Chapter 3.0: Affected Environment and Environmental Consequences

In this Chapter:

- Existing natural and human environment
- Specific impacts from alternatives
- Cumulative impacts
- Comparison of alternatives

This chapter describes the existing environment and the potential impacts of the alternatives on the environment. Most impact definitions are provided in the first part of each resource discussion. Direct and indirect impacts were considered in the short and long-term. Direct impacts are caused by the action and occur at the same time and place. Indirect impacts are caused by the action but would occur at a later time, but still within the reasonably foreseeable future. Impacts can be beneficial or adverse. The impact discussion lists mitigation efforts that could reduce impacts and potential cumulative impacts of the alternatives. Cumulative impacts refer to the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions undertaken by federal or non-federal entities.

3.1 General Description

This chapter describes the prominent features and land use management policies that apply to the South Fork Flathead Subbasin within the Flathead National Forest. Management areas on the Flathead National Forest affected by this action include the Bob Marshall Wilderness and Jewel Basin Hiking Area.

The South Fork Flathead Subbasin drains 1,681 square miles and is bounded on the west by the Swan Mountain range crest and the Continental Divide to the east. The upper half of the drainage (approximately 64 percent) lies within Bob Marshall Wilderness Complex. There is no private land within this subbasin. The communities of Hungry Horse and Martin City lie near the mouth of the South Fork to the north.

Forest elevations range from 3,000 feet in the valley bottoms to mountaintops near 9,000 feet. The average annual temperature at Kalispell is 42.8 degrees Fahrenheit. This average temperature drops with increased altitude in the mountainous areas surrounding Kalispell. The average annual precipitation ranges from approximately 20 inches in the lowest elevations of the Flathead National Forest to nearly 100 inches at the highest peaks. Valleys receive about half of this precipitation as rain and half as snow. About 80 percent of mountain precipitation falls as snow, resulting in a snow pack that exceeds 100 inches on some mountaintops. Snow cover in the alpine areas usually occurs earlier in the season than it does in the foothills.

Streamflow begins to increase in April as the snow pack melts with warming spring temperatures. The stream flows typically peak in late May or June as the snow pack melts. However, not all project area snowmelt or rainfall immediately becomes surface runoff; some water percolates downward as groundwater and resurfaces in springs, seeps, small ponds, and perennial streams at various elevations below the point of infiltration.

The slow release of groundwater provides the stream base flow starting in mid July and continuing on through mid September. Flathead National Forest watersheds provide approximately 7,000,000 acre-feet of water per year to the Columbia River. Flood flows rarely overtop the channel banks of the majority of stream channels in the Flathead River Basin. High flows that erode the upper banks of the channel typically occur every three to five years.

The watersheds of the Flathead National Forest have had a variety of historical and ongoing land management activities since the establishment of the national forest. The major human activities that have occurred over time on the Forest include: wildfire suppression, forest stand thinning, timber harvest, tree planting, road and trail construction/maintenance, grazing, and various motorized and non-motorized recreational activities.

3.1.1 Bob Marshall Wilderness Area

The Bob Marshall Wilderness is part of the Bob Marshall, Great Bear, and Scapegoat Wilderness Complex. This Complex is 1,009,256 acres and follows the Continental Divide about 60 miles from north to south. Several of the lakes that may be treated under this program are located within the Bob Marshall Wilderness Area and adjoining National Forest lands within the South Fork of the Flathead River headwaters.

The affected lakes can generally be described as **cirque basins** that occur near the top of the Swan Mountain Range. Streams that flow from the lakes typically flow for very short distances before they begin to descend in altitude and increase in volume due to tributary inflow. Many lakes have waterfalls near the outlets, or have high gradient outflow streams. These physical attributes prevent downstream fish from re-entering the lakes.

Figure 3-1. Lick Lake is located in the Bob Marshall Wilderness area.

The forest environment in this region is primarily a late **seral forest** dominated by spruce and subalpine fir with a component of lodgepole pine. At elevations greater than 5,800 feet there is a component of whitebark pine. All of the sites are considered high elevation sites--meaning they have a short growing season. Understory vegetation is dominated by huckleberry species. In open areas near the lakes there are areas of rushes, grasses, and forbs. **Scree** slopes and rock outcrops are present within the forested environment. Though 88,000 acres burned within the wilderness in the South Fork Drainage, none of the forested areas around the lakes proposed for treatment were affected by the wildfires of 2003.

There are several permitted commercial outfitters that operate within the wilderness and use the areas/lakes for angling, hiking, hunting, and just enjoying the wilderness. There are also permitted institutional outfitters that are approved on an annual basis within the wilderness in the South Fork.

3.1.2 Jewel Basin Hiking Area

The Jewel Basin Hiking Area is located on the Swan Lake and Hungry Horse Ranger Districts of the Flathead National Forest. The hiking area is 15,349 acres, including 27 lakes and 35 miles of trails. It is managed for semi-primitive non-motorized recreational opportunities, and provides a recreational experience between that found in wilderness and roaded areas. Hikers, backpackers, and fisherman use the area extensively. The management direction for the area prohibits the use of pack animals, motorized vehicles, motorized equipment, mechanized trail vehicles, or helicopter landings. However, the Forest Supervisor may authorize use of motorized equipment or livestock as deemed necessary for the administration of the area and its resources.

All of the Jewel Basin, plus an additional 16,000 acres have been recommended for wilderness designation. The wilderness values of this area are to be protected until Congress makes a decision on whether to include the area into the national wilderness preservation system.

During August 2003, the Flathead National Forest had an extreme wildfire season. There was a large fire complex within Jewel Basin. The forest burned around Blackfoot Lake and Clayton Lake. The severity of the fire ranged considerably in the mature forest, leaving areas of mixed high and low mortality.

Since the area is close to Kalispell, over 10,000 summer visitors enjoy the area for hiking, camping, and fishing. The Camp Misery Trailhead located on the west side of the Jewel Basin is the major trailhead for users of the area. Other trailheads area located at Clayton Creek, Pioneer Ridge, Graves Creek, and Wheeler Creek.

No permitted commercial outfitters access these lakes.

3.2 Fisheries Resources

3.2.1 History of Fisheries in the South Fork Flathead Drainage

MFWP has an extensive history of fisheries management in the South Fork Flathead drainage. Fish stocking has been a major component that includes State, Federal, and private actions, some of which have been unauthorized. MFWP records indicate that from 1926 to 1963 a little more than 3 million fish were stocked in 73 lakes and streams in the South Fork drainage. From 1964 to the present, 1.8 million fish have been stocked in 43 lakes and a single stream. Several attempts have been made to capture wild cutthroat from the South Fork drainage for developing hatchery brood stocks; these attempts occurred in 1952, 1954, 1964, 1965, and 1983. In 1952, fish were collected from Big Salmon Lake and flown by airplane from the Big Prairie Ranger station. In 1964 a helicopter was landed on Big Salmon Lake and fish were captured and transported to hatchery trucks in Seeley Lake. The remaining attempts involved collecting fish from Hungry Horse Reservoir tributary streams. The effort that was started in 1983 represents the beginning of the current westslope cutthroat trout brood stock used by the state. Since that time, this stock has been augmented twice (1984 and 2003) with wild genes to maintain genetic variability. Apart from fish stocking and taking wild fish for brood stocks, survey and inventory of the South Fork fisheries represent the bulk of the fisheries management in the drainage. This includes angler surveys, habitat evaluation, population estimates and monitoring, gill netting, electrofishing, and spawning **redd surveys**.

3.2.2 Existing Conditions

The South Fork Flathead River drains 1,681 square miles of public land. The aquatic resources of the South Fork drainage are extensive. There are approximately 1,898 miles of stream habitat and 355 lakes. Of these lakes, 50 are known to have fish (see Table 3-1), 9 others are purported to have been stocked with fish but their present status is unknown, and the remaining 296 lakes are believed to be fishless. South Fork drainage fish populations were isolated in 1952 by the installation of Hungry Horse Dam located approximately five miles upstream of the mouth.

Table 3-1. Hybridization status of westslope cutthroat trout in natural lakes in the South Fork Flathead Subbasin.

Pure westslope cutthroat (based on stocking records or genetic test)	Hybrid-based on University of Montana genetics lab tests	Suspected hybrid	Stocked or rumored stocked, present status unknown
Beta	Big Hawk (lower)	Crater	Christopher
Big Hawk upper	Black	Three Eagles (lower)	Crimson
Big Salmon	Blackfoot		Hart
Blue	Clayton		Olar (upper)
Cliff	George		Olar (lower)
Devine	Handkerchief		Palisade

Pure westslope cutthroat (based on stocking records or genetic test)	Hybrid-based on University of Montana genetics lab tests	Suspected hybrid	Stocked or rumored stocked, present status unknown
Diamond	Koessler		Pendant
Doctor	Lena		Recluse
Doris -upper	Lick		Shelf
Doris (middle)	Margaret		
Doris (lower)	Necklace (upper)		
Jenny	Necklace (middle upper)		
Jewel (north)	Necklace (middle lower)		
Jewel (south)	Necklace (lower)		
Jewel (east)	Pilgrim (lower)		
Jewel (west)	Pyramid		
Marshall (upper)	Sunburst		
Marshall (lower)	Three Eagles (upper)		
North Biglow	Wildcat		
Seven Acres (upper)	Woodward		
Seven Acres (lower)			
Soldier			
Spotted Bear			
Squaw			
Tom Tom			
Trout			
Twin (upper)			
Twin (lower)			

There are at least 20 lakes and designated portions of their outflow streams that have been identified through genetic analyses as having hybrid trout populations. Two additional lakes, Crater and Lower Three Eagles, are under analysis. Lower Three Eagles is suspected to contain hybrid trout because Upper Three Eagles Lake contains westslope cutthroat x Yellowstone cutthroat hybrids, and it drains into the lower lake. The genetic status of Crater Lake is also under investigation.

3.2.3 Species of Concern

3.2.3.1 Westslope Cutthroat Trout

Westslope cutthroat trout is one of several subspecies of cutthroat trout native to the Rocky Mountain region. It often exhibits bright yellow, orange, and red colors and is generally distinguishable from other inland subspecies of cutthroat trout by the particular pattern of black spots that appear on the body. Lewis and Clark's Corps of Discovery caught westslope cutthroat from the Missouri River near present-day Great Falls, Montana in 1805.

Westslope cutthroat trout are native to streams and lakes in western and central Montana (Columbia, Missouri, and Saskatchewan River drainages); northern and central Idaho (Columbia and Snake River drainages); and a few small, scattered river drainages in Washington and Oregon and British Columbia and Alberta, Canada. Today, populations of westslope cutthroat trout occur almost exclusively in small, isolated streams in mountainous areas.

Westslope cutthroat trout feed primarily on **macroinvertebrates**, particularly aquatic insects, terrestrial insects, and, in lakes, zooplankton. These preferences for macroinvertebrates occur at all ages in both streams and lakes. Westslope cutthroat rarely feed on other fishes.

Figure 3-2. Westslope cutthroat trout.

The westslope cutthroat trout usually reaches maturity at 4 or 5 years of age. Spawning occurs primarily in small tributary streams in June and July when water temperatures reach about 50 F. Fertilized westslope cutthroat eggs are deposited in stream gravels where they incubate for several weeks, the actual period of time dependent upon water temperature. Several days after hatching from the egg, when about one inch long, the fry emerge from the gravel and disperse into the stream. The fry may grow to maturity in the spawning stream or they may move downstream and mature in larger rivers or lakes. Thus, three westslope cutthroat trout life-history types are recognized: resident fish that spend their lives entirely in the tributary; fluvial fish that spawn in small tributaries, their resulting young migrating downstream to larger rivers where they grow and mature; and adfluvial fish that spawn in streams but grow and mature in lakes.

Growth of individual westslope cutthroat trout, like that of fish of other species, depends largely upon the interaction of food availability and water temperature. Resident westslope cutthroat usually do not grow longer than 30 cm (12 inches), presumably because they spend their entire lives in small, coldwater tributaries. In contrast, fluvial and adfluvial westslope cutthroat often grow longer than 30 cm (12 inches) and attain weights of 0.9-1.4 kg (2-3 pounds). Such rapid growth results from the warmer, more-productive environments afforded by large rivers, lakes, and reservoirs.

Populations of westslope cutthroat have declined from historic levels due to a variety of factors, including habitat destruction from logging and associated road building; adverse effects on habitat resulting from livestock grazing, mining, urban development, agricultural practices, and the operation of dams; historic and ongoing stocking of nonnative fish species that compete with or prey upon westslope cutthroat or jeopardize the genetic integrity of the subspecies through hybridization; and excessive harvest by anglers. Some publics believe that the decline in the westslope cutthroat trout is continuing unabated.

Most of the habitat for extant westslope cutthroat trout stocks lies on lands administered by federal agencies, particularly the FS. Moreover, many of the strongholds for westslope cutthroat trout stocks occur within roadless or wilderness areas or national parks, all of which afford considerable protection to this trout species.

The 2000 FWS status review for westslope cutthroat trout found that there are numerous federal and state regulatory mechanisms that, if properly administered and implemented, protect the species and its habitats throughout the range of the subspecies. As of 2000, the FS, state game and fish departments, and National Park Service reported more than 700 ongoing projects directed toward the protection and restoration of the westslope cutthroat trout and its habitats. Finally, westslope cutthroat trout accrues some level of protection from the ESA's Section 7 consultation process in geographic areas where westslope cutthroat distribution overlaps with the distributions of one or more ESA-listed fish species, specifically, bull trout (*Salvelinus confluentus*), steelhead (*O. mykiss*), and Pacific salmon (*Oncorhynchus* spp.) and their habitats on federal lands in the Columbia River basin.

The 2000 status review also revealed that WCT presently inhabit about 4,275 tributaries or stream reaches that collectively encompass more than 23,000 linear miles of stream habitat, distributed among 12 major drainages and 62 component watersheds in the Columbia, Missouri, and Saskatchewan River basins. In addition, westslope cutthroat trout presently inhabit 6 lakes in Idaho and Washington, and at least 20 lakes in Glacier National Park, Montana. Although westslope cutthroat stocks that formerly occupied large, mainstem rivers and lakes and their principal tributaries are reduced from their historic levels, the FWS found that viable, self-sustaining westslope cutthroat stocks remain widely distributed throughout the historic range of the subspecies, most notably in headwater areas. On the basis of the available information, the FWS concluded that the westslope cutthroat trout is not likely to become a threatened or endangered species within the foreseeable future. Therefore, listing of the westslope cutthroat trout as a threatened or endangered species under the ESA was not warranted at that time.

The FWS strongly recommended that state game and fish departments, federal land-management agencies, tribal governments, private groups, and other concerned entities continue to work individually and cooperatively to develop and implement programs to protect and restore stocks of westslope cutthroat trout throughout the historic range of the subspecies. The FWS believes additional actions should be taken (e.g., selective placement of barriers to prevent the upstream movement of nonnative fishes) to further protect extant westslope cutthroat trout stocks throughout their historic range from the adverse effects of nonnative fishes. The FWS stated in its review that it is encouraged by ongoing and planned state and local programs, most notably those in Montana, to protect and restore westslope cutthroat trout within its historic range (USFWS 2000).

Subsequent to the 2000 status review, American Wildlands and four other environmental groups filed a lawsuit arguing that the FWS acknowledged hybridization as a threat to the

species but included hybrids in the overall westslope cutthroat trout population without providing a justification. The Court ruled in favor of the plaintiffs and ordered FWS to reconsider whether to list the westslope cutthroat as a threatened subspecies. In August 2003, after a thorough review of all available scientific information, the FWS again determined that the westslope cutthroat trout does not warrant listing as a threatened species under the Endangered Species Act (see Appendix B). (68 FR 152)

If programs are not implemented and continued as a means of protecting and restoring stocks of westslope cutthroat trout, the result could lead to future restrictions on angling; affect angling opportunities, and the management of this species. The No Action alternative could also lead to a westslope cutthroat ESA listing and more severe restrictions for all activities affecting the species.

3.2.3.2 Bull Trout

Bull trout, a char in the salmon family, are distinguished from other trout and salmon by the absence of teeth in the roof of the mouth, presence of light colored spots, small scales, and differences in the structure of their skeleton (FWS 1997). The bull trout is a federally listed species (threatened) under the ESA.

Bull trout reach sexual maturity between five and seven years of age. They spawn in gravel and cobble pockets in streams during late summer and early fall generally after water temperatures drop below 9 degrees C. Spawning areas are often associated with springs or areas where stream flow is influenced by cold ground water. Bull trout eggs require a relatively long incubation period when compared to the trout and salmon's. In general, eggs hatch before the end of January with emergence occurring in late spring. Fry and juvenile fish are strongly associated with the stream bottom and are found at or near it. Bull trout commonly live to be about 12 years old (FWS 1997).

In the South Fork subbasin, bull trout exhibit two migratory life history forms or strategies: fluvial and adfluvial. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial) or river (fluvial) where they grow to maturity (FWS 1997; Fraley and Shepard 1989).

