

**Lynn Camp Prong, Brook Trout Restoration
Great Smoky Mountains National Park
Final Project Plan, 2008**



Project Purpose and Objectives

The purposes of the project are to continue restoration of Southern Appalachian brook trout to more streams within its natural range in the Great Smoky Mountains and to provide the visiting public with a greater opportunity for recreational fishing of brook trout.

Background

Historically, brook trout have been eliminated from lower-elevation streams due to impacts from logging activities and to the encroachment of non-native rainbow trout into streams exclusively occupied by brook trout. Current data indicates that encroachment by non-native trout has slowed dramatically and is therefore not likely to cause further range loss.

Brook trout distribution data from the 1990s indicates that six brook trout populations have been lost at high elevations, and acidic deposition is suspected as the primary reason for these recent declines. Over 65% of known brook trout streams and populations are at or above an elevation of 1,067 meters and are at risk based on these pH trends of the last 30 years. Therefore, steps to restore brook trout to segments of their historic range at lower elevations where historic logging and non-native encroachment eliminated brook trout, should be taken as soon as possible, as low elevation streams are less likely to be impacted by acidic deposition in the future and can best safe guard brook trout in the long term. The proposed project focuses on appropriate lower-elevation stream habitat.

Project leaders envision four key steps in implementing their restoration goal: (1) preparation; (2) removal of non-natives; (3) restoration of brook trout; and (4) monitoring and recreational fishing. In 2007, project leaders will validate existing fish distribution data and initiate pre-treatment aquatic insect monitoring. In 2008, they will remove non-native rainbow trout using Fintrol[®] (antimycin A). In 2009, they will validate removal success and restock the stream with native brook trout. Once annual population monitoring indicates the reintroduced brook trout have expanded and stabilized (as determined by regular monitoring), the park will open the stream to recreational fishing.

Project Objectives:

1. In September 2008, remove non-native rainbow trout using Fintrol[®] (antimycin).
2. Provide on site training for state and federal biologist in the proper and safe application of antimycin in September 2008.
3. In 2009, validate removal success and restock the stream with native brook trout.
4. Provide recreational fishing opportunities once the brook trout population has expanded and stabilized. This will be determined through annual fish population monitoring activities.

Ecological Significance and Context of the Project

Great Smoky Mountains National Park boasts more than 2,000 miles of protected streams, viable populations of the Southern Appalachian brook trout, and strong partners to assist with restoration efforts through fundraising and volunteers. In recent years, the park and its partners have successfully re-introduced the Southern Appalachian brook trout to 17.2 miles of streams within the Great Smoky Mountains. A key component of any restoration project is the existence of a barrier to prevent re-invasion of non-natives from downstream.

In the Lynn Camp Prong watershed, native “Southern Appalachian” brook trout currently occupy approximately 1.0 mile of marginal habitat in the extreme headwaters of Marks Creek and Lynn Camp Prong (Map, Figure 1). The population in upper Lynn Camp Prong is perhaps the most threatened population of southern Appalachian brook trout in GRSM, as it is open to invasion by rainbow trout and threatened by acidic deposition. A cascade and waterfall exists at 2,000 feet to prevent non-native trout from returning to the restored stream section (Figure 1) which makes the stream well suited for successful restoration.

Benefits

This proposal is a proactive approach to reestablishing native brook trout in a segment of their historic range in GRSM. The successful completion of this project will reconnect populations that have been isolated for over 75 years and increase the number of kilometers of stream that have been restored for native brook trout by approximately 50%. Additionally, the completion of this project will help GRSM meet restoration goals for native brook trout identified in the Park’s fishery management plan. The successful restoration of Lynn Camp Prong will also restore brook trout to approximately 12.8 km (8 miles) of stream below 1,067m, which is less susceptible to acidic deposition and pH effects on trout. Approximately 25% of the remaining habitat designated for conservation on public lands occurs in GRSM; therefore, it is critically important that the Park expand the range where feasible. If successful, fish from the Park could be used as a source of brood stock for other restoration projects in the region.

One of the goals of the Eastern Brook Trout Joint Venture (EBTJV) is the restoration and protection of brook trout in its native range. This group has identified acidic deposition as one of several threats to the long-term survival of the species. If approved, this project will provide training for state and federal biologists interested in learning how to conduct native fish restoration projects using antimycin. The successful completion of this project will help meet the goals of the EBTJV for the range wide protection and preservation of brook trout in its native range.

The Eastern Brook Trout Joint Venture (EBTJV) is in the process of developing a range wide Conservation Plan to insure the protection and preservation of brook trout in its native range. Part of this plan focuses on the development of partnerships and restoration of native brook trout populations in streams where the populations have been significantly reduced or lost. The planned restoration of Lynn Camp Prong will provide the EBTJV with the opportunity to have biologists from the partnering states to receive

training in the use of antimycin for native fish restoration by participating in the project in GRSM. Each participating biologist will receive safety training prior to the implementation of the project and will participate in the range of daily activities during the project to ensure a thorough understanding of the intricacies involved in projects of this type.

Brook Trout Management Strategy

This project is a proactive approach to reestablishing native brook trout in a segment of their historic range in GRSM. The completion of this project will help GRSM meet restoration goals for native brook trout identified in the Park's fishery management plan. The successful completion of this project will reconnect populations that have been isolated for over 75 years and increase the number of kilometers of stream that have been restored for native brook trout by approximately 50%. The successful restoration of Lynn Camp Prong will also restore brook trout to approximately 12.8 km (8 miles) of stream below 1,067m, which is less susceptible to acidic deposition and pH effects on trout. Approximately 25% of the remaining habitat designated for conservation on public lands occurs in GRSM; therefore, it is critically important that the Park expand the range where feasible.

Legal Authority

The Park's brook trout management strategy for GRSM is directed by National Park Service Policies that state "The Service will successfully maintain native plants and animals by

- Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- Restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and" (Management Policies 2006, 4.4.1)

Management policy 4.4.2.2 provides specific guidance for the restoration of native plant and animal species and 4.4.4.2 provides guidance for the removal of exotic species already present.

Project Managers

Stephen E. Moore, Supervisory Fishery Biologist

Matt Kulp, Fishery Biologist

The project managers will conduct project safety meetings and provide instruction in the proper set and operation of antimycin A application stations including data recording. They will direct daily operations of fish collection, placement of live cages with sentinel fish, the collection and holding of other native non-game fish and they will mix and measure the required amount of antimycin for each station and over see cleanup of antimycin equipment. Additionally they will schedule and supervise the setup and operation of the potassium permanganate deactivation station.

The project managers received initial training in the application of antimycin A during a Bull Trout restoration project in Crater Lake National Park. In 2001, Bruce Rosenlund,

USFWS provided additional training during a project in Great Smoky Mountains National Park (GRSM). Since that time they have served as project managers for two additional projects in GRSM, a project in Great Basin National Park and two projects in S.C.

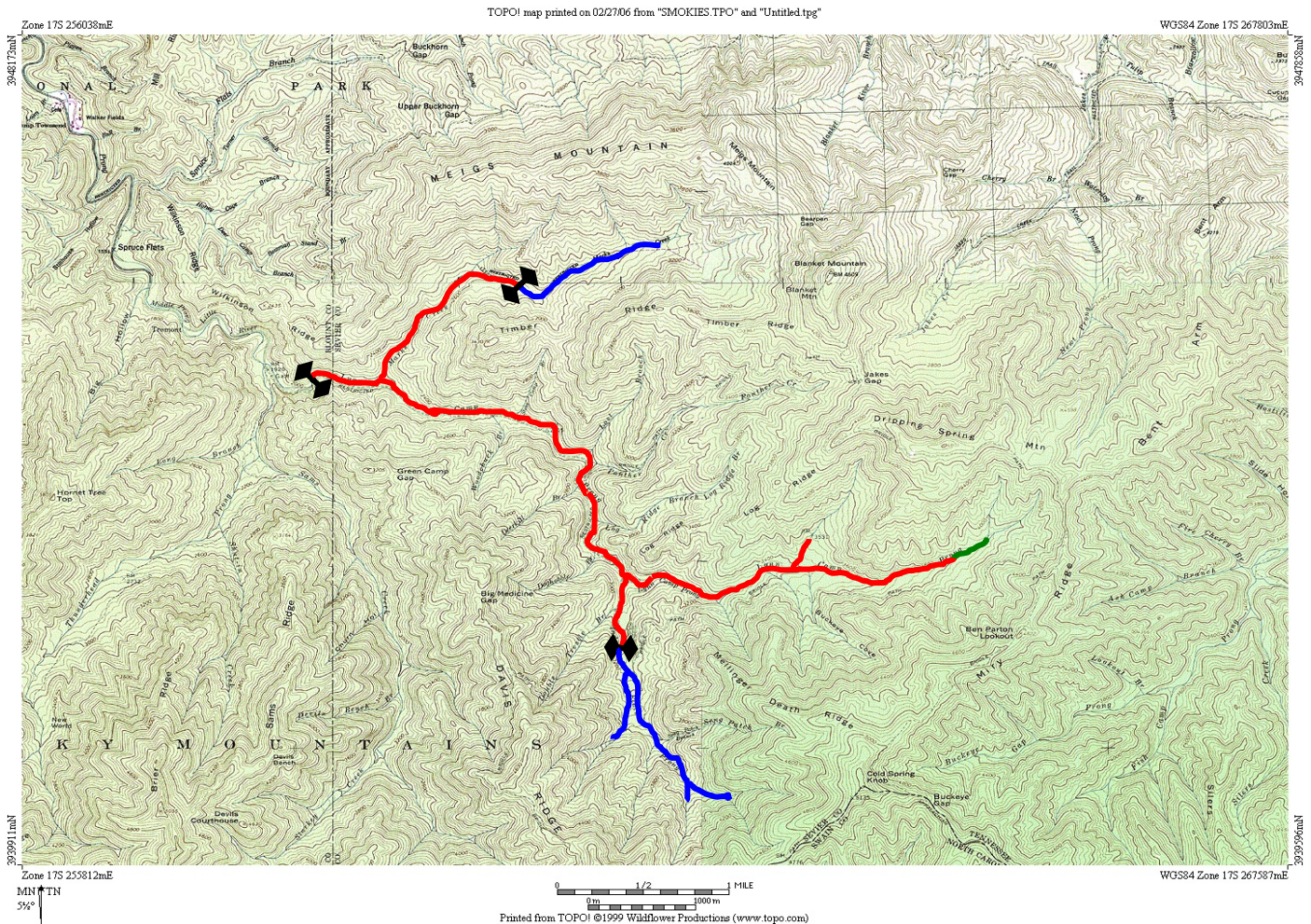
Treatment Overview

Application Dates

September 8 – 19, 2008

Project Area

Figure 1. – Map of Lynn Camp Prong watershed, Great Smoky Mountains National Park, including barrier falls and current brook trout distribution within the watershed. Red lines indicate pure rainbow trout, blue pure brook trout, and green mixed rainbow and brook trout. Natural barriers are noted by dumbbell bars at lower Lynn Camp Prong, Marks Creek, and lower Indian Flats Prong.



Antimycin will be applied to all areas marked in red or green. The cascade and waterfall at 2,000 feet are barriers to the upstream migration of non-native salmonids.

Pre-Treatment Bio-Monitoring

- Prior to treatment, fish population monitoring will be conducted at three to four locations within the treatment area to determine carrying capacity.
- Pre-treatment aquatic insect monitoring will be conducted at six to eight locations within the treatment area.

