical adjustments (downcutting) throughout the system. Toledo and Kauffman (2001) also suggest that increased peakflows can increase the rate of channel entrenchment. The process can by cyclic and compound itself over time.

Stream Classification

Stream classification is difficult to apply at the reach scale for most streams within the project area because bankfull indicators are not apparent or are highly variable. This is due to either significant alteration by livestock grazing, or low discharge spring-fed flow regimes, or both. Therefore, visual estimates were made to determine the range of stream types according to the Rosgen Channel Classification System (Rosgen 1996). Stream types, where applicable, are displayed in Table 2, above.

Streams were categorized into three classes based on their sensitivity to grazing impacts and their ability to recover once these impacts are reduced or eliminated. Highly sensitive streams have the potential to contribute and route significant levels of fine sediment to stream systems or have the potential to change channel form and function relatively easily. These include Rosgen stream types A4-5, C4-5, D3-5, E4-5, F4-5, and G3-6 (Rosgen 1996). Although more easily impacted, they are often more resilient, requiring a shorter time to return to normal function once impacts are reduced or eliminated. F5 and G4 or G5 stream types are the exception here. Due to their entrenched nature, floodwaters are unable to access floodplains. The energy associated with floodwaters is thereby confined to the existing channel, which causes more bank erosion than for less entrenched channels. Entrenched stream types can also be susceptible to downcutting if the stream bottom is composed of fine textured material. Downcutting can lead to a lowering of the water table which can cause the vegetation type within the original riparian zone to change. When deep-rooted shrubs and grasses are replaced by shallow rooted species, such as Kentucky bluegrass, sensitivity of the stream system increases further.

Highly sensitive channels often have overhanging banks composed of fine textured soils, which are easily degraded through bank trampling. Bank trampling and over-utilization of shrubs often results in loss of root structure, vegetative vigor, and ultimately loss of bank structure. These conditions lead to exposed raw banks, increased instream erosion during runoff events, increased sediment loads, and ultimately result in an excessively wide stream channel. Excessively wide channels along a significant portion of stream length can lead to reduced stream velocities and reduced sediment transport capacity. This generally results in aggradation, i.e., the long-term accumulation of sediment in a stream system. The condition is compounded when banks are not allowed to stabilize and rebuild because of continual bank alteration by livestock. Hence, more bank erosion leads to wider

channels, higher sediment loads, and increased aggradation. Loss of bank structure (undercut banks) can also result in increased stream temperature and lower quality fish habitat.

Moderately sensitive stream types are more armored and have less risk of impact associated with grazing, although channel impacts can occur at high use levels beyond the ability of the channel to absorb the impact (Rosgen types A3, A6, B4-5, C3, C6, D6, E3, E6, F3, F6, and G2). These streams take longer to become impaired, but also are less resilient than highly sensitive stream types and generally require longer recovery periods.

Low sensitive stream types do not have the potential to change channel form and function easily and therefore, have a low potential to contribute and route significant levels of fine sediment to stream systems (Rosgen types A1-2, B1-B3, B6, C1-2, F1-2, G1). However, if these stream types are disturbed, either through management actions or catastrophic natural events, they generally will not recover rapidly. They are not resilient.

Of the 7.86 miles of streams surveyed, 2.15 miles have a high sensitivity, 2.45 miles have a moderate sensitivity, and 0.24 miles have a low sensitivity to grazing, while 3.01 miles have variable characteristics that produce segments of different sensitivities within the same reach. Refer to Table 2.

Desired Future Condition

The desired future condition for all riparian systems within the analysis area is to attain a properly functioning condition which provides the physical, chemical and biological attributes to fully support all beneficial uses. Fully supporting riparian systems are expected to exhibit a generally stable channel form (width, depth, sinuosity and gradient), which at the same time adjust in localized areas in response to natural disturbances. Bank erosion, channel scour, and deposition are minimal, but relative to the systems inherent stability. Levels of fine sediment are in balance with the transport capability of the streamflow. Vigor, density and diversity of riparian vegetation is highly similar to potential natural conditions and generally include deep rooted grass, sedge, rush and willow species. Streams are able to route most flood flows (less than 25 year recurrence interval) without significant adjustment to channel dimensions. Extreme floods may occur every 50 to 100 years and cause major channel adjustments, but these events are rare and separated by long periods of recovery and relative stability. Streamflow and water table levels are representative of undisturbed conditions, as are water quality parameters such as temperature, sediment, nutrients, and bacterial concentrations. Properly functioning riparian systems are resilient and better able to buffer the effects of disturbance events and climate extremes.

In a properly functioning condition, with less influence from livestock grazing, the width of perceptible streamflow along spring-fed streams within the project area is expected to be single thread and very narrow, perhaps only inches wide. The riparian zone is expected to be wider and much more densely vegetated. Riparian soils are expected to vigorously absorb and slowly release water. Water movement downslope through the dense organic/root matrix of a wider riparian zone would be slow and mostly imperceptible. Riparian zones are expected to maintain higher soil moisture and water levels during low flow periods.

ENVIRONMENTAL EFFECTS

a. Background

Research Recommendations for Livestock grazing in Riparian Areas

Riparian, stream and landform conditions and characteristics are highly complex and variable. As a result, science has not been able to provide a foolproof management system, or set of management practices, that will ensure recovery of all types of degraded riparian conditions. Therefore it is difficult, if not impossible, to predict with a high degree of certainty, what the future condition of currently degraded riparian systems will be with proposed changes in management. Science has however, provided insight and recommendations that can help determine general trends and rates of recovery of degraded riparian systems with a moderate degree of certainty.

