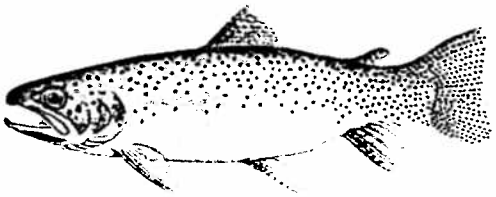
Environmental Assessment

Madison River Drainage Westslope Cutthroat Trout
Conservation and Restoration Program:

Cherry Creek Native Fish Introduction

April 15, 1998



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PART I. PROPOSED ACTION DESCRIPTION

1. **Type of Proposed State Action:** Removal of existing non-native fish with the fish toxicants antimycin, and possibly rotenone, followed by the introduction of native westslope cutthroat trout (*Oncorhynchus clarki lewisi*), with possible future introductions of fluvial Arctic grayling (*Thymallus arcticus*)and mottled sculpin (*Cottus bairdi*).

2. **Agency Authority for the Proposed Action:** Montana Fish Wildlife & Parks

3. **Name of Project:** Madison River Drainage Westslope Cutthroat Trout Conservation and Restoration Program: Cherry Creek Native Fish Introduction

4. **Estimated Commencement Date:** August 1998

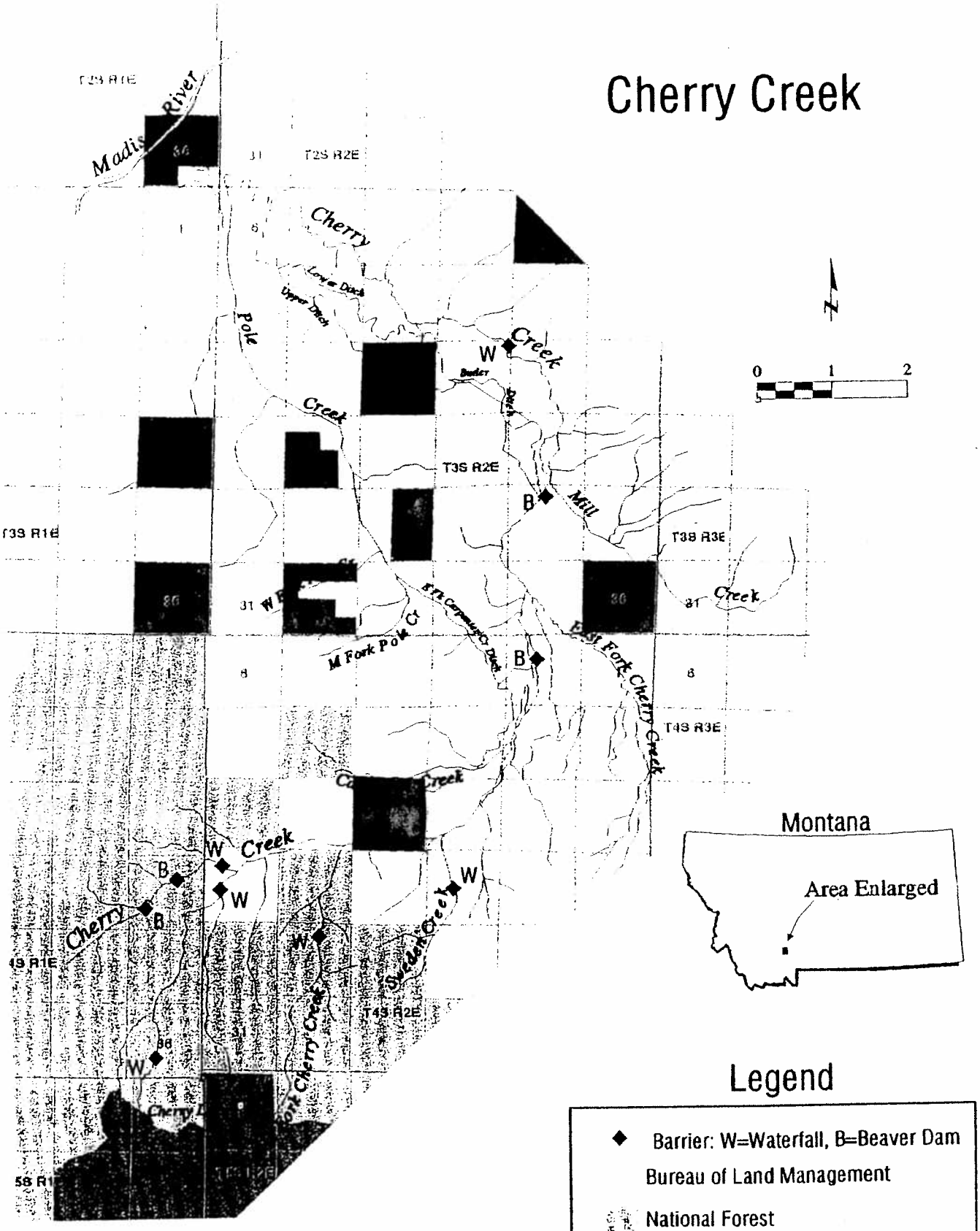
   Estimated Completion Date: September 2003
   Current Status of Project Design (% complete): 20%

5. **Location Affected by Proposed Action (county, range and township):** Madison County, the Upper Cherry Creek drainage basin, located in Townships 3, 4 and 5 South, Range 1, 2 and 3 East.

6. **Project Size:** Estimate the number of acres that would be directly affected that are currently:

	Acres		Acres
(a) Developed:		(d) Floodplain	0
Residential	0		
Industrial	0	(e) Productive:	
		Irrigated cropland	0
(b) Open Space/Woodlands/Recreation	7.3	dry cropland	0
		Forestry	0
(c) Wetlands/Riparian Areas	0	Rangeland	0
		Other	0

Cherry Creek



Legend

- ◆ Barrier: W=Waterfall, B=Beaver Dam
- Bureau of Land Management
- National Forest
- National Forest Wilderness
- State Lands

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Barriers data obtained by Global Positioning System (GPS) and differentially corrected. Hydrography from StreamNet and digitized at 1:100,000. Public landownership and Public Sand Survey data from the Natural Resource Information System (NRIS) at the Montana State Library.

StreamNet

Montana Fish, Wildlife & Parks

8. Narrative Summary of the Proposed Action including the Benefits and Purpose of the Proposed Action.

Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) are under petition for listing as a Threatened species under the Federal Endangered Species Act, while fluvial Arctic grayling (*Thymallus arcticus*) is a Federal Threatened Species candidate (Hunter 1997). Both westslope cutthroat trout and fluvial Arctic grayling are State of Montana Class A species; defined as species with "Limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species or subspecies."

Because of competition (Shepard et al. in preparation) from and hybridization with non-native salmonids, habitat degradation, and overfishing, genetically pure populations of westslope cutthroat trout exist in only about 2.5% of their historic range (Liknes and Graham 1988). In Montana, fluvial Arctic grayling have been reduced to a single remnant population, located in the Big Hole River (Kaya 1990).

The proposed project is part of the Montana Fish Wildlife & Parks (MFWP) Madison River Drainage Westslope Cutthroat Trout Conservation and Restoration Program. The goal of this program is to establish secure refuges for westslope cutthroat trout in tributaries of the upper Madison River. One of the interagency Westslope Cutthroat Trout Steering Committee's draft conservation goals is to establish nine areas supporting westslope cutthroat trout with at least 50 miles of interconnected habitat in each area. Five of these areas are to be located within the upper Missouri River basin. Successful completion of this project would result in the establishment of one of these areas for the upper Missouri. The proposed project is also consistent with the Montana Fluvial Arctic Grayling Workgroup's (1995) fluvial Arctic grayling recovery program. Among the powers and duties of Montana Fish Wildlife & Parks is the "protection, preservation, and propagation of fish..."(MCA 87-1-201 (3)) as well as enhancing the numbers of species indigenous to the State which may be found to be endangered (MCA 87-5-103 (2)).

The proposed project is also a unique example of private, State and Federal entities cooperating in the conservation and preservation of declining native species. In addition to allowing the agencies to have access to the Flying D Ranch for this project, Turner Enterprises, Inc. has volunteered to pay for the majority of project expenses.

The site of the proposed action is the upper portion of Cherry Creek and tributaries, including Cherry Lake, downstream to a 25-foot high waterfall located about eight stream miles above Cherry Creek's confluence with the Madison River. This portion of Cherry Creek drains lands owned by Turner Enterprises, Inc. (TEI) and Federal lands managed by the U.S. Forest Service, including a portion of the Spanish Peaks Unit of the Lee Metcalf Wilderness Area. Also, at least one section of state land (T4S R2E Sec 16) is currently included in the project area.

The upper Cherry Creek drainage basin is particularly well suited for establishing a secure refuge for westslope cutthroat trout. First, a 25-foot waterfall at the downstream end of the project area is a physical barrier to upstream fish migration that will prevent recolonization into the upper Cherry Creek drainage basin of non-native salmonids after the antimycin/rotenone treatment is complete.

Second, the upper Cherry Creek drainage basin includes over 60 miles of streams and a seven-acre lake available for westslope cutthroat trout habitat. Because the area is large, it will support a large population of westslope cutthroat trout that will be more likely to survive in a changing environment over the long term. The large size of the area also decreases the likelihood that a single catastrophic event such as a landslide or outbreak of disease will eliminate the entire population.

Third, the aquatic habitat in the upper Cherry Creek drainage basin is generally of high quality. A qualitative habitat survey of the project area within the Flying D Ranch was done during August 1998 by MFWP biologists. The water quality, sediment levels, temperature, spawning and pool habitat, and riparian conditions were all judged to be suitable for westslope cutthroat trout habitat. Certain riparian

areas showed signs of impact by ungulates, mostly bison. However, TEI has recently implemented a rest-rotation grazing system that should result in improved riparian conditions. Additionally, TEI is installing multi-strand electric fencing that excludes bison from the impacted riparian areas. Outside of these areas, no needs for major in-stream or riparian habitat improvement or restoration were identified within the Flying D Ranch (Pat Clancey and Brad Shepard, MFWP, personal communication).

If grayling are introduced into the upper Cherry Creek drainage basin, they will be introduced into a low gradient reach about 1.5 miles in length located immediately above Cherry Creek Canyon. The grayling may further expand their range another 4.5-5 miles upstream with the removal or modification of an existing irrigation diversion that currently acts as a barrier to upstream fish movement. The suitability of this portion of Cherry Creek as fluvial Arctic grayling habitat is unknown. Previous introductions of grayling into some streams in Montana may have failed because the streams were too small and turbulent. Other stream introductions may have failed because lacustrine (lake-adapted) rather than fluvial (stream-adapted) grayling were used (Kaya 1990).

To successfully establish westslope cutthroat trout and possibly fluvial Arctic grayling, the current non-native fish populations, which consist of brook trout (*Salvelinus fontinalis*), rainbow trout (*Oncoryhnchus mykiss*) and Yellowstone cutthroat trout (*O. clarki bouvieri*), must be removed. Brook trout are thought to compete with cutthroat trout (Griffith 1988; Behnke 1992) and fluvial Arctic grayling (Kaya 1990). Rainbow trout and Yellowstone cutthroat trout will hybridize with westslope cutthroat trout (Liknes and Graham 1988; Behnke 1992).

Under this proposal, existing non-native fish populations will be eradicated with the widely used fish toxicant, antimycin (Gresswell 1991; Stefferud et al. 1992; Meronek et al. 1996; Tiffan and Bergersen 1996). Antimycin, an antibiotic that is EPA registered for removal of fish, is produced in cultures of bacteria of the genus *Streptomyces* (Lee et al. 1971). Antimycin kills fish by irreversibly blocking respiration at the cellular level. The commercially available formulation of antimycin, Fintrol (product information enclosed, Appendix 2) will be applied to the waters of the project area at concentrations of 8 to 12 parts per billion (ppb).

In three small tributaries (East Fork Cherry Creek, Mill creek and Carpenter Creek), the high pH of the water may reduce the effectiveness of the antimycin. Therefore in these tributaries, it may be necessary to do a second treatment using the fish toxicant rotenone. Rotenone is a chemical registered by the EPA for removal of fish, that is derived from the roots of certain South American plants and is widely used in fish removal projects (Meronek et al. 1996). A commercial formulation of rotenone will be used at a concentration of 0.25 to 1.0 part per million. The exact concentrations of antimycin and rotenone to be used will be determined by doing bioassays under field conditions in the project area. Project personnel will collect all the fish that they can find that have been killed by the fish toxicants and bury them on site.

While extremely toxic to fish at the proposed concentrations, antimycin is not harmful to plants, most invertebrates, amphibians, reptiles, birds, or mammals, including humans, either from exposure to treated water, drinking of treated water, or ingestion of poisoned fish (Walker et al. 1964; Schnick 1974a). Certain invertebrates are sensitive to the proposed treatment levels of antimycin, including Cladocera and Copepoda (zooplankton), Amphipoda (scuds), and some species of mayflies and caddisflies. However, populations of these taxa have been found to be only temporarily diminished following treatment (Schnick 1974a; Jacobi and Deegan 1977). Rotenone is also highly toxic to fish, with little or no toxic effects on non-target organisms at the proposed range of concentrations (Cook and Moore 1969; Schnick 1974b; Houf and Campbell 1977; Engstom-Heg et al. 1978).

Antimycin breaks down rapidly in the environment by hydrolysis, exposure to sunlight, due to stream turbulence (Tiffan and Bergersen 1996), and in waters with high pH. After being added to a stream, a dose of antimycin loses much of its toxicity over a drop in stream elevation of about 200 feet (Tiffan and Bergersen 1996). Because of its rapid breakdown, it will be necessary to add antimycin to streams at drip

stations located approximately every 100-120 feet of vertical drop along the stream or at locations separated by the distance that water in the stream flows in one half-hour.

To measure the distance that stream water flows in one half-hour, a fluorescent dye, fluorescein sodium, will be used to produce a bright green color that can be followed along the stream channel. Fluorescein sodium is not toxic to fish at concentrations used in field applications; levels would have to be increased more than 1,000 times to be toxic to rainbow trout (Marking 1969).

The lower portion of Cherry Creek will not be affected because the antimycin is expected to degrade rapidly within the project area, and should be nearly detoxified as it reaches the 25-foot waterfall at the downstream end of the project area. Any residual toxicity would be rapidly detoxified with the elevation loss in the turbulent waters of Cherry Creek Canyon below the waterfall. Additionally, particularly if rotenone is used, the fish toxicants may be detoxified by adding potassium permanganate ($KMnO_4$) at a concentration of one to four parts per million to Cherry Creek at a detoxification station located below the waterfall.

Potassium permanganate has long been used for various applications in fish culture including as a control for external parasites (Lay 1971), and for detoxification of antimycin (Marking and Bills 1975) and rotenone (Lawrence 1956). However, potassium permanganate itself is toxic to fish if concentrations are too high. The toxicity of potassium permanganate to fish is dependent on the particular chemistry of the water in question. Surface waters have a potassium permanganate demand based on the amount of organic materials in the water. Successful use of potassium permanganate to detoxify antimycin and rotenone is based on balancing the amount of potassium permanganate with the natural chemical demand of the water and the chemical demand caused by antimycin or rotenone.

To determine the optimal concentration (from one to four parts per million) of potassium permanganate, bioassays will be performed with trout and water from Cherry Creek. These bioassays will be used to determine the amount of potassium permanganate needed to overcome the water's potassium permanganate demand, neutralize the fish toxicants and not kill fish. When the optimal concentration has been determined, a detoxification station will be set up to dispense this concentration of potassium permanganate at the downstream end of the treatment section. There is a potential for impacts on fish and invertebrates for a length of stream of up to one mile below the detoxification station. These impacts may take place because some time is required for potassium permanganate to mix in the water, as well as for the chemical oxidation of antimycin and rotenone to occur (Bruce Rosenlund, U. S. Fish and Wildlife Service, personal communication).

Due to its large scale, this project will present many challenges. Bruce Rosenlund is fisheries biologist with the U. S. Fish and Wildlife Service who has employed this methodology for over 20 years throughout the western U.S. in native trout restoration projects. Mr. Rosenlund visited the project site in October 1997 for three days to examine the upper Cherry Creek drainage basin and assess the feasibility of the project. He has concluded that the project is feasible (Bruce Rosenlund, U. S. Fish and Wildlife Service, personal communication).

Following application of fish toxicants, electrofishing surveys will be performed to ensure that all of the fish were eradicated within the treatment area. When a complete removal of previously existing fish populations has been documented, fertilized eggs of genetically pure native westslope cutthroat trout will be introduced to the waters of the project site. In addition, introduction of fluvial Arctic grayling and other native fish species such as mottled sculpin is being considered.

Cherry Creek offers an opportunity to evaluate two different donor source strategies for the restoration of westslope cutthroat trout. One strategy is to use a wild donor stock which is a "nearest neighbor". The rationale behind this strategy is that local adaptation may give this stock of fish a selective advantage in a nearby geographic location. Another advantage of this approach is that an existing genetically unique population will be replicated in the wild. The risk of this strategy is that the donor source may be very

narrowly adapted to a specific environment and might not survive well in another environment. This strategy is often termed the specialist strategy. The other strategy is to use a donor source with as broad a genetic makeup as possible. The rationale behind this strategy is that while many individuals originating from this donor source will likely perish, there will be a component that is highly suitable for any particular environment. This strategy is often termed the generalist strategy.

Fertilized eggs from the Washoe Park Fish Hatchery in Anaconda (a generalist) as well as fertilized eggs from a wild stock inhabiting one or more tributaries to the Madison River (a specialist) will be used for the introduction of westslope cutthroat trout to the upper Cherry Creek drainage basin. Graduate research projects at Montana State University will identify genetic markers from these two donor stocks of westslope cutthroat trout. Sampling of the introduced westslope cutthroat trout will be done two years, five years, and ten years following the initial releases of fertilized eggs. The proportion of the population from each donor source will be determined which will allow an evaluation of the relative success of each stock. This technique of genetic sampling can be done by clipping a small portion of a fin and will not require sacrificing any fish.

Streamside incubators, distributed at sites throughout the tributaries at a frequency of about one every 0.25 mile, will be used to incubate the fertilized eggs on-site. The upper Cherry Creek drainage basin will be stocked with about 5 westslope cutthroat trout fry per square meter which is within the range that has been suggested for fully stocking habitats (Everest 1969; Mabbott 1981; Shepard 1983).