Equipment Needs

Camping Equipment (12 – 16 people)

- 7 four man tents (12 – 15 lbs each)
- 2 16 x 20 tarps (20 lbs each)
- 2 two burner cook stoves
- 4 one burner cook stoves
- Coleman fuel (4 – 5 gallons)
- Pots, pans, plates, eating utensils
- Coolers for cold storage (3 70 quart)
- Food (15)
- Personal packs and cloths

Treatment equipment

- 10 – 12 dispensing units(5 gallon buckets with float pan, rebar, hammer and hose, leveling blocks, torpedo level, pitcher, funnel and mesh screen, approximately 20 lbs each)
- 20 – 25 units of antimycin (1 gallon pain cans, 2 lbs each)
- Safety equipment (goggles and Latex or Nitrile gloves), 30 sets
- 3 – 4 backpack electrofishing units (35 lbs each)
- 8 – 12 sets of electrofishing probes
- 8 – 10 backup nets for electrofishing
- 3 – 5 gallons of gas for electrofishers
- 3 backpack fish transporters (10 lbs each)
- 10 – 12 five gallon buckets
- 20 - 24 holding cages (in a transport stage they are about 4 inches thick and vary in size from 18x24 to 30x36)
- 2 twenty gallon tubs (for daily cleaning of antimycin bottles, goggles and gloves)
- Backpack sprayer (2)
- Graduated cylinders for measuring antimycin
- 250 and 500 ml bottles for transport of mixed antimycin to daily treatment locations (20 each)
- Required data sheets and data boards
- Radios and chargers (4 – 6 each)

Regulatory Compliance

FIFRA

Project managers Steve Moore and Matt Kulp have completed the TN Department of Agriculture, Division of Regulatory Services pesticide applicators exam. Both are certified Aquatic pesticide applicators.

CWA

Compliance for the Clean Water Act was completed for this project in 2000 as part of the Environmental Assessment process.

NEPA

The “Environmental Assessment for Using a Piscicide for Brook Trout Restoration, Great Smoky Mountains National Park” was completed in February 2000. This document was sent for a 30 day public review and comment period. The majority of comments received were positive and the Finding of No Significant Impact was approved May 23, 2000.

ESA

No Threatened or Endangered species or critical habitats are in the project area.

Appendices

Final EA

ENVIRONMENTAL ASSESSMENT FOR USING A PISCICIDE FOR BROOK TROUT RESTORATION GREAT SMOKY MOUNTAINS NATIONAL PARK

February 10, 2000

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ENVIRONMENTAL ASSESSMENT FOR USING A PISCICIDE FOR BROOK TROUT RESTORATION GREAT SMOKY MOUNTAINS NATIONAL PARK

I. PURPOSE AND NEED FOR ACTION

A. Purpose

The United States Department of the Interior, National Park Service (NPS), Great Smoky Mountains National Park (GRSM) proposes to chemically treat about 4.0 kilometers of Sams Creek with a piscicide (Antimycin) in order to eliminate non-native fish and to allow the restoration of native brook trout *Salvelinus fontinalis*. Sams Creek is a third order, headwater stream located in the Middle Prong Little River watershed of Tennessee (Appendix A). The treatment is proposed for October 2000 during traditional low water flow periods. If successful, this technique will eventually be used to restore sections of Bear Creek, Lynn Camp Prong, Meigs Post Prong, Desolation Creek, Little Cataloochee Creek and Indian Creek. If additional streams meet the criteria for restoration in the future, they will be added to this list.

The need for this management action is based on the protection of the native Southern Appalachian brook trout, which has been, and in some cases continues to be, out competed by one or more introduced non-native trout species. The purpose for which Great Smoky Mountains National Park was established includes the preservation and perpetuation of the natural resources of the Park in an undisturbed natural condition. As a unit of the National Park System, legislation mandates that Park resources are to be managed in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (NPS Organic Act 1916). NPS Management Policies state that management of exotic (non-native) species, up to and including eradication will be undertaken whenever such species threaten Park resources or public health and when control is prudent and feasible (NPS Management Policies 1988).

The NPS determined that the eradication of non-native fish species and the reestablishment of native brook trout populations are feasible within upper stream reaches of the above listed streams and that such action is required under its legislative mandates and management policies.

This document reviews the potential environmental impacts of the proposed action and alternatives to this action as required by the National Environmental Policy Act (NEPA) and provides evidence and analysis necessary in determining the need to develop an environmental impact statement in reference to the proposed action.

B. Background

The purpose of this action is to protect the native brook trout of Great Smoky Mountains National Park.

This fish species is the only trout native to the Southern Appalachians. Since the turn of the century, this native trout has lost approximately 75 percent of its range in the Park (Kelly et al. 1980). Initial range loss (about 50 percent) has been attributed to logging and resultant water quality degradation (King 1937). This activity virtually eliminated brook trout in streams below about 914 meters (m)(3,000 ft) in elevation. In turn, residents and loggers became concerned because they had no fish to catch. To meet the demand for recreational angling at the time (around 1910), logging companies began stocking both non-native rainbow trout (*Oncorhynchus mykiss*) and northern brook trout. Stocking of northern brook trout continued into the 1950s and stocking of rainbow trout until 1974.

Until 1974, Park staff saw no harm in stocking rainbows and believed that as reforestation occurred in logged-over areas, brook trout would reclaim lost range. However, distribution surveys in the 1970s showed this not to be true and that 45 percent of the range exclusively occupied by brook trout had been lost since the mid-1930s (Kelly et al. 1980). The decline in stream miles exclusively occupied by brook trout was the direct result of rainbow trout encroachment into previously unstocked brook trout streams (Larson and Moore 1985). Native brook trout had become restricted to marginal headwater streams above 1,067 m (3,500 ft), characterized by steep gradients with pH's that were and are slightly more acidic than lower elevations. Based on the report by Kelly et al. (1980), it was determined that the only places brook trout could not be displaced was in streams above waterfalls where rainbows could not ascend.

However, we have now determined that some of the high-elevation headwater streams that were previously thought to be secure brook trout habitat have lost or are losing their populations due to poor water quality. To date, range loss of this type has been documented in six streams. Water quality data from one of these streams show it to be too acidic to support trout life.

Park-wide water quality monitoring data show that stream acidity increases with increasing elevation. Acid deposition monitoring indicates that areas above 1,463 m (4,800 ft) receive some of the highest acidic deposition in North America, and stream acidity appears to be increasing (Flum et al. 1997). If acid deposition continues at current levels, brook trout and other aquatic species may be eliminated from additional headwater streams as well.

Historically, local residents were very vocal about introduced northern strains of brook trout being different from the native brook trout or "speckled trout."

Studies in the 1950s showed that physical differences do exist between Southern Appalachian brook trout and hatchery fish (Lennon 1967). In 1996, a study conducted by the University of Tennessee provided conclusive evidence that Southern Appalachian brook trout are genetically distinct at the subspecies level from northern populations (McCracken et al. 1993). The report also recommends that everything possible be done to protect Southern Appalachian brook trout, the only trout species native to the Southeast.

C. ALTERNATIVES

The National Park Service has considered four alternatives to alleviate the problem of brook trout decline. These are: 1) to eliminate the presence of non-native fish through the use of the piscicide Antimycin, 2) to eliminate the presence of non-native fish through the use of another chemical fish toxicant, Rotenone, 3) to eliminate the presence of non-native fish through the use of electroshocking equipment, and 4) to take no action with regards to the presence of non-native fish and the documented loss of native brook trout.

Alternatives considered but rejected include: hook-and-line fishing, as studies have shown that this approach is only about 20% effective in removing non-native salmonids from a mountain stream habitat; netting or seining, as these devices cannot be used effectively in a boulder strewn flowing river or creek; and the use of explosives, because of concerns for non-target aquatic organisms, low probability of total removal of all non-natives, and potential non-desirable habitat impacts.

Alternative 1. (Preferred Alternative) Removal of non-natives with the use of Antimycin (Fintrol)

Under this alternative, approximately 4.0 kilometers (km) of Sams Creek upstream of the waterfall at an elevation of 646 m would be treated with the piscicide Antimycin, a chemical compound fatally toxic to fish and aquatic insects but less toxic to aquatic animals other than scaled fish. The toxicity of Antimycin below the treatment site would be neutralized (detoxified) with the use of potassium permanganate (KMnO₄). The Sams Creek treatment site would be used as a test for the effectiveness and environmental compatibility of this method of treatment and, if successful, this method would be used to treat other similar streams within Great Smoky Mountains National Park to reestablish displaced native brook trout populations.

Antimycin is an antibiotic, produced in cultures of *Streptomyces*, is toxic to fish, and sold under the trade name of Fintrol. It is EPA approved for fishery use and it kills fish by inhibiting cellular respiration. 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 (Alternative 2) to aquatic animals other than fish. Lennon et al. (1971) stated that Antimycin is the ideal fish toxicant because of its selective effects, its effectiveness at low concentrations in a short exposure time in a wide range of water qualities, it is not repulsive to fish, it is effective on all size classes, and it leaves no residue. Bruce Rosenlund, a U.S. Fish and Wildlife Service biologist with many years experience using Antimycin in the removal of non-native trout in Rocky Mountain National Park, has stated that other advantages include lack of effect on eggs in the gravel and that colder water temperatures do not reduce the toxicity to fish (personal communication). With every 61-76 m (200-250 ft) drop in elevation, aeration and tumbling in the stream break up the large Antimycin molecules, which neutralizes the toxicity of this piscicide. This alternative is anticipated to have the least overall environmental impact with the highest potential for success.

Prior to treatment, flow (discharge) will be determined at six to eight locations along the length of stream to be treated. The discharge at each station will be used to determine the exact amount of Antimycin needed to maintain a concentration of 8 parts per billion (ppb) for 8 hours in the section being treated. Treatment will begin at the upstream end of the project area and proceed downstream. At the end of the first day, the treatment stations will be moved down about 30 m (100 ft) in elevation. Treatment for Day 2 will begin at this point. This stepwise treatment procedure will be followed for the entire project area and will insure two complete applications of Antimycin are administered. During treatment, potassium permanganate (KMnO_4), a detoxifying agent, will be applied to the stream at the downstream end of the project area. This chemical will be applied for a minimum of eight hours each day of treatment to insure that all of the toxicant has been neutralized. It is anticipated that five workdays will be required to complete the treatment.

Additionally, dye retention studies will be used to determine travel time for every 61-76 m (200-250 ft) drop in elevation. These data will estimate the length of time required for the chemical to travel from one treatment station to the next and to coordinate the release of chemical at each station.

One to two days prior to treatment, the stream sections of Sams and Starkey Creeks occupied by brook and rainbow trout will be electrofished to collect as many brook trout as possible. These native trout will be transported to refuge areas that are upstream of the treatment area and released. If possible, these fish will be adipose fin clipped to determine if they return to the areas from which they were collected.

The day prior to treatment, rainbow trout will be collected and placed in holding cages in selected stream reaches along the area to be treated and monitored during treatment to assess effectiveness. Concurrently, selected stream sections (representative of stream size and habitat) will be closed off

with block nets and electrofished (three pass removal). The block nets will be left in place and during treatment, individuals will be assigned to collect, measure and weigh all trout from the section. These data will be used to validate population depletion models currently being used to estimate the population size of stream fishes. All dead rainbow trout within the treatment area will be collected and enumerated. A subset of these fish will be individually weighed and measured to assess population size structure. Once these data are recorded, all fish will be buried to prevent incidental ingestion by wildlife.

Within a week of the completion of treatment, stream reaches selected for population model validation will be electrofished to determine if any fish survived the treatment. In June of the next year, the entire length of treated stream will be electrofished (one pass) to check for the presence of rainbow trout. These data will also be used to evaluate the re-colonization of upstream reaches, the downstream movement of marked fish and reproductive success. Population monitoring will also be conducted in control sites and Inventory and Monitoring (I&M) sites in the treatment area, if fish are present.

If brook trout have only started to re-colonize upstream reaches of the treatment area, then approximately 100 brook trout will be collected and transported downstream and released. Release sites, as well as adjacent sites, will be re-surveyed in September or October to determine survival and movement. This same process will be followed in Year 2 if necessary, the only difference being that releases will target the downstream-most segment of the treatment area. Beginning in Year 3, annual monitoring will be initiated. The project will be considered a success when no rainbow trout are collected for two years and a viable reproducing population of brook trout exists in the treatment area. When this occurs, treatment of other streams identified for chemical renovation in this document will be recommended.

