EXISTING CONDITION OF FISHERIES AND AQUATIC RESOURCES

ANALYSIS AREA

The analysis area for fish and aquatic resources consists of the entire Basin Creek subwatershed (31,355 acres) as well as the Blacktail Creek subwatershed (24,620 acres) (Appendix B, Map 22). The Forest Service manages approximately 28,175 acres of public land in these two subwatersheds. Blacktail Creek is a tributary of Silver Bow Creek approximately one mile below where Basin Creek flows into Blacktail Creek. Silver Bow Creek, tributary to the Upper Clark Fork River, has experienced long-term aquatic resource damage due to discharge of tailings and other hazardous mining wastes. Fish have been eliminated from Silver Bow Creek and the number of aquatic macroinvertebrates is significantly reduced relative to baseline conditions (Natural Resource Damage Program 2002).

The majority of potential aquatic effects of this project would occur in the Basin Creek subwatershed including Herman and China gulches upstream of the Forest Service boundary, an area of approximately 15,502 acres of which 93 percent are public lands administered by the Forest Service. Butte-Silver Bow City/County government (hereafter Butte-Silver Bow) owns narrow parcels of land along and including the stream bottoms of most major stream channels embedded within the Forest Service-owned portions along Basin Creek proper. The majority of proposed project activities and their associated impacts would occur downstream of the lower reservoir (Appendix B, Map 22). The lower reservoir would reduce potential effects associated with activities upstream through the dilution and settling of any sediments moving downstream. Below the lower reservoir, there are three stock ponds (one at 1.4 stream miles and two at 2.1 stream miles downstream) that would also reduce potential effects from activities occurring between the lower reservoir and ponds and originating from the urban interface areas below the lower reservoir in China and Herman gulches (Appendix B, Map 22).

INTRODUCTION

Beneficial uses of water in the Basin Creek subwatershed include coldwater fisheries and domestic water use by the city of Butte. Cutthroat trout is the only aquatic management indicator species designated in the Deerlodge National Forest Plan for the planning area. Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and boreal toad (*Bufo boreas boreas*), two Forest Service Region 1 sensitive species, are found in the Basin Creek subwatershed. A third sensitive aquatic species potentially present, northern leopard frog (*Rana pipiens*), has not been found in the planning area. Eastern brook trout, a nonnative species, (*Salvelinus fontinalis*) is reported to be in Basin Creek downstream of the Forest boundary. Herman Gulch and China Gulch are two tributaries to Basin Creek downstream of the municipal water supply source. Neither stream is fish-bearing on National Forest lands. They provide habitat for boreal toads, spotted frogs, and other species. Two additional sensitive fish species, bull trout (*Salvelinus confluentus*) and fluvial arctic grayling (*Thymallus arcticus*) occur elsewhere on the Beaverhead-Deerlodge National Forest but do not occur in or near this project area. Therefore, these two species will not be analyzed in detail.

Beneficial uses of water in Blacktail Creek include coldwater fisheries featuring both brook trout and westslope cutthroat trout. Boreal toads are also present in the Blacktail Creek subwatershed but none have been located to date within or downstream of the area influenced by this project.

PAST MANAGEMENT

Water has been diverted into Basin Creek from upper Fish Creek for the purpose of augmenting the domestic water supply since approximately 1895. The two dams for the reservoir system were constructed in approximately 1907 in conjunction with upgrading the Fish Creek diversion into Basin Creek. The lower dam blocked fish passage to upstream areas at that time and passage remains blocked by the lower dam today.

Around the turn of the 20th century there was considerable placer mining in the stream bottoms of Basin Creek and a number of its tributaries in the project area, as well as timber harvest in the subwatershed. Most riparian areas have re-grown well-established vegetation but since these activities were directly disruptive of aquatic habitats, existing conditions in some areas still reflect long-term alteration of streambanks and channel straightening.

The dam on the upper reservoir was breached in the mid 1980s by the U.S. Army Corps of Engineers. The breach occurred gradually in stages so as not to cause a large and potentially destructive flush of water downstream. Beavers have at times been trapped out of the stream between the two reservoirs and potentially in other areas as well. This has been done to minimize the risk that *Giardia* spp. would be present in the municipal water supply. One side effect of this beaver trapping is that large pools associated with beaver ponds that benefit aquatic fauna such as spotted frogs and westslope cutthroat trout are no longer being maintained by beaver and are being drained over time as unmaintained beaver dams gradually fail.

CURRENT MANAGEMENT

Management of the Basin Creek reservoir system by Butte-Silver Bow affects aquatic habitat in a number of ways. There is a small sediment-retention dam approximately 200 feet upstream of the inlet to the lower reservoir. Approximately 125 cubic yards of sediment are removed from this sediment dam every 3 to 5 years by Butte-Silver Bow County, indicating that some sediment is moving into Basin Creek and downstream from the portion of the subwatershed between the two reservoirs. During removal of these sediments there is some short-term disturbance to fish residing in the pool created by the sediment weir. However once sediment is removed then a substantial pool is created for fish to reside in until the pool gradually fills in with sediment over several years.

Water is diverted from the upper Fish Creek subwatershed into Basin Creek about 1.5 miles upstream of the upper reservoir. At times approximately 30 to 60 percent of Basin Creek’s stream flow into the lower reservoir can be attributed to the diversion. This water is relatively cold and has a cooling effect on summer water temperatures in Basin Creek, keeping the system above the lower reservoir a hospitable temperature to cold-water fish throughout the summer. This augmented flow also provides more living space for cold-water fishes during summer months than would be present without the diversion. At times the artificially high flows due to the diversion may tend to contribute to streambed and bank scouring processes.

To meet water quality criteria for the existing filtration waiver, the lower reservoir is treated with copper sulfate approximately 6 times per year to limit the extent of algal blooms during summer months. Algae create problems during the chlorination process associated with treating the water for domestic use. Butte-Silver Bow treats the lower reservoir with copper sulfate to minimize the extent of algal blooms that foul the domestic water treatment process. The copper sulfate treatments may kill some fish and tend to limit aquatic productivity in general in the lower reservoir.

In summer months very little water is released from the lower reservoir because Butte-Silver Bow needs to optimize water availability for the domestic water supply. These low flows below the reservoir, combined with agricultural water withdrawals on private lands downstream of the Forest boundary may result in lower Basin Creek running dry in some summers. Fish habitat is substantially limited below the lower reservoir due to these limited flow releases from the reservoir as well as downstream agricultural withdrawals.

The reservoirs and Basin Creek (near the reservoirs) are closed to public access and recreational use. This closure combined with the presence of the impassable lower dam has likely prevented non-native fish species from encroaching on westslope cutthroat trout habitat upstream of the lower reservoir.

There are a number of ongoing activities in Blacktail Creek that affect aquatic conditions. Sanding and snowplowing on 4.5 miles of valley bottom road (Roosevelt Drive) from the northern Forest boundary to Lime Kiln Road introduces sediment annually to the stream. Sanding and snowplowing on an additional 4 miles of road out of the valley bottom in the Blacktail Creek subwatershed also introduces some sediment to Blacktail Creek but at a far lower rate than this work on the valley bottom road.

There are approximately 75 homes in the upper Blacktail Creek subwatershed on private lands embedded within the Forest boundary. Activities on private lands include various degrees of timber harvest and livestock use (primarily horses) along non fish-bearing tributaries to Blacktail Creek as well as along approximately 2 miles of Blacktail Creek proper within the fish distribution.

Lower Blacktail Creek downstream of the Forest boundary flows through many private residences dominated by agricultural (livestock) use, including many horse pastures.

METHODS

The description of the affected environment is based on a variety of surveys. All of the methods provide only a portion of the information on channel condition. Inherent variability in aquatic systems and some level of subjective interpretation on many habitat parameters, results in the assessment of aquatic conditions also requiring professional judgment, which is based on education and experience.

Exploratory fish sampling was done in Basin Creek to determine fish species presence and distribution. Standard field sampling methods using a backpack electroshocker were used on a “spot-check” basis to determine fish presence and distribution. “Spot-checking” means that relatively short stretches of stream (100 - 200 feet) were sampled at dispersed sites throughout the stream length to determine fish distribution based on whether or not fish were found at any given “spot-check” site. No block nets were used during “spot-checks” and only one pass was made from downstream to upstream for each area sampled.

Relative numbers of fish in Basin Creek were compared to those in other nearby streams in the Silver Bow Creek watershed based on electrofishing “spot-check” data. As an index of relative fish abundance between streams, data in this EIS reflect actual numbers of fish caught expressed as one-year-old and older fish per 100 meters of stream length. These numbers only indicate relative abundance and do not represent population estimates.

Stream surveys were conducted in Basin Creek to characterize pool and large wood frequencies along with bankfull width/depth ratios, estimated percent shade cover over the stream, and Rosgen channel types

(Rosgen 1996). Methods were adapted from standard stream survey methods used in Regions 1 and 4 of the U.S. Forest Service (Overton et al. 1997).

Stream habitat attributes for Basin Creek were compared to reference values for streams of similar size and Rosgen channel types determined for streams in the Salmon River Basin in Idaho described by Overton et al. (1995). Channel types are a means of describing the physical attributes of a stream. To determine a stream's Rosgen channel type it is necessary to measure a number of physical characteristics within the stream channel. The interaction of variables such as gradient, sediment size, sinuosity, width/depth ratio, and entrenchment determines how any given channel performs physical functions such as energy dissipation during high flows and transportation of water and sediment under different flow conditions. For Rosgen channel types the letter designation indicates relationships between gradient, width/depth ratio, sinuosity, and entrenchment. Definitions of these terms are provided in the glossary in Appendix A. The number designation in the Rosgen channel type refers to the dominant substrate type present described further below.

Streambed substrate was characterized with pebble counts based on methods described by Bevenger and King (1995). Substrate size classes used for this project are based on modified categories used by Rosgen (1996) as listed below:

Sand and smaller = < 2 mm
Fine Gravel = 2 – 6 mm
Gravel = 6 – 64 mm
Cobble = 64 - 256 mm
Boulder = > 256 mm.

For Rosgen channel types the numerical designation associated with the type indicates the dominant substrate size class for the stream as follows:

1 = Bedrock
2 = Boulders
3 = Cobble
4 = Gravel (including Fine Gravel listed above)
5 = Sand
6 = Silt

Amphibian surveys were conducted at a number of sites in the project area using methods of the "basic survey" described by Thoms et al. (1997) where aquatic habitats, shorelines, and areas on land adjacent to the shorelines were surveyed. The main objective of amphibian surveys was to attempt to determine whether sensitive amphibians (boreal toad or northern leopard frog) were present in aquatic habitats that would potentially be affected by this project. These surveys were done in select locations throughout the project area.

Riparian and stream channel conditions in Herman and China gulches were coarsely assessed using the methods of Prichard et al. (1998). Streams were assessed as properly functioning, functional-at risk, or nonfunctioning based on criteria in Prichard et al. (1998).

Data from aquatic field surveys conducted for this project are located in the project file.

EXISTING CONDITION

Fish Distribution

Basin Creek and Blacktail Creek are the primary fish-bearing stream channels through the project area. Blacktail Creek supports both brook trout and westslope cutthroat trout from the Forest boundary in section 27 (T2N, R7W) southward for approximately 7.5 stream miles to the headwaters. Several small tributaries of Blacktail Creek likely support fish for several hundred feet in their lower ends but Blacktail Creek proper is the primary habitat in this subwatershed.

Fish distribution within Basin Creek was unknown prior to the onset of this project. Downstream of the lower Basin Creek Reservoir, the creek flows through private land where the primary land use is livestock ranching and residential development. There is little information on fish species presence on the private lands downstream of the lower reservoir. The Montana Fish Information System indicates that brook trout are present in lower Basin Creek on private lands downstream of the Forest boundary. Westslope cutthroat trout likely reside downstream of the reservoir system and off National Forest lands as well.

Field sampling to determine fish species presence and distribution within the Basin Creek subwatershed was conducted in fall 2001 and summer 2002 in stream reaches upstream of the lower reservoir (Appendix B, Map 23). Only westslope cutthroat trout were found during field sampling. Small side tributaries to Basin Creek where fish presence is mapped indicate estimated distributions based on stream size, channel gradient and apparent barriers. Fish distribution mapping in main-stem Basin Creek reflects field verification via electrofishing surveys in fall 2001 and summer 2002. Appendix B, Map 23 displays locations where fish were sampled, where westslope cutthroat trout were found, and where genetics samples were collected to determine genetic purity of cutthroat trout. Cutthroat trout were found to be genetically pure westslope cutthroat trout. The westslope cutthroat trout shown in Figure 3.21 below is similar to those found in Basin Creek.

Figure 3.21: Westslope cutthroat trout

Due to substantial declines from their historic range, Region 1 of the U.S. Forest Service and the Beaverhead-Deerlodge National Forest listed westslope cutthroat trout as a sensitive species. Cutthroat trout are identified as a Management Indicator Species in the Deerlodge National Forest Plan. Under the Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana (Montana Department of Fish, Wildlife, and Parks 1999) the Forest Service has committed to conserving westslope cutthroat trout populations that are at least 90 percent genetically pure.

