MONTANA FISH, WILDLIFE & PARKS

ENVIRONMENTAL ASSESSMENT
Westslope cutthroat trout establishment in Rainbow Lake

Draft Environmental Assessment

August 2022

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Montana Fish, Wildlife & Parks

Executive Summary

The proposed action would entail chemical removal of Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) inhabiting Rainbow Lake, which is part of the Wigwam River drainage (Figure 1). CFT Legumine, a commonly used formulation of rotenone, would be the piscicide used to remove fish. After chemical removal, FWP would establish native, nonhybridized westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) to Rainbow Lake. The stocked westslope cutthroat trout would be sourced from the best available non-hybridized population in the upper Kootenai drainage. Fish availability, genetic status, and proximity would guide selection of the specific donor source.

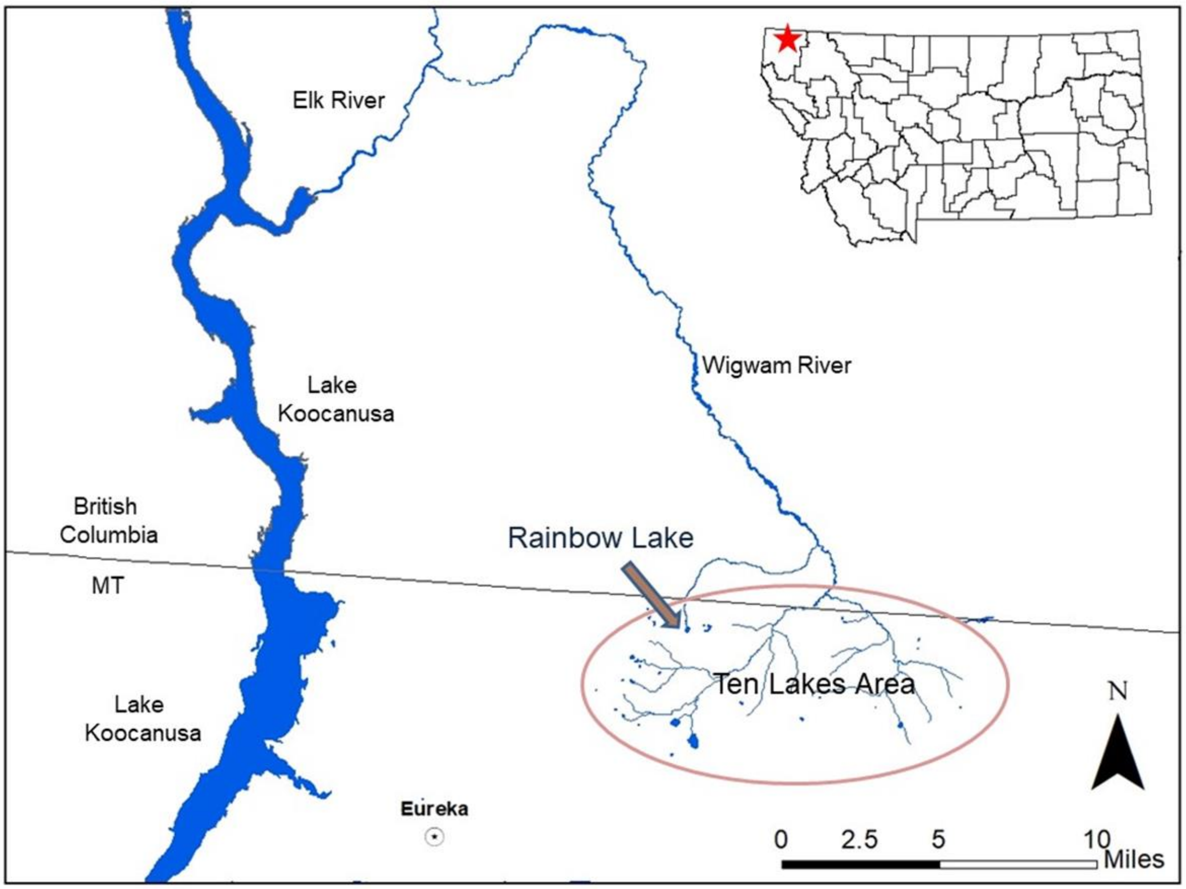

Figure 1. General location of Rainbow Lake located northeast of Eureka, MT.

The conservation and inherent value of native westslope cutthroat trout is substantial. Unfortunately, westslope cutthroat trout have experienced marked reductions in numbers and distribution throughout the species' historic range including the upper Kootenai Basin. Securing a population of nonhybridized westslope cutthroat trout within the upper Kootenai drainage upstream of Libby Dam would secure an invaluable component of this special area's natural heritage for future generations to enjoy. Moreover, conservation of native fish brings a range of benefits to local communities and is required under state and federal law.

Westslope cutthroat trout in the upper Kootenai River drainage face several threats with perhaps the most substantial threat being hybridization with closely related introduced non-native species including rainbow trout (*O. mykiss*) and Yellowstone cutthroat trout. Without management intervention, hybridization will remain a concern to downstream populations because the fish residing in Rainbow Lake will continue to migrate downstream and remain a persistent source of non-native genetic contribution to downstream populations of native westslope cutthroat trout. This project would provide an opportunity to eliminate the source of non-native Yellowstone cutthroat trout that contribute to hybridization in downstream waters. Rainbow Lake is located upstream of a natural barrier which would prevent upstream migration of hybridized fish residing downstream of the barrier.

The objectives of the proposed action are to 1) eliminate a source of Yellowstone cutthroat trout that contributes to the hybridization of westslope cutthroat trout in the Wigwam River drainage, and 2) re-establish an equivalent westslope cutthroat trout recreational fishery in Rainbow Lake by restocking the lake after removal of the Yellowstone cutthroat trout. Several actions have preceded this environmental assessment (EA) including population assessments, genetic testing, and habitat surveys.

EAs are a requirement of the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA), which require state and federal agencies to consider the environmental, social, cultural, and economic effects of proposed actions. This EA considers potential consequences of three alternatives to conserve native fish in the Wigwam River drainage. We also briefly describe three additional alternatives that were dismissed because they are not likely to achieve complete removal of the existing fishery (Alternatives 4 and 5) or they would take decades to make meaningful change in the genetic makeup of the fish inhabiting the lake and would never achieve complete removal of the Yellowstone genes (Alternative 6) The six alternatives are:

Alternative 1: (Preferred): Use the piscicide CFT Legumine to remove the existing Yellowstone cutthroat trout fishery and restock with nonhybridized westslope cutthroat trout from the best available source.

Alternative 2: No action

Alternative 3: Use the piscicide CFT Legumine to remove the existing Yellowstone cutthroat trout fishery and leave the lake fishless.

Alternative 4: Mechanical removal of the Yellowstone cutthroat trout in Rainbow Lake.

Alternative 5: Use angling to remove the Yellowstone cutthroat trout in Rainbow Lake

Alternative 6: Stock westslope cutthroat trout in Rainbow Lake in the presence of Yellowstone cutthroat trout.

Alternative 1 is the preferred alternative. It would have short-term, minor effects on wildlife, recreation, and vegetation. This alternative would be highly beneficial to westslope cutthroat trout and would be a substantial contribution to the long-term conservation of the species in the Wigwam River drainage.

Montana FWP welcomes and encourages public involvement and comment on the proposed actions described in this document. The public comment period will extend from August 11, 2022 to September 8, 2022. Interested parties should send comments to:

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1 PROPOSED ACTION and BACKGROUND

1.1 *Type of Proposed Action and Need*

The proposed action would create a secure population of genetically pure westslope cutthroat trout (WCT) in the Wigwam River drainage. The Kootenai River drainage upstream of Libby Dam was home to aboriginal populations of non-hybridized WCT which have become greatly reduced in distribution and abundance due to hybridization, nonnative fish competition and predation. If the project is successful, it would contribute to the reducing the occurrence and prevalence of WCT hybridization risk in the Wigwam River drainage, and thus contribute to the persistence of this species. This restoration project would result in expanding the range of WCT in the Wigwam River drainage.

FWP suspects that Rainbow Lake was fishless prior to the introduction of the lineage that currently inhabit the lake. The natural waterfall that exists on the outlet tributary about a mile downstream of Rainbow Lake (Figure 2) prevented upstream fish passage and precluded colonization of the lake from downstream fish populations. In the event that natural colonization of aboriginal fish species had occurred, the most likely species that would have historically occupied the lake would have most likely been westslope cutthroat trout. FWP collected fish from Rainbow Lake in 2014 for genetic analysis and the results indicated that the fish currently inhabiting Rainbow Lake are predominantly (> 90% genetic contribution) Yellowstone cutthroat trout. Yellowstone cutthroat trout are not native to the Kootenai River drainage (Budy et al. 2019) but FWP found no stocking records for Rainbow Lake. Of the eight lakes within the Ten Lakes Scenic Area (including Rainbow Lake) that currently contain fish, FWP found stocking records for six of those lakes between 1932-1969 that listed the species stocked a cutthroat trout. However, prior to the development of the westslope cutthroat trout broodstock known as the M012 brood in 1972, FWP fish plants designated as cutthroat trout were predominantly Yellowstone cutthroat trout (Robb Leary, FWP, personal communication). FWP searched our survey inventory records for Rainbow Lake and found one assessment completed in 1964, that identified the fish inhabiting the lake as Yellowstone cutthroat trout and aged the oldest fish captured at four years of age. FWP therefore concluded that the fish inhabiting Rainbow Lake were most likely the result of an unrecorded FWP stocking event that occurred prior to 1960.

Figure 2. Photograph of the natural waterfall on the outlet tributary of Rainbow Lake that prevents upstream fish passage.

1.2 *Need for Action*

Throughout the historic range of WCT in the western United States, it is estimated that the species currently occupies 60.1% of its former range (Shepard et al. 2005). Currently WCT (including slightly hybridized populations consisting of > 90% WCT) occupy approximately 15% of their historically occupied habitat in the Montana portion of the Kootenai River drainage (FWP unpublished data). Most of these populations of WCT exist in areas that are isolated from non-native fishes by a physical fish passage barrier. Several factors have contributed to the declines in distribution and abundance of WCT throughout their range including introductions of nonnative fishes, habitat changes, and overexploitation (Hanzel 1959; Liknes and Graham 1988; Behnke 1992; McIntyre and Rieman 1995; Shepard et al. 1997; U.S. Fish and Wildlife Service 1999). Furthermore, genetic introgression (hybridization) has compromised many remaining WCT populations (Allendorf and Leary 1988) because WCT readily interbreed with closely related species including Yellowstone cutthroat trout, yielding fertile hybrids. Hybridization is especially detrimental, as genes from other species alter the features that make nonhybridized WCT distinct. These alien genes also greatly decrease the fitness of even slightly hybridized fish (Muhlfeld et al. 2009). These detrimental impacts to a species that result from hybridization seldom reverses without management intervention (Muhlfeld et al. 2015; Shepard et al. 2005).

This project will secure a nonhybridized, genetically pure population of westslope cutthroat trout in Rainbow Lake by removing the existing population of predominantly Yellowstone cutthroat

trout. Following the removal of the Yellowstone cutthroat trout, Rainbow Lake will be stocked with genetically pure WCT from Stahl Creek, in the Tobacco River drainage. Genetic conservation principles will guide our population reestablishment efforts. The stocking would reestablish the recreational fishery in the lake.

1.3 *Agency Authority for the Proposed Action*

FWP is required by law (§87-1-201(9)(a) Montana Code Annotated [MCA]) to implement programs that manage sensitive fish species in a manner that assists in the maintenance or recovery of those species, and that prevents the need to list the species under § 87-5-107 MCA or the federal Endangered Species Act. Section 87-1-201(9)(a), M.C.A. (Table 1).

FWP is a signatory to the Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana (FWP 1999, 2007; Table 1) which states: "The management goal for WCT in Montana is to ensure the long-term, self-sustaining persistence of the subspecies within each of the five major river drainages they historically inhabited in Montana, and to maintain genetic diversity and life history strategies represented by the remaining local populations."

Montana state law authorizes FWP to manage wildlife, fish, game and nongame animals to prevent the need for listing under the Endangered Species Act or ESA, and listed, sensitive, or species that are candidates for listing under the ESA must be managed in manner that assists in the maintenance or recovery of the species (MCA§ 87-5-107). In waters where FWP is seeking to remove or control unauthorized species, FWP must endeavor to protect the previously existing fishery and suppress or eradicate the unauthorized species to maintain the existing management objectives for that fishery (ARM 12. 7. 1501[4]). Montana state law also allows the use of chemicals to remove fish (ARM 12. 7. 1503[1][f][ii]).

The proposed action is consistent with all the above referenced laws, administrative rules and policies of the State of Montana and FWP. The replacement of the Yellowstone cutthroat population in Rainbow Lake poses a threat to the continued existence of westslope cutthroat trout downstream of the lake. The proposed action would eliminate this threat by re-establishing an equivalent recreational fishery in the lake.

Table 1. Planning and strategy documents with relevance to Rainbow Lake.

Agency	***Citation***	***Website***
Montana Cutthroat Trout Steering Committee (MCTSC)	Memorandum of Understanding and Conservation Agreement for Westslope Trout and Yellowstone Cutthroat Trout in Montana (MCTSC 2007)	http://fwp. mt. gov/fishAndWildlife/management/yellowstoneCT/
FWP	Montana Statewide Fisheries Management Program and Guide (FWP 2019)	https://fwp.mt.gov/conservation/fisheries-management/statewide-fisheries-management
FWP	Wild Fish Transfer Policy (FWP 1996)	http://fwp. mt. gov/fishAndWildlife/management/westslopeCT/default. html
FWP	Piscicide Policy (FWP 2017)	Internal document
USFWS	Endangered Species Act	http://www. fws. gov/endangered/Endangered Species Act-library/pdf/Endangered Species Actall. pdf
USFS	Montana Wilderness Study Act of 1977	https://www.govinfo.gov/content/pkg/STATUTE-91/pdf/STATUTE-91-Pg1243.pdf

1.4 *Estimated Commencement Date*

Fish removal: August-September 2022

Re-establish fish population in Rainbow Lake – 2023-2027

1.5 *Name and Location of the Project*

Environmental Assessment for Native Westslope Cutthroat Trout Establishment in Rainbow Lake.

Rainbow Lake is a 9.5 acre lake in the Wigwam River watershed, which drains to the Elk River and ultimately Lake Koocanusa (Figure 1). The outlet tributary to Rainbow Lake is an unnamed waterbody that flows approximately 1.5 miles prior to crossing the international border. Proposed activities would be limited to Rainbow Lake and approximately 1.0 miles of outlet tributary directly downstream of the lake. The project would also require closing public access to the lake via USFS road 7091 and trail 89. These access closures would last about one day. Public access to Rainbow Lake would be closed during the period of rotenone and the deactivating agent persistence. The project is in Lincoln County, approximately 11 miles northeast from Eureka, Montana. The legal description is Township T37N, Range R25W, in section 8. The proposed project activities are within the Ten Lakes Scenic Area that were designated as a Wilderness Study Area by the Montana Wilderness Study Act of 1977 (Public Law 95-150).

1.6 *Project Size (Affected Area)*

1.	Developed/residential	0 acres
2.	Industrial	0 acres
3.	Open space/woodland/recreation	0 acres
4.	Wetlands/riparian areas	0 miles
5.	Floodplain	0 acres
6.	Irrigated cropland	0 acres
7.	Dry cropland	0 acres
8.	Forestry	0 acres
9.	Rangeland	0 acres
10.	Mountain lake	9.5 acres
11.	Stream	1.0 miles
12.	Recreational pedestrian hiking trail	0.75 miles
13.	Forest access road	1.9 miles

2 Alternatives

2.1 *Alternatives Considered*

2.1.1 Alternative 1: Preferred Alternative

This project will secure a nonhybridized, genetically pure population of westslope cutthroat trout in Rainbow Lake by removing the existing population of predominantly Yellowstone cutthroat trout using the piscicide rotenone. Following the removal of the Yellowstone cutthroat trout, Rainbow Lake will be stocked with genetically pure WCT from Stahl Creek, in the Tobacco River drainage. Genetic conservation principles will guide our population reestablishment efforts. The chemical proposed for removal of fish uses rotenone as its active agent. Rotenone is a naturally occurring substance derived from the roots of tropical plants in the bean family such as the jewel vine (Derris spp.) and lacepod (Lonchocarpus spp.) that are found in Australia, Oceania, southern Asia, and South America. Rotenone has been used by native people for centuries to capture fish for food in areas where these plants are naturally found. It has been used in fisheries management in North America since the 1930s.

