Fisheries

Analysis Area

Spatial Bounds

The spatial bounds for the fisheries analysis varies by potential impact to fish habitat versus fish populations. Any potential habitat impacts the Hemlock Elk Project may have could take place in the project watersheds.The watersheds are (from north to south):

- Cold Creek,
- Elk Creek, and
- Glacier Creek.

Teepee Creek (an unnamed tributary to the Swan River) located outside of these watersheds will also be analyzed for fish habitat connectivity. Please refer to Map 3-2 for a display of the watersheds and tributary used in the fisheries analysis.

Potential impacts could be felt from the project location downstream to the stream's confluence with the Swan River. As described below, none of the potential impacts are substantial. There are no downstream cumulative effects to the Swan River itself.

Fish populations can move freely about the project area and throughout the Swan Valley. Any potential impact to fish populations in the project area may be felt by the larger "metapopulation" of fish in the valley. Therefore, the analysis area for fish populations is the entire Swan Lake and Swan river valley.

Temporal Bounds

The temporal bounds for the fisheries analysis is 8 years from the project's initiation. This is based on the potential impacts of temporary roads. It is assumed that temporary roads may be used for about 3 years and then it may take another 5 years before the soil and vegetation fully recovers. All other aspects to this project such as timber harvest of upland areas, culvert replacements, etc., would have shorter duration of impacts, likely just 1 or 2 years. Since temporary roads have the longest potential impact, the temporal bounds are 8 years.

Data Sources, Methods, and Assumptions Used

Information for this analysis has been gathered from a variety of sources. Since 1971, the Flathead National Forest, Montana Department of Fish, Wildlife and Parks, PCTC, and Swan Ecosystem Center have conducted over 40 fish population inventories and over 20 fish habitat condition assessments throughout the analysis area. Raw data is available in Project File Exhibit L-4. The following discussion reviews key assumptions used. In addition, peer-reviewed scientific literature has been used as the primary source of information regarding the life histories and habitat requirements of the aquatic organisms and the effect of natural and human-caused disturbances upon those organisms.

The majority of fish population data available has been collected by electrofishing. Electrofishing offers superior ability for crews to identify and accurately measure each fish. Techniques are virtually unchanged since the earliest available data (1971), thus allowing repeat monitoring. The weakness of electrofishing is that it does not effectively capture all fish, since some individuals drift out of sight or escape the area prior to sampling. Cryptic, bottom-dwelling species, such as bull trout and sculpins, especially tend to be underrepresented. Electrofishing is only done in summertime low-flow conditions in a small, representative area [often 328 feet (100 meters) in length]. This analysis assumes that available electrofishing data does an adequate job in characterizing species relative abundance distribution during low flows. It does not assume that if bull trout and sculpins are absent in the survey that they are entirely absent in the stream.

Snorkeling surveys have also been conducted intermittently since 1994, either in daylight or at night with dive lights. Snorkeling, especially at night, offers superior ability to detect bull trout (Banish et al. 2008). However, since fish are not captured for closer inspection or marked, limitations are that it cannot offer a population estimate, it may misidentify fish, and it can only estimate fish sizes. Snorkel surveys can only be done in low-flow, clear water conditions and tend to be for short distances, often only 164 feet (50 meters). An assumption is made that snorkeling surveys do an adequate job of identifying species distribution, but also recognizes that they do not prove species absence and may not fully characterize the population.

Habitat surveys were initially conducted in 1983 (Leathe and Enk 1985), but these are not used. Surveyors visually estimated very long reaches and ascribed a single numeric value for pools, percent gravels, etc. This methodology is not repeatable or verifiable. In 1994, PCTC tallied habitat features in various ~984-foot (300-meter) segments of Cold Creek, Glacier Creek and Windfall Creek. These surveys appear to do a superior job of sampling numerous representative areas of stream and could be repeated. However, no protocol is available that details how habitat features were measured (i.e., how was wood measured). This analysis assumes the PCTC surveys provide similar findings to more current data because it gives expected results but does not use it for comparison against other surveys in the same area. In 1997, the Forest Service collected data for over 2 miles on Elk Creek using methodology defined by Overton et al. (1997). This survey technique sequentially samples every microhabitat feature of a stream and, thereby, avoids the possibility of selecting an unrepresentative area. Habitat features, such as woody debris, pool dimensions, and others, are defined in essentially the same manner as more current surveys, allowing comparison. However, that survey does not have a fixed sampling location and cannot be used for long term monitoring. The assumption is made that the 1997 Elk Creek survey correctly quantifies and averages habitat features for over 2 miles of Elk Creek.

In the late 1990s, fish habitat surveys focused on quantifying microhabitat features in smaller representative areas. These surveys offer superior ability for monitoring since they focus on specific areas and have carefully defined habitat measurements to avoid observer bias (Roper et al. 2004). Protocol evolved gradually until it was finally written down in 2006 (USDA Forest Service 2006). This analysis assumes the gradual change in protocol is trivial and the original surveys are compatible to more recent surveys. This protocol offers statistically defendable methodology for numerous habitat attributes including substrate condition, bank condition, and residual depths of pools. The weakness of this type of survey is that it may not fully typify the rest of the stream, especially since the survey is logistically consuming and managers seldom can afford to survey more than one location per stream. It is assumed that the information collected on these recent surveys is the most trustworthy data and adequately represents the stream condition elsewhere.

The Montana Department of Fish, Wildlife and Parks has also collected several types of data that are used in this report. Bull trout redd counts have been collected on Elk Creek and Cold Creek since 1982 and offer excellent monitoring trends for migratory bull trout spawner escapement. Redd counts can underestimate actual spawning numbers due to flow conditions or overlapping redds and can overlook smaller redds made by resident fish. The assumption is that redd counts offer superior trend data for migratory adults, but do not necessarily reflect actual population size. The Montana Department of Fish, Wildlife and Parks has also annually monitored fine sediment levels in bull trout

spawning habitat of Elk Creek (See Measurement Indicators). The agency has also collected electrofishing information as described earlier.

Measurement Indicators

This analysis focuses on four measurement indicators, namely sediment, water temperature, fish habitat connectivity, and management indicator species (MIS). These components could potentially be impacted by the Hemlock Elk Project. Other fish habitat components such as large woody debris, bank stability, and pool habitat quality are not anticipated to be impacted and not reviewed further. Project File Exhibit L-5 documents the existing condition of INFISH riparian management objectives, eventhough they would not be impacted by the project.

1. **Sediment.** Sedimentation into trout streams is considered a key concern and the most frequently cited type of pollutant in streams of the Pacific Northwest (Bauer and Ralph 2001). In 2004, the Montana Department of Environmental Quality (DEQ) identified sedimentation from tributaries of the Swan Valley as one of the reasons for concern about water quality in Swan Lake (DEQ 2004). In discussions about local fisheries habitat, sedimentation is narrowly focused on the amount of silt, sand, clay, and small gravels that are less than 0.25 inch (6.35 mm) in diameter. This is based on local fisheries research (Weaver and Fraley 1991) and commonly referred to as “fine sediments”.

   The amount of fine sediments in a stream can profoundly affect the quality of fish habitat. The native trout species lay their eggs in between gravel substrate and, if these eggs are covered with fine sediments, they suffocate (McIntyre and Rieman 1995) (Weaver and Fraley 1991). Furthermore, the vast majority of aquatic insect species depends on cobble and gravel substrate that is not “embedded” or stuffed with fine sediments. In extreme cases, where fine sediment is very thick, it can fill in pool habitat and bury logs that fish need for cover and rest. The exact relationship of fine sediment to fish population density is notoriously hard to correlate since fish respond to many habitat variables. Nevertheless, it is commonly accepted that limiting sedimentation is an important way to maintain the health of aquatic resources.

   Though fine sediment is an important parameter, there are no regulatory standards and no consensus on how to quantify the effects (Bauer and Ralph 2001). The challenge comes from the extremely dynamic nature of substrate conditions as it can vary naturally from stream to stream, riffle to riffle, and year to year (Everest et al. 1987). Riparian Management Objectives recommended by INFISH do not have any numeric value for sedimentation.