The presence of westslope cutthroat trout in Basin Creek, in the absence of exotic species, represents a locally unique situation. In most tributaries of Silver Bow Creek on the Butte Ranger District, such as German Gulch, Brown's Gulch, and Blacktail Creek, westslope cutthroat trout must compete with brook trout, an exotic species, and often occur in relatively low numbers compared to brook trout in these streams. Of an estimated total of 69 miles of fish-bearing streams on the Butte Ranger District in the Silver Bow Creek watershed, there are approximately 5.6 stream miles of habitat where westslope cutthroat trout are not under the competitive influence of brook trout. Approximately 4.1 of these miles are in the German Gulch subwatershed while the remaining approximately 1.5 miles are in Basin Creek in this project area (Appendix B, Map 24). Most major tributaries of Silver Bow Creek, including much of German Gulch and its tributaries, Brown's Gulch and its tributaries, and Blacktail Creek, either lack westslope cutthroat trout entirely or support them along with brook trout. Interspecific competition with non-native species, including brook trout, has been described as one of the primary threats facing westslope cutthroat trout (Liknes and Graham 1988, Shepard et al. 1997, Montana Department of Fish, Wildlife, and Parks 1999). The lack of competition with non-native species in Basin Creek gives its westslope cutthroat trout more assurance than for other populations that the Basin Creek fish will persist in the long-term.

The Basin Creek westslope cutthroat trout population is isolated from any other westslope populations. The inlet to the lower reservoir marks the downstream-most point where fish can reside without substantial risk of mortality due to copper sulfate treatments in the lower reservoir or from potential dewatering in areas downstream. The series of dammed stock ponds in Basin Creek downstream of the project area, the dam on the lower reservoir, and the small sediment-retention dam just upstream of the lower reservoir all serve as blockages for potential upstream movement of fish from downstream areas. Lower Blacktail Creek is not highly habitable for fish due to urbanization although some brook trout are believed to be present and some westslope cutthroat trout are likely to be present there. Silver Bow Creek proper in Butte is uninhabitable for fish and presents a chemical barrier to fish movement due to severely impaired water quality (Natural Resource Damage Program 2002). The potential for fish to move from Basin Creek to other tributaries is also limited by these same impediments. These impediments have created a situation where if Basin Creek westslope cutthroat trout are extirpated then there is virtually no natural source of colonists to eventually replace them.

Herman Gulch and China Gulch are two relatively large tributaries to Basin Creek in the wildland urban interface area. These streams have been sampled for fish presence but neither one has been found to support fish populations on the Forest. It is unknown whether either of these streams supports fish in their lower ends downstream of the Forest boundary. Aquatic habitat in these streams off-Forest is in relatively poor condition due to livestock grazing, summer water withdrawals, and private land development.

Bear Gulch, a tributary to the lower reservoir, likely provides habitat for westslope cutthroat trout in its lower several hundred feet of length but there is a natural barrier at this point that would prevent upstream fish passage. This stream probably receives relatively little use by fish.

Aquatic Habitat

Blacktail Creek

No habitat inventories have been conducted in Blacktail Creek. Blacktail Creek is paralleled by valley bottom roads (Highway 2 and Roosevelt Drive) from the Forest boundary southward for the first approximately 4.5 miles of the stream. These roads provide chronic fine sediment inputs and limit riparian vegetation development and floodplain function. The stream alternates in Rosgen stream type from an E4 or E5 type, to a C4 or C5 type, with localized steep A3 reaches mixed in. Upstream of where the stream is paralleled by valley bottom roads, it flows through private land for approximately 2 miles where it tends to be an E4 type. Upstream of this, the remaining 1 mile of fish-bearing stream is steeper with more of an A3 channel type as it approaches the headwaters. Excessive fine sediment loading has long been locally recognized as a problem in Blacktail Creek, particularly in the lower gradient E and C type reaches.

Basin Creek

Westslope cutthroat trout occupy approximately 1.1 miles of stream habitat above the lower reservoir in Basin Creek (Appendix B, Map 23). Approximately 0.65 mile of stream lies between the lower and upper reservoirs while an additional 0.45 mile of stream is used upstream of the upper reservoir. There is a series of steep boulder cascades at the upstream end of their distribution that serves as a barrier and prevents habitation of upstream areas. The upper reservoir is approximately 12 acres in size. Its depth is unknown but it is likely that the upper reservoir supports over-wintering fish. The dam for the upper reservoir has been breached thus allowing fish to leave the upper reservoir and mix in with the population downstream. Fish might also migrate upstream into the reservoir, but there is a steep boulder cascade just downstream of the upper reservoir that likely prevents upstream passage for most fish.

Fish are prevented from moving from the lower reservoir upstream. There is a small sediment-retention dam with an impassable culvert at the lower end of the stream reach that flows into the lower reservoir. This sediment dam is located about 400 feet upstream of the lower reservoir and prevents fish from moving upstream from the lower reservoir.

There are three small tributaries that flow into Basin Creek upstream of the lower reservoir that are believed to support westslope cutthroat trout (Appendix B, Map 23) for short lengths. The total stream length estimated to be available for fish habitat in all these streams combined is approximately 0.4 mile. These streams are extremely small such that while they may provide some spawning habitat during spring and early summer, they provide very little rearing habitat due to their small size. Downstream of the lower reservoir on private lands surrounded by National Forest lands northward to the Forest boundary, an additional 1.4 miles of stream may be occupied to some degree by westslope cutthroat trout but they may co-exist with brook trout in this area. Furthermore, the reach of stream downstream of the lower reservoir is largely dewatered in late summer months thus eliminating the majority of potential aquatic habitat in this area.

At the upstream end of the fish distribution in main stem Basin Creek there is a series of cascades that functions as a natural barrier to upstream fish habitation. This is a 0.25 - 0.5 mile stretch where channel gradient is 15 - 25 percent.

Habitat Condition

The 1.1 miles of Basin Creek upstream of the lower reservoir were surveyed in summer 2002 to describe aquatic habitat and channel condition. The stream was divided into two reaches using the upper reservoir as the break between the two reaches (Table 3.51, Appendix B, Map 25).

Table 3.51: Fish habitat data from Basin Creek stream surveys in summer 2002, along with pertinent reference values from Overton et al. (1995).

Stream Reach	Reach Length	Rosgen Type	Bankfull W/D Ratio	# Pools Per Mile	Reference # Pools	# Pieces Wood/Mi	Reference Wood/Mi	Stream Shade
1	0.65 Mile	G4/F4	7.1	154	117	114	71	<25%
2	0.45 Mile	B3/C4	6.9	95	96*	82	145*	<25%

* Reference values were averaged for B and C type channels of appropriate size from Overton et al. (1995).

Pool numbers and wood quantities in Basin Creek are within the ranges found in reference streams of Overton et al. (1995), suggesting that habitat in Basin Creek is of fair to good complexity as related to these features. This is reasonably consistent with the fact that this stream has not been subjected to substantial mining or riparian timber harvest over the past approximately 80 years. Previously logged and/or mined areas have had time for vegetative recovery which has resulted in nearly natural rates of wood recruitment and recovery of aquatic habitat complexity as evidenced by the relatively large numbers of pools in the surveyed reaches of Basin Creek. Recent mortality to lodgepole pine trees in this riparian area due to the mountain pine beetle outbreak will likely provide for increased wood recruitment to the stream over the next two to three decades.

Westslope cutthroat trout are heavily reliant upon pool habitats for summer and winter habitat (Rieman and Apperson 1989, Ireland 1993, Jakober 1995). Pool depths greater than 1.6 to 2 feet generally provide for the summer and winter habitat needs for larger (> 4”) cutthroat trout (Hanson 1977 and Pratt 1984 as cited by Bjornn and Reiser 1991, Jakober 1995). Basin Creek Reach 1 provides better quality pool habitat based on depths than reach 2 because 35 percent of its pools are deeper than 1.6 feet compared to only 10 percent of pools in Reach 2 (Table 3.52). This is to be expected because Reach 1 is lower in the subwatershed and naturally has a greater amount of stream flow than Reach 2.

Wood in streams has many functions including storage of sediment and organic material, providing cover for fish and other biota, pool formation, and as habitat for aquatic insects (Bisson et al. 1987). Wood is an important cover component for westslope cutthroat trout in streams throughout the year (Rieman and Apperson 1989, Jakober 1995). In the surveyed portion of Basin Creek instream wood is responsible for the formation of 22 percent of pool habitats (Table 3.52). Plunge pools over boulders make up 42 percent of pools while natural scour at outcurves of channel meanders make up 35 percent of pools.

Table 3.52: Pool-forming and maximum depth characteristics of pools in Basin Creek reaches above the lower reservoir.

	Pool-Forming Feature				Maximum Pool Depth		
	Wood	Rock	Meander	Other	< 0.8 feet	0.8-1.6 feet	1.6-2.5 feet
Reach 1	17%	59%	22%	1%	1%	64%	35%
Reach 2	30%	14%	56%	0%	2%	88%	10%
Totals	22%	42%	35%	1%	1%	73%	26%

While aquatic habitat complexity is generally fair to good in much of the surveyed reaches of Basin Creek, the channel appears to be downcut and isolated from its former floodplain as indicated by its G4/F4 Rosgen channel type in Reach 1. The G and F Rosgen channel types are entrenched and downcut in nature. Field observations and notes made during stream surveys also indicate localized downcutting in some portions of Reach 2. The result is that there are areas of active streambank erosion brought about during higher flow events because the stream can no longer overtop its banks and spread out into its former floodplain to dissipate its energy. The breach of the dam at the upper reservoir in the 1980s combined with the diverted flows from the Fish Creek subwatershed into Basin Creek may have contributed to this entrenchment. In addition, at the time of diversion initiation and soon thereafter, Basin Creek was subject to placer mining. Early in the 20th century the stream was likely in a very poor, unstable condition and has likely been recovering for the past approximately 80 years. Active elimination of beavers has allowed historic beaver ponds to breach, resulting in channel downcutting through these areas. It is also noteworthy that in spite of historic placer mining, flow augmentation, timber harvest activities, and beaver elimination, westslope cutthroat trout have persisted in the absence of detrimental non-native fish species in Basin Creek.

The B and C Rosgen types indicated for Reach 2 (Table 3.51) indicate that this reach is generally less entrenched than Reach 1 and therefore has some floodplain connectivity in at least some areas. The number designations in the Rosgen channel types depict dominant streambed substrate size. The 4 in the G4/F4 characterization of Reach 1 indicates that gravel (2 – 64 mm in diameter) is the dominant substrate in Reach 1. The 3 in the B3 channel type for Reach 2 indicates that cobble-sized material (64 – 256 mm in diameter) is the dominant substrate. These substrate characterizations are based on relatively crude visual estimates of the percentage of area covered by each substrate size class made by stream surveyors.

Streambed Substrate

Streambed surface substrate as characterized by “zigzag” pebble counts is dominated by gravel-sized substrate (including fine gravel) at 50, 54, and 52 percent in transects 1, 2, and 3, respectively (Figure 3.22). Transects 1 and 2 were located in Reach 1 while Transect 3 was located in Reach 2 of Basin Creek. Sand and fine gravel combined make up 44, 24, and 40 percent of the surface substrate in transects 1, 2, and 3, respectively (Figure 3.23). These two categories combined include fine particles 6 mm in diameter or less. The difference in fines between transects 1 and 2 may be due, in part, to the presence of a several hundred foot long section of the stream that is experiencing a large amount of bank erosion located between the two transects. Transect 1 is downstream of this area of bank erosion where we might expect to see more fine sediment in the stream while Transect 2 is upstream of this area. In addition, stream channel gradient is slightly higher in the vicinity of Transect 2 than at Transect 1 so there may be a tendency for less fine sediment to be retained in the area of Transect 2 than at Transect 1.

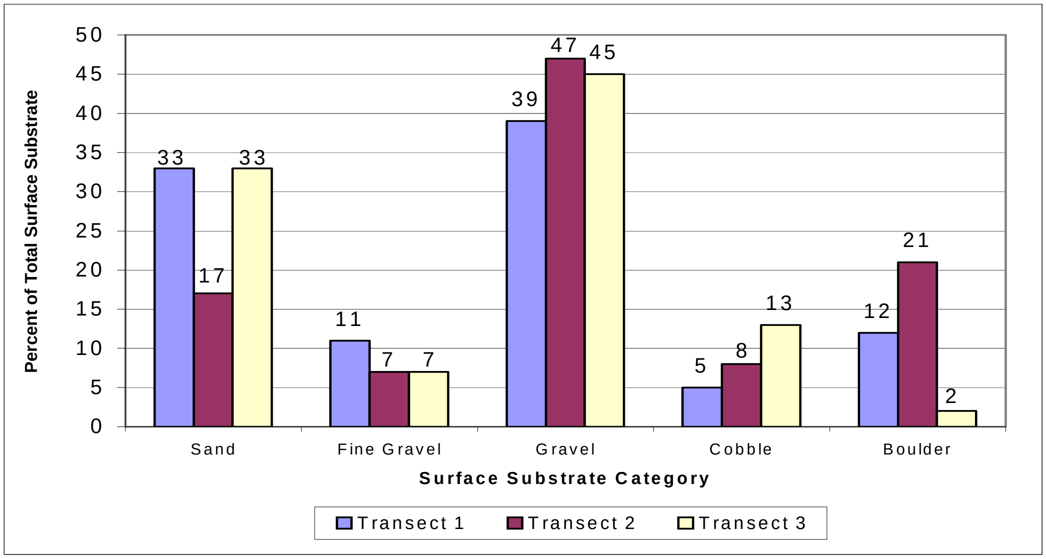

Figure 3.22: Characterization of streambed surface substrates in reaches 1 and 2 of Basin Creek, summer 2002.