FWP visited Rainbow Lake for three consecutive summers in 2019-2021 and the outlet tributary leaving the lake was dry during all years. Flow measurements taken in August 2020 which are representative of flow conditions when the treatment would occur were taken on the outlet tributary at several locations from the lake to the MT/BC border (Figure 3). The outlet tributary was dry for about 0.5 miles downstream of the lake and a flow measurement where the stream channel first contained water again estimated a flow rate of about 4 gallons per minute (GPM) Approximately 449 GPM equate to 1 cubic feet per second (CFS). Several ground water springs

enter the outlet tributary from both sides of the stream between Point 1 and the barrier waterfall (Point 4; Figure 3). Stream flow estimates between Points 2, 3 and 4 (Figure 3) were relatively consistent and averaged 34 GPM. Streamflow at the international border (Point 5; Figure 3) was estimated at 314 GPM, with most the difference measured at the waterfall attributed to the tributary that entering the outlet stream from the east (Figure 3).

Rotenone is applied to the water and enters the fish through the gills. It is effective at very low concentrations with fish because it is readily absorbed into the bloodstream through the thin cell layer of the gills. Mammals, birds and other non-gill breathing organisms do not have this rapid absorption route into the bloodstream and are not affected by consuming treated water or dead fish at concentrations used in fisheries management. Rotenone kills fish by interrupting the Krebs Cycle in individual cells.

The treatment area for the proposed activity encompasses Rainbow Lake and approximately 1.0 mile of the outlet tributary downstream from the lake (Point 3; Figure 3). Waters within the project area would be treated with CFT Legumine fish toxicant following product label recommendations, which is typically within the range of 0.5 and 1.0 ppm product concentration to achieve a complete kill of most species of trout. The exact product concentration will be determined in the field by conducting bioassays on caged fish, with the intent of determining the lowest dose that will meet the project objective of eradication of fish in the project area.

The proposed project will require the use of a helicopter to deliver equipment to Rainbow Lake which will require a landing zone near the project area. Montana FWP proposes using the parking area at the trailhead to USFS trail 89 located at the end of USFS Road 7091 as a helicopter landing zone. The delivery and removal of equipment to and from Rainbow Lake will require temporary closure of USFS Road 7091 for about one day each. The two undeveloped (and non-numbered) access trails to Rainbow Lake from USFS trail 89 (Figure 3) will also be closed during the application of rotenone. Signs will be placed at least one week before the treatment at public access points, trail heads and area campgrounds. Signs will remain in place until rotenone and the deactivating agent in Rainbow Lake are below detectable limits. Montana FWP expects the project to take 4-7 days. Montana FWP will coordinate all closures with the USFS Rexford Ranger District at least one week prior to the project implementation to ensure adequate public notification of the anticipated access delays and closures.

The primary means of delivering the CFT Legumine solution to Rainbow Lake would be to use a venturi siphon system from the manufacturer container using a small boat powered by a small motor to facilitate complete mixing within the lake. Delivery of the rotenone product would be completed in accordance with all established label guidelines. A bioassay would allow calculation of the lowest effective dose of product (CFT Legumine) for the project waters. The concentration of CFT Legumine in Rainbow Lake would be in the range of 0.5 to 1.0 ppm. Once diluted in the lake, the concentration of rotenone (active ingredient) would be 25 to 50 ppb,

which is roughly equal to ¼ to ½ - grains of table salt per liter. Approximate calculations based on estimated lake volume indicate FWP would apply no more than 58 gallons of CFT Legumine, to Rainbow Lake, but exact calculations will be made immediately prior to the application using minimum concentrations obtained through the bioassay results described above to determine the volume of rotenone product to add to the lake. Dispensing the rotenone product would take approximately 4 hours. FWP will monitor the effectiveness of achieving a complete fish kill in Rainbow Lake using caged sentinel fish (hatchery westslope cutthroat trout) located at multiple locations and depths throughout the lake. FWP expects that a complete fish kill will occur within about 12 hours after complete mixing of the rotenone product in the lake.

FWP does not anticipate that the rotenone laden water in Rainbow Lake would enter the outlet tributary because rotenone binds readily to sediments, soil, gravel, and organic matter and these materials act as a barrier to prevent its movement into groundwater (Engstrom-Heg 1971; Engstrom-Heg et al. 1978; Skaar 2001; Ware 2002). Rotenone moves about 1 inch in most soil types, except sandy soils, where it moves about 3 inches before binding to soils (Hisata 2002). FWP also perceives the risk of rotenone laden water traveling downstream of the lake to be very low because we suspect very little ground/surface water connection between Rainbow Lake and the wetted portion of the outlet stream. This statement is based on the fact that during the late summer period after the outlet stream dries up, Rainbow Lake elevation remains relatively constant, and the lake lacks a “bathtub ring” that would suggest substantial water leaving the lake through subterranean flow. However, to mitigate the risk of rotenone-treated water traveling further than anticipated in the outlet tributary, FWP proposes two measures.

In addition to rotenone actively binding to sediments and organic matter, rotenone can also be deactivated with exposure to sunlight or oxidating substances. Potassium permanganate is a strong oxidizer that can effectively deactivate rotenone. After a complete fish kill is achieved in the lake, FWP will begin deactivating the rotenone in the lake by applying a potassium permanganate to minimize the likelihood that rotenone laden water enters the outlet tributary downstream of the lake. FWP staff would apply an aqueous solution of 5% mixture of potassium permanganate to Rainbow Lake to speed rotenone deactivation within the lake. FWP would use lake water to mix with the powdered potassium permanganate to from the solution that would be dispersed in the lake using the same venturi system used for the rotenone. Potassium permanganate can neutralize an equal concentration of rotenone, but the background biological demand of the treatment often requires an additional amount of potassium permanganate be added. The biological demand of Rainbow Lake water would be estimated prior to the treatment and the target concentration of potassium permanganate applied to the lake adjusted accordingly. Rainbow Lake would be considered deactivated when caged sentinel fish placed at several locations and depths throughout the lake survive at least four hours without stress. FWP expects that the deactivation of the rotenone would require no more than about 1,600 pounds of powdered potassium permanganate.

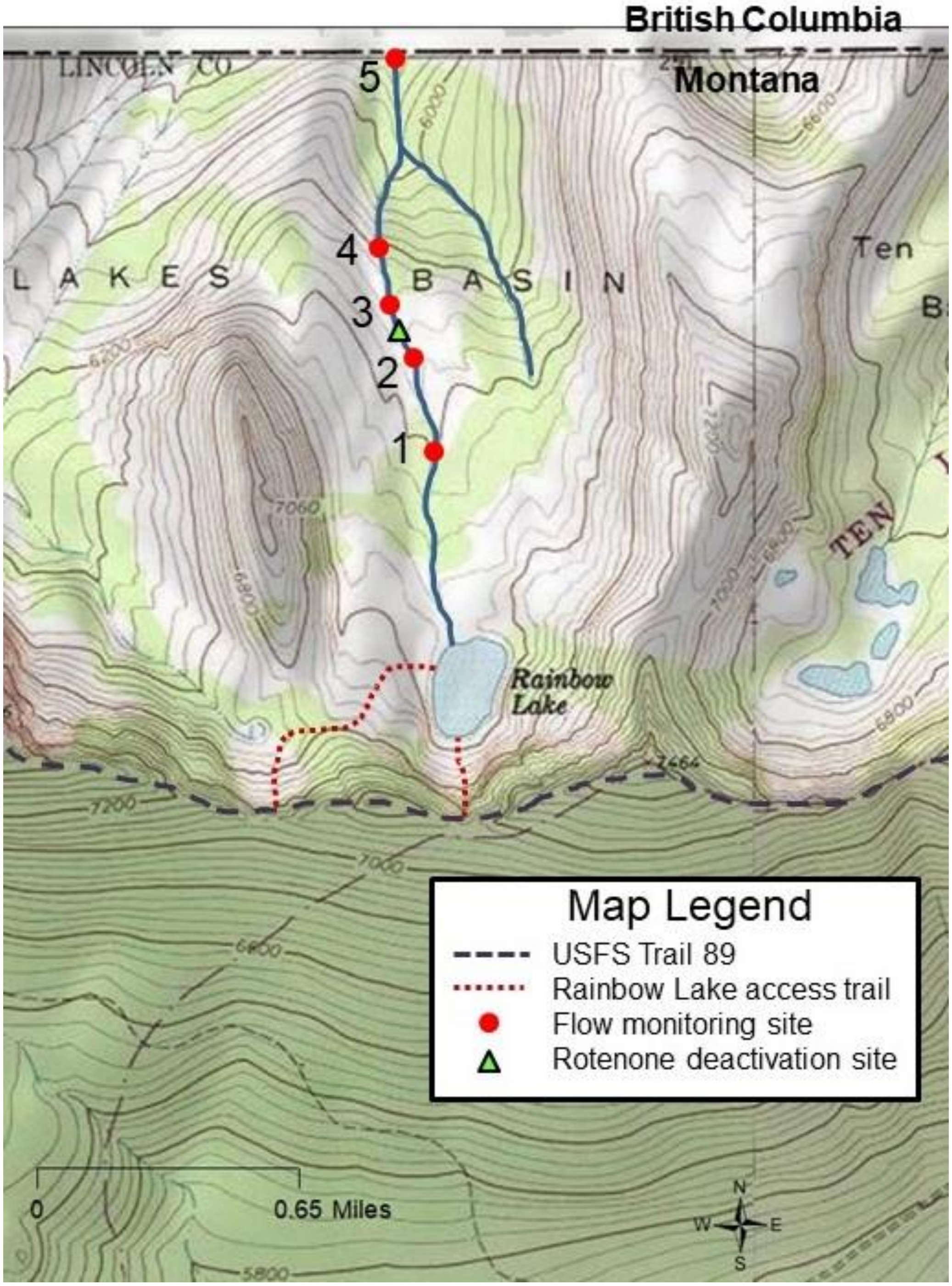

Figure 3. Project map of Rainbow Lake includng access trails, flow monitoring location and the proposed rotenone deactivation site.

FWP also proposes to monitor the outlet tributary for the presence of rotenone using caged sentinel fish throughout the period that fish killing concentrations of rotenone persist in Rainbow Lake. Sentinel fish in the outlet tributary would be placed at locations 2 and 3 (Figure 3) and would be closely monitored for symptoms of rotenone exposure. Previous fisheries surveys in the outlet tributary to Rainbow Lake did not find any fish inhabiting the creek, and we expect this to be the case during the proposed treatment. However, immediately prior to treatment this will be examined again to ensure no fish reside in the creek that could potentially elude removal efforts. We also propose to establish a rotenone deactivation station on the outlet tributary located at 30 minutes water travel time upstream of location 3 (Figure 3). Travel time will be estimated using inert tracer dye prior to project commencement. Should the sentinel fish at either location exhibit stress, potassium permanganate will be added to the outlet stream to effectively neutralize the rotenone. Deactivation activities at this site would continue until the sentinel fish in the outlet tributary and Rainbow Lake survive at least four hours without stress. Freshwater input from a tributary and seeps downstream of the proposed detox site offer additional rotenone containment safeguards by providing a > 10-fold increase in stream discharge before the stream travels into the Canadian portion of the drainage.

Dead fish that surface in the lake would be gathered, their air bladders pierced, and sunk in the deepest part of the lake to reduce the risk of them becoming an attractant to birds, bears, otters, mink or other scavengers. Dead fish naturally decay within a few days and provide nutrients to the lake that support the recovery of the food web.

FWP expects to achieve a complete fish kill in Rainbow Lake with a single rotenone application. However, if a complete fish kill is not achieved, a second treatment may be conducted the following year to achieve complete removal of the non-native fish. FWP would use eDNA sampling to determine if a single rotenone treatment achieved a complete kill of Yellowstone cutthroat trout in Rainbow Lake. See comment 5b below related to fish monitoring.

FWP will monitor for long-term impacts to non-target taxa including zooplankton and amphibians in Rainbow Lake and benthic invertebrates in the outlet tributary. FWP will collect two years of monitoring data for each of these non-target taxa groups to characterize pre-treatment conditions and two successive years of monitoring data after project completion for comparison. Zooplankton density in Rainbow Lake will be estimated using two plankton tows annually. Amphibian relative abundance will be estimated annually using standardized pedestrian surveys along the lake margin each year. Benthic invertebrate densities will be estimated at three sampling locations within the outlet tributary during each year. Differences between pre- and post-treatment metrics of non-target taxa abundance will be compared using standard statistical methods.

FWP will restock Rainbow Lake with fish the first summer after achieving a complete removal of all fish from Rainbow Lake. FWP expects this to occur in the summer of 2023. The source

for genetically pure Westslope Cutthroat Trout will be Stahl Creek and/or other streams in the upper Kootenai River drainage upstream of Libby Dam. Fish collected from the donor populations will be spawned, reared and the resulting fry stocked into the lake at a rate of about 900 fry per year for five consecutive years. Additional genetic monitoring will be conducted at five-year intervals after establishment of the new population and compared to the genetic structure of donor population. If genetic indices such as allelic richness decline, additional supplementation may be necessary in the future. Finally, donor populations will be monitored closely to ensure that removal of WCT does not impact genetic diversity or donor stream fish abundance. To minimize impacts to donor populations, no more than 25% of the population will be collected for hatchery production.

2.1.2 Alternative 2: No Action

Under this alternative the fishery in Rainbow Lake would not be removed. Yellowstone cutthroat trout would remain, and their genetic contribution to downstream populations of westslope cutthroat trout would remain a threat. Westslope cutthroat trout would not be planted in the project area.

2.1.3 Alternative 3: Remove Yellowstone Cutthroat Trout and Leave Fishless

This alternative would remove Yellowstone cutthroat trout as described for the proposed action, but Rainbow Lake would be left fishless, which is the likely historical state until the lake was stocked prior to 1960. This option would remove the hybridization threat to downstream populations of westslope cutthroat trout by Yellowstone cutthroat trout emigrating from the lake but eliminate angling in an area where visitors to the lake able to catch fish since at least 1960, which pre-dates the Wilderness Act of 1964 and establishment of the Ten Lakes Scenic Wilderness Study Area in 1977. Moreover, leaving Rainbow Lake fishless would fail to create a refugia for locally adapted, nonhybridized westslope cutthroat trout that is secure from invasive species, disease, and climate change.

2.2 *Alternatives Considered but Dismissed*

2.2.1 Mechanical Removal of Yellowstone Cutthroat Trout

This alternative would involve using gill nets to remove the unwanted fish from Rainbow Lake, and then stocking trout to these waters. Gill netting has been used successfully to remove unwanted fish from lakes. Bighorn Lake, a 5.2 acre lake located in Banff National Park in Alberta, Canada, was gillnetted from 1997 to 2000 to remove an unwanted population of brook trout (Parker et al. 2001). Over 10,000 net nights (1 net night = 1 net set overnight for at least 12 hours) were conducted over a four year period in Bighorn Lake to remove the population which totaled 261 fish. The researchers concluded that the removal of nonnative trout using gill nets was impractical for larger lakes (> 5 acres). In clear lakes, like Rainbow Lake, trout have the ability to become acclimated to the presence of gill nets and to avoid them. These researchers

reported observing brook trout avoiding gill nets within about 2 hours of being set. It is reasonable to expect that the trout in Rainbow Lake would react similarly.

Knapp and Matthews (1998) reported that Maul Lake, a 3.9 acre lake in the Inyo National Forest in California, was gill netted from 1992 to 1994 to remove a population of brook trout. The population, which totaled 97 fish, was successfully removed with an effort of 108 net days. The researchers reported that following the removal of brook trout from Maul Lake it was mistakenly restocked with rainbow trout. Efforts to remove them using gill nets were implemented immediately. From 1994 through 1997, 4,562 net days were required to remove the 477 rainbow trout from the lake. These researchers reported that gill nets could be used as a viable alternative to chemical treatment. They acknowledged that the small size and shallow depth of Maul Lake were conditions that allowed a successful fish eradication using gill nets. Their criteria for successful fish removal using gill nets include lakes less than 3.9 surface acres, less than 19 feet deep, with little or no inflow or outflow to perpetuate reinvasion, and no natural reproduction. Although not tested, the maximum size of a lake that they felt could be depopulated using gill nets was 7.4 surface acres and 32 feet deep.

Deploying gill nets and traps requires frequent presence at the site to check and reset nets. There would be an incredible time commitment required to attempt this method of fish removal. Due to these considerations and expected incomplete results, this alternative has a low probability of meeting the objectives and was dismissed as a viable option.

2.2.2 Use Angling to Remove Yellowstone Cutthroat Trout from Rainbow Lake and then Stock Westslope Cutthroat Trout

FWP has the authority under commission rule to modify angling regulations for the purpose of removing unwanted fish from a lake or stream. Unfortunately, this method does not guarantee complete removal of all fish. There are a number of reasons why this method may not work, especially in a remote area like Rainbow Lake. First, liberalizing bag limits does not guarantee every angler would keep all of the fish they catch primarily because of differences in value systems among anglers. Recreational angling has been shown to reduce the average size of fish and reduce population abundance. As the size and abundance of fish decreases, angler satisfaction tends to decrease also. For these reasons it may be difficult to attract anglers to a site for voluntary angling especially if angling quality is poor. Second, caring for large bounties of fish in remote locations further dissuades anglers from keeping every fish they catch. Furthermore, very small fish are not vulnerable to angling and can require as much as two years to become vulnerable to the fishery. During this time, adult fish have the opportunity to continue reproducing. The amount of time required for anglers to catch enough fish to make meaningful reductions in abundance would likely require many years. For these reasons this method of fish removal was considered unreliable at achieving the objective of complete fish removal from Rainbow Lake and was eliminated from further analysis.