Bull trout are known to exhibit two life history forms or strategies: resident and migratory. Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn, rear, and reside. Migratory bull trout spawn in tributary streams where juvenile fish rear from one to four years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, salt water (anadromous) where they grow to maturity. Growth of resident fish is generally much slower than migratory fish, and resident fish tend to be smaller at maturity and less fecund (FWS 1997). Bull trout of the South Fork Flathead exhibit adfluvial life history characteristics; they spawn and rear in tributary streams and migrate to Hungry Horse Reservoir to grow and mature. Adult bull trout from the South Fork have been known to exceed fifteen pounds.

Where suitable migratory corridors exist, extensive migrations are characteristic of this species. Retention and recovery of migratory life history forms and maintenance or re-establishment of stream migration corridors is considered crucial to the persistence of bull trout subpopulations throughout their geographic range. Migratory bull trout facilitate the interchange of genetic material between local subpopulations and are necessary for recolonizing habitat where subpopulations are, or become, extirpated by natural or human-caused events (FWS 1997).

Bull trout have habitat requirements that are more specific than those of many other salmonid's. These habitat requirements include: spawning and rearing substrate

composition that includes **free interstitial spaces**; complex cover including, large woody debris, undercut banks, boulders, shade, pools, or deep water; cold water temperatures; channel and hydraulic stability; and connectedness through migratory corridors (FWS 1997).

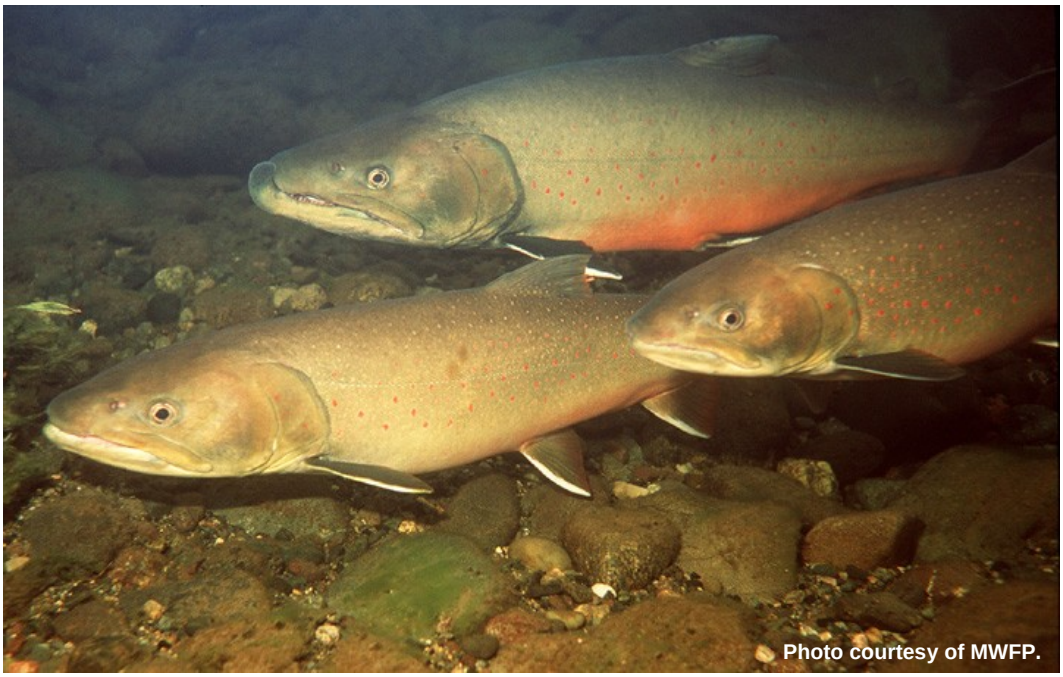

Figure 3-3. The bull trout is a threatened species under the ESA.

Bull trout are not found in any of the lakes proposed for treatment. However, bull trout do occur in the associated drainages downstream of some lakes.

In 2004, the South Fork Flathead drainage, including Hungry Horse Reservoir, will be opened to limited bull trout angling. Anglers will be able to harvest two bull trout per year from Hungry Horse Reservoir. Catch and release angling will be allowed on the South Fork Flathead River. None of the lakes or streams proposed for treatment in this project would be affected by the proposed action.

3.2.3.3 Mountain Whitefish

Mountain whitefish is not a federally listed species, but is native to the South Fork subbasin and is the most abundant game fish in the drainage. A survey completed in 1989 estimated that 32 percent of all fish within Hungry Horse Reservoir are whitefish. However, whitefish are greatly under-utilized as a gamefish relative to their abundance.

Whitefish exhibit seasonal movements associated with feeding, overwintering, and spawning behavior. Whitefish can overwinter in deep stream and river pools or in Hungry Horse Reservoir. Both fluvial and adfluvial life forms of mountain whitefish exist within the South Fork drainage. Whitefish mature at three to five years and spawn from October through December, broadcasting their eggs over gravel and small rocks in shallow, fast-flowing, midstream areas. Whitefish are prolific; one female can produce from 3,000 to 8,000 eggs. After hatching in the spring, fry rear in shallow riffles, backwaters, and stream margins, then move to deeper water as they grow. Juveniles that move to the reservoir generally emigrate from their natal tributary during their first year

of life. Individual whitefish grow to about 19 inches in length. Whitefish are not found in the in the lakes that are proposed for treatment, but are common in downstream waters and in the reservoir.

Mountain whitefish are typically bottom feeders that primarily consume zooplankton and aquatic insect larvae. When bottom food is less abundant, whitefish will eat suspended zooplankton, insect pupa, and insects in the surface film.

Mountain whitefish occur in the Big Salmon, Gordon Creek, and Youngs Creek drainages located downstream from the wilderness lakes However, in most cases they are far enough downstream that contact with fish toxins is not expected. Any loss of mountain whitefish would not be great enough to affect the overall population of this abundant fish.

3.2.4 Current Management Practices

FS policy recognizes that states have "jurisdiction and responsibilities for the protection and management of wildlife and fish populations in wilderness" (FSM 2323.32). Regarding fish stocking, the FS prioritizes species that should be stocked in the following order (FSM 2323.34c):

- Federally listed threatened or endangered, indigenous species
- Indigenous species

Further, this management direction states that species of fish traditionally stocked before wilderness designation (for the Bob Marshall Wilderness, this would be 1964) may be considered indigenous if the species is likely to survive. This would include many of the hybrids and non-native fish that are currently threatening the genetic purity of the westslope cutthroat trout. This, however, would appear to contradict the intent of the Wilderness Act and the ESA to preserve and protect the integrity of native biological communities. The Management Framework for the BMWC (FS and MFWP 1995) acknowledges this dichotomy:

"It is recognized that stocking fish in the BMWC has altered the natural biological community in many of the approximately 40 lakes in the complex that support fish. The practice was established prior to the passage of the Wilderness Act and, although it is controversial, it is a traditional practice and supports a traditional use by visitors."

However, the management framework goes on to outline a more "conservative approach" to fish stocking and redefines "indigenous" as it is to apply in the BMWC:

- Only sensitive, genetically tested native species are stocked and management favors sensitive species.
- Non-indigenous species are considered exotic even if they were present before wilderness designation.

MFWP's drainage-wide fisheries management goals include: 1) maintain self sustaining fish populations; 2) maintain and improve the genetic integrity of westslope cutthroat trout; 3) emphasize a quality fishery over quantity of harvest; and 4) manage the fishery consistent with wilderness management guidelines (MFWP 1991a).

To accomplish these goals, the MFWP maintains high quality lake fisheries by stocking westslope cutthroat trout where needed. Most stocking occurs on a rotational basis, generally at one to five year intervals. At many lakes, a helicopter is used to stock fish, including lakes in wilderness areas. Since the early 1970's, as a rule, rivers and streams

throughout Montana are no longer stocked with fish, in an effort to promote and rely on wild fish in these habitats.

Fishing regulations for the South Fork drainage have been progressively modified with the intent of meeting the above stated management goals. The most significant modification of fishing regulations pertaining to cutthroat trout occurred in the1984 fishing season when the Department implemented more restrictive limits. Wilderness limits were reduced to three fish, none over 12 inches, within streams; and three fish, of any size, from lakes. A catch-and-release area outside the wilderness on the main South Fork from Meadow Creek footbridge to Spotted Bear footbridge was also created to protect fish in higher use areas that are more easily accessed. Later, in 1988, the Department reduced all South Fork drainage tributary and lake limits to coincide with wilderness limits. These limits remain the same today and, based on various population monitoring indices, appear to be providing adequate angling opportunities while protecting the cutthroat fishery.

MFWP regularly monitors the South Fork cutthroat trout fishery by conducting population estimates near the Meadow Creek trailhead and Black Bear guard station. Historically, other cutthroat surveys, monitoring, and population estimates have been conducted on various portions of the river and tributaries and MFWP has continued their efforts to survey and inventory lakes located within the basin. In addition to cutthroat trout, the Department intensively monitors bull trout distribution and abundance throughout the drainage. MFWP has also conducted fisheries investigations within Hungry Horse Reservoir and its tributaries. Annual monitoring includes spawning redd surveys, fall gill netting on Hungry Horse Reservoir, and population abundance estimates for age one fish in tributary streams in an effort to monitor both cutthroat and bull trout populations.

Consistent with article 13 of the Fish Wildlife and Habitat Management Guidelines for the BMWC (FS and MFWP 1995), MFWP implemented a rotenone treatment on Devine Creek Lake in 1996 to remove the only known brook trout population in the South Fork Flathead drainage. The project was completely successful at removing a threatening species and restoring angling opportunity.

3.2.5 Environmental Consequences of Alternative A (No Action)

3.2.5.1 Direct and Indirect Effects on Fisheries Resources

There would be no change in resource conditions under this alternative. Genetic swamp out-type stocking may continue. Continued high-density annual fish stocking would maintain abundant, yet small sized fish.

3.2.5.2 Cumulative Effects on Fisheries Resources

Over time, it is highly likely that the genetic purity of westslope cutthroat trout populations in the subbasin would degrade through continued hybridization. There would be no effect on bull trout or other species of concern.

3.2.6 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.2.6.1 Direct and Indirect Effects on Fisheries Resources

Bull trout are not present in any of the lakes proposed for treatment. However, bull trout do occur in the associated drainages downstream of 13 of the lakes proposed for treatment (table 3-2). The remaining eight lakes either have no downstream bull trout at risk, the bull trout downstream reside in Hungry Horse Reservoir, or the treatment can be contained well before it reaches bull trout waters. It will be necessary to safeguard downstream bull trout populations while removing as many hybrid trout from those streams as possible. It is understood that safeguarding bull trout populations from a piscicide application may prevent some hybrid trout from being removed in some stream segments. The lakes that have bull trout populations downstream include Wildcat, Sunburst, Woodward, Necklace (four lakes), Lena, Lick, Koessler, George, and Pyramid. Although there are no bull trout in Graves Creek downstream of Handkerchief Lake, it will be necessary to protect any bull trout that may be residing at the mouth of Graves Creek in Hungry Horse Reservoir. Eleven of these 13 lakes are located in the Bob Marshall Wilderness. There are three reasons why antimycin, rather than rotenone, would be the preferred fish toxin for these 13 lakes. First, the ability of antimycin to rapidly detoxify in flowing streams makes containment easier. Second, antimycin requires a much lower quantity than rotenone to effect fish kills. This makes the transport of project materials into remote areas easier. Finally, the use of antimycin

Table 3-2. Elevation differential, distance to bull trout populations, and values for natural detoxification using antimycin in lakes with downstream bull trout populations.

Lake	Lake elevation	Elevation at downstream bull trout (ft)	Elevation diff from lake to bull trout habitat	Distance to downstream bull trout habitat (mi)	Detox factor (elev diff ÷200 ft)
George	7,115	5,240	1,875	3.92	9.4
Handkerchief*	3,835	3,560	275	1.33	1.4
Koessler	6,010	5,340	580	0.93	2.9
Lena	6,732	4,420	2,312	9.26	11.6
Lick	5,984	5,280	704	3.23	3.5
Necklace (4)	6,480	4,420	2,060	6.92	10.3
Pyramid	6,927	5,480	1,447	5.21	7.2
Sunburst	5,322	4,160	1,162	7.54	5.8
Wildcat *	5,810	4,040	1,770	3.46	8.9
Woodward	6,433	4,420	2,013	7.73	10.2

**Lake located outside of wilderness.*

would allow the access and transport of supplies to wilderness lakes by the preferred traditional non-motorized means—livestock, which supports wilderness values. George

and Lick lakes are two wilderness lakes that have no trail access, requiring the transport of materials by helicopter.

To determine the level of natural detoxification available, the elevation differential from each lake to the downstream bull trout population was calculated, and then a detoxification factor was calculated based on 200 foot elevation intervals (table 3-2 above). Each 200-foot interval represents one complete detoxification based on studies and evaluations conducted by Tiffan and Bergersen (1996). Detoxification factors for these 13 treatments range from 1.4 to 11.6 times more than necessary based on this literature.

Because antimycin detoxifies naturally in this manner, it would be necessary to install recharge stations in streams below certain lakes to maintain lethality down to the treatment boundary; this would aid in removing as many of the hybrid trout as possible while still allowing a safe buffer for bull trout populations downstream.

3.2.6.2 Cumulative Effects on Fisheries Resources

The cumulative effects of this method would include a progressive reduction in angling quality and quantity among the mountain lake fisheries in the South Fork. This impact would be mitigated by staggering the treatments spatially and over a period of 10 years or more.

Genetic inventories have demonstrated that nonnative and hybridized fish populations have expanded from headwater lakes into one of largest remaining strongholds of westslope cutthroat trout in existence. The use of piscicides is a scientifically proven technique for reducing or eliminating non-native fish species. Combined with the post-treatment stocking of genetically pure westslope cutthroat trout, piscicides offer the greatest known potential to successfully protect westslope cutthroat trout in the South Fork Flathead Watershed. Failure to address this problem will result in further expansion of hybridization, impacting the otherwise secure native fish assemblage upstream of Hungry Horse Dam.

Previous monitoring shows that short-term impacts to the fisheries resource caused by chemical treatment (using antimycin or rotenone) are undetectable within the first three years. Post-treatment restoration of the fishery could be accelerated by initially stocking fish from multiple age classes and sizes. In lakes that have been stocked repeatedly with M012 westslope cutthroat from Montana's captive broodstock, post-treatment stocking with the M012 strain would be the most expedient way to restore the fishery.

Once the non-native fish have been eliminated, MFWP would restock with genetically pure westslope cutthroat trout. If MFWP did not restock, it is likely that illegal, unauthorized stocking with fish of unknown origins would be done. This could further spread non-native fish in the westslope cutthroats' range and defeat the purpose of this proposal.

Non-target fish species (e.g., bull trout, mountain whitefish, sculpins, etc.) occurring downstream of the proposed lakes could be protected during the treatment phase as described earlier in this document. Redundant safeguards have been designed to assure that no long-term impacts to the native species assemblage would result from implementation of the proposed project.

A Biological Assessment was submitted to US Fish and Wildlife Service (USFWS) in April 2002. USFWS concurred that the proposed project does not have any potential to cause an adverse effect on bull trout (*Salvelinus confluentues),* impair suitable seasonal

habitat or permanent habitat, or to degrade unoccupied habitat that is necessary for the survival of the local population of bull trout. Thus, they concurred with the determination of "may effect, not likely to adversely affect" for bull trout (USFWS 2002).

3.2.7 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.2.7.1 Direct and Indirect Effects on Fisheries Resources

The effects would be the same as those for Alternative B (Section 3.2.6.1).

3.2.7.2 Cumulative Effects on Fisheries Resources

The effects would be the same as those for Alternative B (Section 3.2.6.2).

3.2.8 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.2.8.1 Direct and Indirect Effects on Fisheries Resources

The most important direct effect of Alternative D would result from fish suppression efforts. Fish removal using mechanical methods (gill nets and trap nets) would result in a long-term (5 to 10 years) reduction in large trout, which are most vulnerable to capture. The intentional reduction in fish numbers would impact fishing opportunities for humans and, potentially, fish-eating birds.

One of the primary direct effects of Alternative D is the loss of high quality angling opportunities for an extended period of time. Another primary direct effect of Alternative D is the long-term and high volume stocking of lakes. The intentional overpopulation of westslope cutthroat using this method would increase competition and inbreeding as intended, but may also reduce growth rates, the overall size of fish, and enhance the potential for downstream migration because of population pressure. The indirect effect would include promotion of further hybridization downstream as demonstrated by the existing genetic information. Under this alternative, pure downstream cutthroat would continue to be in jeopardy.

3.2.8.2 Cumulative Effects on Fisheries Resources

Coupled with a suppression program expected to last 5 to 10 years on each lake, an aggressive campaign of swamping would increase competition between fish and reduce the overall size and fitness of fish in the lake. It would also prolong the development of a high quality fishery, which may take several years to implement.