   Two sources of data on sediment were used, McNeil Core Samples and Wolman Pebble Counts. McNeil Core Samples have been collected at Elk Creek’s bull trout spawning habitat. The samples sort by weight various substrate categories within a core that extends 6 inches (15 cm) below the stream surface (Weaver 2006). Core samples are assumed to offer superior ability to detect and monitor changes in fine sediment over time. Core samples are logistically expensive and, therefore, Wolman Pebble Counts (Wolman 1954) have been more widely used on the other streams in the analysis area. Pebble counts consist of measuring the average diameter of at least 100 samples within a riffle. Pebble counts have been widely accepted as reproducible data (Kondolf 1997), and it is the professional opinion of the District Fisheries Biologist that local pebble count data has done an adequate job to minimize variability caused by time of year and observer bias (Olsen et al. 2005). However, Archer et a.l (2004) caution that over 100 individual pebble counts are needed to be confident of detecting change at the stream level. Therefore, this analysis assumes McNeil Core Samples are superior for monitoring, while Wolman Pebble Counts are acceptable for inventory, but acknowledges uncertainty about monitoring accuracy. Other, older habitat surveys relied on visual estimates and are not used unless there is no other data.

2. **Habitat Connectivity.** Habitat connectivity describes the ability of fish to freely migrate to all available fish habitat. In undisturbed systems, fish can travel between spawning habitat to rearing habitat, and also from summer to winter habitat. Cutthroat trout and bull trout are well known to migrate great distances due to their complex life histories. Most individual fish are thought to return to the same stream, even the same pool, year after year but a few fish stray into other areas. These straying individuals prevent genetic isolation and can also help rebuild a population that collapsed (such as following a catastrophic flood or fire). Fish populations with unlimited connectivity are more resilient than fragmented, isolated populations (Rieman and McIntyre 1993). Small isolated populations, such as those above a waterfall or culvert in the stream headwaters, are at extreme risk and probably cannot be considered viable. Either the population will collapse suddenly after a catastrophic event or the population will slowly decline due to inbreeding and loss of genetic variability.

   The most common man-made barrier to habitat connectivity is from road culverts. A poorly designed culvert can block upstream migration by creating a velocity barrier, an outlet leap barrier, or insufficient depth barrier or a combination of the three. Nearly all of the perennial stream culverts in the analysis area were surveyed in 2002 for fish passage capability. Data collected was analyzed with FishXing version 3.0 software. Empirical data suggests that this software tends to underestimate the ability of a culvert to pass fish. Therefore it is assumed that if the 2002 inventory concluded the culvert provides passage, it truly does provide habitat connectivity for all aquatic organisms. But if it concluded the culvert was a barrier, it could either be a partial barrier (to juvenile fish only) or a total barrier.

3. **Water Temperature.** Water temperature is well understood to be critical for all aquatic life forms and trout require cold water. Since fish can tolerate short term spikes in temperature, a simple maximum temperature is not as valuable as characterizing stream temperature by averaging the temperature over the warmest 7 consecutive days of the years (usually in late July). This is called the Maximum Weekly Average Temperature (MWAT). Bull trout can tolerate MWAT up to about 15 Celsius (US Fish and Wildlife Service 1998) but optimal temperatures are about 10 Celsius (Rieman and Chandler 1999). Cutthroat trout prefer warmer temperatures with optimal habitat at 12 Celsius and can tolerate up to 20 Celsius (Hickman and Raleigh 1982).

   Water temperature was collected in 1983 surveys using a maximum-minimum thermometer that was checked weekly. The original data was not preserved but the reports noted the overall maximum temperature for the summer. An assumption is made that this tends to be higher than the MWAT and the 1983 data is only utilized if nothing else is available. Beginning in the early 1990's technology advanced so that temperature could be read every 30 minutes and stored all season. This analysis utilized that information to determine MWAT. It is assumed the location of the thermometers adequately characterized the overall stream.

4. **Management Indicator Species.** There are numerous native aquatic species, including fish, amphibians and invertebrates. The Flathead National Forest LRMP has identified bull trout (*Salvelinus confluentus*) and Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) as management indicator species. These indicator species were selected because they are sensitive to habitat degradation, native to the area, and their biological requirements have been documented through research. The Forest Plan assumes that management for these two indicator species would adequately provide habitat requirements for all other native species.

Affected Environment

Historic Condition

The historic condition of sediment and water temperatures in streams is not known since there were no habitat surveys prior to any land management. It is assumed that fine sediment was usually at low levels in most times, but did fluctuate after natural disturbances like wildfires and floods (as described in Water Resources). Stream temperatures also remained steady except for a decade or so after a wildfire. The lack of historic data is a common problem. It is considered acceptable to use data on unmanaged streams as a surrogate for historic data in order to evaluate stream condition (Kershner et al. 2004). Fish habitat connectivity, however, is assumed to have been unimpaired throughout the analysis area up to the point of minimal stream volume or waterfalls.

Westslope cutthroat trout are native to the analysis area. They have co-existed with bull trout for thousands of years and are well adapted to thrive in cold, clean, and relatively unproductive streams found in the Swan River Valley (Trotter 1987). Westslope cutthroat trout (hereafter called cutthroat trout) probably historically occupied every single perennial stream in the Swan Valley, at least part of the year, unless they were blocked by a waterfall. It is assumed they were once widespread and abundant in the Hemlock Elk Analysis Area.

Bull trout are also native to the analysis area but were not historically found in every stream. The distribution of bull trout is based on their life history forms. Migratory bull trout seek out select spawning streams, and the offspring rear in the streams for a few years before migrating to Swan Lake or Swan River to mature. Around age 5 or 6, the adults return to their natal streams briefly to spawn and then return back to the lake or river until the next spawning season. Spawning habitat tends to be in larger streams with plenty of wood (Rich et al. 2003). Bull trout also require cold water temperatures and appear to especially seek out groundwater upwellings to protect their eggs through the winter. Within the analysis area, the mainstem of Cold Creek and Elk Creek (but not the tributaries) provided historic spawning habitat for bull trout. Juvenile bull trout likely moved around and reared throughout these watersheds to some degree, although tributary streams probably had sparse numbers of bull trout as compared to the spawning areas. It is uncertain if bull trout historically exhibited a resident life form anywhere in the Swan Valley. Conventional reports presume that the Swan Valley bull trout metapopulation is exclusively migratory (Montana Bull Trout Scientific Group 1995), but resident populations cannot be discounted altogether. Low numbers of bull trout have been found in Glacier Creek and its tributary Kraft Creek, yet neither of these streams have suitable spawning habitat for migratory fish. Whether these streams historically supported some incidental juvenile rearing or a distinct resident population is uncertain. A study of bull trout in the Rock Creek Drainage found some individual bull trout had complex migration patterns and even seasonally occupied streams that biologists normally consider unsuitable (Carnefix 2002), further confounding the ability to define bull trout presence or absence.

Existing Condition

Sediment: Available data on the existing condition suggests that Cold Creek may have more fine sediment than historically, but Elk Creek and the Glacier Creek Watersheds are near historic condition. The following paragraphs provide information on each major watershed.

Within the Cold Creek Watershed, there are 6 Wolman Pebble Count Data Points, all from the same observer. Two riffles on the North Fork of Cold Creek immediately upstream of its confluence with Cold Creek had 19 to 35 percent fine sediment in 2006 (defined as less than 0.24 inches [6 mm]). Both riffles increased in fine sediment in 2007 from 35 to 47 percent, respectively. The increase of fine sediment may be attributed to implementation of BMP work immediately upstream (thus it is anticipated it will decline in 2008). This is more fine sediment than a comparison of 10 unmanaged streams of similar geology and Rosgen (1994) classification (Gardner et al. 2007). Within the known

bull trout spawning and rearing habitat on main Cold Creek, 4 Wolman Pebble Counts in 2007 found 40 percent fine sediment. Again, this is more fine sediment than a comparison of 3 unmanaged streams of similar geology and Rosgen classification (Gardner et al. 2007). This would be considered "impaired" condition as defined by Forest Plan Implementation Note #10. No other data is available.