2.2.3 Stocking Westslope Cutthroat Trout in the Presence of Yellowstone Cutthroat Trout

This alternative involves stocking Rainbow Lake with westslope cutthroat trout in the presence of the existing Yellowstone cutthroat trout. The stocked hatchery fish would likely also hybridize with the existing naturally reproducing Yellowstone cutthroat trout inhabiting the lakes. Because the existing fish in the lake are predominantly Yellowstone cutthroat trout (> 90% genetics), the length of time to make meaningful changes in the genetic composition of the fish inhabiting the lake would likely require decades and would likely never completely eliminate hybridized fish from these waters. This alternative would likely require a very aggressive stocking program and require stocking numbers of hatchery fish at much higher stocking rates than would be normally considered. The higher stocking densities would likely increase the total number of fish present in the lake and negatively impact fish growth. Reduced fish growth would likely result in smaller fish available for anglers and could be viewed by some as a lower quality angling experience. Although this alternative may temporarily improve angling catch rates for trout in the lakes, it would require many years to attempt and would do little in the near term to conserve westslope cutthroat trout in the upper Kootenai watershed. Based on these considerations, this alternative has a low probability of meeting the objectives and was dismissed for further analysis.

3 Environmental Review

3.1 *Physical Environment*

3.1.1 Land Resources

LAND RESOURCES **Will the proposed action result in:**	**IMPACT Unknown**	**None**	**Minor**	**Potentially Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Soil instability or changes in geologic substructure?		X				
b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil which would reduce productivity or fertility?		X				
c. Destruction, covering or modification of any unique geologic or physical features?		X				
d. Changes in siltation, deposition or erosion patterns that may modify the channel of a river or stream or the bed or shore of a lake?		X				
e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard?		X				

3.1.2 Water

WATER **Will the proposed action result in:**	**IMPACT Unknown**	**None**	**Minor**	**Potentially Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Discharge into surface water or any alteration of surface water quality including but not limited to temperature, dissolved oxygen or turbidity?			X		yes	2a
b. Changes in drainage patterns or the rate and amount of surface runoff?		X				
c. Alteration of the course or magnitude of flood water or other flows?		X				
d. Changes in the amount of surface water in any water body or creation of a new water body?		X				
e. Exposure of people or property to water related hazards such as flooding?		X				

f. Changes in the quality of groundwater?		X				2f
g. Changes in the quantity of groundwater?		X				
h. Increase in risk of contamination of surface or groundwater?			X		yes	see 2a 2f
i. Effects on any existing water right or reservation?		X				
j. Effects on other water users as a result of any alteration in surface or groundwater quality?		X	X			See 2j
k. Effects on other users as a result of any alteration in surface or groundwater quantity?		X				
l. Will the project affect a designated floodplain?		X				
m. Will the project result in any discharge that will affect federal or state water quality regulations? (Also see 2a)			X		yes	2m

Comment 2a

Preferred Alternative

The proposed project is designed to intentionally introduce a pesticide to surface water to remove unwanted fish. The impacts would be short term and minor. CFT Legumine 5% liquid rotenone is an EPA registered pesticide and is safe to use for removal of unwanted fish, when handled properly. The concentration of CFT Legumine 5% liquid proposed will be determined by conducting a bioassay prior to treatment, but will likely be no greater than 1 ppm in Rainbow Lake but could be adjusted within the label-allowed limits based upon the results of on-site assays.

The rotenone product added to Rainbow Lake would be deactivated after FWP was certain that a complete fish kill has been achieved in the Lake. We expect a complete fish kill to take no longer than 1-2 days (see Section 2.6.8 above). FWP does not expect rotenone laden water from Rainbow Lake to enter the outlet tributary because the project would be completed in late summer when about 0.5 miles of the outlet stream is dry. The rotenone treatment would not occur if the outlet tributary is not dry. However, in the unlikely event that rotenone laden water did travel subsurface from the lake and resurface in the outlet stream, the rotenone labels and FWP policy require deactivation with potassium permanganate to prevent toxic levels of rotenone from flowing away from the treatment area. FWP will rely on caged sentinel fish to determine if rotenone is present in the outlet tributary. If this scenario occurs, FWP would commence deactivation in the stream immediately and continue the deactivation operations until rotenone in the outlet stream had diminished and was safe for fish. Potassium permanganate is a dry crystalline substance that can be mixed with stream or lake water to produce a concentration

of liquid sufficient to detoxify the rotenone (2-4 ppm). Deactivation is accomplished after about 15-30 minutes of exposure time between the two compounds.

Several factors influence rotenone's persistence and toxicity. Warmer water temperatures promote deactivation. Rotenone has a half-life of 14 hours at 24 °C, and 84 hours at 0 °C (Gilderhus et al. 1986, 1988), meaning that half of the rotenone is deactivated and is no longer toxic in that time. As temperature and sunlight increase, so does deactivation of rotenone. Higher alkalinity (>170 mg/L) and pH (>9.0) also increase the rate of deactivation. Rotenone tends to bind to, and react with, organic molecules, and availability of organic matter substantially decreases the persistence of rotenone (Dawson et al. 1991). Dilution from groundwater inputs or tributary streams also contributes to deactivation of rotenone.

If rotenone is detected in the outlet tributary, FWP will achieve full neutralization by continuous delivery of potassium permanganate at a rate such that a residual level of potassium permanganate of 0. 5-1.0 ppm is maintained downstream of the application the distance the water flows in 30 minutes. This distance is known as the neutralization or deactivation zone. A chlorine meter would be used to monitor the presence of potassium permanganate at the end of the 30-minute contact zone to ensure that 0. 5-1. 0 ppm potassium permanganate is present and that the rotenone is completely neutralized. In addition to direct measurement of the potassium permanganate in the water, caged fish (hatchery westslope cutthroat trout) will be placed in the stream to monitor the effectiveness of the detoxification station during the treatment. Caged fish would be placed downstream of the 30-minute contact zone and monitored. Distress or the lack thereof in these caged fish indicates whether neutralizing is effective. Application of potassium permanganate would continue until caged sentinel fish placed in the lake and outlet tributary can survive for four hours with no symptoms of stress.

No Action Alternative

The no action alternative would not have any effect on water quality.

Leave Fishless Alternative

Rotenone would have the same effects on surface water quality as the proposed alternative. Potassium permanganate would break down within 30 minutes or less of stream travel time. Freshwater inputs between Rainbow Lake and international border would greatly dilute both chemicals and expedite the deactivation of rotenone.

Comment 2f

Preferred Alternative

No contamination of groundwater is anticipated to result from this project. Because ground water leaving Rainbow Lake must travel through bed sediments, soil, and gravel, and rotenone is

known to bind readily with these substances, we do not anticipate any contamination of ground water (Skaar 2001; Engstrom-Heg 1971, 1976; Ware 2002). Rotenone moves only one inch in most soil types; the only exception would be sandy soils where movement is about three inches (Hisata 2002). In California, studies where wells were placed in aquifers adjacent to and downstream of rotenone applications have 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 groundwater does not occur (FWP unpublished data). For example, at Tetrault Lake, Montana neither rotenone nor inert ingredients were detected in a nearby domestic well, which was sampled two and four weeks after applying 1.8 ppm rotenone to the lake. This well was chosen because it was down gradient from the lake and drew water from the same aquifer that fed and drained the lake. FWP has sampled wells and groundwater in several piscicide projects that removed fish from ponds, and no rotenone, or the inert ingredients of the selected formulation were detected in ponds ranging from 65 to 200 feet from the treated waters. Likewise, application of piscicide to streams has not resulted in contamination of neighboring wells or groundwater. In 2015 and 2016, Soda Butte Creek flowing through Cooke City and Silver Gate, Montana was treated with CFT Legumine. Wells drawing water from the same open aquifer as the treated stream were sampled during and after the treatment and all found to be free of rotenone.

No Action Alternative
The no action alternative would not have any effect on ground water.

Leave Fishless Alternative
Under this option, the effects on groundwater would be the same as the preferred alternative.

Comment 2j

Preferred Alternative
The CFT Legumine label has specific requirements for use in streams or lakes used for irrigation that do not apply to treatment in the Rainbow Lake project area. There are no irrigation diversions or potable water wells located within the proposed treatment area. The nearest private land parcel to the project area is more than 5 miles away. There are no irrigation diversions or potable water wells located within the proposed treatment area. Therefore, precautions associated with irrigation waters would not apply to this project because the proposed activities would not impact other water users.

No Action Alternative
The no action alternative would not have any effect on other water users.

Leave Fishless Alternative
This alternative would have the same effect as the preferred alternative.

Comment 2m

Preferred Alternative
The 2021 Pesticide General Permit issued on a five-year cycle by Montana DEQ provides the authority for FWP to apply piscicides. FWP, and any other piscicide applicator, must develop a pesticide discharge management plan as a condition for coverage under this permit. For FWP, the plan consists of procedures and protocols developed by and detailed in FWP's Piscicide Policy, the AFS Rotenone Standard Operating Procedures manual, and annual training and critique of projects provided by the FWP Piscicide Committee.

No Action Alternative
The no action alternative would not require any permits or consideration of water quality regulations.

Leave Fishless Alternative
This alternative would have the same effect as the preferred alternative.

3.1.3 Air

AIR **Will the proposed action result in:**	**IMPACT Unknown**	**None**	**Minor**	**Potentially Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Emission of air pollutants or deterioration of ambient air quality? (also see 13 (c))			X			3a
b. Creation of objectionable odors?			X		yes	3b
c. Alteration of air movement, moisture, or temperature patterns or any change in climate, either locally or regionally?		X				
d. Adverse effects on vegetation, including crops, due to increased emissions of pollutants?		X				
e. Will the project result in any discharge which will conflict with federal or state air quality regulations?		X				

Comment 3a

Preferred Alternative

The CFT Legumine would be mixed into Rainbow Lake using a small boat powered by an outboard motor. The motor would create emissions; however, the odors, gases, and particulates would dissipate rapidly. The effects of these emissions would be minor and short-term.

No Action Alternative

The no action alternative would not release pollutants to the air.

Leave Fishless Alternvative

This option would have the same effect on air pollution as the proposed action.

Comment 3b

Preferred Alternative

CFT Legumine does not use aromatic hydrocarbons as solvents or dispersants used in other formulations and does not have objectionable odors. It has a slight soapy smell that dissipates rapidly.

Exhaust from the motor dispersing the CFT Legumine in Rainbow Lake would produce objectionable odors. These odors would be short-lived and dissipate rapidly.

Dead fish would cause objectionable odors, although several factors would limit the duration and intensity of the smell of decaying fish. FWP will collect the dead fish that surface on the lake after dispersing the rotenone product and sink them in the lake which would limit the number of decaying and odorous dead fish. Scavengers eat fish carcasses, and rotenone-killed fish do not pose a risk to animals scavenging them (USEPA 2007). The cold waters in treated streams and lakes during a late summer or early fall treatment period at this elevation would promote sinking of dead fish that were missed during the collection process (Parker 1970), and the odor of the decay of sunken fish would not be detectable to humans. Dead fish would decay through microbial action and scavenging by invertebrates and vertebrates. Access to the Rainbow Lake would be closed during treatment. Objectionable odors would be minor and last up to 2 weeks.

No Action Alternative

Not implementing the project would not create objectionable odors.

Leave Fishless Alternative

This option would result in the same conditions as described for the proposed action.

Vegetation 3.1.4

VEGETATION **Will the proposed action result in:**	**IMPACT** **Unknown**	**None**	**Minor**	**Potentially** **Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Changes in the diversity, productivity or abundance of plant species (including trees, shrubs, grass, crops, and aquatic plants)?			X			4a
b. Alteration of a plant community?		X				
c. Adverse effects on any unique, rare, threatened, or endangered species?			X			4c
d. Reduction in acreage or productivity of any agricultural land?		X				
e. Establishment or spread of noxious weeds?		X				
f. Will the project affect wetlands, or prime and unique farmland?		X				

Comment 4a

Preferred Alternative
There would be some trampling of vegetation along the lake and stream during rotenone treatment, deactivation activities and monitoring activities. Rotenone does not affect plants at concentrations used to kill fish. Impacts from trampling vegetation are expected to be short term and minor and should be fully healed within one growing season.

No Action Alternative
Not implementing the project would have no impact on vegetation.

Leave Fishless Alternative
This option would result in the same impacts to vegetations as described for the proposed action.

Comment 4c

Preferred Alternative
Rotenone has no impacts on plant species at fish killing concentrations. The only anticipated impacts to sensitive plant species would be a result of trampling by the personnel during application of the rotenone or potassium permanganate to the lake or stream and any impacts

from trampling are expected to be short term and minor. Any trampling impacts should be fully healed within one growing season. Impacts to sensitive plants can be minimized by staying as much as possible on existing trail systems.

No Action Alternative

Not implementing the project would have no impact on unique, rare or endangered plants.

Leave Fishless Alternative

This option would result in the same impacts to unique, rare or endangered plants as described for the proposed action.

3.1.4 Fish/Wildlife

FISH/WILDLIFE **Will the proposed action result in:**	**IMPACT** **Unknown**	**None**	**Minor**	**Potentially** **Significant**	**Can Impact Be Mitigated**	**Comment Index**
a. Deterioration of critical fish or wildlife habitat?		X				
b. Changes in the diversity or abundance of game animals or bird species?			X		yes	5b
c. Changes in the diversity or abundance of nongame species?			X		yes	5c
d. Introduction of new species into an area?			X			5d
e. Creation of a barrier to the migration or movement of animals?		X				
f. Adverse effects on any unique, rare, threatened, or endangered species?			X			5f
g. Increase in conditions that stress wildlife populations or limit abundance (including harassment, legal or illegal harvest or other human activity)?		X				5g
h. Will the project be performed in any area in which T&E species are present, and will the project affect any T&E species or their habitat? (Also see 5f)		X				
i. Will the project introduce or export any species not presently or historically occurring in the receiving location? (Also see 5d)			X			See 5d

Comment 5b

Preferred Alternative

This project is intended to remove Yellowstone cutthroat trout from Rainbow Lake. These fish were likely stocked prior to 1960 to establish a sport fishery. Cutthroat trout are a gamefish. Impacts to the sport fishery would be short term. Westslope Cutthroat trout would be stocked for five consecutive years the following successful removal of all fish from the lake. Stocking would reestablish the fishery in Rainbow Lake within two to five years.

No Action Alternative

Not implementing the project would have no impact on the current population of Yellowstone cutthroat trout inhabiting Rainbow Lake.

Leave Fishless Alternative

This option would eliminate the population of Yellowstone cutthroat trout currently inhabiting Rainbow Lake, and it would not be replaced with westslope cutthroat trout. Therefore, the overall results would be a reduction in the current distribution and abundance of cutthroat trout within the area and a resultant reduction in recreational fishing opportunity in Rainbow Lake.

Comment 5c

Preferred Alternative

Non-game non-target species that could be impacted are included below.

Mammals

Ingestion of rotenone, either from drinking rotenone-treated water or from consuming dead fish or invertebrates from rotenone-treated water, are the likely routes of exposure for mammals. A substantial body of research has investigated the effects of ingested rotenone in terms of acute and chronic toxicity and other potential health effects. In general, mammals are not affected by rotenone at concentrations used to kill fish. Consuming treated water or rotenone killed fish does not affect mammals at fish killing concentrations because rotenone is neutralized by enzymatic action in their stomach and intestines (AFS 2002). Investigations examining the potential for acute toxicity from ingesting rotenone concluded that mammals would need to consume impossibly high amounts of rotenone-treated water or rotenone-killed fish to obtain a lethal dose. For example, a 22-pound dog would have to drink nearly 8,000 gallons of treated water within 24 hours or eat 660,000 pounds of rotenone-killed fish within a day to receive a lethal dose (CDFG 1994). A half-pound mammal would need to consume 12.5 mg of pure rotenone or drink 66 gallons of treated water for a lethal dose (Bradbury 1986). The effective concentration of commercial formulation of rotenone likely to be used in this project to kill fish is 0.5 to 1.0 ppm, which is several orders of magnitude lower than concentrations that result in acute toxicity to mammals. Evaluations of mammals' potential exposure to rotenone from scavenging indicate that acute toxicity from ingesting rotenone-killed fish is highly unlikely (EPA 2007).