Prior to treatment, aquatic insect surveys will be conducted at the nine sample sites established in 1996-97 and the results compared to those data. The findings will also be compared to I&M data from 1992 - present. If possible, during treatment drift nets will be placed in the stream in an effort to validate the accuracy of current survey techniques for assessing diversity and relative abundance. Within a week of treatment, all sites will be resurveyed to determine the impact of Antimycin on aquatic insect populations. A quarterly sampling schedule will then be implemented for a period of three years to evaluate re-colonization and recovery, if initial sampling indicates that Antimycin has had a negative impact on non-target organisms.

Detoxification of Antimycin

Potassium permanganate (KMnO_4) is a strong oxidizing agent that has been used for various purposes in agriculture, industry, medicine, and water

treatment (Rose and Rose 1966). Walker (1967) pointed out that KMnO_4 could be used to detoxify the fish toxicant Antimycin, however Marking and Bills (1975) show that KMnO_4 is toxic to trout at low concentrations ($< 4\text{mg/l}$). On site toxicity tests at Sams Creek indicate that concentrations of 3mg/l or less of KMnO_4 resulted in no mortality and that 4mg/l resulted in only 20 percent mortality. These tests also showed that 2mg/l of KMnO_4 are sufficient to detoxify Antimycin in Sams Creek (Moore et al. 1998, unpublished data).

Alternative 2. Removal of non-native fish through the use of a different chemical fish toxicant (Rotenone).

The only other EPA approved and commonly used alternative to Antimycin is Rotenone. Rotenone kills fish by blocking oxygen transport across the gill membrane. Rotenone can also be detoxified by the application of potassium permanganate, but is more difficult to neutralize and will hold its toxicity for several days depending on the field conditions encountered. Other disadvantages of using Rotenone include: 1) that it must be used in higher concentrations than Antimycin, 2) it works slowly in colder water temperatures if at all, and 3) fish can detect its presence and move to upwellings of ground water, springs, and tributaries to escape, thus lowering the potential for successful elimination of non-native fish. While Rotenone is generally non-toxic to most mammals and birds at concentrations used to sample fish, these concentrations are generally lethal to zooplankton and many aquatic invertebrates. Magnum and Madrigal (1999) found that aquatic insect populations had not returned to pre-treatment levels five years after a Rotenone treatment in the Strawberry River, Utah. It is anticipated that the use of Rotenone would result in a higher potential for impact to the non-target aquatic organisms within the system. It would also be more difficult to control unwanted impacts to non-target organisms than if Antimycin was used.

If Rotenone was used it would be applied in the same locations and generally under the same methods and control procedures as have been described for Antimycin (Alternative 1).

Alternative 3. Removal of non-native fish through the use of electroshocking equipment.

Electroshocking is a commonly used method of temporarily stunning fish to allow their capture and removal from aquatic habitats. It involves establishing an electrical current (usually AC in GRSM) between two electrodes placed in the water. Fish encountering the electrical current are temporarily stunned, roll over and are easily captured. Electrofishing, when properly conducted, does not result in permanent damage to the majority of fish (Habera et al. 1996). Once captured, fish can be removed or released back into the aquatic environment essentially unharmed.

This approach would have the least amount of impact on non-target aquatic organisms, but is not likely to be successful in the full removal of non-native fish species. Electroshocking has been proven to be about 75% successful in removal of fish from small streams receiving multiple removals in one year or treated annually for five to seven years (Kulp and Moore in press, Moore and Larson 1989, West et al. 1990) in GRSM streams smaller than Sams Creek. Past electroshocking efforts in larger streams with numerous deep pools (> 1.0 m) have never been successfully reclaimed, even when multiple removals were conducted. Results of Habera et al. (1992) indicate that the successful eradication of non-native salmonids is highly improbable in streams with a mean width greater than six meters and four or more pools greater than one meter in depth per kilometer of stream length. In fact, the restoration of Sams Creek using backpack electrofishing techniques was attempted in 1978 and 1979. This effort resulted in the rainbow trout population being significantly reduced in all stream sections. The smallest reductions in density (~75%) occurred in the downstream section, which has numerous deep (>1.0 m) pools and complex habitat (Whitworth 1979). This was also the only reach in which reproduction occurred the year following treatment.

Alternative 4. No Action

If the Park were not to implement the proposed action, it is anticipated that the native brook trout population would continue to decline within Great Smoky Mountains National Park and may eventually become extirpated from all of its native range within the Park.

Under a no-action alternative, the National Park Service would not be meeting its mandate to preserve and protect the natural resources of the Park unimpacted for present and future generations. No action would mean a willful disregard for scientifically viable remedial actions and failure to successfully manage Park resources. The temporary limited environmental impacts to habitat and native aquatic species that will occur under the preferred alternative are not sufficient to justify no action.

D. DESCRIPTION OF THE AFFECTED ENVIRONMENT

A. Non-Living Components

3. Air - Air pollutants are impacting certain Park resources. 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 Sams and Starkey Creeks or any other stream listed (i.e. Bear Creek, Lynn Camp Prong, Meigs Post Prong, Desolation Creek, Little Cataloochee Creek, and Indian Creek) will not affect the quality of air resources.
2. Water - Surrounding vegetative communities, soil chemistry and underlying geology primarily determine water quality in the Park. Mid-elevation streams are characterized as slightly acidic pH (i.e. 6.2-6.9) with low buffering capacity. 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 Park streams is not anticipated to have any adverse effects on water quality. The treatment of Sams Creek or any stream listed will not affect ground water because all the ground water (in the area) is in the form of upwelling that adds flow to the stream.
4. Soils - The soils in the area around the streams identified for restoration are colluvial in nature, formed primarily from sandstone formations and the Anakeesta formation. These soils are deep, well drained and generally have a thick dark surface. The sideslopes further away from the creeks contain residual soils from the same geologic formations and range in depth from 0.5 to 1.0 m (20 to 40 in). The implementation of this project will not affect the surrounding soils of any stream listed in this document in any way.
5. Geology – The underlying geology of the Park is primarily of sedimentary origin (King et al. 1968). The majority of the bedrock found along streams is sandstone, gneisses and schists. Pyritic formations (i.e. acid-bearing rock) underlay some streams. If exposed, leachates from this formation will eliminate all aquatic life for several kilometers downstream. The addition of Antimycin to target streams listed in this document will not affect the underlying geology of these areas.

B. Living Components

Within the Park there are two major ecosystems, one aquatic, one terrestrial. The aquatic ecosystem is made up of approximately 3,404 km of streams in 28 watersheds (Parker and Pipes 1990). Stream elevations range from 266 m to 2,025 m above mean sea level. These streams are deeply incised into the mountains and are characterized by steep gradients, stairstep pools, cascades, riffle habitats, and a substrate composed primarily of boulder, rubble and cobble. Because of this configuration these streams do not have well defined flood plains. Based on established criteria for the determination of wetlands accepted by the NPS, no wetland resources occur within the project area for Sams Creek or any other stream to be eventually proposed for restoration, assuming the Sams Creek restoration is successful.

1. Vegetation - Overstory vegetation along the slopes of Sams Creek and other streams proposed for restoration is dominated by second growth yellow birch (*Betula alleghaniensis*), sweet birch (*Betula lenta*), maples (*Acer sp.*), hemlock (*Tsuga canadensis*), yellow buckeye (*Aesculus flava*), and tulip poplar (*Liriodendron tulipifera*). The dominant understory immediately overhanging the streams includes *Rhododendron* species, *Hydrangea arborescens*, and doghobble (*Leucothoe fontaensiana*).
2. Aquatic Insects - Aquatic insect surveys conducted by Dr. David Etnier of the University of Tennessee indicated that 118 species live within or near the proposed treatment area of Sams and Starkey Creeks in 1997. Most species (>75%) occur in one of the following groups: mayflies (Ephemeroptera), caddisflies (Trichoptera), stoneflies (Plecoptera), and true flies (Diptera). Etnier's study located one invertebrate, a caddisfly, which is an undescribed species. This caddisfly (*Rhyacophila* n.) was found within and outside of the treatment area and is common in Thunderhead Prong and Alum Cave Creek.

In 1987, Dr. Chuck Parker of the US Geological Survey, Biological Resources Division (USGS, BRD) collected an undescribed caddisfly of the genus *Neophylax* at the confluence of Sams and Starkey Creeks (the upper end of the area to be treated). He has since described and named his find as *Neophylax kolodskii* (Parker, in press). Since this collection, Dr. Parker has returned to the original collection site five times, four of which were at the same time of the year. He has also sent biological technicians out twice to attempt to locate additional specimens of this species. One trip was to Sams Creek and the other was a more extensive survey in the Middle Prong of the Little River watershed. None of these efforts were successful at locating additional specimens of this caddisfly.

Dr. David Etnier intensively looked for *Neophylax kolodskii* while conducting aquatic insect surveys for this environmental assessment in 1996 and 1997. Since then, he has looked for this caddisfly, once in

September, 1997 and again in September 1998. In September, 1999, Dr. Etnier, his wife, four of his students and a NPS fishery biologist spent 10 hours each searching the upper reaches of Sams Creek for this species. These efforts failed to collect additional caddisfly specimens.

Aquatic insect samples have also been collected annually in Sams Creek since 1992 as part of the Inventory and Monitoring program. These efforts have also failed to produce additional specimens of this species.

Additional efforts to locate *Neophylax kolodskii* will occur in 2000. Between late April and mid-May *Neophylax* pupae will be collected from Sams Creek and returned to a Living Stream at Twin Creeks for captive rearing. *Neophylax* larvae attach their cases to rocks early in the year and aestivate through the summer, before pupating and emerging as adults in the fall. Because the summers have been unusually hot and dry for the past several years, aestivating *Neophylax* larvae may have been experiencing higher than natural mortality during the summer, which could make locating this species more difficult. Captive rearing should increase the survival and likelihood of collecting this species if it does live in Sams Creek. These pupae should hatch in mid- to late September and will be identified at that time.

In addition to this, the Middle Prong of Little River watershed, as well as other watersheds in the Park, will be intensively sampled with light traps and sweep nets. These collection methods are known to be very effective for collecting adult caddisflies. Collections will be at the same elevation the original collection was made as well as higher and lower elevations in each stream sampled. These collections will also bracket the time of original collection.

Four scenarios are possible as a result of this search:

- A) *Neophylax kolodskii* is only found in the target area. In this case treatment would commence downstream of the area in which it is found. This assumes it is only found in the area of original collection. If found only in Sams Creek, chemical treatment would be abandoned.
- B) The caddisfly is found inside and outside the target area of Sams Creek and other streams. In this case the project will proceed as planned.
- C) The caddisfly is outside the target area, either in Sams Creek or another stream. In this case the project will be conducted as planned.
- D) If these efforts fail to collect additional specimens of this caddisfly inside or outside the target area, then it will be assumed that everything possible has been done to locate it and treatment of the stream will not adversely impact its existence.

No state or federally threatened or endangered invertebrate species were found in the treatment area.

The aquatic insect populations of GRSM have not been as thoroughly studied as other segments of the aquatic ecosystem, and are therefore not as well known. Prior to the implementation of restoration activities on other streams listed in this document, detailed aquatic insect surveys must be conducted to determine species composition and to look for new or rare species. If none are located then the project should follow the same procedure as outlined for Sams and Starkey Creeks.

3. Reptiles and Amphibians - Reptiles are rarely observed in the project area, but northern copperhead (*Agkistrodon contortrix mokeson*), timber rattlesnake (*Crotalus horridus*), black rat snake (*Elaphe obsoleta obsoleta*), and eastern garter snake (*Thamnophis sirtalis sirtalis*) have been observed occasionally. The application of Antimycin to Sams Creek or any other stream listed will not threaten the survival of any of these species.

