# STORM DAMAGE
# HFRA
# PROJECT

# WATER RESOURCES TECHNICAL SPECIALIST REPORT

## Beartooth Ranger District
## Custer National Forest
## Region 1 Forest Service

**/S/ Mark P. Nienow**
**Hydrologist**
**Custer National Forest**
**September 3, 2008, revised January 9, 2009**

## INTRODUCTION

This report focuses on the characteristics and effects of proposed activities on water quality in streams and watersheds. Associated issues include channel morphology, streamflow and water quality. The analysis area includes all watersheds with documented recent blowdown, but focuses on those watersheds with proposed activities for blowdown treatment.

The Report is organized as follows:

EXECUTIVE SUMMARY

**APPLICABLE LAWS, REGULATION AND POLICY**

- **a. Federal**
  - ***-Clean Water Act***
  - ***-Safe Drinking 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***
  - ***-Healthy Forests Restoration Act of 2003***
- **b. State**
  - ***-Montana Water Quality Law***
    - **-Surface Water Classification**
    - **-Surface Water Quality Standards**
  - ***-Total Maximum Daily Load Waterbody List***
  - ***- Streamside Management Zone Law***
  - ***-Stream Protection Act***
- **c. Forest Service**
  - ***-Custer National Forest Land and Resources Management Plan***
- **d. Best Management Practices**
  - ***-R1/R4 Soil and Water Conservation Practices Handbook***
  - ***-Montana Forestry BMPs***

**ASSUMPTIONS, METHODOLOGY AND SCIENTIFIC ACCURACY OF INFORMATION USED**

**AFFECTED ENVIRONMENT**

- **Introduction**
- **a. Natural Characteristics and Processes**
- **b. Human Influences**

**ISSUES**

**ENVIRONMENTAL EFFECTS**

- **a. Effects of the No-Action Alternative**
  - ***-Direct Effects***
  - ***-Indirect Effects***

## EXECUTIVE SUMMARY

Past and present land management activities along with natural events have influenced hydrologic processes in all watersheds within the project area. However, equivalent clearcut area analysis involving past timber harvest, road construction, wildfire and wind events suggests that hydrologic processes in nearly all watersheds are not affected to any substantial degree. The exception is the West Fork Fishtail and Upper Little Rocky watersheds which are in a ECA condition that is at or slightly above levels that could produce measurable changes in annual water yield and possibly streamflow. Blowdown timber stands resulting from the November 2007 wind events are the main reason for these elevated levels.

From a direct and indirect effects standpoint, the proposed treatments would have minimal additional influence on water yield and streamflow for two main reasons. First, hydrologic processes have already been affected by the loss of timber canopy from blowdown. The proposed treatments would not further reduce timber canopy to any substantial degree. Secondly, the amount of blowdown treated is a small percentage of the total blowdown that currently exists. However, from a cumulative effects standpoint, considering the potential for wildfire, the proposed treatments would help to reduce fire intensity within blowdown areas, reduce impacts to riparian areas, and hasten recovery of post-fire landscapes. It must be recognized that these benefits of treatment under a wildfire scenario are localized, as only a small percentage of the total blowdown would be treated. Therefore, from a watershed scale perspective, the proposed action is not substantially different than the no action alternative.

The proposed treatments comply with state and federal water quality laws, and Forest Plan Standards and Guidelines, assuming adequate implementation of BMPs and SMZ regulations.

## APPLICABLE LAWS, REGULATIONS AND POLICY

### a. Federal

### Clean Water Act (CWA)

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 CWA 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 (total maximum daily load) and are discussed further below. Section 404 of the Act gives authority to the Corps of Engineers to review and permit activities that may impact navigable waters of the U.S., similar to the Montana Stream Protection Act discussed below.

**Safe Drinking Water Act**

There are multiple public water systems in the Main Fork Rock Creek as defined by the Safe Drinking Water Act (42 USC 300f). Additionally, numerous privately owned groundwater wells and springs used for residential drinking water, and ditches and wells used for irrigation purposes are fed by water from the Rock Creek, Little Rocky, and East Fishtail watersheds. The Safe Drinking Water Act as amended requires completion of Source Water Delineation and Assessment Reports (SWDARs), which have been completed for numerous public water supplies in the Main Fork Rock Creek and Benbow area.

**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) and include:

(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 Appendix A 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)

**Healthy Forests Restoration Act of 2003**

The Healthy Forests Restoration Act of 2003 (HFRA) established procedures for Federal agencies conducting environmental analysis for authorized hazardous-fuel-reduction projects on Federal land. One purpose of the HFRA is to reduce wildfire risk to municipal water supplies. The Main Fork Rock Creek and Little Rocky drainage all meet HFRA definitions of Municipal Water Supply Systems in that they contain "systems constructed or installed for the collection, impoundment, storage, transportation, or distribution of drinking water."

**b. State**

Montana Water Quality Act directed the Montana Department of Environmental Quality (MTDEQ) to develop a water quality classification system, develop water quality standards to be applied to various water classes, and identify water bodies that do not meet standards (TMDL List). MTDEQ has classified most waters within the analysis area and 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) 2007a).

The Montana 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.

**Total Maximum Daily Load Waterbody List**

Riparian and stream conditions are assessed by 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 Total Maximum Daily Load (TMDL) development of streams are identified in a biennial report from MTDEQ (2006). The 2006 Montana 305(b)/303(d) Water Quality Assessment Database lists two streams within the analysis area where one or more uses are impaired and a TMDL is required (Category 5). TMDL planning has not yet begun on these streams. Refer to Table 4 in the section on Human Influences for more detail.

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 occurring. 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.

**Streamside Management Zone (SMZ) Law and Rules**

The Montana Legislature passed the SMZ Law in 1991 and it became effective in 1993. This law prohibits certain forestry practices, e.g., equipment operation and broadcast burning, within 50 to 100 feet of streams. It specifies other criteria, e.g., retention tree requirements and road construction limitations, for this management zone (ARM 2007b). Refer to the Mitigation section in this report for discussion of the SMZ Law in relation to this project.

**Stream Protection Act – SPA 124**

The Montana legislature enacted The Stream Protection Act in 1965. It requires all government agencies (Federal, State and local) to notify the State of all planned activities that will alter the bed or banks of any intermittent or perennial stream. (MCA 85-5-502 2007). The Montana Department of Fish, Wildlife and Parks administers this Act on Federal land through the SPA 124 permit process. Refer to the section on Mitigation in this report for a discussion of potential permits specific to this project.

