WAC 197-11-960 Environmental checklist.

ENVIRONMENTAL CHECKLIST

Purpose of checklist:

The State Environmental Policy Act (SEPA), chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probable significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or give the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply." Complete answers to the questions now may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of checklist for nonproject proposals:

Complete this checklist for nonproject proposals, even though questions may be answered "does not apply." IN ADDITION, complete the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D).

For nonproject actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of proposed project, if applicable:
Antimycin-A as a Piscicide in Washington Department of Fish and Wildlife Lake and Stream Rehabilitation Program: Use and Health Risks
The Washington Department of Fish and Wildlife (WDFW) proposes to assess the use and risks of the piscicide (pesticide to kill unwanted fish) antimycin-A as an additional tool to eliminate or reduce populations of non-native fish. Antimycin-A would be an additional component of the WDFW's on-going fish management activities as described in the Final Supplemental Environmental Impact Statement on Lake and Stream Rehabilitation. This piscicide, approved by the U.S. Environmental Protection Agency and registered for use in the State of Washington, would be an alternative to rotenone in selected applications of WDFW's Lakes and Streams Rehabilitation program. The department proposes to review this information on potential effects to the environment and human health and request a modification of National Pollutant Discharge Elimination System Permit #WA0041009 based on this review.

2. Name of applicant:
Washington Department of Fish and Wildlife – Fish Program – Fish Management Division

3. Address and phone number of applicant and contact person:

Jon. D. Anderson
Fish Program
Fish Management Division
600 Capitol Way N.
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(360) 902-2711
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4. Date checklist prepared: 19 April 2005

5. Agency requesting checklist: Washington Department of Fish and Wildlife
Fish Program
Fish Management Division

6. Proposed timing or schedule (including phasing, if applicable):
The expected schedule for completing the SEPA process for addressing the effects of antimycin A as a piscicide for use in the WDFW lake and stream rehabilitation program is:

- The Environmental Checklist will be mailed to environmental groups, agencies, fisheries advisory board members, and the public in April 2005.

- The WDFW will hold two public meetings to answer questions and gather public input on this proposal. This activity is a component of the WDFW's on-going fish management activities as described in the Final Supplemental Environmental Impact Statement on Lake and Stream Rehabilitation.

  Spokane: May 3, 2005- 7:00PM-8:00PM
  WDFW Region 1 Conference Room
  8702 N. Division St.
  Spokane, WA 99218

Olympia: May 4, 2005-7:00PM-8:00PM
Natural Resource Building, Room 172,
1111 Washington Street SE, Olympia, WA 98501

- WDFW will accept comments and address questions, and will complete the SEPA process by 1 June.

The annual SEPA process required by the provisions of National Pollution Discharge Elimination System (NPDES) Permit #WA0041009 will be followed. All lakes and streams proposed for treatment are included in an addendum to the Final Supplemental Environmental Impact Statement for Lake and Stream Rehabilitation. The annual SEPA process must be completed prior to conducting lake or stream rehabilitation activities.

When approved for use, any application of antimycin A will be subject to the following annual schedule:

Actions and Time Line for WDFW Lake and Stream Rehabilitation Projects

Step	Action	Approximate Timeline	Action By
1.	Prioritized list of waters to Res. Native Fish Program Mgr	Jan 10	Regions
2.	Statewide prioritized list of waters to be treated this year	Jan 30	Oly*, Regs.
3.	Pre-rehabilitation materials to Regional Native Fish Pgm Mgr	Jan 30	Regions
4.	Order piscicide based on available budget	Feb-Apr	Oly HQ
5.	Landowner and water rights search	Jan-Apr 30	Regions
6.	First contact letters to landowners and water rights holders announcing intent to treat and meeting date	Mar-Apr 30	Regions
7.	First landowner meetings	Apr-May 31	Regions
8.	Treatment List based on available piscicide	Apr 1-15	Olympia HQ
9.	Survey of shoreline for water withdrawals	May-Jun 30	Regions
10.	Collect water withdrawal agreement letters	Jun 30	Regions
11.	Final list of waters for public meetings, including an alternative list of waters as 'back-up'	July 1	Regions
12.	General public meetings	July 1-15	Regions, Oly HQ
13.	Preparation of the SEPA Addendum	July 16-21	Olympia HQ
14.	Publish SEPA Addendum for 30-day public review	July 21	Olympia HQ
15.	Completion of 30-day public review	Aug 20	Olympia HQ
16.	Obtain bids for volatile organic compounds VOC analysis	Aug 20	Olympia HQ
17.	Update spill response plans	Aug 20	Oly HQ, Regions
18.	Schedule treatments	Aug 20	Regions
19.	WDFW Fish Program review and approval	Aug 20-31	Olympia HQ
20.	WDFW Director review and approval	Aug 20-31	Olympia HQ
21.	Draft Emergency fishing regulations to Olympia HQ	Aug 20-31	Regions
22.	Emergency fishing regulations and news release	Upon WDFW Director Approval	
23.	Rehabilitation project lead notebook updates	Upon WDFW Director Approval	
24.	Regions Publish Legal Notifications regarding rehabilitations	10-21 days prior to treatments	
25.	Regions: Notification of residents and businesses	10-21 days prior to treatments	
26.	Posting of waters to be treated	48 hours prior to treatments	
27.	Regions: Pre-treatment sampling and water chemistry	Immediately prior to treatments	
28.	Application of Piscicide	According to Approved Schedule	

29.	Post-treatment sampling, VOCs, semi-VOCs	24 hrs post-treatment – Regions 4 weeks post-treatment - Regions	
30.	Post-treatment bio-assay	3-8 weeks post-treatment – Regs.	
31.	Post-treatment zooplankton sampling	6- and 12-month post-trtmt – Regs	
32.	Post-rehabilitation Critique	As necessary	Oly HQ, Regions
33.	Post-rehabilitation Reports to Olympia WDFW HQ	May 1	Regions
34.	Post-treatment Discharge Report to Dept of Ecology	June 1	Olympia HQ
35.	Dingell-Johnson/Wallop-Breaux Report to USFWS for federally-funded projects	Sept 30	Regions, Oly HQ

* Oly HQ = WDFW Fish Program, Olympia office

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain. Does Not Apply

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.
On March 18, 2003, a Determination of Nonsignificance was made by the WDFW on a proposal to treat 6 miles of the Middle Branch of LeClerc Creek, Pend Orielle County with antimycin to remove eastern brook trout. The project was designed to benefit native westslope cutthroat (*Oncorhynchus clarki lewisi*) and ESA-threatened bull trout (*Salvelinus confluentus*).

A NEPA Environmental Impact Statement (EIS) has been completed for the restoration of westslope cutthroat trout populations in the South Fork drainage of the Flathead River, Montana. To accomplish this work, antimycin A was chosen, with rotenone, as the piscicides of choice for treatment of stream corridors, with rotenone used in lakes and in some stream situations. The effects of antimycin-A on the fisheries, wildlife, soil and vegetation, and water resources of the impact area were assessed, and alternative methodologies were evaluated. Human, recreational and socioeconomic issues, as well as human and environmental health considerations were addressed.

The impacts to human health, and impacts to the environment are similar in the cutthroat restoration program on the Flathead River, and the application of piscicides during the WDFW stream and lake rehabilitation program. WDFW proposes to adopt the following documents:

a) **Type of Document:** South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program. EIS. DOE/EIS-0353.
b) **Lead Agency and Issue Date**: Bonneville Power Administration. June, 2004.
c) **Where copies can be viewed or obtained**: Access to the public for review of Chapter 3 and Appendix D of the EIS is available at the WDFW SEPA Coordinator's address: http://wdfw.wa.gov/hab/sepa/sepa.htm and the document is available in its entirety at: http://www.eh.doe.gov/nepa/docs/deis/eis0353/tocindex.html
d) **The portions of this document applicable to the WDFW proposal are**:

Chapter Three – Affected Environment and Environmental Consequences
Appendix D: Technical Appendix on Use of Piscicides

The overall lake and stream rehabilitation program managed by the WDFW is documented in WDFW's Final Supplemental Environmental Impact Statement (FSEIS) on Lake and Stream Rehabilitation: Rotenone Use and Health Risks

a) **Type of Document**: Final Supplemental Environmental Impact Statement (FSEIS) on Lake and Stream Rehabilitation: Rotenone Use and Health Risks
b) **Lead Agency and Issue Date**: Washington Department of Fish and Wildlife. January, 2002.
c) **Where copies can be viewed or obtained**: Access is available for physical review by contacting Jon Anderson, WDFW Fish Program, 600 Capitol Way North, Olympia, Washington 98501-1091, ph: 360-902-2711. Electronic version is available at: http://wdfw.wa.gov/hab/sepa/sepa.htm
d) **Applicable portions of this document to the WDFW proposal**: Include the summary, introduction, proposed action, description of procedures, and a detailed assessment of impacts.

These other relevant environmental documents have been identified as supporting the decision making for this proposal:

National Park Service. 1999. Great Basin National Park. Environmental Assessment: Bonneville Cutthroat Trout Reintroduction. This documents and analyzes the program to restore the Bonneville cutthroat trout (*Oncorhynchus clarki utah*) into its historic range in the Great Basin National Park in Nevada, using antimycin-A to remove non-native salmonids so that the successful re-stocking of those waters with native Bonneville cutthroat trout could occur.

Forsgren, H. 2004. Decision notice and finding of no significant impact for native fish restoration in Fossil Creek, U.S. Forest Service, Coconino and Tonto National Forests, Gila and Yavapai Counties, Arizona. Albuquerque, N.M. 15pp. This decision notice summarizes the USFS Southwest Regional Forester's decision to implement actions proposed in the Final Environmental Assessment (EA) for native fish restoration in Fossil Creek, located along a portion of the border between the Coconino and Tonto National Forests in Arizona. The purpose of the actions is to enhance and protect the native fish community and their habitat within 9.5 miles of Fossil Creek below Fossil Springs diversion dam by constructing a fish barrier within the Mazatzal Wilderness; salvaging (capture and temporary holding) a portion of native fishes for restocking; eradicating non-native fishes through the application of antimycin A (Fintrol®) in four contiguous stream reaches; protecting habitat to maintain options for future repatriation of fish species extirpated from the Verde basin; and integrating public information and education into the project components.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. None

10. List any government approvals or permits that will be needed for your proposal, if known.

The Washington Department of Fish and Wildlife and the Fish and Wildlife Commission are mandated through RCW 77.04.012 to preserve, protect, perpetuate, and manage the wildlife and food fish, game fish, and shellfish in state waters.

RCW 77.12.420 empowers the Fish and Wildlife Commission to eradicate "undesirable" types of fish. The Commission's right to rehabilitate lakes and streams was affirmed by Thurston-Mason County Superior Court in the case of Patrick vs. Briggs (#27476), January, 1954.

WDFW Fish and Wildlife Commission Policy Number POL-C3010. This policy states that manipulation of

aquatic ecosystems using chemical piscicides is a valuable tool and a cost-effective management tool for providing quality fishing opportunities in many waters of the state.

The Federal Clean Water Act established water quality goals for the navigable waters of the United States. One of the mechanisms for achieving those goals is the National Pollutant Discharge Elimination System of permits. The US Environmental Protection Agency delegated administration of the NPDES permit program to the State of Washington Department of Ecology (RCW 90.48). Their regulations require that a permit be obtained prior to the discharge of treated waters to waters of the state, and establish the basis for effluent limitations. When WDFW obtained NPDES permit #WA0041009, the agency was mandated to complete the SEPA process for the use of antimycin-A prior to its use in fish management activities. It is anticipated that NPDES Permit #WA0041009 will be amended to allow the use of antimycin A as a fish toxicant for certain fish management practices.