Amphibian surveys in the Sams Creek project area by Dr. David Etnier indicated that black belly salamander (*Desmognathus quadramaculatus*) and shovelnose salamander (*Desmognathus marmoratus*) are common in the stream area to be treated. These species also were common in tributaries to Sams Creek that will not be treated and are found throughout the Park. The red spotted newt (*Notophthalmus viridescens viridescens*) is also common in the seeps and small tributaries of Sams Creek and other streams proposed for restoration. Areas of this nature will not be chemically treated and therefore pose no threat to the survival of these species in the Park.

4. Fish - Brook trout and rainbow trout are the only fish species found in Sams Creek, Ekaneetlee Creek, Desolation Creek, Bear Creek, Meigs Post Prong, Little Cataloochee Creek, Beech Creek, and Gunter Fork. However, native non-game fish species [longnose dace (*Rhinichthys cataractae*) and blacknose dace (*Rhinichthys atratulus*)] do live in Lynn Camp Prong and Roaring Fork. In these streams, biologists will collect as many of these fish as possible prior to treatment and transport them to refuge areas downstream where they are commonly found. Once a system has recovered from treatment and stabilized, similar numbers will be collected and returned to the restored stream. If a small number of these fish are lost due to chemical treatment, it will not negatively affect the survival and well being of these populations in the watershed or the Park.

In 1997, the rainbow trout population estimate for the 2.72 km (1.7 mi) of Sams Creek exclusively occupied by rainbow trout was about 755 fish per kilometer or a total of 2,054 rainbow trout. A mixed population of rainbow and brook trout (sympatric) occupies the next 1.28 km (0.8 mi) and the first 0.8 km (0.5 mi) of Starkey Creek. Approximately 385 rainbow trout and 757 brook trout occupy the sympatric section of Sams Creek. The mixed zone of Starkey Creek had about 75 rainbow trout and 140 brook trout based on the 1997 estimate. The intent is to permanently remove rainbow trout from all these sections.

5. Terrestrial Animals - Mammals that would be expected to occur in the project site include black bear (*Ursus americanus*), white-tailed deer (*Odocoileus virginianus*), the exotic European wild boar (*Sus scrofa*), coyotes (*Canis latrans*), squirrels (*Sciurus sp.*), and other small rodents. Several species of passerine birds are expected to occur in the project area. Hawks, owls, and crows may possibly enter the area, but have not historically been seen along the stream corridor. None of the above species is expected to be affected by the application of Antimycin to Sams and Starkey Creeks or any other stream listed in this document.
6. Wilderness - Much of the area within GRSM has been proposed for wilderness designation. Because of this, the majority of the Park, including the treatment area, is managed as defacto wilderness.

NPS Management Policies state: "The Park Service will take no action that would diminish the wilderness suitability of an area recommended for wilderness study or for wilderness designation until the legislative process has been completed."

The proposed project area is located within the area proposed for wilderness designation and, as such, this action could be viewed by some as a negative impact to wilderness values. However, the Park believes that the successful completion of this project will enhance wilderness values by restoring a native trout to a portion of its historic range and simultaneously eliminating an exotic species.

7. Threatened and Endangered Species – There are no federal or state listed threatened or endangered species that are known to inhabit the area to be treated in Sams or Starkey Creeks or any stream listed in this document. Therefore, none would be affected by the proposed action.
8. Human Impacts – The preferred alternative will impose no water quality or ingestion threats to humans in and/or below the treatment area of Sams and Starkey Creeks or any stream listed in this document (Schnick 1974). Antimycin and potassium permanganate (KMnO₄) used for detoxification will be broken down into naturally occurring organic

compounds at non-detectable levels before they leave the Park boundary in Townsend.

E. EDUCATIONAL AND SCIENTIFIC INTEREST

As an experiment, the proposed renovation of Sams Creek provides Park staff with the rare opportunity to study and evaluate the effects of Antimycin on a southeastern stream. Park fishery biologists have demonstrated that methods currently used to estimate population size in a small stream actually underestimate the population by as much as 30 percent! This restoration effort will provide an opportunity to validate the three-pass population estimation technique in different stream orders. In addition, biologists will evaluate the effects of the chemical on aquatic insect and salamander populations. Based on pre-treatment data, biologists can monitor (as needed) the recovery of aquatic insect, salamander, and native brook trout populations.

F. ENVIRONMENTAL CONSEQUENCES

A. Anticipated Site-Specific Impacts of Alternatives Considered

The anticipated environmental consequences of each of the alternatives considered are presented by alternative in the following sections.

1. Alternative 1. (Proposed Action) Removal of non-native fish with the use of Antimycin

a. Anticipated Impacts

1. Short Term Impacts

The short-term impacts of treating this reach of Sams Creek with Antimycin will be profound. All rainbow trout and some brook trout will not survive in Sams or Starkey Creek or any stream listed in this document.

Many of the aquatic insects in the 4-kilometer treatment reach also may not survive the treatment.

Aquatic insect surveys indicate that a minimum of 118 species of aquatic insects can be found in Sams Creek (Etnier 1997, unpublished report). Based on observations by Rosenlund during treatment of western streams, it is believed that the majority of the aquatic insects within the treatment area of Sams and Starkey Creeks will not survive. This same effect will be observed in all other streams proposed for restoration in this document. Precise estimates of the numbers cannot be made because techniques to quantitatively estimate the number of organisms per square meter do not work in

streams dominated by boulder, rubble and cobble substrates. These are renewable resources and their loss is not irrevocable. The brook trout refuge and all fishless tributaries have similar aquatic insect communities. Re-colonization from upstream reaches, tributaries, and untreated downstream reaches will begin almost immediately.

While this scenario appears extreme, experience in mid-west and western streams treated with Antimycin (Jacobi and Deagan 1977; Minckley and Mihalick 1981), shows that the aquatic environment is strongly resilient and the treated reach will return to a stable habitat in a period of months. These studies indicate that within three years of treatment no significant difference in the diversity and density of aquatic insect populations could be detected. We expect similar results in Sams Creek.

Results from the Sun Creek restoration effort in Crater Lake National Park indicate that initially mayfly and stonefly populations were significantly reduced in density but caddisflies were not significantly impacted (Mark Buktenica, personal communication). Based on limited monitoring data the aquatic insect community recovered to pre-treatment levels quickly (Mark Buktenica personal communication). This effort was conducted in the early fall when water temperatures were 0-3°C (33-38°F). In order to reduce potential impacts to the aquatic insect community in Sams Creek, this project will be conducted in late October after water temperatures have declined below 10°C (50°F). Dr. Etnier's report (1997) stated that it is reasonable to assume the proposed piscicide application would not result in the extinction of any species of aquatic insects. All entomologists consulted agree that the proposed action is not likely to result in the extinction of any species from the treatment area; however, it may temporarily eliminate one or more species from Sams Creek.

Additionally, Schnick (1974) indicates that 10–80 ppb of Antimycin had no effect on the survival of mole salamanders or tiger salamanders. This report also indicates that tadpoles and frogs are not affected by 5–10 ppb of Antimycin in laboratory and field studies. These values are at or below application rates proposed for this project. During field toxicity tests in 1998 at Sams Creek, adult and larval (with gills) salamanders were placed in the 8 ppb test bucket with rainbow trout. All trout died within two hours but the salamanders were unaffected after eight hours of exposure. Therefore, it is highly unlikely that these faunal groups will be affected in any way.

Based on studies by Moore et al. (1985) and unpublished results from other studies involving the marking of brook trout and monitoring of their movements, brook trout from the refuge areas will begin to move downstream and re-populate the upstream reaches of the treatment area within a month. Small numbers of brook trout (5-10/100 m) should inhabit the uppermost 0.5 – 1.0 km of the restored stream within a year of treatment.

Not all fish will be lost to the chemical. Three to four weeks prior to treatment the first 3.2 km (2.0 mi) will be opened to fishing (angling will not be allowed in the sympatric zone). Each angler fishing the stream will be required to keep every rainbow trout he/she catches. Based on a previous study of this type conducted in the Park (Larson et al. 1986) we believe that anglers will remove about 50% of the fish from the 3.2 km reach.

The sympatric zone will be electrofished and all brook trout collected will be transported upstream to refuge areas and released. All rainbow trout collected will be euthanatized; however they will become part of continuing studies for age and growth validation and other related scientific investigations.

Those species that may rely on Sams Creek for a portion of their subsistence may be temporarily displaced from the project area. These species may include reptiles and amphibians (snakes, frogs, and salamanders), mid-sized mammals (raccoons and opossum), and possibly bears and the exotic European wild hog. However, none of these species rely solely on the resources in the treatment area of Sams Creek for their survival. No threatened or endangered animal species are known to inhabit the area of Sams Creek.

2. Long Term Impacts

No negative long-term impacts are anticipated. Antimycin is an antibiotic that was originally produced for veterinary use. The tumbling action of the stream physically breaks this chain molecule apart and it loses its toxicity with every 61–76 m (200- 250 ft) drop in elevation. The fragmentation of the molecule produces inert breakdown by-products. To insure complete neutralization of the Antimycin, the chemical potassium permanganate (KMnO_4) will be added at the downstream barrier, the end of the project area. The potassium permanganate oxidizes quickly in natural waters and breaks down into inert compounds. The by-products of these chemicals will be diluted to the range of nanograms per liter and then into the range of non-detection long before the stream exits the Park. No residual effect of this material has been reported in the

literature or is expected here. Water chemistry should return to pre-treatment conditions within 48 hours in Sams Creek or any stream listed for restoration. The production (density and biomass) of aquatic insects is expected to be close to pre-treatment levels within one year. The diversity of aquatic insects should return within three years. Based on restoration experiences in other streams the density of brook trout should return to at least the densities observed for rainbow and brook trout within three to four years as well.

b. Mitigating Measures

1. Short-Term Impacts

Amending the water at the downstream limit of the treatment area with potassium permanganate in Sams Creek will mitigate the impact of toxic effect beyond the area of treatment or any stream proposed for restoration in this document. The application of both toxin and neutralizer will be done by highly qualified individuals who are experienced in the field of aquatic management, and have credentials at the post graduate level in biology and chemistry.

By setting the project start date in late October, the impact of the chemical treatment on aquatic insect populations will be lessened. Experience from Crater Lake National Park demonstrated that in colder water the Antimycin will still kill some aquatic insects but the impact will be small.

Fish and organisms removed by this proposed action will be retrieved from Sams/Starkey Creek or any stream listed in this document and used for scientific research projects, or buried to avoid ingestion by opportunistic scavengers.

Closing the treatment reach to visitor use will stop incidental consumption of the water of Sams Creek or any stream proposed for restoration by the visiting public. However, past research has shown that Antimycin is not hazardous to human health even if someone were to accidentally ingest some of the treated water (Schnick 1974). Downstream reaches of the stream will be posted to advise the visiting public of the project and what precautions that they should take. Treatment will be planned for late October when visitation is low. Human presence and activity will, for the most part, warn off local mammals. A review of toxicity studies relating to Antimycin (Schnick 1974) indicates that animals must be fed large concentrated oral dosages (1-5 mg/kg) before any effect is seen. Given the small

concentration of the two chemicals that would be in the stream, and then for only a short time, an animal could not possibly drink enough water to harm itself.

2. Long-Term Impacts

No negative long-term impacts are expected, however, a program to evaluate the success of this proposed action is planned. For three to five years following treatment, annual brook trout population surveys and quarterly aquatic insect and water quality surveys above, in, and below the treatment area will be conducted. The results of these efforts will be compared to data from pre-treatment surveys to evaluate recovery. Appropriate mitigating actions will be considered, if necessary, although the need for further management action, other than monitoring, is remote.

2. Alternative 2. Removal through the use of Rotenone

Under this alternative, the same or greater short-term impacts to aquatic insect populations would be anticipated. However, a study in Utah (Magnum and Madrigal 1999) indicates that aquatic insect populations do not recover as quickly from Rotenone treatment. Detoxification is also more difficult although monitoring procedures would be the same as for Alternative 1.