**c. Forest Service**

**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 (USDA Forest Service 1986).

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." (page 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." (page 5)

Forest Plan goals 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." (page 3)

Forest Plan 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)

Management standards for timber under MA M include: “harvest timber products only if riparian, wildlife or fish habitat, visual values, and water quality can be improved or protected. Management objectives for these resources will guide the harvest unit size, method of harvest, and the amount of material removed, and silvicultural prescriptions will be used along fishery streams to insure that an adequate number of trees will be available to maximize the continual, natural development of pools necessary to meet the need of the individual fishery involved.” (page 81)

**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 NFS land. BMPs are intended to control the extent, kind, and distribution of soil disturbance and resulting sedimentation effects to stream systems and beneficial uses. To reach these objectives the Forest Service developed a handbook; R1/R4 Forest Service Soil and Water Conservation Practices Handbook (USDA Forest Service 1995). Also refer to the section below on Mitigation and Monitoring.

Few, if any of the BMPs and mitigation measures are dependent on additional funding sources. Their implementation is required as part of fulfilling the harvest or fuel reduction contract.

**Montana Forestry BMPs**

The 1987 Montana Legislature passed House Joint Resolution 49 which directed the Montana Environmental Quality Council to study the effects of forest management practices on watersheds in Montana. This led to the development of the Montana Forestry Best Management Practices (DNRC 2002). These practices are a voluntary approach to addressing non-point source pollution related to timber management activities. As part of the Memorandum Of Understanding between Region 1 Forest Service and the State of Montana, the Forest Service agrees to implement Montana’s Forestry BMP’s for all timber management activities on NFS land.

## ASSUMPTIONS, METHODOLOGY AND SCIENTIFIC ACCURACY OF INFORMATION USED

The analysis area for water resources encompasses fifteen 6 and 7 Hydrologic Unit Code (HUC) watersheds as identified in Table 1. GIS spatial data was used to summarize past, present and proposed activities within these watersheds. The type of activities summarized include existing roads, past and proposed timber harvest, past wild fire, past and proposed prescribed fire, and recent blowdown events. These activities were further summarized by using a equivalent clearcut area (ECA) method which allows past, present and reasonably foreseeable vegetation management, road activities and natural impacts to vegetation to be summarized to a single value for effects determination by watershed. This method and data utilized is described in more detail under the Effects section. Flood

modeling was completed for five watersheds in order to describe the magnitude and probability of flood events that could affect stream systems within and below the Forest boundary. Two 6 HUC watersheds (Fishtail and Little Rocky) were subdivided into 7 HUC watersheds to facilitate this flood modeling effort.

The proposed management activities have the potential to increase upslope sediment production and downslope sediment transport to water courses. The level of risk is a function of the degree of soil disturbance, slope, slope distance and slope filter capacity. Sediment yield in Region 1 Forest Service is typically modeled using the R1/R4 Guide for Predicting Sediment Yields from Forested Watersheds (USDA Forest Service 1981). This project analysis however, does not utilize sediment yield models for the following reasons. Natural surface erosion rates have not been validated for the Custer National Forest. Additionally, except for wildfire, road construction and harvest of green timber stands, erosion rates have not been developed for other activities that occur within these watersheds including recreation, livestock grazing, crop production, historical mining and floodplain development. Therefore, existing models are not capable of adequately quantifying to a single cumulative value, when the effects of these other, non-timber management activities should be accounted for. The only way to address all of these activities cumulatively, is to address each activity individually and then qualify, in general terms, the cumulative effects between specific activities where appropriate. Finally, these types of models cannot provide precise quantification of erosion rates due to high degree of error inherent in the modeling process and therefore are useful only for coarse alternative comparison. However, this project involves only one action alternative.

# 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 are dictated by local landform, geologic material and climate.

Table 1 lists the 13 watersheds evaluated for this project and provides information on watershed size, area above 6000 foot elevation and percent of FS ownership. All watersheds are 6 HUC watersheds (10,000-40,000 acres) except Fishtail and Little Rocky. These two watersheds were subdivided into smaller watersheds to facilitate flood modeling at the FS boundary. Although wind events affected timber stands in the West Fork Rock Creek watershed, the recent Cascade Fire burned portions of these stands. These changed conditions require further evaluation and planning efforts are underway at this time.

**a. Natural Characteristics and Processes**

Elevations within the project area range from 5,500-6,000 feet near the forest boundary to over 12,600 feet on Mt. Wood and Castle Mountain. Based on a 30 year period of record, the average annual precipitation associated with these elevations range from 20 to 40 inches (Montana State Library - Natural Resource Information System (http://nris.state.mt.us/gis/gisdatalib/downloads/precip_Stillwater.pdf and Carbon.pdf).

The underlying geology within the Main Fork portions of the project areas is glacial outwash over pre-Cambrian gneiss. The underlying geology within the Fishtail and Little Rocky Creek portions of the project areas is glacial outwash over pre-Cambrian ultramafic rock of the Stillwater complex and pre-Cambrian gneiss. As you move down-drainage in the project areas toward the prairie, the underlying geology changes to steeply-dipping Paleozoic sedimentary bedrock topped with glacial outwash. The Laramide uplift and ongoing erosion of the Beartooth Mounains have produced steep mountain side slopes, wide and relatively flat glaciated 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 consisting of outwash deposits and landslide-prone sedimentary formations adjacent to the prairie, while recent debris flows have occurred in tributary channels of watersheds recently burned. Perennial flow occurs in both tributary and mainstem channels thoughout the analysis area. Springs and small ponds are also relatively common.

Aquifers and springs in the analysis area serve as source areas for drinking water. SWADRs, intended to meet the technical requirements for completion of the source water delineation and assessment report as required by the Montana Source Water Protection Program (MDEQ 2008) and the federal Safe Drinking Water Act Amendments of 1996 (42 USC 300), have been completed in the Main Fork drainage. These include SWDARs for the City of Red Lodge (Stimson 2003), Beartooth Mountain Youth Camp (Rennick and Stimson 2003), Limberpine Campground (Swierc 2003c), Parkside Campground (Swierc 2003d), Westminster Spires Camp, and Rock Creek Resort (Stimson and Simons 2004b). Available SWADRs indicate that drinking water sources in the Main Fork Rock Creek is high quality and free of contaminants. These reports also indicate that all these drinking water sources are highly susceptible to contamination because they draw water from springs or shallow unconfined acquifers. The SWADRs recommend application of various best management practices, development of emergency spill response plans, replacement of outhouses with vault toilets, and proper maintenance of sewage systems. A SWADR for the Beartooth Mountain Christian Ranch (which is adjacent to the Forest Boundary in the Little Rocky Creek drainage) has been completed, but is not readily available for review (Montana Department of Environmental Quality 2008).