It is recognized that having only 6 Wolman Pebble Counts in such a large basin is a weak dataset and inappropriate to make firm conclusions. Circumstantial evidence does also support that Cold Creek has more sediment than it did historically. Percent surface fines (visual estimate) collected in 1994 by PCTC at 18 transects had values that the USFWS (1998) characterize a watershed "at risk." Furthermore, a 2002 road sediment source survey conducted for the Swan Lake TMDL Report (DEQ 2004) found the Cold Creek Watershed as having the third highest amount of road-related erosion out of 45 inventoried basins in the Swan Valley. The 2002 assessment examined roughly 50 percent of all the road/stream intersects. An independent fish passage assessment in 2003 found 3 additional erosive sites that were overlooked in the TMDL Report, suggesting the road-related erosion could be more substantial than reported. A local landowner on Cold Creek has expressed concern that Cold Creek seems to have more fine sediment now than it did a few decades ago (Hemlock EA Project File Exhibit B-20).

Elk Creek has been more extensively inventoried with both McNeil Core Samples for 17 years and an R1/R4 survey on 2.5 miles in 1997. Both data types were collected upstream of Road #9591 bridge and found comparable results. Elk Creek has relatively little fine sediment and does not indicate any threshold of concern as recommended by the Flathead Basin Commission (1991). Since 1987, core samples have shown some yearly fluctuation, but overall stable trend. Elk Creek cannot be compared to reference data since it is an unmanaged stream and one of the datapoints used to build the database (Gardner et al. 2007). Considering the high amount of bull trout reproductive success in Elk Creek, all indications are that fine sediment levels are at historic conditions.

The Glacier Creek Watershed has no available coring data, but numerous Wolman Pebble Counts collected throughout the basin. Prior to the 2003 Crazy Horse Fire, all tributary streams except Red Butte Creek was within the expected range as compared to reference streams (Gardner et al. 2007). It is unknown why Red Butte Creek had higher amounts of fine sediment, but it may have been a natural stream condition. The Crazy Horse Fire burned much of this watershed in 2003. As disclosed in the Crazy Horse Fire Salvage Project EA (USFS 2004), monitoring found the streams experienced a 10 to 20 percent increase of fine sediment as a result of erosion from burnt stream banks and adjacent slopes. As the forest revegetates, erosion should sharply decrease and fine sediment in streams should flush out. Monitoring conducted on the Little Wolf Fire in Northwest Montana found a decrease in fine sediment levels within 8 years after the fire (Gardner 2002).

No information is available about the sediment condition of the other small watersheds in the analysis area.

Habitat Connectivity: A 2003 assessment of about 80 percent of all road/stream intersects in the Cold Creek Watershed found 6 potential barriers to fish migration (1 additional barrier was found in 2006). The following table itemizes information on each known fish migration barrier.

TABLE 3-?
LIST OF ALL KNOWN FISH MIGRATION BARRIERS IN THE COLD CREEK WATERSHED

Location	Road Jurisdiction	Type of Barrier	Impact to fish
Cold Creek at Road #903	Cost share USFS and PCTC	Twin culverts constricting channel. Inconclusive modeling.	Apparently adult bull trout can pass. Uncertain impacts to juvenile bull trout or cutthroat trout.
Icy Creek at Road	Cost share USFS	Total barrier to all passage	Blocks brook trout and sculpins. Due to

TABLE 3-?
LIST OF ALL KNOWN FISH MIGRATION BARRIERS IN THE COLD CREEK WATERSHED

Location	Road Jurisdiction	Type of Barrier	Impact to fish
#903	and PCTC		proximity to spawning area, likely blocks bull trout rearing.
Unnamed tributary at Road #90511	Plum Creek	Modeled as barrier to juvenile fish	Unknown
Spotted Calf at Road #9591	Forest Service	Blocks juvenile fish	Blocks brook trout (only species present).
Frozen Creek at Road #903	Cost share USFS and PCTC	Total barrier to all passage	Blocks brook trout.(only species present) Due to small stream size, unlikely to be used by bull trout.
Frozen Creek at Road #90523	Plum Creek	Modeled as total barrier	Currently believed fishless due to barrier downstream.
Frozen Creek at Road #90511	Plum Creek	Modeled as total barrier	Currently believe fishless due to barriers downstream.

There are no known culvert barriers anywhere in the Elk Creek Watershed. Prior to the Crazy Horse Fire, the Glacier Creek Watershed had 6 known fish migration barriers. Five of the 6 were remediated in 2004/2005 with BAER funds or post-fire salvage funds. The only remaining migration barrier is on upper Windfall Creek at Road #9590. This culvert is blocking brook trout from about 0.25 miles of habitat. Brook trout are the only species found in this portion of Windfall Creek.

In the small, unnamed tributary north of Cold Creek (nicknamed Teepee Creek), the culvert on Road #888C is routinely plugged by beavers. Although the Forest Service periodically attempts to clear the debris, beavers repeatedly return. The debris in the culvert has created a migration barrier for brook trout, the only species in the stream. This culvert is periodically blocking about 2.5 miles of this small stream.

Temperature: Available data shows that Cold Creek and Elk Creek have cold waters and are suitable for bull trout. The mainsteam of Cold Creek 1983 data and 2003 data on the South Fork of Cold Creek found MWAT suitable for bull trout spawning (even though the South Fork is not verified as spawning habitat). Near the mouth of Cold Creek, the stream is suitable for migratory bull trout, but not cold enough for optimal spawning habitat. As evidenced on aerial photographs, most of the stream lengths have at least pole-sized timber and provide shade, thus temperatures are likely within historic range.

Upper Elk Creek data from 1997, above the bridge on Road #9591, found optimal bull trout spawning temperatures. However monitoring of temperatures from 2005 to 2007 near the mouth of Elk Creek did not find optimal temperatures for either bull spawning or migration. It is speculated that bull trout compensate by migrating upstream earlier than usual or perhaps tolerate conditions at the bottom of deep pools. The warm water may be a natural state, as there is no older data to compare trends. However, the warm temperatures could have been caused by PCTC's riparian harvest on the lowermost mile of the stream shortly before the land was sold to the Swan Ecosystem Center and Confederated Salish & Kootenai Tribes.

Temperature monitoring in 1999 found Glacier Creek to have fairly warm temperatures. Upper Glacier Creek had MWAT that exceeded bull trout tolerance even though low numbers of bull trout have been found in this area. Water temperature is believed to be naturally controlled by Glacier Lake. Immediately below Glacier Sloughs (a large in-channel wetland), the MWAT is even higher and exceeds cutthroat trout tolerance for about 3 miles. However, Kraft Creek is suspected to be much colder and influences lower Glacier Creek's MWAT, so it is tolerable for cutthroat trout but not bull trout. No MWAT data is available for Kraft Creek or any of its tributaries. Judging from the widespread

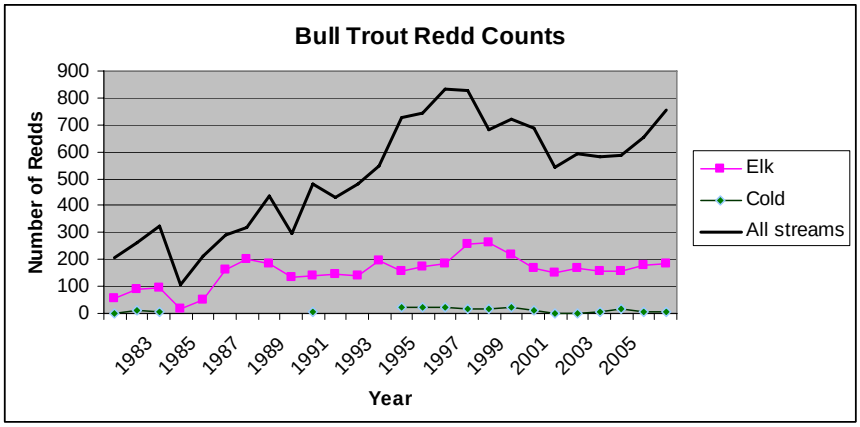
distribution of cutthroat trout and sparse distribution of bull trout, temperatures are likely tolerable, but not optimal, for bull trout. The 2003 Crazy Horse Fire is likely to elevate water temperature another 17 to 34°F (0.5 to 1°C) for a decade (Dunham et al. 2007).