Platts (1991) evaluated 17 grazing systems on their compatibility with fishery needs. These evaluations were based on information in the literature and to a great extent, his own observations. The evaluations were

summarized by rating them on a scale of 1 to 10, with 1 being poorly compatible with fishery needs and 10 being highly compatible. Although fish are not present in some of the reaches surveyed, these riparian areas can provide important habitat for amphibians, neo-tropical birds and small mammals.

Based on Platts (1991), ratings for potential management systems are as follows:

- Continuous season long and short duration/high intensity systems received a rating of 1,
- deferred rotation systems received a rating of 4,
- rest rotation systems received a rating of 5,
- corridor fencing received a rating of 9, and
- complete rest or closure received the highest rating of 10.

"Those systems that provide a high level of control over animal distribution and allow only light use on riparian vegetation are the most compatible with fishery needs" (Platts 1991). Habitat needs for other riparian dependant species in this analysis area are considered to be similar.

Aside from complete rest, there appears to be no single grazing system that will move all types of degraded riparian areas towards recovery with a high cerntainty. Clary and Webster (1989) state: "As more studies of grazing systems are completed, it appears that the complex array of factors in rangelands tends to buffer the theoretical benefits of many systems. This has been true in a number of comparisons of upland grazing, and experience in riparian areas has generally failed to show an advantage to any specific grazing system."

Ehrhart and Hansen (1997) suggest: "[R]iparian grazing might be incorporated into each of the traditional grazing systems-except season long- as long as the condition of the riparian zone itself remains of primary concern. Management, not the system, is the key."

Limiting the time spent in riparian areas and maximizing the time allowed for vegetative regrowth appear to be two important factors with the most potential to maintain functioning riparian systems. Myers (1989) evaluated 34 grazing systems in southwestern Montana and found systems that were successful in maintaining good to excellent riparian conditions:

- provided more days of post-grazing regrowth up to 9/15 (34.9 days compared to 20.8 for unsuccessful systems),
- limited days of hot season (7/1-9/15) grazing (12.5 days compared to 33.4 for unsuccessful systems),
- limited days of fall season (8/15-1/10) grazing (21.0 days compared to 36.5 for unsuccessful systems), and
- limited fall grazing treatment frequency (31.3% compared to 51.1% for unsuccessful systems).

Extrapolation of research results or recommendations from one locality to another always raises questions of whether or not it is appropriate. This problem is underscored by the results from Ehrhart and Hansen (1997) in their evaluation of 71 reaches on 34 ranches. They attempted to correlate vegetation types and riparian health with season of use and length of grazing period. Although some minor correlations where noted, significant correlations were not observed. This is due, in part, to the inability of the study to account for the many nuances between ranch operations. In conclusion they noted "what operators do to encourage livestock not to loiter in the riparian zone while they are in a pasture is more important than either season of use or length of time in the pasture per se".

Chaney et al. (1990) proposed similar rationale as Myers (1989) on limiting use and maximizing time for regrowth. They suggest incorporating one or more of the following features as the most promising strategy for protecting or restoring riparian areas:

- Include the riparian area within a separate pasture with separate management objectives and strategies.
- Fencing or herding livestock out of riparian areas for as long as necessary to allow vegetation and streambanks to recover.

- Controlling the timing of grazing to keep livestock off streambanks when they are most vulnerable to damage, and to coincide with the physiological needs of target plant species.
- Adding more rest to the grazing cycle to increase plant vigor, allow streambanks to heal, or encourage more desirable plant species composition.
- Limiting grazing intensity to a level which will maintain desired species composition and vigor.
- Changing from cattle to sheep to obtain better animal distribution through herding [although, this may have undesirable affects to uplands].
- Permanently excluding livestock from riparian areas at high risk and with poor recovery potential when there is no practical way to protect them while grazing adjacent uplands.

Ehrhart and Hansen (1997) suggest similar management practices related to time of use and time for regrowth:

- Limit the time livestock spend in pastures with riparian areas.
- Control the distribution of livestock within the targeted pasture.
- Ensure adequate residual vegetation cover.
- Provide adequate regrowth time and rest for plants.

In Stream and Riparian Area Management – A Home Study Course for Managers, Surber and Ehrhart (1998) again suggest similar management practices to minimize impacts to riparian areas:

- Tailor the grazing approach to the specific riparian area under consideration.
- Incorporate management of the riparian areas into the overall management plan.
- Select a season of use so grazing occurs during periods compatible with animal behavior, conditions in the riparian area and riparian objectives.
- Limit the time livestock spend in pastures with riparian areas.
- Influence the distribution of livestock within the targeted pasture.
- Ensure adequate residual cover.
- Provide adequate regrowth time and rest for plants.
- Be prepared to play an active role in managing riparian areas.

Mosley et al. (1997) indicate: "[A] growing body of research suggests that grazing intensity is the most important variable affecting response of upland range to cattle grazing. This appears true in riparian ecosystems as well. Even when timing and frequency of grazing are optimal, the plant-soil-water resource will deteriorate if cattle are allowed to excessively graze within riparian ecosystems."

Clearly, science has provided the direction; direction which if adequately implemented, should move degraded riparian conditions on an upward trend towards recovery. However, aside from complete rest, there again appears to be no set of management practices that will ensure recovery of all types of degraded riparian systems.