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 analysis area, the largest recent fires occurred in the

Stillwater drainage in 1988 and 2003 burning over 18,000 acres. Substantial recovery of timber stands is assumed for those fires that occurred two or more decades ago.

Forested areas have endemic levels of insects and minor infections of diseases (see vegetation section) and therefore are not substantially affecting hydrologic processes. However, the wind events of the 2007/2008 winter have affected large areas of timber within some watersheds. Observations from the December 2007 overflight suggest that the watersheds most affected by blowdown include Lower West Rosebud, Upper Little Rocky, West Fork Fishtail and Fiddler Creek. Refer to Table 3.

Under vegetated conditions, natural stream sediment load and transport processes are generally limited to instream erosion. Natural disturbance events (wildfire and blowdown) that significantly reduce vegetative cover can result in significant increases in water yield, surface erosion, slumps and debris flows, especially when followed by high intensity precipitation events. Subsequent sediment delivery to stream systems can be significant, but generally short lived, after these events.

Characteristics of selected streams: Rock Creek generally has moderate entrenchment, sinuosity and gradient with cobble sized substrate (B3 streamtype, Rosgen 1996). Less entrenched segments result in decreased gradient and substrate size (C4 streamtype). Little Rocky and Fishtail Creeks are relatively high gradient with moderate entrenchment and sinuosity, and boulder sized substrate (B2a streamtype). B stream types with large substrate are relatively resistant to changes in streamflow or sediment loads.

Data collected in 2008 on segments of Little Rocky Creek not affected by recent blowdown events suggests that average frequency and size of large woody debris (LWD) is less than eight pieces averaging 1.7 feet dbh per 100 feet of stream (data available from project file). Average frequency of small log jams or potential future jams (defined as two to four pieces with at least one spanner) is just under one per 100 linear feet. Average frequency of large active log jams (defined as five or more pieces) is approximately one per 200 linear feet.

Data has not been collected on stream segments with blowdown, but observations suggest the density of blowdown across the mainstem channel of Little Rocky could exceed the above levels by a factor of two or more. Refer to Figure 1 and 2 for examples of blowdown density across the mainstems of Little Rocky and Fishtail Creek.

From a physical standpoint, LWD is an important component in all streams within the analysis area by adding stability to the system through flow energy dissipation and bank armoring, both of which reduce channel scour and bank erosion. Reduced streamflow velocity and obstacles provided by woody debris cause sediment to be trapped and deposited rather than flushing through the entire system. Too much woody debris may increase channel scour and bank erosion in the short-term, and could result in destabilized channels and riparian areas after high intensity wildfire events in the long term.

Mobility of woody debris is affected by flood stage and existing anchored woody debris. In general, flows at bankfull or below move only small short debris, while flows above bankfull begin to move larger debris, longer distances. Table 2 provides flood discharge estimates for selected watersheds across the analysis area. As a reference point, Rock Creek discharge during the 2008 spring runoff peaked at 1010 cfs on July 3, which is near the 2 year flood level of 1220 cubic feet per second (cfs). These flood discharge estimates suggest that significant increases in flood magnitude can occur between the more frequent event intervals. For example, the estimated flood magnitude for a 5 year event is approximately three times the 2 year event, whereas the 10 year event is roughly six times the 2 year event. This holds true for all watersheds except Rock Creek, where a flood frequency analysis was completed by the USGS from actual streamflow data on Rock Creek (Parrett and Johnson 2004). This streamflow data suggests that increases in flood magnitude between the more frequent events is much less than what was predicted from the discharge estimates. It is important to note that the influence of land management activities or recent blowdown events on water yield or streamflows is not reflected in the estimates in Table 2, but is addressed qualitatively under the Effects section.

**Figure 1. Blowdown across Little Rocky Creek**

**Figure 2. Blowdown across West Fork Fishtail Creek**

Although flood discharge estimates suggest flood stage could increase substantially for even short interval flood events, woody debris mobility will still be limited in spatial extent. The frequency of existing large woody debris influences the mobility of small woody debris. Frequent spacing of large anchored woody debris can help to reduce the formation of large log jams by reducing the distance that floatable debris is transported downstream. In other words, many small log jams result in short travel distances for woody debris, each one trapping a few pieces of debris thereby maintaining the size of small jams, versus a few log jams with longer travel distance, each trapping many more pieces of debris and becoming large jams. Frequent small log jams provide more frequent energy dissipation and cause more frequent floodwaters dispersion to floodplains, and thereby reduce the potential for major channel alteration that can occur with single large log jams.

**b. Human Influences**

Human influences on water resources on NFS lands in the analysis areas include travel routes, recreation, historical mining, timber harvest, fire suppression, livestock grazing and wildlife extirpation. From a watershed and cumulative effects perspective, additional activities occur on private land below the FS boundary that may affect water resources including agriculture (riparian grazing, crop production and irrigation diversions), timber

harvest and floodplain development, but these activities have not been quantified. Refer to Table 3 for activities on NFS land that were quantified by acres or miles.

The 2007 Beartooth Travel Management FEIS identified a couple of road segments in the Rock Creek and Little Rocky Creek watersheds that are impacting water quality; routes 2478, 2414, 241419, 24141A, 24141C and 242119A. Other roads in the analysis area are generally located on mid slopes, which provide adequate filter distance for trapping sediment before it is contributed to streams. Lower Fishtail, Fiddler, Upper Little Rocky, Rock Creek (Wyoming Creek), and West Red Lodge watersheds have the highest road densities.

The 2007 Beartooth Travel Management FEIS also identified a number of dispersed camp sites and locations within developed campgrounds in the analysis area that are contributing to water quality impacts. These sites are located along or at the end of the following routes; 241412, 241413, 2421C and 2421. These sites contribute to water quality impacts by concentrating overland flow and routing flow and sediment to streams or by destabilizing stream banks which has increased bank erosion.

Large scale mining operations for chromite occurred in the 1940's in the Benbow area. The underground mine is located in the upper reaches of Little Rocky Creek, while the historical mill site is located near the lower reaches above the Forest boundary. Access roads to mine sites that ford streams are known sources of sedimentation, as well as mill tailings that are adjacent to tributary streams.

Past timber harvest activities are minimal across the analysis area, but those watersheds with the most acres of treatment include West Red Lodge Creek and Little Rocky Creek (Table 3). These activities are 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.

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.

Livestock grazing on Forest Service land occurs in portions of the analysis area, generally from West Red Lodge Creek west to the Stillwater drainage. While grazing has occurred since the early 1900s, livestock numbers have decreased across the Beartooth District

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. Grazing has been found to adversely impact some riparian systems in this area. Please refer to recent range decisions (2006 Meyers Creek EA, 2008 Beartooth District AMP EA draft) for more information on these impacts.