Chronic toxicity associated with availability of dead fish over time would not pose a threat to mammals, nor would other health effects be likely. Rats and dogs fed high levels of rotenone for 6 months to 2 years experienced only diarrhea, decreased appetite, and weight loss (Marking 1988). The unusually high treatment concentrations did not cause tumors or reproductive problems. Toxicology studies investigating potential secondary effects of rotenone exposure have found no evidence that it results in birth defects (HRI 1982), gene mutations (BRL 1982; Van Geothem et al. 1981), or cancer (Marking 1988). Rats fed diets laced with 10 to 1000 ppm of rotenone over a 10-day period did not experience any reproductive dysfunction (Spencer and Sing 1982). Therefore, chronic exposure to rotenone poses no threat to mammals consuming dead fish or treated water. Rotenone persistence in the environment is not long-term, which also limits the chronic exposure to mammals or other terrestrial organisms. In Rainbow Lake, rotenone would be expected to persist for less than one week if allowed to degrade naturally; however the addition of KMnO4 before this time will hasten degradation and in doing so make chronic exposure to mammals unlikely.

A temporary reduction in prey of aquatic origin has the potential to influence some mammals. The American mink (*Neogale vison*) is a piscivorous mammalian that is most likely to occur in the project area. Mink are opportunistic predators and scavengers, with fish and invertebrates comprising a portion of their diet. Therefore, the reduction in density of fish following treatment may displace mink to adjacent, untreated reaches until fish populations recover. Nonetheless, as opportunists, American mink have flexibility to switch to other prey species and have the ability to disperse.

Other mammalian predators may experience short-term and minor consequences. Opportunistic black bears (*Ursus americanus*), grizzly bears (*Ursus arctos horribilis*) raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), otters (*Lontra canadensis*), and striped skunks (*Mephitis mephitis*) could consume dead fish immediately after piscicide treatment. The temporary reductions of aquatic prey, and the brief availability of dead fish, constitute short-term and minor effects on mammalian predators and scavengers. Dead fish will be collected and sunk in the lake to further reduce this risk.

Birds

Birds have the potential to be exposed to rotenone through ingestion of treated water or scavenging dead fish and invertebrates. Like with mammals, rotenone breaks down rapidly within the gut of birds. Moreover, the concentrations of rotenone in waters treated for fisheries management are far below levels found to be toxic to birds. For example, ¼-pound bird would have to consume 100 quarts of treated water, or more than 40 pounds of fish and invertebrates, within 24 hours, for a lethal dose (Finlayson et al. 2000). The EPA concluded that exposure to rotenone, when applied according to label instructions, presented no unacceptable risks to

wildlife (EPA 2007). In summary, this project would have no adverse effect birds that ingest water, dead fish, or dead invertebrates.

Numerous bird species rely on prey of aquatic origin, and this rotenone project has potential to temporarily decrease forage availability for ospreys and bald eagles that occur in this area. Timing the project for when neotropical migrant songbirds are migrating south mitigates for loss of forage base. Like mammals, birds are highly mobile, so the project may result in short-term displacement of birds that consume fish or aquatic invertebrates.

Reptiles
Reptiles, especially garter snakes, have potential to be exposed to rotenone treated water and could scavenge dead fish. The low concentration of rotenone in water and dead fish indicates reptiles would not experience toxic exposure to rotenone. Moreover, the reptilian gut is likely as efficient, or more efficient, at breaking down rotenone given the ability of reptiles to digest bone, hair, and exoskeletons, all of which are far less degradable than the rotenone molecule.

Amphibians
Amphibians are closely associated with water and have potential to be exposed to rotenone during treatment. In general, adult, air-breathing amphibians are not affected by rotenone at fish killing concentrations (Chandler and Marking 1982, Grisak et al. (2007) but the larvae would likely be affected (Grisak et al 2007, Billman et al 2011). Billman et al. (2011) conducted laboratory toxicity tests of the impacts of rotenone on Columbia spotted frogs (*Rana luteiventris*) and boreal toads (*Anaxyrus boreas boreas*). They found significant mortality to the larval stages of both species if they are exposed for 96 hours to 1 ppm CFT Legumine, but the mortality was less when exposed to lower dosages (0.5 ppm) or for a shorter duration (4 hours or less). In Yellowstone Park rotenone caused nearly 100% mortality in gill-breathing, amphibian tadpoles within 24 hours, but did not affect non-gill breathing metamorphs, juveniles, or adults. In the year(s) following, tadpole repopulation occurred at all water bodies treated with CFT Legumine and population levels were similar to or higher than, pre-treatment levels (Billman et al. 2012). Olsen (2017) found that a concentration of 1 ppm rotenone in the West Fork of Mudd Creek produced 100% mortality of Rocky Mountain tailed frog (*Ascaphus montanus)* tadpoles, but at concentrations of 0.75, 0.5 and 0.25 ppm mortality averaged only 33%. To mitigate for the potential impacts to larval stages of amphibians, applications can be performed later in the year when the larvae are not present, such as the fall, for shorter duration (4 hours) or at a lesser concentration. The Rainbow Lake treatment will occur in late August or early September when most of the larval amphibians within the treatment area would have likely already metamorphized into adult life stages a concentration of less than 1ppm rotenone may be used further minimizing any long-term detrimental impacts to amphibians.

Below is a list of amphibians native to northwest Montana that includes Rainbow Lake and the outlet tributary (Table 2). FWP completed surveys for the presence of amphibians in Rainbow

Lake area in 2016 and observed an average of about 0.22 long-toed salamanders (A*mbystoma macrodactylum*) per minute of survey time. No other species were observed.

Table 2. Amphibians with potential to be exposed to rotenone in Rainbow Lake (from Montana Natural Heritage Program).

Order	Common Name	Scientific Name	Gilled Phase Coincide with late summer/early fall piscicide treatment	Status
Caudata/ salamanders	Long-toed salamander	*Ambystoma macrodactylum*	No	G5, S4
Anura/toads and frogs	Rocky Mountain tailed frog	*Ascaphus montanus*	Yes	G4, S4
	Columbia spotted frog	*Rana luteiventris*	Yes, at higher elevations	G4, S4
	Western toad	*Anaxyrus boreas*	Yes	G4, S2, sensitive (USFS and BLM)
	Pacific chorus frog	*Pseudacris regilla*		G5, S4

S2 = In Montana, at risk due to very limited and/or potentially declining population numbers, range and/or habitat, making vulnerable to extirpation.
G4 = Globally, is apparently secure, although it may be rare in parts of its range, and/or suspected to be declining.
G5 = Globally, the species is common, widespread, and abundant, although it may be rare in parts of its range. The species is not vulnerable in most of its range.
S4 = In Montana, the species is apparently secure, although it may be rare in parts of its range, and/or suspected to be declining.

Long-toed salamanders occupy portions of western Montana east and west of the Continental Divide. This species is unlikely to experience long-term population effects of piscicide treatment. Long-toed salamanders usually lay eggs in ponds or lakes. Larval long-toed salamanders could be exposed to rotenone during the completion of this project. However, larval long-toed salmanders have been shown to be 5 times more tolerant to Prenfish, a formulation of

rotenone using organic solvents and dispersants, than fish, and adult long-toed salamanders survived 96-hour exposure to treatment concentrations of Prenfish used in piscicide projects (Grisak et al. 2007). Adult long-toed salamanders are terrestrial and breed immediately after snowmelt. Most larval forms would likely not be present in the Rainbow Lake or the outlet tributary at the time of rotenone treatment, but those that were present would likely not be harmed at the concentrations proposed for use in this project. There are numerous seeps and springs along the Rainbow Lake outlet tributary that would not be treated with rotenone. These areas would provide refuge and a population source for recolonization if any amphibians were killed as a result of this project. These refuge populations in combination with terrestrial adult lifestages within the project area make it unlikely that long-toed salamanders would suffer any long-term effects from the proposed piscicide treatment. However, if larval life stages of amphibians were present in Rainbow Lake during the rotenone treatment, this could possibly result in the loss or reduction of a year class; however, breeding in following seasons would allow the population to recover.

FWP surveys have not observed western toads in the project area, but a search of the MNHP has records of western toads near the project area. Western toads are a species of concern in Montana. Rotenone would be unlikely to harm adult western toads, as they are highly terrestrial as adults, and their impermeable skin protects toads from toxic chemicals. Moreover, adults would be prone to leave water if they encountered rotenone (Maxell and Hokit 1999).

Western toads will breed in streams, but in slower waters off the main channel. Western toads may also breed in wetlands and lakes in the project area. Laboratory investigations confirm the toxicity of rotenone to western toad tadpoles (Billman et al. 2011); however, the presence of numerous older age classes of terrestrial adults, and their high reproductive potential would counteract any mortality of tadpoles. Western toad populations were not decreased following rotenone treatment in 10 alpine lakes in western Montana (Fried et al. 2018). Female western toads in Montana have clutch sizes reaching 20,000 eggs (Maxell et al. 2003), and such large reproductive potential promotes rapid recovery.

Timing application of piscicide in late summer through early fall would be past the period of metamorphosis for western toads. If gilled forms were still present, they would be unlikely to survive the winter, so mortality associated with piscicide would not be additive {Bryce Maxell, MNHP, personal communication}. Any effects of rotenone treatment on western toads would be minor and short-term.

Rocky Mountain tailed frogs are the most tied to water of all the frogs and would likely experience short-term and minor effects from rotenone exposure. Their reproductive strategy is to mate in August to September and store the sperm overwinter. Eggs are oviposited the next spring, and metamorphosis occurs up to 4 years later. Therefore, at least 1-year class of tadpoles would be exposed to rotenone, with 2 or more exposures being possible. Nevertheless, their life

history strategies make Rocky Mountain tailed frogs resilient to rotenone treatment. Rocky Mountain tailed frogs are a long-lived species, and do not reach reproductive maturity until age 7 or 8. This species would be resilient to rotenone treatment because many older year classes would survive, and treatment concentrations of rotenone do not have an adverse effect on adults (Grisak et al. 2007). In addition, Rocky Mountain tailed frog tadpoles with a four-hour exposure experienced 100% mortality to 1 ppm rotenone; however, with concentrations of 0. 75, 0. 5, and 0. 25 ppm mortality averaged 33% (Olsen 2017). Larger tadpoles were more resilient. While it is possible these frogs inhabit the Rainbow Lake project area, FWP surveys have not observed them.

Columbia spotted frogs typically deposit their eggs in shallow water containing emergent vegetation from mid-April to early June. Complete metamorphosis occurs within 8-16 weeks (Werner et al. 2004). Columbia spotted frogs that have reached a lung-breathing life stage do not suffer an acute response to trout-killing concentrations of piscicides (Grisak et al. 2007). However, piscicide treatments are acutely toxic during the gill-breathing life stage as tadpoles (Billman et al. 2011). Because of this, piscicide treatments are increasingly being implemented late in the fall to reduce exposure to the gill-breathing life stage. The most vulnerable populations of Columbia spotted frogs are those at elevations above 6,500 to 7,000 feet. These populations are temperature limited and will remain as gilled tadpoles throughout the winter (Bryce Maxell, Montana Natural Heritage Program, personal communication). This species was not observed in the Rainbow Lake project area, but likely inhabits the area. Like gill-bearing aquatic macroinvertebrates, frog and toad larvae are sensitive to rotenone, and exposure to rotenone at levels used to kill fish is acutely toxic to Columbia spotted frog, Rocky Mountain tailed frog, and western toad larvae (Grisak et al. 2007; Billman et al. 2012). Although tadpoles may be vulnerable to rotenone, at least some species may be up to 10 times more tolerant than fish (Chandler and Marking 1982). Treatment in late summer or early fall is a recommended practice to prevent effects on frogs and toads, as many are past the gilled life history stage (Grisak et al. 2007). In the short-term, this practice may not be protective of species that remain as gilled larvae for more than 1 year, or at high elevations, where delay in the breeding season and low temperatures delay metamorphosis. Nevertheless, toads and frogs have considerable potential to recover from this short-term disturbance.

Pacific chorus frogs typically breed in in shallow, warm, fishless waters which may or may not have emergent vegetation (Maxell et al. 2009). Pacific Treefrogs typically move into adjacent uplands after breeding and are rarely seen. Adults use terrestrial habitats up to several hundred meters away from their breeding pond. In western Montana these frogs breed in temporary ponds at lower elevation forests and intermountain valleys shortly after snowmelt. In northwestern Montana the highest elevation an individual Pacific chorus frog was found was 4,774 ft elevation (Maxell et al. 2009). Given that Pacific chorus frogs are unlikely to inhabit the project area and

adult Pacific chorus frogs would have low vulnerability to piscicide and be able to leave the project area, this species would not likely suffer long-term impacts from the proposed activities.

Variability of tolerance to rotenone among species of toads and frogs is unknown; however, evidence for resiliency to rotenone of some species suggests a general tolerance is possible. A study in Norway examined the response of lake-dwelling amphibians, the common frog (*Rana temoraria*) and common toad (*Bufo bufo*), to treatment with CFT Legumine (Amekleiv et al. 2015). These species were observed before and 1 year after treatment with rotenone, with adults, eggs, and tadpoles being present following treatment. They concluded CFT Legumine had little effect on these species. A field study among several alpine lakes in northwest Montana reported similar detection frequencies before and after lake treatments for Columbia spotted frogs, long-toed salamanders, western toads, and adult Rocky Mountain tailed frogs (Fried et al. 2018).

Zooplankton

Rotenone has greater initial effects on abundance and diversity of zooplankton than stream-dwelling invertebrates, given the longer period of exposure and their permeable bodies (Vinson et al. 2010). Biomass of zooplankton recovers rapidly; however, zooplankton community composition can take from 1 week to 3 years to return to pretreatment conditions (Beal and Anderson 1993; Vinson et al. 2010). Like stream-dwelling invertebrates, zooplankton have life history strategies that aid in rapid recolonization following disturbance (Havel and Shurin 2004). Recovery of zooplankton varies among taxa, with a dramatic bloom of early colonizers in the first few months (Beal and Anderson 1993). Other taxa take longer to recover, but the diversity and abundance can return as quickly as 6 months. The number and diversity of zooplankton increased in Devine Lake in the Bob Marshall Wilderness in Montana following a rotenone treatment (Rumsey et al. 1996). Densities of zooplankton in upper and lower Martin lakes nearly Olney, Montana were similar to pre-rotenone treatment two years after treatment (Schnee 1996). Although rotenone is toxic to zooplankton, field studies confirm the effects are short-term and minor, with populations rebounding first in biomass, then in diversity.

CFT Legumine is being used across continents in native fish conservation, and research in Norway demonstrated rapid recovery using concentrations and duration of CFT Legumine exposure in lakes like what is proposed for this project. In a Norwegian lake, zooplankton were sampled before application of CFT Legumine, immediately after treatment, and 1-year posttreatment (Amekleiv et al. 2015). CFT Legumine had an initial negative effect on zooplankton, with none detected immediately after treatment. The relative abundance of zooplankton changed from pretreatment to 1-year post treatment, with some species comprising a much higher proportion of the zooplankton community posttreatment. In addition, overall abundance of zooplankton increased considerably posttreatment. Rotenone removed common roach {Rutilus rutilus}, a species of minnow that preys on zooplankton, which was attributed to the population boom of zooplankton.

Zooplankton have multiple ways to recolonize standing waters (Havel and Shurin 2004). Many zooplankton are capable of asexual reproduction, which favors rapid recolonization from existing eggs and zooplankton that survived treatment. Moreover, lakes have a long-term bank of dormant eggs. Wind, animals, and humans disperse dormant eggs from neighboring lakes. In Rainbow Lake, zooplankton communities would likely follow the typical cycle of rapid recolonization of early colonizing species. The zooplankton community would recover in a few months to a few years. The rapid recovery of numbers would reset the food web and provide fertile waters for the return of fish.

As rotenone is toxic to zooplankton, plankton will be sampled before rotenone application and again one year after treatment has been completed. Rainbow Lake would have a bank of dormant eggs to jumpstart recovery, and zooplankton would likely recolonize from influx of dormant eggs from neighboring lakes.

Stream-Dwelling Aquatic Invertebrates

Rotenone can result in temporary reduction of gilled aquatic invertebrates in streams, but they are resilient and recover rapidly. Invertebrates that are most sensitive to rotenone also tend to have short life-cycles, which results in the highest rates of recolonization (Cook and Moore 1969; Engstrom-Heg et al. 1978). Although gill-respiring invertebrates are a sensitive group, many are far less sensitive to rotenone than fish (Schnick 1974; Chandler and Marking 1982; Finlayson et al. 2010). Due to their short life cycles (Wallace and Anderson 1996), strong recolonization ability (Williams and Hynes 1976), and generally high reproductive potential (Wallace and Anderson 1996), aquatic invertebrates are capable of rapid recovery from disturbance (Boulton et al. 1992; Matthaei et al. 1996).