Management Indicator Species: Cold Creek is a bull trout priority watershed (INFISH designation) and supports a migratory spawning population. Private lands on the mainstem of Cold Creek are designated as critical habitat. However, even with fairly extensive population data from electroshocking surveys, snorkel surveys, and redd counts, the existing status of bull trout on Cold Creek is uncertain. Electrofishing data from 1983 found Cold Creek had the greatest number of juvenile bull trout of any stream surveyed that year, but only a single redd. Snorkeling conducted throughout the mainstem in 1994 found bull trout were "common" at nearly every location. However, large tributaries (South Fork, North Fork, and extreme headwaters of Cold Creek) have never been sampled. Several small tributaries were sampled in preparation for this analysis and found only non-native brook trout or native sculpins. Redd counts on Cold Creek found only 25 redds at its peak, and it has been declining for the past decade. This trend is not like the rest of the Swan Valley, which has a stable or increasing population. Cold Creek contributes only an average of 2 percent of all the bull trout redds in the Swan Valley. Figure 1 below illustrates the total redd counts in the Swan Valley, plus also Cold Creek and Elk Creek, specifically. This information suggests that Cold Creek's bull trout may be:

- Declining;
- Primarily resident population, or
- Within historic capability and is just undersampled.

Further information is needed to evaluate hypotheses. If the bull trout population is primarily resident life form, they could be especially vulnerable to hybridization with non-native brook trout, which are abundant in Cold Creek. Recent sampling of other streams in the Swan Valley found brook trout do hybridize with migratory bull trout, but the progeny are sterile (Fredenberg 2007). However, it is speculated that resident bull trout crosses with brook trout are fertile and could have substantial impacts to the population (Barry Hanson, Confederated Salish & Kootenai Tribes Fisheries Biologist, personnal communication).

FIGURE 0-1 – TOTAL BULL TROUT REDD COUNTS FOR COLD AND ELK CREEKS, AND SUMMARY OF FOUR "INDEX STREAMS" CONSISTING OF GOAL, SQUEEZER, LION, AND ELK CREEKS.



Unlike Cold Creek, all information indicates that Elk Creek's bull trout population is strong. Redd count data has been collected annually on Elk Creek since 1982, ranging from a low of 19 redd (1985) to a high of 261 redds (1999). The trend remains stable and reflects the overall Swan Valley trend. Elk Creek averages about 155 redds per year and provides about 31 percent of all bull trout redds counted in the Swan Valley. Electrofishing efforts in 1983 found abundant juvenile bull trout. Montana Department of Fish, Wildlife & Parks personnel have electrofished 492 feet (150 m) of Elk Creek just upstream of Road #9591 for 10 out of 17 years, and found a gradually increasing trend

(Weaver 2006). Daytime snorkel surveys in 1994 and 1997 found “numerous” or “many” bull trout from the mouth to a few miles upstream of Road #9591. Elk Creek is a priority watershed for bull trout, it has designated critical habitat on private land, and it is closed to all recreational fishing in order to protect bull trout.

The Glacier Creek Watershed is not a bull trout priority watershed and has no designated critical habitat. Glacier Creek has been surveyed four times for bull trout redds, both above and below the Glacier Sloughs. No redds were found in 1982, 1995, or 2003, but a single redd was observed in 1983 (above the Sloughs). Two separate redd counts on Kraft Creek have failed to find any redds. Various electrofishing and snorkeling surveys have found juvenile bull low densities in Kraft Creek, Windfall Creek, and lower Glacier Creek, but one sample (1983) found high densities in upper Glacier Creek. Thus, it appears the migratory life form is extremely limited (or non-existent) and juvenile bull trout are scattered in low numbers. It is possible that these watersheds support a resident population or a very small (erratic) migratory population.

The other small watersheds in this analysis area never historically contained bull trout due to their small stream volume.

Although Figure 1 illustrates the current, stable population trend for the overall Swan Valley, there is a new threat to bull trout. Non-native lake trout have recently invaded and colonized Swan Lake. Throughout the range of bull trout, biologists have noted that once lake trout colonize a lake, the native bull trout sharply decline in numbers. At the moment, lake trout have not yet reduced the numbers of large, spawning adults, thus the redd counts appear unaffected by lake trout. But local biologists are confident that redd counts will soon decline unless lake trout can be curtailed. Experimental lake trout removal will begin in 2008 to see if it is feasible to suppress lake trout in the Swan Valley.

The headwaters of the North Fork of Cold Creek has two lakes with stocked populations of cutthroat trout. However, other than these lakes, it appears that cutthroat trout are not abundant in the Cold Creek Watershed. Electrofishing and snorkeling surveys indicate that the mainstem of Cold Creek has a sparse density of cutthroat trout and the small tributaries have no cutthroat trout at all. It is possible that cutthroat trout still reside in the South Fork of Cold Creek or the “Middle Fork of Cold Creek,” since these drainages have not yet been sampled. The decline of cutthroat trout in the Cold Creek Watershed is due to non-native brook trout and, possibly, habitat degradation. Brook trout were stocked in the Swan River Valley decades ago and have become widespread and abundant throughout the Cold Creek Watershed. Juvenile brook trout outcompete juvenile cutthroat trout (Peterson et al. 2004), and over time, this causes the cutthroat trout population to dwindle. However, not all streams in the Swan Valley have succumbed to brook trout. Studies have found that brook trout can invade any stream no matter how steep, but tend to do best in smaller channels with slightly warmer temperatures (Adams 1999). This may explain why the small unnamed tributaries of Cold Creek are now dominated by brook trout, but it does not explain the mainstem. There is also some evidence that brook trout have an advantage in streams with degraded habitat (Dunham et al. 2002), and this may be the situation in Cold Creek. Some recreational fishing takes place in this watershed, but it is very unlikely to be significant enough to affect the population. Rainbow trout are not present in Cold Creek; therefore, hybridization would not explain the population decline.

Elk Creek also has a sparse cutthroat trout density. However, brook trout are also sparse and appear to have been unsuccessful to date in colonizing the stream. Since Elk Creek has numerous bull trout and the majority of the watershed is unroaded and unmanaged, it is unlikely that habitat degradation has taken place. The closure of the stream to all fishing also rules out overfishing. Hybridization with rainbow trout is unlikely since rainbow trout are uncommon in this watershed. So, it is reasonable to conclude the low cutthroat trout density in Elk Creek is a natural condition.

Glacier and Kraft Creek are strongholds for cutthroat trout. Cutthroat trout are widespread and abundant in every part of this watershed except Windfall Creek. Population monitoring has found

cutthroat trout are still genetically pure in most of this watershed but rainbow trout hybrids appear to be slowly becoming more established in lower elevations. Windfall Creek is the only stream with numerous brook trout and cutthroat trout are completely extirpated. Windfall Creek is a small stream with numerous beaver dams, and this may explain why brook trout have successfully invaded it.

Environmental Consequences

Alternative A - No Action
Direct and Indirect Effects

Sedimentation

This alternative does not directly result in any new contribution of sediment to streams. There is no temporary road construction, no culvert replacement, no BMP application along existing roads, which could result in erosion. However, this alternative could have some indirect effects to stream sedimentation, since the alternative does not improve the condition of the sediment sources found on some roads in the project area.