To offset potential impacts to the donor population, only about half the eggs from each wild donor female will be taken to Cherry Creek, while the other half will be incubated and released in streamside incubators located on the donor stream. Also, eggs will be taken from only about half of the females from the donor population to ensure that enough females from the donor population remain to spawn naturally. To provide sufficient numbers of eggs for both Cherry Creek and to allow natural spawning in the donor stream will require that the donor population have at least 1,000 adults.

The overall project is expected to last at least five years. The eradication process will proceed in stages beginning in August 1998 and will take a minimum of three or four years, beginning in the farthest upstream reaches, and progressing downstream. Stream reaches will be treated in August or September to take advantage of low stream flows at this time of year. Terminating a year's treatment where natural barriers to upstream fish movement exist will prevent recolonization between treated and untreated reaches. Where such barriers do not exist, it may be necessary to place gabion-style temporary fish barricades between treated reaches and untreated reaches. The gabions would then be removed when adjacent reaches have been treated. Alternatively, an existing irrigation diversion may be temporarily modified to create a barrier to upstream fish movement.

Roles of Montana Fish Wildlife & Parks and U. S. Forest Service

The jurisdiction and responsibility for the protection and management of wildlife and fish populations on private, state, state and federal lands resides with Montana Fish Wildlife & Parks. The Regional Supervisor of MFWP will decide whether to eliminate non-native trout presently occupying the project area and restock them with westslope cutthroat trout and possibly other native fish species.

The U.S. Forest Service (FS) has jurisdiction and responsibility for the occupancy, use, and management of the National Forest including lands within the Lee Metcalf Wilderness. For this project the Northern Regional Forester will decide whether to approve the use of fish toxicants within Wilderness for the purpose of eliminating non-native trout and will also decide whether to approve a variance for the short-term use of a gasoline powered outboard motor to thoroughly mix the chemical in Cherry Lake.

U.S. Forest Service Policy and Guidelines For Management Of Fish And Wildlife Within Wilderness Areas:

Policy: Chemical treatment may be necessary to prepare waters for reestablishment of native species, to reestablish an endangered or threatened species, and to correct undesirable conditions resulting from the influence of humans.

Guidelines:

1. All federal and State laws and regulations and executive orders relative to the use of the pesticide shall be strictly adhered to.
2. In the selection of a pesticide, preference shall be given to those that can be readily detoxified.
3. Chemical treatment operations should be scheduled during periods of low human use.
4. Fish removed should be immediately disposed of in a manner agreed to by the MFWP and FS.

Policy: As stated in Part 1. Use of Motorized Equipment within the Policies and Guidelines for Fish and Wildlife in Wilderness and Primitive Areas (FS, BLM, and IAFGA—August 1986).

Section 4(c) of the Wilderness Act prohibits the use of motorized equipment within Wilderness Areas. With regard to the use of motorized equipment the emphasis is on the management of the area or wilderness as opposed to the management of a particular resource. This language is viewed as direction that all management activities within wilderness be done without motor vehicles, motorized equipment, or mechanical transport unless truly necessary to administer the area or specifically permitted by other provisions in the Act. It means that any such use should be rare and temporary, that no roads can be built, and wilderness managers must determine such use is the minimum necessary to accomplish the task.

Statement of Support from U. S. Forest Service

The Forest Service does not have regulatory authority to approve or disapprove the removal of existing fish species residing in Cherry Lake or Cherry Creek, nor do they have the authority to approve or disapprove the introduction of westslope cutthroat trout. However, in a Memorandum of Understanding (MOU) between MFWP and the FS dated 9/7/78, the two parties agreed to cooperate and coordinate in the management of the fish and wildlife resource.

9. Listing of any other Local, State or Federal agency that has overlapping or additional jurisdiction.

(a) Permits:

Agency Name	Permit	Date Filed/#
Montana Dept. of Environmental Quality	3A (Water Quality Exemption)	Pending
U. S. Forest Service	Use of Motorized Equipment	Pending
U. S. Forest Service	Pesticide Use Proposal	Pending

(b) Funding:

Agency Name	Funding Amount
US Forest Service and U. S. Fish And Wildlife Service	No direct funding, but portions of personnel salaries covered in proportion to their involvement in this project.

(c) **Other Overlapping or Additional Jurisdictional Responsibilities:**

Agency Name	Type of Responsibility
U. S. Forest Service	Allow use of outboard motor in a Lee Metcalf Wilderness Area
	Allow use of chemical in streams on Forest Service lands

10. List of Agencies Consulted During Preparation of the EA:

Montana Fish Wildlife & Parks

U. S. Forest Service

U. S. Fish and Wildlife Service

Montana Department of Natural Resources and Conservation

Montana Department of Environmental Quality

US Army Corps of Engineers

Montana State Historic Preservation Society

U.S. Environmental Protection Agency

Montana Natural Heritage Program

11. Alternatives Considered In the Environmental Assessment.

Alternative 1: Non-native fish eradication followed by native fish introduction.

Alternative 2: No Action.

12. Alternatives Considered But Not Given Detailed Study.

Alternative 3. Introduction of westslope cutthroat trout and fluvial Arctic grayling without removal of existing fish populations.

The primary factor leading to the decline of westslope cutthroat trout has been hybridization with non-native trout (Liknes and Graham 1988). Brook trout have long been thought (Griffith 1998) to compete with westslope cutthroat trout, and recent findings suggest that brook trout may reduce and eventually replace westslope cutthroat trout, even in high quality habitats (Shepard et al., In preparation). The introduction of non-native salmonids is also thought to be perhaps the most critical factor leading to the decline of fluvial Arctic grayling in Montana (Kaya 1990). Therefore, because it is highly unlikely that the introduction of westslope cutthroat trout or fluvial Arctic grayling will be successful in the presence of non-native rainbow trout, brook trout, and Yellowstone cutthroat trout, this alternative was eliminated.

Alternative 4. Eradication of existing non-native fish populations without introduction of other fish species.

Currently, no fish species that were native to the Madison River drainage exist in Cherry Creek watershed upstream of a 25-foot falls located about 8 river miles upstream from the Madison River. Thus, it is most likely that the upper Cherry Creek drainage basin had no fish populations previous to the introduction of

brook trout, rainbow trout and Yellowstone cutthroat trout by humans. Accordingly, removal of existing fish populations and leaving the upper Cherry Creek drainage basin without fish would be a return to pristine conditions. However, this alternative does not meet the goals of Montana Fish Wildlife & Parks Madison River Drainage Westslope Cutthroat Trout Conservation and Restoration Program or the Interagency Grayling Committee's fluvial Arctic grayling recovery program. Therefore, this alternative was eliminated.

Alternative 5. Physical removal of existing non-native fish populations by electrofishing.

This alternative is not practical because it would be impossible to remove all the existing non-native fish. If any rainbow trout or Yellowstone cutthroat trout were left, they would potentially hybridize with the westslope cutthroat trout. This would not support the recovery effort for westslope cutthroat trout, which seeks to secure genetically pure populations. If all brook trout were not removed, they would likely compete with westslope cutthroat trout and fluvial Arctic grayling. Therefore, this alternative was eliminated because it would not meet the goals of the project.

Alternative 6. Treatment of Cherry Lake with antimycin without the use of an outboard motor.

A gasoline powered outboard motor is needed to ensure a thorough mixing of antimycin in lake environments; the antimycin is diluted in lake water and then pumped into the propwash of a ten horsepower or smaller outboard motor. Previous experience from Colorado alpine lakes has shown that it is essential to use an outboard motor in lake treatments (Bruce Rosenlund, U. S. Fish and Wildlife Service, personal communication). Therefore, this alternative was eliminated because it would not be successful in removing existing fish populations, leading to an overall failure of the project.

PART II. ENVIRONMENTAL REVIEW

Evaluation of the impacts of the Proposed Action, including the secondary and cumulative impacts on the Physical and Human Environment.

A. PHYSICAL ENVIRONMENT

1. LAND RESOURCES Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
a. Soil instability or changes in geologic substructure?			X		YES	1a
b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil which would reduce productivity or fertility?			X		YES	1b
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		YES	1d
e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard?		X				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 1a. Soil instability.

Alternative 1: Proposed Action. To prevent recolonization of fish between treatment years, it may be possible to modify an existing irrigation diversion to serve as a barrier to upstream fish movement from the untreated reach to the treated reach. Alternatively, it may be necessary to place gabion-style temporary fish barricades on the streambed between treated reaches and untreated reaches. All such barriers will be located within boundaries of the Flying D Ranch; barriers will not be needed on U. S. Forest Service lands. Installation of the gabions will involve the use of heavy equipment such as a backhoe and probably 10 cubic yard dump trucks. This activity will likely result in minor, localized disturbance to soils and vegetation at the fish barrier sites. The gabions will be removed when adjacent reaches have been treated.

Mitigation: Disturbed areas will be returned to previously existing conditions by standard reclamation techniques such as placing biodegradable erosion-control fabrics and revegetation of disturbed soils.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 1b. Reduction of soil productivity.

Proposed Action: See comment 1a.

Mitigation: Disturbed areas will be returned to previously existing conditions by standard reclamation techniques such as placing biodegradable erosion-control fabrics and revegetation of disturbed soils.
Alternative 2: No Action. There would be no impact under this alternative.

Comment 1d. Modification of stream channels.

Alternative 1: Proposed Action. As described in comment 1a, it may be necessary to place gabion-style temporary fish barricades on the streambed between treated reaches and untreated reaches. All barriers will be located within the boundaries of the Flying D Ranch; barriers will not be needed on U. S. Forest Service lands. Construction activities associated with placement of these structures may cause the introduction of sediments at the fish barrier site due to disturbance of the stream banks. Additional erosion may occur during high water if stream flows undercut gabions or if over-bank flows take place as a result of the gabion's placement on the streambed.

A portion of the normal sediment yield from the drainage basin upstream of the fish barrier site may accumulate immediately upstream of the gabion. Upon removal of the gabion, this sediment would be released to the stream. This would not affect the quantity of normal sediment yield, but would change the normal pattern of sediment delivery for a short period of time, probably less than one year.

Mitigation: If it is apparent that appreciable amounts of sediment will be introduced to the stream during gabion placement or removal, preventative measures such as silt fence barriers or straw bales will be placed to reduce sedimentation.

Alternative 2: No Action. There would be no impact under this alternative.

2. AIR Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
a. Emission of air pollutants or deterioration of ambient air quality? (also see 13 (c))			X		NO	2a
b. Creation of objectionable odors?		X				
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. For P-R/D-J projects, will the project result in any discharge which will conflict with federal or state air quality regs? (Also see 2a)		X				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Air Resources: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 2a. Emission of air pollutants.

Alternative 1: Proposed Action. Minor amounts of air pollutants will be released as the result of project-related vehicle operation, including equipment used in fish barrier construction and removal and the use of a gasoline powered outboard motor on Cherry Lake.

Alternative 2: No Action. There would be no impact under this alternative.

3. WATER Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
a. Discharge into surface water or any alteration of surface water quality including but not limited to temperature, dissolved oxygen or turbidity?			X		NO	3a
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		YES	3c
d. Changes in the amount of surface water in any water body or creation of a new water body?			X		YES	3d
e. Exposure of people or property to water related hazards such as flooding?		X				
f. Changes in the quality of groundwater?			X		NO	3f
g. Changes in the quantity of groundwater?		X				
h. Increase in risk of contamination of surface or groundwater?		X				
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		YES	3j
k. Effects on other users as a result of any alteration in surface or groundwater quantity?		X				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Water Resources: Increased nutrient levels in stream water may result from decomposition of fish not collected and buried by project personnel. This impact will be temporary and all nutrients will enter the natural biological/chemical cycles of the ecosystem. For example, the increased nutrient levels may lead to a temporary increase in stream algae and aquatic plants.

Comment 3a. Surface water quality.

Alternative 1: Proposed Action. A principal element of the proposed project is to introduce antimycin to Cherry Creek at a concentration of 8 to 12 parts per billion, possibly rotenone at a concentration of 0.25 to 1.0 parts per million, as well as potassium permanganate (KMnO4) at a concentration of 1 to 4 parts per million as a means to deactivate the fish toxicants.

However, this will be only a minor impact on the water quality for several reasons. Concentrations of antimycin, rotenone and potassium permanganate will be very low, rotenone and potassium permanganate in the parts per million, and antimycin in the parts per billion. These chemicals will be introduced into the water for short periods of time, about one to five days per year for three to five years. Apart from their intended toxic effect on fish, the chemicals are relatively benign in the environment.

Antimycin breaks down rapidly in the environment (Walker et al. 1964; Lee et al. 1971; Marking and Dawson 1972; Schnick 1974a). The label for Fintrol, the commercial formulation of antimycin, states that once diluted in water, Fintrol must be used within eight hours to ensure its potency, and that treated waters may usually be restocked within one week following treatment. However, in high-gradient and turbulent streams antimycin loses its toxicity over stream reaches with about 200 feet of vertical relief (Tiffan and Bergersen 1996; Bruce Rosenlund, U.S. Fish and Wildlife Service, personal communication). In the Cherry Creek drainage basin, antimycin will lose its toxicity so rapidly that it will have to be recharged at drip stations along the streams. Moreover, its breakdown products are non-toxic (Herr et al. 1967).

If rotenone is used in small tributaries, it will lose its toxicity as it enters Cherry Creek due to dilution. However, to ensure that Cherry Creek below the waterfall will not be affected, rotenone will be detoxified with potassium permanganate as described in the Narrative Summary.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 3c. Alteration of flows.

Alternative 1: Proposed Action. Portions of the project area contain beaver dams. To effectively treat these areas, flows going into beaver dams may be temporarily diverted. The beaver dams may also be temporarily breached to lower water surface elevations in beaver ponds.

Mitigation: Beavers will be allowed to rebuild dams following treatment in all areas where compatible with current beaver management practices. Beavers normally repair dams very quickly, particularly during late summer or fall. It is expected that beavers will repair dams within a few days following the breach.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 3d. Changes in surface water bodies.

Alternative 1: Proposed Action. See comment 3c.

Mitigation: Beavers will be allowed to rebuild dams following treatment in all areas where compatible with current beaver management practices. Beavers normally repair dams very quickly, particularly during late summer or fall. It is expected that beavers will repair dams within a few days following the breach.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 3f. Changes in groundwater quality.

Alternative 1: Proposed Action. If surface waters within the project area infiltrate into groundwater, the groundwater would be affected. However, as with surface water quality, these effects will be minimal (see comment 3a).

Alternative 2: No Action. There would be no impact under this alternative.

Comment 3j. Effects on other water users.

Alternative 1: Proposed Action. Bioassays on mammals indicate that, at the proposed concentrations antimycin and rotenone will have no effect on mammals, including humans, that drink the treated water (Schnick 1974a; Schnick 1974b). However, the product label for the commercial form of antimycin, Fintrol recommends that treated water not be used for drinking.

Mitigation: Public users of Forest Service trails will be notified of stream treatments during application of antimycin and dyes by posting signs at all trailheads, and where trails cross streams in the area. Signs will describe the chemicals being used and warn against drinking stream water.

Alternative 2: No Action. There would be no impact under this alternative.

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

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Vegetation Resources : No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 4a. Changes in plant productivity.

Alternative 1: Proposed Action. Increased nutrient levels in stream water may result from decomposition of any fish not collected and buried by project personnel. As a result of the increased nutrient levels, there may be a temporary increase in stream algae and aquatic plants. The proposed action will not result in changes in the diversity or abundance of aquatic or terrestrial plants.

Mitigation: Increased aquatic plant productivity is not necessarily a negative impact. However, the amount of nutrients released to the water resulting from the decomposition of fish will be minimized by having project personnel collect and bury as many dead fish as possible.

Comment 4b. Alteration of a plant community.

Alternative 1: Proposed Action. Construction associated with fish barriers will have a minor impact on local plant communities (see Comment 1a).

Mitigation: Disturbed areas will be returned to previously existing conditions by standard reclamation techniques such as placing biodegradable erosion-control fabrics and revegetation of disturbed soils.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 4c. Adverse effects on rare plants.

Alternative 1: Proposed Action. Any disturbances associated with fish barrier construction are anticipated to be minor and localized. However, because specific fish barrier locations have not been identified, and site-specific fish barrier plans and rare plant surveys have not been done, potential impacts associated with barrier construction on rare plants are unknown. Any fish barriers that may be necessary will be on the Flying D Ranch, no barriers will be needed on Forest Service lands.

Activities of crewmembers associated with this project are expected to have minimal trampling effects on plants on the project area.

The Bozeman Ranger District, U. S. Forest Service, did a limited botanical survey of the Cherry Creek prescribed burn area located near upper Cherry Creek on 16 June 1995. No rare or sensitive plants were found in this survey.

Mitigation: When barrier locations have been identified, a survey of rare plants in these areas will identify locations of any rare plants. It will then most likely be possible to avoid disturbing any specific areas identified as having rare plants.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 4e. Spread of noxious weeds.

Alternative 1: Proposed Action. Whenever vehicles are used, there is potential for the spread of noxious weeds. The risk under the proposed project is minor.

Mitigation: The undercarriage and beds of project vehicles will be checked before they enter and leave the project area.

Alternative 2: No Action. There would be no impact under this alternative.

5. FISH/WILDLIFE Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
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	NO	5d
e. Creation of a barrier to the migration or movement of animals?			X		YES	5e
f. Adverse effects on any unique, rare, threatened, or endangered species?			X		YES	5f
g. Increase in conditions that stress wildlife populations or limit abundance (including harassment, legal or illegal harvest or other human activity)?			X		YES	5g

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Fish/Wildlife Resources: Because fish populations in the upper Cherry Creek drainage basin will be reduced for at least 5 years, there will be temporary impacts on any fish-eating birds and mammals present on the project area, such as kingfisher, great blue heron, merganser, osprey, mink, and river otter. Also, if temporary reductions in aquatic invertebrates occur, insectivorous species such as American dippers will be impacted to the extent that they rely on aquatic invertebrates for food. It is likely that the highly mobile species will abandon the area until fish and aquatic invertebrate populations expand to levels high enough to support them once again. However, individual animals displaced from the area could have higher than normal mortality as well as possibly having to compete for occupied territories. Less mobile species would be more severely impacted. Rare birds and mammals are addressed specifically in Comment 5f.