3.3 Wildlife Resources

3.3.1 Listed Terrestrial Species of Concern

The project area provides habitat for several threatened and endangered species. Table 3-3 shows the terrestrial species found in the vicinity of the South Fork Flathead Subbasin that are listed as endangered or threatened under the ESA. See Appendix F for additional information.

Table 3-3. ESA-listed terrestrial species in affected environment.

Species	Category	Expected Occurrence
Bald eagle (*Haliaeetus leucocephalus*)	Threatened	Resident/ transient
Canada lynx (*Felis lynx canadensis*)	Threatened	Resident/transient
Gray wolf (*Canis lupus*)	Endangered	Resident/transient
Grizzly bear (*Ursus arctos horribilis*)	Threatened	Resident/transient

Source: U.S. Fish and Wildlife Service, Montana Field Office, November 8, 2001.

3.3.1.1 Bald Eagle

The bald eagle is an opportunistic predator and feeds primarily on fish, but also consumes a variety of birds and mammals (both dead and alive) when fish are scarce or these other species are readily available. Fish may comprise up to 90 percent of its diet (70 to 90 percent) depending on geographic location, season, and relative abundance. Northern pikeminnow, suckers, salmon, and trout are important fish species preyed on by bald eagles. Bird prey species are more important in bald eagle diets during winter when fish are less available due to ice formation on streams, lakes, and reservoirs. Waterfowl are the most common bird species preyed on by eagles. Mammals are taken at a lesser degree than fish and birds. Mammals are taken as live prey or carrion in all seasons, but become more important during winter (FWS 1996a).

Bald eagles occur in the project area seasonally. However, high altitude and mountainous terrain cause snow and ice to be present in these locations through June. Because bald eagles nest in March and incubate eggs in April, there are few available food sources for them in the project area, thus precluding them from nesting in the area. The nearest bald eagle nest that occurs in the project area is located on Clayton Island on Hungry Horse Reservoir. Regional file data from MFWP indicates the nest has been successful four of the past eight years (see table 3-4 below).

The peak time for fledging for this nest most likely occurs in early July (Bergeron 2002).

Known neighboring bald eagle nests are found at the following locations: Swan Lake Refuge, Echo Lake, Swan River at Ferndale, Salmon Lake, Clearwater River two miles north of Clearwater junction, and Blackfoot River four miles east of Clearwater junction (Casey 2002; Firebaugh 2002).

Table 3-4. Clayton Island bald eagle nesting status.

Year	*Successful*	*# fledged*
1994	Yes	1
1995	No	0
1996	No	0
1997	Yes	1
1998	Yes	1
1999	No	0
2000	No	0
2001	Yes	1

Source: Montana Fish, Wildlife &Parks

3.3.1.2 Canada Lynx

Canada lynx are in the cat family (*Felidea*) and are medium-sized cats 30 to 35 inches long and weighing 18 to 23 pounds. Lynx have large feet adapted to walking on snow, long legs, tufts on the ears, and a black-tipped tail. In northern Idaho and northwest Montana, cedar-hemlock habitat types may be considered primary vegetation for lynx. In central Idaho, Douglas fir on moist sites at higher elevations may also be considered primary vegetation. Secondary vegetation, when interspersed with sub-alpine forests, contributing to lynx habitat includes: cool, moist Douglas fir; grand fir; western larch; and quaking aspen (Ruediger, et al. 2000).

Natal den sites are commonly built in large woody debris, either in downed logs or root wads. Den sites may be located within older regeneration stands (>20 years since disturbance) or in mature conifer or mixed conifer-deciduous (typically spruce/fir or spruce/birch) forests. Stand structure appears to be more important to den site selection rather than cover type (Ruediger, et al. 2000). Lynx appear to prefer to move through continuous forest and frequently use ridges, saddles, and riparian areas (Ruediger, et al. 2000).

Snowshoe hares are the primary prey of lynx, comprising 35 to 97 percent of their diet throughout lynx range. Red squirrels are an important alternate prey, especially during snowshoe hare population lows. Mice, voles, flying squirrels, fish, grouse, and ungulate carrion also occur in their diet (Ruediger, et al. 2000).

Canada lynx are found in the South Fork of the Flathead drainage, the Swan Mountain Range, and the Swan River drainage.

3.3.1.3 Gray Wolf

The gray wolf is the largest member of the dog family (*Canidae*). Wolves do not have any particular habitat requirements except for areas that are void of heavy human use (FWS 1996b). The gray wolf is territorial in most areas. Wolf packs occupy rather specific territories. The number of individuals in a pack and the availability of prey determine territory size; packs dependent on migratory prey tend to have the largest territories. Daily pack movements vary, and distances traveled are greater in winter than in summer. Lone wolves cover larger areas than packs, and their territories may overlap two or three pack territories (Fritts 1982).

Wolf dens are used for bearing and protecting pups, and are often abandoned when pups reach the age of two months. The same den may be used year after year, or different dens may be selected. Pups are sometimes moved from one den to another. During spring and summer, a reproductive pack's movements are centered round den and rendezvous sites. Once pups leave the den site, rendezvous sites become important rearing areas. By late summer, pups are mature enough to travel, and pack movements increase (Young 1944; Mech 1970; Fritts 1982).

Wolves prey primarily on large wild mammals such as deer, elk, moose, caribou, bison, and bighorn sheep. However, wolves are opportunistic feeders, eating a wide variety of food including cattle, sheep, horses, dogs, birds, small mammals, fish, plants, and fruits. Prey items often depend on availability and ease of capture. Wolves are also successful scavengers. Wolves hunt as individuals and in packs (Young 1944; Mech 1970; Fritts 1982).

Two wolf packs are known to exist in the project area. The Spotted Bear Pack, as its name implies, is located near the Spotted Bear river drainage. This pack is believed to consist of five wolves and is known to den near Spotted Bear Lake. Members of this pack have been located at low elevations within the Bunker Creek drainage. Most of the pack's activity occurs on the east side of the South Fork drainage. Sunburst Lake is the closest lake proposed for treatment to the Spotted Bear Wolf Pack. Any interaction with wolves in the project area would likely be limited to encounters with individual wolves that are seeking mates from other packs, or seeking to establish new territories (Sime 2002).

The second wolf pack is known as the Red Shale Pack. This pack consists of eight wolves, and it dens in the Gates Park area of the North Fork Sun River. Members of this pack have been located in the Danaher Creek area of the South Fork Flathead. Pyramid Lake is the closest lake proposed for treatment to the range of the Red Shale Pack. Interaction with this pack is expected to be minimal since this pack does not den in the project area and the project is situated, for the most part, at higher altitudes.

3.3.1.4 Grizzly Bear

Grizzly bears are in the bear family (*Ursidea*) and are generally larger than black bears and can be distinguished by having longer front foot claws (by two to four inches); a distinctive shoulder hump; rounded ears that are proportionately smaller than the head; and a dished-in profile between the eyes and at the end of the snout. Adult bears are individualistic in behavior and normally are solitary wanderers. Females with cubs, bears defending food supplies, and unsecured attractants are common causes of confrontation between humans and bears (FWS 1993).

Home ranges of adult bears may overlap. The home ranges of adult male grizzlies are generally two to four times larger than adult females. The home ranges of females are smaller while they have cubs, but increase when the cubs become yearlings. Home ranges vary in relation to food availability, weather conditions, and interactions with other bears. Home ranges are larger in the Yellowstone Ecosystem compared to the more productive habitats in the northern ecosystems (FWS 1993). Mean time for Grizzly bears to excavate dens is November 5 (range October 17 to December 16). Dens are usually dug on steep slopes where wind and topography cause an accumulation of deep snow and where snow is unlikely to melt during warm periods. Dens are found at an average elevation of 6,400 feet at various aspects on steep slopes (60 percent or greater) (Mace and Waller 1997).

Grizzly bears are opportunistic feeders and will prey or scavenge on almost any available food. Plants with high crude protein content and animal matter are most important food items. The search for food has a prime influence on grizzly bear movements. Upon emergence from the den, grizzlies move to lower elevations, drainage bottoms, avalanche chutes, and ungulate winter ranges where their food requirements can be met. Throughout spring and early summer, grizzlies follow plant **phenology** back to higher elevations. In late summer and fall, there is a transition to fruit and nut sources, as well as herbaceous materials. This is a general pattern; however, bears will go where they can meet their food requirements (FWS 1993).

Grizzly bears are found throughout the project area for the proposed program. During autumn, the diet of grizzly bears varies widely. Foraging on persistent fruits such as *Sorbus spp*. and *Arctostaphylos uva-ursi* are common. An important fall food source is gut piles from hunter-harvested game.

3.3.2 Other Potentially Affected Species

3.3.2.1 Amphibians and Reptiles

In 2001, MFWP, in cooperation with the FS Region 1, commissioned a study to survey the presence and distribution of amphibians in the project area with a particular focus on the lakes listed in this proposal (Maxell 2002). Four amphibian species and two reptile species were detected in the project area: the long toed salamander (*Ambystoma macrodactylum*), Rocky Mountain tailed frog (*Ascaphus montanus*), western toad (*Bufo boreas*), Columbia spotted frog (*Rana luteiventris*), Western terrestrial garter snake (*Thamnophis elagans*), and common garter snake (*Thamnophis sirtalis*). Four other species are believed to occur in the project area, but were undetected: pacific tree frog (*Psuedacris regilla*), northern leopard frog (*Rana pipiens*), western painted turtle (*Chrysemyus picta*), and rubber boa (*Charina bottae*). The western toad and northern leopard frog are the only species in western Montana, and possibly the project area that are considered sensitive. A total of 180 sites were surveyed.

Baseline information has been gathered (Grisak 2002; FS 1999) that indicates that these species are widely distributed throughout the project area. The abundance and diversity of habitat identified by Maxell (2002), and the spatial distribution of these species collectively represents a stable ecosystem.

MFWP have frequently encountered amphibians during electrofishing surveys in 14 Hungry Horse Reservoir tributary streams each year since 1987. Most of these observations were of tailed frog tadpoles, but some adults were observed as well as spotted frogs, western toads, and long toed salamanders (Grisak 2003c). Although tadpoles were not quantified, fisheries personnel have characterized them as “abundant” during these surveys. In streams and lakes throughout the South Fork Flathead, native westslope cutthroat trout and native amphibians co-exist much as they do naturally in these streams.

3.3.2.2 Plankton and Aquatic Insects

Plankton surveys have been conducted on 23 lakes in the South Fork, many of which are lakes listed in this project. There are eight species of plankton and a single planktonic insect species that are known to occur in these lakes (Table 3-5).

Table 3-5. Zooplankton and planktonic insect species sampled from 23 lakes in the South Fork Flathead drainage from 2002 to 2003.

Zooplankton species	Number of lakes present	Maximum per liter	Minimum per liter	Mean per liter
Daphnia throata	17	5.13	0.0054	1.142
Daphnia pulex	9	2.57	0.0025	0.83
Bosmina spp.	5	18.4	0.02	3.732
Holopedium gibberum	2	3.6	3.38	3.49
Cyclops spp.	12	5.85	0.0039	0.655
Calanoid spp.	23	3.82	0.02	1.499
Nauplii	11	3.02	0.01	0.707
Epischura spp.	2	0.02	0.8	0.41
Chyboboridae spp. (insect)	2	0.01	0.05	0.03

Source: MFWP file data.

3.3.2.3 Sensitive Wildlife Species on the Flathead National Forest

Sensitive wildlife species are those that show evidence of a current or predicted downward trend in population numbers or habitat suitability that would substantially reduce species distribution. The Regional Forester has identified 11 sensitive wildlife species on the Flathead National Forest (March 12, 1999). None of the alternatives would have direct, indirect, or cumulative effects on riparian and wetland wildlife species, and therefore there would have no effect on the sensitive common loon, harlequin duck, northern bog lemming, northern leopard frog, or western big-eared bat. The peregrine falcon (likely to soon become a Region One sensitive species), fisher, flammulated owl, and northern goshawk would also not be affected by any of the alternatives. These nine wildlife species will not be discussed further in the body of this Environmental Impact Statement.

3.3.3 Environmental Consequences of Alternative A (No Action)

3.3.3.1 Direct and Indirect Effects on Wildlife Resources

There would be no change in present conditions under this alternative.

3.3.3.2 Cumulative Effects on Wildlife Resources

There would be no change in present conditions under this alternative.

3.3.4 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.3.4.1 Direct and Indirect Effects on Wildlife Resources

For most lakes, a one-time application of fish toxin in the early fall (during low water flow period, near the end of the growing season) would effectively eliminate the

undesirable fish. Gathering and sinking the dead fish in the treated lake would stimulate plankton growth as a food source for restocked westslope cutthroat trout during the following growing season and deter opportunistic scavenging by wildlife. Some amphibians and invertebrates would incur minimal and short-term impacts. Mammals, in general, exhibit low susceptibility. Organisms killed by antimycin or rotenone would not be a threat to other animals if consumed.

In 2003, the Glacier National Park superintendent issued a Finding of No Significant Impact (FONSI) decision document on the Environmental Assessment to Conduct Additional Administrative Helicopter and Fixed Wing Flights in the park. The FONSI concluded that, due to noise and disturbance, the 102 proposed administrative flights would have minor to moderate short-term adverse effects on wildlife such as the bald eagle, Canada lynx, gray wolf, grizzly bear, and bighorn sheep (Holm 2003). Based on this finding and the fewer number of proposed flights, this alternative would likely generate less or similar impacts in the South Fork Flathead, which displays similar landscapes, wildlife species, and soundscapes.

Bald Eagle—Bald eagles (*Haliaeetus leucocephalus*) nest almost exclusively in live trees, usually within one mile in line of sight of a large river or lake. Bald eagles occur in the project area seasonally. However, only one bald eagle nest has been documented in the project area: it is located on Clayton Island on Hungry Horse Reservoir. Regional file data from MFWP indicate that the nest has been successful in four of the past eight years. The peak time for fledging for the Clayton nest most likely occurs in early July (Bergeron 2002).

The bald eagle is an opportunistic predator and feeds primarily on fish, but also consumes a variety of birds and mammals (both dead and alive) when fish are scarce or these other species are readily available. Fish may comprise up to 90 percent of the diet (70 percent to 90 percent), depending on geographic location, season, and relative abundance (FWS 1996a).

Impacts on the bald eagle would include temporary increases in noise and human disturbance associated with the piscicide treatment process and transportation of materials, equipment, and staff to and from lake sites. No flights would occur in the vicinity of the nest.

In some cases, bald eagles might be attracted to these sites by the presence of dead fish. Efforts would be made to keep dead fish from becoming an attractant as noted under the grizzly bear discussion below. No impacts on the bald eagle would be anticipated as a result of possible consumption of contaminated fish and/or water (see Appendix D).

No loss of bald eagle habitat would result from this program. Since all gill-breathing organisms would be killed from the piscicide treatment, there would be a temporary reduction in the availability of fish as a food source for bald eagle that forage in these areas. This impact is expected to be minor and short-term. The lake would only be fishless during the winter following treatment when eagles are not using the area. Fish would be restocked into the lake following melting of the ice covering in early summer. There are numerous alternate food sources that bald eagle can rely on in these areas, including sources located in adjacent lakes. Lakes treated in the same year would be located large distances from one another in different sub watershed units in order to minimize local impacts on foraging.

Canada Lynx—Canada lynx (*Lynx canadensis*) are found in the South Fork of the Flathead drainage, the Swan Mountain Range, and the Swan River drainage.

Impacts on the Canada lynx would include temporary increases in noise and human disturbance associated with the piscicide treatment process and transportation of materials, equipment, and personnel to and from lake sites. Two lakes (or lake systems) are scheduled to be treated each year over the next 10 to 12 years. All applications would take place during September and October. Increases in noise and human disturbance would last approximately four days: one day for set-up, two days to treat and detoxify a lake, and at least one day for clean up. The number of trips needed to deliver materials, equipment, and personnel would vary depending on lake size and method of transport. Lakes treated in the same year would be located large distances from one another in different sub-watershed units in order to minimize local impacts from increased noise and human disturbance. The presence of humans and traffic would likely displace Canada lynx from the project area during the treatment process. Only minor and short-term increases in motorized vehicle use would result from this program.

No loss of Canada lynx habitat or prey items would result from this program. No impacts on Canada lynx are anticipated to result from possible consumption of contaminated fish and/or water (see Appendix D). In addition, no indirect impacts on Canada lynx would be expected as a result of the temporary absence of fish in the lakes.

Gray Wolf—The Spotted Bear and Red Shale packs are the only known Gray wolf (*Canis lupus*) packs in the affected environment. Sunburst Lake is the closest lake proposed for treatment to the Spotted Bear Wolf Pack. Pyramid Lake is the closet to the range of the Red Shale Pack. Interactions with wolves in the project area would likely be limited to encounters with individuals that are seeking mates from other packs, or seeking to establish new territories. May and June are the critical months for wolves in the sense that they are generally tied to a den site. Disturbance during this period may cause wolves to abandon den sites.