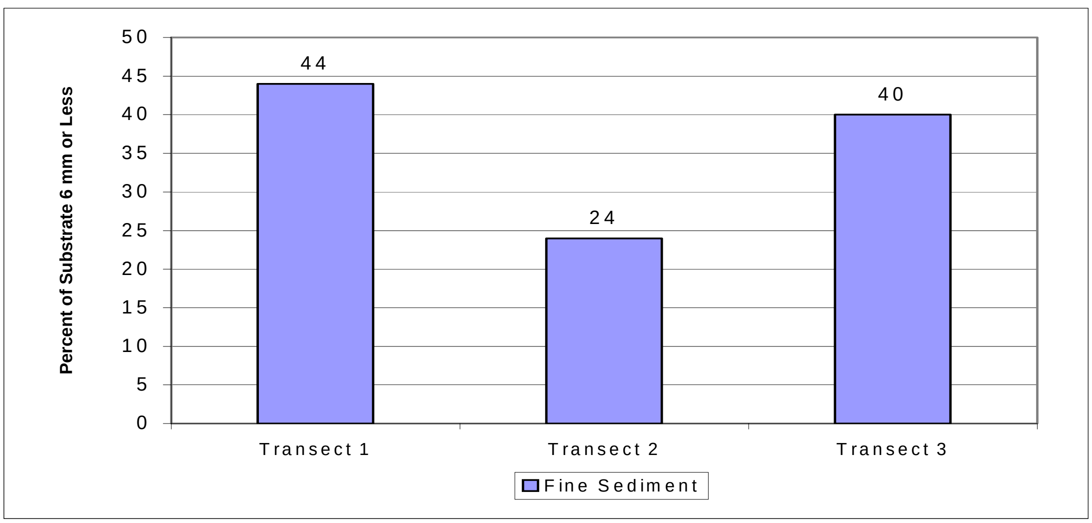

Figure 3.23: Percentage of fine sediment 6 mm in diameter or less in streambed surface substrates at three transect locations in Basin Creek as determined by zigzag pebble counts.

Weaver and Fraley (1993) studied egg-to-fry survival of emerging westslope cutthroat trout fry from various spawning substrate mixtures focusing on fine sediment less than 6.35 mm in diameter. Weaver and Fraley (1993) found that mean westslope cutthroat trout fry emergence success ranged from 76 percent survival with 0 percent fine sediment, down to 26 percent survival at 40 percent fine sediment. Irving and Bjornn (1984) as cited by Reiser and Bjornn (1991) found that cutthroat trout embryo survival was less than 10 percent when fine sediment less than 6.35 mm in diameter made up 40 percent of spawning substrate. Research generally shows that salmonid egg-to-fry survival declines in substrates as quantities of fine sediments increase (Chapman 1988). Fines tend to reduce gravel permeability and pore space, as well as dissolved oxygen in water available to embryos, thus influencing incubation success (Chapman 1988). However, spawning salmonids also tend to “clean” spawning gravel of its fines during redd construction

(Chapman 1988) so that general characterization of streambed substrate, such as described here, likely overestimates the proportion of fine sediment in salmonid redds. While the surface substrate characterization for Basin Creek cannot be directly related to spawning substrate composition, the relatively high amount of substrate less than 6 mm in diameter in some portions of Basin Creek suggests that egg-to-fry survival may be relatively low in some areas.

Pore spaces between substrates ranging from 20 – 75 mm in diameter are important areas for westlope cutthroat trout fry to burrow into and use as over-wintering habitat, while age one year and older fish need substrates greater than 75 mm to burrow into during winter months (Rieman and Apperson 1989, Bjornn and Reiser 1991). If these pore spaces are lacking due to inordinate embeddedness of larger substrates with smaller substrates then over-wintering habitat can be impeded (Rieman and Apperson 1989). The relative lack of cobble and boulder substrates (Figure 3.22) combined with the relative abundance of sand and fine gravel substrates in Basin Creek suggests that over-wintering habitat for older fish may be in short supply in the stream.

Fine sediment may also impair aquatic insect communities. Cordone and Kelley (1961) reviewed studies where fine sediment (mostly silts) reduced aquatic insect production in stream systems. Reiser and Bjornn (1991) reviewed studies showing that in most cases aquatic invertebrate production was reduced when larger streambed substrates were embedded with fine sediments. The relatively large amounts of fine sediment in some parts of Basin Creek may be impairing aquatic insect production in some areas.

Water Temperature

There is a relative lack of water temperature data for Basin Creek. Summer water temperatures were measured at specific points on several occasions in summer 2002. Mid-afternoon water temperature measured on August 25 in Reach 2 was 45ºF while on September 20 it was 43ºF. Afternoon water temperature in Reach 1 measured on August 25 was 53ºF and on September 20 it was also 53ºF. Reiser and Bjornn (1991) described upper temperature tolerances for salmonid fishes being in the range of 73 to 77ºF while general preferred ranges are 50 – 57ºF. Basin Creek, where westslope cutthroat trout reside, appears to be well below the thermal tolerances for salmonids and at or slightly below the generally preferred ranges for summer rearing. The water from Fish Creek augmenting the flow of Basin Creek is relatively cold and since the Fish Creek diversion tends to make up a relatively large proportion of Basin Creek's flow during summer, this tends to keep summer water temperatures cool.

Herman Gulch and China Gulch

Channel conditions of Herman and China gulches were coarsely assessed using Prichard et al. (1998). The portion of Herman Gulch, from the Forest boundary in section 31 (T2N, R7W), eastward 1.2 miles to the headwaters was evaluated as a "nonfunctioning" riparian area. The valley bottom road provides a chronic sediment source to Herman Gulch as well as an impediment to natural riparian vegetation and floodplain function. Many lodgepole pine trees adjacent to the road have been killed by mountain pine beetle and subsequently removed as firewood by the public, thus reducing the down wood recruitment supply for the stream. Many willows appear to be unhealthy with numerous dead stems. Live stems are heavily browsed and do not appear to be re-establishing well.

China Gulch is in slightly better condition than Herman Gulch, rating as "functional-at risk." Approximately 0.8 mile of China Gulch was evaluated from the Forest boundary in section 1 (T1N, R8W) southward to the confluence with a major tributary in section 1. While there is an old road in the riparian area paralleling the stream, it has been closed to the public and does not introduce chronic sediment inputs to the stream, nor does it interfere with floodplain function. Wood recruitment has not been impacted by the road or public removal of beetle-killed trees. This stream still has several residual beaver ponds but willow communities are unhealthy as described above for Herman Gulch. Beavers are no longer actively maintaining their dams, presumably because there is not a source of live vegetation for them to live on. It appears that the existing beaver ponds will eventually be dewatered as the stream cuts through currently unmaintained beaver dams.

Both Herman Gulch and China Gulch are boreal toad habitat with China Gulch likely providing more potential as breeding habitat due to the presence of a greater number of beaver ponds. Several tributaries to China and Herman gulches are dominated by 40 to 100-foot wide valley bottoms with grass/sedge wetlands with aspen and willow present. Stream channels flow through many portions of these wetlands and in some cases remnant beaver ponds exist.

Relative Fish Abundance

Relative numbers of westslope cutthroat trout in Basin Creek were compared to those in other nearby streams in the Silver Bow Creek watershed (Figure 3.24). At 58 fish per 100 meters of stream length, Basin Creek Reach 1 appears to support relatively high numbers of westslope cutthroat trout compared to other streams in the Silver Bow Creek watershed on the Butte Ranger District. At 22 fish per 100 meters of stream length, Reach 2 of Basin Creek (above the upper reservoir) supports relatively moderate numbers of westslope cutthroat trout compared to other streams (Figure 3.24). All streams listed in Figure 3.24 except for Basin Creek and Minnesota Gulch also support populations of brook trout so Norton Creek, German Gulch, and Beefstraight Creek are likely more productive than Basin Creek.

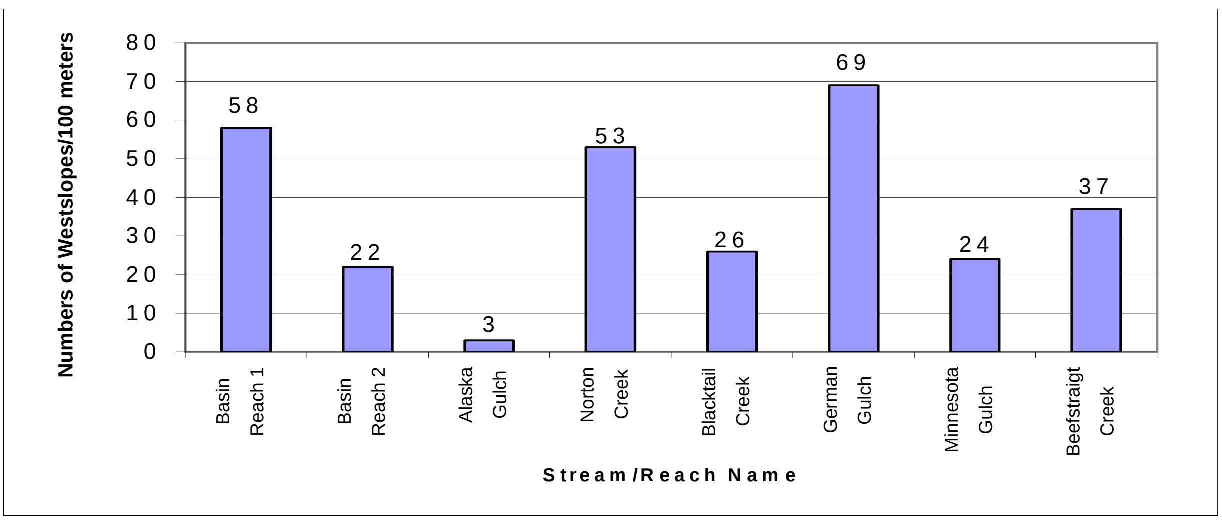

Figure 3.24. Relative numbers of age 1 and older westslope cutthroat trout found in Basin Creek compared to relative numbers found in other streams in recent years (1997-2002) in the Silver Bow Creek watershed on the Butte Ranger District. Numbers are based on “spot-sampling” and do not reflect actual population estimates.

Amphibians

The Forest Service Region 1 and the Beaverhead-Deerlodge National Forest recognize the boreal toad (*Bufo boreas boreas*) and northern leopard frog (*Rana pipiens*) as sensitive species. Boreal toads are found with some regularity on the Beaverhead-Deerlodge National Forest while northern leopard frogs are found highly infrequently on the Forest.

Northern leopard frogs tend to use permanent slow-moving or standing water bodies with considerable vegetation, wet sedge-meadows, cattail meadows, springs, and beaver ponds in streams as habitat (Reichel and Flath 1995, Maxell 2000). They usually breed in ponds or lake edges with dense aquatic vegetation (Corkran and Thoms 1996). Adults are usually found in riparian habitats or on prairies near permanent waters (summarized by Maxell 2000). For the winter months, adults burrow into lake or pond bottoms, or beneath substrate in streams (Maxell 2000).

Adult boreal toads reside in a wide range of habitats including wetlands, forests, woodlands, sagebrush, meadows, and floodplains (reviewed by Maxell 2000). Breeding takes place in shallow, quiet water in lakes, marshes, bogs, ponds, wet meadows, beaver ponds, slow-moving streams, backwater channels of rivers, and roadside ditches (Loeffler 1998, Maxell 2000). Tadpoles metamorphose in mass and may be found in dense aggregations of hundreds of individuals adjacent to breeding habitats upon emergence during summer (Black and Black 1969, Maxell 2000). Young toads are limited in distribution and movement by available moist habitat but adults can move several miles and may reside in marshes, wet meadows, or forested areas (Loeffler 1998). During winter adults hibernate in subterranean chambers underlaid by flowing groundwater to prevent freezing (Campbell 1970) or in small mammal burrows below the frost line (reviewed by Loeffler 1998).

Amphibian surveys were conducted in Bear Gulch Creek and in upper Basin Creek during summer 2001 (Appendix B, Map 26). Spotted frogs (*Rana luteiventris*) and boreal toads were found in Bear Gulch, tributary to the lower reservoir, while only spotted frogs were found in upper Basin Creek (Fernandes 2001). See Figures 3.25 and 3.26 below. Habitats surveyed in 2001 included stream reaches with relatively intact beaver ponds. Areas with the highest numbers of amphibians were usually associated with beaver ponds.