Habitat Connectivity

Alternative A does not restore or further degrade habitat connectivity. No existing fish barriers would be fixed, and no new culverts installed. Eventually, other undersized culverts that currently pass fish may become fish barriers as the outlet drop gradually grows taller. However, this would likely take decades and is beyond the temporal bounds of this analysis.

Water Temperataure

This alternative does not impact water temperatures in any way. There would be no temporary roads which could impact groundwater, nor would there be any harvest activity in riparian areas which could reduce stream shading.

Management Indicator Species

Alternative A does not alter or modify the populations of cutthroat trout or bull trout in any way. Fish habitat would remain the same as current condition. Since the alternative has no direct or indirect impact on habitat, the status and projected trend of cutthroat trout and bull trout would remain unchanged from the existing condition.

Alternative A – No Action
Cumulative Effects

The Cumulative Effects Worksheet (Project File Exhibit ?) considers and describes proposed activities in addition to the past, current, and reasonably froreseeable activities listed in Tables 3-1 and 3-2 of this chapter. Those activities that cumulatively contribute indiscernible effects on the Fisheries Resources are not included in this section, but are discussed in the Cumulative Effects Worksheet. Discussion of those activities that cumulatively affect Fisheries are displayed below. When considering past, present, and reasonably foreseeable activities, Alternative A has a cumulative effect.

Alternative A does not reduce fuel levels on the landscape scale. If a wildlfire escaped initial suppression, it could grow into a large, stand replacing fire. Some large stand replacing fires can lead to increased erosion, but also have long-term benefits from recruitment of new woody cover and pool

habitat. However, there is no way to to forecast what type of fire will occur nor to predict the precise effects of stand replacing fires in the project area, should such a fire occur. The probablility of larger fires is greater in the no action alternative than in the other alternatives, but the degree of risk and the consequence to fish habitat cannot be predicted.

Past actions that have contributed to the existing condition of Cold Creek were road construction, road maintenance, and stocking of non-native brook trout. The amount of fine sediment deposition in Cold Creek may be higher than historic levels and forest roads are the likely culprit. Research has found the most profound source of sediment tends to be from forest roads (Everest et al. 1987). During the initial construction of the roads in Cold Creek (majority in the 1960s and 1970s), erosion from the newly disturbed earth washed into streams at every stream crossing. Cold Creek has a considerable amount of industrial forest, timber management land base, and a corresponding high road density (2.7 miles of road per square mile of land). Periodic maintenance, such as blading and ditch clearing, mobilizes sediments and contributes a chronic amount of erosion. Conversely, the lack of maintenance that addresses culvert conditions and road grade is an on-going source of sedimentation, as noted by the DEQ assessment in preparation of the TMDL Report (DEQ 2004). One particular road, Road #9792 in the headwaters of Spotted Calf tributary, had a poorly designed stream crossing and the culvert washed out in the 1960's. Chronic erosion is still taking place at this site.

Cold Creek also has numerous barriers to habitat connectivity, due to the road network. As described earlier, there are seven known barriers impacting approximately 12 miles of fish habitat to some degree. It is believed that water temperature is within historic range and unaffected by past actions.

The widespread colonization of non-native brook trout has been a profound impact to cutthroat trout, a management indicator species. This invasion may have been facilitated to some degree by possible habitat degradation. Bull trout status in Cold Creek is confusing, and it is unclear if they are within historic range or have been declining. The abundance of brook trout could be negatively impacting bull trout if the bull trout are resident life forms and vulnerable to hybridization.

There are only two known present or reasonably foreseeable projects in the Cold Creek Watershed that could impact fish habitat. First, it is reasonably foreseeable that the barriers to habitat connectivity on Icy Creek and Frozen Creek tributaries will be corrected in 2009. New, larger culverts will be installed with gravel substrate on the bottom of the pipe to allow fish access upstream. This will restore approximately 3 miles of fish habitat currently unavailable. The primary beneficiaries are non-native brook trout, but bull trout will also likely take advantage of the new access for foraging. Cutthroat trout are not present and unaffected by this action. During the installation of the new culverts, a small amount of sedimentation is inevitable, adding a short-term increase to the sediment levels downstream.

The other present and reasonably foreseeable projects are the BMP improvements funded by 319 grants. In 2006, the Swan Lake TMDL Group used a 319 grant to improve about 5 miles of Road #9568 and 2 miles of Road #9599 within the North Fork of Cold Creek Watershed. This project halted at least 40.5 tons of chronic erosion annually, and probably more, since the entire road was not modeled. This resulted in a short term spike of erosion in 2007 from implementation. It is anticipated that the long term reduction will begin in 2008.

Additional 319 grants funds will be used on Road #9591 in 2008. Approximately 3 miles of this road is located in the Cold Creek Watershed. A 2002 report prepared for the TMDL (DEQ 2004) noted 5 point sources that chronically erode about 0.8 tons per year. The District Fisheries Biologist and Road Engineer examined this road more closely in 2007 and found 3 additional point sources of sediment beyond the TMDL report (tonnage was not calculated). Best Management Practices work, such as clearing out ditches, installing cross drains, and blading road surfaces, can mobilize fines. These fines can transport to a stream during the first runoff after the project (2009), but then stabilize as vegetation returns or the soils compact. The amount of short term sedimentation is not known

because it can vary so much due to differences in location and weather. In the long term, this project should greatly curtail the chronic erosion from Road #9591 into Cold Creek.

There is no other reasonably foreseeable project in the Cold Creek Watershed. Plum Creek Timber Company has not identified any lands for disposal in this basin, except possibly to the Nature Conservancy or Trust for Public Land, through the recently announced Montana Legacy Project. Nor have they identified any reasonably foreseeable harvest activities. The Forest Service is not aware of any proposals for subdivision development on private lands in the Cold Creek Watershed.

As a result of the cumulative effects, if the decision maker selects the No Action Alternative, it is anticipated that fish habitat in Cold Creek would experience a small improvement. This is because of actions that correct 2 of the 7 known fish barriers and actions that curtail erosion on about 8 miles of the existing road network. However, no effort to curtail brook trout or restore cutthroat trout is reasonably foreseeable. It is anticipated that the management indicator species, bull trout and cutthroat trout, would continue at current population levels.

Within the Elk Creek Watershed, there is no indication that past actions have impacted sediment or created any barriers to habitat connectivity. It is possible that recent riparian harvest on former PCTC lands in lower Elk Creek has elevated water temperatures beyond historic range, but this cannot be verified. All indications are that the management indicator species have been unaffected by any past actions. Bull trout remain abundant, and it is assumed that the low numbers of cutthroat trout are natural.

There are two reasonably foreseeable activities that could impact Fisheries Resources in Elk Creek. One project is the BMP improvements on Road #9591 to be implemented in 2008. As described earlier, the Swan Lake TMDL Group received a grant to reduce erosion on this road, of which approximately 1 mile is located in the Elk Creek Watershed. This mile has only a single point-source of erosion (right at Elk Creek Bridge) that chronically erodes 0.23 tons annually. This is a trivial change and would not be detectable in Elk Creek.

The other reasonably foreseeable activity is PCTC's proposal to commercially thin 640 acres of lower Elk Creek (immediately downstream of Section 16 in the Hemlock Elk Project Area). It is assumed that PCTC would abide by SMZ law, but would still remove a portion of riparian shade trees. This may further elevate water temperatures in lower Elk Creek to some level. Modeling by Sugden et al. (1998) suggests this activity may increase MWAT up to 33°F (1°C) to about 60 to 63°F (16 to 17°C). However, their model was intended for regeneration harvests, not thinning, therefore the effects could be less. A MWAT of 60 to 63°F (16 or 17°C) is not lethal to bull trout, but certainly not optimal, and may add stress to migratory, spawning fish.

There is no other reasonably foreseeable activity. Plum Creek Timber Company has not announced that it plans to sell their lands in this drainage, again, with the possible exception being lands conveyed under the recently announced Montana Legacy Project as discussed in the Lands Section of this chapter. Therefore, the selection of the No Action Alternative would not change anything to Elk Creek's Fisheries Resources. Bull trout would remain abundant and cutthroat trout would remain scarce. The possibility of increased water temperature in Lower Elk Creek is a concern, but assumed not significant enough to decrease the bull trout population.