Impacts on gray wolf would include temporary increases in noise and human disturbance associated with the piscicide treatment process and transportation of materials, equipment, and personnel to and from lake sites. All applications would take place during September and October. Increases in noise and human disturbance would last approximately four days. The number of trips needed to deliver materials, equipment, and personnel would vary depending on lake size and method of transport. Lakes treated in the same year would be located large distances from one another in different sub-watershed units in order to minimize local impacts from increased noise and human disturbance. The presence of humans and traffic would likely displace gray wolf from the project area during the treatment process. Only minor and short-term increases in motorized vehicle use would result from this program. Roads would be used to transport materials, equipment, and personnel to only one of the 24 lakes scheduled for treatment.

No loss of gray wolf habitat or prey items would result from this program. No impacts on gray wolf are anticipated to result from possible consumption of contaminated fish and/or water (see technical appendices). In addition, no indirect impacts on gray wolf would be expected as a result of the temporary absence of fish in the lakes.

Grizzly Bear—Impacts on grizzly bear (*Ursus arctos horribilis*) would include temporary increases in noise and human disturbance associated with the piscicide treatment process and transportation of materials, equipment, and personnel to and from lake sites. All applications would take place during September and October. Increases in noise and human disturbance would last approximately four days as discussed in Chapter 2. The number of trips needed to deliver materials, equipment, and personnel would vary depending on lake size and method of transport. Lakes treated in the same year would be

located large distances from one another in different sub watershed units in order to minimize local impacts from increased noise and human disturbance. The presence of humans and traffic would likely displace grizzly bear from the project area during the treatment process. Only minor and short-term increases in motorized vehicle use would result from this program.

It is expected that helicopter use and the level of human activity would displace most grizzly bears from the immediate vicinity of a lake during the treatment process. Some bears that may be habituated to humans could remain in the area during the treatment process. Efforts would be made to keep dead fish from becoming an attractant to grizzly bear. Fish that wash up on the shoreline would be taken to deeper water; air bladders would be punctured, and the fish would be sunk. This methodology has been successfully used in previous lake treatments in the proposed project area (Devine Lake in 1994; Tom Tom Lake in 2000).

No impacts on grizzly bear are anticipated to result from possible consumption of contaminated fish and/or water (see Appendix A). To minimize possible interactions between grizzly bear and personnel, requirements outlined in the U.S. Department of Agriculture (USDA) FS Food Storage Special Order LC00-18 would be followed. This includes storing human and livestock food in a bear-resistant manner and packing out any left over food and garbage. It may be possible that grizzly bear would be attracted to these sites by the presence of dead fish and/or human food supplies and garbage. Piscicide containers would also be securely stored.

No loss of grizzly bear habitat would result from this program. Because only one lake or group of lakes in a given sub-watershed unit would be treated in a given year, the grizzly bear could rely on adjacent lakes and other food sources in these areas, thus minimizing local impacts on foraging.

Amphibians— Amphibians have the potential to be directly affected by the application of rotenone, antimycin, and potassium permanganate simply because they use some of the lake and stream environments targeted in this project for portions of their life cycles.

Numerous field evaluations conducted by MFWP indicate that amphibians persist following rotenone applications in the Flathead Basin and, in particular, in the South Fork Flathead. MFWP laboratory studies indicate that spotted frogs, tailed frogs, and long toed salamanders can survive antimycin exposures at levels much higher than those prescribed to kill trout. In addition, there is an exhaustive amount of literature declaring the effects of these compounds on various species of amphibians.

Grisak (2003c) reported that Tom Tom Lake, located in the South Fork Flathead drainage, was treated with rotenone in October, and a survey one year later found numerous spotted frog juveniles, tailed frogs, and long toed salamander larvae. Grisak (2003c) reported the evaluations of 18 lakes treated with rotenone over a 44 year period; he found that amphibians persisted after treatments. Chandler and Marking (1982) found that leopard frog tadpoles were 3 to 10 times more tolerant to rotenone than fish. Brown and Ball (1943) reported that during a May rotenone treatment in Michigan, tadpoles were “greatly affected,” but within three months were “extremely numerous.” Grisak (2003b) reported that tailed frog tadpoles survived exposure to 0.75 ppm formulated rotenone for 24 hours, and 80 percent died at 1 ppm exposure after 24 hours.

Based on this information, MFWP would expect the impacts to native amphibians resulting from this project to be consistent with past applications, laboratory tests, and exhaustive reports from other researchers and biologists. Any impacts to amphibians

stemming from the application of rotenone are expected to be minimal and short-term, and likely limited to larval stages. Implementing these projects in the autumn and fall would further reduce any potential for impacts on native amphibians.

A similar amount of research has been conducted on the effects of antimycin on amphibians. Walker, et al. (1964) reported that tiger salamanders survived 80 ppb exposure for 96 hours, but were killed by 600 ppb. Bullfrog tadpoles survived 24 hours exposure to 20 ppb, but those exposed to 40 ppb died. Berger (1966) reported that bullfrog tadpoles required doses five times (40 ppb) greater than fish killing concentrations to effect lethality. Tiger salamanders required doses 75 times (600 ppb) greater to effect death. Likewise, laboratory studies on newts, frogs, tadpoles, bull frogs, leopard frogs, turtles, and snakes have shown that they will survive exposure to antimycin at levels prescribed for trout removal (Schnick 1974a). In 2003, MFWP laboratory tests on larval long toed salamanders showed 10 percent mortality at 96 hours at 30 and 60 ppb exposure; those exposed to 150 ppb showed 100 percent mortality at 84 hours (Grisak et al. 2004). Spotted frog juveniles exposed to 125 ppb showed 20 percent mortality at 96 hours, and 250 ppb showed 70 percent mortality at 96 hours (Grisak, et al. 2004). Tailed frog tadpoles showed 11 percent mortality when exposed to 56 ppm for 24 hours (Grisak 2003b).

Based on these evaluations, MFWP would expect the impacts on amphibians stemming from the application of antimycin to be minimal and short-term. Efforts to mitigate for or offset any negative impacts could include transplanting amphibians from neighboring populations if necessary, and/or capturing specimens from within each project area before each treatment then releasing them after it is complete.

Plankton and Aquatic Insects—Like fish and amphibians, plankton and aquatic insects have the potential to be affected by rotenone and antimycin treated waters because they depend on some of the proposed lake and stream environments as habitat.

Numerous studies indicate that piscicides have temporary or minimal effects on aquatic insects and plankton. Anderson (1970) reported that comparisons between samples of zooplankton taken before and after a rotenone treatment did not change a great deal. Despite the inherent natural fluctuations in zooplankton communities, the application of rotenone had little effect on the zooplankton community. Cook and Moore (1969) reported that the application of rotenone has little lasting effect on the non-target insect community of a stream. Kiser, et al. (1963) reported that 20 of 22 zooplankton species re-established themselves to pre-treatment levels within about four months of a rotenone application. Cushing and Olive (1956) reported that the insects in a lake treated with rotenone exhibited only short-lived effects.

Both Anderson (1970) and Kiser, et al. (1963) reported that most plankton species survive a rotenone treatment via their highly resilient egg structures. In addition, **parthenogenesis** of some female **plankters** occurs, causing sexual dimorphism, which greatly increases reproduction potential, and ultimately, density. Among the aforementioned studies, variation in climate, physical environment, and water chemistry would likely cause subtle differences in results in other areas.

Case studies conducted on Devine Lake in the Bob Marshall Wilderness from 1994-1996 (Rumsey, et al. 1997) indicate that following a rotenone treatment, invertebrates actually increased in number and, very slightly, increased in diversity. This is supported by observations made by Cushing and Olive (1956), who reported that oligochaete (worms) numbers increased after a rotenone treatment then became stable. Neighboring Ross Lake, in the Bob Marshall Wilderness, is fishless and was used to measure natural insect

and plankton variation during the Devine Lake treatment and evaluation. Invertebrate numbers in Ross Lake were reported to be relatively stable, but the diversity of insects fluctuated considerably over time.

The effects of antimycin on plankton and aquatic insects has been evaluated by many researchers. Callaham and Huish (1969) reported that zooplankton were severely depleted but began to reappear within six to nine days, and bottom insects were not affected by antimycin. Hughey (1975) concluded that four Missouri ponds treated with antimycin showed little short-term and no long-term effect in regard to population levels of zooplankton. The effects from antimycin on plankton were consistent with the natural variability that is characteristic of plankton populations, and re-colonization was rapid and reached near pre-treatment levels within eight months. Antimycin has been found to be non-toxic to some plankton, bottom insects, and water plants at typical fish killing concentrations (Walker, et al. 1964).

The literature suggests that some impacts to aquatic insects and plankton can be expected from the application of rotenone and antimycin, but they are expected to be minimal and short-term. Based on these findings, we would expect similar impacts to these organisms in the proposed lakes and streams.

3.3.4.2 Cumulative Effects on Wildlife Resources

Because of the short duration of each treatment and the limited number of treatments each year, there would be no cumulative effects under this Alternative. A Biological Assessment was submitted to US USFWS in April 2002. USFWS concurred with BPA that the proposed project may affect but is not likely to adversely affect the threatened grizzly bear (*Ursus arctos horribillis*), bald eagle (*Halieaeetus leucocephalus*), or Canada lynx (*Lynx canadensis*) or the endangered gray wolf *(Canis lupus*). (USFWS 2002).

3.3.5 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.3.5.1 Direct and Indirect Effects on Wildlife Resources

The effects would be the same as those for Alternative B (Section 3.3.4.1).

3.3.5.2 Cumulative Effects on Wildlife Resources

There would be no cumulative effects under this Alternative.

3.3.6 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.3.6.1 Direct and Indirect Effects on Wildlife Resources

Human and motorized activities associated with a long-term presence on the lake would likely disrupt normal wildlife behavior. Fish populations would drop over time as suppression techniques were implemented.

Diving ducks, some birds of prey (including bald eagles), and some mammals (e.g., otters) may be attracted to gill nets by dead fish, become entangled, and drown. Dead fish may be an attractant for bears; therefore, they would be collected from the lakes and streams as quickly as possible.

3.3.6.2 Cumulative Effects on Wildlife Resources

There would be no cumulative effects under this Alternative.

3.4 Water Resources

3.4.1 Existing Conditions

The portion of the streams and lakes within the Bob Marshall Wilderness are designated as Outstanding Resource Waters (ORW) [ORW, 75-5-103(20), Montana Code Annotated (MCA)] and have a water-use classification of A-1 [Administrative Rules of Montana (ARM) 17.30.614]. The remainder of the South Fork Flathead Watershed is classified as B-1 (ARM 17.30.610). The portion of South Fork Flathead drainage located in the Bob Marshall wilderness is designated as an ORW because it is within the boundaries of the wilderness, not necessarily because of extraordinary water quality.

The drainages on the Flathead National Forest, including the project area, contribute approximately 7,000,000 acre-feet of water per year to the Columbia River drainage. The chemical water quality of the streams and rivers is generally excellent. The primary water quality contaminant of any consequence is sediment. The MDEQ's 1996 and 2000 303 (d) Reports--Water bodies in need of Total Maximum Daily Load (TMDL) lists several water bodies that are located in the Flathead Basin but none of them are in the South Fork drainage. The South Fork of the Flathead River downstream of Hungry Horse Dam is listed due to hydro-modification caused by the alteration of flow regime as a consequence of the Dam. There are no streams in the South Fork Flathead drainage, located upstream of the dam, that are listed.

The typical stream types found in the project area generally have gradients from 4 to 10 percent, and are characterized by straight (nonsinuous) cascading reaches with frequently spaced pools. Many of the outlet streams associated with the lakes in this project have large waterfalls immediately downstream of the lakes, some reaching 200 feet tall. Also common are streams with gradients from 2 to 4 percent; these streams usually occupy narrow valleys with gently sloping sides.

There are no federal or Montana numeric water quality standards for rotenone or antimycin. However, the Montana Water Quality Act has narrative standards for water quality that prohibit the introduction of substances into waters that are injurious to aquatic life or that affect exiting uses. Under this project, MFWP would apply piscicide for the expressed purpose of killing unwanted fish. There may be some minimal and short-term impacts to other aquatic organisms, but the MDEQ will permit an exemption for this activity under section 75-5-308 of the MCA.

3.4.2 Environmental Consequences of Alternative A (No Action)

3.4.2.1 Direct and Indirect Effects on Water Resources

There would be no change in conditions under this alternative.

3.4.2.2 Cumulative Effects on Water Resources

There would be no change in conditions under this alternative.

3.4.3 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.4.3.1 Direct and Indirect Effects on Water Resources

The alternative does not jeopardize the ORW designation.

Water quantity would not be permanently affected by the proposal. The effects on water quality from the application of piscicides and potassium permanganate would be temporary and would become undetectable after detoxification. See Appendix D for more information on the effect of these chemicals on water quality.

No contamination of groundwater is anticipated to result from this project. Piscicides bind readily to sediments, suggesting that they would not seep into groundwater aquifers (Skaar 2001; Engstrom-Heg 1971, 1976). In California, studies where wells were placed in aquifers adjacent to and downstream of rotenone applications never detected rotenone or any of the other organic compounds in the formulated products (CDFG 1994). Case studies in Montana have concluded that rotenone movement through ground water is minimal. At Tetrault Lake in Montana, rotenone was not detected in a nearby domestic well that was sampled two and four weeks after treatment of the lake with 90 ppb active rotenone. This well was chosen because it was down gradient from the lake and because it drew water from the same aquifer that fed and drained the lake. In 1998, a Kalispell area pond was treated with rotenone. Water from a well located 65 feet from the pond was analyzed; no sign of rotenone was detected. In 2001, another Kalispell area pond was treated with rotenone. Water from a well located 200 feet from that pond was tested four times over a 21-day period and showed no sign of contamination.

Floodplains and wetlands would not be affected by this project because no ground disturbance would occur. Pack animals would be kept at least 200 feet away from the edges of the lakes.

Proper management of the antimycin components would reduce any potential for accidental spills. At the prescribed concentration, Antimycin is virtually non-effective on fish and other aquatic organisms until these components are mixed. These components would be transported separately to avoid unintentional mixing. During transport on livestock, the compounds would be stored in plastic Nalgene®-type bottles with sealed lids. These bottles would be placed in Styrofoam sleeves, wrapped in sealed plastic bags, contained in a wooden or aluminum box, and then wrapped in a manti-tarp. During helicopter or truck transport, these compounds would be sealed in plastic drums or plastic boxes. The potential for water contamination would be minimal.

The only downstream users of water would be outfitter and private hunter camps. Some livestock watering would be expected at some of these downstream locations. A number of factors would aid in the reduction or elimination of project areas users' exposure to compounds: proper containment of piscicide treatments (low concentrations used for fish killing do not have harmful effects on mammals); rapid detoxification of both compounds in flowing streams; temporary closure of the project areas; and proper signing and advance notification that would allow users to find alternate sources for water if necessary.

Because the South Fork Flathead is a headwater system for the Flathead and Columbia River water basins, all water in this area ultimately flows downstream toward municipalities. The closest municipal water intakes are the cities of Hungry Horse,

Columbia Falls, and Kalispell. These three communities acquire their municipal water from wells and not from surface water. This form of water intake would further reduce any chemical exposure to humans. By the time source waters reach municipal locations, adequate dilution and natural detoxification would have occurred. Supplemental detoxification with potassium permanganate hastens this chemical process, and would virtually eliminate the possibility of acute or chronic exposure by humans to harmful levels of the chemicals.

There would be a small possibility of fuel spills from pumps and outboard motors. However such spills would be of small quantities (less than 5 gallons) and would vaporize rapidly. No effects to water resources are expected.

3.4.3.2 Cumulative Effects on Water Resources

Alternative B would have no cumulative effects on water resources, either as habitat or for drinking water.

3.4.4 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.4.4.1 Direct and Indirect Effects on Water Resources

The effects would be the same as those for Alternative B (Section 3.4.3.1).

3.4.4.2 Cumulative Effects on Water Resources

The effects would be the same as those for Alternative B (Section 3.4.3.2).

3.4.5 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.4.5.1 Direct and Indirect Effects on Water Resources

There would be a small possibility of fuel spills from outboard motors. However such spills would be of small quantities (less than 5 gallons) and would vaporize rapidly. No effects to water resources are expected.

3.4.5.2 Cumulative Effects on Water Resources

Alternative D would have no cumulative effects on water resources, either as habitat or for drinking water.

3.5 Soil and Vegetation Resources

3.5.1 Existing Conditions

The project area is characterized by high rugged peaks with cirque basins and lakes at the high elevations, and long heavily forested drainages. Most soils in the project area have a surface layer of silt loam volcanic ash material originating from volcano eruptions on the west coast of the United States. These eruptions occurred from 6,600 years to as recently as the last few decades. The volcanic ash material is consistent in its characteristics and its location throughout the area. It has silt loam textures; high organic matter content ranging from 2, to more than 5 percent; and a high ability to hold and store nutrients.