Surveys were also conducted in summer 2002 and spring/summer 2003 in areas more specifically focused within this project area (Appendix B, Map 26). No amphibians were seen in two small perennial, non-fish-bearing streams while spotted frogs were seen in a small pond area adjacent to Basin Creek between the two reservoirs. Spotted frogs were also seen in Basin Creek proper between the two reservoirs. Suitable boreal toad habitat exists in unsurveyed areas in the project area, particularly in beaver ponds and stream reaches of China Gulch, Herman Gulch, and other unnamed perennial streams in the project area. One boreal toad and numerous spotted frogs were seen in an unnamed tributary to China Gulch in spring 2003 (Appendix B, Map 26). Boreal toad tadpoles were found at one additional site in China Gulch and in a small localized portion of upper Basin Creek Reservoir (Appendix B, Map 26). Numbers of tadpoles found at each site indicated small numbers of breeding adults using each site. No northern leopard frogs were found in areas that would potentially be affected by this project.

Figure 3.25: Spotted frog

Figure 3.26: Boreal toad

EFFECTS TO FISHERIES AND AQUATIC RESOURCES

INTRODUCTION

For the sake of analyzing alternatives, the Basin Creek portion of the project area can be subdivided into several different drainages (Appendix B, Map 27) where the distribution of proposed treatments can be characterized for these drainages. The Herman Gulch drainage is 1,606 acres; the China Gulch drainage is 1,660 acres; the Upper Basin Creek drainage is 7,809 acres drainage and the Lower Basin Creek drainage is 1,829 acres. The Upper Basin Creek drainage contains the approximately 1.5 miles of habitat occupied by westslope cutthroat trout in the absence of non-native species. Lower Basin Creek drainage contains about 1.5 miles of fish-bearing stream on private lands surrounded by National Forest lands. This portion of Basin Creek is believed to be occupied by non-native brook trout as well as westslope cutthroat trout. A small amount of fuels treatment is proposed in all action alternatives in the Blacktail Creek subwatershed.

ALTERNATIVE 1 – NO ACTION

No management activity would occur at this time under the No Action Alternative. This alternative considers the effects of a large-scale (5,400 to 8,000 acres) stand-replacing fire occurring in the year 2028. This scenario is described in the Fire and Fuels section of this FEIS. The fire is presumed to take place in the Basin Creek subwatershed but the exact location of this theoretical fire cannot be predicted.

Fire Effects on Streams and Aquatic Fauna

It is difficult to predict with any certainty what the effects of a large-scale fire in Basin Creek would be to aquatic habitats and resources due to the variability of factors such as post-fire storm patterns and specific intensity and severity of the fire relative to location of aquatic habitats. The discussion below generally characterizes the types of effects expected in Basin Creek in the event of a large-scale stand-replacing fire. The relative severity of any of these effects would be highly dependent on the location of a large-scale fire relative to the location of the most prominent aquatic habitats in Basin Creek.

Wildland fires can have a wide range of effects on stream channels and aquatic habitats. Effects to streams depend on the size and intensity of fires, topography, geology, soil types, nature of post-fire storm events, and pre-existing stream channel and vegetative conditions (Swanston 1991, Gresswell 1999). While some effects may appear to be catastrophic, wildland fire events are important in maintaining long-term aquatic habitat complexity (Reeves et al. 1995, Gresswell 1999). Physical changes to streams are common in the first several to 10 years after a fire (Swanston 1991, Gresswell 1999). The most pronounced effects of fire on stream channel morphology are increases in water, sediment, and woody debris delivered to streams (Swanston 1991).

Stream Flow

Storm flow discharge and annual water yield typically increase after extensive wildland fires (Swanston 1991, Gresswell 1999). Stream channels may undergo measurable widening and deepening in the first several years after large wildland fires, presumably due to increased runoff during storm events (Minshall et al. 1990). Streams within the locality of the theoretical large-scale stand replacing wildland fire under the no action alternative for this project would be prone to channel changes due to increased peak flows.

Large Wood

Post-fire large wood recruitment rates often increase (Jakober 2002) and bring an increase in the rate of pool formation that could ultimately benefit fish once post-fire sediment inputs decrease and already-introduced sediment is transported out of the system (Reeves et al. 1995, Gresswell 1999). Jakober (2002) found that wood quantities in Flat Creek increased after approximately 75 percent of the stream length and 60 percent of the Flat Creek watershed burned at predominantly low to moderate severity. This is consistent with the findings of Minshall et al. (1997) where wood inputs to Yellowstone National Park streams increased in burned streams compared to reference (unburned) streams.

Even without a fire, under Alternative 1, wood recruitment to streams in the project area would likely be increased for an approximately 50-year period following the current mountain pine beetle outbreak. Within the area affected by the fire, there would likely be an additional large pulse of wood input to streams and riparian areas.

In modeling effects of spruce beetle outbreaks and moderately intense wildland fire to spruce/lodgepole-dominated riparian stands on the Bridger-Teton National Forest, Bragg (2000) found that wood input rates increased six to seven-fold for an approximately 50-year period after each disturbance type. Wood quantities in his study stream increased three to four-fold over this period due to the increased input rates. This was generally followed by a marked decline in wood input rates for several decades until the subsequent riparian stands developed and matured to re-establish reduced wood input rates typical of undisturbed riparian areas. Bragg (2000) estimated that it would take 90-130 years for wood input rates to return to pre-disturbance levels after either a beetle outbreak or large-scale fire.

One difference between Basin Creek and the stands modeled by Bragg (2000) is that forested stands in Basin Creek likely undergo more frequent stand-replacing disturbances, either beetle outbreaks or wildland fires every 80 to 120 years, than those modeled by Bragg (2000). So rather than sustaining consistent in-stream large wood loading, periodic natural catastrophic disturbance may create long-term oscillations in wood recruitment rates (Bragg 2000) to streams in the Basin Creek watershed when viewed over periods of several hundred years. Although the timeframes may differ to some degree in Basin Creek, the same trends for wood inputs to streams would generally be expected for Basin Creek in Alternative 1 as those found by Bragg (2000). Increased input of large wood to streams would likely facilitate the development of more complex aquatic habitat that would probably persist for several decades as the wood gradually decays and is transported downstream (Reeves et al. 1995, Bragg 2000).

Sediment

Sediment inputs to streams typically increase after fires (Novack 1988, Swanston 1991, Gresswell 1999). The amount of sedimentation is highly dependent upon the inherent erodibility of the burned area (Swanston 1991, Gresswell 1999). Jakober (2002) found that fine sediment in Flat Creek on the Bitterroot National Forest did not appreciably increase after approximately 75 percent of the stream length and 60 percent of the Flat Creek watershed burned at predominantly low to moderate severity. Burton (2000) documented localized sediment and wood inputs to streams brought on by post-fire debris flows on the Boise National Forest in areas where fires burned at a high severity. After a post-fire period of several years where sediment and large wood inputs may increase in a stream, sediment inputs tend to decrease and already-introduced sediment may be gradually transported out of the system. As this sediment is transported out of the stream, the large wood recruited to the stream after the fire can increase the amount of pool habitat and ultimately provide high quality aquatic habitat for the long term (Reeves et al. 1995, Gresswell 1999).

A large-scale fire in Basin Creek would not be expected to contain many areas of severe soil damage. Of the approximately 51,910 acres in the Mussigbrod Fire Complex (46,469 acres actually burned) of 2000 on the Beaverhead-Deerlodge National Forest, approximately 629 acres burned with a high severity while the rest was low and moderate severity (Beaverhead-Deerlodge National Forest 2000). Soil erosion potential increases as burn severity increases. Much of the Mussigbrod Complex was stand-replacing in nature. There are currently very few forest floor fuels throughout much of the Basin Creek subwatershed. By 2028, these fuel quantities are expected to increase markedly such that the severity of a fire in 2028 would be much greater in places than if a fire were to occur now. These fuel loads of 2028 would be similar to those in much of the Mussigbrod Fire. If a fire in Basin Creek burns similarly to the Mussigbrod Fire, most of the burned area would be of low and moderate severity with relatively small areas of high severity mixed in. This suggests that soil erosion would be relatively low throughout most of the theoretical Basin Creek fire. Increases in erosion and sedimentation of streams as a result of such a fire would be expected to be limited as found by Jakober (2002) in moderate severity burned areas and higher in high severity burned areas. As post-fire wood is recruited to streams, some short-term (several years) localized streambank erosion would also be expected as streams adjust to newly recruited wood.

Effects to Aquatic Invertebrates

Fire effects to aquatic invertebrate communities are highly dependent on the character of a specific fire. Minshall et al. (1997) found that rapid short-term changes (1 year) to aquatic insect communities, fine sediment increases in streams, and changes in channel morphology were most pronounced in first and second order streams (similar to Herman Gulch, China Gulch, and their tributaries) after the 1988 fires in Yellowstone National Park. Aquatic insect communities tended to recover fairly rapidly after the first year post-fire. Macroinvertebrate abundance, species richness, and diversity may increase or decline within the first few years after a fire (Jones et al, 1993 as cited by Gresswell 1999). Fire severity and distance from streams may be correlated with macroinvertebrate species diversity (Lawrence and Minshall 1994 as cited by Gresswell 1999). Short-term declines in macroinvertebrates may be countered by post-fire increases within 2 to 3 years post-fire.

Water Temperature and Nutrient Concentrations

Wildland fires may lead to increased water temperature and nutrient concentrations. Elevated water temperatures may result if streamside vegetation is substantially reduced. Amaranthus et al. (1989) documented summer water temperature increases of up to 10.0°C one year after a fire in portions of three headwater streams in southwestern Oregon reduced stream shading from approximately 90 percent to as low as 30 percent. Nutrient levels, such as phosphorous, nitrate-nitrogen, and ammonium nitrogen are commonly elevated in streams for at least the first few weeks to months after a fire (Swanston 1991, Gresswell 1999, Minshall et al. 2001).

Under Alternative 1 many lodgepole pine trees in riparian and upslope areas would continue to die for some unknown period due to the current mountain pine beetle outbreak. A fire that might result in even more riparian tree mortality would follow. In riparian areas there would be canopy loss and tree mortality that would result in decreased stream shade. Decreased stream shade could potentially lead to increased water temperatures during summer low flow periods. This effect would likely be most pronounced in small, perennial non-fish bearing streams and some portions of upper main stem Basin Creek upstream of the fish distribution where riparian forest canopy provides a substantial amount of shade.

Stream surveyors estimated the fish-bearing portion of Basin Creek upstream of the lower reservoir in summer 2002 to have less than 25 percent of the stream shaded by vegetation and other natural features. Tree mortality associated with either a continuation of the current mountain pine beetle epidemic or a large-scale wildland fire along the fish-bearing portion of Basin Creek would not further reduce shade to a great degree because stream shading from forest canopy closure is already relatively low. While some temperature increases would be expected in small non-fish bearing streams due to shade loss, potential water temperature effects associated with continued riparian tree mortality in Basin Creek below where the Fish Creek diversion enters would be attenuated by the influx of cold water from the Fish Creek diversion. Long-term water temperature increases associated with loss of riparian forest canopy would not likely take place and affect cold-water species residing in Basin Creek proper due to the cooling effect of the Fish Creek diversion flow during summer.

Direct Mortality to Fish

In extreme cases of high intensity fire in streamside areas, fish death may occur, apparently due to lethal water temperatures or toxic levels of trace elements and nutrients such as ammonium, phosphorous, or heavy metals (Gresswell 1999). Fish mortality has also been attributed to application of fire retardants (summarized by Gresswell 1999). In highly erosive watersheds when severe fires are followed by intense storms, fish may be eliminated from streams for a time (until recolonization) due to flooding and heavy sedimentation (Novack 1988). Burton (2000) observed localized mortality of fish in small streams affected directly by high severity fires and in streams affected by post-fire debris flows. Burton (2000) reported that most of these affected reaches were recolonized within 5 years of fire or debris flow events. Minshall et al. (1997) observed some dead cutthroat trout in streams of the most severely burned watersheds in Yellowstone National Park. They suggested that this mortality was due to high ammonia levels arising from smoke during the fires (Minshall et al. 1997). In extreme cases where fire has locally extirpated fish from affected streams, if there is a source of fish nearby to recolonize, then the affected streams may be repopulated at relatively high densities within 2-5 years after the fire (Novack 1988, Gresswell 1999, Burton 2000).

Potential Effects in Upper Basin Creek Reservoir

Upper Basin Creek reservoir is an important aquatic habitat for westslope cutthroat trout. In areas where lakes freeze over in winter, such as Basin Creek, some lakes undergo oxygen depletion under the ice over the winter (Wetzel 1975). One potential concern associated with a large-scale wildland fire is the possibility that such a disturbance could alter oxygen regimes in the upper reservoir. Fire could increase nutrient inputs to the reservoir and thereby increase biomass production and respiration by living organisms. This in turn would lead to subsequent decomposition (and increased oxygen use by decomposers) of the increased number of dead organisms brought on by the increase in productivity (Tonn et al. 2003). This could create winterkill of fish and markedly affect fish populations. Increased nutrient inputs could also cause oxygen depletions that limit the depth to which fish could survive in a lake year round.