Threatened and Endangered Species: Numerous fish, amphibian and other species are designated as threatened or endangered under the federal Endangered Species Act or as endangered, threatened or sensitive by the Washington State Endangered Species Act. Washington Fish and Wildlife Commission Policy Number POL-C3010 requires that waters will not be treated in ways which would cause significant negative impacts to fish or wildlife which are state or federally listed as Threatened, Endangered, Sensitive or Candidate Species. An exception may be granted in the case of a biological emergency. Any activity that might adversely impact a species listed as "threatened" or "endangered" under the federal Endangered Species Act (16 U.S.C. § 1531 et seq.) must be authorized by the appropriate agency (U.S. Fish and Wildlife Service or National Marine Fisheries Service) to ensure that the "take" does not jeopardize the recovery of the species. When conducting lake and stream rehabilitations using materials purchased with federal funds from the Dingell-Johnson/Wallop-Breaux programs, WDFW enters into formal ESA Section 7 consultation with the U.S. Fish and Wildlife Service to determine that the program will not adversely impact any ESA-listed species. The WDFW lake and stream rehabilitation program will obtain ESA authorization under Sections 6(c), 7, or 10 of the Act for any project that may "take" a listed species.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The WDFW proposes to adopt Chapter 3 – Affected Environment and Environmental Consequences, and Appendix D: Technical Appendix on Use of Piscicides of the South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program, Environmental Impact Statement, DOE/EIS-0353, as its commitment to assess the use and risks of the piscicide (pesticide to kill unwanted fish) antimycin-A as an additional tool to eliminate or reduce populations of non-native fish.

The use of piscicides to remove non-native, undesirable species of fish would achieve the goal of the management agency to re-propagate the treated body of water with desirable, native species of fish, and/or restore ecological balance with other ecosystem components. The use of antimycin may be preferable to the use of rotenone, the sole currently-used piscicide, in selected treatments. Certain treatments to remove non-native fish species would achieve the goal of allowing the natural re-propagation of native vertebrates to bodies of water that might have had no historical fish species present.

a) Describe the need for the action. (Whenever possible this should identify the broad or fundamental problem or opportunity that is to be addressed, rather than a legislative or other directive.)

The Washington Department of Fish and Wildlife is mandated to manage the fishery resources of the State. Habitat alterations and the widespread stocking of non-native fish have reduced populations of native species, and have reduced the effectiveness of fisheries management initiatives.

Exotic fish pose a particular problem because their effects and their spread cannot be readily observed. Exotic or other undesirable fish may deplete or extirpate native invertebrates, amphibians or fish by competition and/or predation. In order to restore populations of native fish and wildlife species, or to provide a desired fish species component in lakes and streams, it is sometimes necessary to eradicate unwanted, non-native fish species from selected waters. The removal of undesirable fish by mechanical means has not been effective, as it is impossible to achieve a complete removal of those fish with traps, nets, electrofishing, hook and line, or other physical methods. Piscicides provide the most effective method for the removal of undesirable fish (Rinne and Turner 1991).

In Washington, formulations of rotenone have been used as the primary piscicide for these purposes since 1940. The use of antimycin-A as an alternative piscicide had not been undertaken, due to cost considerations. However, antimycin-A does not cause an avoidance response in fish, as does rotenone, which makes antimycin a preferred alternative in situations where fish might avoid treated waters (Dawson et al. 1998). Flowing, medium-gradient waters and lakes with freshwater springs provide opportunities for fish to avoid treated waters. If the piscicide can not be detected by the fish, they will be less likely to seek sanctuary in areas of the lake or stream where treated water can not penetrate. Antimycin has a short effective contact time, and due to its apparent irreversibility fish that later find their way into untreated water are likely to succumb (Gilderhus 1972). Also, antimycin A is easier to transport to remote sites than rotenone, due to the much smaller quantity of piscicide that is required for effective treatment.

Antimycin is an antibiotic produced by molds of the genus Streptomyces that is found naturally in forest soils. It was first used as a piscicide in 1963, and is favored because it is not detected by fish and can be applied in cold alpine waters in parts per billion (ppb), which is one thousand times less than the amount needed for rotenone. Antimycin works by entering the fish gills and inhibiting fish to absorb oxygen at the cytochrome level, which takes longer than at the cellular level. Antimycin inhibits oxygen metabolism by disrupting electron transport at Complex III of the electron transport chain. Antimycin prevents the passage of electrons from cytochrome *b* to cytochrome *c*1 by inhibiting the activity of coenzyme Q-cytochrome *c* reductase. Once introduced into Complex III, the inhibition caused by antimycin is not easily reversed (Rieske et al. 1967a, 1967b). Antimycin is a selective piscicide, meaning that it affects some fish more than others (Burress and Luhning 1969a, 1969b; Berger et al. 1969). It is frequently used to clean catfish ponds of unwanted fish, since catfish are very resistant to it (Lloyd 1987).

b) Describe the objective(s) of the proposal, including any secondary objectives that may be used to shape or choose among alternatives.

The objectives of the proposal are:

- to comply with the requirement of NPDES Permit #WA0041009 that WDFW complete the SEPA review process regarding the use of antimycin as a fish toxicant, and

- to provide for the use of antimycin-A as a preferred piscicide in certain fish management applications where the use of rotenone may not achieve management goals, and

- to allow the WDFW lake and stream rehabilitation program to continue in a safe, environmentally-conscious manner.

WDFW has considered several alternatives to the use of antimycin as a piscicide in the agency's lake and stream rehabilitation program.

Alternative 1: Continued use of rotenone as the sole piscicide in the WDFW lake and stream rehabilitation program.

The use of the piscicide rotenone, as allowed under NPDES Permit #WA0041009, is very biologically-effective and cost-effective for the majority of WDFW lake rehabilitation projects. Use of this chemical in streams has not been undertaken due to the complexities, costs, potential environmental impacts, and likelihood of incomplete mortality to target species. For a number of reasons, as identified in Section 11(a), rotenone may not be the best, most effective piscicide for the eradication of unwanted exotic fish species. Furthermore, there is a potential for a fish species to develop resistance to rotenone through the process of directional selection (Orciari 1979).

Alternative 2: Mechanical removal

The removal of undesirable fish from lakes and streams through the use of nets, traps, angling, electrofishing, and water management may result in a reduction in the numbers of undesirable fish species. However, complete elimination of the targeted species is unlikely, and high productivity of these species would result in the populations of the undesired species returning to pre-treatment levels within a few seasons, negating the effects of the treatment

Alternative 3: Use of antimycin A as a piscicide in selected lake and stream rehabilitation projects.

Antimycin, like rotenone, blocks the transfer of electrons in the mitochondria during cellular respiration in sensitive organisms. Scientists believe that fish are more sensitive to antimycin than mammals and birds because antimycin, like rotenone, is rapidly absorbed into the bloodstream from the water across the gills of fish. Finlayson et al. (2002) stated that the lethality (100% mortality) of antimycin to fish varies from <1.0 µg/L for most trout and char (Family: Salmonidae) to 25 to 200 µg/L for most freshwater catfish (Family: Ictaluridae). Most minnows (Family: Cyprinidae) and sunfish (Family: Centrarchidae) suffer mortality at antimycin concentrations of 5.0 to 10 µg/L (Berger et al. 1969). Fry and fingerlings are more sensitive than juvenile and adult fish (Berger et al. 1969).

When accounting for differences in lethality and percentage of active ingredients in two formulated products, approximately 20 times more Noxfish® (a rotenone formulation) must be used to obtain the same effect as Fintrol® when trout are the target species. Gilderhus (1972) noted that both chemicals perform similarly to eliminate trout with similar contact times of 2 hours (5 µg/L antimycin and 50 µg/L rotenone). However, when carp or suckers are the target species, antimycin has an advantage over rotenone; 6 hours exposure to 5 µg/L antimycin produced results similar to an 18-hour exposure to 50 µg/L rotenone (Gilderhus 1972). Conversely, bullheads and other catfish species are relatively tolerant of antimycin (Walker et al. 1964). However, antimycin does not repel fish like rotenone. Dawson et al. (1998) reported that the invasive species ruffe (*Gymnocephalus cernuus*) is repelled at 0.1 µg/L rotenone from Noxfish® but is not repelled by 0.01 µg/L of antimycin from Fintrol®

c) Describe the existing regulatory/planning framework as it may influence or direct the proposal.

Pre-Treatment Procedures

According to the Final Supplemental Environmental Impact Statement for WDFW Lake and Stream Rehabilitation: Rotenone use and health risks (2002), a lake or stream is selected for piscicide treatment when a viable trout fishery can be provided with plants of catchable sized trout, or a warm water species fishery is not producing a desirable fishery. Additionally, management decisions may be implemented to remove competing species to restore a depleted population of native fishes, or to eradicate a deleterious aquatic invasive species that has been introduced into state waters. The WDFW District Fish Biologist directly charged with managing the lake or stream's fish makes these determinations. Standard indicators of fishery performance are the species composition and average catch per hour estimates derived from sampling the lake or stream or conducting creel censuses, fish size or growth and abundance from annual pre-season sampling. When poor performance is coupled with gillnet and/or electroshocking sampling data showing the presence or an increase in species outside the management emphasis, the WDFW District Fish Biologist may recommend treatment of the water to his supervisor, the Regional Fisheries Program Manager.

The District Fish Biologist must complete a pre-rehabilitation plan (Appendix I) containing vital information on the proposed treatment.

In calculating the dosage of piscicide needed to achieve control of the undesired population of fish, the biologist considers a variety of physical and biological factors, the most important being target species, the presence or absence of sensitive aquatic species, water chemistry, past success or failure in the lake and presence or absence of weedy areas or shoreline vegetation.

Dosage is to be calculated based on liquid containing a specified concentration of antimycin-A, and is expressed as parts liquid formulation - not pure antimycin-A - per billion or per million parts of lake water (ppb or ppm) on a weight basis. One ppb is equivalent to one microgram per liter (1 μg/L) and one ppm is equivalent to one milligram per liter (1 mg/L).

The liquid formulation of Fintrol® Concentrate currently available for use by WDFW contains 23% antimycin, and inert ingredients soy lipids (15%), and acetone (62%) in a diluent consisting of Diethyl Phthalate, Nonoxyl-9 and acetone. Biologists adjust the amount of liquid to be used to conform to the concentration initially calculated based on the need to eradicate a given species of target fish. The actual amount of piscicide needed is based on the estimated weight of water in the lake or volume of stream segment to be treated. This is determined by volumetric calculations using WDFW surveys on the particular lake or stream segment.

The Regional Fisheries Program Manager presents the list of proposed treatments along with justification and evidence of review by the Regional Habitat Program Manager, the Regional Wildlife Program Manager and the Regional Director to the Fisheries Management Division headquarters. Approval at this stage may depend not only on the validity of the biological justification, but to other considerations such as the lake's public use and its importance as a recreational fishery or other conflicting uses, and the availability of piscicide. Statewide priorities are established, and a list of candidate waters developed.

After developing a list of candidate waters, the public is notified through general news release, usually in early summer, both statewide and in the vicinity of the waters proposed for treatment. Area Fish Biologists also contact landowners, determine water rights, and solicit public opinion from lakeshore residents and other groups in the area. Public meetings are held in the vicinity of the proposed waters to explain the human, social and biological effects of treating the proposed bodies of water, prior to a final decision. The final list of candidate waters is issued for public review in the counties where the waters are located as an addendum to the 2002 FSEIS to meet State Environmental Policy Act requirements.

The final decision is made by the agency Director. Even with Director approval there is still a possibility that a body of water may not be treated if all pre-treatment steps such as water control measures (diking, damming) or public notifications have not been completed.

Safety Procedures

Applicators (WDFW employees and volunteers) are required to use piscicides in accordance with the product label. The use of formulated antimycin-A must be supervised on-site by at least one person who has Washington Department of Agriculture certification as a pesticides applicator. The project supervisor must have the authority to start and stop the piscicide application and be well versed in the state regulatory requirements regarding safe and legal use of the product, and applicator and public safety. All personnel involved with the piscicide application must receive safety training specific to the formulated product that will be used. The guidelines for the Hazard Communications Program set forth in WDFW's Safety Program Manual must be followed.