Because fish can detect the presence of Rotenone and will move to refuge areas, and this chemical is not as effective in cold water, the probability of success is much lower. Additionally, it is more difficult to neutralize Rotenone in water with colder temperatures, therefore, increasing the likelihood of downstream impacts.

3. Alternative 3. Removal of non-natives by electroshocking

Restoration using backpack electrofishing techniques would be the least impacting to non-target organisms. However, efforts to restore Sams Creek to brook trout using electrofishing in 1978 and 1979 failed to remove all non-native rainbow trout. The reasons for failure were primarily due to the numerous deep pools, complex habitat, especially in the downstream half of the area to be treated and loss of funding. Restoration efforts using electrofishing techniques have also failed in five other streams because of stream size, complex habitat, numerous deep pools and loss of funding.

4. Alternative 4. No Action Alternative

If this alternative were to be selected, Sams Creek and any of the other streams identified for future chemical treatment, would not be restored using Antimycin and the species residing in and around them would continue to co-evolve. No temporary or long-term negative impacts would occur to the stream

aquatic insect or amphibian communities due to the fish removal actions, but long-term impacts may continue to occur due to the presence of non-native fish. No action could also result in local extinction of native brook trout populations in Sams Creek and other headwater streams throughout the Park. This alternative would result in the National Park Service neglecting its legislatively mandated policy (NPS Organic Act 1916) to protect and restore native species where feasible (NPS Management Policies 1988).

B. Biological Community Relationship Impacts

Aquatic ecosystems of the Park are made up of different populations that interact and form communities that are naturally regulated. Similar communities are found in main streams and tributaries across the Park where the underlying geology, soils, and vegetative communities are the same. The implementation and completion of this project will not disrupt community balance outside the project area.

C. Cumulative Impacts

No negative long-term environmental impacts are anticipated through implementation of the proposed action. Negative environmental impacts of the proposed action are anticipated to be temporary and will result in an overall improvement to the environment, since exotic fish will have been removed from a portion of the Park.

The Park will continue attempts to restore native brook trout by mechanical and other means as well. However, these are known to be ineffective in larger streams. The cumulative impact of the proposed action will be a further reduction of non-native trout species in the Park.

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VII. PUBLIC INTEREST

In as much as this is a proposal to affect living creatures in a National Park, there is expected to be some public interest. The proposed action is not an unusual or special project in the field of aquatic resource management as evidenced by its use in other National Parks and other areas of the United States. The fact that it is being done in a National Park is enough to seek a forum for public comment. The circulation of this document and the comments received concerning this project may indicate the level of public interest in the proposed action and will be used to modify project implementation as necessary.

VIII. PARTICIPATING STAFF

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APPENDIX

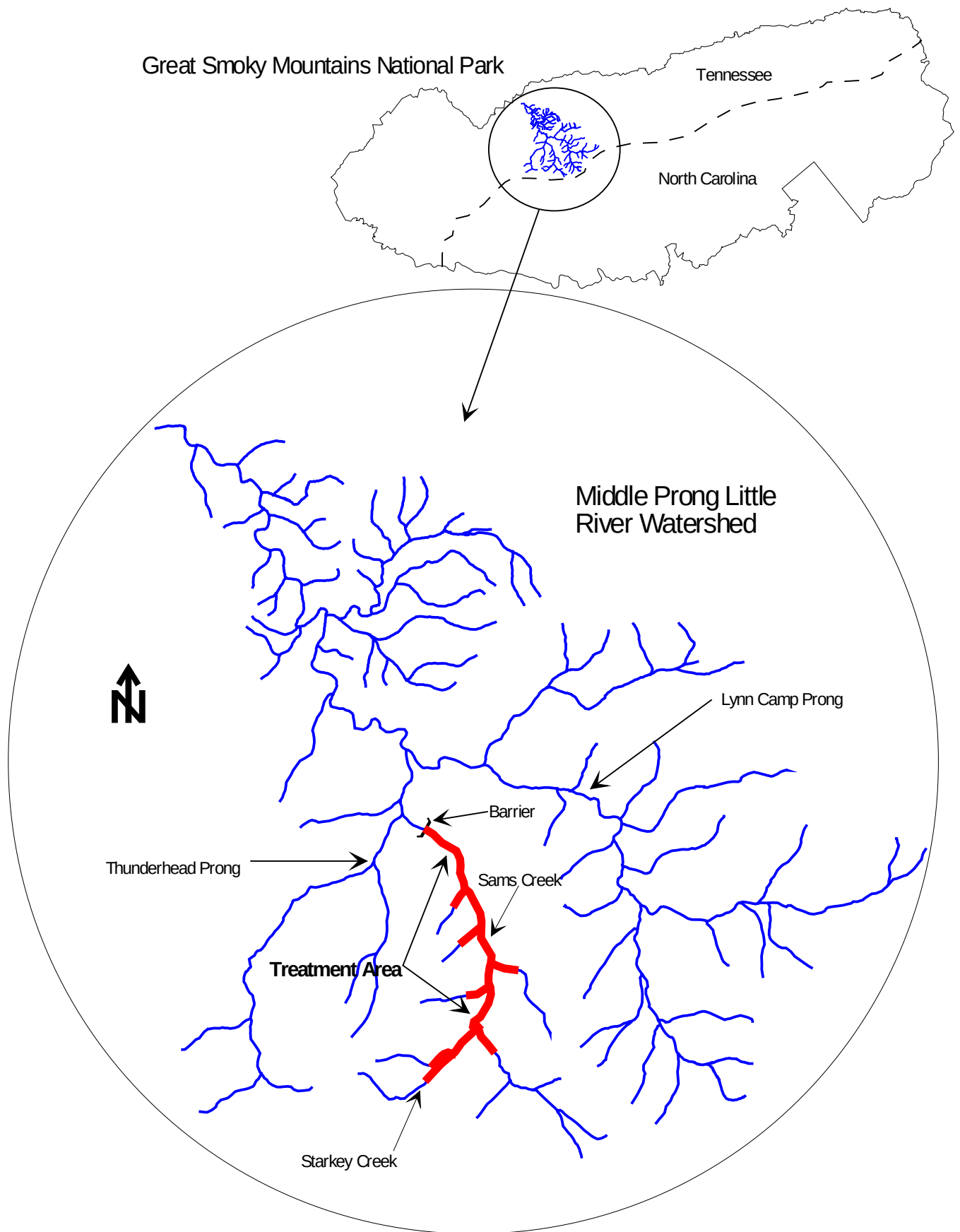


Figure 1.- Watershed map of Middle Prong Little River, Great Smoky Mountains National Park, including proposed treatment area on Sams Creek. Shaded area indicates proposed treatment area of Sams Creek.

Table 1

Completed Task FY98 and 99

- Rainbow/Brook Trout Distribution Surveys
- Annual Fish Population Surveys
- Annual Aquatic Insect Surveys (I&M) 2 sites
- Flow/Dye Retention Studies
- Aquatic insect surveys: 9 sites under our Cooperative Agreement with the University of Tennessee, including control sites upstream of the area to be chemically treated, a site in Thunderhead Prong, control sites in tributaries and sites in the reach of Sams Creek to be treated with the ichthyocide.

Project Task FY99 – 02

TASK	1999	2000	2001	2002
Treatment		X	X*	
Dye Retention/Flow Studies	X	X		
Fish Population surveys	X	X	X	X
Aquatic Insect/Salamander Monitoring	X	X	X	X
Rainbow/Brook Trout Distribution Evaluation		X	X	X
Water Quality Monitoring	X	X	X	X
Open to Angling (2 weeks)		X		
Move Brook Trout to Refugia		X		
Validation of Fish population Estimators		X		
Progress Report		X	X	X
Final Report				X

*If necessary, for any rainbow trout found in follow-up surveys.

Official ESA Correspondence

There were no threatened or endangered species in the project area so there was no ESA correspondence.

FONSI

FINDING OF NO SIGNIFICANT IMPACT ENVIRONMENTAL/ DECISION NOTICE ON ASSESSMENT FOR USING A PISCICIDE FOR BROOK TROUT RESTORATION IN GREAT SMOKY MOUNTAINS NATIONAL PARK

I. Background

The National Park Service (NPS) has prepared and made available for public review the **Environmental Assessment for Using a Piscicide for Brook Trout Restoration in Great Smoky Mountains National Park** (EA). The EA documented the potential environmental and social impacts from implementing four primary options for restoration of the Sams Creek brook trout fishery as a pilot project. If successful, the same technique may be used in other locations specified in the EA. The EA identified the preferred alternative of "Removal of non-natives with the use of antimycin (Fintrol)." The EA was completed in February 2000 and was placed on public review for 30 days. During this review period, public meetings were held in Gatlinburg and Pigeon Forge, TN, Waynesville (2) and Bryson City, NC to receive comments.

The purpose of this document is to record selection of an alternative and a finding of no significant impact pursuant to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (43 CFR 1500).

II. Need for Action

The need for this management action is based on the protection of the native Southern Appalachian brook trout, which has been, and in some cases continues to be, out-competed by one or more introduced non-native trout species. The purpose for which Great Smoky Mountains National Park (GRSM) was established includes the preservation and perpetuation of the natural resources of the Park in an undisturbed natural condition. As a unit of the National Park System, legislation mandates that Park resources be managed in such manner and by such means as will leave them unimpaired for the enjoyment of future generations (NPS Organic Act 1916). NPS Management Policies state that management of exotic (non-native) species, up to and including eradication, will be undertaken whenever such species threaten Park resources or public health and when control is prudent and feasible (NPS Management Policies, Fisheries Management 4:7&8, Restoration of Native Plants and Animals 4:10, Management of Exotic Species Already Present 4:12, 1988).

The NPS determined that the eradication of non-native fish species and the re-establishment of native brook trout populations are feasible within selected portions of the streams listed in the EA and that such action is required under its legislative mandates and management policies. A pilot project has been proposed for Sams Creek. If

successful and no adverse impacts are detected, the same procedures may be used in portions of Meigs Post Prong, Lynn Camp Prong, Little Cataloochee Creek, Bear Creek, and Indian Creek.

This document reviews the potential environmental impacts of the proposed action and alternatives to this action as required by the National Environmental Policy Act (NEPA) and provides evidence and analysis necessary in determining the need for an Environmental Impact Statement in reference to the proposed action.

III.

IV. Alternative Selection

The NPS selects Alternative 1: Removal of non-natives with the use of antimycin (Fintrol). This alternative provides for the restoration of a 4.0-kilometer (km) section of Sams Creek from an allopatric (a single species living in a area) rainbow trout and sympatric (more than one species living in a area) rainbow/brook trout population to an allopatric brook trout population. This section of Sams Creek is currently closed to trout fishing and would remain closed until the results of the recovery efforts are evaluated.

The aquatic insects and brook trout population in the stream will be monitored to determine recolonization and recovery rates. Once brook trout populations become re-established and stable, the stream may be opened to fishing.

V. Alternatives Considered

The EA contains detailed descriptions of the proposed plan and alternatives considered. In summary, the selected alternative in the EA specifies the following actions:

Remove rainbow trout from a 4.0 km section of Sams Creek using the piscicide antimycin (Fintrol).

Use natural recolonization of brook trout from upstream areas, along with transporting brook trout from upstream areas into the lower reaches of the treatment area.

Monitor the impacts, recolonization, and recovery rates of aquatic insect and amphibian populations throughout the treatment area.

Three other alternatives were evaluated: Alternative 2: Removal of non-natives with rotenone, Alternative 3: Removal of non-natives with electrofishing, and Alternative 4: No action.