Grazing use of riparian vegetation appears to be a significant factor to measure in order to determine the proper duration of use, and allowable use levels appear to be an important management tool to control duration of use. Clary and Webster (1989, 1990) provide recommendations for maximum allowable streamside utilization of herbaceous forage and residual stubble heights by season of use as follows:

- Spring use should be limited to no more than 65%, while summer use should be limited to no more than 40 to 50%, and fall use should be limited to no more than 30%.
- Stubble height remaining at the end of the grazing period should be 4 to 6 inches. Special situations such as critical fisheries habitats or easily eroded streambanks may require stubble heights greater than 6 inches.

According to the Leonard et al. (1997), utilization guidelines, where used for riparian areas and riparian pastures, should:

- Maintain both herbaceous and woody species (where present) in a healthy and vigorous condition and facilitate their ability to reproduce and maintain different age classes in the desired riparian plant community.
- Leave sufficient plant residue to protect banks, filter sediment, and dissipate energy during runoff events.
- Maintain consistency with other resource values and objectives; e.g., esthetics, water quality, etc.

Although riparian forage utilization is an important tool to consider for managing grazing impacts on riparian systems, it is not the only tool. The R1/R4 Forest Service Handbook - Soil and Water Conservation Practice - 17.05 identifies two additional tools that have been found to be helpful to manage grazing impacts; streambank alteration and woody plant utilization (USDA Forest Service 1995). Streambanks and woody shrubs are important components of riparian systems and fishery habitat, which can also be significantly damaged by moderate to high levels of grazing use. Since streambank alteration is easier to monitor than woody species utilization, streambanks are the focus for the remaining discussion in this section.

In Grazing Management for Riparian-Wetland Areas, Leonard et al. (1997) states: “Limit streambank shearing and trampling to acceptable levels. (However, bank trampling guidelines should be set separately for stream reaches where this is important.)”

The Montana Monitoring for Success Guidebook (MT Department of Natural Resources and Conservation 1999) states: “[L]imiting livestock disturbance to streambanks helps maintain or improve water quality, vegetation production, and fish and wildlife habitat.” The guidebook also provides methodology for measuring streambank alteration and suggests that observer variability is generally consistent when streambank disturbance exceeds 25%. The guidebook was supported and signed by individuals from 18 State and Federal agencies and private organizations including the Montana Stockgrowers and Woolgrowers Associations and the Montana Association of State Grazing Districts.

The Idaho Soil Conservation Commission prepared a management practice titled Proper Grazing Use, Riparian Areas BMP Component Practice (Mosley et al. 1997). It incorporates the following key points related to streambanks:

- Streambank condition will show improvement until streambanks are stable and well vegetated or otherwise protected. Unvegetated or unstable streambanks will not increase but will show improvement until a stable condition is reached. This should be reflected in yearly streambank assessments, which over time show a trend of improvement (or maintenance) through an evaluation schedule in the grazing plan.
- Make management checks from half to two-thirds of the way through the planned season of use to determine the degree of use and condition of streambanks to provide time to make needed adjustments in grazing management.
- Final utilization and streambank condition will be determined at the end of the grazing season in the riparian unit.
- Livestock damage to streambanks can severely impact beneficial uses and should be given special consideration when developing livestock management plans for riparian areas.
- To prevent soil compaction and the development of shear points, livestock trailing on the streambanks should be discouraged by placement of obstructions or other methods.
- In systems where [streambank] stability is controlled by substrate, browse species or streambank damage will be used to determine proper levels of utilization.
- In streams that are deeply entrenched with vertical banks, or in situations where little or no herbaceous hydrophytic vegetation is present, the proper degree of use will be determined by the district conservationist taking into consideration streambank damage and deterioration and standards for utilization of woody species.
- Record streambank condition including percent breakage and percent stable streambanks before and at the end of the grazing season.

One final point that is continually emphasized by research is the need to rest degraded riparian areas prior to initiating management changes. Clary and Webster (1989, 1990) suggest the following: “Degraded riparian areas

may need complete rest to initiate the recovery process. The length of rest will depend upon vegetative composition and streambank condition. It may be as short as one year or it may be 15 years or longer. Recovery of degraded streambank form usually will require more time than the recovery of plant community composition, in some cases much more time, particularly if the channel has become incised and confined. Once an area has improved to a mid or high-seral status, through the use of rest or careful management, rotation management systems may allow riparian habitats to remain in good condition while being grazed."

Mosley et al. (1997) provides additional support for those recommendations: "It is important to note that riparian areas in degraded condition cannot withstand grazing as frequently as healthy riparian areas. Extended periods of rest or deferment from grazing may be needed to achieve recovery or at least jumpstart the process. The length of this recovery period will vary from site to site."

b. Effects Common to All Alternatives

Direct effects occur at the same time and place as the proposed activity. Installation, reconstruction or removal of water developments are the only activities considered to cause direct effects to riparian areas and water quality, and none of those activities are proposed under any alternative.

Short-term vs. Long-term Productivity

There are no short-term versus long-term productivity issues for water resources under any alternative.

Irreversible/irretrievable Commitments

There are no irreversible/irretrievable commitments on water resources under any alternative.

Unavoidable Adverse Effects

There are no unavoidable adverse effects on water resources under any alternative.

c. Effects Common to All Action Alternatives

Indirect effects occur at a later time or distance from the proposed activity. Free-ranging livestock are considered indirect effects to riparian systems and water quality as the activity is dispersed spatially and temporally.

d. Mitigation Included Under All Alternatives

There is no mitigation included, aside from the proposed management, under any alternative.

e. Effects By Alternative

Twenty stream reaches and five ponds are evaluated under the various alternatives displayed below. Those riparian areas currently functioning at-risk are evaluated for their potential to improve, while those areas currently functioning properly are evaluated for their potential to decline.