At a minimum, specific safety training must include information on the following: (1) how to read and understand the product label; (2) the acute and chronic applicator exposure hazards; (3) routes and symptoms of pesticide overexposure; (4) how to obtain emergency medical care; (5) decontamination procedures; (6) how to use the required safety equipment; (7) safety requirements and proper procedures for pesticide handling, transportation, storage and disposal. The Training Records must be maintained in accordance with federal and state regulatory requirements.

The product label requires the use of Personal Protective Equipment (PPE) and material safety data sheet when using pesticide products. The following PPE requirements for antimycin-A pesticide products are to be followed:

> For liquid piscicide formulation applications - To reduce respiratory exposure to the liquid antimycin formulation, employees must wear a NIOSH approved half or full face air purifying respirator using organic vapor cartridges approved for pesticides. Respirator cartridges are to be changed at the end of each work day. Safety splash goggles, butyl rubber gloves and tyvek coveralls must be worn to reduce dermal exposure to the liquid formulation.

Employees who are assigned to use respirator equipment must be included in the department's respiratory protection program. This program requires all respirator users to complete a confidential medical questionnaire to be reviewed by a contracted medical professional. Once the medical contractor advises the department on the employee's capability to use respirator equipment, the employee must then complete respirator use training and fit testing. The fit testing and training must be repeated annually and records maintained.

The lake or stream rehabilitation project staff must always include an employee with first aid and CPR training. First aid supplies, an emergency eye wash shower and emergency plan procedures must also be present.

Treatment Procedure

Shortly before treatment, lake waters are divided into sections of similar volume, and these sections are marked using buoys and shoreline markers. The antimycin formulation is added to streams over 8-10 hr at the prescribed concentration at drip stations placed along the stream. Multiple drip stations are necessary to maintain the necessary piscicide concentration throughout the stream, as antimycin concentration can decline due to aeration, binding to biota and sediments, and dilution. The drip stations are monitored throughout the application period to maintain a constant addition rate.

A detoxification station will be established at the bottom end of each treatment stream segment. Approximately 2 mg/L potassium permanganate ($KMnO_4$) would be added over 8 to 20 hours at these stations to neutralize piscicides before flowing into untreated waters downstream. Bioassays using caged trout will be utilized to determine if the treatments or outflow were killing fish.

Application into lakes would take place by applying commercial antimycin liquid formulation from a boat using mechanical or hand sprayers or using a drip system. Application into streams would take place using a drip system at selected points along the stream. In high-gradient streams, drip stations should be spaced at every 60-75 m of elevation loss to be effective (Tiffan and Bergersen 1996). Colder water temperatures and higher pH reduce the effectiveness of antimycin, and adjustments to this spacing should be considered in those circumstances. Shorelines and marshy areas may be sprayed with the liquid formulation to increase the coverage and effectiveness of the application. Fish killed by the piscicide treatment will generally remain in the treated body of water.

Additionally, Fish and Wildlife Enforcement Officers and/or biological staff patrol the waters and application sites to prevent the public from picking up dead fish or swimming in the lake or stream during the piscicide application.

The most common dosages of antimycin-A used in the waters to be treated in Washington are expected to range between 1 and 20 ppb of Fintrol Concentrate for a period of 8-10 hours in the section of water to be treated. At this level, most trout and spiny-rayed fishes (Centrarchids) would be controlled. Catfish are resistant to antimycin at levels used to control other fish species.

Post-Treatment Procedures
In streams and in lakes with stream outlets, runoff must be controlled or detoxified. In some cases, the runoff is small enough that it can be controlled by damming off flows (using sandbags and plastic tarping, for example) until the piscicide is naturally degraded. When this is not possible, an oxidizing agent - usually potassium permanganate - is dripped into the outlet stream to detoxify the rotenone before it can harm fish and invertebrates very far down stream. From 1992 - 2002, such detoxification was been necessary in 3.6% of the Washington lakes treated with rotenone. Finlayson et al. (2000) and Archer (2001) provide detailed guidelines for detoxification with potassium permanganate.

In the lake or stream itself, antimycin-A degrades naturally in a few hours to days at the most in lowland lakes, and somewhat longer in more sterile sub-alpine or alpine lakes. At intervals following treatment, WDFW Area Fish Biologists usually perform a series of simple bioassays to determine how long the lake remains toxic to fish: hatchery rainbow trout are commonly suspended in the water column in cages and when these fish survive 1-6 days in the lake, it is considered nontoxic.

The biologist submits a Post-Rehabilitation Report (see Appendix II) for each water treated; it describes, among other things, the probability of a complete kill, water conditions at the time of treatment, and detoxification measures if any.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with

any permit applications related to this checklist.

Statewide, in lakes and streams where the need has been identified to remove exotic or undesirable fish species for rehabilitating and recovering native fish populations or other native aquatic communities. The treatments are conducted to eliminate non-native undesirable fish species, to the benefit of native fish, species of concern, or desirable species and stocks. Treatments may occur statewide to remove deleterious species that have the potential to adversely impact native species in the aquatic system.

B. ENVIRONMENTAL ELEMENTS

1. **Earth**

a. General description of the site (circle one): Flat, rolling, hilly, steep slopes, mountainous, other . . . . . .
The use of piscicides in fisheries management may occur in streams and lakes statewide. A wide diversity of geology, soils and topography may be encountered. Minor ground disturbances may occur while accessing stream and lake shores, or when assembling drip stations. The stream and lake bottoms likewise have a wide diversity of substrates, ranging from mineral clays, sands, gravels and bedrock to heavily-sedimented, organic mucks.

None of the actions involved in the use of antimycin-A include ground-disturbing activities that would degrade soil resources or accelerate geomorphic processes. The recommended piscicide binds readily with sediments. However, this binding also detoxifies the antimycin and renders it environmentally benign (Gilderhus 1982).

b. What is the steepest slope on the site (approximate percent slope)? Does Not Apply

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland. Does Not Apply

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe. Does Not Apply

e. Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill. Does Not Apply

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe. Does Not Apply

About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)? None

g. Proposed measures to reduce or control erosion, or other impacts to the earth, if any: Does Not Apply

2. Air

a. What types of emissions to the air would result from the proposal (i.e., dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities if known.

The diluent used with Fintrol antimycin-A product contains a surfactant (Diethyl Phthalate), a detergent (Nonolyl-9) and acetone. Air pollutants impact certain areas of the State. Air quality and its effects (acid

deposition, regional haze, and ozone pollution) are determined by a number of factors, some natural but most are anthropogenic. The addition of liquid antimycin to the waters of the State of Washington will not affect the quality of air resources.

There is a small possibility that the piscicides would emit a short-term odor during application. According to the Material Safety Data Sheet, the inhalation of vapors or aerosol could irritate the eyes, nose and respiratory tract of personnel in proximity to the application of antimycin-A by spraying.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.
Does Not Apply

c. Proposed measures to reduce or control emissions or other impacts to air, if any:
Application will be conducted according to the label, and aerosol applications would not be conducted during periods when wind might disperse the product.

3. **Water**
a. Surface:

Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

In Washington, exotic fish species have been introduced into numerous waters to provide food, to provide sport fishing opportunities, as forage fish, as a biological control of undesirable pests such as mosquitoes, and to control nuisance aquatic vegetation. The adverse impact on native fish species by fish introductions has been well documented (Wydoski and Whitney 2003).

Approximately 200 lakes and ponds in Washington are included in the current WDFW lake and stream rehabilitation program. Yet-to-be identified ponds, lakes and stream reaches, which are populated with undesirable, exotic, or detrimental fish species are the waters most likely to be treated with antimycin-A. WDFW Fish and Wildlife Commission policy POL-C3010 specifically states "waters will not be treated in ways which would cause significant negative impacts to fish or wildlife which are state or federally listed as Threatened, Endangered, Sensitive or Candidate Species."

Waters that potentially may be treated include lakes and streams. The timing of treatments would preclude the application of antimycin-A during periods of high runoff, where control of the piscicide could not be managed through physically blocking stream flows or through the use of neutralizing compounds such as potassium permanganate or chlorine. Lakes and streams that might be treated will be identified during the annual SEPA process for the WDFW lake and stream rehabilitation program (see section A.6).

Toxicity tests at U. S. Fish and Wildlife Service laboratories indicate that water quality is not affected by the addition of antimycin (Schnick 1974). The use of this chemical in lakes and streams is not anticipated to have any adverse effects on water quality.

In a thermally stratified lake, the thermocline is a barrier to the distribution of liquid fish toxicants applied to the epilimnion. To ensure that antimycin is distributed to deeper waters, the chemical would be applied to the

lake surface at the time of spring or fall turnover, utilizing the natural lake mixing as the only means of distributing the toxicant to deeper water (Schneider 1974).

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.
Yes. The treatments of the selected lakes and streams are all made in the waters as described. Refer to Sections A.6, A.11.c, and A.12.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.
Does Not Apply.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.
No withdrawals or diversions are anticipated.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.
All potential treatments are made in lakes or streams.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.
Yes, the piscicide antimycin A formulation will be applied to lake or stream waters per the labeling requirements.

Shortly before treatment, lake waters are divided into sections of similar volume, and these sections are marked using buoys and shoreline markers. The antimycin formulation is added to streams over 8-10 hr at the prescribed concentration at drip stations placed along the stream. Multiple drip stations are necessary to maintain the necessary piscicide concentration throughout the stream, as antimycin concentration can decline due to aeration, binding to biota and sediments, and dilution. The drip stations are monitored throughout the application period to maintain a constant addition rate.

A detoxification station will be established at the bottom end of each treatment stream segment. Approximately 2 mg/L potassium permanganate ($KMnO_4$) would be added over 8 to 20 hours at these stations to neutralize piscicides before flowing into untreated waters downstream. Bioassays using caged trout will be utilized to determine if the treatments or outflow were killing fish.

Application into lakes would take place by applying commercial antimycin liquid formulation from a boat using mechanical or hand sprayers or using a drip system. Application into streams would take place using a drip system at selected points along the stream. In high-gradient streams, drip stations should be spaced at every 60-75 m of elevation loss to be effective (Tiffan and Bergersen 1996). Colder water temperatures and higher pH reduce the effectiveness of antimycin, and adjustments to this spacing should be considered in those circumstances. Shorelines and marshy areas may be sprayed with the liquid formulation to increase the coverage and effectiveness of the application. Fish killed by the piscicide treatment will remain in the treated body of water.

Additionally, Fish and Wildlife Enforcement Officers and/or biological staff patrol the waters and application sites to prevent the public from picking up dead fish or swimming in the lake or stream during the piscicide application.

The most common dosages of antimycin-A used in the waters to be treated in Washington are expected to range between 1 and 20 ppb of Fintrol Concentrate for a period of 8-10 hours in the section of water to be treated. At this level, most trout and spiny-rayed fishes (Centrarchids) would be controlled. Catfish are resistant to antimycin at levels used to control other fish species.

b. Ground:
1) Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.
Does Not Apply

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.
Does Not Apply

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.
The piscicide will not be applied to upland areas, and no runoff will occur.