Comment 5b. Changes in diversity and abundance of game species.

Alternative 1: Proposed Action. Application of fish toxicants to the waters of the Cherry Creek drainage basin will result in the elimination of the existing fish population. Since brook trout, rainbow trout and Yellowstone cutthroat trout are game species; this would be a significant impact on game species in this area.

A reach of Cherry Creek located in the lower portion of the project area, about two miles above the waterfall was surveyed by Inter Fluve, Inc. biologists during April 1990. Population estimates from this survey revealed that rainbow and brook trout were abundant in this reach (Table 1) although fish over 10 inches were rare (Figure 1).

Montana Fish Wildlife & Parks performed a survey of the upper reaches of the Cherry Creek drainage basin in August 1997 to determine the upstream limits of fish distribution in the upper Cherry Creek

Daniel McGuire of McGuire Consulting surveyed aquatic invertebrates in November 1997. His preliminary report is presented in Appendix 1. He also concluded that although some types of aquatic invertebrates may be reduced temporarily, antimycin treatments are not expected to have any long-term impacts.

Fish: Mottled sculpin, a member of most Montana mountain stream ecosystems east of the continental divide, are currently being considered for introduction into the project area. If they are introduced, this will increase their local abundance as well as the biological diversity of the project area.

Amphibians: Montana Fish Wildlife & Parks personnel observed spotted frogs (*Rana pretosia*) on the project area in August 1997. Beyond this observation, the status and distribution of amphibians on the project area is not known. However, pretreatment amphibian surveys are scheduled for spring 1998, as well as surveys following treatment. If any species present before treatment were absent following treatment, these species would be reintroduced.

Other amphibian species which may be present on the project area are Western toads (*Bufo boreas*), Northern leopard frogs (*Rana pipiens*), western chorus frogs *(Pseudacris triseriata*), and tiger salamanders (*Ambystoma tigrinum*).

Reports in the literature indicate that antimycin has no effect on amphibians at the proposed concentrations of 8 to 12 ppb (Walker 1964; Schnick 1974a). For example, tiger salamanders survived exposure at 80 ppb for 96 hours, while bullfrog tadpoles survived 20 ppb, but perished when exposed to 40 ppb for 24 hours (Walker 1964). The LC50 (lethal concentration at which 50% of tested organisms die) for leopard frogs was from 48 to 59 ppb in water of varying hardness (Lesser 1972, cited in Schnick 1974a). No information on antimycin toxicity to spotted frogs, chorus frogs or western toads could be located, but toxicity is probably similar to other frog species.

Rotenone is toxic to most gill-breathing larval amphibians, but is not harmful to adults (Schnick 1974b), except tiger salamanders (Hamilton 1941, cited in Schnick 1974b). However, because the treatment will take place in August or September, is it likely that the majority, if not all amphibians will have metamorphosed into adults by this time. Moreover, all of the species listed above prefer to breed in the standing water of ponds, rather than in streams. The areas where rotenone will potentially be used are primarily running water, and although some small beaver dams and other pond-like habitats are located in the areas that may be treated with rotenone, most of the beaver ponds on the project area are located elsewhere and will not be treated with rotenone.

Tiger salamanders are semi-aquatic, and although some adults may remain in breeding ponds (Reichel and Flath 1995), adults are more often found in upland areas where they inhabit animal burrows or other moist places after breeding (Stebbins 1966). Tiger salamanders may overwinter as larvae in colder, high elevation habitats. In some habitats, they exhibit neotony: becoming sexually mature as fully aquatic forms with external gills, known as axolotls (Reichel and Flath 1995). Any larval, neotonic or adult tiger salamanders present in areas treated with rotenone will likely be impacted by the treatment.

Temporary breaches in beaver dams will reduce the amount of wetland habitat available for amphibians. However, beavers normally repair dams very quickly, particularly during late summer or fall. Thus, by allowing beavers to rebuild dams, this habitat will be recovered within a very short time period, probably within a day or two.

Reptiles: Painted turtles (*Chrysemys picta*) and Western rattlesnakes (*Crotalis viridis*) are known to exist in the lower reaches of Cherry Creek (Robert G. Bramblett, personal observation), but it is not known if they occur on the project area. Other reptiles that may occur on the project area include rubber boa (*Charina bottae*), western yellow-bellied racer (*Coluber constrictor*), gopher snake (*Pituophis melanoleucus*), common garter snakes (*Thamnophis sirtalis*), and Western terrestrial garter snake (*Thamnophis elegans*). The literature on antimycin toxicity reports no effect for reptiles, but is limited to

drainage basin (Table 2, Figure 2). Brook trout were common in most of the upper Cherry Creek drainage basin, while Yellowstone cutthroat trout were common in Cherry Lake Creek and West Fork Pika Creek, a small tributary to Cherry Lake Creek. Yellowstone cutthroat trout are also present in Cherry Lake, as well as Cherry Lake's inlet streams.

Mitigation. The introduction of westslope cutthroat trout and possibly fluvial Arctic grayling is mitigation for the removal of currently existing non-native fish populations. It is expected that these species will become as abundant as the current fish population. For example, following the removal of brook trout from White's Gulch, a tributary to Canyon Ferry Reservoir on the Missouri River, an extant westslope cutthroat trout population expanded to reach densities and a biomass similar to the total population of brook and cutthroat trout combined that existed prior to the removal of brook trout (Brad Shepard, MFWP, personal communication). In addition, for all fish over 3 inches, the proportion of fish within the total population over 8.0 inches increased from about 31% to about 46%.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 5c. Changes in nongame species.

Alternative 1: Proposed Action. **Aquatic Invertebrates.** Most studies have found that at proposed levels, antimycin is harmless to most aquatic invertebrates found in streams and standing waters (Walker et al. 1964; Herr et al. 1967; Schnick 1974a; Houf and Campbell 1977). A study in a Wisconsin trout stream did find temporary reductions in aquatic invertebrates including certain caddisflies, a cranefly, a mayfly and a scud (Jacobi and Degan 1977). However, concentrations of antimycin in this stream reached as high as 44 parts per billion, about 4 times higher than the proposed concentration for this project.

Certain invertebrates will probably be affected at the proposed levels of antimycin, including Cladocera and Copepoda (zooplankton), Amphipoda (scuds), and certain mayflies and caddisflies, although populations of these taxa are only diminished temporarily (Schnick 1974a). Bruce Rosenlund, a USFWS Biologist with extensive experience with antimycin treatments in Colorado, has observed that the effect of antimycin on aquatic invertebrates is more severe in waters with a pH at or below 7.0. However, he has also observed that these invertebrate populations recover rapidly. On the project area, pH's of 7.0 and below are common (Table 2).

In general, most studies report that aquatic invertebrates, except zooplankton are much less sensitive to rotenone treatment than fish (Schnick 1974b). One study reported that no significant reduction in aquatic invertebrates was observed due to the effects of rotenone, which was applied at levels twice as high as the levels proposed for this project (Houf and Campbell 1977). In all cases the reduction of aquatic invertebrates was temporary, and most treatments used a higher concentration of rotenone than proposed for this project (Schnick 1974b). In a study on the relative tolerance of different types of aquatic invertebrates to rotenone, Engstrom-Heg et al. (1978), reported that the long-term impacts of rotenone are mitigated because those insects that were most sensitive to rotenone also tended to have the highest rate of recolonization. The authors of this study also suggest that it is probable that in most streams, only mild and temporary damage to aquatic invertebrates would occur in treatments using rotenone at levels ten times higher than the levels proposed for this project.

Because of their short life cycles (Anderson and Wallace 1984), good dispersal ability (Pennack 1989) and generally high reproductive potential (Anderson and Wallace 1984), aquatic invertebrates are capable of rapid recovery from disturbance (Jacobi and Deegan 1977; Boulton et al. 1992; Johnson and Vaughn 1995; Matthaei et al. 1996; Nelson and Roline 1996). Moreover, since many headwater reaches of tributaries in the Cherry Creek drainage basin have no fish (Table 2), they will not be treated with fish toxicants. Therefore, these headwater areas will be available to serve as sources of aquatic invertebrates for recolonization into treated areas.

unspecified turtles, snapping turtles and a water snake, at concentrations of antimycin up to 10 ppb (Schnick 1974a). Reptiles are apparently not affected by rotenone treatments (Schnick 1974b).

Birds and Mammals: Birds and mammals on the project area may be exposed to antimycin or rotenone through direct exposure to, or drinking of toxicant-treated water, or by eating fish killed by fish toxicants. In Schnick's (1974a) summary of the literature on toxicity testing of antimycin, none of the tests showed any effect of antimycin on birds or mammals. This review included studies that examined direct exposure to water and eating fish killed by antimycin. In addition, she reported on toxicology studies that calculated the LD50 (dose at which 50% of tested individuals die) with direct feeding of antimycin to birds and mammals. LD50's for birds and mammals were in the range of parts per million, which is at least one thousand times higher than the proposed concentrations on this project. Antimycin is also not hazardous for humans at the proposed concentrations.

Rotenone is similarly benign to birds and mammals. For example, a guinea pig would have to drink 15.8 gallons of rotenone–treated water, or eat 22 pounds of fish killed by rotenone within 24 hours to receive a lethal dose. Similarly, 0.2 pound bird would have to drink approximately 26 gallons of rotenone–treated water, or eat 220 pounds of fish killed by rotenone within 24 hours to receive a lethal dose.

Summary of effects on nongame species: It is expected that impacts on all non-game species will be minor and/or temporary, except for mottled sculpin, which, if introduced, will likely expand into a large area of previously unoccupied habitat.

Mitigation: Although the probability of eliminating a species of amphibian from the project area is very low, any amphibian species not documented in the post-treatment survey will be reintroduced. Frog, toad or salamander egg masses will be located in the nearest neighboring population and placed in suitable habitat within the project area to facilitate their reestablishment.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 5d. Introduction of a new species into an area.

Alternative 1: Proposed Action. The lack of any native fish species above the waterfall on Cherry Creek strongly suggests that the upper Cherry Creek drainage basin had been without fish probably since the Pleistocene glaciation, until they were introduced to the area by humans. Therefore, although the proposed action is to introduce fish species native to the Madison River basin, the introduction of any fish species to upper Cherry Creek would be an introduction of a new species. However, from the perspective of the current condition of the ecosystem, the introduction of westslope cutthroat trout (and possibly other species) to the upper Cherry Creek drainage basin would be mitigation for the removal of the non-native fish populations currently present there.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 5e. Creation of a barrier to the movements of animals.

Alternative 1: Proposed Action. As discussed previously (See Narrative Summary and Comments 1a and 1d), it may be necessary to place temporary fish barriers to prevent recolonization between treatment years.

Mitigation. Temporary fish barriers will be removed following treatment.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 5f. Adverse effects on rare animals.

Alternative 1: Proposed Action. A summary of effects of Alternatives 1 and 2 on threatened, endangered, and sensitive species is presented in Table 3. The rationale for the assessment of effects are presented below.

Westslope cutthroat trout. As discussed in the narrative summary of the proposed action, the project will result in a substantial beneficial impact to this species.

Yellowstone cutthroat trout. Yellowstone cutthroat trout are present in Cherry Lake and some of the nearby tributaries (Table 2). Their presence in these areas is not natural; Montana Fish Wildlife & Parks introduced them to the Cherry Creek drainage basin as part of their mountain lake stocking program. The proposed project will eliminate the Cherry Lake population. However, because the Cherry Lake Yellowstone cutthroat trout population is not native, its removal from Cherry Lake is not detrimental to the species in its native habitat.

Fluvial Arctic grayling. If fluvial Arctic grayling are introduced and become established in the upper Cherry Creek drainage basin, this would represent a substantial beneficial impact on this species.

Western Big-Eared Bat. The diet of this bat consists of over 90% night-flying moths. A large percentage of these moths are from the family Noctuidae, a large and common group of moths (Dennis Flath, MFWP, personal communication). Although some Noctuids are semi-aquatic, terrestrial Noctuids are probably much more common on the project area (Daniel L. Gustafson, Montana State University, personal communication). Moreover, no Noctuids were collected in Daniel McGuire's survey (See Appendix 1) of aquatic insects on the project area. Therefore, since it is unlikely that a reduction in these moths will occur, it is unlikely that there will be an impact on the Western Big-Eared Bat.

Gray wolf. If wolves are present, they may forage on fish killed by antimycin or rotenone. However, eating fish killed by antimycin or rotenone is not toxic to mammals (Schnick 1974a; Schnick 1974b).

Grizzly Bear. Grizzly bears are known to occur on the project area (Brad Shepard, MFWP, personal communication). Fish are an important item in the diet of grizzly bears where abundant, predictable and vulnerable concentrations occur, such as along salmon spawning streams and in tributaries of Yellowstone Lake during spawning runs (Lance Craighead, Montana State University, personal communication). There are probably spawning runs of Yellowstone cutthroat trout out of Cherry Lake, but in all likelihood the concentrations of fish are not large enough to attract grizzly bears. Although bears may forage on fish killed by antimycin or rotenone, bioassays have shown that this does not affect mammals (Schnick 1974a; Schnick1974b). Human activities may cause grizzly bears to move out of an area, but intense human activity will be temporary. Current plans are that up to 50 or 60 persons will be present during treatment, for a period of about 2-3 weeks per year for up to 5 years.

Wolverine. Wolverines occur in low population densities and may occur on the project area, but no impact is expected on this species (Kurt Alt, MFWP, personal communication).

Lynx. Because they do not rely on fish or any other animal impacted by this project, there is no anticipated impact on lynx (Kurt Alt, MFWP, personal communication).

Trumpeter swan. Because is unlikely that they occur on the project area, there is no anticipated impact on trumpeter swan (Dennis Flath MFWP, personal communication).

Harlequin duck. It is possible that harlequin ducks occur on the project area. Harlequin ducks do eat aquatic invertebrates and the temporary, minor suppression of aquatic invertebrates anticipated from this project may reduce their food supply. Therefore, if present, a minor impact on harlequin ducks may result from this project (Dennis Flath, MFWP, personal communication).

Bald Eagle. The following information was obtained from an interview with Dr. Al Harmata, Adjunct Professor, Montana State University, 16 January 1998.

A bald eagle (*Haliaeetus leucocephalus*) nest is located near lower Cherry Creek, about 1 mile from the Madison River. This is outside the project area, which begins about four miles upstream on Cherry Creek. This nest has produced about seven young during the period from 1993-1997. After attachment of a radio transmitter, the female eagle was relocated by radio telemetry during the period from 1 July through 15 September 1990. Locations were made during mid-day, from about 11:00 AM to 4:00 PM. About 75% of these relocations were within the project area, in an area along upper Cherry Creek, about 10 miles away from the nest.

Dr. Harmata described this area as a wetland with small beaver dams and snags for eagle perches. He did not consider this area typical of areas in which eagles forage for fish. He believes that the eagles may have been hunting ducks or young beavers, scavenging large animal carcasses, or quite possibly using this area for loafing.

Two factors lend support to the idea that this was a loafing area. First, this area is more remote, quieter, at a higher elevation and therefore perhaps cooler than the nest area, all characteristics of loafing areas. Second, the time period of the observations was not during the primary foraging period for eagles, which is shortly after dawn. If this area was used primarily for loafing, activities associated with the project would probably have minimal effect on the pair of eagles nesting on lower Cherry Creek.

In the Greater Yellowstone Ecosystem, bald eagle nests are generally located as close as possible to foraging areas. The straight-line distance from the nest to the project area boundary is about four miles. This area includes about seven stream miles of lower Cherry Creek that will not be impacted by this project. A model developed by Dr. Harmata for bald eagles in the Greater Yellowstone Ecosystem suggest that, for nests of medium productivity, such as this nest, the majority of foraging areas are within 2.5 miles of the nest location. This model would therefore predict that the area on upper Cherry Creek, 10 miles from the nest is not an important foraging area. Moreover, a characteristic of productive nests is an even distribution of foraging areas within the eagle's home range. When this even distribution of foraging areas exists, the importance of any one foraging area is diminished.

Dennis Flath, MFWP non-game biologist was also interviewed and he concluded that there would be no effect on bald eagles.

Ferruginous Hawk. Because it is unlikely that a breeding population of ferruginous hawks occurs on the project area and because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (James Zelenak, raptor biologist, personal communication).

Peregrine falcon. Because it is unlikely that peregrine falcon occur on the project area and because they do not have significant ecological interactions with fish, it is unlikely that this project will have any effect on them (Marco Restani, Montana State University, personal communication).

Flammulated owl. Flammulated owls may occur on the project area, but because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (Dennis Flath, MFWP, personal communication).

Boreal owl. Boreal owls probably occur on the project area, but because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (Dennis Flath, MFWP, personal communication).

TURNER ENDANGERED SPECIES FUND

Hours spent working on projects for the Turner Endangered Species Fund.

EMPLOYEE _____

PAY PERIOD _____

FIRST WEEK:

PROJECT NAME	MON.	TUES.	WED.	THUR.	FRI.	SAT.	SUN.

SECOND WEEK:

PROJECT NAME	MON.	TUES.	WED.	THUR.	FRI.	SAT.	SUN.

Employee's signature: _____

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Black-backed woodpecker. Black-backed woodpeckers may occur on the project area, but because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (Dennis Flath, MFWP, personal communication).

Mitigation. The introduction and subsequent growth of westslope cutthroat trout populations will mitigate for any impacts on rare species caused by the temporary reduction in fish populations. Similarly, if a reduction in aquatic invertebrates occurs and impacts any species, the natural recovery of their populations will mitigate for the temporary impacts.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 5g. Increase in conditions that stress or limit abundance of wildlife.

Alternative 1: Proposed Action. The removal of fish populations and potential temporary reduction of aquatic macroinvertebrates in the project area will result in a decline in food resources for fish-eating and possibly for insect-eating wildlife. This impact will abate after fish populations are established and as insect populations recover following treatment.

Short-term increases in noise and activity associated with the proposed project may create periods of temporary stress in some wildlife species. Periods of intensive activity on the project area are expected to last about 2-3 weeks each year for 3-5 years. Because of the temporary nature of this disturbance, impacts are predicted to be minor.