Alternative 1 – No Grazing

Indirect Effects

New livestock grazing impacts to riparian systems and riparian dependant species will no longer occur under this alternative. Streambanks that are currently trampled from past grazing will gradually stabilize and over-utilized riparian vegetation will increase in vigor and density. Infiltration and absorption capacity of overly compacted soils at spring sites and along low discharge, spring fed systems will increase, thereby improving water storage and release processes.

Cumulative Effects

Existing cumulative effects models for water and sediment yield are not adequate to quantify to a single cumulative value, the effects of all the diverse activities in individual drainages including wildfire/prescribed fire, mining, camping, off-highway vehicle use, grazing, floodplain development, timber harvest, and road networks. The only way to address these cumulatively is to address each activity individually and then qualify, in general terms, the cumulative effects between specific activities where appropriate.

Past and present timber harvest activities, prescribed fire and existing roads will continue to be an insignificant influence on riparian systems as described under the affected environment. However, natural flood and wildfire events may impact these riparian systems and riparian dependant species in the future, and reduce the anticipated rate of recovery from past grazing influence.

Forest Plan Consistency and Other Required Disclosures

Compliance with Forest Plan standards and state and federal water quality regulations will occur over a relatively short timeframe as at-risk riparian areas attain a properly functioning condition which fully supports all beneficial uses.

Conclusions for Environmental Consequences

This alternative would provide the fastest rate of recovery for all grazing impacted riparian areas and ensure that these areas achieve a properly functioning condition which fully supports all beneficial uses and complies with all pertinent laws, regulations and policy. There is no risk of reaches currently functioning properly to reverse trends due to livestock grazing.

Alternative 2 - Current Management

Indirect Effects

This alternative proposes no change from current *permitted* management. However, it is important to understand that *actual use* in four of the five allotments over the last two decades has been substantially lower than *permitted use* (10 to 32% lower), and three of the five allotments have had significant *non-use* (22-44% non-use). Refer to Table 6. Assuming future management under this alternative reflects past *actual use*, five riparian systems currently functioning at-risk, in part due to recent grazing management, will continue to be at-risk. Four systems currently at-risk, due in part to historical grazing management, will continue on an upward trend. Sixteen riparian systems are expected to continue to function properly. In the event that future management under this alternative reflects *permitted use*, grazing pressure on riparian systems is expected to increase from what has occurred over the last two decades. At-risk riparian systems and some of the more accessible and sensitive systems currently functioning properly may revert to a declining trend. This scenario is possible in East and West Rosebud Allotments for sensitive systems that include EB01, EB03, WB02, WB06 and WB08.

No grazing is proposed for the Black Butte Allotment under this alternative and therefore, there is no risk of affecting riparian areas.

Cumulative Effects

Past and present timber harvest activities, prescribed fire and existing roads will continue to be an insignificant influence on riparian systems as described under the affected environment. However, natural flood and wildfire events may impact these riparian systems and riparian dependant species in the future. The degree of impact may be compounded by continued livestock grazing under the current management, but mainly for those riparian areas currently functioning at-risk.

Forest Plan Consistency and Other Required Disclosures

Under this alternative, all reasonable grazing BMPs will not be applied. Some riparian areas will continue to function at-risk. Habitats for riparian dependant species will continue to be degraded and therefore beneficial uses will continue to be less than fully supported. Compliance with Forest Plan standards and state and federal water quality regulations will not be possible under this alternative.

Conclusions for Environmental Consequences

This alternative maintains some riparian areas in less than properly functioning condition. Depending on whether future management reflects past actual use or permitted use, there is a risk of reaches currently functioning properly to reverse trends due to livestock grazing. This alternative does not comply with all pertinent laws, regulations and policy.

Alternative 3 - Proposed Action

The changes in grazing management proposed under this alternative are designed to reduce grazing duration and improve livestock distribution. Better livestock distribution will increase use of under-utilized secondary range and reduce over-utilization on primary range and grazing pressure on riparian areas. The riparian objective is to change the existing at-risk conditions associated with grazing to an upward or improving trend, and ultimately achieve properly functioning condition for these areas.

Indirect Effects – Summary Across Analysis Area

The proposed management for all pastures would provide flexibility for number of livestock, type of livestock, turn on dates and duration, with a few exceptions. The earliest turn-on date would generally be July 1, but never before June 15, and duration would be limited to no more than 30 days in every allotment. Permitted AUMs would be maintained for two allotments, reduced for two allotments and increased for one allotment (Table 5).

Additional management tools are proposed to reduce the time livestock loiter in the riparian zone in all allotments. These tools include:

- A utilization standard of 55 percent will be implemented on key use areas in four out of five allotments (60 percent in areas primarily composed of timothy grass). A standard of 35-40 percent would be implemented in the Black Butte Allotment. This includes key riparian reaches. This standard is a tool or “mid-season trigger” for herding livestock out of critical areas or moving livestock off the pasture. It is also a “end of season indicator” to help evaluate the implementation and effectiveness of management during the past grazing season. Consistent and diligent herding practices will be required by the permitee to ensure utilization standards are not exceeded.
- The use of mineral supplements will be encouraged to help draw livestock away from critical areas.
- Herding will be encouraged to help move livestock away from critical areas.