2) Could waste materials enter ground or surface waters? If so, generally describe.
Piscicide applications to lakes or flowing streams are not expected to enter ground waters, due to the short effective life of the chemical in the water, and its propensity to bind with sediments, rendering it harmless.

d. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any: Does Not Apply

4. **Plants**

a. Check or circle types of vegetation found on the site:
The vegetation on the site will vary.

b. What kind and amount of vegetation will be removed or altered? None. Antimycin A does not impact vegetation.

c. List threatened or endangered species known to be on or near the site. None. Any listed species identified would be considered through federal ESA Section 7 consultation. Internal WDFW pre-treatment planning will identify any listed or sensitive species present to ensure that piscicide treatment operations do not jeopardize the continued existence of the species.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any: Does Not Apply

5. **Animals**

a. Circle any birds and animals that have been observed on or near the site or are known to be on or near the site: Wildlife may be present when piscicide treatments occur.

b. List any threatened or endangered species known to be on or near the site. Current fish species listed under the U.S. Endangered Species Act in Washington State include:

Bull Trout - Threatened
Chinook salmon
- Puget Sound ESU – Threatened
- Lower Columbia River ESU – Threatened
- Upper Columbia River Spring-run chinook ESU – Endangered
- Snake River Spring/Summer-run chinook ESU – Threatened
- Snake River Fall-run chinook ESU – Threatened

Chum salmon
- Hood Canal Summer-run chum ESU – Threatened
- Columbia River chum ESU – Threatened

Sockeye salmon
- Snake River sockeye ESU – Endangered
- Ozette Lake sockeye ESU – Threatened

Steelhead
- Upper Columbia River steelhead ESU – Endangered
- Middle Columbia River steelhead ESU – Threatened
- Lower Columbia River steelhead ESU – Threatened
- Snake River basin steelhead ESU – Threatened

Washington Native Resident Fish Listing Status

	STATUS	
SPECIES	FEDERAL	STATE
Bull trout (*Salvelinus confluentus*)	Threatened	WDFW SC
Coastal cutthroat trout (*Oncorhynchus clarki clarki*	SC	none
Westslope cutthroat (*Oncorhynchus clarki lewisi*	SC	none
Pacific lamprey (*Lampetra tridentata*)	SC, petition review 2005	none
River lamprey *(Lampetra ayresi*)	SC, petition review 2005	WDFW SC
Western brook lamprey (*Lampetra richardsoni*)	none, petition review 2005	none
Pygmy whitefish (*Prosopium coulteri*)	none	WDFW SS
Olympic mudminnow (*Novumbra hubbsi*)	none	WDFW SS
Leopard dace (*Rhinichthys falcatus)*	none	WDFW SC
Umatilla dace (*Rhinichthys umatilla*)	none	WDFW SC
Lake chub (*Couesius plumbeus*)	none	WDFW SC
Mountain sucker (*Catostomus platyrhynchus*)	none	WDFW SC
Margined sculpin (*Cottus marginatus*)	SC	WDFW SS

SS = State Sensitive
SC = State Candidate
SC = Federal Species of Concern – red flag list, no legal status, first alert, just below candidate listing

Washington Native Mussel Listing Status

SPECIES	STATUS /DNR RANK FEDERAL	STATE
Yukon floater (*Anodonta beringiana*)	none	DNR SR
California floater (*Anodonta californiensis*)	SC	WDFW SC
		DNR S1S2
Western floater (*Anodonta kennerlyi*)	none	DNR S2S3
Oregon floater (*Anodonta oregonensis*)	none	DNR S2
Winged floater (*Anodonta nuttalliana)*	none	DNR SH
Western ridged mussel (*Gonidea angulata*)	none	DNR S2
Western pearlshell (*Margaritifera falcata*)	none	DNR S3

S1 = Critically imperiled (5 or fewer occurrences)
S2 = Vulnerable to extirpation (6 to 20 occurrences)
S3 = Rare or uncommon (21 to 100 occurrences)
SH = Historical occurrences only, but still expected to occur
SR = Reported, but without persuasive documentation

Other: Bald Eagles (*Haliaeetus leucocephalus*) may be present at, or attracted to, bodies of water treated with piscicides. Wolves (*Canis lupus*) or grizzly bears (*Ursus arctos*) are not likely to be present at the site of any treatment site. Antimycin A is not toxic to birds or other animals that may ingest fish killed by that piscicide.

If federal funds are used to purchase antimycin-A for stream and lake rehabilitation, its use will be consistent with all applicable federal law and rules. When federal funding is used, or when rehabilitation occurs on federal lands, consultation is required under Section 7 of the Endangered Species Act to determine potential impacts to ESA-listed species, and to ensure that the stream or lake rehabilitation does not jeopardize federally listed species.

Threatened and Endangered Species: Numerous fish, amphibian and other species are designated as threatened or endangered under the federal Endangered Species Act or as endangered, threatened or sensitive by the Washington State Endangered Species Act. Washington Fish and Wildlife Commission Policy Number POL-C3010 requires that waters will not be treated in ways which would cause significant negative impacts to fish or wildlife which are state or federally listed as Threatened, Endangered, Sensitive or Candidate Species. An exception may be granted in the case of a biological emergency. Any activity that might adversely impact a species listed as "threatened" or "endangered" under the federal Endangered Species Act (ESA: 16 U.S.C. § 1531 et seq.) must be authorized by the appropriate agency (U.S. Fish and Wildlife Service or National Marine Fisheries Service) to ensure that the "take" does not jeopardize the recovery of the species. When conducting lake and stream rehabilitations using materials purchased with federal funds from the Dingell-Johnson/Wallop-Breaux programs, WDFW enters into formal ESA Section 7 consultation with the U.S. Fish and Wildlife Service to determine that the program will not adversely impact any ESA-listed species. The WDFW lake and stream rehabilitation program will obtain ESA authorization under Sections 6(c), 7, or 10 of the Act for any project that may "take" a listed species.

c. Is the site part of a migration route? If so, explain. Pacific flyway

d. Proposed measures to preserve or enhance wildlife, if any:
In Washington, exotic fish species have been introduced into numerous waters to provide food, to provide sport

fishing opportunities, as forage fish, as a biological control of undesirable pests such as mosquitoes, and to control nuisance aquatic vegetation. The adverse impact on native fish species by fish introductions has been well documented (Wydoski and Whitney 2003).

Approximately 200 lakes and ponds in Washington are included in the current WDFW lake and stream rehabilitation program. Yet-to-be identified ponds, lakes and stream reaches, which are populated with undesirable, exotic, or detrimental fish species are the waters most likely to be treated with antimycin-A. WDFW Fish and Wildlife Commission policy POL-C3010 specifically states "waters will not be treated in ways which would cause significant negative impacts to fish or wildlife which are state or federally listed as Threatened, Endangered, Sensitive or Candidate Species."

6. **Energy and natural resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Fuel costs for vehicle operation and maintenance for the current WDFW lake and stream rehabilitation program average $3,500/year.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

Does Not Apply

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Does Not Apply

7. **Environmental health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, which could occur as a result of this proposal? If so, describe.

Risk of explosion: According to the Material Safety Data Sheet, antimycin-A liquid formulation contains acetone, which has lower and upper explosive limits of 2.6% - 12.8%. Autoignition temperature is listed as 869° F.

Releases to the environment:

Although pesticides are used widely to control unwanted species, legitimate public concerns have been raised regarding the safety and health effects to humans. As with any pesticide, direct exposure to, or consumption of piscicides at full strength, can have harmful or sometimes fatal effects on humans. Antimycin is an EPA-registered pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA). Measures to ensure mandated safe use of piscicides during WDFW lake and stream rehabilitation projects are described in Section 11.c of this document, under the heading "Safety Procedures".

Public safety issues consist mainly of possible public encounters with antimycin A. Direct ingestion of normal quantities of stream water during peak treatment would not affect humans and livestock, and there are no reports of negative effects to humans or wildlife from consuming dead fish produced by stream renovation. Antimycin degrades rapidly. During active treatment, there will be signing describing the activities to discourage human consumption of stream water or fish killed by the treatment. There will be no significant effects on public health and safety.

1) Describe special emergency services that might be required. None are anticipated. Any spills that may occur during transportation will be cleaned up according to label requirements and WDFW spill response procedures identified in pre-treatment planning documentation for each site.

2) Proposed measures to reduce or control environmental health hazards, if any:
Following the treatment, a complete visual survey will be conducted to evaluate the success of the renovation. In the case of stream rehabilitations, a complete electrofishing survey, utilizing battery powered backpack electrofishers, may be conducted to determine the success of the treatment. The lead WDFW fish management biologist will complete a Post-Rehabilitation Report Form (Appendix II) following treatment.

WDFW Fish Management staff conduct annual post-rehabilitation critiques to assess the effectiveness, safety, and operational procedures of lake and stream rehabilitation. Results of the critique are used in subsequent years' planning to increase the effectiveness and safety of the WDFW lake and stream rehabilitation program.

b. Noise
1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)? Does Not Apply

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.
Intrusive noise levels vary depending on time, wind direction, and location. Sources of noise during the application include road traffic, motorboats, and human activity (e.g., generators, motors, and people). There are also administrative activities that create noise, such as helicopter flights. Noise is generally concentrated and more apparent at and near the site of applications. Operations are conducted during the daytime, and would result from operation of vehicles, boats, and pump motors. Duration of any individual project may take up to 2 or 3 days.

3) Proposed measures to reduce or control noise impacts, if any:
Personnel conducting piscicide treatment operations are required to wear personal protective devices at the site of the operation of motors, per WDFW safety procedures developed for each treatment project.

8. **Land and shoreline use**
What is the current use of the sites and adjacent properties?
The lakes and streams that may be treated for the control of undesirable fish species are used for recreation, for fish and wildlife habitat, and for range and agricultural activities. Private housing may be present in the areas upland from treated bodies of water. Current uses and land-use planning designations are considered during the pre-treatment planning process for bodies of water proposed for treatment with piscicides.

b. Has the site been used for agriculture? If so, describe. Livestock grazing and other agricultural activities may occur in the vicinity of bodies of water proposed for treatment.

c. Describe any structures on the site. Does Not Apply

d. Will any structures be demolished? If so, what? Does Not Apply

e. What is the current zoning classification of the site? Does Not Apply - Various

f. What is the current comprehensive plan designation of the site? Does Not Apply - Various

g. If applicable, what is the current shoreline master program designation of the site? Does Not Apply - Various

h. Has any part of the site been classified as an "environmentally sensitive" area? If so, specify. Does Not Apply - Various

i. Approximately how many people would reside or work in the completed project? Approximately 10-18 WDFW biologists have generally conducted lake and stream rehabilitation projects using rotenone piscicide. It is anticipated that similar staffing would be required for applications of antimycin A for lake and stream rehabilitation.

j. Approximately how many people would the completed project displace? None

k. Proposed measures to avoid or reduce displacement impacts, if any: Does Not Apply

Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any: Does Not Apply

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing. Does Not Apply

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing. Does Not Apply

c. Proposed measures to reduce or control housing impacts, if any: Does Not Apply

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed? Does Not Apply

b. What views in the immediate vicinity would be altered or obstructed? Does Not Apply

c. Proposed measures to reduce or control aesthetic impacts, if any: Does Not Apply

11. **Light and glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur? Does Not Apply

b. Could light or glare from the finished project be a safety hazard or interfere with views? Does Not Apply

c. What existing off-site sources of light or glare may affect your proposal? Does Not Apply

d. Proposed measures to reduce or control light and glare impacts, if any: Does Not Apply

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?
Recreational angling occurs in most waters of the state. Boating, swimming, and shore-side recreation activities such as camping and hiking may occur.

b. Would the proposed project displace any existing recreational uses? If so, describe. The Washington Department of Fish and Wildlife prohibits angling in waters to be treated immediately prior, and subsequent to, application of piscicides. This prohibition generally is continued until the effects of the piscicide have disappeared, and following restoration of the fishery resource through artificial propagation or natural production of native species. Other recreational activities, such as swimming, would be discouraged during the active treatment period through signage and contact by agency personnel until the piscicide has dissipated from the environment. Recreational boating and shore-based recreation should not be affected.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any: Recreationists in the area would likely not be exposed to the treatments because treatment areas would be closed to fishing. Proper warning through news releases, signing at access points, and administrative personnel in the project area should be adequate to keep unintended recreationists from being exposed to any treated waters. Administering application in the fall of the year may further reduce exposure due to the relatively low number of recreational users at that time of year.