Mitigation: Westslope cutthroat trout and any other fish species that are introduced will provide food for fish-eating animals, when their numbers and biomass reach the pre-treatment levels. Any reduction in food for insect-eating animals will be regained when aquatic invertebrates recover from their temporary reductions.

Alternative 2: No Action. There would be no impact under this alternative.

Bald Eagle. The following information was obtained from an interview with Dr. Al Harmata, Adjunct Professor, Montana State University, 16 January 1998.

A bald eagle (*Haliaeetus leucocephalus*) nest is located near lower Cherry Creek, about 1 mile from the Madison River. This is outside the project area, which begins about four miles upstream on Cherry Creek. This nest has produced about seven young during the period from 1993-1997. After attachment of a radio transmitter, the female eagle was relocated by radio telemetry during the period from 1 July through 15 September 1990. Locations were made during mid-day, from about 11:00 AM to 4:00 PM. About 75% of these relocations were within the project area, in an area along upper Cherry Creek, about 10 miles away from the nest.

Dr. Harmata described this area as a wetland with small beaver dams and snags for eagle perches. He did not consider this area typical of areas in which eagles forage for fish. He believes that the eagles may have been hunting ducks or young beavers, scavenging large animal carcasses, or quite possibly using this area for loafing.

Two factors lend support to the idea that this was a loafing area. First, this area is more remote, quieter, at a higher elevation and therefore perhaps cooler than the nest area, all characteristics of loafing areas. Second, the time period of the observations was not during the primary foraging period for eagles, which is shortly after dawn. If this area was used primarily for loafing, activities associated with the project would probably have minimal effect on the pair of eagles nesting on lower Cherry Creek.

In the Greater Yellowstone Ecosystem, bald eagle nests are generally located as close as possible to foraging areas. The straight-line distance from the nest to the project area boundary is about four miles. This area includes about seven stream miles of lower Cherry Creek that will not be impacted by this project. A model developed by Dr. Harmata for bald eagles in the Greater Yellowstone Ecosystem suggest that, for nests of medium productivity, such as this nest, the majority of foraging areas are within 2.5 miles of the nest location. This model would therefore predict that the area on upper Cherry Creek, 10 miles from the nest is not an important foraging area. Moreover, a characteristic of productive nests is an even distribution of foraging areas within the eagle's home range. When this even distribution of foraging areas exists, the importance of any one foraging area is diminished.

Dennis Flath, MFWP non-game biologist was also interviewed and he concluded that there would be no effect on bald eagles.

Ferruginous Hawk. Because it is unlikely that a breeding population of ferruginous hawks occurs on the project area and because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (James Zelenak, raptor biologist, personal communication).

Peregrine falcon. Because it is unlikely that peregrine falcon occur on the project area and because they do not have significant ecological interactions with fish, it is unlikely that this project will have any effect on them (Marco Restani, Montana State University, personal communication).

Flammulated owl. Flammulated owls may occur on the project area, but because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (Dennis Flath, MFWP, personal communication).

Boreal owl. Boreal owls probably occur on the project area, but because they do not have significant ecological interactions with fish, it is unlikely that this project will have any impact on them (Dennis Flath, MFWP, personal communication).

Table 1. Summary of data collected by Inter-Fluve, Inc. in the Butler Section of Cherry Creek during April 1990. Population estimates were generated using the modified Petersen mark-recapture technique (Seber 1973). Numbers following ± are 95 % confidence intervals.

Age (years)	Number (Fish/mile)	Mean Total Length (Inches)	Mean Weight (Pounds)	Biomass (lbs./mile)	Condition Factor
		Rainbow Trout Butler Section One			
I	686 ± 84	3.1	0.01	10.0	1.31
II	845 ± 116	5.9	0.08	68.0	0.99
III	771 ± 32	8.6	0.23	176.0	0.99
IV and older	148 ± 32	9.9	0.28	41.4	0.75
Totals	2450 ± 148	6.8	0.13	253.6	1.04
		Brook Trout Butler Section One			
I	845 ± 63	4.1	0.02	18.7	0.80
II	1521 ± 63	6.8	0.11	163.6	0.91
III and older	232 ± 32	8.7	0.21	47.0	0.86
Totals	2598 ± 95	6.3	0.10	229.2	0.87
		Rainbow Trout Butler Section Two			
I	3867 ± 148	3.1	0.01	39.6	1.01
II	1288 ± 70	5.6	0.06	82.4	0.96
III	1225 ± 28	8.4	0.21	267.7	1.01
IV and older	486 ± 28	10.5	0.41	203.6	0.99
Totals	6836 ± 169	6.4	0.15	593.4	1.00
		Brook Trout Butler Section Two			
I	753 ± 28	4.0	0.02	15.0	0.81
II	1316 ± 28	6.9	0.11	149.6	0.93
III and older	471 ± 14	8.7	0.22	104.8	0.92
Totals	2534 ± 42	6.5	0.11	269.4	0.89

Table 2. Summary of data collected by Montana Fish Wildlife & Parks in upper Cherry Creek drainage basin during August 1997. Some of the stream names are informal. Mile refers to the stream mile of the tributary above the confluence with another tributary.

Stream	Mile	pH	Fish Species Captured
Carpenter Creek	1.0	7.4	brook trout
Carpenter Creek	2.0	7.8	brook trout
Carpenter Creek	3.0	7.5	brook trout
Cherry Lake Creek	0.5	---	Yellowstone cutthroat trout
Cherry Lake Creek .	1.5	5.8	Yellowstone cutthroat trout
Cherry Lake Creek	2.0	5.8	Yellowstone cutthroat trout
Cherry Lake Creek	2.5	6.0	Yellowstone cutthroat trout
Cherry Lake Creek	3.0	6.0	Yellowstone cutthroat trout
Cherry Lake Creek	3.6	7.9	Yellowstone cutthroat trout
Cherry Lake East Inlet	0.0	7.7	Yellowstone cutthroat trout
Cherry Lake West Inlet	0.0	6.0	no fish
Cherry Tributary 14.9	0.0	5.7	no fish
Cherry Tributary 14.9	0.0	5.4	no fish
Cherry Tributary 8.6	0.6	7.0	no fish
East Fork Cherry Creek	4.0	7.1	brook trout
East Fork Cherry Tributary 2.3	0.1	8.0	no fish
East Fork Pika	3.5	6.0	no fish
Middle Fork Pika	2.9	6.9	no fish
Middle Fork Pika	3.9	6.5	no fish
South Fork Cherry Creek	1.0	6.1	brook trout
South Fork Cherry Creek	1.5	6.4	no fish
South Fork Cherry Creek	2.0	6.0	no fish
South Fork Cherry Creek	2.5	6.0	no fish
South Fork Cherry Creek	3.0	6.5	no fish
South Fork Cherry Creek	3.5	6.6	no fish
South Fork Cherry Creek	4.0	6.8	no fish
South Fork Cherry Creek	4.5	7.0	no fish
South Fork Cherry Creek	4.5	7.4	no fish
South Fork Cherry Creek	4.5	7.4	no fish
Sweden Creek	0.2	6.3	brook trout
Sweden Creek	2.0	7.6	no fish
Sweden Creek	2.0	7.0	no fish
Sweden Creek	2.5	5.6	no fish
West Fork Carpenter	0.1	7.4	brook trout
West Fork Cherry Tributary 14.9	0.0	6.7	no fish
West Fork East Fork Cherry	0.0	7.2	brook trout
West Fork East Fork Cherry	0.7	6.6	brook trout
West Fork Pika	0.7	6.8	Yellowstone cutthroat trout

Table 3. Summary of conclusion of effects on threatened, endangered, and sensitive species. Experts were biologists familiar with the species interviewed for their assessment of project impacts on that species. Alternative 1: Non-native fish eradication followed by native fish introduction. Alternative 2: No Action. Rationale for conclusion of effects is contained in the Environmental Assessment, Comment 5f.

Species	Expert[a]	Status[b]	Alternative 1[c]	Alternative 2[c]
Westslope Cutthroat Trout (*Oncorhynchus clarki lewisi*)	Shepard	SS	BI	NI
Yellowstone Cutthroat Trout (*O. clarki bouvieri*)	Shepard	SS	NI	NI
Fluvial Arctic grayling (*Thymallus arcticus*)	Shepard	CAN	BI	NI
Western Big-Eared Bat (*Plecotus townsendi*)	Flath	SS	MIIH	NI
Gray Wolf (*Canis lupus*)	Flath	PFL	NE	NE
Grizzly Bear (*Ursus arctos horribilus*)	Craighead	TH	NE	NE
Wolverine (*Gulo gulo*)	Alt	SS	NE	NE
Lynx (*Felis lynx*)	Alt	SS	NE	NE
Trumpeter Swan (*Cygnus buccinator*)	Flath	SS	NE	NE
Harlequin Duck (*Histrionicus histrionicus*)	Flath	SS	MIIH	NE
Bald Eagle (*Haliaeetus leucocephalus*)	Flath	TH	NE	NE
Ferruginous Hawk (*Buteo regalis*)	Zelenak	SS	NE	NE
Peregrine Falcon (*Falco peregrinus*)	Restani	EN	NE	NE
Flammulated Owl (*Otus flammeolus*)	Flath	SS	NE	NE
Boreal Owl (*Aegolius funereus*)	Flath	SS	NE	NE
Black-backed Woodpecker (*Picoides arcticus*)	Flath	SS	NE	NE

[a] Brad Shepard; Fisheries Biologist, Montana Fish Wildlife & Parks.
Dennis Flath, Non-game Wildlife Biologist, Montana Fish Wildlife & Parks

Table 3, Continued.
Lance Craighead Ph.D., Adjunct assistant professor, Montana State University Bozeman.
Kurt Alt, Wildlife Biologist, Montana Fish Wildlife & Parks.
Al Harmata Ph.D., Adjunct Assistant Professor, Montana State University Bozeman.
James Zelenak, Raptor Biologist with background in ferruginous hawk research.
Marco Restani Ph.D., Adjunct Assistant Professor, Montana State University Bozeman.

[b] CAN = US Fish and Wildlife Service candidate endangered or threatened species.
SS = US Forest Service sensitive species
PFL = The gray wolf is currently regarded as "proposed for listing" as endangered by the USFWS for populations in the Greater Yellowstone Ecosystem. Any wolves reintroduced into Yellowstone National Park or any wild individuals that may inhabit the area are classified as a "nonessential experimental population".
TH = US Fish and Wildlife Service threatened species.
EN = US Fish and Wildlife Service endangered species.

[c] BI = Beneficial impact.
MIIH = May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or loss of viability to the population or species.
NE = No effect

Prepared by Robert G. Bramblett
Reviewed by Kurt Alt

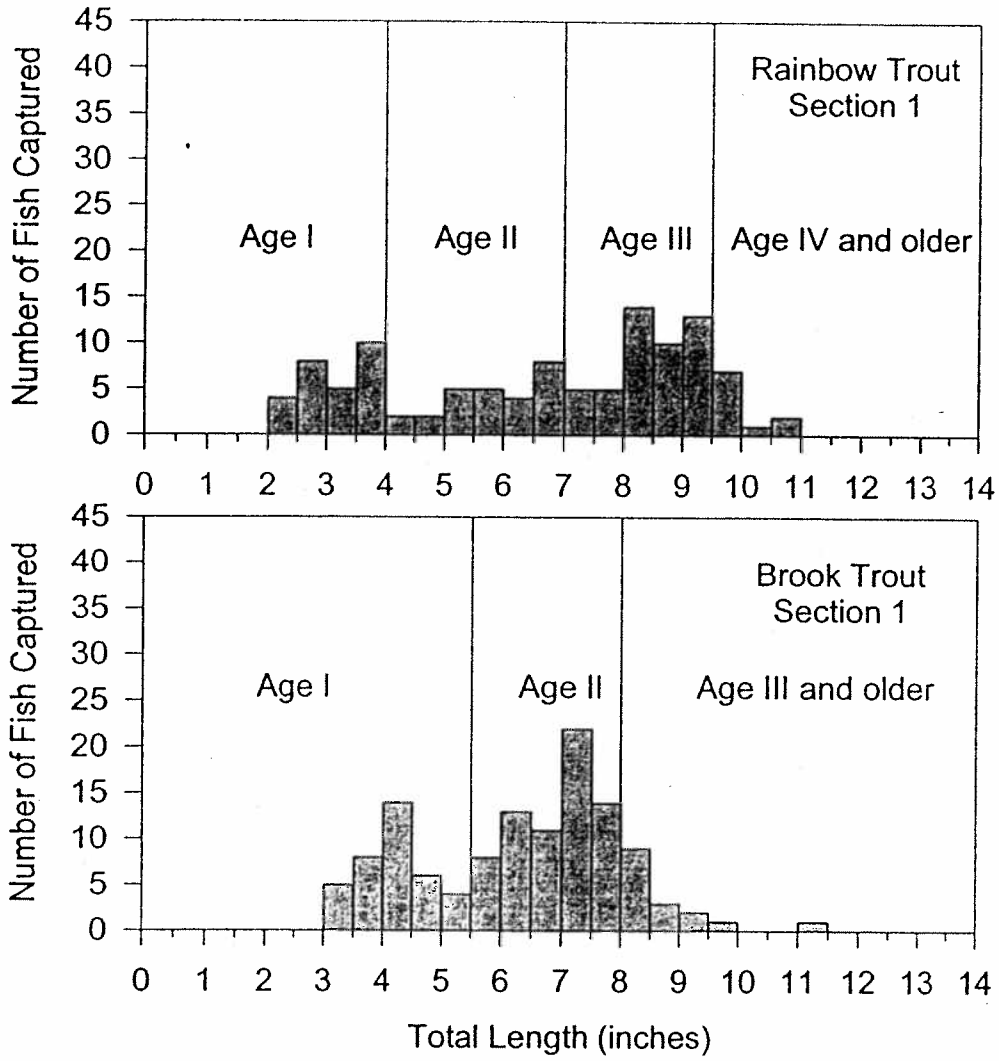


Figure 1. Length-frequency histogram of rainbow and brook trout captured during electrofishing survey by Inter-Fluve, Inc. in section one of the Butler reach of Cherry Creek during April 1990.

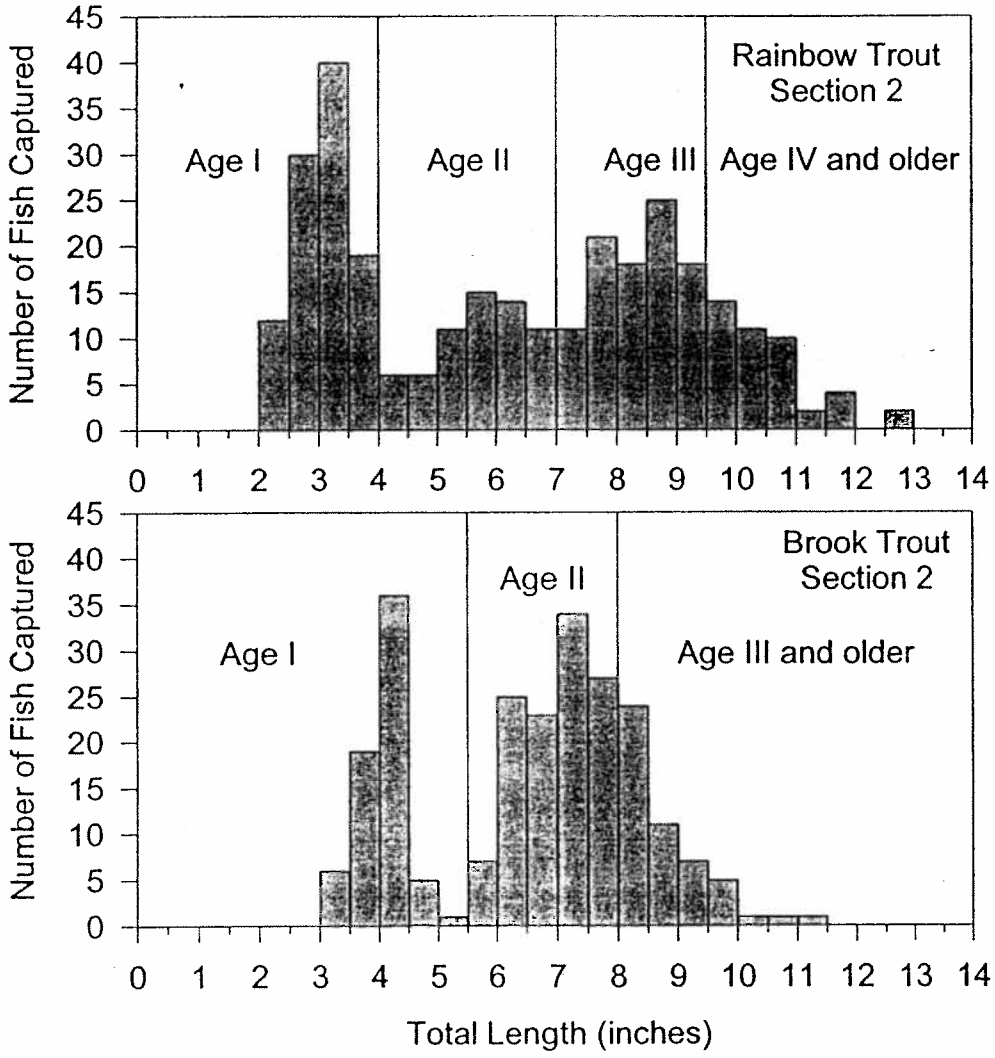
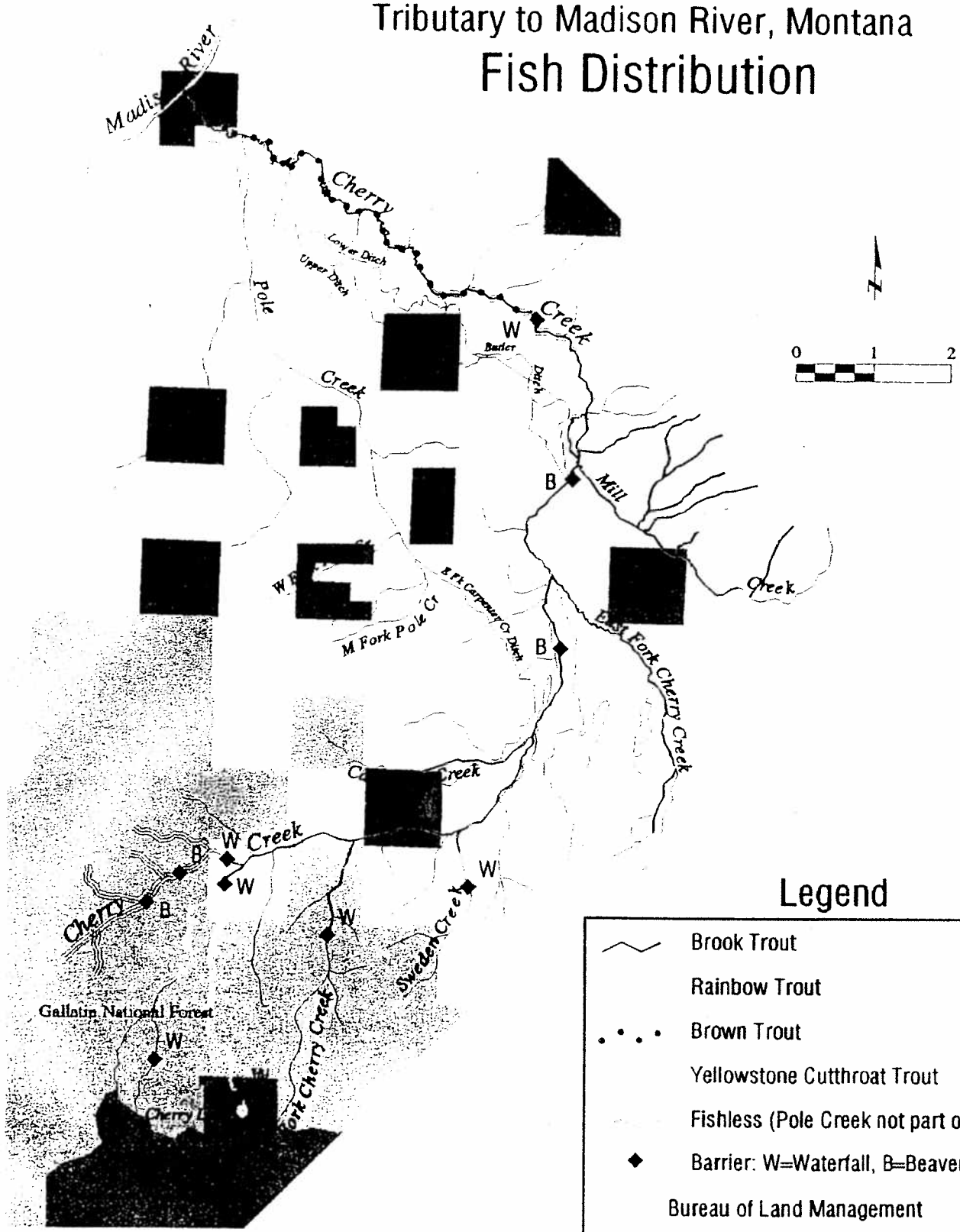