VI. Rationale for Selection and Summary of Public Comment and Impacts

A summary of the comments received during the public review process is found in the attached “Synthesis of Public Comment” and “Summary of the Substantive Comments Identified for the Environmental Assessment for Using a Piscicide for Brook Trout

Restoration in Great Smoky Mountains National Park.” Federal and state land management agencies, the Tennessee Chapter of the American Fisheries Society and fishery professionals from universities in Tennessee and North Carolina unimanously endorsed the proposed project. Written comments from 13 of 15 organizations responding also endorsed the project. Representatives from two organizations expressed concerns that the proposal did not evaluate enough alternatives or that there was too great a risk involved. Comments received from the general public indicated that the majority supported the proposed action regarding the management of brook trout restoration efforts in Sams Creek and other proposed streams. However, some organizations and a portion of the public expressed concern, related to: (1) brook trout protection and management, (2) acidification effects (not germane to this initiative), and (3) general chemical (antimycin) effects.

The rationale for the selection of the preferred alternative (Alternative 1) takes into consideration the substantive comments that were received during the review process.

The four main areas of concern are described below:

Brook Trout Protection and Management. The majority of comments received were from residents of Tennessee and North Carolina. Comments were also received from other southeastern and mid-west states. Most of the comments were in favor of brook trout restoration using antimycin. The common reasoning behind these comments was the need to use alternative, proven techniques to meet restoration goals and expand the range of the fish into larger streams that are not being impacted by acidic deposition. Several commentors referred to the importance of maintaining the habitat brook trout and other species live in, in order to perpetuate the species for future generations to enjoy. Initial concerns were related to a newspaper article in the *Asheville Citizen Times* March 6, 2000 that was interpreted by some people to mean that *all* GRSM streams would be restored using this technique and that the Park would close all streams to fishing. Information disseminated at meetings helped educate participants that these efforts were only to be conducted in a small portion of the Park’s streams and would not affect *all* trout waters.

Acidification Effects. There were several comments made regarding the underlying Parkwide problems with stream acidification and its potential effects on the brook trout restoration program. Stream acidification is recognized as a high priority management concern that adds impetus to the Sams Creek restoration project. Much of the public clearly understands the pertinent need to address the long-term acidification issues in GRSM in conjunction with restoration projects to provide adequate habitat for current and future brook trout populations. Application of antimycin will neither enhance nor buffer the effects of acidification in GRSM streams because the origins of the Parks’ existing acidification problem comes from sources outside the Park. Finally, Alternative 4, No Action does not provide a timely solution to the GRSM acidification issue.

VII.

VIII. General Chemical (Antimycin) Impacts. Much of the concern regarding the preferred alternative revolved around impacts to other non-target organisms both

in and around the treatment area. There was also the misconception that the NPS was interested in eradicating *all* exotic trout species from the Park as previously described. There are no federally protected species found in the treatment area. In addition, thorough literature reviews and field trials in other NPS units indicate that we should not anticipate any negative impacts to non-target species throughout the process. In addition, there are no potential adverse impacts to people or public drinking water from the preferred action. In all cases, the antimycin will be neutralized and oxidized into undetectable common organic compounds before reaching any areas where people could contact it.

IX.

A small number of comments focused on the theory that the treatment may incur irrevocable damage to the ecosystem. From previous restoration activities using antimycin in NPS units there are no data that would suggest any irrevocable impact to the stream ecosystem.

- X. Topics of Interest.** Several of the public responses included comments peripheral to the project, but worth discussion. Some of these comments focused upon the distinction between “native” versus “non-native” species in NPS units. Other comments included popular sentiment of local anglers that the NPS reaffirm its goal to eventually reopening brook trout streams to fishing for the enjoyment of the public. We reaffirmed our commitment to this goal and indicated our intentions to work toward this goal in the near future.

Summary

There will be no long-term impacts to stream habitat, protected species or their habitat, or any other unique habitat. Short-term impacts will occur to aquatic macroinvertebrate fauna during the treatment period; however, these populations will start to recolonize the treatment area from upstream and tributary populations unaffected by the treatment within one to two weeks of treatment. There will be no significant short- or long-term impacts to non-target plants, animals, or humans. There will be no significant impacts to air or water quality or related values. Therefore, the selected alternative is in compliance with related laws and implementing regulations.

Implementation of the selected alternative will restore a portion of Sams Creek to a pre-existing condition, unimpacted by exotic rainbow trout.

XI. Conclusion

The National Park Service adopts Alternative 1, Removal of non-natives with the use of antimycin (Fintrol). The implementation of this alternative does not constitute a major federal action significantly affecting the quality of the human environment pursuant to the National Environmental Policy Act of 1969. Accordingly, an Environmental Impact Statement will not be prepared.

Approved: _____
Regional Director
Southeast Region

Date: _____

SYNTHESIS OF PUBLIC COMMENT

Process Used to Solicit Public Comment

An Environmental Assessment (EA) for the Sams Creek brook trout restoration project was completed in February 2000. The EA was placed on review for agency and public comment March 6, 2000 and comments were accepted until April 6, 2000. Paid public notices ran in nine newspapers the week of March 6, 2000. A cover letter dated March 3, 2000 was sent out announcing the availability of the EA to all media surrounding the Park as well as 320 cooperating agencies, interest groups, and individuals. In addition, the EA was made available at public meetings held in Bryson City and Waynesville, North Carolina and in Pigeon Forge and Gatlinburg, Tennessee where information about the work proposed in the EA was presented. Presentations were made at four Trout Unlimited chapter meetings where the EA was also made available. The EA was furnished to partners with Trout Unlimited who also placed it on three publicly accessible websites.

Public/Agency Comment

Comments received, regarding the **Environmental Assessment for Using a Piscicide for Brook Trout Restoration in Great Smoky Mountains National Park**, were evaluated to determine if the full range of alternatives was considered during the environmental review process; whether the environmental consequences of alternatives described in the EA were accurately analyzed; and whether the environmental analysis and resulting conclusions were understood by the public and other agencies.

The following comments were received during the comment period. Responses have been made to clarify and address issues of importance and concern and the proposal modified, as appropriate, to respond to the comments that were received.

ELECTED OFFICIALS

CONGRESS of the UNITED STATES: Honorable John J. Duncan, Jr.

1. Inquired on behalf of a constituent who did not believe such an action was safe or in the best interest of protecting fishery and aquatic resources in the Park.

RESPONSE: “ Thank you for the letter regarding concerns of your constituent. The National Park Service recognizes the safety issues related to the use of the chemical and will follow standardized safety protocols. The restoration of native species is a mandated function of the National Park Service and the proposed techniques are accepted nationally.”

FEDERAL AND STATE AGENCIES

UNITED STATES DEPARTMENT OF INTERIOR, FISH AND WILDLIFE SERVICE

1. The EA is adequate and supports the conclusion of not likely to adversely affect. They concur with this analysis and state that the requirements of Section 7 of the Endangered Species Act (ESA) have been fulfilled. They recommend (1) systematic surveys of invertebrate and vertebrate species be completed in all streams proposed for treatment, (2) recolonization of treatment reaches by invertebrate species be assured, and (3) in-situ toxicity testing be conducted in the treatment area and downstream of the project area during treatment.

RESPONSE: “Thank you for your response. (1) Streams will be prioritized for restoration and detailed surveys of invertebrate and vertebrate species will be conducted prior to treatment will be conducted. (2) Research, following treatment in western parks, indicates that invertebrates re-colonize the stream quickly from untreated tributaries and upstream reaches. The same pattern of re-colonization has occurred in streams treated with rotenone in the Cherokee National Forest in TN. (3) In-situ toxicity testing will be conducted within the treatment area and in downstream control sections each day of the project.”

UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE: CHEROKEE NATIONAL FOREST, NATIONAL FORESTS IN NORTH CAROLINA, and SOUTHERN RESEARCH STATION

1. Implementation of the strategy outlined in the EA will reduce the threat posed by rainbow trout to brook trout viability. The preferred alternative, Alternative 1, removal of rainbow trout with antimycin, offers the highest likelihood of success. The proposed project is an excellent example of science based “proactive” conservation biology.

RESPONSE: Comment noted.

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

1. NC Wildlife Resources Commission supports the proposed action. They recommend that state and local water supply sections and the Division of Water Quality be made aware of the project during the implementation phase so they can respond to questions from the public.

RESPONSE: Comment noted.

**STATE OF NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER QUALITY**

1. We have no real concerns about the project. We agree that post-treatment monitoring is a key component of this proposed action.

RESPONSE: Comment noted.

TENNESSEE WILDLIFE RESOURCES AGENCY

1. We have thoroughly reviewed the protocols and procedures for site preparation, antimycin treatment, and monitoring detailed in the EA and judge them to be appropriate for achieving the stated objectives.

RESPONSE: Comment noted.

**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION,
WATER POLLUTION CONTROL**

1. Based upon our review of the EA, TDEC-WPC has no objections to Alternative 1, which involves the use of antimycin as a piscicide, provided the safeguards and procedures are followed that are detailed in your proposal.

RESPONSE: Comment noted.

**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION,
WATER SUPPLY**

1. The EA did not provide specific information describing the techniques the Park Service plans to use to verify that the oxidation of the antimycin by potassium permanganate is effective.

RESPONSE: Insitu monitoring using rainbow trout and salamanders will be conducted immediately downstream of the potassium permanganate station, approximately 200 m downstream of the confluence of Sams Creek and Thunderhead Prong and about 500 m downstream of that point. The combination of oxidation of antimycin by potassium permanganate and the breakdown of antimycin through tumbling and hydrolysis in the stream should prevent the chemical from having any effect downstream of the confluence of Sams Creek and Thunderhead Prong (about 500 m below the neutralization station). If trout in the monitoring cages are not affected, then it must be assumed that potassium permanganate and tumbling action of the stream water has completely oxidized the antimycin. In this case, there will be no threats or risk to human health and safety.

2. The removal area is upstream of public water supply system intakes used by the city of Maryville. Maryville is approximately 15 miles downstream from the application

area. Should Maryville be concerned about any residual antimycin in the river at its intake?

RESPONSE: The concentration of antimycin in the stream at the potassium permanganate station will be about eight parts per billion. Potassium permanganate will be added at a concentration of 4 parts per million at the detoxification station (approximately 200 times the concentration of antimycin) to oxidize the antimycin. Experience from western parks has shown this adequate to detoxify the antimycin. In addition, about 500 m downstream of the potassium permanganate station is the confluence with Thunderhead Prong. About 1 km downstream from this point is the confluence with Lynn Camp Prong. The confluence with West Prong, Little River is 9.6 km downstream of this point, and the confluence with Little River is about 500 m downstream of this point. Based on flows taken at or near the potassium permanganate station in October and from the U.S. Geological Survey gauge at the Park boundary, Sams Creek water will be diluted 15-20:1 before the water leaves the Park. Additional dilution will occur between the Park boundary and the intake 24 km downstream of the boundary.

Research has demonstrated that tumbling, aeration, and photo oxidation associated with a 61 – 76 m (200-250 ft) drop in elevation breakdown the antimycin molecules and neutralizes the toxicity of this piscicide. The elevation drop from the neutralization station to the park boundary is 305 m (1000 ft.) and 67 m (220 ft.) from the boundary to the intake.

Given this combination of factors, the Park is confident that no residual antimycin can reach the intake for the Maryville water system.

GEORGIA DEPARTMENT OF NATURAL RESOURCES, WILDLIFE RESOURCES DIVISION

1. Review of the Environmental Assessment for the Sams Creek project shows that the benefits to the conservation of native brook trout outweigh any risks involved. You have a well researched and clearly documented plan that will enable you to meet your stated purpose. The selection of antimycin as the preferred alternative appears sound, given the alternatives analysis in your document and your staff's experience with various restoration techniques.

RESPONSE: Comment noted.

PIGEON FORGE, TENNESSEE, DEPARTMENT OF TOURISM

1. Steve Moore recently spoke to our Pigeon Forge Rotary Club about the Park's brook trout restoration program. I wanted to let you know that there were many questions asked and plenty of positive comments after Steve's program.

RESPONSE: Comment noted.