Mussigbrod Lake is a lake located on the Beaverhead-Deerlodge National Forest where a large-scale stand replacing fire (Mussigbrod Fire) took place in 2000. This lake has a maximum depth of approximately 52 feet, with a large proportion of its surface area averaging 10-13 feet in depth. While this lake experienced substantial algal blooms due to nutrient loading after the Mussigbrod fire and some apparent reduction in depth inhabitable to fish due to oxygen depletion, no fish kills were reported in the first two years after the Mussigbrod Fire (Lentz 2002). Fish species in the lake include stocked trout species for recreational fisheries.

St-Onge and Magnan (2000) studied effects of fire in lakes with granitic geology in Canada. Their lakes had a mean maximum depth of approximately 55 feet and ranged in size from 42 to 158 acres. While these lakes were larger in area than Upper Basin Creek Reservoir, their maximum depths were relatively similar to the maximum depth of Upper Basin Creek Reservoir and their geologies were relatively similar. Wildland fires burned over an average of 84 percent of watershed areas in study lakes. St-Onge and Magnan (2000) found no significant differences in catch per unit effort of several fish species, including brook trout, in lakes having undergone fire compared to control lakes one and two years after fire disturbance. They noted some alteration of age class structure for some species but found no severe reductions in post-fire fish densities (St-Onge and Magnan 2000).

The bathymetry of Upper Basin Creek Reservoir is largely unknown. One known measurement is that the height of the dam is approximately 49 feet above the original channel bottom. Current water levels are approximately 8 feet below the height of the dam due to the breaching of the dam by the Corps of Engineers. This suggests that the maximum depth of the upper reservoir may be approximately 41 feet. This depth is relatively similar to that in Mussigbrod Lake where no fish kills have been observed since the 2000 Mussigbrod Fire. It is also similar to the depths of lakes studied by St-Onge and Magnan (2000) where no significant reductions in fish populations were found after large-scale fires. This suggests that Upper Basin Creek Reservoir would not necessarily experience fish kills in the aftermath of a large-scale wildland fire situated above the reservoir in the watershed.

Effects to Amphibians

There is relatively little information on fire effects to amphibians (Pilliod et al. 2003). The two most prominent amphibian species in the project area are Columbia spotted frogs and boreal toads. Columbia spotted frogs are tied directly to aquatic habitats and immediate riparian areas. The most likely time a large-scale fire would occur in the Basin Creek watershed under Alternative 1 would be during August through September. During these times, young boreal toads would be highly dependent to aquatic and riparian habitats while adults could be in either riparian or upslope habitats. As with fish, amphibians may be susceptible to direct mortality associated with elevated levels of nitrite, nitrate, or other nitrogenous compounds in aquatic habitats if site-level fire severity is high (Pilliod et al. 2003). On the other hand increased levels of these nutrients can increase the productivity of aquatic habitats and provide more food for amphibian species increasing their densities (Pilliod et al. 2003).

Indirect effects would be highly dependent on the localized intensity and severity of fire relative to the location of aquatic habitats. Effects described above for loss of stream shade and subsequent potential for increased water temperatures may occur in amphibian habitats more than in fish habitat with this project because amphibians reside in smaller streams that are more dependent on riparian forest canopy to provide stream shade than are fish in the planning area. Additional potential effects to amphibians include sedimentation of their habitats as described above, and losses of forest floor duff, litter, and down wood.

The latter effect would potentially reduce habitat available for adult boreal toads during winter through spring months.

In the context of habitat succession, a wildland fire may be important to maintaining a diverse range of habitat conditions at a landscape scale at any given point in time. Fires open forest canopies and are often a natural disturbance to riparian vegetation communities that strongly influence amphibian habitats (reviewed by Pilliod et al. 2003). One summer after a large wildland fire in Glacier National Park, western toads were found breeding in a number of ponds that had not been used for two years prior to the fire, as well as three additional ponds that had been dry prior to the fire but held water after the fire apparently due to short-term increased water yield (reviewed by Pilliod et al. 2003). This suggests that while there may be short-term detrimental effects of wildland fire to boreal toads, they might actually benefit from the habitat changes brought about by fire in some cases.

Summary for Basin Creek

Alternative 1 presumes a high intensity fire, with mostly low to moderate ground fire severity, would occur in Basin Creek. If this fire were to occur in an area that encompasses the westslope cutthroat trout habitat in Basin Creek, then extensive fish kills could occur. The risk of this occurring is unknown but is believed to be low. If fire occurs in Basin Creek, but not Fish Creek, then the cold, high-quality water diverted into Basin Creek from Fish Creek would tend to attenuate effects upon Basin Creek water, and would decrease the chances of direct fish mortality due to fire. If direct mortality of upper Basin Creek fish occurred to a point of extirpating them, there would be no source of colonists available to naturally re-occupy the stream because this population is isolated.

Risk of substantial direct mortality to fish appears to be low where fires burn in mosaic patterns. Jakober (2002) documented changes to westslope cutthroat trout and bull trout populations after 60 percent of the Flat Creek watershed, and approximately 75 percent of the studied stream length was burned. Approximately 75 percent of the burned areas were low to moderate severity burns. One year after the fire westslope cutthroat trout populations were nearly twice what they had been prior to the fire, while bull trout populations remained essentially unaffected relative to pre-fire conditions.

Generally the effects on aquatic habitats and organisms described above would likely be most pronounced in the smallest stream channels in the Basin Creek watershed. So long as a fire is not severe enough to extirpate fish from Basin Creek in the short-term, aquatic habitat quality could actually improve in Basin Creek due to post-fire inputs of large wood to streams in the long-term (several decades). This is consistent with the conclusions of several investigators (Reeves et al. 1995, Minshall et al. 1997, Gresswell 1999).

EFFECTS OF ACTION ALTERNATIVES

Table 3.53 characterizes the relative amounts of different management activities proposed by alternative. Overall Alternative 4 proposes the greatest amount of activity followed in sequence by alternatives 5, 3, and 2. Of the action alternatives, Alternative 4 also proposes the most activity in the Upper Basin drainage where the westslope cutthroat trout reside in the absence of non-native species. Alternative 4 also proposes the most activity in the Herman Gulch drainage (786.4 acres out of a total of 1,606 acres in the drainage), as well as the Lower Basin drainage (792.5 acres out of a total of 1,829 acres in the drainage). Alternatives 4 and 5 propose the most activity in the Blacktail Creek drainage although the amount of activity proposed is small (231 acres) compared to the subwatershed size (24,620 acres). Alternative 3 proposes the most activity in the China Gulch drainage. This alternative proposes activity on 994.8 acres of a total of 1,660 acres in the drainage. Alternative 2 proposes the least amount of activity in all drainages and in the planning area on the whole.

Table 3.53: Acreages of different treatment types by alternative for the entire project area, including the portion of Basin Creek watershed above the lower reservoir. (Acreage figures are approximat3 and may vary slightly (by up to 60 acres total per alternative) from other acreages provided elsewhere in this document.

Activity By Alternative		Treatment Acres by Drainage					
		China Gulch	Herman Gulch	Blacktail Creek	Lower Basin	Upper Basin	Total
Alt. 1	No Action	0	0	0	0	0	0
Alt. 2	Lodgepole Thin	0	64	9	0	41	114
	Lodgepole Regen	46	135	25	9	73	288
	Douglas-fir Thin	116	199	23	181	0	518
	Prescribed Fire	26	0	24	94	36	181
	Total	188	397	81	285	151	1,101
Alt. 3	Lodgepole Thin	0	66	9	0	41	117
	Lodgepole Regen	483	336	25	9	269	1,123
	Douglas-fir Thin	394	219	23	232	125	993
	Prescribed Fire	117	7	24	94	68	311
	Total	995	628	81	335	504	2,543
Alt. 4	Lodgepole Thin	33	140	51	126	498	848
	Lodgepole Regen	318	289	38	344	929	1,918
	Douglas-fir Thin	262	353	109	180	241	1,145
	Prescribed Fire	85	5	33	142	96	362
	Total	698	786	231	793	1,765	4,273
Alt. 5	Lodgepole Thin	33	133	51	10	191	418
	Lodgepole Regen	301	289	38	58	449	1,135
	Douglas-fir Thin	260	353	109	180	217	1,118
	Prescribed Fire	85	5	33	126	93	342
	Total	679	780	231	374	950	3,014

The primary potential direct and indirect effects to aquatic habitats associated with the action alternatives include changes in streamflow regimes and increased sediment inputs to streams and wetlands. Sediment-related effects are most likely to emanate from treatment areas adjacent to riparian areas because sediment originating from these areas has the least distance to travel before it enters aquatic habitats. Additional potential effects include increased stream temperatures, reduced wood recruitment to aquatic habitats, and chemical contamination due to fuel spills.

One indicator of relative risk of direct and indirect effects to aquatic resources is total linear miles of riparian habitat adjacent to proposed fuels reduction activities (Table 3.54). Alternative 3 entails the greatest amount of activity adjacent to riparian areas followed by alternatives 4, 5, 2, and 1. Alternative 3 proposes the most activity adjacent to riparian areas in the China Gulch and Herman Gulch drainages. Alternative 4 proposes the most activity adjacent to riparian areas in the Upper Basin drainage where westslope cutthroat trout reside in the absence of non-native species.

Table 3.54: Cumulative linear miles of riparian habitat adjacent to proposed fuels reduction activity by alternative.

Riparian Miles with Adjacent Treatment by Alternative (Percentage of Total Miles of Riparian in Drainage)						
Alternative	China Gulch	Herman Gulch	Blacktail Creek	Lower Basin	Upper Basin Creek	Total Riparian Miles by Alt.
Alternative 1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0
Alternative 2	0.5 (7%)	1.8 (28%)	0 (0%)	0.8 (13%)	0.4 (2%)	3.5
Alternative 3	4.9 (69%)	3.0 (46%)	0 (0%)	0.8 (13%)	1.4 (6%)	10.1
Alternative 4	1.2 (17%)	1.9 (29%)	0 (0%)	0.8 (13%)	1.6 (6%)	5.5
Alternative 5	1.2 (17%)	1.9 (29%)	0 (0%)	0.6 (10%)	1.2 (5%)	4.9

All action alternatives propose thinning and prescribed burning of a sage/grass park adjacent to approximately 0.2 mile of Basin Creek downstream of the lower reservoir in the Lower Basin drainage. This treatment would entail a 300-foot no treatment buffer on Basin Creek. This is the only fish-bearing stream adjacent to which activity is proposed.

The majority of riparian areas adjacent to where activities are proposed are either perennial non-fish-bearing streams or wetlands larger than 1 acre in size (Table 3.55). Riparian areas with perennial non-fish-bearing streams and wetlands larger than 1 acre would receive 150-foot no-treatment buffers from the edge of stream channels or wetlands. Those with intermittent streams or wetlands smaller than 1 acre would receive 50-foot no-treatment buffers.

Table 3.55: Miles of riparian area adjacent to proposed fuels treatment by alternative. Peren = perennial streams/wetlands larger than 1 acre. Interm = intermittent streams/wetlands smaller than 1 acre.

Riparian Miles with Adjacent Treatment by Riparian Type										
	China Gulch		Herman Gulch		Lower Basin		Upper Basin		Total	
Alternative	Peren	Interm	Peren	Interm	Peren	Interm	Peren	Interm	Peren	Interm
Alt 1	0	0	0	0	0	0	0	0	0	0
Alt 2	0.2	0.3	1.3	0.5	0.7	0.1	0	0.4	2.2	1.3
Alt 3	4.2	0.7	2.4	0.6	0.7	0.1	1	0.4	8.3	1.8
Alt 4	0.9	0.3	1.4	0.5	0.7	0.1	0.5	1.1	3.5	2
Alt 5	0.9	0.3	1.4	0.5	0.5	0.1	0.4	0.8	3.2	1.7

Proposed Roads

Most fuels treatment activities would be conducted from temporary roads constructed for the project, and then decommissioned at the end of project implementation. These temporary roads may exist for up to three years before they are decommissioned. Ketcheson and Megahan (1996) found that 70 percent of road-related erosion occurred within the first year of road construction in granitic watersheds. Temporary roads constructed for this project would likely generate eroded sediment with potential for it to access aquatic habitats. Table 3.56 displays the approximate miles of road proposed by alternative and drainage. Approximately 20 percent of the road miles in each alternative listed in Table 3.56 have existing roadbeds that would require some maintenance or slight reconstruction for use with this project

Alternative 3 proposes the greatest amount of roads followed closely by alternatives 4 and 5. In addition to the temporary road miles proposed, Alternative 4 also proposes use of approximately 5 miles of motorized trail (not included in Table 3.56) to provide access into the Roadless Area for fuels reduction treatments. These trails include the Bear Gulch Trail which would need some reconstruction work in order for it to be serviceable, as well as two new trails stemming from the Bear Gulch Trail. New trails would be decommissioned upon completion of work with this project.