The 2006 Montana 305(b)/303(d) Water Quality Assessment Database indicates that only one stream requiring a TMDL (Cat. 5) is located within a watershed were salvaged activities are proposed; Fishtail Creek . Refer to Table 4 below. This TMDL segment is located from the confluence with the West Fork Rosebud upstream to its headwaters. Aquatic life and cold water fisheries (trout) are listed as partially supported. The probable causes are iron and lead with unknown sources. It is highly unlikely that existing Forest Service management activities influence iron and lead concentrations in Fishtail Creek, due both to the overall lack of management activities in the drainage and the limited influence that timber management activities have on iron and lead concentrations.

## Table 1 – LIST OF WATERSHEDS EVALUATED

| WATERSHED # | WATERSHED NAME | TOTAL ACRES | ACRES ABOVE 6000 FEET[1] | PERCENT FS OWNERSHIP |
|---|---|---|---|---|
| 100700050105 | Stillwater River Headwaters-Woodbine Creek | 40510 | 38386 | 100 |
| 100700050201 | Upper West Fork Stillwater River | 28642 | 28642 | 100 |
| 100700050203 | Lower West Fork Stillwater River | 14772 | 12230 | 83 |
| 10070005040101 | WF Fishtail Creek | 9172 | 8975 | 100 |
| 10070005040102 | EF Fishtail Creek | 6944 | 6693 | 100 |
| 10070005040103 | Lower Fishtail Creek | 7997 | 847 | 20 |
| 100700050403 | Fiddler Creek | 18030 | 6192 | 36 |
| 100700050404 | Lower West Rosebud Creek | 29020 | 24738 | 88 |
| 10070005050101 | Lower Little Rocky Creek | 5323 | 470 | 23 |
| 10070005050102 | Upper Little Rocky Creek | 6812 | 6046 | 100 |
| 100700060901 | Rock Creek-Wyoming Creek | 32086 | 22742 | 71 |
| 100700060902 | Lake Fork | 24205 | 24205 | 100 |
| 100700061001 | West Red Lodge Creek | 30089 | 14221 | 53 |

[1]This information is used for flood modeling in selected watersheds.

## Table 2 – FLOOD DISCHARGE ESTIMATES[1] FOR SELECTED WATERSHEDS IN ANALYSIS AREA

| WATERSHED NAME | Flood Discharge (cubic feet per second) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Probability of Occurrence/Associated Recurrence Interval | | | | | | | |
| | 50%/2yr | 20%/5yr | 10%/10yr | 4%/25yr | 2%/50yr | 1%/100yr | 0.5%/200yr | 0.2%/500yr |
| EF Fishtail Creek | 45 | 137 | 274 | 429 | 614 | 837 | 1109 | 1558 |
| WF Fishtail Creek | 57 | 171 | 339 | 526 | 749 | 1016 | 1341 | 1875 |
| Fishtail Creek | 126 | 365 | 695 | 1093 | 1540 | 2071 | 2713 | 3758 |
| Fiddler Creek | 97 | 293 | 546 | 914 | 1303 | 1772 | 2343 | 3284 |
| Upper Little Rocky Creek | 44 | 135 | 269 | 426 | 610 | 833 | 1105 | 1554 |
| Little Rocky Creek | 70 | 214 | 409 | 670 | 958 | 1304 | 1728 | 2425 |
| Rock Creek near Red Lodge[2] USGS # 06209500 peaked at 1010 cfs on July 3, 2008 Peak of record 3110 cfs on June 4, 1957 | 1220 | 1690 | 2000 | 2390 | 2680 | 2960 | 3250 | 3630 |

[1]Estimates based on procedures provided in Parrett and Johnson 2004. NOTE: Estimates can have substantial errors of prediction, generally 50 to over 100 percent.
[2]Flood discharge estimates for Rock Creek were developed by the USGS from actual stream data and can be found in Parrett and Johnson 2004.

**Table 3 – PAST AND PRESENT HUMAN ACTIVITIES AND NATURAL EVENTS BY WATERSHED***

| WATERSHED NAME | PAST HARVEST ACRES | PAST FIRE ACRES | FS ROADS MILES | TOTAL ROADS MILES | BLOWDOWN ACRES |
|---|---|---|---|---|---|
| Stillwater River Headwaters-Woodbine Creek | 0 | 17300 | 2 | 6 | 56 |
| Upper West Fork Stillwater River | 0 | 911 | 7 | 7 | 146 |
| Lower West Fork Stillwater River | 32 | 5 | 15 | 19 | 64 |
| WF Fishtail Creek | 0 | 1 | 0 | 0 | 2250 |
| EF Fishtail Creek | 13 | 0 | 0 | 0 | 897 |
| Lower Fishtail Creek | 47 | 152 | 12 | 28 | 519 |
| Fiddler Creek | 0 | 4 | 2 | 32 | 1032 |
| Lower West Rosebud Creek | 44 | 476 | 16 | 19 | 2306 |
| Lower Little Rocky Creek | 57 | 10 | 9 | 20 | 119 |
| Upper Little Rocky Creek | 71 | 24 | 24 | 25 | 2536 |
| Rock Creek-Wyoming Creek | 54 | 424 | 41 | 42 | 288 |
| Lake Fork | 5 | 243 | 3 | 3 | 262 |
| West Red Lodge Creek | 95 | 60 | 24 | 27 | 984 |

***Only activities that cover substantial acreage are accounted for. Activities with small disturbance areas such as mine sites or dispersed campsites are not accounted for, although access roads to these small sites are.**

**Table 4 - Summary of Streams on the 2006 Montana 303(d) List Within or Immediately Adjacent to the Project Area**

| TMDL CATEGORY 4A and 5 STREAMS (TMDLs REQUIRED) | | | | |
|---|---|---|---|---|
| **Name 6HUC ID TMDL category** | **Probable Impaired Use[1]** | **Probable Cause of Impairment** | **Probable Source of Impairment** | **Location** |
| Fishtail Creek 100700050401 Category 5 | Aquatic Life Support (P)<br>Cold Water Fishery - Trout (P) | Iron, Lead | Sources Unknown | Headwaters to mouth. |
| Willow Creek 100700061005 Category 5 | Aquatic Life Support (P)<br>Cold Water Fishery - Trout (P)<br>All other uses not assessed | Low flow alterations, Sedimentation/siltation | Irrigated Crop Production | Headwaters to mouth. Mostly below Forest. |
| **TMDL CATEGORY 1, 3 and 4C STREAMS (TMDLs NOT CURRENTLY REQUIRED)** | | | | |
| **Stream/6HUC ID/TMDL category** | **Probable Impaired Use** | **Probable Cause of Impairment** | **Probable Source of Impairment** | **Location** |
| Rock Creek 100700060901/03 Category 1 | All uses fully supported | na | na | State line to West Fork. |
| Rock Creek 100700060906 Category 4C | Aquatic Life Support (P)<br>Cold Water Fishery - Trout (P)<br>Primary Contact - Recreation(P) | Low flow alterations | Flow alterations from Water Diversions, Irrigated Crop Production | West Fork Rock Creek to Red Lodge Creek. Below Forest boundary. |
| Wyoming Creek part of 100700060901 Category 1 | All uses fully supported | na | na | State line to mouth. |