Fisheries managers are using CFT Legumine across continents in native fish conservation projects, and these efforts follow protocols equivalent to what is proposed for this project, which allows for generalizations among studies. Practices to limit mortality of nontarget organisms include using the lowest effective concentration to kill fish and limiting the duration of exposure. Consistently, studies of aquatic invertebrates in waters treated with CFT Legumine under current practice show the populations recover within a year (Skorupski 2011; Kjærstad et al. 2015; Bellingan et al. 2019). Mortality associated with rotenone application as proposed for this project is slight to moderate (Skorupski 2011), leaving a substantial proportion of invertebrates unharmed. These survivors reproduce and contribute to recovery of the community.

Treatment with rotenone mimics environmental stressors under which aquatic invertebrates evolved. Streams are prone to periodic disturbance such as floods, wildfire, and extreme drought, and these events can kill or displace invertebrates from reaches of stream. Aquatic invertebrates are adapted to periodic disturbance and have several mechanisms to recolonize depopulated reaches. Combined, these mechanisms result of rapid recovery of aquatic invertebrates affected by rotenone treatment or reduced by natural disturbance.

There are many seeps and springs that enter the outlet tributary that are not capable of supporting fish but do support aquatic invertebrates. These habitats could serve as a recolonizing source after the proposed rotenone treatment. Aquatic invertebrates have a strong tendency to drift (Townsend and Hildrew 1976; Williams and Hynes 1976; Brittain and Eikeland 1988), which is transport of invertebrates by stream flow. Aquatic invertebrates are adapted to running waters, but they can be dislodged or they may actively drift to avoid predation or find new food patches (Brittain and Eikeland 1988). The importance of drift in dispersal of stream-dwelling invertebrates is an area of extensive study. Moreover, drift is what makes fly fishing with nymphs possible as a sport, as artificial nymphs mimic naturally drifting invertebrates.

Downstream drift of invertebrates is the major mechanism by which aquatic invertebrates recolonize streams and accounted for over 40% of invertebrates recolonizing experimentally depopulated reaches of stream (Williams and Hynes 1976). Fishless headwater reaches are not treated with rotenone, and these areas have tremendous capacity to contribute high diversity and large numbers of invertebrates (Wipfli and Gregovich 2002; Hollis 2018). The amount of energy contributed from aquatic and terrestrial invertebrates and detritus drifting from 1 kilometer {0.62 miles} of fishless headwaters could support 100-2000 young of the year salmonids (Wipfli and Gregovich 2002). Although rate of drift varies with numerous factors (Brittain and Eikeland 1988), treated reaches of the outlet stream would receive a substantial, continuous supply of invertebrates from untreated seeps and springs, which would contribute to rapid recovery of invertebrate populations. The short-term reduction and absence of fish would also contribute to recovery of invertebrate populations providing a productive stream when fish are returned to treated streams.

Reproduction by aerial adults is the secondary mechanism aquatic invertebrates use to recolonize streams. Reproduction by winged adults accounted for 28% of invertebrates recolonizing experimentally depopulated reaches of stream (Williams and Hynes 1976). Having a winged adult state that flies upstream to reproduce or disperses from neighboring areas counteracts the constant passive or active drift of larval invertebrates and allows for repopulating reaches following disturbance.

Movement of invertebrates from deeper in the substrate and from downstream are other mechanisms of recolonization. Upstream movement of aquatic organisms is a relatively minor mechanism for recovery (Williams and Hynes 1976) and would likely not be a large contributor to recovery in streams with a downstream barrier. In contrast, invertebrates moving up from deeper in the streambed have better potential to contribute to recovery. Experimentally, this source contributed about 18% of invertebrates recolonizing a depopulated reach (Williams and Hynes 1976). Eggs, pupae, and larvae deeper in the streambed may be resistant to rotenone or not receive lethal concentrations of rotenone, especially in reaches with substantial groundwater contribution, which would dilute rotenone applied at the surface. In rotenone projects in

Montana, impressive hatches of invertebrates have been observed the day after a stream was treated with rotenone indicating substantial numbers of invertebrates are present posttreatment to immediately jumpstart recovery.

Because piscicide has potential to alter abundance and species composition of aquatic invertebrates over the short-term, FWP piscicide policy requires pretreatment sampling of benthic aquatic invertebrates (FWP 2017). The timing and intensity of sample varies with the potential for the project to have adverse effects on invertebrate species of concern and the potential for controversy. Review of the MNHP's species of concern database did not yield records of invertebrate species of concern in the project area.

Review of the MNHP species of concern database and absence of benthic species of concern in samples collected in the outlet tributary in 2016 place this project in the category 1 benthic invertebrate monitoring protocols (Table 3) (FWP 2017). Samples would be collected within a month before application of CFT Legumine in the treatment area and an untreated control in the same stream. Invertebrates would be identified to the lowest practical taxonomic level allowing for calculation of standard metrics of biological integrity such as number of taxa, number and percentages of mayflies, stoneflies, and caddisflies.

Table 3. Benthic macroinvertebrate sampling procedures and protocols for categories 1 and 2 (FWP 2017).

Category	***Sample Locations***	***Sample Dates***	***Sample gear, sample size***	***Metrics***
1	Control & treatment area {same stream}	• 1 year to 1 month pretreatment • 1 year posttreatment	Travelling kick net {1 sample in each of 3 sites in treatment area and 1 sample in control area}	• Taxa richness • EPT indices • CPUE Identify to lowest practical taxonomic level
2	Control, treatment area, deactivation zone {same stream}	• 1-year pretreatment and no more than 1 month pretreatment • At least 1 month posttreatment, pre-runoff the following spring, and 1 year posttreatment	Use DEQ's current sampling and analysis protocols, including 3 sites in treatment area, control area, and deactivation zone	• Taxa richness • EPT indices • CPUE • Functional feeding group metrics • Habit metrics • Composition metrics • Richness metrics Build a reference collection, have an independent taxonomist identify 10% subset for quality assurance, and identify to lowest practical taxonomic level

Mussels and Clams

No mussels or clams are known to exist in the project area. Nevertheless, freshwater mussels tend to have a much higher tolerance to rotenone than fish or other aquatic invertebrates (Hart et al. 2001). Chandler and Marking (1982) found that clams and snails were between 50 and 150 times more tolerant than fish to Noxfish (5% rotenone formulation). Dolmen et al. (1995) found that pearl mussels exposed in a field experiment to 5 ppm rotenone for 12 hours experience no mortality. In laboratory experiments these same authors determined the upper lethal limit for western pearl mussels (*Margaritifera falcata*) was 30-40 ppm rotenone which is more than 30 times the application rate for the proposed project. Experiments were conducted in the West Fork Mudd Creek in the Big Hole River drainage in 2013 on western pearlshell mussels. The results of these experiments indicated that rotenone applied to a stream at a concentration of 1 ppm for 4 hours had no acute effect on mussel mortality 24 or 72 hours after exposure (Olsen 2017). Given that no mussels or clams are known to exist in the project area and their relatively high tolerance to rotenone exposure, this project is not expected to impact mussels or clams.

No Action Alternative
Not implementing the project would have no impact on the distribution or abundance of animals.

Leave Fishless Alternative
This alternative would have the same impacts as the preferred alternative.

Comment 5d

Fish

Preferred Alternative
Although FWP was unable to locate stocking records for Rainbow Lake, it was most likely stocked with Yellowstone cutthroat trout prior to 1960 by the Montana Fish and Game (the former agency name of MT FWP). Yellowstone and westslope cutthroat trout are both subspecies of cutthroat trout. This project is designed to replace the Yellowstone cutthroat trout with WCT. Therefore, this project would result in the introduction of a subspecies of cutthroat trout (westslope) that has not been previously stocked in Rainbow Lake. Although Rainbow Lake was likely historically fishless due to the water fall barrier, westslope cutthroat trout are common within the larger Wigwam River drainage downstream of the fish barrier. This project will be beneficial to WCT, by reducing potential source of a non-native subspecies capable of hybridizing with westslope cutthroat trout.

No Action Alternative
Not implementing the project would leave the existing population of Yellowstone cutthroat trout in Rainbow Lake.

Leave Fishless Alternative
This alternative would not re-introduce westslope cutthroat trout into Rainbow Lake after the removal of the Yellowstone cutthroat trout population.

Comment 5f

Preferred Alternative
Review of the MNHP's database on animal species of concern found several animal species of concern with potential to be in the project area (Table 4). Information on distribution, migration, habitat use included here are from the field guide information in the MNHP's website {MNHP animal field guide}, which includes citations.

Table 4. Animal species of concern within the project area {MNHP animal field guide}.

Family	Common Name	Scientific Name	State Status	USFS Status
Bufonidae	Western toad	*Anaxyrus boreas*	S2	Sensitive
Anatidae	Harlequin duck	*Histrionicus histrionicus*	S2B	Sensitive
Strigidae	Great gray owl	*Strix nebulosa*	S3	
Picidae	Black-backed woodpecker	*Picoides arcticus*	S3	Sensitive
Picidae	Pileated woodpecker	*Dryocopus pileatus*	S3	
Accipitridae	Northern goshawk	*Accipiter gentilis*	S3	
Accipitridae	Golden eagle	*Aquila chrsaetos*	S3	
Accipitridae	Bald eagle	*Haliaeetus leucocephalis*		Sensitive
Falconidae	Peregrine falcon	*Falco peregrinus*	S3	Sensitive
Corvidae	Clark's nutcracker	*Nucifraga columbiana*	S3	
Fringillidae	Cassin's finch	*Haemorhous cassinii*	S3	
Fringillidae	Evening grosbeak	*Coccothraustes vespertinus*	S3	
Fringillidae	Gre-crowned Rosy-finch	*Leucosticte tephrocotis*	S2	
Certhiidae	Brown creeper	*Certhia americana*	S3	
Turdidae	Veery	*Catharus fuscescens*	S3B	
Turdidae	Varied thrush	*Ixoreus naevius*	S3B	
Vespertilionidae	Townsend's big-eared bat	*Corynrhinus townsendii*	S3	Sensitive
Vespertilionidae	Yuma myotis	*Myotis yumanensis*	S3	
Vespertilionidae	Long-legged myotis	*Myotis Volans*	S3	
Vespertilionidae	Long-eared myotis	*Myotis evotis*	S3	
Vespertilionidae	Little brown myotis	*Myotis lucifugus*	S3	
Vespertilionidae	Fringed myotis	*Myotis thysanodes*	S3	
Vespertilionidae	Silver haired bat	*Lasionycteris noctivagens*	S4	
Bovidae	Bighorn sheep	*Ovis canadensis*		Sensitive
Mustelidae	Wolverine	*Gulo gulo*	S3	Proposed
Felidae	Canada lynx	*Lynx canadensis*	S3	Threatened
Canidae	Gray wolf	*Canis lupus*		Sensitive
Ursidae	Grizzly bear	*Ursos arctos*		Threatened

S2 = at risk because of very limited and/or potentially declining abundance, range, or habitat, making it vulnerable to extirpation in the state.
B=Breeding populations are potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.
S3 =Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas
areas.
Sensitive = population viability is a concern on Forest Service lands as evidenced by a significant downward trend in population or habitat capacity.
Proposed = any species that is proposed under the Federal Register to be listed under section 4 of the Endangered Species Act
Threatened = listed as threatened under the Endangered Species Act

Western toads are likely present in the project area. See Amphibians for review of the literature on potential for rotenone projects to affect western toad. In summary, this project would have little effect on western toad, as the project would occur after metamorphosis, and western toads have tremendous reproductive capacity, which makes them resilient to short-term disturbance.

The MNHP database has records of several bird species of concern in the project area. Most bird species of concern inhabit terrestrial environments and rely on terrestrial food sources. Fieldworkers in the project area would result in short-term disturbance to these species, although some species are tolerant to presence of humans. Some may drink treated water; however, the exceptionally low toxicity in treated water, and the short duration rotenone remains toxic in the environment would not result in health risks to birds drinking water.

The Wigwam River drainage may provide breeding habitat for harlequin duck. However, the outlet tributary is likely too small of tributary to provide quality nesting or foraging habitat for this species. Nevertheless, in the unlikely scenario that harlequin ducks were present in the project area, the following factors would contribute to the proposed activities not affecting this species. Harlequin ducks migrate to mountain streams in the Intermountain West from the Pacific Coast for breeding. Breeding birds arrive in late April to early May, and males leave in June. Females and young depart from late July to early September. Ducklings would be fledged and close to out-migrating during the proposed project period if they had not already left. Fieldworkers would be a short-term disturbance to harlequin ducks if still present. Rotenone could increase the availability of invertebrates through drift of killed invertebrates. Exposure to rotenone through eating invertebrates or drinking water would not present a health risk. These factors would result in short-term and minor disturbance to harlequin ducks and the possible benefit of greater accessibility of rotenone-killed invertebrates.

Golden and bald eagles have potential to scavenge dead fish; however, the low concentration of rotenone in fish tissues, and its rapid breakdown in the environment would not present a health risk to eagles.

Seven species of bat (Table 4) may be present in the project area during the time of project implementation. Even though the specific habits used by each species may differ slightly, the overall potential for impact of the proposed actions can be generalized for all species. The habitats used by these species of bats for roosting and hibernation will not be impacted by the proposed activities. Bats are in general nocturnal creatures that eat flying insects. The relatively short-term reduction of emergent invertebrates from aquatic origin resulting from the proposed actions would result in short-term and minor effects on these seven species of bats would at most because of the relatively small area of impact and the mobile ability of bats to forage in nearby areas no impacted by the proposed activities.

The project area is within habitat likely to be occupied by wolverines. This species has been proposed for inclusion for protection under the endangered species list, and the State of Montana considers it an S3 species that is potentially at risk due to limited or declining numbers, range, or habitat. Wolverines live in alpine tundra, and boreal and mountain coniferous forests. Wolverines are mobile within large home ranges. The presence of fieldworkers may displace them temporarily from a small portion of their home range. Wolverines are opportunistic in their food habits and could eat rotenone-killed fish or drink rotenone-treated water; however, as discussed in the Mammals section above, the low concentrations and short duration of rotenone

in the environment would not pose a health concern to wolverines. This project would have minor and short-term disturbance to wolverines, as they would be resilient to human activities in a small portion of their home range for the duration of the project.

Canada lynx likely inhabit this region of northwest Montana (MNHP 2018). However, if present, lynx would stick to Engelmann spruce-subalpine fir communities and remain in or close to dense forest cover and avoid forest openings and meadows. Canada lynx are specialists and prey mostly on snowshoe hare but will switch to red squirrels or grouse when hare populations are limited (USFWS 2017). The project would have a slight potential to displace the rare, dispersing Canada lynx in the project area. If present during treatment, a Canada lynx could be exposed to rotenone treated water; however, the exposure would be of too short a duration and concentration to cause a health risk. Canada lynx would be unlikely to scavenge dead fish. Canada lynx would be most sensitive to large-scale changes in terrestrial habitat, which would not occur with this proposed action. The combination of rarity of Canada lynx in the project area, their habitat and food preferences, and short duration of project would result in negligible effects on Canada lynx

Grizzly bears are present in the project area and seen with relative frequency (MNHP 2018). Project activities including aircraft operation and rotenone application by fieldworkers would have potential to disturb or temporarily displace grizzly bears, and conflict between bears and humans would be possible. The proposed action contains mitigation measures to minimize disturbance to grizzly bears. These include compliance with the Northern Continental Divide Ecosystem Area Food/Wildlife Attractant Storage Order that ensure all attractants including rotenone, food, and garbage would be secured throughout the duration of the project either in bear-proof containers or behind electric fences.

Fieldworkers would be trained in bear country safety practices, such as safe food storage, making noise, and they would carry bear spray. Handling, transporting, and storing dead fish would increase the risk of conflicts with grizzly bears in the remote project area, so fish would be left to decay. Grizzly bears do not rely on fish as a primary food source at this elevation; however, they would opportunistically scavenge fish carcasses. They would also have potential to be exposed to rotenone-treated water; however, the low concentration and short duration of exposure of rotenone through eating dead fish or drinking treated water would not pose a health risk to grizzly bears. In summary, the short-term presence of fieldworkers and dead fish have potential to result in conflicts with grizzly bears but following bear safety practices would decrease potential for conflicts that would be detrimental to humans or bears.

The proposed work will involve the use of a helicopter to deliver equipment to Rainbow Lake. FWP and BPA biologists used the “Guide to Effects Analysis of Helicopter Use in Grizzly Bear Habitat” which is a guiding document compiled by the Montana/Northern Idaho Level I Terrestrial Biologists Team (2009) to determine the appropriate level of effect on grizzly bears for the proposed project. The affects analysis considered the overall disturbance duration, frequency, intensity, and severity associated with helicopter use as well as the other human activities associated with this project. Therefore, this project would not likely adversely affect grizzly bears.

The project site is within the range of the gray wolf. Various packs may use this area at times but are not dependent on the lake or fish in the lake for food. The impacts to this species would be non-existent.