Plant communities in this region are naturally diverse. Most of the major vegetative habitat types common to western Montana are located here. The interaction of topographic and climatic variation is evidenced in the wide array of habitats, ranging from the warm dry ponderosa pine (*Pinus ponderosa*)/bunchgrass (*Agropyron spicatum*) type to the cool moist whitebark pine (*Pinus albicaulis*) types. Nearly all tree species native to western Montana grow within the national forest boundaries. Much of the project area is high country with slopes that rise above timberline. In the higher elevation forested areas, subalpine fir and whitebark pine predominate. A mixture of Douglas fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), and Engelmann spruce (*Picea engelmannii*) are found across these higher elevations. Ponderosa pine occurs at lower elevations with native grasses and sagebrush in the valley bottoms in the upper reaches of the drainages. Localized fens with rare plants can be found in the upper reaches of the South Fork. Whitebark pine communities are generally in decline and western white pine communities are in decline in the lower reaches of the South Fork.

3.5.2 Listed Species – Water Howellia

Water howellia, (*Howellia aquatilis*) is an annual aquatic species that grows as a mostly submerged plant rooted in the bottom sediments of ponds and sloughs. Water howellia is typically found in two general types of wetland/riparian habitat: small isolated ponds and river oxbows that may be abandoned or hydrologically linked to adjacent river systems.

Range-wide, no occurrences of water howellia have been found in elevations over 4,500 feet. The FWS has determined that the range of water howellia does not extend above 5,000 feet on the Flathead National Forest. All of the lakes associated with this project are found above 5,000 feet in elevation, except for Handkerchief Lake, which is located at 3,835 feet. No occurrences of water howellia have been noted in the vicinity of Handkerchief Lake (Mantas 2002).

3.5.3 Candidate Species – Slender Moonwort

Slender moonwart (*Botrychium lineare*) is not currently listed; therefore, it has no legal status. However, because this project could potentially span a period of 10 to 12 years, caution should be exercised with regard to the species. There are three known occurrences in Glacier National Park and one historic occurrence (not seen since 1978) at Mission Falls on the Flathead Indian Reservation in Lake County. The occurrences on Glacier National Park are roadside. Habitat for this species varies from forested openings, to grasslands, to disturbed trails and roads, typically at higher elevations

(starting at 4,600 feet). There may be potential habitat for this species within the project area, especially alongside trails at higher elevations (Davis 2003).

3.5.4 Sensitive Species

There are a few known occurrences of alpine/subalpine forest sensitive plants that might be minimally affected by this proposed project. Several of these have the potential to occur within the affected environment.

- *Astragalus lackschewitzii* - rock scree, gravel banks.
- *Botrychium spp.* - various habitats.
- *Cetraria subalpina* (lichen) - base of shrubs or whitebark pine near timberline.
- *Diphasiastrum sitchense* - alpine meadows, rocky barrens, conifer woodlands. It occurs along the trails near the Picnic Lakes that lead to Black Lake.
- *Erigeron lackschewitzii* - gravelly talus.
- *Oxytropis podocarpa* - alpine ridges and slopes.
- *Potentilla quinquefolia* - gravel ridges and slopes.
- *Salix barrattiana* - lake shores, boggy meadows.

3.5.5 Environmental Consequences of Alternative A (No Action)

3.5.5.1 Direct and Indirect Effects on Soil and Vegetation Resources

There would be no change in conditions under this alternative.

3.5.5.2 Cumulative Effects on Soil and Vegetation Resources

There would be no change in conditions under this alternative.

3.5.6 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.5.6.1 Direct and Indirect Effects on Soil and Vegetation Resources

No direct or indirect effects on soil resources are anticipated if the proposed action is implemented. Minor soil compaction and abrasion may occur as a result of trail use by pack animals and associated camping near treatment sites. However, this is an accepted means of transportation in this primitive area. This amount of stock would be similar to what is currently used by private and commercial users who install, use and maintain hunting and fishing camps.

It is not likely that the piscicides would have a negative impact on plant species. For example, antimycin, has been used in Japan as an extremely effective fungicide on rice plants (Harada, et al. 1959; Dunshee, et al. 1949). Based on the fact that it is used to control fungus on living rice plants without apparent damage and that the concentrations used to kill fish are very low, it is unlikely that there would be any effects on vegetation in the project area. Schnick (1974b) also listed several researchers who reported rotenone having no affect on either algae or rooted aquatic vegetation. Many of the same researched listed in Schnick (1974b) reported an increase in plankton density

immediately following a rotenone application. This phenomenon is corroborated by Bradbury (1986) who reported that 9 of 11 water bodies in Washington treated with rotenone demonstrated an algae bloom. Bradbury attributed this to an increase in phosphorus resulting from the decaying fish through bacterial breakdown and release of bound organic and dissolved inorganic forms.

There are no known occurrences of water howellia in the affected environment. There are no vernal pothole ponds or abandoned river oxbows within any areas affected by this project. As Handkerchief Lake is the only lake at an elevation that could support water howelliia, appropriate surveys for the listed plant would be conducted by a qualified botanist prior to any activity in this area. If water howellia is discovered, appropriate actions would be taken to ensure that these plants are not disturbed during the application process (such as temporary flagging and fencing of these areas). No impacts on water howellia, its habitat, or potential habitat would occur as a result of implementing Alternative B.

If there are any occurrences of slender moonwart in the project area, only ground disturbance in the nature of ripping up the soil would possibly affect plant root systems or associated **mycorrhizal fungi**. Since the seasonal implementation period for the treatments is in August and September, the plants would probably have already **sporulated**, thus partially protecting them from adverse effects on propagation. In addition, non-native weeds brought in along trail corridors by hikers and livestock may also have long-term effects on population viability if there were unknown occurrences within the project area.

Forest sensitive plants may occur in the affected environment. Because equipment and personnel would be flown into Black Lake, there would probably be no effects on *Diphasiastrum sitchense*. Similarly, the potential for adverse effects on *Salix barrattiana* along lake shores within the project area would be minimal. The nearest known occurrences are in Glacier County. Although there would be some potential for these species to occur at higher elevation, it is not likely that they would be impacted. Unknown occurrences of these plants would only be affected if trails bisect the screes and gravelly slopes where most of the habitat is located for these plants (Davis 2003).

In the event of spill of any chemicals or fuels, clean-up will follow the MFWPs spill-contingency plan developed as part of the treatment plan for each lake. This will address specifically how to handle clean-up and or disposal of contaminated soil. These plans will follow suggestions from the product labels, the Material Safety Data Sheets or other plans and manuals.

3.5.6.2 Cumulative Effects on Soil and Vegetation Resources

Alternative B would have no cumulative effects on soil or vegetation resources.

3.5.7 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.5.7.1 Direct and Indirect Effects on Soil and Vegetation Resources

The effects of Alternative C would be less than those discussed under Alternative B (Section 3.5.6.1) as there would be no hikers or livestock to disturb soils and vegetation along trails, or to convey non-native weed seeds. In addition, since personnel crews and their accompanying livestock, camp sites and equipment, and chemical stockpiles, would

be located at lakes for a shorter period of time, there would be less physical disruption to the environment.

As for Alternative B, in the event of a spill of any chemicals or fuels, clean-up will follow the MFWPs spill-contingency plan.

3.5.7.2 Cumulative Effects on Soil and Vegetation Resources

The effects would be the same as those for Alternative B (Section 3.5.6.2).

3.5.8 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.5.8.1 Direct and Indirect Effects on Soil and Vegetation Resources

Even though suppression techniques used at each lake may differ based on differing environments, the impacts to soil and vegetation resources would be similar. Suppression techniques, such as gill-netting, trapping, or seining would require long-term activity by personnel such as camping near lakeshores, the use of motorboats to set and check nets or traps, and transport to and from the lake. Each of these activities would likely be continued for several years. Long-term camping and storage of equipment would lead to trampling of vegetation, soil compaction, loss of vegetation cover, and ultimate site degradation.

Research has shown that vegetation response to trampling is dependent more on plant morphology than on specific site conditions. In general, erect herbs are readily damaged by trampling, but recover quickly. **Chamaephytes** (low-growing **forbs**) are more resistant, but take longer to recover. Non-erect herbs are the most stable when subjected to trampling (Cole 1995a, 1995b). Site-specific impacts can be predicted based on the structure of local plant communities.

Alternative D would not impact water howelliia or any other listed species (see 3.5.6.1).

3.5.8.2 Cumulative Effects on Soil and Vegetation Resources

Alternative D may have cumulative effects on soil and vegetation resources as a result of long-term camps being established near the lakes to carry the activities proposed in this Alternative.

3.6 Land Use and Wilderness Resources

There are several administrative and legislative land use designations superimposed over the project area in the South Fork Flathead River Drainage on the Flathead National Forest. Designated wilderness, special use areas, and other management areas on the Flathead National Forest are all treated differently in terms of access, use, and management practices.

3.6.1 Hiking Area Designation

The Jewel Basin Hiking Area (Management Area 19) consists of about 15,000 acres. The area provides opportunities for a recreational experience between that found in wilderness and areas accessible by roads, but satisfied by neither. The area is managed for semi-primitive non-motorized recreational opportunities. This area is recommended for wilderness classification; therefore, the FS is to protect all wilderness values that presently exist. The Jewel Basin Hiking Area is located on the Swan Lake and Hungry Horse ranger districts, Flathead National Forest.

Packstock, motorized vehicles, motorized equipment, mechanized vehicles, and helicopter landings are not permitted in the hiking area by the public. The Forest Supervisor may authorize use of motorized equipment or livestock as deemed necessary for the administration of the area and its resources.

3.6.2 Wilderness Designation

A portion of this proposed project would occur in The Bob Marshall Wilderness (Management Area 21), classified in 1964 by the U. S. Congress. The Spotted Bear Ranger District, Flathead National Forest, manages about 70 percent of the designated

Figure 3-4. A high mountain lake in the Bob Marshall Wilderness.

wilderness. These areas are managed to: "preserve wilderness character, to allow natural processes to operate freely, and for the use and enjoyment of the American people."

Motorized vehicles, motorized equipment, mechanized trail vehicles, and helicopter landings are not conforming uses; the public is not permitted these uses in the Wilderness Area. Examples of exceptions that have been granted in the past include search and rescue and firefighting. However, the Forest Supervisor may authorize use of motorized equipment as deemed necessary for the administration of the area and its resources. MFWP is committed, to the extent possible, to minimizing the number of aircraft trips in and out of the Wilderness Area and National Forest. The Regional Forester may authorize chemical treatments to prepare waters for reestablishment of certain species.

The management direction for the BMWC focuses on delivery and preservation of those wilderness-related benefits specified in the Wilderness Act of 1964; the National Forest Management Act of 1976; the Department of Agriculture and FS policy guidelines; the Forest Plan; and the Flathead Land and Resource Management Plan of 1986. The Flathead Land and Resource Management Plan of 1986 includes the amended Recreation Management Direction of 1987 for the BMWC; the International Association of Fish and Wildlife Agencies 1986 agreement; the Fish, Wildlife and Habitat Management Framework for the BMWC (FS and MFWP 1995) and February 1997 Supplement. Selected excerpts from these laws and management guidelines follow.

3.6.3 Wilderness Mandates, Policies, and Directives

3.6.3.1 Federal

Primary direction for managing Wilderness comes from the Wilderness Act of 1964 (PL 88-577). According to the Act, the purpose for establishing Wilderness areas is:

> " . . . to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States . . . leaving no lands designated for preservation and protection in their natural condition. . . . " (Subsection 2a)
>
> " . . . for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness and so as to provide for the protection of those areas, the preservation of their wilderness character . . . " (Subsection 2a)

Several subsections of the Act further characterize Wilderness and address the administration of these congressionally designated lands:

> "A Wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." (Subsection 2c)
>
> ". . . an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements of human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of

> land . . . ; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic or historical value . . .” (Subsection 2c)
>
> “. . . wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation and historical use.” (Subsection 4b)
>
> “. . . there shall be no commercial enterprise and no permanent road within any wilderness area designated by this Act and, except as necessary to meet minimum requirements for the administration of the area for the purpose of this Act . . . there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area.” (Subsection 4c)

Primary direction for managing National Forests comes from the National Forest Management Act of 1976.

> “In developing, maintaining, and revising plans for units of the National Forest System pursuant to this section, the Secretary shall assure that such plans--(1) provide for multiple use and sustained yield of the products and services obtained there from . . . and, in particular, include coordination of outdoor recreation, range, timber, watershed, wildlife and fish, and wilderness.” (Subsection 6e)

Wilderness management is also discussed in the context of forest planning in the following sections of the Code of Federal Regulations:

> 36 CFR Part 219.18 Planning--Wilderness Management
>
> “Forest planning shall . . . provide for limiting and distributing visitor use of specific areas in accord with periodic estimates of the maximum levels of use that allow natural processes to operate freely and that do not impair the values for which wilderness areas were created . . . ”
>
> 36 CFR Part 261.16 Prohibitions--Wilderness
>
> “Prohibits motor vehicles, motorboats, motorized equipment, bicycles, hang gliders, aircraft landings, and dropping or picking up of materials or people by aircraft.”
>
> 36 CFR Part 293.2 Wilderness
>
> “ . . . In carrying out such purposes, National Forest Wilderness resources shall be managed to promote, perpetuate, and, where necessary, restore the wilderness character of the land and its specific values of solitude, physical and mental challenges, scientific study, inspiration, and primitive recreation. To that end:
>
> (a) Natural ecological succession will be allowed to operate freely to the extent feasible.
>
> (b) Wilderness will be made available for human use to the optimum extent consistent with the maintenance of primitive conditions.

> (c) In resolving conflicts in resource use, wilderness values will be dominant to the extent not limited by the Wilderness Act, subsequent establishing legislation, or the regulations in this part."

3.6.3.2 State

The state has no specific mandate to manage fish and wildlife in a wilderness area; however the powers and duties of the agency include statutory directives for fish and wildlife management in the state including:

M.C.A. 87-1-702.

The Montana Fish, Wildlife & Parks (FWP) " . . . is hereby authorized to perform such acts as may be necessary to the establishment and conduct of fish restoration and management projects…"

M.C.A. 87-1-201

(9) (a) . . . the department shall implement programs that:

> (i) Manage wildlife, fish, game, and non-game animals in a manner that prevents the need for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531et seq.;
>
> (ii) Manage listed species, sensitive species, or a species that is a potential candidate for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531et seq., in a manner that assists in the maintenance or recovery of that species.

3.6.3.3 Forest Service Policy

The FS Manual Direction for Wilderness (FSM 2320, June 1990) indicates that Wilderness is a unique and vital resource. In addition to offering primitive recreational opportunities, it is valuable for its scientific and educational uses, as a benchmark for ecological studies, and for the preservation of historical and natural features.

FSM 2320 takes its authority from the Wilderness Act of 1964 and states several FS objectives (FSM 2320.2):

> "Maintain and perpetuate the enduring resource of wilderness as one of the multiple uses of National Forest System land."
>
> "Maintain wilderness in such a manner that ecosystems are unaffected by human manipulation and influences so that plants and animals develop and respond to natural forces." This proposal is designed to help correct ecosystem imbalances caused by past actions (i.e., stocking and illegal species introduction).
>
> "Minimize the impact of those kinds of uses and activities generally prohibited by the Wilderness Act, but specifically excepted by the Act or subsequent legislation."
>
> "Protect and perpetuate wilderness character and public values including, but not limited to, opportunities for scientific study, education, solitude, physical and mental challenge and stimulation, inspiration, and primitive recreation experiences."

The wilderness management model outlined in FSM 2320.6 describes the philosophy that should drive management decisions:

> "Manage wilderness toward attaining the highest level of purity in wilderness within legal constraints."
>
> "Where a choice must be made between wilderness values and visitor or any other activity, preserving the wilderness resource is the overriding value. Economy, convenience, commercial value, and comfort are not standards of management or use of wilderness."

Management direction for the use of motorized equipment or mechanical transport in wilderness as it pertains to this proposal is found in FSM 2326 which states: "Do not approve the use of motorized equipment or mechanical transport unless justified as described in 2326.1" (FSM 2326.03).

FSM 2326.1 lists several acceptable "conditions under which use may be approved." Condition five states:

"Allow the use of motorized equipment or mechanical transport only . . . to meet minimum needs for protection and administration of the area as wilderness, only as follows:

> a. A delivery or application problem necessary to meet wilderness objectives cannot be resolved within reason through the use of nonmotorized methods.
>
> b. An essential activity is impossible to accomplish by nonmotorized means because of such factors as time or season limitations, safety, or other material restrictions."

However, FS wilderness management policy dictates that, "Where there are alternatives among management decisions; wilderness values shall dominate over all other considerations except where limited by the Wilderness Act, subsequent legislation, or regulations" (FSM 2320.3). Maintaining naturalness and wildness should dominate what the BPA, FS, and MFWP do in relation to this proposal.

3.6.4 Wilderness Experience

Based on the language in the Wilderness Act (Subsection 2c), wilderness experiences should be characterized by naturalness and solitude. Management influence should not dominate the experience.