Figure 2. Length-frequency histogram of rainbow and brook trout captured during electrofishing survey by Inter-Fluve, Inc. in section two of the Butler reach of Cherry Creek during April 1990.

Cherry Creek

Tributary to Madison River, Montana

Fish Distribution



Legend

- Brook Trout
- Rainbow Trout
- Brown Trout
- Yellowstone Cutthroat Trout
- Fishless (Pole Creek not part of study)
- Barrier: W=Waterfall, B=Beaver Dam
- Bureau of Land Management
- National Forest
- National Forest Wilderness
- State Lands

Map produced by:
Jeffrey Hutten
Montana Fish, Wildlife & Parks
Information Services Unit
490 N. Meridian Rd.
Kalispell, MT 59901
406-751-4571

Fish distribution and barriers data obtained by Global Positioning System (GPS) and differentially corrected. Hydrography from StreamNet and digitized at 1:100,000. Public landownership data from the Natural Resource Information System (NRIS) at the Montana State Library.

/fwp/spot/jeff/emhydro/cherry.cmp
February 20, 1998

STREAMNET

Montana Fish, Wildlife & Parks

B. HUMAN ENVIRONMENT

6. NOISE/ELECTRICAL EFFECTS Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
a. Increases in existing noise levels?			X		NO	6a
b. Exposure of people to severe or nuisance noise levels?			X		NO	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				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Noise/Electrical Effects: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 6a. Increase in noise levels.

Alternative 1: Proposed Action. Short-term increases in noise and activity associated with the proposed project may create periods of temporary stress in some wildlife species. Periods of high human activity on the project area are expected to last about 2-3 weeks each year for 3-5 years. Because of the temporary nature of this disturbance, it is predicted to be a minor impact.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 6b. Exposure of people to nuisance noise levels.

Alternative 1: Proposed Action. An outboard boat motor will be needed to ensure a thorough mixing of antimycin throughout the waters of Cherry Lake. The antimycin will be diluted in lake water and then pumped into the propwash of an outboard motor mounted on an inflatable raft. The motor and raft will be packed into Cherry Lake with horses. Previous experience in Colorado alpine lakes has shown that it is essential to use an outboard motor in lake environments; treatments done without an outboard motor have failed to remove all fish from lakes (Bruce Rosenlund, U. S. Fish and Wildlife Service, personal communication).

The treatment on Cherry Lake will occur on 1-2 days during August for two or possibly three years. The noise levels produced by the boat motor may be perceived as a nuisance by people camping or fishing on the lake, particularly since it is within a wilderness where such noise is not expected.

Alternative 2: No Action. There would be no impact under this alternative.

7. LAND USE Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
a. Alteration of or interference with the productivity or profitability of the existing land use of an area?			X		YES	7a
b. Conflicted with a designated natural area or area of unusual scientific or educational importance?		X				
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?			X		NO	7c
d. Adverse effects on or relocation of residences?		X				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Use: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 7a. Alteration of or interference with existing land use.

Alternative 1: Proposed Action. Implementation of the Gallatin National Forest Plan and the settlement Agreement to the Appeal of the Gallatin National Forest by the Madison/Gallatin Chapter of Trout Unlimited, Inc. has resulted in a stream classification system which provides the needed specificity for management of the Forest fishery habitat resources. The stream classification system consists of four stream classes and a cumulative effects rationale based on fishery resource values and Forest Service management requirements.

Because lower Cherry Creek supports spawning and rearing habitat to the internationally renowned Madison River fishery, and as a cumulative effects rationale supports the application of the Class A status to these waters, Cherry Creek is currently classified as a Class A stream. The introduction of westslope cutthroat trout into Cherry Creek would not change the stream classification from a Class A as streams supporting sensitive fish species also carry this status. Sensitive species are those species in which population viability is a concern. Class A streams have a habitat management objective which requires the Forest to provide habitat at a level which is at least 90% of the habitat capability.

As the existing watershed condition and associated fish habitat attributes of Cherry Creek are reflective of a watershed in near pristine condition. The Habitat Objective of 90% capability is currently being met for the drainage as a whole.

Specific FS proposals and ongoing activities within the Cherry Creek drainage include prescribed fire, livestock grazing, outfitting, recreational angling, and noxious weed treatment. No specific proposal for timber harvest currently exists within the Cherry Creek drainage. The Chief of the Forest Service has proposed an 18-month moratorium on new road construction in inventoried roadless areas. Cherry Creek is part of the Madison inventories roadless area unit 1-579. Several thousand acres of the Cherry Creek area are identified within the Forest Plan as suitable for timber harvest. Although the moratorium on road construction does not preclude harvest by other methods, the likelihood of entry into this area for the

purpose of timber harvest in the near future is low. However, as long as there is a demand for federal timber and as long as the area is within the suitable timber base, the option for harvest is possible.

Three prescribed burns totaling 1,925 acres are proposed for the spring of 1998 through the year 2000 within the Cherry Creek drainage. Given the low risk of accelerated sediment delivery from small spring burns, the use of 100-foot buffer areas along the streams, and the high quality of existing condition of the watershed, potential effects to the aquatic system are expected to be extremely minimal. As fire is a natural component of the ecosystem and native fish assemblages evolved over time with this phenomenon, this type of activity is very compatible with the objective of maintaining watershed health.

Two federally authorized grazing allotments exist within the project area. The previously stated Forest Plan standards associated with a Class A stream still apply to Cherry Creek regardless of whether the stream supports a sensitive fish species or provides high water quality to downstream recruitment habitat to the Madison River.

The Forest Service's level of constraint for all activities mentioned above would be the same regardless of westslope cutthroat trout presence. This is based on the current Class A status and the overall high quality condition of the watershed. If the westslope cutthroat trout become formally listed as a threatened species under the Endangered Species Act, any activity the Forest Service authorizes, funds, or carries out in watersheds supporting westslope cutthroat trout could not result in jeopardizing the continued existence of the species or adversely modify critical habitats. The Forest Service would need to consult with, and receive concurrence from the U. S. Fish and Wildlife Service on activities within those drainages supporting westslope cutthroat trout as is currently being done with any other threatened or endangered species.

Roadless Area Character and Wilderness Area Management

The project area includes a small portion of the Spanish Peaks Unit of the Lee Metcalf Wilderness Area and a large portion of inventoried roadless area 1-549. The following briefly describes the existing situation relative to the six roadless evaluation criteria: (1) natural integrity, (2) apparent naturalness, (3) remoteness, (4) solitude, (5) special features, and (6) manageability/boundaries/size.

Natural integrity: The approximately 12,000 acre analysis area has seen little human-caused, surface-disturbing activities such as timber harvest, mining, or roading to any substantial degree. One two-track road roughly follows the Old Indian Trail and parts of Forest Service Trail 401 to the Cherry Creek Ranger Station. One large lightning-caused fire approximately 500 acres in size was suppressed in 1963 with hand crews and many other smaller fires have been suppressed in the last 30 years. Other than fire suppression, cattle grazing, and the introduction of non-native fish species, naturally functioning ecosystem processes are intact in the area.

Apparent Naturalness: This area appears primarily to have been affected by the forces of nature. The lack of surface-disturbing activities has resulted in preserving a natural appearing landscape.

Remoteness: This area is very remote with only two access routes available to the general public. Access from the north is restricted by the Flying D Ranch and the south side is bordered by the Spanish Peaks Unit of the Lee Metcalf Area which restricts motorized access. Forest Service Trail 401 allows motorized access into the area from the Spanish Creek trail 10 miles to the east. The Trail Creek trail on the Beaverhead National Forest access the area from the west. The area receives very little motorized use due to the technical nature of Trail 401. The relative long distance of the area from any developments such as Highways 191 or 287 results in a remote setting.

Solitude: The remoteness and lack of easy access into this area restricts the number of people in the area. The heaviest use period of the Cherry Creek area is during the fall hunting season and even then,

off trail encounters with other people are infrequent. The Cherry Creek area offers the unique opportunity to feel isolated from civilization.

Special Features: The large, unfragmented and undeveloped nature of the Cherry Creek area offers a variety of unique biological, ecological, and cultural features. The diverse and varied vegetative community types and elevations found within and adjacent to the project area provide extensive habitat blocks for climax community structure. Large carnivores such as mountain lion and grizzly bears have been sited in the area. The landscape would be considered "distinctive" under the Visual Management System.

Boundaries/Size/Manageability: The total size of the project area in National Forest Systems Lands is about 12,000 acres within the Cherry Creek drainage. The area is bounded on the south by the Spanish Peaks Unit of the Lee Metcalf Wilderness Area and on the North by the Flying D Ranch. The Cherry Creek area is part of the Madison inventoried roadless unit 1-549. This area was released from further consideration through the forest planning for wilderness designation in the Lee Metcalf Wilderness Bill.

Since the proposed action requires no road construction or earth disturbing activities on Forest Service lands, the roadless character of the landscape will not be altered. The presence of crewmembers and workers within the remote area during the antimycin treatment and the use of the outboard motor will cause temporary disturbance to the solitude of the area by the noise associated with the motor and talking.

Mitigation: The highest potential for interaction with the backcountry user would occur during the fall hunting season for the months of September, October, and November. The proposed date of late August for activity associated with this project would not coincide with the fall hunting season and therefore mitigates any potential conflicts with it. The loss of solitude from noise production would be temporary in nature and would not result in a irreversible or irretrievable loss.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 7c. Conflict with existing land use that would prohibit proposed action.

Alternative 1: Proposed Action. An exemption from the U.S. Forest Service will be necessary to allow the use of a gasoline powered outboard motor in the Lee Metcalf Wilderness area. An outboard motor is needed to ensure a thorough mixing of antimycin in lake environments; the antimycin is diluted in lake water and then pumped into the propwash of an outboard motor. Experience in Colorado alpine lakes have shown that it is essential to use an outboard motor in lake treatments (Bruce Rosenlund, U. S. Fish and Wildlife Service, personal communication).

Alternative 2: No Action. There would be no impact under this alternative.

8. RISK/HEALTH HAZARDS Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
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				
c. Creation of any human health hazard or potential hazard?			X		YES	8c

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Risk/Health Hazards: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 8a. Risk of a release of hazardous substances.

Alternative 1: Proposed Action. There is a minor risk of spilling antimycin, rotenone or potassium permanganate directly into the stream. Antimycin, rotenone and potassium permanganate are normally diluted in water first and then dripped into the stream at a constant rate by using a device that maintains a constant head pressure, called a "drip station". If undiluted antimycin, rotenone or potassium permanganate is spilled, or if a drip station tips into the stream, a higher concentration of chemical in the stream will result. This will likely cause a higher mortality of fish and aquatic macroinvertebrates in the area downstream from the spill. Because antimycin breaks down rapidly in turbulent waters, and a turbulent canyon reach exists in the lower 2.5 miles of the project area, it is very unlikely that an antimycin spill will kill fish outside of the project area.

Mitigation: If a toxic dose of antimycin or rotenone passes downstream of the waterfall, it will be detoxified by adding potassium permanganate to Cherry Creek at the detoxification station, located immediately below the waterfall. This will prevent a fish kill in the waters of lower Cherry Creek. Project personnel will be trained in the use of antimycin, rotenone and potassium permanganate and will be aware of the hazards of spilling either chemical directly into the stream. To prevent the possibility of large spills, no more antimycin, rotenone and potassium permanganate than needed for immediate use will be held near the stream.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 8c. Creation of a human health hazard.

Alternative 1: Proposed Action. There is a minor risk of a health hazard for project personnel associated with eye or skin contact with Fintrol, the commercial formulation of antimycin. Contact of fintrol with the eyes can cause intense pain and irritation immediately or within several hours following contact. Additionally, soft contact lenses will absorb antimycin fumes and hold them against the eye, causing extreme eye irritation (Bruce Rosenlund, U. S. Fish and Wildlife Service, personal communication).

There is a minor risk of a health hazard for project personnel associated with eye or skin contact, or drinking the commercial formulation of rotenone. Project personnel will be trained in safety procedures and will wear rubber gloves and safety goggles when mixing or handling fish toxicants.

Bioassays on mammals indicate that at the proposed concentrations, antimycin and rotenone will have no effect on mammals, including humans, that drink the treated water (Schnick 1974a; Schnick 1974b). However, the product label for the commercial form of antimycin, Fintrol recommends that treated water not be used for drinking. There will be no human health hazard to water users in lower Cherry Creek or the Madison River.

Mitigation: Project personnel will wear protective goggles and gloves when mixing or applying Fintrol. No soft contact lenses will be worn by project personnel. If any contact with eyes or skin occurs, area will be flushed immediately and repeatedly with water.

Alternative 2: No Action. There would be no impact under this alternative.

9. COMMUNITY IMPACT Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
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		YES	9d.
e. Increased traffic hazards or effects on existing transportation facilities or patterns of movement of people and goods?		X				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Community Impacts: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 9d.

Alternative 1: Proposed Action.

Any use of Cherry Lake and the public portions of Cherry Creek for fishing by commercial outfitters will be affected following eradication of current fish populations. The Gallatin National forest currently authorizes and permits one guiding service to provide fishing within the Cherry Creek area. The removal of the existing fish populations from Cherry Lake and Cherry Creek will preclude fishing opportunities in this area for about five years. However, this outfitter is authorized 350 service days for day use horseback riding and fishing over a large area of the Forest including: the Bridger/Bangtail Mountain Ranges; Spanish Peaks, Cherry Creek area; Gallatin Range north and west side from Bear Canyon south to the Yellowstone National Park boundary; South Madison Range and Slough Creek.

Actual use reports submitted to the Gallatin National Forest by the permittee for the specific activity of fishing within the Cherry Creek drainage from 1994 to 1996 are as follows: 1994 - 12 service days, 1995 - 12 service days, 1996 - no service days.

Mitigation: Outfitter use can resume when introduced westslope cutthroat trout populations have become established. Current Montana fishing regulations allow harvest of westslope cutthroat trout in lakes, and future harvest in Cherry Creek may be allowed by exemption to the MFWP's Statewide Fishing Regulations (Brad Shepard, Montana Fish Wildlife & Parks, personal communication). If westslope cutthroat trout are listed as a Threatened Species, the U. S. Fish and Wildlife Service will hold the authority to allow or not allow angling.

Alternative 2: No Action. There would be no impact under this alternative.

10. PUBLIC SERVICES/TAXES/UTILITIES Will the proposed action result in:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
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		NO	10a
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				

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Land Resources: No cumulative or secondary effects are anticipated.

Comment 10a. Effect on need for government service.

Alternative 1: Proposed Action. Following introduction of native fish species, MFWP along with Montana Cooperative Fisheries Research Unit personnel will periodically monitor the growth and status of the population. At some point in the future, this population may be used as a source of fish or eggs to start other westslope cutthroat trout or fluvial Arctic grayling populations.

Alternative 2: No Action. There would be no impact under this alternative.

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

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Aesthetics/Recreation: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 11a. Creation of aesthetically offensive effects.

Alternative 1: Proposed Action: The sight and sound of an outboard motor powered raft in a wilderness area will create what may be considered an aesthetically offensive sight to public users of the wilderness area.

Mitigation: The use of an outboard motor will only last one to two days each year for two or three years. Users of the Wilderness area will be notified of the project by posting signs at trailheads leading into the area. This will allow backcountry users to avoid the Cherry Lake area during treatment.

Alternative 2: No Action. There would be no impact under this alternative.

Comment 11c. Alteration of recreational opportunities.