Table 3.56: Approximate miles of road proposed by alternative.

	Total Road Miles by Alternative/Drainage					
Alternative	**China Gulch**	**Herman Gulch**	**Blacktail Creek**	**Lower Basin**	**Upper Basin Creek**	**Total**
Alt 1	0	0	0	0	0	0
Alt 2	2.8	3.8	0	2	0.4	9
Alt 3	8.2	4.9	0	1.2	2.7	17
Alt 4	6.5	5.1	0.1	1.2	3.5	16.4
Alt 5	6.5	5.1	0.1	1.2	3.5	16.4

Included in the roads described above (Table 3.56), it was assumed based on existing road condition that alternatives 2 and 3 would entail reconstruction or maintenance and timber haul on approximately 0.7 mile and 0.5 mile of the existing China Gulch Road, respectively, (0.2 mile on National Forest Lands and the remainder on private lands) in and near the riparian area of China Gulch. For most of its length this reconstructed road is at least 150 feet from the stream and is on flat ground where any eroded sediment would tend to travel a short distance and be trapped by the grassy riparian vegetation. Under all action alternatives an assumption was made based on existing road condition that approximately 0.7 mile of the existing valley bottom road in Herman Gulch would be reconstructed and used for timber haul on National Forest lands. With the exception of these two roads, all other roads would be temporary and would be decommissioned upon completion of this project.

The most potentially impactive roads to aquatic habitats would likely be those that are located within 300 feet of aquatic habitats. Belt et al. (1992) suggested that filter strips on the order of 200 to 300 feet are generally effective in controlling sediment that is not channelized. Loeffler (1998) documented that in one study in Rocky Mountain National Park most male boreal toads were usually found within 300 feet of water. Table 3.57 displays miles of road and trail constructed or reconstructed by alternative within 300 feet of aquatic habitats. This 300-foot distance is not intended to be an absolute threshold directly indicative of aquatic impacts. It is intended to be a conservative distance on which to base a comparison of action alternatives relative to each other for aquatic resource risk. This distance does not correspond to widths of Riparian Habitat Conservation Areas (RHCAs) in most riparian areas of this project.

Table 3.57: Road miles within 300 feet of aquatic habitats by alternative. Recon = reconstructed road. Temp = temporary road to be decommissioned upon completion of project. Road miles not identified as "temp" or "trail" are reconstructed or maintained road segments required for use in these alternatives, the roads along Herman and China gulches.

Total Road/Trail Miles within 300 Feet of Aquatic Habitats by Alternative/Drainage						
Alternative	**China Gulch**	**Herman Gulch**	**Blacktail Creek**	**Lower Basin**	**Upper Basin Creek**	**Total**
Alt 1	0	0	0	0	0	0
Alt 2	1.2 (0.5 temp)	1.1 (0.4 temp)	0	0	0	2.3 (0.9 temp)
Alt 3	2.1 (1.6 temp)	1.2 (0.5 temp)	0	0	0	3.3 (2.1 temp)
Alt 4	0.7 temp	1.4 (0.7 temp)	0	0	1.4 (1.2 trail) (0.2 temp)	3.5 (1.2 trail) (1.6 temp)
Alt 5	0.7 temp	1.4 (0.7 temp)	0	0	0.2 temp	2.3 (1.6 temp)

Alternative 4 proposes the most road or trail construction/reconstruction within 300 feet of streams followed in order by alternatives 3, 2, and 5. Alternatives 2 and 3 would entail reconstruction and use of both the China and Herman Gulch valley bottom roads while alternatives 4 and 5 entail reconstruction of the Herman Gulch road but not the China Gulch road. Alternative 4 includes reconstruction and use of the Bear Gulch trail, a portion of which is in or near a riparian area in the Roadless Area.

INFISH standards and guidelines direct the Forest Service to "minimize road and landing locations in Riparian Habitat Conservation Areas." As a comparison of how each alternative relates to this standard and guideline, Table 3.58 displays the road and trail miles proposed within RHCAs.

Table 3.58: Miles of road and trail constructed, reconstructed, and used by alternative within Riparian Habitat Conservation Areas. Temp = temporary road. Road miles not identified as "temp" or "trail" are reconstructed or maintained road segments required for use in these alternatives, the roads along Herman and China gulches.

Total Road/Trail Miles within 150 Feet of Aquatic Habitats by Alternative/Drainage						
Alternative	**China Gulch**	**Herman Gulch**	**Blacktail Creek**	**Lower Basin**	**Upper Basin Creek**	**Total**
Alt 1	0	0	0	0	0	0
Alt 2	0.5 (0.3 temp)	1.0 (0.3 temp)	0	0	0	1.5 (0.6 temp)
Alt 3	0.5 (0.3 temp)	0.9 (0.2 temp)	0	0	0	1.4 (0.5 temp)
Alt 4	0.2 temp	0.9 (0.2 temp)	0	0	1.1 (1.0 trail) (0.1 temp)	2.2 (1.0 trail) (0.5 temp)
Alt 5	0.2 temp	0.9 (0.2 temp)	0	0	0.1 temp	1.2 (0.5 temp)

Of the action alternatives, Alternative 4 appears to least meet the INFISH standards and guidelines to minimize road locations within RHCAs, followed in order by alternatives 2, 3, and 5. Road miles in Table 3.58 would pose a moderate to high risk of delivering sediment to wetlands or streams. This was verified by a series of Water Erosion Prediction Project (WEPP) model runs for a small subsample of the roads. In particular, in the DEIS, one 900-foot long section of a proposed temporary road in all action alternatives along a 55 percent slope approximately 50 feet from Herman Gulch posed a high risk of contributing sediment to the stream. This road was dropped from consideration and this unit is now proposed for helicopter logging. A 1,000-foot long section of proposed temporary road in lower China Gulch approximately 100 feet from the stream in Alternative 2 poses a moderate to high risk of delivering sediment to China Gulch.

Some erosion and sedimentation of aquatic habitats would be expected on a small-scale in localized areas associated with proposed activity. The most likely places this would occur would be from the roads listed in Table 3.58 and along stream or wetland crossings. For this analysis it was assumed that a stream crossing would be necessary in upper Herman Gulch to access a proposed fuels treatment area north of the creek in all action alternatives. All other stream crossings were explicitly delineated with the proposed temporary road network by alternative. There are four crossings proposed in Alternative 2, three crossings in Alternative 3, two crossings in Alternative 4, and two crossings in Alternative 5. No stream crossings are proposed in fish-bearing streams in any action alternatives with this project. Stream or wetland crossing construction would entail localized alteration of aquatic habitat morphology that would likely occur along tens of feet of habitat at each crossing. Stream crossing structures would be designed to accommodate 100-year storm events and would be removed upon completion of this project. Additional localized sediment inputs to Herman Gulch would be expected with the proposed reconstruction of its valley bottom road in all action alternatives. All proposed new roads would be temporary and would be decommissioned upon completion of the project.

Sedimentation in Streams and Wetlands

One of the primary potential impacts of this project to aquatic habitats is erosion and subsequent sedimentation of aquatic habitats. One key aspect of the potential for sedimentation is the juxtaposition of roads relative to aquatic habitats. Roads are generally the primary sediment source associated with timber harvest operations (Furniss et al. 1991, Belt et al. 1992, King 1993). Belt et al. (1992) reviewed a number of studies associated with roads and summarized that vegetated filter strips (buffers) of 200-300 feet are generally effective in controlling unchannelized sediment. Unchannelized sediment rarely traveled more than 300 feet downslope from its source even in steep highly erosive granitic terrain (Belt et al. 1992). Quigley and Arbelbide (1997) reviewed work by Ketcheson and Megahan (1996) to the effect that the single most significant variable affecting sediment travel distance from soil disturbing activities is the volume of material displaced. That is, sediment transport distances are greater with greater quantities of sediment displaced (Quigley and Arbelbide 1997). Most of these studies have been done in the context of specified road construction and use in forested settings. Few studies appear to be available on sediment transport distances associated with temporary roads or strictly from timber harvest units in the intermountain west.

The RHCA buffers identified in all action alternatives are expected to minimize sediment inputs to aquatic habitats. The most likely sources of sediment would be those described in the section on roads above. WEPP model runs showed a low risk of sediment effects originating from the proposed treatment areas themselves. Proposed temporary roads are located in upslope areas to the extent practicable with each alternative.

The soils scientist report for this project indicates that, with the exception of localized effects from road construction and use, relatively little erosion is expected with ground disturbance in proposed treatment areas with this project (see Soils Scientist report in supporting data file). The soils scientist and hydrologist anticipate that INFISH buffers would generally be adequate to prevent sedimentation in stream channels and wetlands arising from proposed fuels treatment areas for all action alternatives with this project.

Of the three sensitive aquatic species, sediment-related effects would likely most affect boreal toads because they are likely to be the most widely distributed sensitive aquatic species in the project area. Boreal toads would also likely be affected by activity adjacent to riparian areas because many of them tend to reside in or adjacent to riparian areas. No northern leopard frogs have been found in the project area to date and westslope cutthroat trout are limited in their distribution to areas upstream of most proposed activity.

Streamflow Effects

Aquatic habitat morphology could potentially be changed by increased peak flows. The potential for increased peak flows is predicted to be minimal with all action alternatives because widespread lodgepole pine mortality due to the mountain pine beetle outbreak is likely to facilitate a natural increase of annual water yield by approximately 12.5 percent (see the Hydrology report in the supporting data file). This increase in water yield reflects some unknown increase in magnitude or duration of peak flows. The greatest potential annual water yield increase predicted for any of the five drainages analyzed for this project with any action alternative would be 15 percent in Herman Gulch with alternative 4 (the most impactive alternative for flow effects). This increase is very similar to what would be expected under natural conditions brought about by the mountain pine beetle outbreak.

A 14.25 percent annual water yield increase is predicted with Alternative 4 for China Gulch where stream channel morphology may be at greatest risk due to existing conditions. In main stem China Gulch there is a series of remnant beaver dams no longer being maintained by beavers because willow communities are currently inadequate to support beavers. The remnant beaver dams are likely destined for failure because there are no beavers present to maintain them. The ponds upstream of these remnant beaver dams are likely to be dewatered in the near future even under natural conditions, especially with the advent of increased peak flows due to the mountain pine beetle outbreak.

Annual water yield increases for Upper Basin and Lower Basin drainages are 13 percent and 12.5 percent, respectively, for Alternative 4, the most potentially impactive of alternatives in each of these areas. The potential water yield increase for Blacktail Creek subwatershed is negligible given the small amount of activity proposed relative to the subwatershed size. These drainage-level water yield increases compare similarly to the 12.5 percent annual water yield increase predicted for the no action alternative even in the absence of a large-scale fire. The additional annual water yield increases associated with proposed fuels management activities are minimal compared to what is expected to occur even in the absence of management. These management-related water yield increases would not likely affect stream channel condition or morphology to any greater extent than what is expected to occur in the absence of management because of the mountain pine beetle outbreak.

Water Temperature

Stream water temperatures vary by time of year with maximum water temperatures being reached during warm summer months when flows are generally at their lowest and solar radiation is at its highest (Beschta et al. 1987). This leads to some possibility about the potential for summer maximum temperatures to be increased if shade is decreased and streams are subsequently exposed to increased solar radiation. Removal of streamside shading vegetation may increase summer water temperatures and decrease winter water temperatures (Beschta et al. 1987, Chamberlin et al. 1991). The influx of cold water to the fish-bearing portion of Basin Creek in the project area due to the Fish Creek diversion effectively functions like a large spring influence by keeping summer flows relatively high and water temperatures relatively low.

Under the no action alternative, even without the advent of a wildland fire, there may be stream temperature increases brought about by the widespread mortality of lodgepole pine trees in riparian areas. This widespread tree mortality will result in reduced canopy cover over perennial streams and may result in increased summer water temperatures in the areas most affected by mountain pine beetle.

In all action alternatives, fish-bearing streams would have 300-foot no-treatment buffers, perennial non-fish bearing streams and wetlands greater than 1-acre in size would have 150-foot no-treatment buffers, and intermittent streams and wetlands less than 1-acre in size would have 50-foot no-treatment buffers. Buffer strips ranging in width from 80 to150 feet in width have generally been found to provide sufficient shade to prevent changes in stream temperatures (Beschta et al. 1987, Belt et al. 1992, Quigley and Arbelbide 1997). For this project all fish-bearing streams and perennially flowing non-fish-bearing streams and wetlands larger than 1-acre would have at least 150-foot no-treatment buffers on them regardless of the extent of mountain pine beetle mortality to lodgepole pine. Therefore no effects to stream temperatures would be expected with the action alternatives in this project. Any temperature increases in the project area would likely be associated with natural riparian tree mortality.