3.6.4.1 Naturalness

Wilderness naturalness is generally diminished or enhanced by recreational impacts, nonconforming but allowed uses, and natural processes. Recreational impacts due to overuse of a particular area, such as trampling, devegetation, social trails, and depleted firewood and littering all contribute to the lack of perceived naturalness by wilderness visitors and can negatively impact the experience.

Special provisions that are allowed in wilderness, but are nonconforming have great potential for diminishing the perceived naturalness of wilderness and should be managed to minimize intrusion. Examples of special uses that impact naturalness include: commercial grazing, mining infrastructure, access roads for administrative use or "inholding" landowners. Aircraft use in wilderness would fall into this category and should be used with great discretion. However, aircraft have the benefit of not leaving a lasting footprint on the land and of minimizing impact duration to a few hours.

Natural ecological processes and wildlife are easily observable signs of naturalness that most users identify readily and associate with a high-quality wilderness experience.

Charismatic **megafauna** (e.g., deer, moose, and eagles) normally top this list, while other natural processes such as wildfire and avalanches are perceived in a more negative light. Education of these processes can often clarify perception (Hendee and Dawson 2002).

3.6.4.2 Solitude

Wilderness solitude is a relative term that varies in meaning from one visitor to the next. It is an important component of the wilderness experience; however, social conditions tend to affect experiences more than natural conditions. Solitude is defined and impacted by the presence of other visitors, conflicts with other visitors, and visitor behavior.

Managers often try to manage for solitude by minimizing crowding of the resource. This is usually expressed in terms of the number of encounters per day. These levels of acceptable use are set by managers in response to user surveys and wilderness research that relate visitor satisfaction with the experience to density of users during a given time period. Solitude can also be impacted by encounters with nonrecreational uses, such as grazing, mining, or administrative uses that create noise, air pollution, or other distractions. These conflicts of uses have the potential to negatively impact the wilderness experience. Even different types of recreational users may have their experiences impacted by unwanted encounters with each other. Examples include encounters between an individual and groups or hikers and equestrians. Different or conflicting uses and their impact on the wilderness solitude experience can be tempered by associated visitor behavior such as littering, rule breaking, and yielding trail rights-of-way (Hendee and Dawson 2002).

3.6.5 Minimum Tool Analysis

The FS prepared a Draft Minimum Tool Analysis in 2003 to determine if administrative action was warranted and, if so, to determine the minimum tool required to address the need. The FS determined that the issue could not be resolved outside of wilderness and that if the issue is not resolved, or action not taken, the natural processes of the wilderness would be adversely affected by allowing the loss of genetically pure stocks of westslope cutthroat trout in the South Fork drainage. If the current situation is allowed to continue, the wilderness would continue to be home to non-native fish species and the remaining native cutthroat may be lost. These species are evidence of human manipulation due to their introduction in the past by fish managers and others (for reasons different than those that drive fish stocking practices today) before the area was designated as wilderness. A Final Minimum Tool Analysis is not normally completed prior to having an approved decision.

In the draft minimum tool analysis, the application of piscicides by motorboat, transported by packstring--except to inaccessible lakes such as Lick and George Lakes where a helicopter would be used to transport supplies, equipment, personnel--and utilizing an outboard motor for distributing the antimycin in the water, is preferred over other methods that may prove disruptive to wilderness solitude and entail repeated, long-term applications. (Long-term applications require the continued use of outboard motors. See Alternative D for a description.) Because pack stock is not allowed in the Jewel Basin Hiking Area, , application by aircraft and motorboat at target lakes would fulfill minimum tool requirements and best address the resource values. Antimycin is preferred for the wilderness lakes because it requires fewer trips for transport of supplies than other piscicides, thereby reducing potential impacts to the environment and wilderness visitors. Furthermore, its properties make it easier to contain in drainages that contain non-target species like the bull trout.

Rotenone is preferred for most Jewel Basin Hiking Area and National Forest lakes because it is suitable for application by aircraft in certain situations. Also rotenone's properties make it beneficial to achieve downstream objectives, unlike antimycin that must be reapplied more frequently due to its degradation in rapidly flowing streams. This draft Minimum Tool Analysis would be re-evaluated after the environmental analysis for the project is complete and the EIS is finalized.

3.6.6 Environmental Consequences of Alternative A (No Action)

3.6.6.1 Direct and Indirect Effects on Land Use and Wilderness Resources

There would be no change in conditions under this alternative.

3.6.6.2 Cumulative Effects on Land Use and Wilderness Resources

There would be no change in conditions under this alternative.

3.6.7 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.6.7.1 Direct and Indirect Effects on Land Use and Wilderness Resources

In protecting the South Fork native cutthroat populations, the genetic integrity of the westslope should be enhanced both in and out of the wilderness. Addressing the issue of protecting the species would take a step toward improving the biological integrity of the wilderness by replacing non-native species with a native species.

Since antimycin requires less volume per area treated than other piscicides, fewer aircraft trips and pack animals would be required, limiting associated impacts. The wilderness experience (e.g., solitude) of users in the area may be affected during the time of delivery and application. This includes the intrusion of additional people, stockpiling of material for those areas delivering material by traditional means (stock), setting up campsites, and the sight and sound of aircraft and other motorized equipment. These impacts would also occur in non-wilderness areas.

To reduce the number of trips, SEAT aircraft, instead of helicopters, would be used for non-wilderness applications where possible. Most lakes would be treated over a three to four day period of time. There would be moderate short-term adverse impacts on proposed wilderness due to noise and disturbance from flights.

There would be a temporary reduction (1 to 3 years) in angling opportunity at treated lakes.

The planned stocking of genetically pure westslope cutthroat trout following removal of hybrids would return the overall angling conditions similar to those that are present today.

3.6.7.2 Cumulative Effects on Land Use and Wilderness Resources

There are no cumulative effects.

3.6.8 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.6.8.1 Direct and Indirect Effects on Land Use and Wilderness Resources

The effects on Jewel Basin and non-wilderness areas would be the same as those in Alternative B (see section 3.6.7.1). Wilderness sites would experience slightly more impact as there would be additional aircraft flights than proposed in Alternative B.

3.6.8.2 Cumulative Effects on Land Use and Wilderness Resources

There are no cumulative effects.

3.6.9 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.6.9.1 Direct and Indirect Effects on Land Use and Wilderness Resources

The effect of Alternative D on wilderness resources would be of longer duration than that of Alternatives B or C. Examples from the literature indicate that to implement such a program would require a substantial commitment of personnel over many years, and would likely result in an inability to meet the project goal of complete fish removal. The use of the suppression technique of gill netting involves long periods of trapping and netting that require the use of an outboard motor and boat. Alternatives B and C, to be successful, apply such use for one or two days rather than the entire season. Swamping would also affect the wilderness resource since fish populations would be artificially sustained as opposed to a self-sustaining natural fishery. The use of gill netting and other suppression techniques would disrupt natural wilderness processes.

3.6.9.2 Cumulative Effects on Land Use and Wilderness Resources

There would be no cumulative effects.

3.7 Recreational Resources

3.7.1 Recreational Use

The scenic landscape and primitive setting draws a variety of recreational users to the Flathead Valley. A partial list of recreational activities includes:

- Backcountry camping and hiking
- Horseback riding
- Sport fishing (rivers, lake, stream)
- Hunting
- Trapping
- Winter sports (backcountry skiing, cross-country skiing, snowmobiling, snowshoeing)
- Wildlife viewing/bird watching
- Photography

Recreational public uses such as sightseeing, hiking, camping, and snowmobiling would be expected to continue. Public use is anticipated to increase over the next 10 years.

Visitor use studies for the BMWC were completed in 1970 and 1982. There is a sense that recreational use is generally up over the last 20 years, with increased summer use from activities such as backpacking and rafting, and some increase in stock use. Fall use, related primarily to hunting, has decreased some. An additional visitor use study was conducted in 2003. At this time only a preliminary analysis of the data is available, however it is consistent with the 1970 and 1982 studies. There is low foot and stock use in the South Fork Flathead drainage during June. There is still snow remaining in the high country and creeks are high because of spring runoff. Conditions are also rainy. Most passes are open by early July. In July and August, foot, stock and raft use increases dramatically as most snow has melted, rivers have returned to moderate levels, and warmer temperatures dominate. In the South Fork, a large percentage of use is concentrated along the South Fork Flathead River and the lakes containing fish.

In July and August, many of the lakes receive moderate to high foot and stock use. Most of the use requires overnight stays because of the long distances traveled to get in and out of the area. Some summer outfitter base camps offer clients day or overnight use at lakes. Shaw Creek base camp is used both in the summer and fall and is located within two to six miles of several of these lakes. The lakes are readily accessible which allows for day use throughout the summer. Those lakes on the fringes of the wilderness or near summer outfitter base camps typically receive more use than those lakes that are 15 to 20 miles from a trailhead and take two to three days to access.

MFWP uses angler log reports to estimate the amount of fishing pressure a particular water or group of waters in the South Fork Flathead drainage receives. Because this is only a survey and not a census, the data are used to provide a measure of the estimated amount of angling pressure that any water receives. This is a statistically valid sampling method. These statistics may be used for a variety of reasons, including:

1. Estimating the amount of angler use on a particular water or group of waters,

2. Determining the presence of any angler use of a particular water, or
3. Trends in angler use between years.

It is recognized that, in certain years, use may be underestimated on some lakes and overestimated on others. However, multiple year sampling and combining estimates on multiple lakes helps to estimate the amount of angler use for all lakes over an extended period of time.

Table 3-6. Angler use estimates for select lakes in the South Fork Flathead River drainage from 1989 to 2001, and statewide rank based on 1,529 fisheries in the state.

Lake	*1989*	*1991*	*1993*	*1995*	*1997*	*1999*	*2001*	*Mean*	*State ranking*
Big Hawk	---	99	---	44	38	---	---	60	1173
Black	48	89	199	196	135	38	41	107	912
Blackfoot	1282	75	25	311	34	123	478	332	479
Clayton	164	304	289	116	396	83	368	245	579
George	60	76	---	180	---	---	---	105	923
Handkerchief	1096	327	632	703	573	660	924	702	320
Koessler	---	---	---	---	---	---	---	---	---
Lena	---	---	---	165	---	---	---	165	712
Lick	---	---	---	88	---	---	---	88	983
Margaret	288	56	105	250	108	42	36	127	846
Necklace (4)	---	---	189	---	46	---	---	118	869
Pilgrim	---	---	---	---	---	34	---	34	1404
Pyramid	72	37	25	---	---	83	69	57	1175
Sunburst	103	49	115	175	39	45	149	96	965
Three Eagles (2)	---	---	---	---	---	---	---	---	---
Wildcat	181	74	40	148	39	90	214	112	886
Woodward	60	572	---	34	67	45	---	156	732
Total								**2493**	**157**

Source: Montana statewide angler pressure (MWFP 1989, 1991, 1993, 1995, 1997, 1999, 2001), Bozeman.

The big game hunting season in the Bob Marshall and Great Bear wildernesses (hunting districts 150 and 151) begins September 15. Use is fairly heavy from mid-September to late October, and then tapers off as the statewide big game season begins in late October. Most fall use is stock related and 40 to 50 percent of the total fall use is outfitter related. There are several fall base camps that are within day use distance of lakes that are proposed for treatment. While most of the use in the fall is geared towards hunting, there

Figure 3-5. A young angler on the Flathead National Forest.

is the occasional fishing experience, and mixing of services is provided. The outfitters that operate in the base camps near the lakes proposed for treatment would have a changed condition in relation to fishing opportunities (size success) at least for the short-term. In the first three years following treatment there would likely be angling opportunities, but they would be different than those that were available prior to treatment.

3.7.1.1 Limits of Acceptable Change Plan

The Limits of Acceptable Change (LAC) plan for the BMWC was completed in 1987 and amended to the Forest Plan. LAC serves as a tool to help manage visitor use and impact on the forest. LAC data have been collected and assembled for two consecutive five-year periods (1988-1992 and 1993-1997). Most data have been collected for the 1998-2002 period, but have not yet been input into the database. Many lake sites exceeded LAC standards at the time the LAC plan was written. Overall, standards for most areas are improving, but most lakes that contain, or may contain fish, have exceeded LAC standards. This may be attributed to reasons other than fish presence, including location along a mainline trail, outfitted use, and convenience. For example, many alpine lakes are attractive to visitors for their scenic setting and wild, remote conditions that provide solitude. Lakes situated along a mainline trail may also provide a convenient place to rest and obtain water.

Opportunity Classes represent a spectrum of wilderness experience opportunities within the BMWC. These classes describe existing areas where different resource and social conditions are found. The primary determinant of these classes is the setting, which describes the overall environment in which recreation occurs. Setting also influences what specific types of activities can occur and, ultimately, determines what types of experiences users can achieve. The setting is formulated using a number of factors such as remoteness, size, and amount of landscape alteration or development, number of

recreational users and their noticeability, and management constraints. Recreation opportunity classes also identify management actions that are acceptable within each class. Inherent in the descriptions are different levels of resource and social conditions acceptable for each class in the spectrum.

Three components are used to describe opportunity classes: resource, social, and managerial settings. Each component has several elements that are used to describe differences between opportunity classes. One end of the spectrum includes Opportunity Class I, which is the most pristine designation; at the other is Opportunity Class IV, which allows for the widest range of use and impacts while still retaining overall Wilderness character.

Opportunity Class I (OCI)

Woodward Lake (65.0 acres) is in OC I. Woodward has exceeded the standards of two of four LAC indicators. This is down from three exceeded standards in the past. The lake receives moderate levels of foot and stock summer and fall use.

Resource Setting—Opportunity Class I is characterized by an unmodified natural environment. Ecological and natural processes are not measurably affected by the actions of users. Environmental impacts are minimal, restricted to temporary loss of vegetation where camping occurs and along some stock travel routes. These areas typically recover on an annual basis, are subtle in nature, and generally not apparent to most visitors.

Social Setting—This area provides an outstanding opportunity for isolation and solitude free from evidence of human activities, and very infrequent encounters with users. The user has outstanding opportunities to travel across country utilizing a maximum degree of outdoor skills. This environment often offers opportunities for a very high degree of challenge, self-reliance, and risk. Interparty contacts will be very few while traveling and rare to non-existent at the campsite.

Managerial Setting—Management strongly emphasizes sustaining and enhancing the natural ecosystem.

Opportunity Class II (OCII)

Lena, Lick, Koessler, and George Lakes are all in OCII. Lena Lake (74.2 acres) is utilized by the outfitted summer Shaw base camp that is located 5.4 miles away, as well as by other foot and stock users. Lena exceeds two of four standards for LAC indicators. Lick Lake (19 acres) went from one to two of the four LAC indicators with exceeded standards. Koessler Lake (81.5 acres) exceeds the standards on all four of the four LAC indicators. Koessler Lake is accessed by the outfitted summer Shaw base camp that it located 4.1 miles away, as well as by other foot and stock users. Use is mostly summer foot and stock access to fish. George Lake (114.2 acres) has increased from one to three of four LAC indicators with exceeded standards. Most use is expected to be summer foot cross-country travel to fish at the lake.

Resource Setting—Opportunity Class II is characterized by an essentially unmodified natural environment. User actions minimally affect the ecological and natural processes and conditions. Environmental impacts are low and restricted to minor losses of vegetation where camping occurs and along most travel routes. Most impacts recover on an annual basis and will be apparent to only a low number of visitors.

Social Setting—A high opportunity exists for exploring and experiencing isolation from the sights and sounds of man with the probability of encountering other users being low.

The user has good opportunity for experiencing independence, closeness to nature, tranquility, and self-reliance through the application of primitive recreation skills. These opportunities occur in an environment that offers a high degree of challenge and risk. Interparty contacts will be low on the trail and fairly low at the campsite, with parties often camped in isolation.

Managerial Setting—Management will emphasize sustaining and enhancing the natural ecosystem.

Opportunity Class III (OCIII)

Both Sunburst Lake and Pyramid Lake are in OCIII. An essentially unmodified natural environment is expected in OCIII. Sunburst had only one of four LAC indicators with exceeded standards. This is a popular summer overnight camping area and fishing destination for people on foot and with stock. Pyramid Lake (8.9 acres) has two of four LAC indicators with exceeded standards. There is fairly heavy foot and stock summer use.

Resource Setting—Opportunity Class III is characterized by an essentially unmodified natural environment. In a few areas ecological and natural processes are moderately affected by the action of users. Environmental impacts are moderate, with most areas along travel routes and near human impacted sties showing moderate losses of vegetation. Impacts in some areas often persist from year to year and are apparent to a moderate number of visitors.

Social Setting—Moderate opportunities for exploring and experiencing isolation from the sights and sounds of man, with the probability of encountering other users being low to moderate. The user has moderate opportunities for experiencing independence, closeness to nature, tranquility and self-reliance through the application of primitive recreation skills. These opportunities occur in a natural environment that normally offers a moderate degree of challenge and risk. Contact with other visitors both on the trail and while camped will be moderately frequent.

Managerial Setting—Management will emphasize sustaining and enhancing the natural ecosystem.