Alternative 1: Proposed Action. Following eradication of current fish populations, there will be no fishing opportunity in Cherry Lake and the public portions of Cherry Creek for up to 5 years. However, Cherry Lake is among other high mountain lakes that exist within the northern portion of the Spanish Peaks Unit of the Lee Metcalf Wilderness Area. Big Brother, Jerome Rock, Marcheta, and Spanish Lakes are a few of these lakes that support strong populations of Yellowstone cutthroat trout and are available fishing sites for both the permitted guided and unguided public. Also, public fishing use may resume when introduced westslope cutthroat trout populations have become established. Current Montana fishing regulations allow harvest of westslope cutthroat trout in lakes, but streams are under a catch-and-release policy.

To avoid potential contact with concentrated antimycin, it may be necessary to close the immediate area of Cherry Lake to public use during antimycin treatments. The anticipated duration of the closure, if necessary, would be for one or two days per year for two or three years.

Mitigation: Current Montana fishing regulations allow harvest of westslope cutthroat trout in lakes, and future harvest in Cherry Creek may be allowed by exemption to the MFWP's Statewide Fishing Regulations (Brad Shepard, Montana Fish Wildlife & Parks, personal communication). If westslope

cutthroat trout are listed as a Threatened Species, the U. S. Fish and Wildlife Service will hold the authority to allow or not allow angling. Some users will consider the opportunity to catch native westslope cutthroat trout as an improvement in the quality of recreational opportunities.

Alternative 2: No Action. There would be no impact under this alternative.

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

Narrative Description and Evaluation of the Cumulative and Secondary Effects on Cultural/historical Resources: No cumulative or secondary effects beyond those described in comments are anticipated.

Comment 12a.

Alternative 1: Proposed Action. It may be necessary to construct barriers to upstream movement of fish on the Flying D ranch, as described in Comment 1a. Such construction will result in minor, localized disturbance of the soil. Therefore, a very minor risk of destruction or alteration of sites, structures or objects of prehistoric, historic or paleontological significance exists.

Mitigation: The State Historic Preservation Office of the Montana State Historical Society has conducted archaeological surveys on the Flying D Ranch. When the specific locations for any necessary fish barriers have been located, the State Historic Preservation Office will be contacted to assess the risk of destruction or alteration of sites, structures or objects of prehistoric, historic or paleontological significance, based on their surveys. If they have no archaeological information for the barrier locations, it may be necessary to have a survey done on site. Through communication with the State Historic Preservation Office, it is highly likely that any damage to cultural/historical resources can be completely avoided.

Alternative 2: No Action. There would be no impact under this alternative.

C. SIGNIFICANCE CRITERIA

13. SUMMARY EVALUATION OF SIGNIFICANCE Will the proposed action, considered as a whole:	IMPACT				Can Impact Be Mitigated	Comment Index
	Unknown	None	Minor	Potentially Significant		
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		YES	13a
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		NO	13e

Comment 13a. Overall cumulative impacts.

Alternative 1: Proposed Action. As discussed in the previous comments, all of the anticipated impacts of the proposed action to the physical and human environment are minor, with two exceptions. The two areas where potentially significant impacts are anticipated (see Comments 5b and 5d) are related to changes in the diversity and abundance of game animals (rainbow, brook and Yellowstone cutthroat trout, see Comment 5b) and introduction of new species (westslope cutthroat trout and possibly fluvial Arctic grayling and mottled sculpin, see comment 5d) into an area. However, these impacts are inherent to the overall goal of the proposed action. The proposed action considered as a whole, is not anticipated to result in impacts that are cumulatively considerable.

Alternative 2: No Action. There would be no impact under this alternative.

Mitigation: As discussed in Comment 5b, the introduction of westslope cutthroat trout and possibly fluvial Arctic grayling is mitigation for the removal of currently existing non-native fish populations. It is expected that these species will become as abundant as the current fish population.

Comment 13e. Controversy about nature of impacts.

A minor amount of controversy has been generated by the proposed action. During the scoping process, three public meetings were announced and held in Bozeman, Three Forks and Ennis. A total of six members of the public attended these three meetings. Fifteen letters were received from members of the public and interested organizations during the 45 scoping comment period. Eleven of these letters voiced opposition to the proposed action, while four were in support. At the three public meetings, in an informational narrative available at the FWP office in Bozeman, and in two letters written by MFWP personnel appearing in the Bozeman Chronicle, information was presented that described the nature of the project and its associated impacts. This information was intended to eliminate misconceptions about the nature of the impacts and thereby reduce the amount of controversy associated with the proposed action.

Evaluation and listing of mitigation, stipulation, or other control measures enforceable by the agency or another government agency: None applicable.

Statement of Potential for Cumulative Effects:

Other past, present, and reasonably foreseeable activities within the area were reviewed for potential cumulative effects in association with the proposed action. No such effects were identified.

PART III. EA CONCLUSION SECTION

1. Based on the significance criteria evaluated in this EA, is an EIS required? YES / NO If an EIS is not required, explain why the EA is the appropriate level of analysis for this proposed action:

An EIS is not required under Montana Environmental Policy Act (MEPA), because projects that lack significant effects to the physical and human environment are appropriately addressed through an Environmental Assessment. For the proposed action, all of the anticipated impacts of the proposed action to the physical and human environment are minor, with two exceptions. The two areas where potentially significant impacts are anticipated (Comments 5b and 5d) concern impacts that are integral to the goals of this project, and they are considered to be beneficial. These impacts are related to changes in the diversity and abundance of game animals (Comment 5b, rainbow, brook and Yellowstone cutthroat trout) and introduction of new species (Comment 5d; westslope cutthroat trout and possibly other native fishes) into an area.

2. Describe the level of public involvement for this project if any and, given the complexity and the seriousness of the environmental issues associated with the proposed action, is the level of public involvement appropriate under the circumstances?

Public involvement appropriate for this project included a 45 day open comment scoping period, and three open public scoping meetings (Bozeman, Ennis, Three Forks). Request for comments was announced on local radio stations and newspapers. In a letter to the editor of the Bozeman Chronicle written by Pat Clancey, a request for written public comments was also announced. In addition, comments were requested in the Gallatin National Forest National Environmental Policy Act Quarterly Review, 1st Quarter, 1998.

3. Duration of comment period if any:

Copies of the Environmental Assessment will be sent to all parties who commented during the scoping process and also will be available for public comment for a period of 30 days at:.

MFWP Region 3 Headquarters
1400 South 19th Ave.
Bozeman, MT 59718-5496

Comments should be sent to the address below, and must be received by 5:00 PM on 25 May 1998.

MFWP
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Appendix 1.

PRELIMINARY REPORT:

Aquatic Macroinvertebrate Survey
Cherry Creek Drainage, Madison County, MT
November, 1997

Prepared for:

Turner Ranches, Inc.

Bozeman, MT 59701

Prepared by:

Daniel L. McGuire
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Espanola, NM

January, 1998

INTRODUCTION

Westslope Cutthroat trout are native to southwest Montana. This species is of special concern to due reduced distributions and dwindling populations . Additional populations are needed to insure the survival of this species. To this end, the Montana Fish Wildlife & Parks (MFWP) and Turner Ranches propose to establish a population of westslope cutthroats in the Cherry Creek Drainage. Cherry Creek and its tributaries offer an unparalleled opportunity to establish a large population of westslope cutthroats in approximately 80 miles of stream. In order to establish a self-sustaining westslope cutthroat population, existing populations of introduced salmonids must be removed. The plan calls for several years of treatment with Antimycin A to eliminate brook, rainbow and Yellowstone cutthroat trout in portions of the drainage.

Aquatic macroinvertebrates in the Cherry Creek drainage basin were surveyed to provide baseline data for an Environmental Assessment of this project. Aquatic macroinvertebrate communities consist primarily of immature insects, including stoneflies (Plecoptera), caddisflies (Trichoptera), mayflies (Ephemeroptera), true flies (Diptera), beetles (Coleoptera) and others. The objectives of this survey are to (1) provide a species (taxon) list of macroinvertebrates in the Cherry Creek Drainage,(2) describe the composition, structure and functional attributes of existing macroinvertebrate communities, (3) develop a baseline for evaluating impacts of Antimycin treatments on macroinvertebrate populations and communities, and (4) provide a current assessment of biotic condition in the drainage.

STUDY AREA

Aquatic macroinvertebrates were collected at 11 sites within the drainage. Each of the major aquatic habitat types within the study area was surveyed. Cherry Creek was sampled a six locations ranging from the lower valley (RM 5.6) through canyons (RM 9.5) and foothills (RMs 10.7, 12.7 and 15.1) to a high gradient boulder-cascade reach in the mountains (RM 20.4). Collections were also made in four tributaries (Mill, East Fork Cherry, Carpenter and Cherry Lake creeks) and a large spring system in Cowboy Canyon (RM 10.9).

METHODS

Field work was conducted on November 7-9, 1997 by Dan McGuire (McGuire Consulting) and Pat Clancey (MFWP). Techniques used to collect, process, and analyze macroinvertebrate samples are described in the Montana Rapid Bioassessment Macroinvertebrate Protocols (RBP): sampling and sample analysis SOP's (Bukantis 1996).

Replicate traveling kick samples were obtained from two consecutive riffle habitats at each site. Samples were collected with a rectangular (18" wide by 9" tall), 900 micron mess net. The net was held along the stream bottom while the collector disturbed (kicked) the substrate on a diagonal path across the riffle. Sample duration (seconds) and sample lengths (ft) were recorded for each sample. Samples were preserved in ethyl alcohol.

Supplemental data collected at each site included visual estimates of substrate composition, aquatic vegetation coverage, and habitat condition. A Montana RBP habitat assessment field sheet (Bukantis 1996) incorporating visual ratings of nine habitat parameters was completed at each site (Appendix to this report not included in this Environmental Assessment but is available from MFWP).

In the laboratory, RBP III sorting methodology (Plafkin et al. 1989) was employed to obtain an ~300-organism subsample from each kick-net collection. Macroinvertebrates were identified to the lowest

taxonomic level practical, usually genus or species. Based on the ~300-organism subsample, a suite of metrics were calculated to characterize the macroinvertebrate community. The metrics quantify various aspects of community structure, functional composition or taxonomic composition. Tolerance values and functional designations used in metric calculations were those compiled by Bukantis (1996).

The remainder of the sample was examined for rare taxa by an experienced entomologist. Taxa present in the sample but not found in the subsample were included in the species list for each site.

RESULTS

The raw data, descriptive statistics and values of metrics used to characterize macroinvertebrate communities are presented in Appendix 1A.

The Cherry Creek drainage supported a diverse macroinvertebrate fauna that was typical of healthy southwest Montana streams. Approximately 22,000 organisms, representing 114 taxa (Table 1), were collected during this investigation. The relatively high number of taxa found in the samples reflected the diverse range of habitats in the drainage. Individual sites yielded from32 to 51 taxa (spring at RM 10.9 and Cherry Creek RM 12.7, respectively).

A total of 101 insect taxa were identified in the samples. Dipterans were the most diverse group with 35 taxa including 19 genera of midges. Caddisflies were the next most diverse order with 25 taxa. Stoneflies, mayflies and beetles were also well represented (16, 15 and 9 taxa, respectively). A single species of water boatmen was collected. Other taxa collected included four families of worms (Oligochaetes), two species of scud (Amphipoda), two species of snail and single species of fingernail clam, flatworm, mite, horsehair worm (Nematomorpha) and leech.

Mayflies, stoneflies and caddisflies were the predominate macroinvertebrates in the Cherry Creek drainage. These three groups comprised 77% of the organisms collected (30, 24, and 23% , respectively). All three groups were abundant at most sites, however; relative dominance varied among sites (Figure1). Stoneflies were numerically dominant in the spring at River Mile 10.9 and the upstream station on Cherry Creek (RM 20.4). Caddisflies were the most abundant macroinvertebrates in the East Fork of Cherry Creek and the downstream Cherry Creek site (RM5.6) while mayflies were the most numerous organisms at seven sites in the drainage. Beetles accounted for nine percent of organisms collected and attained their highest relative abundance in the spring at River Mile 10.9. Flatworms were also fairly abundant at this site. Dipterans, although taxonomically diverse, accounted for only eight percent of the organisms collected. Although scuds were the most abundant species in lower Mill Creek, non-insects were minor components of the benthic fauna at most sites. All non-insect taxa combined representing about six percent of the macroinvertebrates collected.

Due to the variety of habitats sampled, only three taxa were collected at all 11 sites. The stonefly, *Zapada cinctipes*, the mayfly, *Cinygmula* spp., and the riffle beetle, *Heterlimnius corpulentus*, were found throughout the study area. These taxa were among the most abundant organisms in the November samples; however, 24 other taxa with more restricted distributions were abundant at one or more sites (Table 2).

A suite of 10 metrics was used characterize the fauna at each site (Table 3). Various attributes of community composition, structure, and function were calculated based on paired ~300 organism subsamples. These data can be used to quantify macroinvertebrate community responses to Antimycin treatments. They can also be compared to criteria developed for mountain and foothills streams by the Montana Department of Environmental Quality (Bukantis 1996) to evaluate existing biological integrity as well as water and habitat quality.

During November 1997, metric values for all six reaches of Cherry Creek, as well as sites on lower Cherry Lake Creek and Carpenter Creek, indicated a healthy community and nonimpaired biological integrity. Reduced biological integrity of the benthic community, likely due to fine sediment deposition and substrate embeddedness was evident in Mill Creek, East Fork Cherry Creek. The East Fork Cherry Creek also apparently suffered from higher than optimal summer temperatures, while benthic community diversity was reduced in the Spring system in Cowboy Canyon, probably due to its relatively constant temperature.

DISCUSSION

Macroinvertebrates are important components of stream ecosystems, and are the energy links between primary producers (algae), organic inputs to the stream and fish. They are also good indicators of water and habitat quality due to their limited mobility, predictable associations with specific habitats, and differential tolerances to pollution.

While antimycin is extremely toxic to fish it is generally less so to macroinvertebrates (Walker et al. 1964). Most macroinvertebrates are not affected at the concentrations used to eradicate salmonids (Houf and Campbell 1997). However, some macroinvertebrate taxa are killed or adversely affected at higher concentrations (Jacobi and Degan 1977; Walker et al. 1964; Lesser 1972). Jacobi and Degan (1977) reported temporary reductions in populations of some macroinvertebrates due to mortality and increased drift following the application of high antimycin concentrations (17-44 ug/l) in a Wisconsin trout stream. Populations of the affected taxa had recovered to pretreatment levels by the next summer.

There are hundreds of macroinvertebrate species in the Cherry Creek drainage. Given that macroinvertebrates typically exhibit wide ranges of tolerances to toxicants, it is likely that some species will be adversely affected by antimycin treatments. However, most macroinvertebrate populations typically recover quickly from toxic pulses (Sibley et al. 1991 and Wallace et al. 1991). Recoveries from episodic events are facilitated by numerous life history strategies and mechanisms (Reice et al. 1990). This include short life cycles, high fecundity, population refugia (eggs, diapausing larvae, and terrestrial adults), and multiple dispersion mechanisms (aerial adults and drift). A few macroinvertebrate taxa that are particularly sensitive to antimycin and have poor recuperative powers (i.e. scuds) may suffer long-term impacts from the treatment. However the macroinvertebrate community as a whole is quite resilient and should not be negatively affected. A greater change in community composition may result from the temporary removal of predaceous fishes than from the antimycin treatments.

CONCLUSIONS

1. The aquatic macroinvertebrate communities in the Cherry Creek drainage are diverse and generally healthy. The November samples contained 114 taxa of aquatic macroinvertebrates. This is not an exhaustive list. Additional taxa would undoubtedly be found with additional sampling.

2. All the macroinvertebrates found in the Cherry Creek drainage basin are widely distributed in southwestern Montana.

3. Antimycin treatments are not expected to have any long-term impacts on macroinvertebrate communities. Minor changes in community composition should not affect the functional dynamics or biological integrity.

4. Populations of a few sensitive species may experience short-term reductions attributable to mortality and/or increased drift. Most of these populations should recover within one year.

RECOMMENDATION

1. Additional macroinvertebrate sampling should be conducted. Before-and-after surveys during the initial antimycin treatments would document impacts (or lack of) to the macroinvertebrate community.

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APPENDIX 1A

Macroinvertebrate Data
11 sites in the Cherry Creek Drainage Basin
Madison County, MT
November, 1997

Table 1. Checklist of aquatic macroinvertebrates collected in the Cherry Creek drainage during November, 1997.

INSECTA		INSECTA	
COLEOPTERA		EPHEMEROPTERA	
Dytiscidae	*Agabus sp.*	Baetidae	*Baetis bicaudatus*
	Oreodytes sp.		*Baetis tricaudatus*
Hydrophilidae		Ephemerellidae	*Caudatella hystrix*
Elmidae	*Cleptelmis ornata*		*Drunella doddsi*
	Heterlimnius corpulentus		*Drunella grandis*
	Lara avara		*Drunella spinifera*
	Narpus concolor		*Ephemerella aurivillii*
	Optioservus sp.		*Ephemerella inermis*
	Zaitzevia sp.		*Ephemerella infrequens*
TRICHOPTERA		Heptageniidae	*Cinygmula spp.*
Brachycentridae	*Brachycentrus americanus*		*Epeorus grandis*
	Brachycentrus occidentalis		*Epeorus longimanus*
	Micrasema bactro		*Rhithrogena spp.*
Glossosomatidae	*Anagapetus sp.*	Leptophlebiidae	*Paraleptophlebia sp.*
	Glossosoma sp.	Siphlonuridae	*Ameletus sp.*
Helicopsychidae	*Helicopsyche sp.*	PLECOPTERA	
Hydropsychidae	*Arctopsyche grandis*	Capniidae	
	Ceratopsyche oslari	Leuctridae	
	Ceratopsyche slossonae	Nemouridae	*Visoka cataractae*
	Cheumatopsyche sp.		*Zapada cinctipes*
	Parapsyche elsis		*Zapada columbiana gp.*
Hydroptilidae	*Hydroptila sp.*		*Zapada oregenensis gp.*
Lepidostomatidae	*Lepidostoma sp.*	Pteronarcidae	*Pteronarcella badia*
Leptoceridae	*Oecetis sp.*	Taeniopterygidae	*Taenionema sp.*
Limnephilidae	*Apatania sp.*	Chloroperlidae	*Kathroperla sp.*
	Ecclisomyia sp.		*Sweltsa sp.*
	Hesperophylax sp.	Perlidae	*Hesperoperla pacifica*
Uenoidae	*Oligophlebodes sp.*		*Doroneuria sp.*
	Neothremma sp.	Perlodidae	*Isoperla fulva*
Philopotamidae	*Dolophilodes sp.*		*Isoperla sp.*
Rhyacophilidae	*Rhyacophila betteni gp.*		*Megarcys sp.*
	Rhyacophila brunnea gp.		*Skwala americana*
	Rhyacophila coloradensis gp.	HEMIPTERA	
	Rhyacophila hyalinata gp.	Corixidae	*Sigara sp.*
	Rhyacophila sibirica gp.		