ORGANIZATIONS

Written comments were received from fifteen organizations regarding the proposed brook trout restoration project for Sams Creek. Thirteen of the organizations were in support of the EA and the use of antimycin. One organization was in favor of restoration but requested more alternatives be considered and was not in favor of antimycin to eradicate non-native rainbow trout from the proposed site. Another organization was not in favor of any action that could effect the water quality of Fontana Lake. Other issues and comments raised were: consider more alternatives; Fontana Lake water quality; breadth and scope of the EA; brook trout protection; non-target organisms; re-opening brook trout fishing; benefits of restoration project are enormous.

PUBLIC COMMENTS

Forty-eight written comments were received from the public. Most of the responses were written to support or oppose the work proposed in the EA. A few individuals made comments and/or suggestions to the EA itself, without stating support for any alternative. The majority of the public (81%) was in support of Alternative 1: Removal of Non-Natives with the Use of Antimycin. In order of interest, the percentage of public support for the remaining alternatives were: 17 % in favor Alternative 4: No Action; 2% in favor of Alternative 3: Removal of Non-Natives with the Use of Electrofishing; and 0% was in favor of Alternative 2: Removal of Non-Natives with the Use of Rotenone.

In addition, two petitions were received. One contained 124 signatures in support of Alternative 3: Removal of Non-Natives with the Use of Electrofishing. No other alternatives were supported by the petition. The petition was in favor of restoration in streams that are not accessible to fishing due to terrain limitations and stream canopy closure. The second petition was received anonymously in the Superintendents secretary's office, with no cover letter or address for the responsible individual. This petition contained over 400 names but contained no addresses or telephone numbers for any individual and cannot be responded to. The petition ask that efforts to eliminate all rainbow and brown trout from the Park be stopped, a action that was not identified in the proposal and is therefore not an issue. Additionally this petition appeared to be a copy of the original.

The three main topics of interest pertaining to the proposed brook trout restoration project included:

1. Management of native Southern Appalachian brook trout
2. Chemical (antimycin) impacts to the environment and other organisms
3. Great Smoky Mountains National Park acid deposition problems

The topics were broken-down into six main subjects of interest or concern including brook trout protection, underlying acidification, impacts to other organisms, chemical (antimycin) concerns, alternative restoration techniques, and ecosystem management. The main issues brought up by the comments included:

1. BROOK TROUT PROTECTION:

- Protection from acidification
- Protection of only native trout species for enjoyment of future generations

2. UNDERLYING ACIDIFICATION:

- Need to find a solution to the underlying acidification problem; one of the causes of brook trout habitat loss

3. IMPACTS TO OTHER ORGANISMS:

- Effects on non-target organisms, including endangered species
- Effects on humans

4. CHEMICAL (ANTIMYCIN) CONCERNS:

- Already enough problems with water without adding antimycin
- Look at effects of acidification on antimycin

5. ALTERNATIVE RESTORATION TECHNIQUES:

- Allow fishing or fish traps to remove non-natives
- Consider more alternatives for non-native removal

6. ECOSYSTEM MANAGEMENT:

- Impossible to return Great Smoky Mountains National Park to a natural state
- Destroying a productive ecosystem

PUBLIC COMMENT SUMMARY

A complete summary of the comments received by the National Park Service pertaining to the Sams Creek Brook Trout Restoration Environmental Assessment has been

prepared. Copies of the comments and responses are available for public review at the Great Smoky Mountains National Park headquarters.

**SUMMARY OF THE SUBSTANTIVE COMMENTS IDENTIFIED FOR
THE ENVIRONMENTAL ASSESSMENT FOR USING A PISCICIDE FOR
BROOK TROUT RESTORATION IN GREAT SMOKY MOUNTAINS
NATIONAL PARK**

ELECTED OFFICIALS

CONGRESS of the UNITED STATES: Honorable John J. Duncan, Jr.

1. Inquired on behalf of a constituent who did not believe such an action was safe or in the best interest of protecting fishery and aquatic resources in the Park.

RESPONSE: Thank you for the letter regarding concerns of your constituent. The National Park Service recognizes the safety issues related to the use of the chemical and will follow standardized safety protocols. The restoration of native species is a mandated function of the National Park Service and the proposed techniques are accepted nationally.

FEDERAL AND STATE AGENCIES

ALTERNATIVE PREFERENCE

SUPPORTS ALTERNATIVE 1: REMOVAL OF NON-NATIVES WITH THE USE OF ANTIMYCIN	9
SUPPORTS ALTERNATIVE 2: REMOVAL OF NON-NATIVES WITH THE USE OF ROTENONE	0
SUPPORTS ALTERNATIVE 3: REMOVAL OF NON-NATIVES WITH THE USE OF ELECTROFISHING	0
SUPPORTS ALTERNATIVE 4: NO ACTION	0

**UNITED STATES DEPARTMENT OF INTERIOR, FISH AND WILDLIFE
SERVICE**

1. The EA is adequate and supports the conclusion of not likely to adversely affect. They concur with this analysis and state that the requirements of Section 7 of the Endangered Species Act (ESA) have been fulfilled. They recommend (1) systematic surveys of invertebrate and vertebrate species be completed in all streams proposed for treatment, (2) recolonization of treatment reaches by invertebrate species and (3) insitu toxicity testing be conducted in the treatment area and downstream of the project area during treatment.

RESPONSE: Thank you for your response. (1) Streams will be prioritized for restoration and detailed surveys of invertebrate and vertebrate species prior to treatment will be

conducted. (2) Research, following treatment in western parks, indicates that invertebrates recolonize the stream quickly from untreated tributaries and upstream reaches. (3) Each day of the project insitu toxicity testing will be conducted within the treatment area and in downstream control sections.

**UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE:
CHEROKEE NATIONAL FOREST, NATIONAL FORESTS IN NORTH
CAROLINA, and SOUTHERN RESEARCH STATION**

1. Implementation of the strategy outlined in the EA will reduce the threat posed by rainbow trout to brook trout viability. The preferred alternative, Alternative 1, removal of rainbow with antimycin, offers the highest likelihood of success. The proposed project is an excellent example of science based, “proactive” conservation biology.

RESPONSE: Comment noted.

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

1. NC Wildlife Resources Commission supports the proposed action. They recommend that state and local water supply sections and the Division of Water Quality be made aware of the project during the implementation phase so they can respond to questions from the public.

RESPONSE: We will contact the NC Division of Water Quality during the planning phase of any project proposed for the NC side of the Park.

**STATE OF NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES,
DIVISION OF WATER QUALITY**

1. We have no real concerns about the project. We agree that post-treatment monitoring is a key component of this proposed action.

RESPONSE: Comment noted.

TENNESSEE WILDLIFE RESOURCES AGENCY

1. We have thoroughly reviewed the protocols and procedures for site preparation, antimycin treatment, and monitoring detailed in the EA and judge them to be appropriate for achieving the stated objectives.

RESPONSE: Comment noted.

**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION,
WATER POLLUTION CONTROL**

1. Based upon our review of the EA, TDEC-WPC has no objections to Alternative 1, which involves the use of antimycin as a piscicide, provided the safeguards and procedures are followed that are detailed in your proposal.

RESPONSE: Comment noted.

**TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION,
WATER SUPPLY**

1. The EA did not provide specific information describing the techniques the Park Service plans to use to verify that the oxidation of the antimycin by potassium permanganate is effective.

RESPONSE: Insitu monitoring using rainbow trout and salamanders will be conducted immediately downstream of the potassium permanganate neutralization station, approximately 200 m downstream of the confluence of Sams Creek and Thunderhead Prong and about 500 m downstream of that point. The combination of oxidation of antimycin by potassium permanganate and the breakdown of antimycin through tumbling and hydrolysis in the stream should prevent the chemical from having any effect downstream of the confluence of Sams Creek and Thunderhead Prong (about 500 m below the neutralization station). Antimycin is far more toxic to fish than to humans. If trout in the monitoring cages are not effected, then it must be assumed that potassium permanganate and tumbling action of the stream has completely oxidized the antimycin. That being the case, the chemicals pose no threat to humans.

2. The removal area is upstream of public water supply system intakes used by the city of Maryville. Maryville is approximately 15 miles downstream from the application area. Should Maryville be concerned about any residual Antimycin in the river at their intake?

RESPONSE: The concentration of antimycin in the stream at the potassium permanganate neutralization station will be about 8 parts per billion. Potassium permanganate will be added at a concentration of 4 parts per million at the station (approximately 200 times the concentration of antimycin) to oxidize the antimycin. Experience from western parks has shown this is more than adequate to detoxify the antimycin. In addition, about 500 m downstream of the potassium permanganate neutralization station is the confluence with Thunderhead Prong. About 1 km downstream from this point is the confluence with Lynn Camp Prong. The confluence with West Prong, Little River is 9.6 km downstream of this point, and the confluence with Little River is an additional 500 m downstream of this point. Based on flows taken at the neutralization station in October and from the U.S. Geological Survey gauge at the Park boundary, Sams Creek water will be diluted 15-20:1 before the water leaves the Park. Additional dilution will occur between the Park boundary and the intake 24 km downstream of the boundary.

Research has demonstrated that tumbling, aeration, and photo oxidation associated with a 61 – 76 m (200-250 ft) drop in elevation breaks down the antimycin molecules, and neutralize the toxicity of this piscicide. The elevation drop from the neutralization station to the Park boundary is 305 m (1000 ft.) and 67 m (220 ft.) from the boundary to the intake.

Given this combination of factors the Park does not believe it possible that residual antimycin could reach the intake for the Maryville water system.

GEORGIA DEPARTMENT OF NATURAL RESOURCES, WILDLIFE RESOURCES DIVISION

1. Review of the Environmental Assessment for the Sams Creek project shows that the benefits to the conservation of native brook trout outweigh any risks involved. You have a well researched and clearly documented plan that will enable you to meet your stated purpose. The selection of antimycin as the preferred alternative appears sound, given the alternatives analysis in your document and your staff's experience with various restoration techniques.

RESPONSE: Comment noted.

PIGEON FORGE, TENNESSEE, DEPARTMENT OF TOURISM

1. Steve Moore recently spoke to our Pigeon Forge Rotary Club about the Park's brook trout restoration program. I wanted to let you know that there were many questions asked and plenty of positive comments after Steve's program.

RESPONSE: Comment noted.

ORGANIZATIONS

ALTERNATIVE PREFERENCE

SUPPORTS ALTERNATIVE 1: REMOVAL OF NON-NATIVES WITH THE USE OF ANTIMYCIN	13
SUPPORTS ALTERNATIVE 2: REMOVAL OF NON-NATIVES WITH THE USE OF ROTENONE	0
SUPPORTS ALTERNATIVE 3: REMOVAL OF NON-NATIVES WITH THE USE OF ELECTROFISHING	0
SUPPORTS ALTERNATIVE 4: NO ACTION	2

SOUTHERN APPALACHIAN BIODIVERSITY PROJECT

1. We applaud your efforts to restore brook trout but believe that more alternatives should be considered, since this is an experiment. We encourage you to undertake a smaller project in the beginning, given the unknown factors involved.

RESPONSE: All feasible alternatives were considered and evaluated in the Environmental Assessment. The majority of small streams that can be restored using electrofishing have been completed. Streams that can be restored using antimycin are larger and thus the experiment is needed on a stream the size of Sams Creek to assess the viability of the technique. The accessibility, yet isolation of Sams Creek make it ideal for this purpose.

2. We question the fact that this EA will authorize the use of antimycin beyond the experimental use in Sams Creek.

RESPONSE: No other streams will be treated until Sams Creek is evaluated and proven successful. Prior to treatment, complete vertebrate and invertebrate inventories will be completed and appropriate plans developed to monitor recolonization. If the Park is not successful at Sams Creek, the use of Antimycin may not be used elsewhere.

3. We encourage you to take a more cautious approach and include the various users.

RESPONSE: We feel we have taken appropriate steps to include all user groups. In fact, many of these groups will assist with the project.

4. “How will NPS prevent public beliefs that the water is clean, although the poison is gone, similar to attached newspaper article about Lake Davis, California?”