13. **Historic and cultural preservation**

a. Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe. It is not anticipated that the activities consequent to this proposal would impact any historic or cultural resources.

b. Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site. Does Not Apply

c. Proposed measures to reduce or control impacts, if any: Does Not Apply

14. **Transportation**

a. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any. Individual projects are proposed, evaluated and subject to annual public notice. Those annual project proposals include maps that identify the bodies of water proposed for treatment, and associated public access.

b. Is site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?
Does Not Apply

c. How many parking spaces would the completed project have? How many would the project eliminate?
Does Not Apply

d. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private). Does Not Apply

e. Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so,

generally describe. Current lake and stream rehabilitation projects authorized by NPDES Permit #WA0041009 generally are conducted with a staff of approximately 12-15 WDFW biologists. Sufficient transportation for personnel, equipment for rehabilitation, and safety gear has required the use of 8-10 vehicles. It is anticipated that similar transportation would be required for applications of antimycin. Aerial transport of personnel and equipment to remote locations may be utilized on selected projects.

f. How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur. Current lake and stream rehabilitation projects authorized by NPDES Permit #WA0041009 generally are conducted with a staff of approximately 12-15 WDFW biologists. Sufficient transportation for personnel, equipment for rehabilitation, and safety gear has required the use of 8-10 vehicles. It is anticipated that similar transportation would be required for applications of antimycin.

g. Proposed measures to reduce or control transportation impacts, if any:
Impacts that may result from land or aerial transportation to treatment sites will be evaluated in the annual pre-treatment planning process for individual projects.

15. **Public services**
a. Would the project result in an increased need for public services (for example: fire protection, police protection, health care, schools, other)? If so, generally describe.
It is not anticipated that the activities consequent to this proposal would increase the need for public services.

b. Proposed measures to reduce or control direct impacts on public services, if any.
Personnel of the Washington Department of Fish and Wildlife are present during all treatments to monitor the operation and ensure the safety and well-being of the public and the affected environment.

16. **Utilities**
a. Circle utilities currently available at the site: electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other. Does Not Apply

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity that might be needed. Does Not Apply

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Jon. Anderson
Washington Dept. Fish and Wildlife
Fish Program, Fish Management
600 Capitol Way North
Olympia, WA 98501-1091

Date Submitted: 19 April 2005

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

The assessment of human, social, and biological impacts is included in Chapter 3 of the adopted document (South Fork Flathead Watershed Westslope Cutthroat Trout Conservation Program. Environmental Impact Statement. DOE/EIS-0353.

Noise: Intrusive noise levels vary depending on time, wind direction, and location. Sources of noise during the application include road traffic, motorboats, and human activity (e.g., generators, motors, and people). There are also administrative activities that create noise, such as helicopter flights. Noise is generally concentrated and more apparent at and near the site of applications.

Risk of explosion: According to the Material Safety Data Sheet, antimycin-A liquid formulation contains acetone, which has lower and upper explosive limits of 2.6% - 12.8%. Autoignition temperature is listed as 869° F.

Releases to the environment:
Although pesticides are used widely to control unwanted species, legitimate public concerns have been raised regarding the safety and health effects to humans. As with any pesticide, direct exposure to, or consumption of piscicides at full strength, can have harmful or sometimes fatal effects on humans. Antimycin is an EPA-registered pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA). Measures to ensure mandated safe use of piscicides during WDFW lake and stream rehabilitation projects are described in Section 11.c of this document, under the heading "Safety Procedures".

Public safety issues consist mainly of possible public encounters with antimycin A. Direct ingestion of normal quantities of stream water during peak treatment would not affect humans and livestock, and there are no reports of negative effects to humans or wildlife from consuming dead fish produced by stream renovation. Antimycin degrades rapidly. During active treatment, there will be signing describing the activities to discourage human consumption of lake or stream water or fish killed by the treatment. There will be no significant effects on public health and safety.

<u>Effects of Antimycin-A:</u>
Antimycin was discovered in 1945 as an product of Streptomyces fungus, which inhibited a plate culture of *Venturia inaequalis*, a fungal pathogen of apples. It was subsequently shown to prevent or reduce the growth of *Bacillus cereus* and several fungi (Leben and Keitt 1948).

Subsequently, tests were conducted by the Wisconsin Alumni Research Foundation that showed antimycin to be highly toxic to fish (Derse and Strong 1963), and suggested that it might be useful in fish management because the minute amounts which killed goldfish (*Carassius auratus*) are harmless to other aquatic animals. They also showed that the piscicide degrades in water within a matter of hours or days.

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

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

The calculation is based on several assumptions:
- Sub-chronic RfD for antimycin = 0.0017 mg/kg-day,
- Average body mass of 70 kg (BW),
- A person consumes 2 L of water per day (DI)

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

1) A factor of 10 based on the uncertainty in the animal to human translation,
2) A factor of 10 based on average human to sensitive human uncertainty, and
3) A factor of 3 based on the limited number of studies.

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

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

The calculation of the antimycin criteria is as follows:

0.0017 mg/kg-day (RfD) * 70 kg (BW) / 2 L/day (DI)

Based on the prescribed concentration from the product label of 5-10 ppb, and the anticipated concentration that would likely be used in this project of 7-8 ppb, the maximum allowable concentration that could be used in the water is 10 µg/L. As with rotenone, the major threat to human health resulting from the use of antimycin is from accidental exposure to abnormally high concentrate during application. To avoid this, applicators are

cautioned by the product label, and required by the Washington State Department of Agriculture to use protective gear, as listed above.

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

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

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

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

Any threats to human health during application could be greatly reduced with proper use of safety equipment. Recreationists in the area would likely not be exposed to the treatments because treatment areas would be closed to fishing. Proper warning through news releases, signing at access points, and administrative personnel in the project area should be adequate to keep unintended recreationists from being exposed to any treated waters. Administering application in the fall of the year may further reduce exposure due to the relatively low number of recreational users at that time of year.

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

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

- Antimycin breaks down within hours of application
- Most dead fish will sink the lake bottom and/or be collected and sunk in the lakes
- The compound will be diluted by freshwater downstream of the application sites
- Project areas will be well signed so users can find an alternate source of water
- Supplemental detoxification using potassium permanganate will neutralize the antimycin

Max treatment rate of 10µg/L Antimycin:

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

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

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

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

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

Degradation of antimycin A: According to Hubert and Schmidt (2001), antimycin A is susceptible to alkaline degradation; hydrolytic cleavage occurs at the lactone carbonyl sites on the cyclic diester, degrading to antimycic acid and a lactone fragment. Degradation of antimycin A was found to be rapid in natural waters, and is accelerated by high pH, high temperatures, and sunlight. Water hardness and alkalinity do not appear to have a significant effect on the rate of degradation. Complete degradation can take from 1-14 days, but it usually occurs within 4-7 days (Lennon 1966) . The pH of water dramatically affects the degradation of antimycin A (Lee et al. 1971, Marking and Dawson 1972); at 12◦C the half-life of biological activity of antimycin A in laboratory tests was 310 hours in water at pH 6.0, but only about 1.5 hours at pH 10. Marking (1975) found that the detoxification of antimycin at high (9.5) pH was caused by two factors. The piscicide was biologically unavailable at the high pH, and since antimycin is a weak acid that ionizes in alkaline solutions, the ionized form does not pass cell membranes as readily as the lipid-soluble un-ionized form.

Detoxification of Antimycin-A with Potassium Permanganate ($KMnO_4$):
The use of potassium permanganate as a piscicide detoxicant has been assessed in the WDFW Final SEIS for lake and stream rehabilitation (2002), and is an approved activity, mandated for detoxification of rotenone as prescribed in NPDES Permit #WA0041009. The procedures and effects of its use are presented herein for general information.

Although activated charcoal has been demonstrated in the laboratory to be effective in removing antimycin from water (Dawson et al. 1976), the significantly greater volumes of water inherent in fisheries management programs require different methods to detoxify piscicides in the field situation. Experiments also show that chlorine is effective for detoxifying antimycin in soft water at pH 7.5 (Dawson and Marking 1974). After 2 hours of contact time, 0.5 mg/L of chlorine detoxified 10 µg/L of antimycin to a concentration that was sublethal to green sunfish (*Lepomis cyanellus*) in 96-hour toxicity tests.

Because potassium permanganate is a strong oxidizing agent, care must be taken when handling the product. Permanganate is considered a "hazardous chemical" because it can react with certain reducing agents and generate heat. The human health hazards on the Material Safety Data Sheet (MSDS, Appendix IV) lists it as an irritant to eyes, skin, respiratory system, and gastro-intestinal tract. When handled properly, it is safer than other commonly used oxidants. In applying the reference dose for manganese to a risk assessment, it is important that the assessor consider the ubiquitous nature of manganese, specifically that most individuals will be consuming about 2-5 mg Mn/day in their diet. This is particularly important when one is using the reference dose to determine acceptable concentrations of manganese in water and soils. It is recommended that the upper end of the range recommended by the NRC (5 mg/day, described below) be considered to represent a typical human intake from total dietary sources. For determination of acceptable concentrations of manganese in water and soil, then, the risk assessor would subtract this amount from the level specified by the RfD [i.e., 10 mg/day (RfD) – 5 mg/day (typical dietary intake) = 5 mg/day (remaining)]. For applying this number to a non-dietary scenario, it is also recommended that a modifying factor of 3 be applied.

The rationale for this modifying factor is three-fold. First, while there is no significant difference between absorption of manganese as a function of the form in which it is ingested (i.e., food versus water), there is some degree of increased uptake from water in fasted individuals (Francis and Forsyth 1995). Second, the 1989 study by Kondakis et al. (*in* Francis and Forsyth 1995) has raised concerns for possible adverse health effects associated with a lifetime ingestion of drinking water containing about 2 mg/l manganese. While no data are available to quantify total intake of manganese, one would not expect this concentration of manganese in water to be a problem based on dietary information revealing intakes ranging from 2 to 10 mg/day that are not associated with adverse health effects. Third, although toxicity has not been demonstrated, there are remaining concerns for infants fed formula which typically has a much higher concentration of manganese than does human milk (U.S. EPA 2004). If powdered formula is made with drinking water, the manganese in the water would represent an additional source of intake.

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

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

Assuming no exposure from soil and a 70 kg person drinking 2 L/day, the suggested advisory level is: 0.0238 mg/kg-day x 70 kg x 1 day/2 L = 0.8 mg/L Mn.

Although manganese is a constituent element of this compound, it is anticipated that once it is broken down, it will be in the form of manganese dioxide (MnO_2) and will precipitate out of the water column. This biogenic precipitation is similar to the reaction between calcium (Ca^{++}) and bicarbonate (HCO_3), which is a naturally occurring reaction.

A histological and hematological study was performed to evaluate the effect of waterborne exposures of channel catfish *Ictalurus punctatus* to potassium permanganate (Darwish et al. 2002) at concentrations of $KMnO_4$ representing one, three, and five times the therapeutic concentrations (0.438, 1.315, and 2.190 mg/L, respectively). No mortalities were observed in fish not exposed (control) or in fish exposed to the therapeutic dose of $KMnO_4$. Mortalities were only observed in fish exposed to three and five times the therapeutic dose of $KMnO_4$ (9.4% and 49.6%, respectively) with most of these mortalities occurring from exposure to 2 d postexposure. The gills of surviving fish exposed to three and five times the therapeutic dose for 36 hours appeared normal at 8 days postexposure. Neutrophil count and plasma alanine transaminase activity increased significantly in fish exposed to five times the therapeutic dose; lactate dehydrogenase activity showed no

change. Exposure to the therapeutic dose at three times the therapeutic exposure time caused mild lesions but recovery occurred within 48 hours postexposure. Likewise, all stress indicators measured (except packed cell volume at the 2.19 mg/L concentration) were indistinguishable from unexposed controls within 48 hours postexposure (Griffin et al. 2002), and at the 0.4 mg/L concentration, no changes were observed in any measured stress indicator, suggesting that $KMnO_4$ could be used as a therapeutic agent for channel catfish farming. Straus (2004) found similar results were determined with hybrid striped bass (female white bass *Morone chrysops* X male striped bass *M. saxatilis*).