Table 1. Checklist of aquatic macroinvertebrates collected in the Cherry Creek drainage during November, 1997.

INSECTA		ANNELIDA	
DIPTERA		Enchytraeidae	
Chironomidae	*Brillia sp.*	Lumbricidae	
	Cardiocladius sp.	Naididae	
	Cricotopus nostocladius	Tubificidae	(w/o capilliform chaetae)
	Cricotopus sp.	Hirudinea	
	Diamesa sp.	Glossiphoniidae	*Helobdella stagnalis*
	Eukiefferiella spp.	CRUSTACEA	
	Hydrobaenus sp.	Amphipoda	
	Micropsectra sp.	Gammaridae	*Gammarus sp.*
	Nanocladius sp.	Talitridae	*Hyallela azteca*
	Orthocladius sp.	MOLLUSCA	
	Pagastia sp.	Aycylidae	*Ferrissia sp.*
	Parametriocnemus sp.	Physidae	*Physella sp.*
	Paraphaenocladius sp.	Sphaeriidae	*Sphaerium sp.*
	Potthastia sp.	TURBELLARIA	
	Rheotanytarsus sp.	NEMATAMORPHA	
	Symposiocladius sp.	HYDRACARINA	
	Tanytarsus sp.		
	Thienemannimyia gp.		
	Tvetenia sp.		
Tipulidae	*Antocha sp.*		
	Dicranota sp.		
	Hesperoconopa sp.		
	Hexatoma sp.		
	Limnophila sp.		
	Ormosia sp.		
	Tipula sp.		
Athericidae	*Atherix sp.*		
Muscidae	*Limnophora sp.*		
Empididae	*Chelifera sp.*		
	Clinocera sp.		
Psychodidae	*Pericoma sp.*		
Ptychopteridae	*Ptychoptera sp.*		
Ceratopogonidae	Ceratopogoninae		
Simuliidae	*Simulium spp.*		
	Prosimulium sp.		

Table 2. Distributions and relative abundances of aquatic macroinvertebrates comprising at least five percent of the organisms collected at one or more sites in the Cherry Creek drainage during November, 1997.

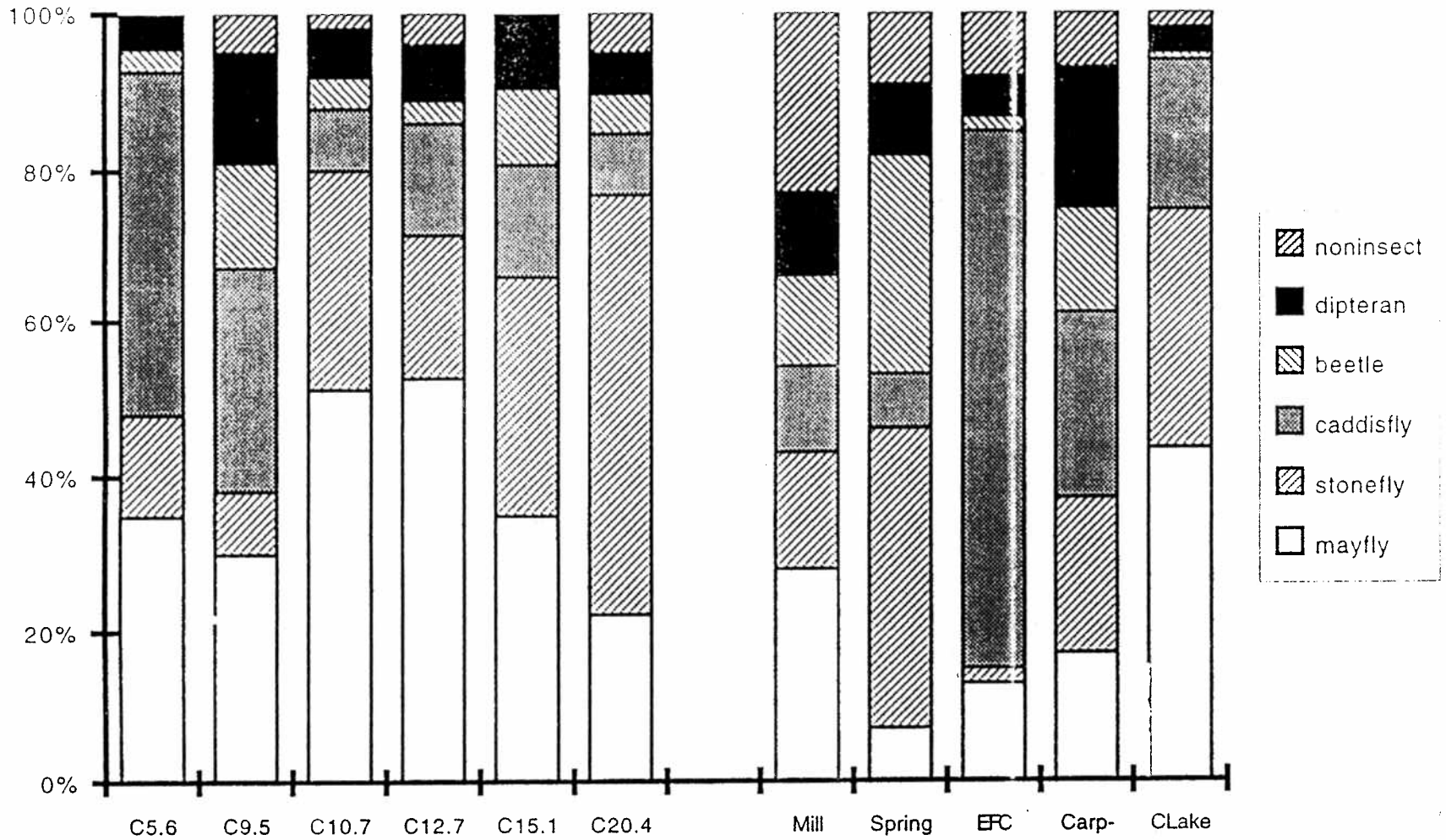
		Stream:	Cherry Creek						Mill	Spring	E Fork	Carpent	Cherry
		Site:	5.6	9.5	10.7	12.7	15.1	20.4	Creek	10.9	Cherry	Creek	Lake Cr.
COLEOPTERA													
Elmidae	*Heterlimnius corpulentus*												
	Optioservus sp.												
EPHEMEROPTERA													
Baetidae	*Baetis tricaudatus*												
Ephemerellidae	*Drunella grandis*												
	Ephemerella inermis												
Heptageniidae	*Cinygmula spp.*												
	Epeorus grandis												
	Rhithrogena spp.												
Leptophlebiidae	*Paraleptophlebia sp.*												
PLECOPTERA													
Nemouridae	*Zapada cinctipes*												
	Zapada oregenensis gp.												
Taeniopterygidae	*Taenionema sp.*												
Chloroperlidae	*Sweltsa sp.*												
Perlodidae	*Isoperla fulva*												
	Skwala americana												
TRICHOPTERA													
Brachycentridae	*Brachycentrus occidentalis*												
Glossosomatidae	*Glossosoma sp.*												
Hydropsychidae	*Arctopsyche grandis*												
	Ceratopsyche oslari												
	Cheumatopsyche sp.												
	Parapsyche elsis												
Lepidostomatidae	*Lepidostoma sp.*												
Limnephilidae	*Hesperophylax sp.*												
Uenoidae	*Oligophlebodes sp.*												
Rhyacophilidae	*Rhyacophila brunnea gp.*												
AMPHIPODA													
Gammaridae	*Gammarus sp.*												
TURBELLARIA													

Relative abundance: <1%= 1-5%= 5-10%= 10-20%= >20%=

Table 3. Mean metric values characterization aquatic macroinvertebrate communities at 11 locations in the Cherry Creek drai November, 1997 (two ~300 organism kick samples at each site).

Stream:	Cherry Creek						Mill	Spring	E. Fork	Carp-	Cherry
River Mile:	5.6	9.5	10.7	12.7	15.1	20.4	Creek	10.9	Cherry Creek	enter Creek	Lake Creek
Metric											
Taxa richness	28	32	36	38	40	38	27	23	26	39	36
EPT richness	19	20	23	27	28	24	12	10	14	22	26
% EPT	93%	68%	88%	87%	81%	85%	55%	53%	85%	61%	94%
Biotic index	2.1	2.0	1.8	1.5	1.8	1.9	3.2	3.4	4.4	2.9	1.0
Shannon diversity	3.6	4.2	3.9	4.1	4.4	3.6	3.7	3.0	3.3	4.6	3.9
% dominant taxon	27%	14%	20%	27%	13%	32%	27%	43%	40%	10%	25%
% collectors (gatherer + filterer)	37%	51%	31%	31%	33%	18%	43%	44%	78%	54%	15%
% scraper + shredder	49%	41%	61%	51%	52%	69%	49%	39%	15%	25%	68%
% Baetidae of Ephemeroptera	6%	6%	14%	1%	8%	2%	4%	92%	9%	0%	4%
% Hydropsychinae of Trichoptera	16%	1%	0%	16%	0%	0%	97%	3%	73%	22%	0%

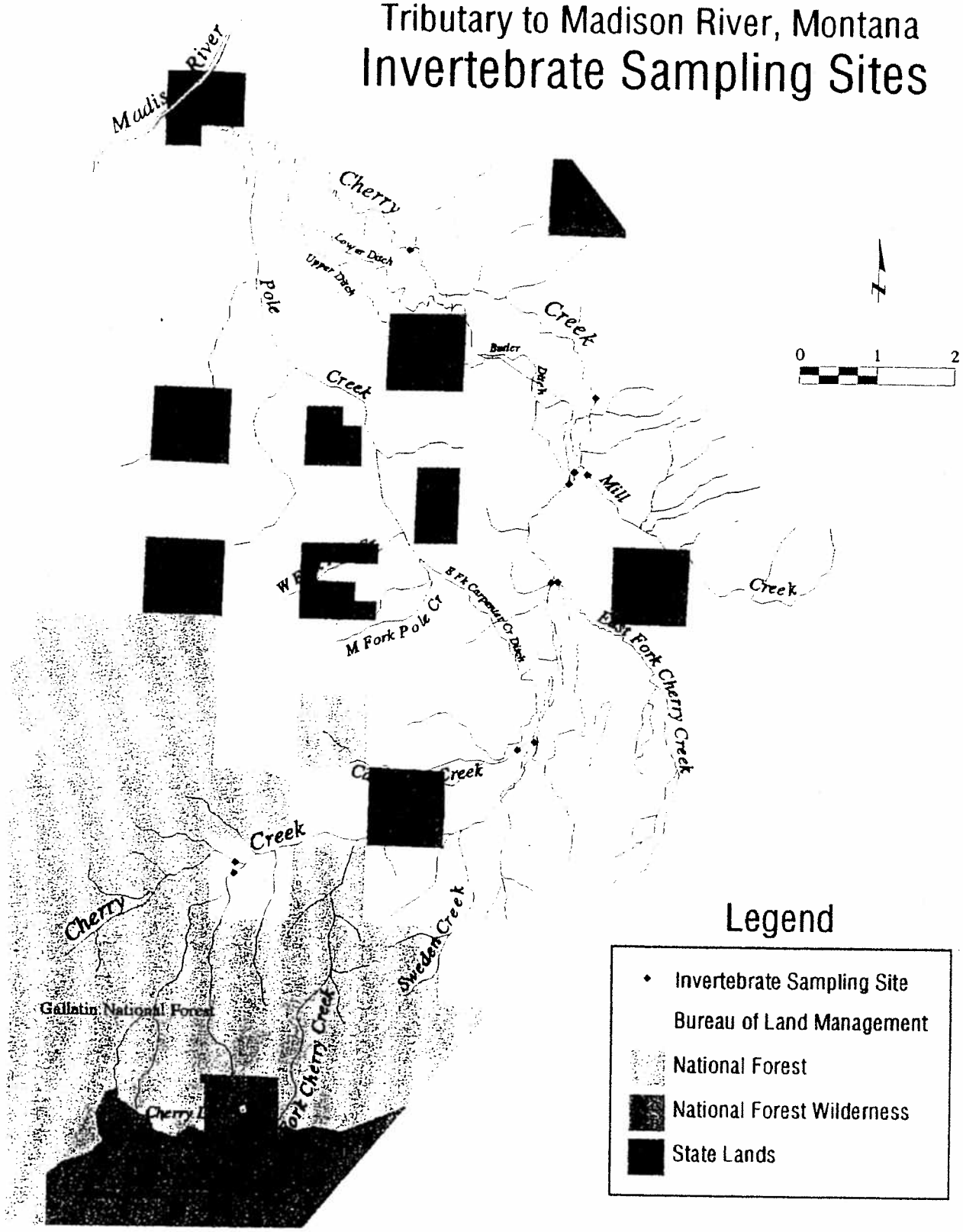
Figure 1. Relative abundance (%) of magor macroinvertebrate groups at 11 sites in the Cherry Creek Drainage - November, 1997.



Cherry Creek

Tributary to Madison River, Montana

Invertebrate Sampling Sites



Map produced by:
Jeffrey Hutten
Montana Fish, Wildlife & Parks
Information Services Unit
490 N. Meridian Rd.
Kalispell, MT 59901
406-751-4571

Invertebrate sampling site data obtained by Global Positioning System (GPS) and differentially corrected. Hydrography from StreamNet and digitized at 1:100,000. Public landownership data from the Natural Resource Information System (NRIS) at the Montana State Library.

/fwp/spot/jeff/cmhydro/insites.cmp
February 20, 1998

STREAMNET

INFORMATION

Montana Fish, Wildlife & Parks

Appendix 2

Antimycin and Rotenone Labels

FINTROL®

Fish toxicant

For partial or complete eradication of undesirable freshwater fish

IMPORTANT: USE PROTECTIVE GOGGLES AND PROTECTIVE GLOVES AT ALL TIMES WHEN MIXING, HANDLING, OR APPLYING FINTROL. Any contact of FINTROL with the eyes can cause *intense pain and irritation* immediately or within several hours following contact. Avoid contact of FINTROL with skin. If any contact occurs with eyes or skin, flush repeatedly with water immediately. Consult physician if discomfort occurs.

FINTROL-CONCENTRATE contains acetone. If swallowed, give 2 to 4 glasses of water to dilute acetone, induce vomiting, and consult physician. FINTROL-CONCENTRATE is flammable: keep away from heat and flame.

FINTROL-CONCENTRATE is designed for use in running waters, streams, and shallow waters. This liquid form of FINTROL may be applied to lakes and ponds by boat bailer method or spray equipment. Spray methods are useful at depths to 1 foot. Boat bailer and drip tubes, applied at the propeller wash, are used at other depths. Application from an airplane is *not* recommended.

Each can of FINTROL-CONCENTRATE [containing 240 cc. FINTROL-CONCENTRATE (solution 20%) and 240 cc. Diluent] will, after mixing, treat approximately 38 acre-feet of water at 1 p.p.b.

AQUABIOTICS CORP.
P.O. Box 10576
10750 Arrow Pt. DR NE
Bainbridge Island, WA 98110
EPA Reg. No. 39096-2

Licensed by:
Wisconsin Alumni Research Foundation

Trademark licensed by
Ayerst Laboratories, Inc.

Before applying FINTROL to either public or private waters, write to the Director of the State Fish and Game Department or Conservation Department for State and Federal regulations governing the use of fish toxicants in your area.

DESCRIPTION

The active ingredient of FINTROL is antimycin A. When absorbed through the gills of fish, antimycin A kills by interfering with the respiration of body cells. Antimycin A does not repel fish. This is an important advantage, particularly when running waters, bog lakes, and the epilimnion, or upper layer, of large lakes are treated. Fish make no attempt to escape contact with the toxicant by seeking to move into waters that are clear of it. FINTROL'S action is rapid and irreversible.

Sensitivity to FINTROL varies widely among fish species. Hence it may be employed to selectively destroy certain species, without affecting other species concurrently inhabiting the same body of water.

Sensitive
Gizzard, shad, trouts, pikes, carp, minnows, suckers, brook stickleback, white bass, sunfishes, perches, freshwater drum, sculpins.

Least Sensitive
Shortnose gar, bowfin, goldfish, catfish.

FINTROL also may be used to selectively destroy certain age groups of species; younger fish are more sensitive to FINTROL.

Providing the concentration is correctly estimated, FINTROL can be used effectively at any time of year in either cold, warm, soft, hard, acid, alkaline, clear or turbid (muddy) waters. (See TABLE 1 and instruction for bioassay.)

FINTROL does not impart detectable taste or odor to treated waters. In the usual, recommended concentrations it causes no apparent harm to aquatic plants, insects, or bottom fauna. Since FINTROL'S active ingredient degrades rapidly, the reclaimed waters may be restocked soon after treatment. **(See HOW TO DETERMINE WHEN TREATED WATER MAY BE RESTOCKED.)** There is very little interruption in availability of the waters for recreational, agricultural, industrial, or other purpose.

USES

FINTROL is used to cull undesirable species of fish from freshwater lakes, ponds, and streams. It can be used to eliminate all fish from a body of water (complete kill). Or, it can be used to remove only certain fish species or size groups from mixed populations (selective kill).

A **complete kill** may be achieved with a concentration of anywhere from 5 to 25 p.p.b. of active ingredient. **(See HOW TO DETERMINE THE MOST EFFECTIVE CONCENTRATION.)** FINTROL is particularly advantageous for complete kills because it detoxifies so rapidly the pond can usually be restocked in about a week, or as soon as caged fish survive 48 hours' exposure to the treated waters.