Large Wood Recruitment

Wood recruitment rates to aquatic habitats would be largely unaffected in any action alternatives. The majority of wood entering streams and aquatic habitats originate within a distance equal to one site-potential or effective tree height from the subject area (Robison and Beschta 1990). The average site-potential tree height throughout most of the project area is approximately 100 feet. The INFISH riparian buffers would ensure nearly natural wood recruitment rates in all fish-bearing streams (300-foot buffers) and perennial non fish-bearing streams (150-foot buffers). Quigley and Arbelbide (1997) reviewed that buffer widths of 100 to 150 feet are generally adequate to provide for natural woody material recruitment rates to streams. Wood recruitment rates on intermittent streams and wetlands less than 1-acre adjacent to treatment areas would be slightly reduced from natural because buffers would only be 50 feet in width in these areas. The majority of riparian areas adjacent to proposed treatments are perennial streams or wetlands larger than 1-acre in size and would therefore receive 150-foot buffers.

Chemical Contamination

There is some potential for hazardous materials such as fuel, hydraulic fluid, or oil to enter aquatic habitats in the event of an accidental breakage of equipment or accidental spill. Small-scale leaks of hydraulic fluid and fuel commonly occur during timber harvest operations when equipment breaks down. Operation and refueling of equipment would be excluded from riparian areas by virtue of the INFISH riparian buffers. In addition, as per INFISH standards and guidelines, road locations in riparian areas have been minimized and no landings would be located in riparian areas under any action alternatives. Unless there is an accidental spill of large volumes of hazardous material, the likelihood of contaminants reaching aquatic habitats is low.

Additional Effects to Boreal Toads

In addition to the potential effects described above for aquatic habitats, there are additional potential effects to boreal toads. Because boreal toads reside in upslope areas from autumn through spring, they may be crushed by equipment and vehicles used during fuels reduction activities (Bryce Maxell, personal communication, 2003). This mortality could be associated with activity in treatment areas as well as on roads used for implementation. Tree and down wood removal, particularly from regeneration harvest units may create migration barriers that prevent toads from accessing upslope over-wintering areas. Running over ground with equipment may also collapse small mammal burrows used for over-wintering by boreal toads (Loeffler 1998). Loeffler (1998) documented that in the Southern Rocky Mountain population of boreal toads, most male toads are usually found within 300 feet of water while females are more wide-ranging and have been found as far away as 2.5 miles from their breeding habitats. Based on these findings, the relative risk of these impacts by action alternative would likely vary commensurately with the relative amounts of ground disturbing activities located adjacent to riparian habitats. From this perspective Alternative 3 poses the greatest risk to boreal toads followed in order by alternatives 4, 5, and 2. Alternative 1 (no action) would entail some risk of boreal toads and amphibian burrows being crushed by heavy equipment and vehicles during fire suppression activities associated with the theoretical wildland fire in 2028.

Two known boreal toad sites were found in close proximity to proposed fuels treatment activity in alternatives 3, 4, and 5. Under these alternatives these sites would be buffered with a 500-foot no-treatment buffer to protect the habitat in the immediate area of the breeding sites. Bartelt (2000) found that 75 percent of all adult male toad movements in his study were confined to an approximately 500-foot radius of breeding sites during the breeding season. Fuels treatment activity within approximately ¼-mile of each of these sites would be conducted during winter (December 1 through March 15) while toads are hibernating to minimize the risk of mechanically crushing individual toads. Slash burning in these units would occur from November 1 through November 30, with the possibility of allowing slash burning in October if we receive considerable snowfall in that month that would drive boreal toads into hibernation. Areas to which these mitigation measures apply are described in the project file for this project.

One additional effect to boreal toads is the potential for toads to be killed by prescribed burning treatments in colonized parks in action alternatives. These treatments would have to occur during spring months when any boreal toads present in these parks would potentially be emerging from hibernation. Breeding individuals over-wintering in colonized parks might vacate them en route to breeding habitats prior to prescribed burning activities. Individuals not moving toward breeding habitats would probably at greater risk of mortality due to prescribed fire activities. Table 3.53 above displays prescribed burning acres by alternative where this effect might occur. Alternative 4 at approximately 362 acres creates the greatest risk to toads, followed in order by Alternative 5 at 342 acres, Alternative 3 at 311 acres, and Alternative 2 at 181 acres.

CUMULATIVE WATERSHED EFFECTS

Aside from direct and indirect effects to aquatic resources, the potential effects of this project must be considered in the context of cumulative effects along with other activities in each subwatershed. The ongoing or reasonably foreseeable activities that have the greatest potential to affect aquatic conditions and contribute to cumulative watershed effects in each subwatershed are described below.

Basin Creek

Basin Creek, downstream of the lower reservoir, undergoes a variety of land use practices that affect water quality and aquatic habitat. The stream flows through private lands where water is withdrawn for irrigation, thus reducing summer low flows. The riparian area undergoes livestock grazing through much of its length downstream of the lower reservoir. There is also rural residential development along or near the creek. These activities have served to alter riparian vegetation to some degree, increase sediment inputs to the stream, and reduce instream flows. Even further downstream Basin Creek flows through an urbanized portion of Butte before it joins with Blacktail Creek. These ongoing activities have limited the potential for aquatic productivity in lower Basin Creek.

Little Basin Creek is a tributary to Basin Creek whose confluence is on private land several miles downstream from the current project area. This stream is not believed to be fish-bearing. The lower portion of Little Basin Creek drainage has similar agricultural and rural residential land uses as lower Basin Creek before it enters the city of Butte. The headwaters of Little Basin Creek are located on National Forest lands. There are two small-scale water transmission lines from the National Forest to private lands in upper Little Basin Creek. The Big Sky Girl Scout Camp is located on private land inholdings along the valley bottom of Little Basin Creek surrounded by National Forest lands. This facility includes several buildings for the camp where educational activities including horsemanship and day-use hiking classes are conducted.

There are four recreational residences on National Forest lands in Basin Creek downstream of the reservoir. Three of these are along the stream bottom in Herman Gulch and one is in Basin Creek subwatershed downstream of the lower reservoir. The permittees for these residences are responsible for reducing fire risk and hazard trees at these cabins. Continuing maintenance and use of the valley bottom road in Herman Gulch associated with the summer homes introduces some sediment to Herman Gulch. The Herman Gulch road is a known sediment source to Herman Gulch, particularly during intense thunderstorms. In addition, mountain pine beetle has recently swept through this area creating the need to fall riparian “hazard” trees around the valley bottom summer homes. Public firewood cutting has occurred along about 0.5 mile of the Herman Gulch road near the recreation residences in the riparian area thus reducing the snag quantities and down wood source to Herman Gulch.

Livestock grazing occurs on National Forest lands both upstream and downstream of the lower reservoir. The allotment (Blacktail Allotment) is permitted for 92 cow/calf pairs for use between June 16 and September 30 each year. The Twin Calf pasture in the Basin Creek subwatershed includes four small tributaries to lower Basin Creek. This allotment was in non-use status in 1999, 2000, 2001, and 2003. Portions of China Gulch have riparian vegetation conditions that are suggestive of long-term over-browsing of willows. This over-browsing is likely from a combination of cattle and big game. A portion of the Moose Camp allotment also incorporates a portion of the headwaters of Basin Creek subwatershed upstream of the reservoirs. Recently cattle use of this area has been light as there is relatively little forage available in this portion of the allotment.

Each year lower Basin Creek reservoir is treated with copper sulfate to minimize algal blooms that could react with the chlorine used to treat the water for municipal use. Such a reaction could create large amounts of flocculent that would create noncompliance with the conditions of the filtration waiver and render Basin Creek water unusable as a domestic water supply. While the copper sulfate treatments allow for continued treatment and use of Basin Creek water, they do limit aquatic productivity in lower Basin Creek reservoir.

During late summer flow releases from lower Basin Creek reservoir are minimized in order to store as much water in the reservoir as possible for domestic use. This creates extremely low flows in Basin Creek downstream of the reservoir thus minimizing the amount of aquatic habitat available.

There is occasional maintenance performed on each of the Basin Creek reservoir dams and the Fish Creek diversion system. Any ground disturbing activities create the potential for erosion, sedimentation, and stream channel alterations. There is currently a proposal to update some facilities at the lower reservoir dam and lessen the steepness of the sideslopes of the outlet at the upper dam. The latter project would likely create a small amount of sedimentation and disturbance in Basin Creek where westslope cutthroat trout reside but these effects would likely be minor.

There is a powerline corridor in the headwaters of Basin Creek that is a vegetatively cleared strip approximately 40 feet wide by about 3 miles in length in the subwatershed. This area is maintained clear of trees to protect the powerline. A native surface maintenance road provides some access to the powerline. This road occasionally undergoes slight erosion. Some small amounts of sediment may enter Basin Creek from along the access road.

The Highland Mine was a hard-rock gold mining operation in the headwaters of Basin Creek. It operated in the 1930s and included a mill site that was built in 1932 but was moved to the other side of the Continental Divide into Middle Fork Moose Creek due to water quality concerns on the part of the Butte Water Company. Water flowing from a mine adit at the Highland Mine site reaches Basin Creek via surface flow. Recent investigations detected metals in the adit water after it had interacted with waste rock material high in pyrite located downslope of the adit opening. The remedy to this situation involved routing the adit runoff around the waste rock, thus preventing it from picking up heavy metals.

There is currently one private residence in the headwaters of Basin Creek accessed via the Highland Road. There is small-scale erosion taking place off the spur roads associated with this property but the potential for this erosion to reach Basin Creek is minimal because it is located so far from a stream.

Highland Road is maintained as a major tie-through road in the headwaters of Basin Creek. This road is subject to erosion at times during snowmelt and severe thunderstorm periods. Some relatively small amounts of sediment may access Basin Creek from this road, particularly where sediment may be picked up by the Fish Creek diversion where it crosses beneath the road.

In 1999 there was a blowdown event on some upper slopes in the headwaters of Basin Creek. Approximately 48 acres of this ground was salvage logged via helicopter. No substantial erosion effects have been observed from this recent activity.

The Montana State Department of Natural Resource~~s~~ Conservation (DNRC) plans to harvest timber from 53 acres of land in lower Herman Gulch in 2004. Forest stands on this ground have undergone a high rate of tree mortality due to the mountain pine beetle outbreak. This timber harvest would entail reconstructing and hauling timber off approximately 0.7 mile of road that is within 50 feet of a perennial non-fish-bearing tributary to Herman Gulch. There would likely be one stream crossing installed during this reconstruction. There would likely be some sediment inputs to this Herman Gulch tributary as well as the removal of some of its long-term wood recruitment potential for the stream due to riparian timber removal.

Over the past two years, approximately 60 acres of private land downstream of the lower reservoir has been partial-cut logged using ground-based systems. In part this has been a response to lodgepole pine mortality brought on by the mountain pine beetle outbreak but some of these acres are Douglas-fir stands that have been thinned. Most of these lands are outside riparian areas. Some small amounts of sediment are likely entering Basin Creek, particularly from skid trails associated with this activity.

The Bear Gulch Trail is a recreational trail designated for motorized use as it passes through the Roadless Area in the western portion of the planning area. Approximately 5 miles of the trail are located within the Basin Creek subwatershed. Its trailhead is near Basin Creek Municipal Park and terminates in Burton Park on the other side of the Continental Divide from Basin Creek. This trail may be reconstructed within the next two or three years. Portions of this trail have ongoing erosion problems, particularly near where it originates in Basin Creek. The trail is in relatively good condition as it passes through Bear Gulch, where boreal toads are known to reside. Sediment eroded off the trail accesses a small riparian area along the northern portion of the trail near Basin Creek. This riparian area is not well connected to Basin Creek so sediment inputs to Basin Creek from this trail are likely minimal.

A portion of the Continental Divide National Scenic Trail is proposed for construction with approximately 16 miles of trail to be located in the planning area. This would be a ridgetop trail approximately 24 inches wide with 8-foot wide clearing limits designed for non-motorized use. The potential for this trail to impact aquatic resources is negligible.

There is a proposal for private acquisition of approximately 2 acres of National Forest land in the Herman Gulch drainage. This parcel of land currently has a road that goes through the property approximately 20 feet from a private residence. This land would be used for a private residence. Some small scale erosion and sedimentation of Herman Gulch is expected with this acquisition.

The eastern-most 0.8 miles of the Herman Gulch Road beyond the last recreational use cabin on the road is proposed for conversion to a non-motorized trail. The trail would have a 2-foot wide tread with a 5-foot wide horizontal clearing limit and a 10-foot high vertical clearing limit. This would entail maintaining the first 0.4-mile portion of the trail in the existing roadbed and relocating the eastern and southern-most 0.4-mile portion of the trail outside the valley bottom. The stream and valley bottom in this latter area where the current roadbed is located in and along the stream channel would be restored to improve riparian and aquatic function. Restoration of this valley bottom would include abandonment of the existing roadbed, placement of large woody material in the stream and valley bottom, revegetation of the riparian area with willows and/or sedges, and some localized physical reconfiguration of the stream channel in places where the current roadbed has encroached into the stream channel proper. From this work there would likely be some localized short-term (2 to 3 years) sediment inputs to Herman Gulch but in the long-term sediment inputs would be reduced from this portion of the creek where the existing roadbed in the stream bottom currently contributes sediment annually due to its poor existing condition.