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

## ISSUES

Potential effects to water quality have been identified as a key issue for the Beartooth Front Storm Damage Clean-up and Fuels Reduction Healthy Forests Restoration Act Project. For this analysis, effects to water quality are disclosed by focusing on the effects of the proposed activities to hydrologic processes and water resources; specifically water yield, sedimentation, and channel and floodplain function. Units of measure that will be utilized to display effects are equivalent clearcut area acres (ECA), number of stream crossings, and miles of temporary roads.

## ENVIRONMENTAL EFFECTS

Indirect and cumulative effects are discussed in terms of risk of causing measurable changes to water quality or quantity. If the risk is identified as low or unmeasurable (not detectable), it means that the increases in water quantity or quality due to the proposed activities cannot be distinguished from variations that are occurring naturally, or from variations that are occurring from existing or past activities.

### a. Effects of the No-Action Alternative

Watersheds, undisturbed by human influences, are not static systems. Deep snowpacks and heavy spring rains can cause significant flooding. Wildfire, wind, or insect and disease mortality can drastically alter the vegetative composition of a watershed. Depending on the extent of mortality and rate of stand decomposition, impacts to stream systems can be significant. Beneficial uses, including aquatic and riparian habitat, can be negatively affected by these natural events. However, watersheds left undisturbed after natural events, can and do recover rapidly, and ultimately provide conditions that fully support all beneficial uses within a relatively short period of time. These natural disturbances occur infrequently, which allows for significant and generally rapid recovery of hydrologic and erosional processes prior to the next major disturbance event. This results in pulse effects, which are moderate to high in magnitude, but low in frequency. Within the current climatic regime and prior to significant human influence, aquatic systems have developed under pulse type disturbances.

### NO-ACTION ALTERNATIVE DIRECT EFFECTS

There are no directs effects associated with the no-action alternative.

### NO-ACTION ALTERNATIVE INDIRECT EFFECTS

In contrast to direct effects, indirect effects occurs at a later time and/or distance from the activity. Indirect effects concerning water resources generally result from changes in soil and hydrologic processes, i.e., increases in either water or sediment yield across a landscape, and the subsequent effects of these increases on channel, floodplain and wetland functions.

Individual reaches with high blowdown density: The amount of blowdown in areas of highest blowdown density exceeds current levels of LWD along stream reaches unaffected by the recent blowdown by at least two to three times. Under a scenario where the riparian area does not burn with high intensity, windthrown trees will gradually settle into the stream channel and banks. In areas of high blowdown density, an excessive amount of woody debris in the channel is likely to cause excessive scour of channel bottom and banks due to localized flow diversions and increased flow velocity. However, during flood events, water levels would overtop banks and access floodplains where flows would be dispersed and flood energy dissipated. Again, due to the high cobble/boulder content of banks and adjacent floodplains, armoring of banks from rootwads, and frequent but small log jams, substantial changes to existing channel courses would not be anticipated under the No-action alternative.

Water Yield: Human activities or natural events that remove or destroy a significant amount of timber canopy have the potential to alter hydrologic processes (Troendle 1983, Stednick 1996). A reduction in forest canopy will decrease transpiration and evaporation rates, which results in increases to on-site water yield. Reductions in forest canopy may also increase snowmelt rates which can increase bankfull flows (magnitude or duration). Since bankfull flows are the flow levels that define channel geometry and provide most of the energy for bank erosion, channel scour, and sediment transport, increases in bankfull flows (magnitude or duration) have the potential to accelerate these instream erosion processes.

The influence of vegetation treatments or natural events on water yield is typically measured by the degree of crown reduction in the mature timber stand. Reductions in crown cover were estimated for the areas of blowdown and converted to an equivalent clearcut area (ECA). Equivalent clearcut area calculations reflect different levels of forest canopy reduction, but standardize these different levels to a percentage of a clearcut acre. The relationship of percent canopy reduction to ECA acre is nonlinear as presented in Forest Hydrology Part II (USDA Forest Service 1973).

According to Troendle (1983), 20 to 30 percent ECA in a watershed is required to initiate measurable changes in streamflow. Stednick (1996) suggests that 15 percent is sufficient to detect changes in annual water yield in the Rocky Mountain region, while 50 percent is necessary for the Central Plains.

The ECA values for blowdown (and associated percent HUC values) in Table 5 suggest that West Fork Fishtail and Upper Little Rocky watersheds are at or slightly above levels presented above that could produce measurable changes in annual water yields and possibly streamflows. However, the effects of crown reduction on streamflows diminish as the drainage area increases. In other words, effects that may be measurable (detectable) in small headwater drainages (100 to 1000 acres) will be masked by other natural and human variables and become undetectable as the drainage area increases. Complete (headwaters to mouth) watersheds within the analysis area range from 6812 acres (Upper Little Rocky) to 40,510 acres (Stillwater River Headwaters- Woodbine Creek). Additionally, past management activities or natural events that affect crown

cover are expected to have little effect on streamflows associated with extreme flood events (50 or 100 year recurrence interval). Brooks (1997) suggests "as the amount and duration of precipitation increases, the influence of the soil-plant system on stormflow diminishes. Therefore, the influence of vegetative cover is minimal for extremely large precipitation events that usually are associated with major floods. Changes in land use, particularly changes in forest cover, will more likely affect smaller floods with return periods from 5 to 20 years for example, than major floods with return periods of 50 years or greater." Troendle (1994) suggests that "...generally smaller [streamflow] peaks (precipitation limited) are influenced proportionally more than large peaks with the largest, or extreme [flood] events probably not affected by treatment."

In conclusion, ECA modeling for the No-action alternative indicates that streamflows and water yields could slightly increase in the West Fork Fishtail and Little Rocky drainages due to blowdown, but there is a low risk that existing levels of blowdown would cause substantial increases in water yield and streamflow downstream of the immediate blowdown areas. Based on ECA modeling, no detectable increases in streamflows and water yields would be expected in other streams analyzed for the No-action alternative.