Under optimal circumstances, in ponds managed for sports fishing, **selective kills** may be achieved at concentrations as low as 0.5 to 1.0 p.p.b. However, because these concentrations are extremely low, there is no rule of thumb that can be relied upon to determine them accurately. A BIOASSAY IS ALWAYS REQUIRED TO PINPOINT THE OPTIMAL CONCENTRATION FOR SELECTIVE KILLS. (Literature describing this procedure is available upon request.)

A **selective kill** has these advantages: It can be made without interrupting sport fishing for more than a week or so, and fishing may be gradually improved without restocking. In the past, when bluegill, minnows, or green sunfish dominated a pond managed for bass, the usual solution to the problem was the total removal of all the fish with a fish toxicant. This meant restocking and little or no fishing for one or two years. Now — with FINTROL — this is no longer necessary. Low concentrations of FINTROL will affect small bluegill, green sunfish, and minnows primarily. Only a few of the very small bass will succumb. The bulk of the adult bluegill and green sunfish will not be affected. Thus FINTROL helps to bring about a balanced relationship between the bass and bluegill populations. This improves fishing without interrupting it for any appreciable length of time.

In **catfish farming** FINTROL can be used to *selectively eliminate* the trash fish (scale fish) that commonly reduce the yields and increase the costs of the commercial catfish farmer. It is possible to do this with FINTROL because concentrations that will eliminate scale fish generally will not harm adult catfish. The scale fish most often encountered by the catfish farmer will succumb to anywhere from 5 to 10 p.p.b. of active ingredient (See TABLE 1) whereas, under ordinary circumstances, it takes in excess of 20 p.p.b. to kill catfish. [Caution should be exercised during "stress conditions" of unusually high water temperature and reduced oxygen content when the sensitivity of fishes to chemicals may increase.]

HOW TO SELECT THE APPROPRIATE FORMULATION

The nature of the water to be treated (its depth and rate of flow) and the character of the surrounding land are factors to be taken into consideration when determining the formulation of FINTROL to employ in a given situation.

HOW TO DETERMINE THE MOST EFFECTIVE CONCENTRATION

For complete kills and also,
for removal of scale fish from catfish ponds.
The concentration of antimycin A required to kill one or more species of fish in any given body of water depends upon: 1) the sensitivity of the species to be eradicated, and 2) the chemical and physical properties of the water at the time of application of the toxicant; the pH and the temperature of the water being the most important of these chemical and physical factors under ordinary circumstances. Therefore, to determine what concentration of antimycin A will be required to kill the undesirable fish in your pond or lake:

1) identify the species to be eradicated,
2) determine the pH and average water temperature by measuring at various sites and depths,
3) refer to TABLE 1 for approximate concentrations,
4) conduct a bioassay to pinpoint the optimal concentration.

TABLE 1 provides a rough estimate of the concentrations required for a **complete kill** under various environmental conditions. However, since water chemistry is subject to sudden alteration by many variable, and often unpredictable factors (pollution, heavy bloom, weather, drawdown, etc.) it should be realized that such changes may affect the performance of the toxicant. For this reason, measurements of pH and water temperature should always be taken as close to the time of treatment as is feasible.

METHODS OF APPLICATION

IMPORTANT: DURING APPLICATION OF FINTROL, ALL PERSONS IN THE IMMEDIATE VICINITY SHOULD WEAR PROTECTIVE GOGGLES AND PROTECTIVE GLOVES.

Liquid formulation: Directions for mixing: Add the Diluent [blue label] to the FINTROL-CONCENTRATE (solution 20%) [green label] in the oversize mixing container. Cap tightly and invert 2 to 3 times to mix thoroughly. Further dilute with AT LEAST five (5) gallons of water to insure that the acetone contained in FINTROL-CONCENTRATE will not affect rubber parts on any equipment that might be used to apply it. After water has been added, apply within eight (8) hours. [Note: The solution obtained by mixing the Diluent with FINTROL-CONCENTRATE (solution 20%) retains potency for up to seven (7) days. But once water has been added to this solution, it must be used within eight (8) hours to ensure potency.]

After appropriate dilution with water, the liquid formulation of FINTROL can be applied to lakes and ponds by the boat bailer method or spray equipment. Spray methods are useful at depths to one foot. Boat bailer and drip tubes when applied at the propeller wash are useful at greater depths. Pinpoint applications to shoal areas and small, isolated ponds can readily be made with back-pack sprayers. (See CAUTION on use of PROTECTIVE GOGGLES AND PROTECTIVE GLOVES.)

In streams, FINTROL-CONCENTRATE is most often applied through drip stations established to meter the toxicant at a precalculated rate. Information on the use of such equipment may be obtained from state and/or federal agencies, experienced in stream treatment.

It is recommended that all applications of FINTROL be made at daybreak or as soon as there is enough light to work by.

PRECAUTIONS

USE PROTECTIVE GOGGLES AND PROTECTIVE GLOVES at all times when mixing, handling, or applying FINTROL. Any contact of FINTROL with the eyes can cause *intense pain and irriation* immediately or within several hours following contact. Avoid contact of FINTROL with skin. If any contact occurs with eyes or skin, flush repeatedly with water immediately. Consult physician if discomfort occurs. FINTROL-CONCENTRATE contains acetone. If swallowed, give 2 to 4 glasses of water to dilute acetone, induce vomiting, and consult physician. Should inhalation of the vapors of FINTROL-CONCENTRATE cause nausea, fresh air will dispel it.

FINTROL may be fatal or harmful if swallowed.

Keep FINTROL out of reach of children, pets, livestock, and wildlife. Thoroughly rinse all containers prior to disposal. Pending the conclusion of studies now in progress, fish killed with antimycin A should not be consumed by man or animals. Treated waters must not be used for drinking by man or animals, or for crop irrigation, until fingerling rainbow trout or fingerling bluegills survive 48 hours' exposure in livecars in the treated waters.

Leftover portions of diluted liquid formulation retain potency for up to seven (7) days. But once water has been added to FINTROL-CONCENTRATE, it must be used within eight (8) hours to ensure potency.

Due to its acetone component, FINTROL-CONCENTRATE is flammable: keep away from heat and flame.

HOW TO DETERMINE WHEN TREATED WATER MAY BE RESTOCKED

Since antimycin A degrades rapidly following application, waters can usually be restocked about one week following treatment with FINTROL. Place livecars containing a sensitive species of fish in the treated water. It is recommended that these fish be fingerling rainbow trout or fingerling bluegills if the water temperature is between 35° and 68°F. When the water temperature exceeds 68°F, only fingerling bluegills should be used. If the fish survive for 48 hours, the water may be restocked.

HOW TO DETOXIFY FINTROL WITH POTASSIUM PERMANGANATE ($KMnO_4$)

If it should be necessary to detoxify FINTROL in the outflow of a pond to prevent killing fish downstream, apply potassium permanganate ($KMnO_4$) at 1 part per million (1 p.p.m.) to the outflow. Drip systems of hose-and-clamp or carburetor types can be employed to continuously dispense a solution of potassium permanganate into the water at the discharge outlet.

To evaluate the effectiveness of the detoxification process, place livecars containing fingerling rainbow trout or fingerling bluegills approximately 100 yards downstream from the site of $KMnO_4$ introduction. The water is considered detoxified if the fish survive for at least 48 hours in the livecar.

To detoxify FINTROL-treated streams, apply $KMnO_4$ at 1 p.p.m. at detoxifcation stations. Continue the application of $KMnO_4$ until all FINTROL-treated water has passed the station. The water may be considered detoxified when fingerling rainbow trout or fingerling bluegills survive for at least 48 hours in livecars placed 100 yards downstream from the site of potassium permanganate ($KMnO_4$) introduction.

Special Instructions: Prior to the use of a fish toxicant in either public or private waters, the Director of the State Fish and Game Department or Conservation Department must be contacted to determine whether a permit is required. Such products must be used by or under the technical supervision of personnel of state and federal fish and game agencies, trained in fisheries management, who will provide any special instructions applicable to the particular geographical area.

TABLE I — FOR ROUGH ESTIMATION OF CONCENTRATIONS* OF FINTROL (ANTIMYCIN A) NEEDED FOR COMPLETE† ERADICATION OF DIFFERENT FISH SPECIES, UNDER VARIOUS COMBINATION OF WATER TEMPERATURE AND WATER pH

TARGET SPECIES**	SENSITIVITY OF TARGET SPECIES TO FINTROL (in p.p.b. of active ingredient)	EFFECTIVE CONCENTRATION OF FINTROL* (in p.p.b. of active ingredient)			
		When pH is 8.5 or less		When pH is 8.5 or more	
		water temperature above 60°F.	water temperature below 60°F.	water temperature above 60°F.	water temperature below 60°F.
col. 1	col. 2	col. 3	col. 4	col. 5	col. 6
gizzard shad, trouts, pikes, carp, minnows, suckers, brook stickleback, white bass, sunfishes, perches, freshwater drum, sculpins	5-10	5	7.5	7.5	10
shortnose gar, bowfin, goldfish, catfish	15-25	15	20	20	25

* The concentration level suggested by this table should be confirmed by an on-site bioassay.
† This table is applicable only when a *complete* kill is desired. Do not use it for a selective kill. (See the following section.)

**Fish nomenclature according to American Fisheries Society.

Note (columns 1 and 2) that the sensitivity of the target species determines the concentration range. To eradicate sensitive species, it is recommended that the appropriate formulation of FINTROL be applied so that the body of water will have a concentration of from 5 to 10 p.p.b. of antimycin A, depending upon variation in pH and water temperature. For more tolerant species, higher concentrations are recommended. Laboratory studies indicate that less sensitive fish will succumb at concentrations of from 15 to 25 p.p.b. of antimycin A, depending upon variations in pH and water temperature. Columns 3 to 6 show how to adjust for pH and water temperature. Note that, in general, the lower the pH, the less FINTROL required. The higher the water temperature, the less FINTROL required. The ideal situation for a complete kill would combine: a highly sensitive species, low pH and high water temperature.

For selective kills in ponds managed for sports fishing

*The only way to determine the concentration of FINTROL needed for a selective kill is to perform a bioassay. This involves subjecting both the target and nontarget fish to several concentrations of FINTROL to determine the minimum lethal dose. (A description of the bioassay procedure is available upon request.)

HOW TO CALCULATE THE AMOUNT OF FINTROL TO BE ADDED TO A BODY OF WATER TO OBTAIN A GIVEN CONCENTRATION

To calculate the amount of FINTROL to be added to a body of water for eradication of undesired species, the following steps should be taken:

Determine the volume of water to be treated in acre-feet. This can be arrived at by multiplying the surface area in acres by the average depth in feet.

Determine the concentration to be used.

Multiply the number of acre-feet to be treated by the value given opposite the desired concentration in the table for the formulation to be used. (See Tables.)

TABLE FOR RAPID ESTIMATION OF FINTROL-CONCENTRATE REQUIREMENTS

Desired Concentration (p.p.b. active ingredient)	Amount of FINTROL-CONCENTRATE per acre-foot†	
	cc*	oz. (approx.)
1 p.p.b.	12.3	½
2 p.p.b.	24.6	¾
3 p.p.b.	36.9	1¼
4 p.p.b.	49.2	1½
5 p.p.b.	61.5	2
6 p.p.b.	73.8	2½
7 p.p.b.	86.1	2¾
8 p.p.b.	98.4	3¼
9 p.p.b.	110.7	3¾
10 p.p.b.	123.0	4

*Obtained by multiplying 12.3 cc. by the p.p.b.

Note: 1 measuring teaspoon = 5 cc.; 1 measuring tablespoon = 15 cc; ¼ standard measuring cup = 60 cc.; ½ standard measuring cup = 120 cc.; 1 standard measuring cup = 240 cc.

Sample calculation:
To treat 75 acre-feet at 3 p.p.b., use:
36.9 cc. x 75 = 2,767 cc. of FINTROL-CONCENTRATE
or
1¼ fl. oz. x 75 = 93¾ fl. oz. of FINTROL-CONCENTRATE.

Robert G. Brumblay

Liquid Emulsifiable
RESTRICTED USE PESTICIDE
Due to Aquatic Toxicity

96 veg

ACTIVE INGREDIENTS:	
*Rotenone	5.0% w/w
Other Associated Resins	10.0%
INERT INGREDIENTS†:	85.0%
	100.0 %w/w

*Roussel Bio's Noxfish ® brand of rotenone fish toxicant.
Roussel Bio Corp., 400 Sylvan Avenue, Englewood Cliffs, N.J. 07632
† Contains aromatic hydrocarbons.

KEEP OUT OF REACH OF CHILDREN
WARNING

SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS

DIRECTIONS FOR USE
GENERAL INFORMATION

Noxfish is a specially formulated product containing rotenone, to be used in fisheries management for the eradication of fish from lakes, streams and reservoirs. Noxfish will not solidify nor show any separation at temperatures down to 40°F, and is stable for a minimum of one year when stored in sealed drums at 70°F.
RE-ENTRY STATEMENT: Do not swim in rotenone - treated water until the application has been completed and all pesticide has been thoroughly mixed into the water according to label instructions.

DIRECTIONS

Apply this product only as specified on this label. Noxfish is registered for use by or under permit from, and after consultation with State and Federal Fish and Wildlife Agencies. Do not use dead fish as food or feed. Do not use water treated with rotenone to irrigate crops or release within 1 mile upstream of a potable water or irrigation water intake in a standing body of water such as a lake, pond or reservoir.

FOR USE IN PONDS, LAKES AND RESERVOIRS

Special Instructions: Water alkalinity, temperature, and turbidity are usually different in each type water. Because these factors change the effectiveness of piscicides, consult your State Game and Fish representative before use to determine the correct concentration of this product needed for the type kill desired. Noxfish disperses readily in water both laterally and vertically, and will penetrate below the thermocline in thermally stratified bodies of water.
Computation of Acre-Feet: an ACRE-FOOT is a unit of volume of a body of water having the area of one acre and a depth of one foot. To determine acre feet in a given body of water, make a series of transects across the water body taking depths with a measured pole or weighted line. Add the soundings and divide by the number made to determine the average depth. Multiply this average depth by the total surface acres to find the acre-feet to be treated. If number of surface acres is unknown, contact your local Soil Conservation Service, which can determine this from aerial photographs.
Amount of Noxfish Needed for Specific Uses: To determine the approximate number of gallons of Noxfish Toxicant (5% Rotenone) needed, find your "Type of Use" in the first column of the Table below and then divide the corresponding numbers in the third column, "Number of Acre-Feet Covered by One Gallon", into the number of acre-feet in your body of water.

Type of Use	Parts Per Million of Noxfish	Number of Acre-Feet Covered by One Gallon
Selective treatment	0.10 to 0.13	30 to 24
Normal pond use	0.5 to 1.0	6.0 to 3.0
Remove bullheads or carp	1.0 to 2.0	3.0 to 1.5
Remove bullheads or carp in rich organic ponds	2.0 to 4.0	1.5 to 0.75
Preimpoundment treatment above dam	3.0 to 5.0	1.0 to 0.60

EPA Reg. No. 432-172
EPA Est.: See Lot No. For Correlation
A 42545-MO-1
F 10370-TX-1
P 655-GA-1
P- 3/21/90

NET CONTENTS:
1 GALLON (3.79 Liters)

Agro Evo

ROUSSEL BIO CORPORATION
PO Box 1077 400 Sylvan Avenue
Englewood Cliffs

Pre-Mixing and Method of Application: Pre-mix with water at a rate of one gallon Noxfish to 10 gallons water. Uniformly apply over water surface or bubble through underwater lines.
Detoxification: Noxfish treated waters detoxify under natural conditions within 1 week to 1 month, depending upon temperatures, alkalinity, etc. Rapid detoxification can be accomplished by adding chlorine or potassium permanganate to the water at the same rate as Noxfish in parts per million plus enough additional to meet the chlorine demand of the untreated water.
Removal of Taste and Odor: Noxfish treated waters do not retain a detectable taste or odor for more than a few days to a maximum of one month. Taste and odor can be removed immediately by treatment with activated charcoal at a rate of 30 ppm for each 1 ppm Noxfish remaining. (Note: As Noxfish deactivates, less charcoal is required).
Restocking After Treatment: Wait 2 to 4 weeks after treatment. Place a sample of fish to be stocked in wire cages in the coolest part of the treated waters. If the fish are not killed within 24 hours, the water may be restocked.
FOR USE IN STREAMS IMMEDIATELY ABOVE PONDS, LAKES, OR RESERVOIRS.
Allow Noxfish to drain from drum directly into center of stream at a rate of 0.85-1.7 cc per minute for each cubic foot of water flowing per second in the stream (0.5-1.0 part per million Noxfish or 0.025-0.05 ppm rotenone).

IMPORTANT: READ BEFORE PURCHASE OR USE:
WARRANTY STATEMENT

Our recommendations for the use of this product are based upon tests believed to be reliable. The use of this product being beyond the control of the manufacturer, no guarantee, expressed or implied is made as to the effects of such or the results to be obtained if not used in accordance with directions or established safe practice. The buyer must assume all responsibility including injury or damage, resulting from its misuse as such, or in combination with other materials.

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS
WARNING

May be fatal if swallowed. May cause eye injury. Causes skin irritation. Do not get in eyes, on skin, or on clothing. Wear protective goggles, faceshield, or safety glasses. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

ENVIRONMENTAL HAZARDS

This pesticide is extremely toxic to fish. Fish kills are expected at recommended rates. Consult your State Fish and Game Agency before applying this product to public waters to determine if a permit is needed for such an application. Do not contaminate untreated water when disposing of equipment washwaters.

PHYSICAL HAZARDS

FLAMMABLE: KEEP AWAY FROM HEAT AND OPEN FLAME. FLASH POINT MINIMUM 45°F (7°C).

STATEMENT OF PRACTICAL TREATMENT

If swallowed: Do not induce vomiting. Call a physician or Poison Control Center. Drink promptly a large quantity of milk, egg whites, gelatin solution, or if these are not available drink large quantities of water. Avoid alcohol. Get medical attention.
If in eyes: Flush with plenty of water. Get medical attention.
If on skin: Wash with plenty of soap and water. Get medical attention.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

STORAGE AND DISPOSAL

Pesticide Disposal: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.
CONTAINER DISPOSAL: Triple rinse (or equivalent). Then offer for recycling or reconditioning or puncture and dispose of in a sanitary landfill.