Opportunity Class IV (OCIV)

The four Necklace Lakes are in OCIV and include Lower (13.8 acres), Middle Lower (3.7 acres), Middle Upper (9.5 acres), and Upper (8.7 acres). For all lakes, most camping and fishing use occurs in summer by foot and stock users. There is some fall hunting use.

- Lower and Middle Lower have one of four LAC indicators exceeded.
- Middle Upper Lake went from zero to two of four LAC indicators exceeded.
- Upper Lake did not exceed standards for any indicator.

Resource Setting—Opportunity Class IV is characterized by a predominantly unmodified natural environment. Natural conditions in many locations may be substantially affected by the action of users. Environmental impacts are relatively high in areas along major travel routes, along popular river corridors and lakeshores, and near major entry points. Impacts often persist from year to year and there may be moderate loss of vegetation and soil at some sites. Impacts are readily apparent to most visitors.

Social Setting—Opportunities for exploring and experiencing isolation from the sights and sounds of man are moderate to low. The probability of encountering other area users is moderate to high. The user has the opportunity for a high degree of interaction with

the natural environment, often with low or moderate challenge and risk. Much of the time contacts with other users will be relatively high, both on the trail and at campsites. It may be common during the main use season for some parties to come within sight and sound of each other.

Managerial Setting—Management will be oriented to sustaining and enhancing the natural ecosystem.

3.7.1.2 Indicators

Indicators of resource and social conditions were identified within the BMWC (see table 3-7). Indicators establish a basis for identifying a need for management action for both areas and specific sites where conditions may be in conflict with those selected as management objectives. Indicators were selected based on their relevancy to the identified issues, the presence of a valid and reliable method of measurement, their sensitivity to change in resource and social conditions, and their ability to monitor conditions.

Table 3-7. LAC indicators for the Bob Marshall Wilderness Complex.

Issue	Indicator
Social	
Solitude while traveling	Number of trail encounters per day
Campsite solitude	Number of other parties camped within sight or continuous sound per day
Environmental	
Human impacted site conditions	Area of barren soil core (sq. ft.) at each human impacted site (excluding authorized horse handling facilities)
	Number of human-impacted sites per 640-acre area
	Number of human impacted sites above a particular condition class index per 640-acre area
Range conditions	Degree of forage utilization (percentage)
	General trend
	Overall condition
	Visual appearance (Maximum impact)
	Forest succession, vegetation changes

Source: Bob Marshall Wilderness Complex Recreation Management Direction – 1987 for the Bob Marshall Wilderness Complex, amended 1987 in the Flathead, Lolo, Lewis and Clark and Helena National Forests, Land Management Forest Plans.

Each opportunity class has specific standards (thresholds or limits of acceptable change to resource or social conditions) that indicators are supposed to measure. In most of the lake areas, the following indicators have been measured and have met the standard for the applicable opportunity class:

- Number of human impacted sites per 640-acre area
- Number of human impacted sites above a particular condition class index per 640-acre area
- Area of barren soil core at each human impacted site

3.7.1.3 Scenery

The Flathead National Forest offers an array of spectacular glaciated peaks and alpine lakes that visitors can use for hiking, camping, fishing, wildlife watching, and other activities. The visual prominence of the mountains defines this area and serves as both a barrier and a backdrop for the forest. The establishment of the forest, BMWC, and nearby Glacier National Park was rooted in the preservation and appreciation of the scenic resources of the area, which are still very important.

The lakes mostly occur in a natural forested environment, punctuated by open meadows and tumbling mountain streams. Many lake sites offer stunning vistas of surrounding mountains and forested hillsides.

3.7.1.4 Soundscape

Soundscapes are acoustic (pertaining to sound) environments. People experience soundscapes by hearing, rather than by seeing. Soundscapes may include both mechanical and natural sounds. They may vary in their character from day to night, and from season to season.

Natural Soundscapes are resources that may include sounds created by wind, flowing water, mammals, birds, insects, and other biological and physical components.

Natural Ambient Sound Levels are the natural soundscape conditions that exist in a park in the absence of any human-produced noise. This is sometimes referred to as **natural quiet**.

Natural sounds predominate through most of the forest. Natural sounds include those made by animals, water, wind, and other natural phenomena. Natural quiet does not mean complete silence; it exists when the only sound produced is by the natural and historic components of the landscape. Most agree that it is thought of as a mixture of mostly low decibel background sounds punctuated by the songs and wingbeats of birds and insects, or by the faint clatter and calls of other wildlife.

In the wild, sound is a matter of life and death. Birds, insects, mammals, and amphibians rely on complex communication networks to live and reproduce. In habitats where wildlife vocalizations signify mating calls, danger from predators, or territorial claims, hearing these sounds is essential to animal persistence and survival. It is also a critical part of the wilderness and recreation experience sought by the millions who visit the Flathead National Forest and BMWC each year.

Intrusive noise levels vary depending on time, wind direction, and location. Sources of noise in the forest include road traffic, motorboats, and human activity (e.g., generators, music, and people). There are also administrative activities that create noise, such as helicopter flights. Noise is generally concentrated and more apparent in developed areas and along roads.

3.7.2 Environmental Consequences of Alternative A (No Action)

3.7.2.1 Direct and Indirect Effects on Recreational Resources

There may be future restrictions on recreational angling resulting from continued degradation of the cutthroat. It is possible that more restrictive angling or elimination of angling for sensitive species would need to be implemented over time. Alternative A could lead to a decline in westslope cutthroat trout populations, potentially leading to a listing that could affect fishing and tourism, and outfitters and guides.

3.7.2.2 Cumulative Effects on Recreational Resources

There would be no change in conditions under this alternative. The potential loss of pure westslope cutthroat trout in one of the largest strongholds in the United States would impact the quality of angling opportunities now and in the future.

3.7.3 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.7.3.1 Direct and Indirect Effects on Recreational Resources

Humans in the flight paths or areas near lakes being treated could find bothersome noise and visual effects from aircraft, motor boats, humans, and pack animals. These impacts would be temporary and minimal. Noises and odors from motorboats, pump motors, and aircraft during application would be limited to the duration of treatment.

The treated lake water would appear somewhat milky immediately after the treatment, but would become clear again within a short time.

The LAC standards are not expected to change with the implementation of alternative B. There could be more natural rehabilitation of existing camp sites as the lakes within wilderness would not be popular destinations with anglers immediately following treatment, though the lakes could still be popular places to camp.

During transport and application within Jewel Basin, users would have a much different experience than what they would likely be expecting; additional aircraft would change visitor experience.

Angling limits could be lifted a few years prior to any action in order to allow the public to remove as many fish as possible.

3.7.3.2 Cumulative Effects on Recreational Resources

Angling opportunities on lakes scheduled for treatment may be temporarily improved as restrictions such as size and catch limits would be lifted for a season or two prior to treatment. After treatment, angler displacement would likely occur until the fishery recovered (usually one year but possibly up to three years later).

3.7.4 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.7.4.1 Direct and Indirect Effects on Recreational Resources

The effects would be the same as those for Alternative B (Section 3.7.3.1). In addition, during applications in wilderness, users in the helicopter flight zone could have their wilderness experience impacted, potentially affecting their level of satisfaction. This could be partially mitigated by signing trailheads with the dates, activities, and potential impacts on wilderness so users could make choices. Effects in Jewel Basin would be the same as Alternative B.

Angling limits could be lifted a few years prior to any action in order to allow the public to remove as many fish as possible.

3.7.4.2 Cumulative Effects on Recreational Resources

The effects would be the same as those for Alternative B (Section 3.7.3.2).

3.7.5 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.7.5.1 Direct and Indirect Effects on Recreational Resources

Users in and around areas near lakes being treated could find noise and visual effects from aircraft, motor boats, humans, and pack animals bothersome. Suppression techniques, such as gill-netting, trapping, or seining, would require long-term camping near lakeshores, use of motor boats to set and check nets or traps, and travel to and from the lake. Each of these activities would be continued from five to seven years, and would likely impact the recreational desirability of the lake and surrounding areas during that time.

Angling limits may be lifted a few years prior to any action in order to allow the public to remove as many fish as possible.

3.7.5.2 Cumulative Effects on Recreational Resources

The effects would be similar to those for Alternative B (Section 3.7.3.2), but with angler displacement extending to several years.

3.8 Socioeconomic Issues

3.8.1 Existing Conditions

The Flathead National Forest includes parts of six Montana counties: Flathead, Lincoln, Lake, Missoula, Powell, and Lewis and Clark. About three-fourths of the area of the Forest is in Flathead County. Flathead County encompasses 3,262,720 acres or 5,098 square miles. Approximately 94 percent of the land mass is National or State Forest Land, Wilderness, agricultural, and corporate timber land, thus confining development to the remaining six percent of the area. The project area has no private land holdings.

The region offers an abundance of recreational opportunities, including: Flathead National Forest, Glacier National Park, designated hiking areas, world class fly fishing, two ski resorts, Flathead Lake, and Hungry Horse Reservoir. Flathead County is among the fastest growing and is the fourth most populated county in Montana. The area is an important part of the Northern Continental Divide Ecosystem, which covers most of northwest Montana. This area has significant economic value on a regional, national, and international scale when recreation and tourism, wildlife, and aesthetic values are considered along with a significant timber management program. However, it is beyond the scope of this analysis to evaluate markets for all these resources because they have not been identified as significant economic issues with respect to the proposed action. The emphasis here is on the economic effects that the proposed action and alternatives would have on the local outfitters and guide industry.

Demographic trends in Flathead County are indicative of changes in the region and provide context for potential effects in the project area. There are three incorporated cities in Flathead County. Kalispell, which is the largest, has a population of approximately 14,223. Two additional major municipalities include Whitefish, with a population of 5,032; and Columbia Falls, with a population of 3,645. Countywide, according to the U.S. Census Bureau, population has increased from 59,218 in 1990, to an estimated 74,471 in 2000. This represents a 25.8 percent increase in 10 years. Residents native to Montana are now greatly out numbered by new residents. A large percentage of new residents are retirees and middle-aged professionals (Flathead County 2002).

Development of tourist attractions has greatly increased in recent years. This development has contributed to the influx of tourists and tourism based services, and moved the economic base towards Recreation and Tourism, and creating new jobs in the service industry. Flathead County's population increases by 40 percent during the months of June through August (Flathead County 2002).

This section presents a description of the local economic environment that could be potentially affected by the proposed action amendment along with an estimate of what those effects might be. Emphasis would be placed on those components of the economy that were identified throughout the scoping process, primarily through public comments.

The primary concern related to the economic environment was the ongoing viability of local outfitters and guides that rely on the fisheries resource for employment and income. Both residents and non-residents spend a substantial about of money in the Flathead County area in pursuit of their sport. Visitors to Montana spent $145,000,000 in Flathead County in 1998. In fact, tourism and ranching/farming vie for the state’s largest industry.

3.8.1.1 Commercial Outfitter and Guide Operations

The Fishing Outfitters Association of Montana and the Montana Outfitters and Guides Association list 44 outfitters in this part of the state. At least one-fourth of these companies offer fishing expeditions in the South Fork Subbasin or surrounding drainages. Several specialize in dry fly fishing for westslope cutthroat trout and actively promote guided angling for the native fish component of the area.

In the summer, a large percentage of use is concentrated along the South Fork Flathead River and the lakes containing fish. There are four summer outfitter base camps permitted that allow concentrated use in these and surrounding areas. Approximately 10 to 20 percent of the overall summer use is provided by outfitters. While summer roving use levels drop off by early September, outfitters begin to take in equipment for their fall hunting base camps at this time.

3.8.1.2 Tourism

Flathead National Forest is well known within the tourism industry. Many visitors coming to Glacier National Park extend their visits into northwest Montana, including portions of the forest. It is most likely that visitors to the Flathead would visit Jewel Basin, known widely for its day hikes and some of the wilderness lakes that are within one to two days of the trailheads (e.g., Pyramid and Sunburst Lakes). Visitors wanting a backcountry trip without hiking or stock may choose to visit Handkerchief Lake.

3.8.2 Environmental Consequences of Alternative A (No Action)

3.8.2.1 Direct and Indirect Effects on Socioeconomic Issues

Alternative A could lead to a decline in westslope cutthroat populations potentially leading to a listing that could affect tourism and outfitters and guides.

3.8.2.2 Cumulative Effects on Socioeconomic Issues

There would be no change in conditions under this alternative.

3.8.3 Environmental Consequences of Alternative B (Proposed Action: Fish Toxins – Combined Delivery and Application Methods)

3.8.3.1 Direct and Indirect Effects on Socioeconomic Issues

Individual lakes and portions of their outlet streams would be unable to serve outfitters and guides for angling for an estimated one to three years until a sport fishery is restored. MFWP and FS would work with those operating commercial services on lakes and streams in and out of the wilderness, and notify them well in advance of treatment so that they may schedule alternative sites for their activities.

Some of the lakes (Sunburst, Woodward, Necklace Lakes, Lena, Lick, Koessler, George, and Pyramid) under consideration for treatment are used by guides and outfitters as destinations, or as part of a wilderness fishing or hunting route. The “wilderness experience” of proceeding through an undisturbed and relatively pristine area is an implicit part of the excursion package offered to anglers or hunters. Access to these lakes varies from a managed system trail to cross-country access. Guides and outfitters are required to file an operational plan to indicate place, time, and duration of trips into the wilderness area. Within the wilderness in the South Fork drainage, there are 25 outfitters

that are permitted to operate in the summer season and 21 in the fall season. These plans are submitted to the FS for review and approval prior to use. The use is included in the annual operating plan with each specific permit. See table 3-6 in section 3.7.1 for historic use levels by lake.

Most summer-season use within the South Fork drainage is by roving trips—groups traveling on foot or with stock. The lakes proposed for treatment are included on some of the proposed itineraries. Many of the trips include fishing or just observation of different parts of the wilderness. Three base camps operate within the summer period in the South Fork. From approved base camp locations, guides and outfitters generally provide guests with day trips within the wilderness that could include visits to Woodward, Necklace Lakes, and Lena, Lick, Koessler, and George lakes. Another wilderness experience is provided via float trips on the South Fork River.

In the fall period there are approximately 21 approved base camp locations with most use related to the early fall hunting season, which begins on September 15. In addition to the general season, there is a four week period of hunting that opens at the end of October. The season is set by MFWP, and opening dates vary annually. Additional fishing and day trips, not related to hunting, occur in the fall period. Outfitters indicate the type of use that will be occurring on the annual itinerary request. All of the lakes identified within the wilderness would have some use occurring in the fall period by current outfitters. Camps are spread out within the South Fork drainage; there is a base camp near Pyramid Lake, one base camp within the Gorge Creek drainage near Sunburst Lake, and two base camps in the Lena, Lick, Woodward, George and Necklace Lakes areas.

3.8.3.2 Cumulative Effects on Socioeconomic Issues

There is expected to be a cumulative effect on regional guides and outfitters and associated tourism during the periods proposed for treatment. There would be an opportunity cost to guides and outfitters as potential tourists, adjusting for changes in expectation and experience, opt to delay their travel plans, visit other locations, or book expeditions through other guides and outfitters.

3.8.4 Environmental Consequences of Alternative C (Fish Toxins – Motorized/mechanized Delivery and Application Methods)

3.8.4.1 Direct and Indirect Effects on Socioeconomic Resources

The effects would be the same as those for Alternative B (Section 3.8.3.1).

3.8.4.2 Cumulative Effects on Socioeconomic Resources

The effects would be the same as those for Alternative B (Section 3.8.3.2).

3.8.5 Environmental Consequences of Alternative D (Suppression Techniques and Swamping)

3.8.5.1 Direct and Indirect Effects on Socioeconomic Resources

The effects would be the same as those for Alternative B (Section 3.8.3.1). Since angling would not be compatible with gill netting activities, these lakes would not be available to anglers. Additionally, while suppression activities are being implemented, the area may not provide the type of wilderness experience many people would be seeking. Eventually

these lakes would be fishable and the long-term effects for fishing would be the same as with Alternatives B and C.

3.8.5.2 Cumulative Effects on Socioeconomic Resources

The effects would be the same as those for Alternative B (Section 3.8.3.2).

3.9 Human Health

Although pesticides are used widely to control unwanted species, legitimate public concerns have been raised regarding the safety and health effects to humans. As with any pesticide, direct exposure to, or consumption of piscicides at full strength, can have harmful or sometimes fatal effects on humans. Rotenone and antimycin are EPA registered pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA).

3.9.1 Rotenone

There are no federal or Montana numeric water quality standards for rotenone; however, MDEQ (2001) used the EPA method of calculating human health criteria based on non-carcinogenic effects to estimate a safe level for life long exposure to water and the consumption of fish exposed to water containing rotenone: 40μg/L water plus fish. The calculation is based on several assumptions:

- Long-term (70 years) exposure,
- Average body mass of 70 kg (BW),
- A person consumes 2 L of water per day (DI),
- A person consumes 0.0065 kg of fish per day (FI),
- Reference Dose (RfD) for rotenone = 0.004 mg/kg-day (EPA, Integrated Risk Information System, IRIS)
- Some chemicals tend to increase in fish tissue over the concentration in the water or bio-concentrate. The amount the chemical increases in the fish relative to the ambient concentration is the bio-concentration factor (BCF). The BCF does not include possible food chain effects.