**NO-ACTION ALTERNATIVE CUMULATIVE EFFECTS**

Total ECA acres for past and present land management activities and natural events on National Forest System land and total roads within the watershed are displayed in Table 5. Again, West Fork Fishtail and Upper Little Rocky watersheds are at 22 and 30 percent of the watershed in a ECA condition which is at or slightly above levels that could produce measurable changes in annual water yields and possibly streamflows. This is mainly due to blowdown as previously discussed.

Given the current vegetative conditions and associated fuel accumulations throughout the project area, there is potential for wildfires to occur that may also be outside the range of variability (intensity and duration) that has occurred over the last few hundred years. Under a high intensity/long duration wildfire scenario, the risk of impact to adjacent soils, streams and floodplains could be substantial in areas of high blowdown density. Depending on wildfire intensity and residence time, effects could result in substantial loss of vegetative cover and resiliency; detrimental impacts to soils; loss of instream woody debris; and channels, banks and adjacent floodplain areas becoming highly unstable. Channel adjustments (scour and bank erosion) could be expected, especially during high precipitation/runoff events. However, due to the high cobble/boulder content of adjacent soils, these adjustments are not likely to be substantial across the entire stream system. These stream systems would eventually stabilize as vegetative recovery occurs during post-fire years.

Cumulative watershed scale impacts from a wildfire scenario would depend on intensity, duration, location and amount of area burned. Water yield, surface erosion, mass wasting, streamflow and instream erosion would all increase relative to the magnitude of these fire effects. Post-fire run-off can contain increased levels of nutrients and sediment (Miller et al 2006, Wondzell and King. 2003). Such increases could potentially affect water quality

and quantity in shallow wells with surface water connection and irrigation ditches that serve communities and residences in the analysis areas. Existing roads and floodplain development, such as campgrounds, recreational residence tracts, organizational camps, irrigation diversion structures, bridges, and culverts, would compound the effects of a stand replacement wildfire. Roads would increase surface and subsurface drainage efficiency, routing upslope waters to natural channels at higher rates, thereby increasing floodwater levels. Floodplain developments that restrict floodwater access to floodplains would also result in higher flood stage. The combination of these conditions would increase the risk of more flood damage to streams and adjacent human developments following a wildfire. The effects would be highest in those drainages or subdrainages that burn with high intensity over a large area and where road density or floodplain development is moderate to high.

**Table 5 – SUMMARY OF NO-ACTION ALTERNATIVE ECA ANALYSIS BY WATERSHED**

| WATERSHED NAME | HARVEST ECA ACRES | FIRE ECA ACRES | ROAD ECA ACRES | BLOWDOWN ECA ACRES | ECA – EXISTING ACRES | PERCENT HUC ECA EXISTING |
|---|---|---|---|---|---|---|
| Stillwater River Headwaters-Woodbine Creek | 0 | 4795 | 12 | 56 | 4863 | 12 |
| Upper West Fork Stillwater River | 0 | 565 | 13 | 110 | 688 | 2 |
| Lower West Fork Stillwater River | 4 | 2 | 37 | 64 | 106 | 1 |
| WF Fishtail Creek | 0 | 0 | 0 | 2004 | 2005 | 22 |
| EF Fishtail Creek | 2 | 0 | 0 | 650 | 653 | 9 |
| Lower Fishtail Creek | 7 | 20 | 55 | 362 | 444 | 6 |
| Fiddler Creek | 0 | 1 | 63 | 1001 | 1065 | 6 |
| Lower West Rosebud Creek | 10 | 216 | 37 | 1145 | 1407 | 5 |
| Lower Little Rocky Creek | 10 | 1 | 39 | 9 | 59 | 1 |
| Upper Little Rocky Creek | 14 | 7 | 49 | 2007 | 2076 | 30 |
| Rock Creek-Wyoming Creek | 8 | 159 | 81 | 37 | 284 | 1 |
| Lake Fork | 0 | 81 | 5 | 254 | 340 | 1 |
| West Red Lodge Creek | 18 | 20 | 53 | 755 | 846 | 3 |
| TOTAL | 72 | 5868 | 444 | 8454 | 14836 | na |

**b. Effects of the Action Alternative**

**ACTION ALTERNATIVE DIRECT EFFECTS**

Construction of new stream crossings, i.e., bridges, culverts or fords, and use of fords, are the only actions that would have direct effects to water resources. This is due to the immediate sediment delivery and flow disruption that generally occurs during installation and removal of the structure. Temporary crossings are proposed for both skidding operations and log hauling. Log cribs would be used for skidding across two sites on perennial streams and up to nine sites on intermittent watercourses (unit 1- Little Rocky Cr. and unit 60- Fishtail Cr.). Two temporary skidder bridges and one improved ford are proposed at three sites on perennial streams, and two temporary culverts are proposed at two sites on intermittent streams (unit 1- Little Rocky Cr. and unit 60- Fishtail Cr.). Minor and temporary sediment generation is anticipated for all log crib and bridge locations during installation and removal. Temporary culverts would generate the most sediment during installation and removal, but levels should be minimal once installed. Construction of an improved ford may generate the least sediment during installation and removal, but the most sediment during operations. However, all crossings would meet the requirements of SMZ regulations, Montana Forestry BMP's, and MTDFWP 124 permit stipulations. All temporary crossing locations would be fully rehabilitated to ensure approaches are adequately drained, revegetated, stabilized and closed to future traffic. Sediment generation should subside to background levels soon after sites are closed and rehabilitated.

**ACTION ALTERNATIVE INDIRECT EFFECTS**

Since a reduction in timber canopy has already occurred as a result of the winter 2007/2008 natural blowdown events, removing all or a portion of the windthrown timber will have little additional influence on water yield and streamflows in the short-term. Additionally, proposed thinning and prescribed burning activities would affect a minimal amount of actual timber canopy across a minimal amount of watershed area, and therefore also have little additional influence on water yield or streamflows. The proposed treatments would affect one percent or less of any single watershed.

Although adverse indirect effects are not anticipated from these proposed treatments, long-term beneficial effects are. Removal of blowdown and associated slash, combined with thinning to further reduce fuel loads would reduce the potential for high intensity/long duration fire in localized riparian areas, thereby reducing the magnitude of adverse impacts to streams, wetlands, floodplains, and overall water quality.