Within the Glacier Creek Watershed, the 2003 Crazy Horse Fire burned about 11,000 acres and is estimated to have generated 7,663 tons of sediment the first year after the fire (subsequently returning to base levels in the following years). Management actions that have impacted the Glacier Creek Watershed primarily revolve around the introduction of non-native brook trout and rainbow trout. Brook trout have completely replaced (or displaced) MIS cutthroat trout in Windfall Creek, but they have not yet been able to successfully colonize the rest of this watershed. Rainbow trout are causing a slow, ongoing loss of genetic purity of cutthroat trout. Bull trout are uncommon, but there is no indication that this is not a natural condition. While initial road construction likely contributed

sediment, available data indicates that sediment levels have returned to historic condition. All but one barrier to habitat connectivity created by roads was resolved in 2005. The only remaining known migration barrier is blocking about 0.25 miles of Windfall Creek to brook trout. It is assumed that the warm water temperatures are natural due to flows from Glacier Lake, Glacier Sloughs, and a temporary increase from the 2003 Crazy Horse Fire.

There are several present or reasonably foreseeable projects in the Glacier Creek Watershed that contribute to cumulative effects. One project is the BMP improvements on Road #9591. Roughly 3.5 miles of Road #9591 is located within the Glacier Creek Watershed, and the 2002 TMDL Study found 5 point-sources that erode 29.4 tons of erosion annually. Further investigation by the District Fisheries Biologist found this study probably underestimated the chronic erosion, since it did not consider in-stream erosion and long, unrelieved road ditches. This road would be improved to BMP standards in 2008 and several culverts would be replaced. The implementation of this project would trigger some short term sedimentation, but ultimately curtail most of the chronic erosion.

It is also reasonably foreseeable that private lands in the Glacier Creek Watershed would be further subdivided. New subdivisions are taking place in low elevation areas of Glacier Creek within the Stoner Lake and Loon Lake outflows. These developments would have no impact to fish habitat since the streams are intermittent. However, a slight increase of fishing pressure could be expected in the Glacier Creek Watershed as the population grows, and this may lead to very slight increase of cutthroat trout harvest and bull trout hooking mortality. Other than these ongoing developments, PCTC has not proposed to sell any further lands in the Glacier Creek Watershed.

There are no reasonably foreseeable activities in the “Teepee Creek” Tributary. The beavers would likely continue to plug the culvert at Road #888C and this would remain a barrier to brook trout migration upstream.

Alternatives B, C, and D
Direct and Indirect Effects

Fuel and Vegetation Treaments

The three action alternatives have almost identical impacts to Fisheries Resources and are, therefore, analyzed as the same. The difference between alternatives is seasonal restrictions for certain harvest units and whether or not the regeneration harvests are included. The winter-harvest-only restriction of certain units in Alternative C is no different to Fisheries Resources compared with Alternative B. This alternative allows temporary roads to be built during the summer, even though harvesting would not begin until winter. The potential concern about temporary roads in the Elk Creek Watershed is not mitigated by this alternative, since the roads would still be built in the summer. Alternative D has no regeneration harvest units proposed. This does not change the modeled water yields from the Proposed Action (See Water Resources Section of this EA) and, therefore, has no indirect impact to fish habitat. The minor changes in BMP haul routes between the alternatives are trivial. The difference of 0.3 miles of BMP application is inconsequential to Fisheries Resources since none of the roads have substantial, ongoing erosion.

Best Management Practices implementation would take place on Roads #9553, 9595, 9586 and 10289. None of these roads are considered sediment sources, and the BMP improvements would have only a small benefit to fish habitat. Road #9591 is also a haul route. This road currently has numerous significant erosion point sources. However, a 319 grant has been awarded to the Swan Lake TMDL Working Group to improve this road, and it is not considered a direct or indirect consequence of this project, though the overall effect of implementing these BMP’s is beneficial.

The Hemlock Elk Project includes about 3.5 miles of new, temporary roads to access units in T20N R17W, Section 16. None of these roads cross any streams or approach riparian areas, thus there is

no potential for sedimentation to reach the stream. However, there is some uncertainty about the indirect effects to the water temperature of Elk Creek. Roads, even temporary roads, compact the soil and can potentially interfere with groundwater movement. This concern is thought to be more prevalent when the road is located where the groundwater is close to the surface. No groundwater tests are available, but this 640-acre section of land has 32 known wetlands (possibly more) and about 1 mile of key bull trout spawning habitat. These attributes strongly suggest groundwater percolates through the area close to the surface. However, this geographic area also has highly variable topography with numerous small ridges (5-10' high) and plateaus.

The protection of near-surface groundwater may be critical to bull trout ecology, especially in order to provide suitable water temperature (Frissell 1999). Frissell proposes that locations with shallow groundwater be spatially mapped and then protected from human alteration. This poses a challenge for assessment of Hemlock Elk Project, since shallow groundwater has not been spatially mapped. A reasonable conclusion is that groundwater is most likely close to surface in mapped riparian landtypes (Sirucek and Bachurski 1995), or within roughly 100 feet of existing wetlands, or in low areas between the ridges and plateaus. The temporary road proposed to reach Unit 21 does cross an ephemeral draw, and this area could potentially disturb groundwater. Plus, the first 83 feet (25 m) of the temporary road to access Unit 19 is located on a riparian landtype. The other roads travel very close to, but do not enter riparian landtypes. Thus, it is judged that the roads would have only a minor and temporary risk to groundwater, and it is not likely to have measurable consequences to bull trout habitat.

The proposed vegetation management would have no impact to fish habitat. The units would have designated RHCA buffers with no activity within them. The undisturbed vegetation by the streamside should be highly effective as capturing any overland erosion or sedimentation before it reaches streams (Castro and Rickendorf 1995) (USDA Forest Service 1995). Furthermore, as disclosed in the Water Resource Section of this EA, no indirect effects to stream flow regime are anticipated, therefore, avoiding indirect in-stream sedimentation. The riparian areas would also continue to provide shade and protect stream water temperature.

The Hemlock Elk Project has several harvest units, skid trails or temporary roads on "Tributary One." This tributary consists of a series of wetlands connected by an intermittent stream and is fishless except for a single stocked wetland on private lands (stocked with cutthroat trout). A temporary road would be constructed across "Tributary One" to access Unit 10. As a Design Criteria to protect water quality, a culvert would be placed in the channel during dry periods and left there until all harvest activity is completed. No sedimentation is expected during implementation, but by next spring, some erosion would be likely since the stream banks would still be unvegetated. The sedimentation would most likely settle in the next wetland downstream. This wetland is fishless, so this action has no consequence to fish habitat. To access parts of Units 10 and 5a, designated skid trails would cross "Tributary One." These portions of the unit only need access for a single season, and a road is not needed. It is possible that a slight amount of erosion could be generated by the trampled banks the next spring. This sediment would settle in the wetlands downstream and would not reach fish habitat

Resource Enhancements

As distinct from the proposed fuels and vegetative actions, the Hemlock Elk Project also would authorize several possible resource enhancment activities that cause short term sedimentation, but long term sedimentation reduction from the existing situation. These projects are not design features to mitigate impacts of the proposed action and occur on sites physically separated from the proposed fuels and vegetation treatments. Several of these resource enhancement projects improve fish habitat connectivity but do not appear to impact water temperature. The following discussions review the direct and indirect effects of each aspect of the resource enhancement projects in decreasing magnitude of importance to Fisheries Resources.