The project would be beneficial to westslope cutthroat trout, a species of concern that is currently not in the project area. This project would provide substantial habitat within an area predicted to remain suitable for westslope cutthroat trout despite the warming climate. This project would eliminate a source of Yellowstone cutthroat trout to the Wigwam River drainage and the greater upper Kootenai River watershed.

Bull trout (*Salvelinus confluentus*) are common within the Wigwam River drainage, including Rabbit Creek, which is a tributary to the Wigwam River. The unnamed outlet tributary from Rainbow Lake is a tributary to Rabbit Creek, but bull trout are not found upstream of the natural barrier falls. Therefore, the proposed actions will have no effect on bull trout or their habitat.

In summary, the effects of the proposed action would not result in a trend toward federal listing or loss of population viability for any listed species within the analysis area. FWP and BPA staff determined that there would be "no effect" to all threatened or endangered species (except grizzly bears), and that any impacts to grizzly bears would be short term and minor and not likely to adversely affect grizzly bears. In June 2022, BPA staff contacted the US Fish and Wildlife Service to request informal consultation to request concurrence with this affects determination.

No Action Alternative

Not implementing the project would have no effect on most of the species of concern in the area, except for western toad and Yellowstone cutthroat trout. Rainbow trout may continue to exert predation pressure on western toads that they did not evolve with.

Leave Fishless Alternative

This alternative would have the same effects on species of concern as the proposed action for the duration of the treatment. However, since Rainbow Lake would be left fishless, no fish would not be available to mammals and birds that eat fish. Westslope cutthroat trout inhabiting waters downstream of the natural fish barrier would not benefit from the elimination of a source of hybridizing species of trout.

Comment 5g

Proposed Alternative

Presence of aircraft and fieldworkers would result in short-term disturbance to wildlife and may temporarily displace animals from occupied habitat. Large mammals would have the greatest potential to be disturbed by presence of humans. This disturbance would be short-term and

minor disturbance. Conservation and monitoring often brings fieldworkers into remote areas, and this project would be similar to common practice.

No Action Alternative
Wildlife would not experience increased stress if the project is not implemented.

Leave Fishless Alternative
This option would result in the same potential for stress on wildlife as the proposed action.

3.2 *Human Environment*

3.2.1 Noise/Electrical Effects

6. NOISE/ELECTRICAL EFFECTS Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Increases in existing noise levels?			X			6a
b. Exposure of people to serve or nuisance noise levels?			X			6b
c. Creation of electrostatic or electromagnetic effects that could be detrimental to human health or property?		X				
d. Interference with radio or television reception and operation?		X				

Comment 6a

Preferred Alternative
Rainbow Lake is located in a remote location with relatively low recreational visitation. The only noise generated from this project would be from a generator that will be used at the detox station but is consistent with present levels. The noise generated from this would be short term and minor.

No Action Alternative
There would be no noise generated by this alternative.

Leave Fishless Alternative
This option would result in the same noise levels as the proposed action.

Comment 6a

Preferred Alternative

This project would bring short-term increases in noise from several sources. The increased presence of humans would result in increased noise from talking, walking through the forest, and making their presence known as part of bear safety. Helicopters would be required to transport equipment and the piscicide product to the project area which may occur over an estimated 6 trips over two days. Mixing CFT Legumine in Rainbow Lake would require a gas motor, which would run for no more than three days total.

No Action Alternative

There would be no noise generated by this alternative.

Leave Fishless Alternative

This option would result in the same noise levels as the proposed action.

Comment 6b

Preferred Alternative

This action would use a helicopter, boat motor, and a gas powered generator that would result in noise that some could reasonably consider to be a nuisance. The noise would be of short duration. Noise from helicopters would be the most apparent and travel the farthest. Noise from the boat motor would last up about two days during the rotenone and potassium permanganate product applications. The generator driving the power auger applying potassium permanganate would be running no more than an estimated four days. Any noise generated from the proposed activities would be short term and minor.

No Action Alternative

Not implementing the project would not expose people to noise that would be perceived as a nuisance.

Leave Fishless Alternative

This option would result in the same noise levels as the proposed action.

3.2.2 Land Use

7. LAND USE Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Alteration of or interference with the productivity or profitability of the existing land use of an area?		X				

b. Conflicted with a designated natural area or area of unusual scientific or educational importance?			X			7b
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?			X			7c
d. Adverse effects on or relocation of residences?		X				

Comment 7b

Preferred Alternative
This proposed project area is within Ten Lakes Scenic Area that were designated as a Wilderness Study Area by the Montana Wilderness Study Act of 1977. The project would result in presence of field crews, their camps, and helicopters to transport supplies and equipment. This disturbance would be short-lived lasting. Press releases and placing signs near stream access points would alert the public to the project. Actions would be limited to the Rainbow Lake area (Figure 3), leaving the majority of the Ten Lakes Scenic Area undisturbed. The proposed actions were coordinated with the USFS Rexford Ranger District. The proposed actions would maintain the wilderness character of the areas and the potential inclusion in the National Wilderness Preservation System that existed in 1977 when the act was passed.

No Action Alternative
Not implementing the project would result in no conflict with designated natural areas.

Leave Fishless Alternative
This alternative would have the same impacts to natural areas as the preferred alternative.

Comment 7c

Cumulative Impacts: Impacts on land use from the proposed action would be short term and minor. FWP does not expect the proposed action to result in other actions that would impact land use in the project area. FWP does not foresee any other activities in the general vicinity that would add to impacts of the proposed action. As such there are no cumulative impacts related to land use from the proposed treatment of the proposed creek with piscicides.

Preferred Alternative
Recreation is the primary land use in the project area, and the proposed project would have potential to result in short-term disruption of land uses. The presence of fieldworkers could alter some visitors’ enjoyment of the area. This alteration would be short-term.

Waters in the project area would be temporarily closed to access while rotenone was active in the water. The CFT Legumine label requires restriction of recreational activities including wading, swimming, boating, and fishing while rotenone is being applied, so treated waters would be closed to public access until rotenone has been deactivated, either naturally or through application of potassium permanganate. Public access to Rainbow Lake would remain closed until the rotenone deactivating agent (potassium permanganate) is no longer measurable. Signs would be posted at trailheads and access points advising visitors to the closures.

The proposed timing for the project coincides with part of the general archery season and upland game bird hunting season. Project activity within the project area may displace game species, although this disturbance would be short-term and minor.

A goal of the project is complete eradication of Yellowstone cutthroat trout currently occupying Rainbow Lake, so recreational fishing would be impacted until transplanted westslope cutthroat trout reestablish the fishery in the lake. Full recovery of the fishery would likely take 2-4 years. No data on angling use of Rainbow Lake are available.

Replacing the existing Yellowstone cutthroat trout fishery with locally adapted westslope cutthroat trout could mitigate for the short-term absence of fish in Rainbow Lake. Westslope cutthroat trout are the trout native to this part of the upper Kootenai River Ecosystem and are a key component of its biological heritage. After the fishery is reestablished, visitors to the Rainbow Lake would have the rare opportunity to catch native westslope cutthroat trout in a remote setting. Moreover, this project would protect the westslope cutthroat trout in the Wigwam River drainage by removing this source of genetic contamination. The short-term lack of fishing opportunity would bring tremendous conservation and recreational value over the long-term.

Cumulative Impacts: Impacts on land use from the proposed action would be short term and minor. FWP does not expect the proposed action to result in other actions that would impact land use in the project area. FWP does not foresee any other activities in the general vicinity that would add to impacts of the proposed action. As such there are no cumulative impacts related to land use from the proposed treatment of the proposed creek with piscicides.

No Action Alternative

Not implementing the project would result in no changes to existing land uses.

Leave Fishless Alternative

This alternative would have the same short-term impacts to recreational land use as the preferred alternative. However, if Rainbow Lake were left fishless after the removal of the Yellowstone cutthroat trout inhabiting the lake, the recreational fishing opportunities at Rainbow Lake would be long-term.

3.2.3 Risks/Health Hazards

8. RISK/HEALTH HAZARDS Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Risk of an explosion or release of hazardous substances (including, but not limited to oil, pesticides, chemicals, or radiation) in the event of an accident or other forms of disruption?			X		yes	8a
b. Affect an existing emergency response or emergency evacuation plan or create a need for a new plan?			X		yes	8b
c. Creation of any human health hazard or potential hazard?			X		yes	see 8a 8c
d. Will any chemical toxicants be used?			X		yes	see 8a

Comment 8a

Preferred Alternative
The principal risk of human exposure to hazardous materials from this project would be limited to the applicators. All applicators would wear safety equipment required by the product label and SDS sheets. All applicators would be trained on the safe handling and application of the piscicide and potassium permanganate. Piscicide applicators become certified applicators upon passing examinations given by the Montana Department of Agriculture. Beyond this, FWP imposes additional requirements on its own employees through its internal piscicide policy (FWP 2017). An independent certified applicator must accompany each treatment, with "independent" status assigned to an individual who would not be expected to work on the treatment as part of their normal duties. Therefore, at least 2 Montana Department of Agriculture certified pesticide applicators would supervise and administer the project. Materials would be transported, handled, applied and stored according to the label specifications to reduce the probability of human exposure or spill.

No Action Alternative
There would be no human exposure or hazardous materials used by this alternative.

Leave Fishless Alternative
The human health risks for this alternative would be the same as those for the preferred alternative.

Comment 8b

Preferred Alternative

FWP piscicide policy requires a treatment plan be developed for rotenone projects (FWP 2017). The treatment plan provides the basis for ensuring effective chemical application while protecting health and safety and preventing accidents and spills. The treatment plan lays out a clear chain of command, requirements for training, and delegation of roles and responsibilities. Safety measures include a spill contingency plan, provisions for first aid, and requirements for personal protective equipment. Implementing projects in remote areas requires establishing clear lines of communication among members and ability to communicate with emergency responders. Fieldworkers will maintain communication with handheld radios and will be trained in their use. The plan includes provisions for monitoring and quality control. Implementing this project should not affect existing emergency plans. FWP's implementation plan provides internal risk management and safety provisions to minimize the need of requiring an outside emergency response, so any effects on existing emergency responders would be short-term and minor.

No Action Alternative

There would be no need for an emergency plan for this alternative.

Leave Fishless Alternative

This alternative would require the same emergency plans as the preferred alternative.

Comment 8c

Preferred Alternative

Information examined here includes an analysis of human health risks relating to rotenone exposure (EPA 2007, Fisher 2007). Acute toxicity refers to the adverse effects of a substance from either a single exposure or multiple exposures in a short space of time. Rotenone ranks as having high acute toxicity through oral and inhalation routes of exposure, and low acute toxicity through exposure to skin (EPA 2007; Table 5). Acute toxicity would be applicable to undiluted rotenone formulation, with median lethal doses for rats ranging from 39. 5 mg/kg for female rats, and 102 mg/kg for male rats. A rat would need to ingest or inhale 0.04 g of undiluted rotenone for a lethal dose. As rotenone is 5% of most rotenone formulations (including the CFT Legumine formation proposed for use in this project), a 1 kg rat would have to consume 0.63mL of formulation to receive a lethal dose. Because the treatment area would be closed to public access during rotenone application, exposure of humans to undiluted 5% rotenone formulation would not occur. Only personnel involved in the project who actively measure and are applying the chemical could be exposed. Oral or inhalation risks for these persons can be reduced or eliminated by proper use of personal protective equipment.

Chronic exposure is repeated oral, dermal, or inhalation of the target chemical (EPA 2007; Table 5). In humans, chronic exposure is the length of time equivalent to approximately 10% of the life span. Most piscicide treatments last less than 4 days, thus rotenone exposure to rotenone

would be limited to the days during treatment implementation. Therefore, the only people likely to experience chronic exposure are the applicators who dispense diluted CFT Legumine over multiple projects. The use of protective eyewear, gloves and dust/mist respirators (in the case of hand held devices that dispense rotenone) is sufficient to protect worker health.

The analysis of dietary risks considered threats to the subgroup “females 13-49 years old” and examined exposure associated with consuming exposed fish and drinking treated surface water (EPA 2007; Table 5). In determining potential exposure from consuming fish, the EPA used maximum residues in fish tissue. The concentrations of residue considered were conservative, meaning that they may have been an overestimate of the rotenone concentrations in muscle tissue, as they included unpalatable tissues, where concentrations may be higher. The EPA concluded that acute dietary exposure estimates resulted in a dietary risk below the EPA’s level of concern; therefore, consumption of fish killed by rotenone does not present an acute risk to the sensitive subgroup.

Table 5: Toxicological endpoints for rotenone (EPA 2007)

Exposure Scenario	**Dose Used in Risk Assessment, Uncertainty Factor (UF)**	**Level of Concern for Risk Assessment**	**Study and Toxicological Effects**
Acute Dietary (females 13-49)	NOAEL = 15 mg/kg/day UF = 1000 aRfD = 15 mg/kg/day = 0. 015 mg/kg/day 1000	Acute PAD = 0. 015 mg/kg/day	Developmental toxicity study in mouse (MRID 00141707, 00145049) LOAEL = 24 mg/kg/day based on increased resorptions
Acute Dietary (all populations)	An appropriate endpoint attributable to a single dose was not identified in the available studies, including the developmental toxicity studies.		
Chronic Dietary (all populations)	NOAEL = 0. 375 mg/kg/day UF = 1000 cRfD = 0. 375 mg/kg/day = 0. 0004 mg/kg/day 1000	Chronic PAD = 0. 0004 mg/kg/day	Chronic/oncogenicity study in rat (MRID 00156739, 41657101) LOAEL = 1. 9 mg/kg/day based on decreased body weight and food consumption in both males and females
Incidental Oral Short-term (1-30 days) Intermediate-term (1-6 months)	NOAEL = 0. 5 mg/kg/day	Residential MOE = 1000	Reproductive toxicity study in rat (MRID 00141408) LOAEL = 2. 4/3. 0 mg/kg/day [M/F] based on decreased parental (male and female) body weight and body weight gain
Dermal Short-, Intermediate-, and Long-Term	NOAEL = 0. 5 mg/kg/day 10% dermal absorption factor	Residential MOE = 1000 Worker MOE = 1000	Reproductive toxicity study in rat (MRID 00141408) LOAEL = 2. 4/3. 0 mg/kg/day
Inhalation Short-term (1-30 days) Intermediate-term (1-6 months)	NOAEL = 0. 5 mg/kg/day 100% inhalation absorption factor	Residential MOE = 1000 Worker MOE = 1000	[M/F] based on decreased parental (male and female) body weight and body weight gain
Cancer (oral, dermal, inhalation)	Classification; No evidence of carcinogenicity		

UF = uncertainty factor, NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, aPAD = acute population adjusted dose, cPAD = chronic population adjusted does, RfD = reference dose, MOE = margin of exposure, NA = Not Applicable

The EPA analysis of acute dietary risk for both food and drinking water concluded;

> *When rotenone is used in fish management applications, food exposure may occur when individuals catch and eat fish that either survived the treatment or were added to the water body (restocked) prior to complete degradation. Although exposure from this route is unlikely for the general U.S. population, some people might consume fish following a rotenone application. EPA used maximum residue values from a bioaccumulation study to estimate acute risk from consuming fish from treated water bodies. This estimate is considered conservative because the bioaccumulation study measured total residues in edible portions of fish including certain non-edible portions (skin, scales, and fins) where concentrations may be higher than edible portions (tissue) and the Agency assumed that 100% of fish consumption could come from rotenone exposed fish. In addition, fish are able to detect rotenone's presence in water and, when possible, attempt to avoid the chemical by moving from the treatment area. Thus, for partial kill uses, surviving fish are likely those that have intentionally minimized exposure.*
>
> *Acute exposure estimates for drinking water considered surface water only because rotenone is only applied directly to surface water and is not expected to reach groundwater. The estimated drinking water concentration (EDWC) used in dietary exposure estimates was 200 ppb, the solubility limit of rotenone. The drinking water risk assessment is conservative because it assumes water is consumed immediately after treatment with no degradation and no water treatment prior to consumption.*
>
> *Acute dietary exposure estimates result in dietary risk below the Agency's level of concern. Generally, EPA is concerned when risk estimates exceed 100% of the acute population adjusted dose (aPAD). The exposure for the "females 13-49 years old" subgroup (0.1117 mg/kg/day) utilized 74% of the aPAD (0.015 mg/kg/day) at the 95th percentile (see Table 5). It is appropriate to consider the 95th percentile because the analysis is deterministic and unrefined. Measures implemented as a result of this RED will further minimize potential dietary exposure (see Section IV).*

As for evaluating the human chronic risk from exposure to rotenone treated water, the EPA acknowledges the four principle reasons for concluding there is a low risk. First, the rapid natural degradation of rotenone. Second, using active detoxification measures by applicators such as potassium permanganate. Next, properly following piscicide labels which prohibit the use near water intakes. Finally, proper signing, public notification or area closures which limit public exposure to rotenone treated water.