On-site sediment production is anticipated from the proposed activities that utilize heavy equipment to remove or pile trees. However, the majority of this sediment would be deposited and stabilized prior to reaching streams and wetlands. Adhering to Streamside Management Zone regulations and Best Management Practices would help minimize sediment production from the proposed vegetation treatments and road construction/maintenance, and reduce sediment transport downslope. Less than two miles

of temporary road would be constructed to facilitate log hauling; 0.6 miles in the Little Rocky drainage and 1.1 miles in the Fishtail drainage. Except for crossing sites, temporary road locations are far enough away from perennial streams to provide an adequate filter zone for sediment deposition. The effects of both temporary road construction and skidding operations would be short-term as roads and skid trails stabilize and revegetate after closure. Closure and obliteration of temporary roads would involve ripping, seeding, slashing and installation of appropriate drainage features.

**Table 6 – Summary of Existing ECA and Action Alternative Proposed Treatment by Watershed**

| WATERSHED NAME | ECA - EXISTING | PERCENT HUC ECA EXISTING | PROPOSED TREATMENT | PERCENT HUC TREATED |
|---|---|---|---|---|
| Stillwater River Headwaters-Woodbine Creek | 4863 | 12 | | 0 |
| Upper West Fork Stillwater River | 688 | 2 | | 0 |
| Lower West Fork Stillwater River | 106 | 1 | | 0 |
| WF Fishtail Creek | 2005 | 22 | 52 | 1 |
| EF Fishtail Creek | 653 | 9 | 24 | <1 |
| Lower Fishtail Creek | 444 | 6 | 28 | <1 |
| Fiddler Creek | 1065 | 6 | | 0 |
| Lower West Rosebud Creek | 1407 | 5 | | 0 |
| Lower Little Rocky Creek | 59 | 1 | 44 | 1 |
| Upper Little Rocky Creek | 2076 | 30 | 64 | 1 |
| Rock Creek-Wyoming Creek | 284 | 1 | 90 | <1 |
| Lake Fork | 340 | 1 | | 0 |
| West Red Lodge Creek | 846 | 3 | | 0 |
| TOTAL | 14836 | na | 302 | na |

## ACTION ALTERNATIVE CUMULATIVE EFFECTS

The proposed treatments would have minimal additional influence on water yield and streamflow, and therefore cumulative watershed effects would be very similar to the No Action Alternative.

The amount of blowdown treated would be relatively minor; approximately five percent across the analysis area. Therefore, a substantial amount of riparian area would remain susceptible to the potential impacts described under the No Action Alternative. This would be especially true in West Fork of Fishtail, but also portions of East Fork Fishtail, Upper Little Rocky, Lower West Rosebud and Fiddler Creek.

As previously mentioned, there would be potential for large scale wildfire events to occur across the analysis area. The proposed fuel treatments are designed to improve firefighter safety, improve defensibility of structures and adjacent private property, and improve

ingress and egress along certain travel routes. These treatments may also help to reduce human caused fire starts and improve initial attack success. However, due to the density and expanse of fuels across the analysis area, wildfires that are not initially suppressed would still have the potential to develop into large scale fires. From a cumulative watershed scale perspective, large scale stand replacement wildfire in headwater areas would decrease water quality due to increased surface erosion, mass wasting, streamflow and instream erosion throughout the entire mainstem. This is possible for all mainstem channels discussed in this analysis under a large scale wildfire scenario.

The proposed activities are not expected to further impact Fishtail Creek, identified in the 2006 Montana 305(b)/303(d) Water Quality Assessment Database as a stream segment that requires a TMDL. It is highly unlikely that the proposed activities will influence the listed sources of impairment (iron and lead) in Fishtail Creek, either directly, indirectly or cumulatively.

**Action Alternative and No-Action Alternative** Short-term vs. Long-term Productivity: There are no short-term versus long-term productivity issues for water resources under any alternative.

**Action Alternative and No-Action Alternative** Irreversible/irretrievable Commitments: There are no irreversible/irretrievable commitments on water resources under any alternative.

**Action Alternative and No-Action Alternative** Unavoidable Adverse Effects: There are no unavoidable adverse effects on water resources under any alternative.

**Action Alternative and No-Action Alternative** Compliance with Laws, Regulations and Policy ; All alternatives comply with state and federal water quality laws, and Forest Plan Standards and Guidelines, assuming adequate implementation of BMPs and SMZ regulations.

## MITIGATION AND MONITORING

The effects on water resources and statements pertaining to compliance with applicable law, regulation, and policy assume all of the following mitigation is incorporated during project implementation:

Use of fords to facilitate yarding or hauling: To comply with the MT SMZ regulations (ARM 2007b), Class 1 and 2 streams would only be crossed for skidding purposes by suspended means, i.e., log cribs or temporary bridges and only with alternative practice approval from DNRC. Class 1 and 2 streams would not be forded for skidding purposes, but Class 3 streams could be forded at 200 foot minimum intervals, at stable sites and only when the stream is dry. Streams could however, be forded for hauling activities. The associated BMP suggests that unimproved fords should be avoided. Improved fords would consist of hardening approaches and channel bottom in order to minimize the generation or delivery of fine sediment. Hardening could consist of rubber mats, concrete

planks or a layer of substrate that is larger than currently exists which would not be mobilized by high flows.

Temporary Roads and stream crossings would be obliterated and restored: To ensure effective rehabilitation and long term drainage of temporary roads, temporary road prisms would be obliterated and blocked so as to not be passable by off-highway vehicles. To the extent practical, logging slash (cull logs, rootwads, large limbs) would be placed along the road prism, especially at points of entrance to the road. Overly compacted segments would be ripped as needed, and seeded with a certified noxious weed free seed mix prior to placing slash. All culverts, log cribs and skidder bridges installed for this project would be removed and crossing site approaches would be restored to match adjacent topography. For temporary roads on existing non-system routes, these routes would be reclaimed to ensure accessibility would not be improved over pre-project conditions, thereby ensuring traffic related sediment production/transport would not increase over pre-project conditions. New fords would always be considered temporary and full rehabilitation of crossing sites would occur after hauling activities cease. Rehabilitation would include recontouring and ripping if necessary, installation of adequate drainage, and slash placement to disperse overland flows and eliminate potential for public motorized access.

Streamside Management Zone Law and Rules would be applied in unit layout and design and during operations: Alternative practices have been reviewed and approved by the MT-DNRC to allow salvage of blowdown material within SMZs. These practices are related to equipment operations, leave tree requirements, temporary crossings and SMZ flagging. Portions of units that are mainly thinning of green timber will revert back to and comply with standard SMZ regulations. Forest Service COR and operator would be fully informed of all stipulations prior to implementation.