Resource Enhancement Project #2 would rehabilitate on-going sedimentation problems on Road #9792 in the headwaters of “Spotted Calf Creek.” The road was constructed in 1967 to poor standards and has not been used or maintained since. An undersized culvert installed across an unnamed, perennial tributary to “Spotted Calf Creek” washed out approximately 35 years ago, eroding approximately 5 to 8 tons of road fill. The culvert remains in the creek bed, and the stream has scoured around it. The road captured three springs near this area, and since there are no culverts, they have merged into a perennial stream that travels 150 feet down the center of the road before discharging into the main tributary. A portion of the road fill was created with unstable soils and has a spring emerging at the toe of the fill. This area is not currently eroding, but could collapse if the spring continues to weaken the fill, possibly triggering another 5 tons of erosion. The Resource Enhancement Project would attempt to stabilize the situation with hand tools. Hand crews would attempt to ditch the springs across the road prism, so they do not scour down the length of the road. The diversion of springs would scour a small amount of erosion (possibly a ton) for a few years until the new channels stabilize. Erosion matting and willows would be planted at the toe of the road fill to prevent it from collapsing. The old culvert would remain behind since it is too heavy to carry. This project should help slow, but not completely halt ongoing erosion since the stream would likely scour a little more beside the old culvert.

Another Resource Enhancement Project is the removal of an old bridge abutment on lower Cold Creek (Project #3). Road #9767 previously crossed Cold Creek in a single span native timber bridge but the decking was removed about 15 years ago. The timber abutments were left behind and are holding back some road fill. The abutments do not constrict the channel, and they are not in imminent danger of collapse, but would be removed so that deterioration of the wood or a flood event does not wash them out and trigger sedimentation. Removing the abutments could result in a very small amount of erosion at the toe of the bank. Heavy machinery (likely an excavator) would have to cross Cold Creek twice during implementation, and this would also disturb the channel, thereby resulting in short term turbidity. As a Design Criteria, the excavator would be washed prior to implementation of the project. Due to its location in bull trout rearing habitat, it is possible that juvenile bull trout would be disturbed and flee from the project area. Work would be completed in daylight hours between July 15 and August 31 to minimize impacts to adult, migratory bull trout. This project would not necessarily result in less erosion, since the site is not currently eroding. The project is designed to prevent a future problem.

Also within the Cold Creek Watershed, the Hemlock Elk Project proposes replacing a fish migration barrier at “Spotted Calf Creek” (Project #4). The new culvert would be counter sunk to incorporate streambed materials; the culvert would be large enough to pass 100-year flood events. The act of removing culverts invariably results in channel disturbance and sedimentation (even with mitigation measures provided below) during project implementation. However, over the long term, the new culvert should ultimately reduce channel erosion. The old pipe is undersized and actively scours out the channel downstream after each runoff. The new culvert would be designed to prevent any further channel scouring and, therefore, reduce sedimentation. This project helps restore fish habitat connectivity to about 1 mile of “Spotted Calf Creek.” Brook trout are currently the only species remaining in “Spotted Calf Creek,” and this project has no value to cutthroat trout since they are extirpated in the stream. Fish passage at “Spotted Calf Creek” is unlikely to benefit bull trout either, since it is several miles upstream of known bull trout occurrence and probably too small for bull trout to occupy.

Resource Enhancement Project #9 would remove an old bridge abutment on Road #561F at Kraft Creek. This project is located in the area where cutthroat trout are abundant and juvenile bull trout are observed in low densities. A minor amount of erosion below the toe of the abutments is taking place but otherwise the site is stable. Removing the old abutments would trigger some short term sedimentation. Heavy equipment would cross the stream and this would also cause some sedimentation. As described for the Cold Creek Bridge, the equipment would be washed prior to work as a Design Criteria. The newly exposed banks are then resloped (flatter than historic condition) and

stabilized with rocks, straw, and vegetation. The objective of the project is to prevent the possibility of catastrophic sedimentation when the abutments rot away.

Resource Enhancement Project #6 involves clearing out debris placed by beavers in a culvert on Road #888C. Beavers have diligently plugged the culvert in hopes of creating a beaver dam on “Teepee Creek.” If periodic cleaning does not work, this project would replace the culvert altogether with a larger culvert that discourages beavers from building a dam at this location. This project would provide habitat connectivity on “Teepee Creek” for another 2.5 miles. Brook trout are the only species present in “Teepee Creek”. Restoring habitat connectivity would benefit brook trout but have no impact to bull trout or cutthroat trout.

Another Resource Enhancement Project #5 involves removing one culvert that blocks fish migration in Upper Windfall Creek and also removing three other culverts on nearby tributaries. All of these culverts are point-sources of sedimentation, since they are undersized and scour the streambanks downstream each year during high flows. As described earlier, removing or replacing culverts would generate some sedimentation during the project implementation, even with Design Criteria. After completion, it is expected that the chronic sedimentation would be halted and the stream condition would improve over the existing condition. Providing fish passage would restore habitat connectivity to Upper Windfall Creek would allow brook trout (and possibly sculpins) approximately 0.25 mile of additional spawning and rearing habitat from the current condition. Cutthroat trout are not present in the stream. A single bull trout was observed about 1 mile downstream (presumably foraging); but due to the small stream size at the project area, bull trout would not occupy upper Windfall Creek and would not benefit from this project.

Another Resource Enhancment Project in the Cold Creek Watershed is restoration of road-related impacts in the headwaters of Spotted Calf Creek (Project #1). Roads #10291 and 9850 have several known or suspected erosion point-sources that are contributing sediment to Spotted Calf Creek. This project would replace all four existing culverts beyond the berm on Road #10291 in order to halt chronic erosion and prevent catastrophic failure. The replacement of four culverts would result in channel disturbance and short term erosion. Additional cross drainages may be installed as needed to eliminate water from collecting in ditches.

Resource Enhancement Project #7 proposes replacing an undersized culvert on Road #10289 on “Tributary One.” The existing 4-inch diameter culvert is either undersized or improperly set and has created substantial scouring downstream. Replacing this culvert would halt chronic erosion into the wetland downstream. This particular wetland is stocked with cutthroat trout. A small amount of sedimentation would settle in to the pond, but it is not substantial enough to degrade water quality or harm fish habitat. No natural spawning takes place in this wetland, and the population is entirely maintained by stocking.

Resource Enhancement Project #8 involves reducing sediment along Road #10257 where the road encroaches wetlands. The wetlands are fishless, and this project would have no impact to Fisheries Resources.

Weed treatment resource enhancements would follow the established guidelines in the NIWC Decision Notice, and this type of activity has been determined to have no impact to Fisheries Resource. The hand planting would also have no impact to fish habitat, since it is an extremely minor ground disturbance. Regenerating aspen stands would have no potential impact to fish habitat since it is upland.

Alternatives B, C, and D
Cumulative Effects

The Hemlock Elk Project, in combination with the past, present, and reasonably foreseeable actions described earlier, would cumulatively add short term sedimentation. The project adds a small amount

of sediment above and beyond all that has taken place in the past. Resource Enhancement Projects #1, 2, 3, 4, 5, 6, and 9 all involve some disturbance of the stream beds and short term erosion during project implementation. None of the temporary roads or vegetation management associated with the project would contribute sediment. This short term sedimentation could take place at the same time as reasonably foreseeable new fish passages at Icy Creek and Frozen Creek and during BMP implementations on Road #9591.

To the extent that the resource enhancement projects can be funded and implemented (see Chapter 2, Resource Enhancements for detail), there would continue to be a trend of sediment reduction within the project area over the long term. The vegetation and fuel project which comprises the proposed action would not adversely affect fish habitate even if considered without the long term beneficial effects of the resource enhancements. As discussed earlier, the BMP's associated with the project would constitute, at most, a very small improvement in long term conditions.