Table 6 - Comparison of Current and Proposed Permitted Use and Actual Use

ALLOTMENT	PROPOSED PERMITTED USE			CURRENT PERMITTED USE	ACTUAL USE[1]				
	SYSTEM[2]	AUMs	CHANGE FROM CURRENT PERMITTED AUMs (number/ percent)	AUMs	GRAZED/ RESTED (years)	AVERAGE USE OVER GRAZED YEARS		AVERAGE USE OVER EIGHTEEN YEARS	
						AVERAGE AUMs	DIFFERENCE BETWEEN ACTUAL USE AND CURRENT PERMITTED USE	AVERAGE AUMs	DIFFERENCE BETWEEN ACTUAL USE AND CURRENT PERMITTED USE
Black Butte	RR	80-110	na	0	0/18	0	0	0	0
Butcher Creek	DR	48	-21/-30%	69	14/4	62	-10%	48	-30%
East Rosebud	LS	150	0	150	13/5	114	-24%	82	-45%
West Rosebud	DR	226	0	226	10/8	153	-32%	85	-62%
Red Lodge Creek	DR	134	-57/-30%	191	18/0	158	-17%	158	-17%

[1] Actual Use over the last 18 years (1990-2007).
[2] DR= Deferred Rotation, LS= Late Season, RR= Rest Rotation.

Because livestock management over the last two decades has been highly variable in four of the five allotments, either through intermittent years of rest or variability in numbers, duration and AUMs, and because proposed management allows for flexibility in numbers and duration, it is not possible to compare current and proposed management in order to estimate effects. Additionally, the Black Butte allotment has not been grazed since 1970, which also eliminates the potential to compare current and proposed management in terms of numbers, duration and AUMs. Finally, management changes that result in significant increases in grazing intensity (flash grazing as proposed in West Rosebud and Black Butte Allotments) can change distribution patterns significantly enough to cause an increase in grazing pressure on some reaches currently functioning properly.

Even under the best of circumstances when current and proposed livestock management can be compared, predicting the effects of management on future riparian conditions is a highly uncertain task. This is due to the variability of natural processes and characteristics, the uncertainty of the effectiveness of proposed management, and the uncertainty in implementation. Due to these factors, adaptive management will be a key component of the proposed management. Monitoring will be a key component of adaptive management to help identify downward trends before conditions become difficult to reverse.

As mentioned above, utilization standards will be implemented under this proposed management. Since these standards have never been implemented in any of the allotments, they should help to reduce livestock pressure on riparian areas. However, uncertainty about the effectiveness of these standards in relation to riparian systems and any anticipated level of improvement is high. This uncertainty is due to 1) the relatively high value of the proposed standard (55/60%) when compared to recommended levels for riparian forage, 2) the inability to compare the proposed standard with past levels of utilization, 3) uncertainty about the level of implementation and management that will occur, and 4) unknown correlation between utilization of streamside forage and physical bank alteration, the later of which is the impact of actual concern. This is especially true where timothy grass occurs as the utilization standard in these areas will be 60 percent.

A 55/60 percent utilization standard exceeds the levels recommended by Clary and Webster (1989, 1990) to maintain or improve riparian conditions, i.e., 40-50 percent for summer use and 30 percent for fall use. Additionally, on the Beaverhead-Deerlodge National Forest in Montana, Bengeyfield and Svoboda (1998) found that prescribed bank alteration standards were generally reached before streamside forage utilization standards on meadow stream systems. Streamside forage utilization standards prescribed on the Beaverhead-Deelodge National Forest range from 30 to 45 percent for early summer use (July), to 10 to 20 percent for late fall use (October). Again, montioring will be crucial to determine the effectiveness of the proposed utilization standards and the need for additional mid-season triggers specific to stream channel attributes.

Improvement in riparian conditions will also require consistent and diligent implementation of all the proposed management tools, including adaptive management. These tools will compliment each other if adequately implemented. Upslope mineral supplements, when combined with frequent herding, could substantially reduce grazing pressure on riparian areas and allow livestock to remain on the pasture longer while meeting utilization standards.

Although riparian areas are expected to improve, this improvement may be short-term until a new static level (plateau) in condition is reached. This new plateau may be less impacted than current conditions, but may still be functioning at-risk. Proposed changes to current management, i.e. either reduced AUMs, reduced duration of grazing or the utilization standard, may not reduce impacts on riparian attributes sufficiently to restore proper functioning conditions or fully support beneficial uses. A properly functioning condition may not be achieved unless additional management strategies are implemented; strategies that would be identified through long-term trend monitoring and implemented through adaptive management. Additional management strategies could include mid-season triggers specific to stream channel attributes.

.Indirect Effects by Allotment

West Rosebud Allotment

The most significant change in management in this allotment would be fencing the Gravel Pit, Shorey Swamp and Shorey Jungle Pastures out of private land. This would change the allotment from a two pasture to five pasture

deferred rotation system and provide more control and better distribution of livestock across the allotment, especially in the three pastures fenced out of private land. Permitted AUMs would remain at 226 across the allotment, but would be effectively reduced in the West Rosebud and Morris Creek pastures because of the addition of three pasture from fencing. Except for construction of a stock driveway (0.8 miles), no other range improvements are proposed.

Three riparian areas are currently at-risk, in part due to grazing practices over the last two decades. Additionally, four other areas currently functioning properly have a high sensitivity to grazing. Because of the significant difference between past actual use and proposed permitted use in this allotment, and the fact that permitted AUMs across the allotment will remain unchanged, estimating trends or future conditions for riparian areas with even a moderate level of certainty is not possible. Implementation of adaptive management that includes mid-season, end-of-season and long-term trend monitoring will be the only way ensure recovery of riparian areas currently at-risk and maintenance of other areas currently functioning properly. This would be critical under high intensity or flash grazing management which could occur every 5-6 years.