A proposal was submitted in July 2003 to conduct mineral exploration on two unpatented mining claims on National Forest lands in the China Gulch drainage. Shallow pits would be dug by hand for potential quartz deposits. Five exploratory pits are proposed, however, if assay results are positive then there is a possibility that an amended plan of operation would be submitted. This work is proposed to occur in summer/fall of 2003 with reclamation following the work. Access to the site would be by foot. There are no riparian areas associated with this work so no effects to aquatic habitats are expected.

Blacktail Creek

Much like lower Basin Creek, lower Blacktail Creek downstream of the Forest boundary flows through private land much of which is used for livestock grazing (cattle and horses). As it flows further into town, it passes through an urbanized area where riparian vegetation and channel function have been substantially altered. There are numerous roads and residences in lower Blacktail Creek on private lands.

The middle portion of the watershed contains private land inholdings surrounded largely by National Forest lands. There are over 50 residences in this area so Blacktail Creek experiences some impacts associated with livestock grazing (mostly horses) along about 2 miles of its length as it passes through this rural residential area. Small non-fish-bearing tributaries to Blacktail Creek experience similar activities. Some timber harvest also occurs on the private lands. In 2003 approximately 210 acres of private land in this area were logged largely to remove lodgepole pine that had been killed or affected by the mountain pine beetle infestation. There are also localized sediment inputs from native surface driveways into Blacktail Creek in this residential area.

As in Basin Creek, cattle grazing from the Blacktail Allotment occurs in the Blacktail Creek subwatershed. As previously mentioned, cattle use has been relatively light in recent years as cows have been on the allotment in only one of the past four years. Some localized streambank trampling does occur with the grazing however, particularly at times in the headwaters of Blacktail Creek upstream of the residential development in the middle portion of the subwatershed.

In 2002-2003 the Forest Service harvested approximately 285,000 board-feet of timber from Thompson Park from approximately 42 acres, including some riparian timber harvest. This was logged during winter over snow to minimize ground disturbance. Associated with this project was the reconstruction of the 0.25 mile Archery Range road adjacent (within 50 feet) to a small non-fish-bearing tributary of Blacktail Creek. This included gravel surfacing to reduce surface erosion and sediment inputs to the small creek as well as the installation of several ditch relief culverts to reduce the extent of water concentration along the road. Large amounts of down wood (from approximately 70 trees) were added to this stream alongside the road to trap and retain sediment in that stream and prevent it from moving directly into Blacktail Creek in Thompson Park.

The Beaverhead-Deerlodge National Forest is considering proposals to cut and remove additional dead and dying hazard trees in Thompson Park around the archery range and in areas that receive concentrated recreational use, but are not developed sites. Treatment would occur on up to 250 acres each for the archery range and concentrated recreation areas over the next two years. The total amount of treatment would not exceed 500 acres. INFISH standards and guidelines would be applied during planning and implementation including RHCA buffers so effects to aquatic habitats should be minimal.

Over the next several years it is anticipated that a number of recreation facilities within Thompson Park, most of them in the riparian area of Blacktail Creek, would be reconstructed. Seven recreation sites (picnic sites, trailheads, sanitation facilities) along Montana Highway 2 would be reconstructed along with 33 miles of trails, and rehabilitation and/or obliteration of 9 miles of roads. These activities would likely produce short-term sediment inputs to Blacktail Creek but would likely reduce long-term sediment inputs to the creek from these recreation facilities and promote riparian vegetation recovery.

The west end of State Highway 2 originates in the Blacktail Creek subwatershed in Butte. Several miles of it heading east are in an upslope position. However, it follows closely alongside Blacktail Creek for approximately 2.5 miles. The presence and maintenance of Highway 2 along with the lower 2 miles of Roosevelt Drive in the riparian area of Blacktail Creek have direct effects to the creek by limiting riparian vegetation development and floodplain function, and altering stream channel morphology. Sediment from along these 4.5 miles of valley bottom road readily enters Blacktail Creek during rainstorm or runoff events. These valley bottom roads from the northern Forest boundary to Lime Kiln Road are sanded and snowplowed several times annually. This activity also introduces sediment to Blacktail Creek as these roads are only several to tens of feet away from the creek throughout much of their lengths in this area. Sanding and/or snowplowing an additional approximately 4 miles of road in upslope areas in the Blacktail Creek subwatershed probably also introduces sediment indirectly to Blacktail Creek and its tributaries but at a far lower rate than this work on the valley bottom roads.

One additional side effect of the 4.5 miles of valley bottom road has been the chronic removal of dead and down wood from the riparian area via hazard tree removal and public firewood cutting. This has reduced the riparian down wood source for Blacktail Creek.

Approximately 3 miles of the Lime Kiln Road was reconstructed and resurfaced with gravel in the late 1990s to reduce sediment inputs to Blacktail Creek. This has been effective at reducing sediment inputs from road surface runoff.

There are a number of special use permits on National Forest lands in the Blacktail Creek subwatershed including two recreation residences, three domestic water lines, telephone and powerlines, and the archery range in Thompson Park. There may be localized erosion and sedimentation effects from these activities but they are small-scale in nature and highly localized.

There are four private road use permits in the Roosevelt Drive area. These roads provide access to private land. Two additional road use permits are proposed in the same area. These are generally short roads that may have some small-scale erosion associated with them.

The Forest Service prepared and environmental assessment, decision notice, and finding of no significant impact for the Lime Kiln Timber Sale in the Blacktail Creek subwatershed in 1999. This project was never implemented and is pending further environmental analysis. The preferred alternative would have harvested timber from approximately 366 acres, constructed 0.5 mile of temporary road, and closed 0.6 mile of existing roads in the Roosevelt Drive and Lime Kiln areas of the Highland Mountains. Potential aquatic effects of this project are pending additional environmental analysis.

Context of Basin Creek Hazardous Fuels Reduction Project

The Basin Creek Hazardous Fuels Reduction project would contribute to cumulative watershed effects to some degree. The contribution to these effects in the Blacktail Creek subwatershed would be minimal with all action alternatives as fuels reduction treatments are proposed on at most only 231 acres in this 24,620-acre subwatershed. The ongoing effects to Blacktail Creek associated with urbanization at its lower end, the 4.5 miles of valley bottom roads, and ongoing land uses on private lands are and will continue to be dominant in shaping aquatic habitat conditions in this stream relative to activities proposed with this project.

Fuels reduction treatments are proposed on up to approximately 4,042 acres in the 31,355-acre Basin Creek subwatershed. Tributaries within the Basin Creek subwatershed would likely undergo some localized increased sedimentation, particularly Herman and China gulches, with all action alternatives. This would most likely be associated with reconstruction of and timber haul on valley bottom roads in these drainages as well as construction and use of temporary roads near riparian areas. However, WEPP model runs simulating upslope fuels reduction activities indicated a low risk of erosion adding additional sediment to aquatic habitats from the upslope treatments.

Water yield increases even at the small drainage scale (1,600 acres) are predicted to be 0 to 2.5 percent higher in the most impactive alternative (Alternative 4) than natural increases predicted to occur because of tree mortality brought on by the mountain pine beetle outbreak. These water yield increases translate into some unknown potential peak flow increases. These increases associated with any action alternatives would be minimal at the entire Basin Creek subwatershed scale. The contribution of this project to cumulative watershed effects would likely be small.

Cumulative Effects to Boreal Toads

To date, boreal toads have been found in five locations in the Basin Creek subwatershed (Map 26) out of a total of 14 separate survey sites judged to have potential for breeding. (A map of surveyed sites in addition to those shown on Map 26 is located in the project file). One site where boreal toads were found in 2003 had been surveyed in 2001, when no boreal toads were found. At one site surveyed on two separate occasions in 2003, no boreal toads were seen on the first survey but toad tadpoles confirming breeding at this site were found on the second survey. These findings suggest that there may be variability in the use of habitats such that surveyed sites where no boreal toads were found in a particular year could potentially be used in other years. It also suggests that the timing of surveys is crucial in determining presence of boreal toads.

Breeding has been confirmed at two of the five known sites in the Basin Creek subwatershed. Breeding may occur at some of the other known sites as well. This project proposes fuels reduction activities in close proximity to two of the five known sites, near one of the two known breeding sites. Mitigation described above and in Chapter 2 would be applied at these two known sites to minimize risk of impacting toads. Fuels reduction activities near these two sites are not expected to markedly alter the sites or prevent their continued use by toads.

Boreal toads likely reside in a number of additional unsurveyed sites in the Basin Creek subwatershed both on and off the Forest. There is additional potential habitat for boreal toads downstream of the Forest boundary on private lands, particularly associated with two ponded areas on Basin Creek proper just north of the Forest boundary, and in Basin Creek itself between and downstream of these ponds. There are approximately 5 miles of habitat in main stem Basin Creek off the Forest that are likely usable by toads. These areas have not been surveyed to determine presence of boreal toads.

Of the ongoing and reasonably foreseeable activities on National Forest lands described above in the Basin Creek subwatershed, none of them stand to markedly affect the known boreal toad sites in this subwatershed. Livestock use, timber harvest activities, and residential development affect potential boreal toad habitats on private lands downstream of the Forest boundary.

In the Blacktail Creek subwatershed boreal toads have been found at one site in the headwaters. Breeding was confirmed at this site in 2003 and it does not stand to be affected by this project because it is approximately 1.5 miles upstream of any proposed activity. Only one other site in Blacktail Creek, at the north end of the subwatershed near the Forest boundary in Thompson Park, has been surveyed. No boreal toads have been found to date in this Thompson Park area. Given that only two sites have been surveyed in Blacktail Creek subwatershed, there is a large amount of potential habitat in Blacktail Creek proper (approximately 7 stream miles), particularly through Thompson Park and downstream, that has potential to support boreal toads. Other smaller streams in the headwaters on both private and National Forest lands may also support toads as well.

Of the ongoing and reasonably foreseeable activities described above in the Blacktail Creek subwatershed, none of them stand to affect the one known boreal toad breeding site. The valley bottom roads (Highway 2 and Roosevelt Drive) along Blacktail Creek, livestock use, and residential development affect the potential use of Blacktail Creek by boreal toads by occupying riparian habitat and introducing sediment to Blacktail Creek. Highway 2 and Roosevelt Drive may preclude use of a good portion of Blacktail Creek by boreal toads because these roads parallel the stream for approximately 4.5 miles of its length. As such, these roads may form a barrier to movement into and out of Blacktail Creek. They may also cause direct mortality to toads due to their high traffic levels adjacent to the stream.

A broad-scale examination of boreal toad habitats at the Forest scale is contained in the aquatic biological evaluation for this project in Appendix F. In general, habitats for boreal toads are widespread and well distributed across the Forest. The Basin Creek Fuels Reduction project is not expected to pose a risk to viability of this species.

SUMMARY COMPARISON OF ACTION ALTERNATIVES

Overall, Alternative 3 creates the most risk for sensitive amphibians, boreal toad and northern leopard frog, followed in order by alternatives 4, 5, and 2. This is based primarily on the distribution of proposed treatments relative to their adjacency to riparian areas where these species would reside (Table 3.54).

For westslope cutthroat trout, the Upper Basin drainage is the most critical area because this is where the westslope cutthroat trout reside in the absence of non-native species, in habitat that is in relatively good condition. Alternative 4 poses the greatest risk to westslopes by virtue of the relatively large amount of treatment (1,765 acres) proposed in the Upper Basin drainage. Although most treatments in this alternative are located on or near ridgetops, this alternative also has the greatest amount of proposed activity adjacent to riparian areas in the Upper Basin drainage with treatments proposed adjacent to 1.6 miles of riparian areas (Table 3.54). Alternative 5 poses the next highest amount of risk to westslopes, followed in order by alternatives 3 and 2. Expected effects to westslope cutthroat trout and their habitat are expected to be small with all action alternatives.

All action alternatives are consistent with aquatic/riparian standards and guidelines in INFISH. INFISH amended the Deerlodge National Forest Plan and rendered aquatic standards and guidelines in the Deerlodge National Forest Plan to be moot on the west side of the Continental Divide (Timchak 1999) because INFISH provides more protection to aquatic resources than any previous standards in the Deerlodge National Forest Plan. INFISH standards and guidelines are being applied throughout this project area as described above and in the mitigation measures outlined in Chapter 2.

Summary of Aquatic Biological Evaluation Effects Determinations

All alternatives may impact individuals or habitat of westslope cutthroat trout, boreal toads, and northern leopard frogs but would not likely contribute to a trend toward federal listing or loss of population or species viability. The No Action alternative creates some risk to sensitive aquatic species due to the assumption of a large-scale wildland fire in 2028. This project would have no impact to bull trout and arctic grayling. See the aquatic Biological Evaluation for a detailed analysis and rationale in Appendix F.