The calculation of the Rotenone criteria is as follows:

0.004 mg/kg-day (RfD) * 70 kg (BW)

2 L/day (DI) + (0.0065 kg/day (FI) * 770 L/kg (BCF))

The rotenone formulation that would be used contains five percent active ingredient. When the formulation is applied to achieve 1 mg/L in the water body, the active ingredient concentration is 0.05 mg/L or 50 μg/L. The target concentration would be 10 μg/L above the calculated long-term safe level. But the long-term safe level was determined using the standard assumption that fish would be exposed to rotenone and be able to bio-concentrate rotenone. This assumption is extremely protective. Rotenone is a natural chemical but is not naturally found in Montana, and is not a chemical likely to be found in fish that are commercially available for consumption. Fish exposed to rotenone at the target concentration would die within two to three hours; thus bio-concentration is very unlikely. Most of the dead fish in the treated lakes will sink to the bottom of the lake. Fish that wash up during the crew's presence at the lake would be collected for disposal.

The potential long-term risk to humans with water as their only source of rotenone exposure yields 140μg/L as a safe long-term concentration. Since tissue and water concentrations of rotenone decline quickly after a treatment, and people would not likely

be exposed to treatments on a continual basis, hazardous life-long exposure to rotenone is extremely unlikely.

Public health issues surrounding the use of rotenone have been studied extensively. In general, the EPA through FIFRA certification process has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment (Finlayson, et al. 2000) as long as the label instructions are followed.

In their description of how South American Indians prepare and apply *Timbó*, a rotenone parent plant, Teixeira, et al. (1984) reported that the Indians extensively handled the plants during a mastication process, and then swam in lagoons with the plant pulp on their backs for distribution. No harmful effects were reported.

Finlayson, et al. (2000) reported that the EPA "has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment." In relation to air quality, they further note that "No public health effects from rotenone use as a piscicide have been reported." No waiting period is specified for swimming in rotenone-treated water.

Aside from the rotenone itself, liquid formulations also consist of petroleum emulsifiers. Finlayson (2000) wrote regarding the health risks of these constituent elements:

> " . . . the EPA has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment. The California Environmental Protection Agency found that adverse impacts from properly conducted, legal uses of liquid rotenone formulations in prescribed fish management projects were nonexistent or within acceptable levels (memorandum from J. Wells, California Department of Pesticide Regulation, to Finlayson, 3 August 1993). Liquid rotenone contains the carcinogen trichloroethylene (TCE). However, the TCE concentration in water immediately following treatment (less than 0.005 mg TCE per liter of water [5 ppb]) is within the level permissible in drinking water (0.005 mg TCE per liter of water, EPA 1980b). None of the other materials including xylenes, naphthalene, piperonyl butoxide, and methylnaphthalenes exceed any water quality criteria guidelines (based on lifetime exposure) set by the EPA (1980a, 1981a, 1993). Many of these materials in the liquid rotenone formulations (trichloroethylene, naphthalene, and xylene) are the same as those found in fuel oil and are present in waters everywhere because of the frequent use of outboard motors . . ."

California Department of Fish and Game (CDFG, 1994) calculated that the maximum expected level of these contaminants following a treatment level of 2 ppm formulation are TCE 1.1 ppb; toluene 84 ppb; xylenes 3.4 ppb; naphthalene 140 ppb.

The product label states:

> " . . . do not use dead fish for food or feed, do not use water treated with rotenone to irrigate crops or release within ½ mile upstream of a potable water or irrigation water intake in a standing body of water such as a lake, pond, or reservoir. . . . do not allow swimming in rotenone treated water until the application has been completed and all pesticide has been thoroughly mixed into the water according to the labeling instructions. This product is flammable and should be kept away from heat and open flame . . ."

The major risks to human health from rotenone come from accidental exposure during application. This is the only time when humans are exposed to concentrations that are greater than that needed to remove fish. To prevent accidental exposure to liquid formulated rotenone, the Montana Department of Agriculture requires applicators to be:

- Trained and certified to apply the pesticide in use
- Equipped with the proper safety gear, which, in this case, includes fitted respirator, eye protection, rubberized gloves, hazardous material suit
- Have product labels with them during use
- Contain materials only in approved containers that are properly labeled
- Adhere to the product label requirements for storage, handling, and application

Any threats to human health during application could be greatly reduced with proper use of safety equipment. Recreationists in the area would likely not be exposed to the treatments because temporary trail closures would preclude many from being in the area. Proper warning through news releases, signing at trailheads, trail closures, and administrative personnel in the project area should be adequate to keep unintended recreationists from being exposed to any treated waters. Dead fish will be collected and sunk in the lakes or removed from the site. Administering application in the fall of the year would further reduce exposure due to the relatively low number of users in this remote area.

Aerial application of rotenone on lakes has been successful and is commonly used today (Spielman 2003; Finlayson, et al. 2000). Due to the potential for rotenone to become aerosolized temporarily during this type of application, there is an inhalation risk to ground applicators. To guard against this, ground applicators would be equipped with protective clothing, eye, and breathing equipment.

3.9.2 Antimycin

There are no Federal criteria or Montana water quality standards for antimycin. The sub-chronic effects to humans from antimycin exposure can be derived from a recent study (Stillmeadow 2001) in which rats were exposed to varying levels of antimycin for 90 days and by a study in 1967 by Herr, Greselin, and Chapplel. In both studies, the authors found no effects (mortality, body weights, food consumption, hematology, histopathology, clinical chemistry) (No-Observed-Adverse-Effect Level, NOAEL) at a dose level of 0.5 mg/kg/day.

It is appropriate to develop a sub-chronic criteria in this case because the chemical will be used only once in each lake and stream and the chemical breaks down in a matter of hours (extremely shorter timeframe than chronic conditions). Using the EPA methodology of calculating human health criteria, an estimate of a safe sub-chronic exposure to water containing antimycin is 59.5 μg/L.

The calculation is based on several assumptions:

- Sub-chronic RfD for antimycin = 0.0017 mg/kg-day,
- Average body mass of 70 kg (BW),
- A person consumes 2 L of water per day (DI),

The EPA has not published an RfD for Antimycin in the Integrated Risk Information System. For this project a sub-chronic RfD was calculated using the NOAEL above and three separate uncertainty factors:

1) A factor of 10 based on the uncertainty in the animal to human translation,

2) A factor of 10 based on average human to sensitive human uncertainty, and

3) A factor of 3 based on the limited number of studies.

The estimated RfD is: $\frac{0.5 \text{ mg/kg-day}}{10*10*3 \text{ (uncertainty factors listed above)}} = 0.0017 \text{ mg/kg-day}$

Some chemicals tend to increase in fish tissue over the concentration in the water or bio-concentrate. BCF is the amount the chemical increases in the fish relative to the ambient concentration. The BCF does not include possible food chain effects. Antimycin has not been shown to bio-concentrate to levels where harmful effects are anticipated. Ritter and Strong (1966) reported that twenty-one humans associated with their study consumed between one and five 4-oz. servings of fish killed by antimycin and suffered no ill effects. Based on this, they concluded that antimycin-killed fish would be safe as human food. Schnick (1974a) reported that antimycin is not hazardous to humans whether it is consumed in water or food. Therefore, a BCF was not used in the calculation of the sub-chronic exposure criteria.

The calculation of the antimycin criteria is as follows:

0.0017 mg/kg-day (RfD) * 70 kg (BW) /

2 L/day (DI)

Based on the prescribed concentration from the product label of 5-10 ppb, and the anticipated concentration that would likely be used in this project of 7-8 ppb, the maximum allowable concentration that could be used in the water is 10 ug/L.

As with rotenone, the major threat to human health resulting from the use of antimycin is from accidental exposure to abnormally high concentrate during application. To avoid this, applicators are cautioned by the product label, and required by the Montana Department of Agriculture to use protective gear, as listed above.

The product label for antimycin states: " . . . it can be fatal if swallowed or absorbed through the skin, causes substantial but temporary eye injury, is a skin irritant, should not be inhaled, and that protective clothing, eye wear and breathing apparatus should be worn . . ."

The acute toxicity (short-term dose) of antimycin to humans is unknown. Precautions will be taken to limit exposure of high concentrations of Antimycin to mixing and chemical application. Antimycin naturally decomposes very quickly minimizing the potential for accidental intake of a large dose of the chemical.

The major risks to human health from antimycin come from accidental exposure during application. This is the only time when humans are exposed to concentrations that are greater than that needed to remove fish. To prevent accidental exposure to antimycin, the Montana Department of Agriculture requires applicators to be:

- Trained and certified to apply the pesticide in use

- Equipped with the proper safety gear which, in this case, includes eye protection and rubberized gloves
- Have product labels with them during use
- Contain materials only in approved containers that are properly labeled
- Adhere to the product label requirements for storage, handling, and application

Any threats to human health during application could be greatly reduced with proper use of safety equipment. Recreationists in the area would likely not be exposed to the treatments because temporary trail closures would preclude many from being in the area. Proper warning through news releases, signing at trailheads, trail closures, and administrative personnel in the project area should be adequate to keep unintended recreationists from being exposed to any treated waters. Dead fish will be collected and sunk in the lakes or removed from the site. Administering application in the fall of the year would further reduce exposure due to the relatively low number of users in this remote area.

Antimycin piscicide consists of an active ingredient (antimycin) and several inert constituent components (soy lipids, Diethyl phthalate, Nonoxyl-9 detergent [or nonylphenol polyglycol ether], and acetone).

The following table provides estimated criteria for the long term exposure, but this is likely never to occur. The primary reasons for this include;

- Antimycin breaks down within hours of application
- Most dead fish will sink the lake bottom and/or be collected and sunk in the lakes
- Municipal water intakes are located great distances downstream, and they take their water from wells
- The compound will be diluted by freshwater downstream of the application sites
- The project is located in a remote area at a time when use is relatively low
- The project area will be well signed so users can find an alternate source of water
- Trails will be closed during and shortly after the application which will limit people from being in the project area
- Supplemental detoxification using potassium permanganate will neutralize the antimycin

Max treatment rate of 10μg/L Antimycin:

Carrier Chemical	Concentration	Water Quality Standard	RfD	Estimated Criteria
Acetone	65 μg/L	N/A	0.9 mg/kg-day	31,500 μg/L
Nonylphenol polyglycol ether	12.5μg/L	N/A	N/A	---
Diethyl phthalate	7 μg/L	23,000 μg/L	N/A	---

Nonoxyl-9 [nonylphenol polyglycol ether] is used in antimycin formulations to make the solution more soluble in water. It is a detergent developed in the early part of the 20th century as a solution for cleaning hospital surfaces. Determined to be an effective spermicidal, it became a leading component in lubes, condom lubricants, and contraceptive films. It is used as an ingredient in skin lotions, scar crèmes, and post medical treatment skin cremes, but is a powerful irritant to internal body surfaces. Skaar (2001) writes:

> " . . . The nonylphenol polyglycol ether does contain some residual amount of ethylene oxide (maximum of 5 mg/L) which is a potential carcinogen. Under a typical treatment level of 10 ug/L antimycin, the maximum level of ethylene oxide introduced into the water would be 62.5 pg/L.
> This compound has a very low vapor pressure and is expected to volatilize immediately upon application. There are no water quality standards for this chemical. The little bit of toxicological information available on rats suggests that this concentration is far below one that would have an effect on any mammal drinking from an antimycin-treated stream or lake. The ATSDR Public Health Statement (1990) states that rats are killed in one day by a 4,000 ug/g dose in the food. A dose of 2,000 ug/g for 21-30 days caused liver damage and stomach irritation. This Statement also says that ethylene oxide in water will either breakdown or be destroyed by bacteria within a few days, suggesting that long-term exposure to this chemical is not possible . . ."

The Fish Toxicant Kit Use Direction Leaflet that accompanies the antimycin label states:

> ". . . fish killed with antimycin A should not be consumed by man or animals. Treated waters should not be used for [swimming] drinking by man or animals, or for crop irrigation, until fingerling rainbow trout or fingerling bluegills survive 48 hours exposure in live cars in the treated waters . . . due to its acetone component, Fintrol Concentrate (antimycin) is flammable: keep away from heat and flame . . ."

3.9.3 Potassium Permanganate

Because potassium permanganate is a strong oxidizing agent, care must be taken when handling the product. Permanganate is considered a "hazardous chemical" because it can react with certain reducing agents and generate heat. The human health hazards on the Material Safety Data Sheet (MSDS) lists it as an irritant to eyes, skin, respiratory system, and gastro intestinal tract. When handled properly, it is safer than other commonly used oxidants. In applying the reference dose for manganese to a risk assessment, it is important that the assessor consider the ubiquitous nature of manganese, specifically that most individuals will be consuming about 2-5 mg Mn/day in their diet. This is particularly important when one is using the reference dose to determine acceptable concentrations of manganese in water and soils. It is recommended that the upper end of the range recommended by the NRC (5 mg/day, described below) be considered to represent a typical human intake from total dietary sources. For determination of acceptable concentrations of manganese in water and soil, then, the risk assessor would subtract this amount from the level specified by the RfD [i.e., 10 mg/day (RfD) - 5 mg/day (typical dietary intake) = 5 mg/day (remaining)]. For applying this number to a non-dietary scenario, it is also recommended that a modifying factor of 3 be applied. The rationale for this modifying factor is three-fold. First, while the data described in section I.A.4 of the IRIS file suggest that there is no significant difference between absorption of manganese as a function of the form in which it is ingested (i.e., food

versus water), there was some degree of increased uptake from water in fasted individuals. Second, the study by Kondakis et al. (1989) has raised concerns for possible adverse health effects associated with a lifetime ingestion of drinking water containing about 2 mg/l manganese. While no data are available to quantify total intake of manganese, one would not expect this concentration of manganese in water to be a problem based on dietary information revealing intakes ranging from 2 to 10 mg/day that are not associated with adverse health effects. Third, although toxicity has not been demonstrated, there are remaining concerns for infants fed formula which typically has a much higher concentration of manganese than does human milk (see section I.A.4 of the IRIS file for further discussion). If powdered formula is made with drinking water, the manganese in the water would represent an additional source of intake.

Using the recommended appropriation of 5 mg Mn/day for dietary contributions and a modifying factor of 3 for exposures from soil and drinking water and a body weight of 70 kg, yields a value of 0.0238 mg/kg-day.

Exposure from water + Exposure from soil = (10-5)/(3x70) = 0.0238 mg/kg-day

Assuming no exposure from soil and a 70 kg person drinking 2 L/day, the suggested advisory level is:

0.0238 mg/kg-day x 70 kg x 1 day/2 L = 0.8 mg/L Mn.

Although manganese is a constituent element of this compound, it is likely that once it is broken down, it will be in the form of manganese dioxide (MnO2) and will precipitate out of the water column. This biogenic precipitation is similar to the reaction between calcium (Ca++) and bicarbonate (HCO3), which is a naturally occurring reaction.

3.10 Unavoidable Adverse Effects, Irretrievable and Irreversible Commitments of Resources

The implementation of Alternative A would have an unavoidable adverse effect on the genetic purity of the westslope cutthroat trout populations in the subbasin, and the potentially irreversible effect of extirpating the subspecies within the project area. The other three alternatives would have the unavoidable adverse effect of operating motorized equipment in wilderness and the Jewel Basin Hiking Area. None of the three action alternatives would involve irretrievable or irreversible commitments of resources.

3.11 Relationship of Short-term Uses and Long-term Productivity

Alternative A would result in losing the genetic purity of the westslope cutthroat trout while maintaining the short-term quality of the fisheries. Alternatives B and C would each impact the quality of the fisheries in the short-term (1-3 years). Alternative D would impact quality of the fisheries for 5-10 years. Alternatives B, C, and D would each preserve the genetic purity of the westslope cutthroat trout in the South Fork Subbasin over the long-term.

3.12 Unaffected Resources

After a review of resources and issues generated through scoping, analysis, and consultation with local tribes, the following were identified as being unaffected and, therefore, not relevant to this analysis.

3.12.1 Air Quality

None of the alternatives would affect air quality. There is a small possibility that the piscicides would emit a short-term odor during application.

3.12.2 Cultural/Tribal Resources

None of the alternatives include ground-disturbing activities that would compromise or degrade any non-inventoried cultural resource sites. The Confederated Salish and Kootenai Tribes; and the Blackfeet Nation and the Kootenai Tribe of Idaho have been contacted regarding this project and its potential to disturb cultural resources. None of the tribes have indicated any specific concerns. Tribes would be contacted prior to lake treatment so that site-specific issues may be addressed and tribal members may be notified of short-term disturbances.

3.12.3 Geophysical

None of the alternatives include ground-disturbing activities that would degrade soil resources or accelerate geomorphic processes. The piscicides recommended bind readily with sediments. However, this binding also detoxifies them and renders them environmentally benign.

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