East Rosebud Allotment

No significant change in permitted management is proposed in this allotment. Permitted AUMs will remain at 150. However, livestock distribution is expected to improve by utilizing upland forage on both sides of East Rosebud Creek. This should reduce grazing pressure on riparian areas. Except for construction of a temporary and portable loading/holding corral, no other range improvements are proposed in this allotment.

Only one stream reach is currently functioning at-risk in this allotment and it is likely due to historical grazing pressure, not recent grazing management. However, two other reaches in the allotment are still sensitive to grazing. Because of the significant differences between past actual use and past permitted use in this allotment, and the fact that permitted AUMs will remain unchanged, estimating trends or future conditions for riparian areas with even a moderate level of certainty is not possible. Implementation of adaptive management that includes mid-season, end-of-season and long-term trend monitoring will be the only way ensure recovery of riparian areas currently at-risk and maintenance of other areas currently functioning properly.

Butcher Creek Allotment

The most significant change in management would be the proposed reduction in permitted AUMs from 69 to 48 (-30%). Except for the possible extension of a drift fence, no other range improvements are proposed in this allotment.

All five riparian systems in this allotment were determined to be functioning at-risk, due in part to recent grazing pressure. Although there are significant differences between past actual use and proposed permitted use in this allotment, the proposed reduction in AUMs will somewhat reflect past actual use. However, since the allotment is relatively small and water sources are confined to lower elevations near fence lines, livestock will tend to congregate there. Short duration grazing and a high level of herding will be required to minimize impacts to riparian systems. Implementation of adaptive management that includes mid-season, end-of-season and long-term trend monitoring would be the best way to ensure recovery of riparian areas currently at-risk.

Red Lodge Allotment

The most significant change in management would be the proposed reduction in permitted AUMs from 191 to 134 (30%). Except for the possible extension of a drift fence, no other range improvements are proposed in this allotment.

Riparian systems in this allotment are of limited extent and have not been surveyed.

Black Butte Allotment

Livestock have not grazed this allotment since 1970. The proposed management would permit between 80 and 110 AUMs under a rest-rotation system. Grazing would occur every other year and rotate from early, mid and late

season. Although the riparian systems (two ponds and one stream reach) are currently functioning properly, they are still sensitive to grazing pressure, especially the ponds. Excessive trampling at the drain-point of the ponds could result in lower water levels in the ponds. Because livestock water sources are limited in this allotment, riparian areas are at high risk of being impacted. Implementation of adaptive management that includes mid-season, end-of-season and long-term trend monitoring would be the only way to ensure riparian areas continue to function properly. This would be critical under high intensity or flash grazing management which could occur every 6-8 years.

Cumulative Effects

Past and present timber harvest activities, prescribed fire, and existing roads will continue to be an insignificant influence on riparian systems as described under the affected environment. However, natural flood and wildfire events may impact these riparian systems and associated fish and wildlife species in the future, and the degree of impact may be compounded by continued livestock grazing under the proposed management, but mainly for those riparian areas currently functioning at-risk.

Forest Plan Consistency and Other Required Disclosures

Under this alternative, all reasonable grazing BMPs could be applied through adaptive management. Riparian areas and habitats for riparian dependant species would improve over the long-term or maintain so that beneficial uses would be fully supported. Compliance with Forest Plan standards and state and federal water quality regulations is possible under this alternative through adaptive management.

Conclusions for Environmental Consequences

This alternative improves and maintains all riparian areas, but would likely require long-term trend monitoring and adaptive management to fully achieve desired riparian conditions.

Effects by Alternative Summary

The following table (7) summarizes the effects by alternative relative to anticipated trend in riparian condition.

Table 7 - Summary of Anticipated Trend in Riparian Condition across the Project Area

	Alternative 1	**Alternative 2**	**Alternative 3**
Direct	no activity	no activity	no activity
Indirect	improve to PFC	static or decline	improve[1]
Cumulative	improve to PFC but relative[2]	static or decline	improve but relative[1, 2]

[1] Full improvement to PFC may not occur without long-term monitoring and adaptive management.
[2] Natural disturbance events and other human activities could influence the recovery and future condition of riparian areas.

MONITORING

A long-term trend monitoring plan is recommended to determine if the proposed management is improving riparian conditions at a satisfactory rate and maintaining areas currently functioning properly. Long-term monitoring will also help determine correlations between forage utilization standards and bank/riparian conditions. Upon full implementation of the proposed action, at least two full rotation cycles may be necessary to provide sufficient time to establish trends.

Long-term trend monitoring is proposed in all allotments, except Red Lodge. If trend monitoring indicates that the rate of riparian improvement is slow or becomes static and attainment of desired conditions is not probable, adjustments to the proposed management may be necessary. Adjustments could be made to planned grazing systems (Aum's numbers or duration), livestock distribution tools including mid-season triggers, or infrastructure including fences and water developments.

Long-term indicators and methods may include:

Riparian vegetation: The composition and condition of vegetation along stream banks and adjacent riparian areas provides critical information on the stability and resiliency of the riparian system and the condition of associated aquatic and riparian habitat. Improving riparian vegetation is, more often than not, the key or first step towards improving channel and habitat conditions. Methodology that quantifies vegetation composition in a linear and repeatable fashion along the stream course may be used. Effectiveness Monitoring for Streams and Riparian Areas within the Upper Columbia River Basin, Sampling Protocol, Vegetation Parameters (Coles-Ritchie 2005). is an example of this type of methodology.