Antimycin and potassium permanganate used for detoxification will be broken down into naturally occurring organic compounds at non-detectable levels before they leave the treatment area. The use of antimycin A and potassium permanganate will impose no water quality or ingestion threats to humans in and/or below the treated area of any treated lake or stream section (Schnick 1974).

Effects of antimycin by human consumption

Schultz and Harman (1976) investigated the potential intake of antimycin by consumption of treated fish. Antimycin is frequently used as a thinning agent in commercial catfish ponds. Fish that are not killed by the chemical may be harvested. In their study, the level of antimycin to which the fish were exposed was 10-200 times the normal application rate. If it is assumed that 50% of a treated fish was edible, there would be an average of 17μg of antimycin in a normal restaurant serving (4 oz or 113g) of fish, or about 0.24 μg/kg for a person weighing 70 kg (154 lb). If the fish had been in antimycin-free water for 96 hours post-treatment, these values would decrease to 9.91 μg of antimycin in a 113g serving or 0.141 μg/kg for a 70-kg person. Based on the latter values, an individual would have to consume more than 7000 servings of fish at one sitting to accumulate a dose of 1 mg/kg of antimycin. In comparison, the oral LD50 for rats is 28 mg/kg, and for mice 55 mg/kg (Herr et al. 1967).

Proposed measures to avoid or reduce such increases are: inherent in the planning and application of piscicides by project biologists. Factors such as water temperatures, alkalinity, pH, and suspended sediments are considered during the pre-treatment planning for each application. Appropriate concentration of antimycin A are determined to ensure the eradication of the undesirable non-native species targeted by the treatment, and to ensure that minimal impacts will affect the native species and populations, humans and livestock.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

The waters treated provide habitat for a wide array of native and exotic species of fish, amphibians, invertebrates, and plants. Aquatic birds and mammals, as well as those using the riparian edges of the stream or lake, will be present at the time of treatments.

The toxicity of antimycin is diminished by high alkalinity, temperature, sunlight, and the metabolic activity of aquatic organisms. Antimycin has a half-life of only a few hours in fast moving non-acidic waters. Antimycin, when used in proper concentration, is less harmful than the recommended killing concentration of Rotenone to aquatic animals other than fish.

Antimycin-A degrades rapidly and most waters can be restocked with fish within 2 weeks of treatment (Gilderhus et al. 1969). Antimycin A in waters flowing from a prescribed project area will also be detoxified with the use of potassium permanganate (Marking and Bills 1975). In addition, antimycin in fish-killing concentrations is largely specific to fish and causes no harm to most of the other aquatic animals. No effect was reported on turtles, salamanders, frogs (tadpoles and adults), snakes, herons, ducks, and or terns at concentrations toxic to fish (Walker et al. 1964, Gilderhus et al. 1969).

Plants: Antimycin-A does not impact living plants. There will be minor impacts on vegetation at access sites when launching boats into lakes or preparing drip sites into streams. Research has shown that vegetation response to trampling is dependent more on plant morphology than on specific site conditions. In general, erect herbs are readily damaged by trampling, but recover quickly. Chamaephytes (low-growing forbs) are more resistant, but take longer to recover. Non-erect herbs are the most stable when subjected to trampling (Cole 1995a, 1995b). Site-specific impacts can be predicted based on the structure of local plant communities.

Gilderhus (1982) tested several fish toxicant in the presence of plants (*Elodea canadensis*) and suspended clays, and found little effect on the activity of rotenone and antimycin.

Invertebrates: The effects to aquatic invertebrates are dependent upon the species. The concerns over the use of piscicides and the popularity of their use (Finlayson et al 2002, McClay 2002) prompts the need to understand the impacts these piscicides may have on stream fauna. Benthic invertebrates are of concern as they form a major component of stream and lake food webs. Concentrations of antimycin A used to eliminate fish populations were determined to be generally ineffective at impacting invertebrate populations (Walker et al. 1964).

The parasiticidal activity of antimycin A was tested against a monogenean gillworm (*Cleidodiscus pricei*) on fingerling and adult channel catfish (Ictalurus punctatus). The gillworm was eliminated from fingerling catfish at concentrations of 0.5, 1.0 and 5.0 μg/L and from adults at 1.0 and 3.5 μg/L (Rawson and Fox 1974).

Use of Fintrol at 10 ppb to renovate an Arizona spring brook to manage the endangered Sonoran topminnow (*Poeciliopsis occidentalis*) resulted in a few invertebrates dying or exhibiting distress (Meffe 1983), including amphipods and zygopterans. Three weeks following treatment, all major invertebrate groups present prior to treatment were present and abundant, and no invertebrate species was considered to be seriously affected.

Cerreto (2004) measured responses of invertebrates to the application of 10 ppb of antimycin A by the Wyoming Department of Fish and Game to LeBarge Creek. Crustaceans appeared to be more susceptible to antimycin than insects due to differences in respiratory physiology. Crustaceans rely on gill or cutaneous respiration to get dissolved oxygen into blood and tissue, providing a direct route of entry for antimycin. Most aquatic insects respire via gas-filled trachea which are not open to the external environment or have open spiracles with barriers to keep material from the external environment out (e.g., hydrofuge hairs) and blood does not play a major role in gas exchange (Merrit and Cummings 1996). Because antimycin does not have a gaseous phase, it is possible that gas filled trachea may act as a barrier to antimycin entering the respiratory and circulatory system of insects, leaving only ingestion and absorption through the cuticle as routes of entry. Insects that rely on respiratory pigments (such as some chironomids), early insect instars that sometimes have liquid-filled trachea, and invertebrates that do not have a tracheal system, such as some Collembola (Chapman 1982), may be more sensitive to antimycin as well. However, such studies have not been performed.

Benthic annelids and insects appear to be more tolerant of antimycin than planktonic and benthic crustaceans. Callaham and Huish (1969) observed no measurable effects on benthic invertebrates in three ponds receiving successive 1.2 μg/L and 5.0 μg/L antimycin applications. Gilderhus (1969) found antimycin applications had no measurable effects on benthic invertebrates in ponds and streams. Antimycin applications of 10.4 μg/L had no measurable effects on Ephemeroptera, Odonata, and Hemiptera, and a 12 μg/L application had no effect on chironomids.

However, data on responses of aquatic invertebrates in Ord Creek (Apache County, Arizona) indicated a dramatic short-term effect by the toxicant antimycin-A on the invertebrate community. Free-living organisms,

baetid mayflies, chloroperlid stoneflies, simuliid dipterans, and hydropsychid trichopterans, were killed immediately by the renovation, and drifted downstream (Minckley and Mihalick 1981). Long-term changes were minimal with regard to numbers, biomass, and diversity of the invertebrate community. These results indicated that there could be a small impact to Apache trout in regards to their food source. This impact was determined to be small and would not have a lasting impact on the fish community.

Antimycin A was tested in the laboratory on the amphipods *Asellus intermedius, Dugesia dorotocephala, Gammarus pseudolimnaeus,* and *Hyalella azteca* (Baumann et al. 1977). *H. azteca* and *G. pseudolimnaeus* were very sensitive with 96 hr LC_{50}s <10 μg/L. *A. intermedius* also showed mortality at this level in one series of experiments. *D. dorotocephala* showed no mortality at 15 μg/L of antimycin A for eight days. The 96 hr ECT 50 values at μg/L of antimycin A were determined for *G. pseudolimnaeus* (1.4 hm) and *H. azteca* (5.3 hm). Based on these results, the 10 μg/L level of antimycin A normally used in fish control would probably eliminate *G. pseudolimnaeus* and *H. azteca*, two important fish food organisms.

When Big Dry Creek, New Mexico was treated with antimycin A in 1985, there was a minimal, short-term effect on the macroinvertebrate community, but no long-term effect was documented (Mangum 1985, US Fish and Wildlife Service 1993).

Antimycin-A is a thiol-group-blocking agent that is found to reduce the initial and total uptake of ecdysone (a molting hormone) into crayfish (*Astacus leptodactylus*) hypodermis. However, antimycin-A did not reduce the retention of that hormone. The inhibitory effect of antimycin A could be completely overcome. Antimycin A is without any effect on the retention of the hormone even after 1 hour of incubation. Moreover, antimycin A was demonstrated to be washed out and maximal uptake regained (Daig and Spindler 1983). The use of antimycin to remove non-native fishes and allow for the reintroduction of native Southern Appalachian brook trout in the Great Smoky Mountains National Park did not impact crayfish or mollusks (Steve Moore, Chief Fisheries Biologist, Great Smoky Mountains National Park, personal communication).

Antonioni (1974) exposed 2 species of mussels (*Lampsilis siliquoidea* and *Elliptio dilatatus*) to 4 dosage levels of antimycin (5, 10, 12 & 15 ppb at 17°, 22° and 27°C) a lab test using liquid Fintrol® on the 2 species of mussel and found that antimycin was lethal to mussels at those dosages and over a long period of time (27 days). However, Waller et al. (1993) tested the toxicity of 18 chemicals to exotic zebra mussels (*Dreissena polymorpha*), and a unionid mussel, threehorn wartyback (*Obliquaria reflexa*). An LC_{50} value could not be estimated for antimycin and potassium permanganate due to insufficient mortality of the test organisms. The toxicity of the candidate chemicals was generally greater to fish than to threehorn or zebra mussels. Rainbow trout and channel catfish were significantly more sensitive than zebra mussels to all of the chemicals tested.

Vertebrates:
The effects of antimycin on fish have been thoroughly studied and reviewed. A brief overview is presented here, as comprehensive reviews are available elsewhere (Walker et al. 1964, Berger et al. 1969, Gilderhus et al. 1969, Schnick 1974).

Fish:
When added directly to the circulatory system, antimycin can be toxic to animals in low concentrations. When antimycin is added to water in an organic solvent, it passes through the gill epithelium of fish, enters the blood stream, and is delivered throughout the body. Toxic effects on fish injected with antimycin were similar to fish immersed in a solution containing antimycin (Berger et al. 1969).

Antimycin-A is lethal to most freshwater fish species at low concentrations and short exposure times, affecting

fish species at different concentrations. Fish eggs react slowly to the toxic effects of antimycin, often taking more than 72 hours to exhibit mortality, and mortality is difficult to determine by gross observation (Olson and Marking 1975). Trout and spiny-rayed fish are killed at relatively low concentrations, and catfish species are more resistant to the treatment (Schultz and Harman 1976). Walker et al. (1964) found that carp (*Cyprinus carpio*) and other rough fish were killed by small concentrations in short exposures at cool and warm temperatures, but longnose gar (*Lepisosteus osseus*), bowfin (*Amia calva*), black bullheads (*Ictalurus melas*) and yellow bullheads (*I. natalis*) were relatively resistant to the quantities tested. Diet has no apparent influence on the sensitivity of fish to antimycin (Marking et al. 1984).

Lethal concentrations of antimycin to fish can range from < 1 µg/L to > 200 µg/L, depending on the target species and water quality. The species most sensitive to antimycin include gizzard shad (*Dorosoma cepedianum*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), white sucker (*Catostomus commersoni*), Iowa darter (*Etheostoma exile*), yellow perch (*Perca flavescens*), common carp (*Cyprinus carpio*), green sunfish (*Lepomis cyanellus*), pumpkinseed sunfish (*Lepomis gibbosus*), and walleye (*Sander vitreus*). These species are susceptible to antimycin concentrations <1 µg/L (Walker et al. 1964, Berger et al. 1969). Antimycin-tolerant species include black bullhead (*Ictalurus melas*), brown bullhead (*Ictalurus nebulosus*), yellow bullhead (*Ictalurus natalis*), channel catfish (*Ictalurus punctatus*), gar (*Lepisosteus* spp.), goldfish (*Carassius auratus*), and bowfin (*Amia calva*). Antimycin concentrations ranging from 25 to >200 µg/L are required to kill these species (Walker et al. 1964, Berger et al. 1969, Gilderhus et al. 1969). Several mechanisms may determine the level of sensitivity of fish to antimycin, although no research exists. Oxygen requirements of some species are reflected in the tolerance to antimycin. Salmonids, which require high oxygen concentrations, are among the most sensitive whereas ictalurids, which are more tolerant of low oxygen concentrations, are least sensitive.