The resource enhancements however would provide the potential more significant improvement of long term conditions over the existing condition. This is because Resource Enhancement Projects #1, #2, #4, and #5 curtail chronic sedimentation that is taking place along fish habitat. Projects #3 and #9 do not fix current problems, but prevent new ones from starting altogether. All of these actions are addressing sedimentation associated with past road construction. Due to the preponderance of projects in the Cold Creek Watershed, this watershed could have measurable improvements (reduced sediment). The Hemlock Elk Project continues the trend in restoration that began with BMP improvements on Roads #9568 and 9599 (TMDL grant) and throughout the Glacier Creek Watershed (Crazy Horse Fire Salvage). Additional restoration is reasonably foreseeable with more BMP improvements on Road #9561 and replacing undersized culverts on Icy and Frozen Creeks (tributaries of Cold Creek). All of these actions are cumulatively reducing ongoing sedimentation and improving fish habitat conditions, or to the extent they can be implemented, have the potential to do so.

The resource enhancement projects also provide the opportunity to continue the trend of improving habitat connectivity. Past road construction has created seven fish barriers in the Cold Creek Watershed, six in the Glacier Creek Watershed, and one on "Teepee Creek." Post-fire rehabilitation and salvage work removed six of the seven barriers on Glacier Creek. It is reasonably foreseeable that two barriers (Icy and Frozen) would be removed in the Cold Creek Watershed. Some of the resource enhancement projects could remove another barrier in Cold Creek, the last barrier in Glacier Creek, plus another barrier in the "Teepee Creek" Tributary The cumulative effects these two resource enhancements associated with this project combined with the 8 previous or other ongoing watershed projects described above, provide the opportunity restore 10 out of 14 originally known fish migration barriers.

The Hemlock Elk Project probably would not contribute to the possible warming trend of Elk Creek's water temperature. As described earlier, there is concern about the existing condition of water temperatures in lower Elk Creek, which may have been due to recent riparian timber harvest by PCTC. It is reasonably foreseeable that PCTC will selectively harvest (within legal limits of the SMZ law) another mile of lower Elk Creek, just downstream of the Forest Service's proposed activity in Section 16. Vegetation management activities proposed in the Hemlock Elk project would have no impact to water temperatures since a 300 foot buffer would provide plenty of shade. Rather, the concern is the potential impact of the project's proposed temporary roads that could interfere with groundwater movement. As described earlier, this concern is raised but ultimately judged that is in unlikely to have a measurable impact. Therefore, while the concern lingers, the reasonable conclusion is that the Hemlock Elk Project would not cumulatively add to warmer water temperatures in Elk Creek.

The Hemlock Elk Project would reduce the likelihood of a large, stand-replacing wildfire to some degree. This would avoid any short-term but substantial sedimentation but also defers the long-term benefits of new wood and pool habitat. As described earlier, it is impossible to determine when and where such a fire would occur. The potential impacts to fish habitat by deferring or minimizing a landscape fire cannot be evaluated.

To the degree they are implemented, the resource enhancement projects associated with the Hemlock Elk Project add a small amount of habitat disturbance to bull trout in the short term, and then ultimately help improve bull trout habitat slightly. The short term disturbance is due to sedimentation during the implementation of various resource enhancement projects. These resource enhancement projects are covered by a programmatic biological assessement and the short term disturbance is the basis for a “may affect, likely to adversely affect” bull trout BA determination in the programmatic BA. The fuels, temporary roads and vegetation treatments are covered under the project BA and the determination for the impacts of these activities is “may affect, not likely to adversely affect” bull trout for this component of the project.

The long term improvements are due to reductions in chronic sediment and prevention of other sediment sources. The improved fish passages are not in bull trout habitat and have no benefits to bull trout. Neither the short term impact nor long term improvements would be substantial enough to affect bull trout populations. The Hemlock Elk Project would not cumulatively add or subtract from the problem of non-native lake trout and brook trout. New and improved fish habitat connectivity would not facilitate brook trout invasion since brook trout are already present. Lake trout occupy only lakes or large rivers, they are never found in tributary streams like “Spotted Calf” or Windfall Creeks.

Cutthroat trout would also experience short term harm to habitat due to sedimentation from implementation of resource enhancement projects. Over the long term, they would benefit from reduce sedimentation and prevent of other sediment sources. Cutthroat trout neither benefit from nor are harmed by improved fish passage at “Spotted Calf,” Windfall, or Teepee Creek, since they are not present in those streams. The Hemlock Elk Project would not add to the cumulative effect of non-native brook trout or rainbow trout. While brook trout are likely to increase in numbers in Spotted Calf, Windfall, and Teepee Creeks, this would have no impact to cutthroat trout.

Regulatory Framework and Consistency

All of the action alternatives are consistent with all regulatory framework for Fisheries Resources. The Forest Plan determined that cutthroat trout and bull trout are MIS and prohibited “unacceptable fish losses” from land management actions. This project is anticipated to have minor short term impacts followed by small long term gains and would not result in unacceptable population losses.

In 1990, the Forest adopted Amendment #3, which added more trout stream standards. In certain bull trout streams (including Elk Creek and Cold Creek), sediment modeling and incorporation of monitoring would be used to evaluate projects to bull trout habitat. This analysis has completed that aspect by use of modeling in the Water Resources Section and all available fish population and habitat monitoring. The amendment also requires that sediment delivery rates do not pose a significant threat to spawning or rearing habitat, and this analysis has determined only a very minor short term sedimentation that is not significant. The third requirement is an inventory of channel conditions, which has been fulfilled with available habitat data. The fourth requirement is to open up debris barriers as necessary, but this is not needed in either stream. Amendment #3 also details the acceptable limits of riparian harvest for any stream with cutthroat trout. The Hemlock Elk Project has no riparian harvest and meets the goal of the amendment. Finally, the amendment seeks to control sediment sources on cutthroat trout streams and the Hemlock Elk Resource Enhancement Projects do address all known sediment sources in the project area.

Forest Plan Implementation Note #10 sets further guidelines for key bull trout streams including Elk and Cold Creeks. Streams with over 35 percent fine sediment would be considered “threatened” and precaution is needed. Streams with over 40 percent fine sediment would be “impaired.” Elk Creek has less than 35 percent fine sediment and is not of concern. Available data on Cold Creek indicate it may be “impaired,” although there is insufficient information to verify. Implementation Note #10 states that if disturbance activity is planned in an “impaired” watershed, proactive steps are needed to be sure there is no additional sediment loading and to stabilize existing problems. The Hemlock Elk Project includes vegetation management in the Cold Creek Watershed, but analysis has found that no sedimentation is anticipated from that activity. The resource enhancement projects in the Cold Creek Watershed are intended to stabilize known existing problems. Therefore, this project meets the regulatory framework on Implementation Note #10.

In 1995, the Forest Service adopted INFISH with the goal of recovering native fish populations. In order to achieve the goal, several riparian management objectives were established. Activities must not retard the attainment of those goals. Any activity within a RHCA needs to be analyzed by a site-specific analysis or watershed analysis. The Hemlock Elk Project does not have any proposed treatment within RHCAs, with the exception of Unit 1. As disclosed in the site-specific analysis (Project File L-1), this action does not retard the management objectives and fully complies with INFISH.

Bull trout are listed as a “threatened” species under the ESA. A BA is required for significant Federal actions that may impact bull trout. This has been prepared and is in Project File L-1. The impacts of the proposed action (vegetation management) were determined “**may affect, not likely to adversely affect**” to the bull trout. Concurrence is expected from the US Fish and Wildlife Service at a later date. The resource enhancement projects such as culvert replacements or removals, road maintenance and bridge abutment removals were analyzed in this document but these effects were already covered under the U.S. Fish and Wildlife Service’s April 29, 2008 Biological Opinion of the Effects to Bull Trout and Bull Trout Critical Habitat from Road Management Activities (Project File Exhibit ?). All terms and conditions outlined in this Biological Opinion will be applied.

Westslope cutthroat trout are listed by the Regional Forest as a “sensitive species.” A BE has been prepared for each alternative. The BE determination was that all action alternatives **“may impact individuals or habitat but will not likely result in a trend towards federal listing or reduced viability for the population or species.”** This is because of the anticipated short term sedimentation impact regardless of long term benefits. Because the Hemlock Elk Project does not cause a trend towards Federal listing or reduced viability, it achieves regulatory compliance.