Channel geometry: Bankfull width, bankfull depth, top of bank width and floodprone width (if entrenchment is an issue) may be monitored by measuring approximately 50 semi-permanent cross-section locations. However, channel geometry measurements may not be useful or feasible on reaches that have low discharge, spring flow regimes, or which lack distinct bankfull features.

Where appropriate, bankfull depth is measured at either one-foot intervals or at 10 points, whichever is the lesser amount (includes depths at both end points). Floodprone width is a horizontal distance measured at the elevation equal to two times maximum bankfull depth. Top of bank width is measured from the break in bank angle of the lowest bank along a level line to the opposite bank. This width measurement is used on reaches where high levels of bank alteration make identification of bankfull stage difficult or impossible.

These distance measurements can be plotted to display a cumulative distribution curve by year monitored. The curves can then be compared visually and statistically between years monitored.

Bank stability: This parameter is a good comprehensive indicator of physical stream health. It may be monitored through a classification system developed by Burton, et al. (2007). Their system qualifies bank cover and bank stability independently and provides four possible combinations of cover and stability, plus false bank and unclassified categories.

Instream surface fines (grid method): This parameter may be monitored to determine instream surface fine composition. Semi-permanent transects may be established in relatively stable riffles not directly influenced by temporary features such as log debris jams. The transects are moved only if necessary to keep them centered in the riffle. Surface fines are measured by placing a 49-intersection steel grid on the stream bottom and determining particle size category under each intersection. The number of intersections that lie over substrate less than 0.25 inches in diameter are be tallied. However, rather than randomly tossing the grid, it is placed side by side across each transect from stream margin to margin, with readings taken at each placement of the grid. This technique is efficient, repeatable, more comprehensive, and less subject to observer bias than random grid tosses.

Percent surface fines can then be computed by averaging the percentage of intersections lying over fine substrate (less than 0.25 inches) for all read grids on both transects at each monitoring site. A non-parametric Mann-Whitney test can be used to determine a significant difference ($p=0.05$) between years. However, long-term trends will be more meaningful than year-to-year variations.

Photo points: Two or more photo points may be established along each key reach. Photos would be taken of riparian vegetation, stream channel, stream banks and other features that have the potential to document changing riparian conditions. Additional photo points can be added in future years to capture additional characteristics or conditions that arise which should to be documented. Hall (2002) is a suggested methodology.

Short-term indicators and methods:

Bank alteration: This parameter may be monitored to determine correlations with utilization levels of adjacent key riparian vegetation areas, and correlations with other long-term indicators of riparian/stream health. The 2005 Region One Bank Alteration Protocol (USDA Forest Service 2005) is a suggested methodology. The basic procedure involves estimating alteration along both banks of a 100-200 foot stream segment using a point intercept method. This method requires the observer to draw an imaginary line from the tip of their boot

perpendicular to waters edge at sample points defined by a full pace. If the line intercepts any alteration, then one count is tallied. Alteration is defined as vertical bank shear, hoof depressions of one half inch or greater that expose soil or roots, or heavily compacted trails. Both sides of the bank are measured independently and then averaged to determine percent of total bank altered along the transect. Monitoring should occur as close to turn off as possible.

REFERENCES

Armour, C., D. Duff and W. Elmore. 1994. The Effects of Livestock Grazing on Western Riparian and Stream Ecosystems. Fisheries. Vol. 19, No. 9. September, 1994. pp 9-12.

Bengeyfield, P. and D. Svoboda. 1998. Determining allowable use levels for livestock movement in riparian areas. Specialty Conference on Rangeland Management and Water Resources. Proceeding. American Water Resources Association. Reno, NV.

Blackburn, W.H. 1983. Livestock Grazing Impacts on Watersheds. Rangelands. Vol. 5, No. 3. June, 1983. pp 123-125.

Burton, T.A., E.R. Cowley and S.J. Smith. 2007. Monitoring Stream Channels and Riparian Vegetation- Multiple Indicators. Idaho Technical Bulletin 2007-01.
[Online]. Available: http://www.blm.gov/id/st/en/info/publications/technical_bulletins/tb_07-01.html

Chaney E., W. Elmore, and W.S. Platts. 1990. Livestock Grazing on Western Riparian Areas. U.S. Environmental Protection Agency. Region 8. page 38

Clary, W.P. and B.F. Webster. 1989. Managing grazing of riparian areas in the Intermountain Region. Gen. Tech. Report INT-263. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 11p.

Clary, W.P. and B.F. Webster. 1990. Riparian Grazing Guidelines for the Intermountain Region. Rangelands 12(4), pgs 209-212, August 1990.

Coles-Ritchie, M. 2005. Effectiveness Monitoring for streams and riparian areas within the Upper Columbia River Basin, Sampling Protocol, Vegetation Parameters. 28 pgs.

Ehrhart, R.C. and P.L. Hansen. 1997. Effective Cattle Management in Riparian Zones: A Field Survey and Literature Review. Montana BLM Riparian Technical Bulletin No. 3. USDI, Bureau of Land Management, Montana State Office. Billings, Montana. pages 19-22.

Elmore, W. and R.L. Beschta. 1987. Riparian Areas: Perceptions in Management. Rangelands. Vol. 9, No. 6, December, 1987. pp 260-265.