No recreational access (e.g., wading, swimming, boating, and fishing) would be allowed within the treatment area while rotenone is being applied. At applications rates less than 1.8 ppm there is no risk to human health after the chemical has been applied to the water and once the rotenone

is mixed recreational access can resume. At application rates greater than 1.8 ppm in streams recreational access can be removed 72 hours after application is complete. For lakes and ponds where rotenone is applied at 1.8 ppm or more, recreational access can be restored following a 24-hour bioassay demonstrating survival of sentinel fish or 14 days, whichever is less. We plan to treat at no higher than 1.0 ppm concentration and anticipate a temporary public access closure to Rainbow Lake of up to seven days. The closure will be placarded throughout the treatment zone and the road will be blocked and manned by USFS and/ or FWP law enforcement officers. The aggregate risk to human health from food, water and swimming does not exceed the EPA level of concern (EPA 2007).

Recreationists in the area would likely not be exposed to the treatments because a temporary closure would preclude any from being in the area. Proper warning through news releases, signing the project area, road closure and administrative personnel in the project area should be adequate to keep unintended recreationists from being exposed to any treated waters. Administering application in late summer would further reduce exposure due to the relatively low number of users in this area.

Fisher (2007) conducted an analysis of the inert constituent ingredients found in the rotenone formulation of CFT Legumine for the California Department of Fish and Game. These inert ingredients are principally found in the emulsifying agent Fennodefo[99] which helps make the generally insoluble rotenone more soluble in water. The constituents were considered because of their known hazard status and not because of their concentrations in the Legumine formulation. Solvents such as xylene, trichloroethylene (TCE) and tetrachloroethylene are residue left over from the process of extracting rotenone from the root and can be found in some lots of Legumine. However, inconsistent detectability and low occurrence in other formulations that used the same extraction process were below the levels for human health and ecological risk. Solvents such as toluene, *n*-butylbenzene, 1,2,4 trimethylbenzene and naphthalene are present in Legumine, and when used in other applications can be an inhalation risk. However, because of their low concentrations in this formulation, the human health risk is low. The remaining constituents, the fatty acid esters, resin acids, glycols, substituted benzenes, and *1*-hexanol were likewise present but either analyzed, calculated or estimated to be below the human health risk levels when used in a typical fish eradication project.

Methyl pyrrolidone is also found in CFT Legumine. It is known to have good solvency properties and is used to dissolve a wide range of compounds including resigns (rotenone). Analysis of Methyl pyrrolidone in CFT Legumine showed it represents about 9% of the formulation (Fisher 2007). The analysis concluded regarding the constituent ingredients in CFT Legumine;

> "…None of the constituents identified are considered persistent in the environment nor will they bioaccumulate. The trace benzenes identified in the solvent mixture of CFT

> Legumine™ will exhibit limited volatility and will rapidly degrade through photolytic and biological degradation mechanisms. The PEGs are highly soluble, have very low volatility, and are rapidly biodegraded within a matter of days. The fatty acids in the fatty acid ester mixture (Fennodefo99™) do not exhibit significant volatility, are virtually insoluble, and are readily biodegraded, although likely over a slightly longer period of time than the PEGs in the mixture. None of the new compounds identified exhibit persistence or are known to bioaccumulate. Under conditions that would favor groundwater exchange the highly soluble PEGs could feasibly transmit to groundwater, but the concentrations in the reservoir, and the rapid biodegradation of these constituents makes this scenario extremely unlikely. Based upon a review of the physical chemistry of the chemicals identified, we conclude that they are rapidly biodegraded, hydrolyzed and/or otherwise photolytically oxidized and that the chemicals pose no additional risk to human health or ecological receptors from those identified in the earlier analysis. None of the constituents identified appear to be at concentrations that suggest human health risks through water, or ingestion exposure scenarios and no relevant regulatory criteria are exceeded in estimated exposure concentrations…"

To limit exposure to those applying rotenone, proper safety equipment would be used according to the label requirements.

The advantage of CFT Legumine over Prenfish is that it has less petroleum hydrocarbon solvents such as toluene, xylene, benzene and naphthalene. By comparison, Prenfish has a strong chemical odor. CFT Legumine is virtually odor-free and performs almost identically to Prenfish.

Concern over a potential link between rotenone and Parkinson's disease (PD) often emerges in piscicide projects. Research into links between rotenone and PD include laboratory studies intended to induce PD-like symptoms in laboratory animals as a tool for neuroscientists to conduct PD-related research (Betarbet et al. 2000; Johnson and Bobvraskaya 2015), epidemiological studies of PD in farm workers (Kamel et al. 2006; Tanner et al. 2011), and laboratory studies evaluating risks associated with inhalation (Rojo et al. 2007). Laboratory studies inducing PD-like symptoms do not provide a relevant model for field exposure by humans. These studies entail injection into the bloodstream of extremely high concentrations of rotenone, often with a chemical carrier to facilitate absorption into tissue, for long durations. Such studies have little applicability to uses of rotenone as a piscicide.

Epidemiological studies do not provide clear evidence that rotenone has a causal link with PD. A recent study linked the use of rotenone and paraquat with the development of Parkinson's disease in humans later in life (Tanner et al. 2011). The after the fact study included mostly farmers from 2 states within the United States who presumably used rotenone for terrestrial application to crops and/or livestock. The results of epidemiological studies of pesticide exposure, such as this one have been highly variable (Guenther et al. 2011). Studies have found no correlations between pesticide exposure and PD (e.g., Jiménez-Jiménez 1992; Hertzman

1994; Engel et al. 2001; Firestone et al. 2010), some have found correlations between pesticide exposure and PD (e.g., Hubble et al. 1993; Lai et al. 2002; Tanner et al. 2011) and some have found it difficult determine which pesticide or pesticide class is implicated if associations with PD occur (e.g., Engel et al. 2001; Tanner et al. 2011). Recently, epidemiological studies linking pesticide exposure to PD have been criticized due to the high variation among study results, generic categorization of pesticide exposure scenarios, questionnaire subjectivity, and the difficulty in evaluating the causal factors in the complex disease of PD, which may have multiple causal factors (age, genetics, environment) (Raffaele et al. 2011). A specific concern is the inability to assess the degree of exposure to certain chemicals, including rotenone, particularly the concentration of the chemical, frequency of use, application (e.g., agricultural, insect removal from pets), and exposure routes (Raffaele et al. 2011). No information is given in the Tanner et al. (2011) study about the formulation of rotenone used (powder or liquid) or the frequency or dose farmers were exposed to during their careers. There is also no information given about the personal protective equipment used or any information about other pesticides farmers were exposed to during the period of the study. Without information on how much rotenone individuals were exposed to and for how long, it is difficult to evaluate the potential risk to humans of developing Parkinson's disease from aquatic applications of rotenone products. Laboratory studies of risks associated with inhalation of rotenone of concentrations likely encountered by fieldworkers have not found PD-like symptoms in exposed rodents (Rojo et al. 2007).

The state of Arizona conducted an exhaustive review to the risks to human health of rotenone use as a piscicide (Guenther et al. 2011). They concluded:

> "To date, there are no published studies that conclusively link exposure to rotenone and the development of clinically diagnosed PD. Some correlation studies have found a higher incidence of PD with exposure to pesticides among other factors, and some have not. It is very important to note that in case-control correlation studies, causal relationships cannot be assumed and some associations identified in odds-ratio analyses may be chance associations. Only one study (Tanner et al. 2011) found an association between rotenone and paraquat use and PD in agricultural workers, primarily farmers. However, there are substantial differences between the methods of application, formulation, and doses of rotenone used in agriculture and residential settings compared with aquatic use as a piscicide, and the agricultural workers interviewed were also exposed to many other pesticides during their careers. Through the EPA reregistration process of rotenone, occupational exposure risk is minimized by: new requirements that state handlers may only apply rotenone at less than the maximum treatment concentrations (200 ppb), the development of engineering controls to some of the rotenone dispensing equipment and requiring handlers to wear specific PPE."

To reduce the potential for exposure of the public to rotenone during the proposed treatment, areas treated with rotenone would be closed to public access. Placard signs would be placed at access points informing the public of the closure and the presence of rotenone treated waters. Personnel would be onsite to inform the public and escort them from the treatment area should they enter. Rotenone treated waters would be contained to the proposed treatment areas by adding potassium permanganate to the stream at point 3 (Figure 3). Potassium permanganate would deactivate any remaining rotenone before leaving the project area. The efficacy of the deactivation would be monitored using fish (the most sensitive species to the chemical) and a hand-held chlorine meter. Therefore, the potential for public exposure to rotenone treated waters is very minimal. The potential for exposure would be greatest for those certified applicators and operators applying the chemical. To reduce their exposure, label mandates for personal protective equipment would be adhered to (see Comment 8a).

No Action Alternative

There would be no increased human health hazard associated with this alternative.

Leave Fishless Alternative

This alternative would have the same human health hazards as the preferred alternative.

3.2.4 Community Impact

9. COMMUNITY IMPACT Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Alteration of the location, distribution, density, or growth rate of the human population of an area?		X				
b. Alteration of the social structure of a community?		X				
c. Alteration of the level or distribution of employment or community or personal income?		X				
d. Changes in industrial or commercial activity?		X				
e. Increased traffic hazards or effects on existing transportation facilities or patterns of movement of people and goods?		X				

3.2.5 Public Services/Taxes/Utilities

10. PUBLIC SERVICES/TAXES/UTILITIES Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Will the proposed action have an effect upon or result in a need for new or altered governmental services in any of the following areas: fire or police protection, schools, parks/recreational facilities, roads or other public maintenance, water supply, sewer or septic systems, solid waste disposal, health, or other governmental services? If any, specify: ________		X				
b. Will the proposed action have an effect upon the local or state tax base and revenues?		X				
c. Will the proposed action result in a need for new facilities or substantial alterations of any of the following utilities: electric power, natural gas, other fuel supply or distribution systems, or communications?		X				
d. Will the proposed action result in increased used of any energy source?		X				
e. Define projected revenue sources		X				
f. Define projected maintenance costs		X				

3.2.6 Aesthetics/Recreation

11. AESTHETICS/RECREATION Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Alteration of any scenic vista or creation of an aesthetically offensive site or effect that is open to public view?		X				
b. Alteration of the aesthetic character of a community or neighborhood?		X				

c. Alteration of the quality or quantity of recreational/tourism opportunities and settings?			X		yes	See 11c
d. Will any designated or proposed wild or scenic rivers, trails or wilderness areas be impacted? (Also see 11a, 11c)		X				

Comment 11c

Preferred Alternative

Removal of fish using CFT Legumine would result in temporary loss of angling at Rainbow Lake. Westslope cutthroat trout would be stocked in the lake after rotenone has degraded to provide fishing opportunities in this lake, which currently provides recreational fishing. The lake fishery may take up to five years to fully recover to the current state. Stocking the lake would commence the first summer after successful removal of all Yellowstone cutthroat trout from the lake and will continue for five consecutive years. Fishers during the first years of recovery should expect to catch smaller fish until stocked fish grow to larger sizes. FWP will monitor the catch and size of fish in Rainbow Lake for several years to ensure an equivalent fishery is reestablished in Rainbow Lake and adjust stocking density and frequency if needed. A tourism report is not necessary to quantify these impacts.

The proposed project will require the use of a helicopter to deliver equipment to Rainbow Lake which will require a landing zone near the project area. Montana FWP proposes using the parking area at the trailhead to USFS trail 89 located at the end of USFS road 7091 as a helicopter landing zone. The delivery and removal of equipment to and from Rainbow Lake will require temporary closure of USFS road 7091 for about one day each. The two undeveloped (and non-numbered) access trails to Rainbow Lake from USFS trail 89 (Figure 3) will also be closed during the application of rotenone. Signs will be placed at least one week before the treatment at public access points, trail heads and area campgrounds. Signs will be removed once the application and deactivation is complete. Montana FWP will coordinate all closures with the USFS Rexford Ranger District at least one week prior to the project implementation to ensure adequate public notification of the anticipated access delays and closures. The impacts to public recreation will be minimized by conducting the road and trial closures to weekdays when public recreational use is lower.

No Action Alternative

Recreation would remain unchanged if the project is not implemented.

Leave Fishless Alternative

Removal of fish using CFT Legumine would result in the permanent loss of angling opportunity at Rainbow Lake because the natural fish barrier on the outlet tributary of Rainbow Lake prevents natural recolonization of the lake from downstream fish bearing waters.

3.2.7 Cultural/Historic Resources

12. CULTURAL/HISTORIC RESOURCES Will the proposed action result in:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Destruction or alteration of any site, structure or object of prehistoric historic, or paleontological importance?		X				
b. Physical change that would affect unique cultural values?		X				
c. Effects on existing religious or sacred uses of a site or area?		X				12c
d. Will the project affect historic or cultural resources?		X				

Comment 12c:

Preferred Alternative

The project site is located within the aboriginal range of the Confederated Salish and Kootenai Tribes of the Flathead Nation. In May 2022, cultural officers for the tribe and the Montana State Historic Preservation Office were contacted. To date there have been no cultural or religious resources identified at the project site. There will be no ground-breaking activities associated with this project, and no known cultural or religious ceremonies proposed for the same time this project is proposed. There will be no impacts to historical, cultural or religious values.

Salish and Kootenai Tribal Council
PO Box 278
Pablo, MT 59855

No Action Alternative

This alternative would not affect any religious or sacred uses.

Leave Fishless Alternative

This alternative was included in the consultation with the Confederated Salish and Kootenai Tribes for the preferred alternative.

3.2.8 Summary Evaluation of Significance

13. SUMMARY EVALUATION OF SIGNIFICANCE Will the proposed action, considered as a whole:	IMPACT Unknown	None	Minor	Potentially Significant	Can Impact Be Mitigated	Comment Index
a. Have impacts that are individually limited, but cumulatively considerable? (A project or program may result in impacts on two or more separate resources which create a significant effect when considered together or in total.)		X				
b. Involve potential risks or adverse effects which are uncertain but extremely hazardous if they were to occur?		X				
c. Potentially conflict with the substantive requirements of any local, state, or federal law, regulation, standard or formal plan?		X				
d. Establish a precedent or likelihood that future actions with significant environmental impacts will be proposed?		X				
e. Generate substantial debate or controversy about the nature of the impacts that would be created?	X				yes	13e
f. Is the project expected to have organized opposition or generate substantial public controversy? (Also see 13e)	X					13f
g. List any federal or state permits required.						13g

Comment 13e

The use of pesticides can generate controversy from some people. The proposed fish removal project was tentatively approved by the FWP Fish and Game Commission during the December 2021 meeting. Additionally, a proposed fishing regulation that removed the daily bag limit for angling on Rainbow Lake was presented to the Fish and Game Commission in April 2020, and the Commission initiated public review and comment of the proposed regulation on April 20,

2022, and accepted public comment until the June 23, 2022 Commission meeting which the Commission will act on the proposed change. Public outreach and information programs can educate the public on the use of pesticides.

Comment 13f

It is unknown if this project will have organized opposition. Public scoping for the project resulted in five responses suggesting little interest from much of the public.

Comment 13g

The following permits required and will be secured by FWP prior to project implementation:

- MDEQ Pesticide General Permit
- US Forest Service Pesticide Use Permit

4 Public Comments Instructions

The comment period is 30 days. Comments must be received by 5 p.m., September 8, 2022.

Submit written comments to:

Jim Dunnigan
Montana Fish, Wildlife & Parks
Region 1
385 Fish Hatchery Road, Libby, MT 59923
jdunnigan@mt.gov
406-293-4161 X 200

Prepared by: Jim Dunnigan Date: June 24, 2022

5 LITERATURE CITED

AFS (American Fisheries Society). 2002. Rotenone stewardship program, fish management chemicals subcommittee. www. fisheries. org/rotenone/.

Allendorf, F. W., and R. F. Leary. 1988. Conservation and distribution of genetic variation in a polytypic species, the cutthroat trout. Conservation Biology 2:170–184.

Amekleiv, J. V., G. Kjæstad, D. Dolmen, and J. I. Koksvik. 2015. Studies of invertebrates and amphibians in connection with the rotenone treatment of the Lake Vikerauntjønna – NTNU Vitenskapsmuseet. Naturhistorisk Rapport 7:1-47.

Beal, D. L. and R. V. Anderson. 1993. Response of zooplankton to rotenone in small pond. Bulletin of Environmental Contamination and Toxicology 51:551-556.

Behnke, R. J. 1992. Native trout of Western North America. American Fisheries Society, Monograph 6, Bethesda, Maryland.

Bellingan, T., S. Hugo, D. Woodford, J. Gouws, M. Villet, and O. Weyl. 2019. Rapid recovery of macroinvertebrates in a South African stream treated with rotenone. Hydrobiologia 834:1-11.

Betarbet, R., T. B. Sherer, G. MacKenzie, M. Garcia-Osuna, A. V. Panov, and T. Greenamyre. 2000. Chronic systemic pesticide exposure reproduces features of Parkinson’s disease. Nature Neuroscience. 3 (12): 1301-1306.