Appropriate Stream Permits would be secured: When locating and constructing temporary roads and skid trails, intermittent or perennial stream crossings would be avoided. Where crossings cannot be avoided, appropriate BMPs would be incorporated into the crossing design. 124 permits from the Montana Department of Fish, Wildlife and Parks have been reviewed and approved for installation of crossing structures and salvage operations along banks of all perennial streams. Measures would be taken to ensure FS COR and operator are fully aware of all permit stipulations prior to implementation.

Clarification of Stream definition to be applied in unit layout and design and during operations: The minimum criteria to meet the definition of a stream under the Montana Forestry BMPs (DNRC 2002) is the same as for Class 3 streams under the SMZ Law (ARM 2007b), i.e., dry scoured or partially scoured channels that flow less than six months per year and generally do not conduct water to the next order drainage downslope. Class 3 streams can be dry one year and flowing for a short duration the next year. Mitigating impacts to natural drainage features that do not meet these minimum stream criteria would still be addressed through BMPs.

Monitoring would occur: A Custer National Forest level BMP Audit would be scheduled and completed on select treatments and roads within two years of full project implementation (could exclude pile burning, but should include temporary road obliteration).

## REFERENCES


42 USC 300f. 2006. United States Code, Title 42--The Public Health And Welfare, Chapter 6a--Public Health Service, Subchapter Xii--Safety Of Public Water Systems. Available online at: http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=browse_usc&docid=Cite:+42USC300f

Administrative Rules of Montana. 2007a. Title 17 – Environmental Quality, Chapter 30 – Water quality, Subchapter 6 - Surface Water Quality Standards and Procedures. Helena, MT. (Online). Available: http://www.mtrules.org/gateway/Subchapterhome.asp?scn=17.30.6

Administrative Rules of Montana. 2007b. Title 36 – Natural Resources and Conservation, Chapter 9 – Forestry, Subchapter 3 - Streamside Management Zone Rules. Helena, MT. (Online). Available: http://www.mt.nrcs.usda.gov/technical/ecs/forestry/technotes/forestryMT18/

Brooks, K.N., P.F. Folliott, H.M. Gregensen, and L.F. DeBano. 1997. Hydrology and the Management of Watersheds. Iowa State University Press. Ames, IA. (pages 127 and 130)

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.

Healthy Forest Restoration Act of 2003. Available online at: http://www.fs.fed.us/biology/wildecology/HFRA.pdf

Miller WW, DW Johnson, TM. Loupe, JS. Sedinger, EM Carroll, JD Murphy, RF Walker and D Glass. 2006. Nutrients flow from runoff at burned forest site in Lake Tahoe Basin. California Agriculture, Volume 60, Number 2. Available online at: http://calag.ucop.edu/0602AMJ/pdfs/3_BurnRunoff.pdf

Montana Code Annotated. 2007. Title 87 – Fish and Wildlife, Chapter 5 – Wildlife Protection, Part 5 – Stream Protection. Helena, MT. (Online). Available: http://data.opi.state.mt.us/bills/mca/87/5/87-5-502.htm

Montana Department of Environmental Quality. 2008. Online Montana Source Water Protection Query System. Available online at: http://nris.state.mt.us/wis/swap/swaplist.asp

Montana Department of Environmental Quality. 2006. 2006 Integrated 305(b)/303(d) Water Quality Report. (Online). Available: http://www.deq.state.mt.us/CWAIC/wq_reps.aspx?yr=2006qryId=13196

Montana Department of Natural Resources and Conservation. 2002. Best management practices for forestry in Montana. MTDNRC, Forestry Division, Missoula, MT. (Online). Available: http://dnrc.mt.gov/forestry/serviceforestry/ForestryBestManagementPractices/BMPs.pdf

Parrett, C. and D.R. Johnson. 2004. Methods for estimating flood frequency in Montana based on data through water year 1998. Water Resources Investigation Report 03-4308. U.S. Geological Survey, Reston, Virginia. 101 pgs.

Rennick, Laura and J. Stimson 2003. Beartooth Mountain Youth Camp Source Water Delineation and Assessment Report. Available online at: http://www.deq.mt.gov/ppa/swp/nrisreports/MT0062577.htm

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

Stednick, John D. 1996. Monitoring the effects of timber harvest on annual water yield. Journal of Hydrology. 176:79-95.

Stimson, Jim. 2003. Montana DEQ Source Water Delineation and Assessment Report for City of Red Lodge. Available online at: http://www.deq.mt.gov/ppa/swp/nrisreports/MT0000314.htm

Stimson, Jim and M. Simons 2004b. Source Water Delineation and Assessment Report, Public Water Supply: Rock Creek Resort. Available online at: http://www.deq.mt.gov/ppa/swp/nrisreports/MT0000004.htm

Swierc, James. 2003b. Greenough Lake Campground Source Water Delineation andAssessment Report. Available online at: http://www.deq.mt.gov/ppa/swp/nrisreports/MT0062227.htm

Swierc, James. 2003c. Limber Pine Campground Source Water Delineation and Assessment Report. Available online at: http://www.deq.mt.gov/ppa/swp/nrisreports/MT0062224.htm

Swierc, James. 2003d. Parkside Campground Source Water Delineation and Assessment Report. Available online at: http://www.deq.mt.gov/ppa/swp/nrisreports/MT0062228.pdf

Troendle, Charles A. 1983. The Deadhorse Experiment: A Field Verification of the Subalpine Water Balance Model. U.S. Dept. of Agriculture - Forest Service, Research Paper RM425. Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 7 p.

Troendle, C.A. and W.K. Olson. 1994. Potential Effects of Timber Harvest and Water Management on Streamflow Dynamics and Sediment Transport. General Technical

Report RM-247. U.S. Dept. of Agriculture - Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 7 p.

USDA - Forest Service. 1973. Forest Hydrology Part II - Hydrologic Effects of Vegetation Manipulation. Northern Region. Missoula, MT. (page 39)

U.S. Dept. of Agriculture - Forest Service. 1981. Guide for predicting sediment yields from forested watersheds. Northern Region. Missoula, MT. (page 15)

USDA - Forest Service. 1986. Custer National Forest and National Grasslands Land and Resource Management Plan. USDA Forest Service, Billings, MT. 186 pages. Available online at: http://www.fs.fed.us/r1/custer/projects/environmental/index

USDA - Forest Service. 1995. Forest Service Handbook 2509.22 - Soil and Water Conservation Practices. USDA Forest Service, Missoula, MT. Chapters 11, 13, 14, 15 and 18.

Wondzell, S. M., and J. G. King. 2003. Post-fire erosional processes in the Pacific Northwest and Rocky Mountain region. Forest Ecology and Management 178:75-87