Federal Register. 1982. National Forest System Land and Resource Management Planning, Department of Agriculture, Forest Service. 36 CFR Part 219. Vol. 47, No. 190, September 30, 1982. 4 pages.

Hall, F.C. 2002. Photo point monitoring handbook. Part A- field procedures and part B – concepts and analysis. Gen. Tech. Report PNW-GTR-526. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 48p./134p. 2 parts.

Kauffman, J.B., W.C. Krueger and M. Vavra. 1983. Impacts of Cattle on Streambanks in North-eastern Oregon. Journal of Range Management. Vol. 36, No. 6. November, 1983. pp 683-685.

Leonard, S., G. Kinch, V. Elsbernd, M. Borman, S. Swanson. 1997. Riparian Area Management – Grazing Management for Riparian-Wetland Areas. Technical Report 1737-14 1997. USDI – Bureau of Land Management. Denver, CO. pages 46-49, 51.

MT-DEQ, 2006. 2006 Montana 3305(b)/303(d) Water Quality Report. [Online]. Available: http://www.deq.state.mt.us/CWAIC/default.aspx. Dept. of Environmental Quality. Helena, MT.

MT-DNRC, 1999. Monitoring for Success- Ranch Planning, Upland Monitoring, Stream Channel and Riparian Area Monitoring. Montana Monitoring Work Group. Montana Department of Natural Resource and Conservation. Helena, MT. 41p.

MT-NRIS, 2005. Montana State Library - Natural Resource Information System. Average Annual Precipitation Map – Stillwater County. [Online]. Available: http://nris.state.mt.us/gis/gisdatalib/downloads/precip_Stillwater.pdf

Mosley, J.C., P.S. Cook, A.J. Griffis and J. O'Laughlin. 1997. Guidelines for Managing Cattle Grazing in Riparian Areas to Protect Water Quality: Review of Research and Best Management Practices Policy. Idaho Forest, Wildlife and Range Policy Analysis Group. University of Idaho. Moscow, Idaho. Report No. 15. 67 pages.

Myers, L.H. 1989. Grazing and riparian management in southwestern Montana. In: Gresswell, R.E., B.A. Barton and J.L. Kershner (eds.). Practical approaches to riparian resource management: an educational workshop. USDI, BLM, Billings, Montana. pages 117-120.

Platts, W.S. 1991. Livestock Grazing. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19:389-423.

Ponce, Victor M. 1989. Baseflow Aaugmentation by streambank storage. Pacific Gas and Electric Company, Dept of Research and Development. San Ramon, CA. 91 pgs.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO. Chpt 5, page 6.

Surber, G. and B. Ehrhart. 1998. Stream and Riparian Area Management – A Home Study Course. Montana State University Extension Service. Bozeman, MT. 78 pages plus videos and attachments.

Toledo, Z.O. and J.B. Kauffman. 2001. Root biomass in relation to channel morpholopgy of headwater streams. Journal of the American Water Resources Association, 37(6). December, 2001. pgs 1653-1663.

U.S. Code. Title 16-Conservation, Chapter 2-National Forests, Subchapter I-Establishment and Administration, Sec. 528- Development and administration of renewable surface resources for multiple use and sustained yield of products and services; Congressional declaration of policy and purpose. [Online]. Available: http://www.gpoaccess.gov/uscode/. Search 16USC528.

U.S. Code. Title 16-Conservation, Chapter 2-National Forests, Subchapter I-Establishment and Administration, Sec. 531- Definitions. [Online]. Available: http://www.gpoaccess.gov/uscode/. Search 16USC531.

USDA-FS, 1995. Forest Service Handbook 2509.22 - Soil and Water Conservation Practices. U.S. Department of Agriculture - Forest Service, Missoula, Montana. Chapters 17 and 18.

USDA-FS, 1996a. Letter from FS Chief Jack Ward Thomas and BLM Director Mike Dombeck to Regional Forestors and State Directors initiating a effort on Accelerating Cooperative Riparian Restoration and Management. March 20, 1996. Washington D.C. 6p.

USDA-FS, 1996b. Letter from Chief Jack Ward Thomas directing Regional Foresters, R-1 thru 6 to adopt Proper Functioning Condition as a minimum standard for riparian assessments. November 27, 1996. USDA Forest Service, Washington D.C.

USDA-FS. 2002. Lewis and Clark National Forest Plan Monitoring and Evaluation Report 2000-2001, Lewis and Clark National Forest, Great Falls, MT.

USDA-FS, 2005. Proposed standardized protocol for measuring bank alteration on grazing allotments for Region One National Forests. U.S. Department of Agriculture - Forest Service Missoula, Montana. 4p.

USDA-NRCS, 2005. Montana Conservation Practice Specification for Prescribed Grazing Code 528. U.S.D.A. – Natural Resources Conservation Service. . [Online]. Available: http://efotg.nrcs.usda.gov/treemenuFS.aspx

USDA-NRCS, 1999, MT-DNRC, 1999. Best Management Practices for Grazing - Montana. Montana, Dept. of Natural Resources and Conservation. Helena, MT. 29 p.

USDI-BLM, 1998. A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas. Technical Report 1737-15 1998. USDI – Bureau of Land Management. Denver, CO.126 p.

USDI-BLM, 2003. A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas. Technical Report 1737-16 1999, revised 2003. USDI – Bureau of Land Management. Denver, CO.109 p.

Wiley, R. 2006. Custer NF Assistance Briefing Paper. National Riparian Service Team. Prineville, OR. 20 p.