Billman, H. G., S. St-Hilaire, C. G. Kruse, T. S. Peterson, and C. R. Peterson. 2011. Toxicity of the piscicide rotenone to Columbia spotted frog and boreal toad tadpoles. Transactions of the American Fisheries Society 140:919-927.

Billman, H. G., C. G. Kruse, S. St-Hilaire, T. M. Koel, J. L. Arnold, and C. R. Peterson. 2012. Effects of rotenone on Columbia spotted frogs Rana luteiventris during field applications in lentic habitats in southwestern Montana. North American Journal of Fisheries Management. 32:781-789.

Boulton, A. J., C. G Peterson, N. B. Grimm, and S. G. Fisher. 1992. Stability of an aquatic macroinvertebrate community in a multiyear hydrologic disturbance regime. Ecology. 73 (6):2192-2207.

Bradbury, A. 1986. Rotenone and trout stocking: a literature review with special reference to Washington Department of Game’s lake rehabilitation program. Fisheries management report 86-2. Washington Department of Game.

Brittain, J. and T. J. Eikeland. 1988. Invertebrate drift — A review. Hydrobiologia 166:77-93.

BRL (Biotech Research Laboratories). 1982. Analytical studies for detection of chromosomal aberrations in fruit flies, rats, mice, and horse bean. Report to U. S. Fish and Wildlife Service (USFWS Study 14-16-0009-80-54). National fishery research Laboratory, La Crosse, Wisconsin.

Budy, P., K. B. Rogers, Y. Kanno, B. E. Penaluna, N. P. Hitt, G. P. Thiede, J. Dunham, C. Mellison, W. L. Somer, and J. DeRito. 2019. Distribution and status of trout and char in North America. Pages 193-250 *in* J. L. Kershner, J. E. Williams, R. E. Gresswell, and J. Lobon-Cervia, editors. Trout and char of the world. American Fisheries Society, Bethesda, Maryland.

CDFG (California Department of Fish and Game), 1994. Rotenone use for fisheries management, July 1994, final programmatic environmental impact report. State of California Department of Fish and Game.

Chandler, J. H. and L. L. Marking. 1982. Toxicity of rotenone to selected aquatic invertebrates and frog larvae. The Progressive Fish Culturist. 44(2):78-80.

Cook, S. F. and R. L. Moore. 1969. The effects of a rotenone treatment on the insect fauna of a California stream. Transactions of the American Fisheries Society 83 (3):539-544.

Dawson, V. K., W. H. Gingerich, R. A. Davis, and P. A. Gilderhus. 1991. Rotenone persistence in freshwater ponds: effects of temperature and sediment adsorption. North American Journal of Fisheries Management. 11:226-231.

Dolman, D., J. V. Arnekleivo, and T. Haukebo. 1995. Rotenone Tolerance in the Freshwater Pearl Mussel *Margaritifera margaritifera*. Nordic Journal of Freshwater Research 7)21-30.

Engel LS, Seixas NS, Keifer MC, Longstreth WTJ & Checkoway H. 2001. Validity study of self-reported pesticide exposure among orchardists. J Expo Anal Environ Epidemiol, 11, 359–368

Engstrom-Heg, R, R. T. Colesante, and E. Silco. 1978. Rotenone tolerances of stream-bottom insects. New York Fish and Game Journal. 25 (1):31-41.

Engstrom-Heg, R. 1971. Direct measure of potassium permanganate demand and residual potassium permanganate. New York Fish and Game Journal. 18(2):117-122.

EPA, 2007. United States Environmental Protection Agency, prevention, pesticides and toxic substances (7508P). EPA 738-R-07-005. Reregistration Eligibility Decision for Rotenone, List A Case No. 0255.

Finlayson, B. J., R. A. Schnick, R. L. Cailteux, L. DeMong, W. D. Horton, W. McClay, C. W. Thompson, and G. J. Tichacek. 2000. Rotenone use in fisheries management: administrative and technical guidelines manual. American Fisheries Society, Bethesda, Maryland.

Firestone, J. A., J. I. Lundin, K. M. Powers, T. Smith-Weller, G. M. Franklin, P. D. Swanson, W. T. Longstreth Jr., and H. Checkoway. 2010. Occupational Factors and risk of Parkinson's Disease: A population-based case–control study. American Journal of Industrial Medicine 53:217-223.

Fisher, J. P. 2007. Screening level risk analysis of previously unidentified rotenone formulation constituents associated with the treatment of Lake Davis. for California Department of Fish and Game. Environ International Corporation, Seattle, Washington.

Fried, L. M, M. C. Boyer, and M. J. Brooks. 2018. Amphibian Response to Rotenone Treatment of Ten Alpine Lakes in Northwest Montana. North American Journal of Fisheries Management 38:237-246.

FWP (Montana Fish, Wildlife & Parks). 2019. Statewide fisheries management plan. Montana Fish, Wildlife & Parks, Helena, Montana.

FWP (Montana Fish, Wildlife & Parks). 2017. Piscicide policy. Montana Fish, Wildlife & Parks. Helena, Montana.

Gilderhus, P. A., J. L. Allen, and V. K. Dawson. 1986. Persistence of rotenone in ponds at different temperatures. North American Journal of Fisheries Management. 6: 129-130.

Gilderhus, P. A., V. K. Dawson, and J. L. Allen. 1988. Deposition and persistence of rotenone in shallow ponds during cold and warm seasons. US Fish and Wildlife Service Investigations in Fish Control, No. 5

Grisak, G. G., D. R. Skaar, G. L. Michael, M. E. Schnee and B. L. Marotz. 2007. Toxicity of Fintrol (antimycin) and Prenfish (rotenone) to three amphibian species. Intermountain Journal of Sciences. 13(1):1-8.

Guenther, H., M. Schaefer, B. Alteneder, P. Bashaw, B. Davidson, P. Fernandez, M. Fulton, J. Gray, R. Held, D. Herrington, H. Holub, R. Jones, D. Kupel, E. Masters, J. Nelson, C. Paradzick, J. Peterson, P. F, D. Rule, A. Reeve, L. Riley, D. Shooter, R. Shuler, S. Spangle, and E. Stewart 2011. Rotenone review advisory committee final report and

recommendations to the Arizona Game and Fish Department. Arizona Game and Fish Department.

Hanzel, D. A. 1959. The distribution of the cutthroat trout (Salmo clarki) in Montana. Proceedings of the Montana Academy of Sciences 19:32–71.

Hart, R. A., T. Brastrup, D. D. Kelner, and M. Davis. 2001. The freshwater mussel fauna (*Bivalvia: Unionidae*) of the Knife River, Minnesota, following a rotenone treatment. Journal of Freshwater Ecology, 16(4):487-492.

Havel, J. E. and J. Shurin. 2004. Mechanisms, effects, and scales of dispersal in freshwater zooplankton. Limnology and Oceanography 49:1229-1238.

Hertzman C, Wiens M, Snow B, Kelly S & Calne D. 1994. A case–control study of Parkinson’s disease in a horticultural region of British ColumFbia. Mov Disord, 90: 69–75

Hisata, J. S. 2002. Lake and stream rehabilitation: rotenone use and health risks. Final supplemental environmental impact statement. Washington Department of Fish and Wildlife, Olympia. Washington.

Hollis, J. M. 2018. Export of invertebrate drift from fishless headwater streams. Master's Thesis. Natural Resources: Fisheries, Humboldt State University, Arcata, California.

HRI (Hazelton Raltech Laboratories). 1982. Teratology studies with rotenone in rats. Report to U. S. Geological Survey. Upper Midwest Environmental Sciences Center (USFWS Study 81-178). La Crosse, Wisconsin.

Hubble JP, Cao T, Hassanein RES, Neuberger JS & Koller WC. 1993 Risk factors for Parkinson’s disease. Neurology, 43:1693-1697.

Jiménez-Jiménez FJ, Mateo D & Giménez-Roldán S. 1992. Exposure to well water and pesticides in Parkinson’s disease: Acase–control study in the Madrid area. Mov Disord, 7, 149–152.

Johnson, M. E. and L. Bobrovskaya. 2015. An update on the rotenone models of Parkinson’s disease: Their ability to reproduce the features of clinical disease and model gene-environment interactions. Neurotoxicity 46:101-116.

Kamel, F., C. Tanner, D. Umbach, J. Hoppin, M. C. Alvanja, A. Blair, K. Comyns, S. M. Goldman, M. Korell, J. W. Langston, G. Ross, and D. Sandler. 2007. Pesticide exposure and self-reported Parkinson's disease in the agricultural health study. American journal of epidemiology 165:364-374.

Kjærstad, G., J. Amekleiv, and J. Speed. 2015. Effects of three consecutive rotenone treatments on the benthic macroinvertebrate fauna of the River Ogna, central Norway. River Research and Applications 32:572-582.

Knapp, R.A. and K.R. Matthews. 1998. Eradication of nonnative fish by gill netting from a small mountain lake in California. Restoration Ecology, vol. 6, 2:207-213.

Lai, BCL, Marion SA, Teschke K & Tsui JKC. 2002. Occupational and environmental risk factors for Parkinson's disease. Parkinsonism Rel Disord, 8:297–309

Liknes, G. A., and P. J. Graham. 1988. Westslope cutthroat trout in Montana: life history, status, and management. Pages 53–60 *in* R. E. Gresswell, editor. Status and management of interior stocks of cutthroat trout. American Fisheries Society, Symposium 4, Bethesda, Maryland.

Lui, Y, J. D. Sun, L. K Song, J. Li, S. Chu. Y. Yuan, and N. Chen. 2015. Environment-contact administration of rotenone: A new rodent model of Parkinson's disease. Behavioral Brain Research 294:149-161.

Marking, L. L. 1988. Oral toxicity of rotenone to mammals. Investigations in fish control, technical report 94. U. S, Fish and Wildlife Service, National Fisheries Research Center, La Crosse, Wisconsin.

Matthaei, C. D., Uehlinger, U., Meyer, E. I., Frutiger, A. 1996. Recolonization by benthic invertebrates after experimental disturbance in a Swiss prealpine river. Freshwater Biology. 35(2):233-248.

Maxell, B. A., and D. G. Hokit. 1999. Amphibians and Reptiles. Pages 2. 1-2. 29 in G. Joslin and H. Youmans, coordinators. Effects of recreation on Rocky Mountain wildlife: A Review for Montana. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society. 307pp.

Maxell, B., K. Nelson, and S. Browder. 2003. Record clutch size and observations on breeding and development of the western toad (Bufo boreas) in Montana. Northwestern Naturalist 83:27.

Maxell, B. 2009. Distribution, identification, status, and habitat use of Montana's amphibians and reptiles. Montana Natural Heritage Program. Helena, Montana.

McIntyre, J. D. and B. E. Rieman. 1995. Westslope cutthroat trout. Pages 1-15 in M. K. Young, technical editor. Conservation Assessment for Inland Cutthroat Trout. USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

MNHP (Montana Natural Heritage Program). 2018. Montana Natural Heritage - SOC report: animal species of concern. Montana Natural Heritage Program. Helena, Montana.

Montana Cutthroat Trout Steering Committee (MCTSC). 2007. Memorandum of understanding and conservation agreement for westslope cutthroat trout and Yellowstone cutthroat trout in Montana.

Muhlfeld, C., S. T Kalinowski, T. McMahon, M. L Taper, S. Painter, R. Leary, and F. W Allendorf. 2009. Hybridization rapidly reduces fitness of native trout in the wild. Biology letters 5:328-331.

Muhlfeld, C. C., S. E. Albeke, S. L. Gunckel, B. J. Writer, B. B. Shepard and B. E. May. 2015. Status and Conservation of Interior Redband Trout in the Western United States, North American Journal of Fisheries Management, 35(1): 31-53. DOI: 10.1080/02755947.2014.951807

Olsen, J. R. 2017. Streams Surveyed in the Big Hole Drainage 2010-2016. Federal Aid Project Number: F-113 April 1, 2011 – April 1, 2017. Montana Fish, Wildlife and Parks, Helena, MT.

Parker, B.R., D.W. Schindler, D.B. Donald, and R.S. Anderson. 2001. The effects of stocking and removal of a nonnative salmonid on the plankton of an alpine lake. Ecosystems (2001) 4:334-345.

Raffaele, K., S. Vulimiri, and T. Bateson. 2011. Benefits and barriers to using epidemiology data in environmental risk assessment. The Open Epidemiology Journal 411:99-105.

Rojo, A. I. C. Cavada, M. R. de Sagarra, and A. Cuadrado. 2007. Chronic inhalation of rotenone or paraquat does not induce Parkinson's disease symptoms in mice or rats. Experimental Neurology 208:120-126.

Rumsey, S., J. Fraley, and J. Cavigli 1996. Ross and Devine lakes invertebrate results – 1994-1996. File report. Montana Fish, Wildlife & Parks. Kalispell, Montana.

Schnee, M. E. 1996. Martin Lakes 1-year, posttreatment rotenone report. Montana Fish, Wildlife & Parks. Kalispell, Montana.

Schnick, R. A. 1974. A review of the literature on the use of rotenone in fisheries. USDI Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, LaCrosse, Wisconsin.

Shepard, B. B., B. Sanborn, L. Ulmer, and D. C. Lee. 1997. Status and risk of extinction for westslope cutthroat trout in the upper Missouri River Basin, Montana. North American Journal of Fisheries Management 17:1158-1172.

Shepard, B. B., B. E. May and W. Urie. 2005. Status and Conservation of Westslope Cutthroat Trout within the Western United States, North American Journal of Fisheries Management 25(4): 1426-1440, DOI: 10.1577/M05-004.1

Skaar, D. 2001. A brief summary of the persistence and toxic effects of rotenone. Montana Fish, Wildlife & Parks, Helena.

Skorupski, J. A. 2011. Effects of CFT Legumine rotenone on macroinvertebrates in four drainages in Montana and New Mexico. Master's Thesis. College of Science, University of North Texas, Denton, Texas.

Spencer, F. and L.T. Sing. 1982. Reproductive responses to rotenone during decidualized pseudogestation and gestation in rats. *Bulletin of Environmental Contamination and Toxicology*. 228: 360-368.

Tanner, C., F. Kamel, G. Ross, J. Hoppin, S. Goldman, M. Korell, C. Marras, G. Bhudhikanok, M. Kasten, A. Chade, K. Comyns, M. Richards, C. Meng, B. Priestley, H. Fernandez, F. Cambi, D. Umbach, A. Blair, D. Sandler, and J. Langston. 2011. Rotenone, paraquat, and Parkinson's disease. Environmental health perspectives 119:866-872.

Townsend, C. R. and A. Hildrew. 1976. Field experiments on the drifting, colonization and continuous redistribution of stream benthos. The Journal of Animal Ecology 45:759-772.

USEPA. 2007. Reregistration eligibility Decision for rotenone. EPA 738-R-07-005. USEPA, Washington, D.C

USFWS (U.S. Fish and Wildlife Service). 1999. Status review for westslope cutthroat trout in the United States. United States Department of Interior, U.S. Fish and Wildlife Service, Regions 1 and 6, Portland, Oregon and Denver, Colorado.

USFWS (U.S. Fish and Wildlife Service). 2017. Species status assessment for the Canada lynx (Lynx canadensis) contiguous United States distinct population segment. Version 1.0 October 2017. U. S. Fish and Wildlife Service. Lakewood, Colorado.

Van Goethem, D, B. Barnhart, and S. Fotopoulos. 1981. Mutagenicity studies on rotenone. Report to U. S. Geological Survey. Upper Midwest Environmental Sciences Center (USFWS Study 14-16-009-80-076), La Crosse, Wisconsin

Vinson, M., E. Dinger, and D. Vinson. 2010. Piscicides and invertebrates: after 70 years, does anyone really know? Fisheries 35:61-71.

Wallace, J. and N. H. Anderson. 1996. Habitat, life history and behavioral adaptations of aquatic insects. Pages 41-73 in R. W. Merritt, and K. W. Cummins, editors. An Introduction to

the Aquatic Insects of North America, 4th edition. Kendall/Hunt Publishing Company, DuBuque, Iowa.

Ware, G. W. 2002. An introduction to insecticides 3rd edition. University of Arizona, Department of Entomology, Tuscon. on EXTOXNET. Extension Toxicology Network. Oregon State University web page.

Werner, J. K., B. A. Maxell, P. Hendricks, and D. L. Flath. 2004. Amphibians and Reptiles of Montana. Mountain Press Publishing Company, Missoula, Montana. 262 pp.

Williams, D. D. and H. B. N. Hynes. 1976. The recolonization mechanisms of stream benthos. Oikos 27:265-272.

Wipfli, M. S. and D. P. Gregovich. 2002. Export of invertebrates and detritus from fishless headwater streams in southeastern Alaska: Implications for downstream salmonid production. Freshwater Biology 47:957-969.