Gilderhus (1979) investigated the efficacy of antimycin for the control of larval sea lamprey (*Petromyzon marinus*) in lentic habitats, and found it to be effective against adult and larval forms.

Rach et al. (1994) experimented with antimycin (Fintrol) bait as a fish toxicant, and found that such formulations could control carp populations. The formulation (5 mg/kg of antimycin in fish meal and binder) was effective at > 0.346 mg/kg of fish. The bait concentrations required higher dosages, due to the lower efficiency of antimycin when ingested than when adsorbed at the gill-water interface.

Reptiles and Amphibians:
In laboratory and field tests, Walker et al. (1964) found that plankton, aquatic plants, bottom fauna, salamanders, tadpoles, and turtles were not harmed by piscicidal concentrations of antimycin. Antimycin A has less effect than rotenone on amphibians, and aquatic macroinvertebrates when applied in recommended dosages, although it does cause mortality of amphibians (US Fish and Wildlife Service 1993).

Gilderhus et al. (1969) observed no effects on non-target vertebrates in 8 ponds and 5 streams treated with antimycin. Although no measurements were made, they reported no observable effects on salamanders (Ambystomidae), adult and larval frogs (Ranidae), turtles (Chelydridae), or water snakes (Colubridae). Walker et al. (1964) conducted bioassays on adult tiger salamanders (*Ambystoma tigrinum*) and bullfrog larvae (*Rana catesbiana*). Tiger salamanders survived an 80 µg/L exposure for 96 hr and were killed by a 600 µg/L, 96 hr exposure. Bullfrog larvae survived a 20 µg/L, 24 hr exposure to antimycin and were killed by a 40 µg/L, 24 hr exposure. Bioassays for both species were conducted at 12° C and toxic effects occurred at concentrations and exposure periods that far exceed typical piscicidal treatments. Schnick (1974) observed no mortality to leopard frogs (*Rana pipiens*) in typical piscicidal concentrations and exposure periods. Observed LC_{50}s ranged from 3.8 µg/L for 96 hr to 59 µg/L for 24 hr. Observations following antimycin treatment of approximately 5km of

Sun Creek, Klamath County, Oregon to eradicate non-native eastern brook trout showed no mortality of amphibians (Buktenica 1997). The use of antimycin to remove non-native fishes and allow for the reintroduction of native Southern Appalachian brook trout in the Great Smoky Mountains National Park did not impact native salamanders (Steve Moore, Chief Fisheries Biologist, Great Smoky Mountains National Park, personal communication).

Birds:
Antimycin is not known to effect birds (Schnick 1974). Gilderhus et al. (1969) observed no effects on non-target vertebrates in 8 ponds and 5 streams treated with antimycin. No effects were observed on birds, including herons (Ardeidae), surface feeding ducks (Anatinae), diving ducks (Aythyinae), gulls (Larinae), and terns (Sterninae), feeding on fish killed by antimycin.

Mammals:
Antimycin-treated water was given to dogs and rats as the sole source of drinking water and antimycin-killed fish were administered to dogs and rats as one-half their diet in tests lasting 3 months (Greselin and Herr 1974). In both studies, no toxic effects were noticed in the animals which drank treated water or which ate fish killed by antimycin. A decrease in food consumption was observed in a few dogs and rats at the beginning of the test. It was not considered toxic manifestation but was clearly the reaction of the animals to the bitter taste of the compound. Antimycin lacks a direct route of entry to other vertebrates. The possibility of an unintentional and prolonged infusion or sub-dermal injection is quite remote.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:
The application of antimycin A will be conducted by licensed personnel according to label restrictions, following analysis of impacts on fish and wildlife in the treated area, as discussed in section 11.c

3. How would the proposal be likely to deplete energy or natural resources?
It is not anticipated that the activities resulting from this proposal will deplete energy or natural resources.

Proposed measures to protect or conserve energy and natural resources are: Does Not Apply

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?
The use of antimycin and rotenone to control exotic species of fish for the benefit of native species may impact recreational fisheries currently directed toward those exotic species. The restoration of depleted populations of threatened, endangered or sensitive species may result in less restrictive land use limitations, as species are removed from listings under the Endangered Species Act.

The use of antimycin for removal of exotic fish species to benefit and restore depleted populations of native species is well-documented:

The National Park Service has used antimycin to remove exotic fish from several National Parks as part of the restoration program for native fish species. Gresswell (1991) reported on the use of antimycin to remove exotic eastern brook trout (*Salvelinus fontinalis*) for the benefit of native Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) in Yellowstone National Park, Wyoming.

At Crater Lake National Park, Oregon, antimycin was used to eradicate exotic brook trout to restore native bull trout, *Salvelinus confluentus*, currently listed as Threatened under the Endangered Species Act (Buktenica 1997). Rosenlund and Stevens (1992) reported that Fintrol® had been used to remove non-native salmonids from 26 Colorado lakes and streams between 1973 and 1990 to re-establish populations of Greenback (*O. c. stomias*) and Colorado River cutthroat trout (*O. c. pleuriticus*). Antimycin was used to eradicate exotic rainbow trout (O. mykiss) from Sams Creek, Great Smoky Mountains National Park, Tennessee (National Park Service 2000), as part of a program to introduce eastern book trout which are native to that area.

Proposed measures to protect such resources or to avoid or reduce impacts are: All lake and stream rehabilitations will conform to the provisions of Fish and Wildlife Commission Policy C3010, which states:

The control of undesirable fish populations using chemical piscicides is a valuable and cost effective management tool for providing quality fishing opportunities and protecting native species in many waters of the state.

Specific policies:
1. All lake and stream rehabilitations will follow state and federal laws.
All proposed rehabilitations will adhere to state water quality requirements (WAC 173-201A), the Washington Pesticide Control Act (RCW 15.58), State Environmental Policy Act (SEPA) and federal Clean Water Act.

a. All applicable environmental, health and safety regulations will be followed.
All proposed rehabilitations will follow and adhere to chemical piscicides labeling restrictions and chemical materials safety data sheet requirements to ensure protection of the public, Department personnel and environment during rehabilitation treatments.

2. Waters will not be treated in ways which would cause significant negative impacts to fish or wildlife which are state or federally listed as Threatened, Endangered, Sensitive or Candidate Species.
An exception may be granted in the case of a biological emergency.

3. The public will be part of the decision-making process.
A public meeting will be held in the vicinity of the proposed rehabilitation(s) before a final decision is made.

4. An appropriate assessment of existing fish populations and associated risks will be undertaken for all natural bodies of water proposed for treatment if they have not been previously treated.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?
It is not anticipated that the activities consequent to this proposal would affect land or shoreline uses. Fisheries management activities to remove undesirable exotic species of fish may conflict with current recreational uses of those species by sport fishers. This issue is not specific to the use of antimycin as a fish toxicant.

Proposed measures to avoid or reduce shoreline and land use impacts are: Does Not Apply

6. How would the proposal be likely to increase demands on transportation or public services and utilities?
It is not anticipated that this proposal will increase demands on transportation or public services and utilities.

Proposed measures to reduce or respond to such demand(s) are: Does Not Apply

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

The activities included in this proposal will comply with all applicable local, state and federal policies and laws. The use of antimycin-A in lake and stream rehabilitation will be consistent with the Washington Fish and Wildlife Commission Policy No. POL-C3010, with the requirements of the WDFW National Pollutant Discharge Elimination System Permit #WA0041009 (and any subsequent permits), and with WDFW health and safety policies.

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APPENDIX I

PRE-REHABILITATION PLAN
Name of Water to be Rehabilitated

I. PROPOSAL
A. Justification for Proposed Rehabilitation

B. Physical Description of Water Proposed for Rehabilitation
l. WATER NAME:
2. LOCATION: Section(s) Township Range County.
3. SURFACE ACRES:
MAXIMUM DEPTH (feet):
4. VOLUME (lbs H2O):
5. OUTLET (describe):
6. STREAM:
FLOW (cfs):
7. PUBLIC ACCESS:
8. LAND OWNERSHIP: PUBLIC % PRIVATE %
9. ESTABLISHED RESORTS:

C. Proposed Management Actions
1. WATER:
2. TARGET SPECIES:
3. DATE LAST REHABED:
4. PROPOSED TREATMENT DATE:
5. REPLANTING DATE:
6. SPECIES:
7. CATCHABLES: FINGERLINGS:
8. PROPOSED TOXICANT:
CONCENTRATION:
AMOUNT (AT x% ACT. INGRED):
9. METHOD OF APPLICATION:
10. CREW DESCRIPTION: Leader(s)

II. PURPOSE (Description):

III. INTENDED OUTCOME/MEASURE OF SUCCESS:

IV. RESOURCE IMPACTS:

V. MITIGATING FOR ADVERSE IMPACTS:

VI. RECREATIONAL IMPACT: ALSO SEE PROPOSAL I.A.

VII. ECONOMIC IMPACTS:

VIII. RELATED MANAGEMENT ACTION:

IX. PUBLIC CONTACT:

Initiated by:

APPENDIX II

POST TREATMENT DISCHARGE MONITORING REPORT

1. Water Name:

2. County:

3. Section: Township: Range:
Latitude: Longitude:

4. Date(s) of Treatment:

5. Purpose of Treatment:

6. Name of Licensed Applicator:

7. Lake Description: Surface Acres: ;Volume, Acre Feet:

Maximum Depth: ; Average Depth:

8. Stream Description: Width: ; Length:

Flow Rate of Stream/Outlet (cu. ft. per sec.):

Volume and Weight of Water Treated (gallons, pounds):

9. Name of Fish Toxicant Product Used:

10. Description of Treatment Method(s):

11. Quantity of Fish Toxicant used (pounds and/or gallons):

12. Concentration of piscicide in formulated product:

13. Concentration of active fish toxicant in water (ppb or ppm):

14. Water conditions/quality: Temperature: ; pH: ; Hardness: ;

Alkalinity: ; Other:

15. Detoxification of rotenone or antimycin treated water (if required): Description of detoxification methods/equipment; potassium permanganate application rate (pounds per hour); flow rate of stream/outlet (cu. ft. per sec.); estimate of average concentration (ppm):

16. Description of lake inlets(s)/outlet(s) and any temporary water control measures (if required):

17. Period of Toxicity (duration of water quality reduction):

18. Eradicated fish species, and likelihood of a complete kill (effectiveness):

19. Results of pre and post treatment monitoring:

20. Impact on non-target organisms:

21. Description of treatment/detoxification and other comments:

22. Copy of the amended FSEIS for lakes/streams treated during the reporting period including all SEPA comments, results and decisions

APPENDIX III

Draft - General Information on Stream Rehabilitation

Pre-renovation activities will begin with personnel identifying public access areas, drip station locations, and difficult treatment sites that will require backpack spraying. Difficult treatment sites include backwaters, seeps, and springs not influenced by the streams flow. A hip chain will be used to measure distances, and flagging will be placed to mark drip station locations. In addition, detoxification sites will be marked. An additional station will be placed further downstream in the event that the primary detoxification station fails to fully detoxify treated water.

Measurement of stream discharge and physical parameters (pH and water temperature) throughout the treatment area will be taken. This data will be used to estimate the amount of antimycin-A and potassium permanganate needed. A bioassay using caged fish (non-native trout) will then be conducted to determine toxicant concentrations (typically 10 to 20 ppb), and distances between drip stations (typically 328 to 492 feet (ft)). A final determination of the amount of antimycin-A to be used will be made using label directions and the bioassay results.

A salvage of resident native fish will be conducted prior to treatment. Fish will be captured using one or more battery-powered backpack electroshockers. Salvaged fish will be maintained in a net pen near the treatment site, or transported by truck to a local fish hatchery. Following a successful renovation, salvaged fish will be returned to the treated area.

When acceptable weather conditions occur, a field crew will add pre-determined amounts of antimycin-A to the water in each drip station and the drip stations will be activated. A second field crew will then begin the backpack sprayer application. Addition of antimycin-A, activation of each drip station and backpack sprayer application will occur sequentially, on an upstream to downstream basis. When drip stations are empty, they will be rinsed with stream water, which will be poured into the stream. Stations will then be dismantled and collected. During the treatment period, drip stations will be monitored to ensure that all deployed sites are operating properly, and the stream and access areas will be patrolled to ensure that recreationists are advised of the treatment.

Detoxification of stream water with potassium permanganate will start at least one hour before antimycin-A is expected at the downstream end of the treatment area, and will continue for at least 24 hours after the calculated end of the antimycin treatment. Staff will remain onsite for the duration of detoxification to continuously monitor the flow from the detoxification station.

Nonnative trout will be placed in a live car approximately 1,000 ft downstream of the primary detoxification site. Monitoring will determine if fish in the live car begin dying because of incomplete detoxification at the primary station. If this occurs, the next downstream detoxification station will be activated. Dead fish throughout the treatment area may be collected and disposed.

Following the treatment, a complete visual survey and complete electrofishing survey, utilizing battery powered backpack electrofishers, will be conducted to evaluate the success of the renovation.

If live fish are collected or observed, a second deployment of antimycin-A will be planned. In addition, macroinvertebrates within the treatment area will be monitored to evaluate their recovery.

Appendix IV: MSDS Sheet on Antimycin A

Antimycin A in Acetone Issued 04/17/1997

Antimycin
MATERIAL SAFETY SHEET

Section 1. Chemical Product and Company Identification

NAME: ANTIMYCIN A IN ACETONE

MANUFACTURER: Aquabiotics Corporation
10750 Arrow Point Drive
Bainbridge Island, WA 98110
Telephone Number: 1-206-842-1708
Fax Number: 1-206-842-7266

Section 2. Composition/Information On Ingredients

INGREDIENT NAME:		Acetone *
CONCENTRATION:		80.0000%
CAS/RTECS NUMBERS:		67-64-1 AL3150000
OSHA-PEL 8HR TWA:		750 ppm
	STEL:	1000 ppm
	CEILING:	N/L
ACGIH-TLV 8HR TWA:		750 PPM
	STEL:	1000 PPM
	CEILING:	N/L
OTHER	8HR TWA:	N/A
LIMITS	STEL:	N/A
	CEILING:	N/A

* Hazardous per OSHA criteria

INGREDIENT NAME:		Antimycin A *
CONCENTRATION:		20.0000%
CAS/RTECS NUMBERS:		1397-94-0 / CD0350000
OSHA-PEL 8HR TWA:		N/L
	STEL:	N/L
	CEILING:	N/L
ACGIH-TLV 8HR TWA:		N/L
	STEL:	N/L
	CEILING:	N/L
OTHER	8HR TWA:	N/A
LIMITS	STEL:	N/A
	CEILING:	N/A

* Hazardous per OSHA criteria

Section 3. Hazards Information

EMERGENCY OVERVIEW: Flammable Liquid and a marine hazard. The active component is toxic by ingestion and may also by skin absorption. It is an eye, skin and respiratory irritant.

ROUTE(S) OF ENTRY:	Skin:	Yes
	Inhalation:	Yes
	Ingestion:	Yes
INGESTION RATING:	Highly Toxic	
SKIN ABSORPTION RATING:	Possibly highly toxic	
INHALATION RATING:	N/D	
CORROSIVENESS RATING:	N/D	
SKIN CONTACT RATING:	Irritant	
SKIN SENSITIZATION RATING:	N/D	
EYE CONTACT RATING:	Irritant	

TARGET ORGANS: Eyes, skin, respiratory tract, cardiovascular system, nervous system, kidneys, possible fetus

CARCINOGENICITY RATING: NTP: N/L IARC: N/L OSHA: N/L ACGIH: N/L None

SIGNS AND SYMPTOMS: N/D . Inhalation of vapors or aerosol could irritate the eyes, nose and respiratory tract. Direct contact with skin or eyes could produce severe irritation. Systemic intake could produce a decrease in blood pressure, nausea, light headedness, dizziness, excitement, incoordination, weakness, loss of coordinated speech and drowsiness.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: N/D. Available information suggests pre-existing eye, skin, respiratory, kidney, nervous system or cardiovascular ailments.

Section 4. First-aid Measures

EYES: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. No known antidote. Provide symptomatic/supportive care as necessary.

SKIN: Remove from source of exposure. Flush with copious amounts of water. If irritation persists or signs of toxicity occur, seek medical attention. No known antidote. Provide symptomatic/supportive care as necessary.

INGESTION: Remove from source of exposure. Seek medical attention. No known antidote. Provide symptomatic/supportive care as necessary.

INHALATION: Remove from source of exposure. If signs of irritation or toxicity occur, seek medical attention. No known antidote. Provide symptomatic/supportive care as necessary.

Section 5. Fire Fighting Measures

FLASH POINT:	0 F (for acetone)
FLASH POINT METHOD:	Closed Cup
LOWER EXPLOSIVE LIMIT(%):	2.6% (for acetone)
UPPER EXPLOSIVE LIMIT (%):	12.8% (for acetone)
AUTOIGNITION TEMPERATURE:	869 F (for acetone)

FIRE AND EXPLOSIONS HAZARDS: Flammable Liquid. Keep away from heat, sparks and open flame.
EXTINGUISHING MEDIA: Use "alcohol" foam, dry chemical or carbon dioxide. Water may be ineffective.
FIRE FIGHTING INSTRUCTIONS: Wear protective clothing and self-contained breathing apparatus.

Section 6. Accidental Release Measures
SPILL OR RELEASE PROCEDURES: Recover product and place in an appropriate container for disposal. Ventilate and wash the spill area.

Section 7. Handling and Storage
HANDLING: Ground and bond all containers during transfer operations
STORAGE: Tight container.
SPECIAL PRECAUTIONS: Wash hands and face after handling this compound.

Section 8. Exposure Controls/Personal Protection

ENGINEERING CONTROLS:	Use local exhaust.
RESPIRATORY PROTECTION:	Air purifying respirator with organic vapor cartridge.
SKIN PROTECTION:	Butyl rubber.
EYE PROTECTION:	Full-face respirator.
OTHER PROTECTION:	Wear saranex tyvek coverings with hood and shoe covers if contact may occur.

Section 9. Physical and Chemical Properties

APPEARANCE/PHYSICAL STATE:	Brown to black liquid
ODOR:	Acetone
BOILING POINT:	56.2 C (for acetone)
MELTING/FREEZING POINT:	-94.6 C (for acetone)
VAPOR PRESSURE (mm Hg):	N/D
VAPOR DENSITY (Air = 1):	N/D
EVAPORATION RATE:	N/D
BULK DENSITY:	N/D
SPECIFIC GRAVITY:	0.8 (for acetone)
SOLUBILITY:	Miscible in water, alcohols, ethers and most organic solvents.
pH:	N/D
VISCOSITY:	N/D

Section 10. Stability and Reactivity

CHEMICAL STABILITY:	Neutralize active component with bleach, potassium permanganate, or other strong oxidizer.
INCOMPATIBILITIES:	Oxidizers
HAZARDOUS DECOMPOSITION PRODUCTS:	N/D
HAZARDOUS POLYMERIZATION:	N/D

Section 11. Toxicological Information
ORAL TOXICITY: N/D. LD50 = 30 mg/kg in rates for antimycin A. LD50 = 1738-10,700 mg/kg in mice, rats and rabbits for acetone.
DERMAL TOXICITY: N/D. Cumulative lethal dosage for antimycin A in rabbits about 65-170 mg/kg in animals receiving one gram of a 5% suspension in carbowax twice daily for three applications. Death possibly

the result of absorption through broken skin as marked inflammation present after second application. LD50 = 20,000 mg/kg in rabbits for acetone.
INHALATION TOXICITY: N/D. A 10% formulation of antimycin A in alcohol administered to rats and guinea pigs as an aerosol for 10 minutes a day for 5 days at a nominal concentration of 170 mg/m3 produced eye irritation with corneal lesions and respiratory irritation and damage. LCLo = 16,000 ppm/4H in rats and 467,300 ppm/1 H in mice for acetone. Vapors can cause irritation of the respiratory tract.
CORROSIVENESS: N/D
DERMAL IRRITATION: N/D. No irritation found following dermal application of 0.5 gram of a 5% suspension of antimycin A in carbowax (25 mg antimycin A); however, exudation, edema and scab formation were found after the first two of six applications over three days. Acetone mildly irritating to rabbit skin. Repeated or prolonged contact can cause dermatitis.
OCULAR IRRITATION: N/D. Corneal opacity clearing in four weeks resulted following application of 0.1 gram of antimycin A to the eyes of guinea pigs. Application of 0.5 grams of 5% antimycin A in alcohol to the eyes of rabbits resulted in slight redness. Acetone severely irritating, with corneal injury in rabbits. Vapors can cause eye irritation and burning. Can cause stinging if splashed in the eyes.
DERMAL SENSITIZATION: N/D.
SPECIAL TARGET ORGAN EFFECTS: N/D. Dietary administration of antimycin A a dosage of 10 mg/kg/day for four weeks produced soft stools and reduced water gain in rats. Dietary administration at a dosage of 0.5 mg/kg/day to rats prior to and during pregnancy resulted in reduced body weight of the offspring (about 10%). Infusion to dogs at a rate of 1 mcg/kg/minute for 1 hour produced no adverse effects; however, infusion of 10 mcg/kg/minute produced depressed blood pressure, slowed heart rate and death. Acetone causes central nervous system depression at elevated vapor concentrations and irritation at lower concentrations. Produced kidney injury in rats at oral dosages of 500 mg/kg/day or more.
CARCINOGENICITY INFORMATION: N/D

Section 12. Ecological Information

ECOLOGICAL INFORMATION: Marine hazard. Used in conjunction with a surfactant to kill fish.

Section 13. Disposal Considerations

WASTE DISPOSAL METHODS: Dispose of product in accordance with federal, state and local regulations.

Section 14. Transport Information

DOT STATUS:	Regulated
PROPER SHIPPING NAME:	Flammable Liquids, toxic, n.o.s. (Acetone, Antimycin A), 3, UN1992, II
HAZARD CLASS:	3
UN NUMBER:	UN1992
PACKING GROUP:	II
IATA/ICAO STATUS:	Regulated
PROPER SHIPPING NAME:	Flammable liquid, toxic, n.o.s., (Acetone, Antimycin A)
HAZARD CLASS:	3
UN NUMBER:	UN1992
PACKING GROUP:	II
REPORTABLE QUANTITY:	5000/2270
IMO STATUS:	Regulated
PROPER SHIPPING NAME:	Not Authorized
HAZARD CLASS:	N/D

UN NUMBER:	N/D
PACKING GROUP:	N/D
REPORTABLE QUANTITY:	N/D
FLASH POINT:	0 F (for acetone)

Section 15. Regulatory Information

TSCA STATUS:	Exempt
CERCLA STATUS:	N/D
SARA STATUS:	N/D
RCRA STATUS:	N/D
PROP 65 (CA):	N/D

Section 16. Other Information

LEGEND: N/A =
N/D = Not Determined
N/L = Not Listed
L = Listed
C = Ceiling
S = Short-term
® = Registered Trademark of Aquabiotics Corporation
™ = Registered Trademark of Aquabiotics Corporation