RESPONSE: The work proposed for Sams Creek cannot be compared with Lake Davis, California. The use of antimycin is shown an effective piscicide that can be effectively neutralized.

FONTANA LAKE USERS ASSOCIATION

1. We are concerned for the water quality in the Fontana Lake, which would serve as one of the many drainage points below the introduction sites where these practices would initially be implemented. We, as an organization, oppose any practice that has the possibility of degrading our aquatic ecosystem. It is with all due respect that we, as an organization, write to you, voice our stance on this issue and hope that, together, we can find a reasonable and respectable solution.

RESPONSE: We believe that the water quality in Fontana Lake will not be affected due to elevation drop, dilution, and detoxification with potassium permanganate. In addition, the Sams Creek project is not in the Fontana Lake watershed.

TENNESSEE CHAPTER OF THE AMERICAN FISHERIES SOCIETY

1. We believe that the study, as described in the EA, is well designed to evaluate the project objectives. This study will allow adequate evaluation before other streams are restored. We firmly believe that antimycin is the best piscicide for this project. This effort also will allow a series of studies that will greatly further the knowledge and understanding of the aquatic biota in the Great Smoky Mountains National Park.

RESPONSE: Comment noted.

2. We hope the support of the largest group of professional fishery scientists in Tennessee will help move this project forward.

RESPONSE: Comment noted.

SMOKY MOUNTAINS HIKING CLUB

1. The Smoky Mountains Hiking Club is a supporter of the NPS efforts to rid the Smokies of exotic plants and animals and supports the efforts to reintroduce extirpated species and prevent other extirpations from occurring. A unanimous decision, by our Board of Directors, was made to support this project.

RESPONSE: Comment noted.

APPALACHIAN VOICES

1. In general, we support the goals of this proposal, specifically the need to remove exotic rainbow trout from lower reaches of Sams Creek in order to facilitate the reintroduction of native brook trout. We also agree with the experimental use of antimycin in Sams Creek, versus the more harmful rotenone.

RESPONSE: Comment noted.

2. Our greatest concern is the breadth and scope of this Environmental Assessment and the presumption that it will cover not just the activity on Sams Creek, but also on Bear Creek, Lynn Camp Prong, Meigs Post Prong, Desolation Creek, Little Cataloochee Creek, and Indian Creek. Given the scientific and logistical uncertainty surrounding this “experiment,” it seems inappropriate for this EA and any subsequent decision notice to provide blanket authority to treat six streams. We would like to see individual Environmental Assessments done for each stream (and any other candidates).

RESPONSE: The Environmental Assessment evaluated all viable scientific methods for the restoration of native trout. The pre-treatment and monitoring protocols used for the pilot project on Sams Creek will be followed for each stream identified in the Environmental Assessment assuming the Sams Creek project is successful. If not the Park will assess other options at that time, including terminating future restoration projects.

FEDERATION OF FLY FISHERS

1. I have read your Environmental Assessment related to brook trout restoration on Sams Creek, within the park, and I agree with your proposed project.

RESPONSE: Comment noted

WESTERN NORTH CAROLINA ALLIANCE

1. We applaud your goal of restoring native species (in this case native brook trout) to the Great Smoky Mountains National Park. We agree that reducing or removing exotic species is often desirable, and in some cases, the only means of successfully achieving this goal.

RESPONSE: Comment noted.

2. There is wide scientific acknowledgement that different streams and watersheds in the Southern Appalachian mountains have greatly varying diversity. To use a cookie cutter approach to antimycin experimentation would be a serious error and contrary to credible scientific method.

RESPONSE: The Environmental Assessment evaluated all viable scientific methods for the restoration of native trout. The pre-treatment and monitoring protocols used for the pilot project on Sams Creek will be followed for each stream identified in the Environmental Assessment and is considered scientifically credible by all reviewers in the scientific community.

3. We are concerned that the goals of the All Taxa Biodiversity Inventory, currently underway in the Smokies, may be compromised by the expansion of the project into streams not inventoried as thoroughly as Sams Creek.

RESPONSE: The pre-treatment inventory and monitoring protocols used for the pilot project on Sams Creek will be explicitly followed for each stream identified in the Environmental Assessment.

TROUT UNLIMITED

GREAT SMOKY MOUNTAINS CHAPTER

1. We feel that the antimycin offers the best alternative for total removal of the said fish and that potassium permanganate is the proper neutralizer as a fail safe to insure that no fish or benthos will be killed downstream of the restoration site.

RESPONSE: Comment noted.

2. We are not for the eradication of the brown and rainbow trout throughout the park, they are valued for their beauty and sport.

RESPONSE: We do not support the wholesale elimination of rainbow and brown trout because it is physically impossible, although they are non-native. For a stream to be considered for brook trout restoration it must have a barrier to prevent non-native trout from returning, a history of brook trout being present in the stream and be feasible to accomplish. Only thirteen streams could *possibly* be restored in the Park. This represents about 40 miles of stream out of over a 1000 miles of fishable streams.

3. We do not want to see this stream remained closed after it is treated and deemed a success (brook trout sustaining themselves after the three year observation period).

RESPONSE: Re-opening brook trout streams to fishing is one of the goals of this project.

TUCKASEIGEE CHAPTER

1. The chapter supports the proposal to conduct brook trout restoration on Sams Creek, including the use of antimycin, and believes that the adverse environmental impacts are minimum while the possible environmental benefits – restoring and helping to insure the survival of the Southern Appalachian brook trout – are enormous.

RESPONSE: Comment noted.

LITTLE RIVER CHAPTER

1. We hold that our beliefs are similar in that conservation is accomplished through restoration, proper management of resources, and hard labor. Our chapter is in support of the efforts to restore brook trout in the Sams Creek watershed.

RESPONSE: Comment noted.

LAND O' SKY CHAPTER

1. We support the proposal to conduct brook trout restoration on Sams Creek, including the use of antimycin. Upon review of the Environmental Assessment, it is obvious that other methods of exotic removal are inappropriate and would be ineffective.

RESPONSE: Comment noted.

2. We urge the Great Smoky Mountains National Park to continue the work of brook trout restoration in the park. Native species are precious, with a value not measurable solely in dollars and cents. We strongly support their protection and reintroduction wherever appropriate and possible.

RESPONSE: Comment noted

NORTHWESTERN CHAPTER

1. We are in full support of the use of antimycin to eliminate non-native fish. This piscicide has been used in other national parks (Yellowstone) for similar reasons with excellent results.

RESPONSE: Comment noted.

DOGWOOD ANGLERS CHAPTER

1. We, at Dogwood Anglers, feel very strongly that the proposal as stated in the Environmental Assessment has been properly researched and is a scientifically sound project. Thus far, only small reaches of streams have been repopulated with brookies and it is a good idea to move to a large watershed for repopulation.

RESPONSE: Comment noted.

2. Please also be aware that Dogwood Anglers not only is supporting this project by writing this letter, but is also planning to donate all of the net proceeds from its brook trout raffle in 2000 to this project.

RESPONSE: Comment noted.

3. In the decision making process, please be sure to consider the following facts: 1. The federal mandate to reintroduce native species to our national parks wherever possible. 2. The success of eradication of non-native trout in other areas of the U. S. by the use of antimycin, in particular in the western national parks. 3. The need to provide a large watershed at lower elevations for Southern Appalachian brook trout to help protect the subspecies. 4. The success of other restoration projects both within and outside the Smokies. 5. The expertise of the fisheries staff and consultants. Please be sure to base your decision on the scientific data and not on emotional or misinformed information.

RESPONSE: Comment noted.

NORTH CAROLINA COUNCIL OF TROUT UNLIMITED

1. The North Carolina Council of Trout Unlimited (NCTU) has reviewed the proposed restoration work on Sams Creek, including the use of antimycin to eradicate the exotics from this stream, and fully supports this effort.

RESPONSE: Comment noted.

2. The NCTU believes that the adverse environmental impacts are minimal while the possible environmental benefits – that of restoring and helping to insure the survival of the Southern Appalachian Brook Trout – are enormous.

RESPONSE: Comment noted.

3. Trout Unlimited has supported this effort through many hours of donated labor to remove exotics by electroshocking and it is aware of the limitations on this method of removal. In streams, such as Sams Creek, where the pools are too deep for electroshocking to work, other methods of eradication must be used. As explained in the EA, the use of antimycin is the best possible choice to remove the exotics and pose no threat to the rest of the environment.

RESPONSE: Comment noted.

TROUT UNLIMITED – NATIONAL

1. Every reasonable option has been examined and the recommendations in the EA are clearly the best path for restoring native brook trout to the park. The EA is based on a thorough examination of all of the potential risks and benefits that the project poses for the ecology of the Great Smoky Mountains National Park.

RESPONSE: Comment noted.

2. There is little doubt that some people will object to the reintroduction effort. Such objections always arise because of the risks associated with change. However, there is also a risk with not taking any action. At this point, it is clear that if we don't take action soon, we will lose a great natural feature of the park – the Southern Appalachian brook trout. The brook trout is of value not only to the people of the southeast, but is a unique resource of national significance and is a priority for TU national.

RESPONSE: Comment noted.

PUBLIC COMMENTS

PETITION

ALTERNATIVE PREFERENCE

SUPPORTS ALTERNATIVE 1: REMOVAL OF NON-NATIVES WITH THE USE OF ANTIMYCIN	0
SUPPORTS ALTERNATIVE 2: REMOVAL OF NON-NATIVES WITH THE USE OF ROTENONE	0
SUPPORTS ALTERNATIVE 3: REMOVAL OF NON-NATIVES WITH THE USE OF ELECTROFISHING (124 signatures)	1
SUPPORTS ALTERNATIVE 4: NO ACTION	0

INDIVIDUAL RESPONSES

ALTERNATIVE PREFERENCE

SUPPORTS ALTERNATIVE 1: REMOVAL OF NON-NATIVES WITH THE USE OF ANTIMYCIN	34
SUPPORTS ALTERNATIVE 2: REMOVAL OF NON-NATIVES WITH THE USE OF ROTENONE	0
SUPPORTS ALTERNATIVE 3: REMOVAL OF NON-NATIVES WITH THE USE OF ELECTROFISHING	1
SUPPORTS ALTERNATIVE 4: NO ACTION	6

TOPICS OF INTEREST

BROOK TROUT PROTECTION

NEED TO PRESERVE BROOK TROUT	22
CLOSING STREAMS TO FISHING IS ENOUGH TO PROTECT BROOK TROUT	1
INVERTEBRATE DENSITY AND DIVERSITY NEED TO BE AT PRE-TREATMENT LEVELS BEFORE STOCKING BROOK TROUT	1
BROOK TROUT ARE LOSING HABITAT	3

WOULD LIKE TO SEE FUTURE GENERATIONS ENJOY BROOK TROUT	2
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UNDERLYING ACIDIFICATION

NEED TO STOP ACIDIFICATION (GENERAL)	5
BURN ACIDIC DECAY TO REDUCE ACIDIFICATION	1
ADD LIME TO STREAMS TO REDUCE ACIDIFICATION	2
CONTROL NUMBER OF AUTOMOBILES ENTERING THE PARK TO REDUCE ACIDIFICATION	1
REDUCE EMISSIONS FROM TVA (AND OTHERS) TO REDUCE ACIDIFICATION	1

IMPACTS TO OTHER ORGANISMS

EFFECTS ON OTHER ENDANGERED ORGANISMS	2
EFFECTS ON NON-TARGET ORGANISMS	5
EFFECTS ON HUMANS	1
DO NOT ELIMINATE ALL RAINBOW AND BROWN TROUT FROM THE PARK	4
EFFECTS ARE MINIMAL	4

CHEMICAL (ANTIMYCIN) CONCERNS

LOOK AT EFFECTS OF ACIDIFICATION ON ANTIMYCIN	1
ALREADY ENOUGH PROBLEMS WITH WATER WITHOUT ADDING MORE CHEMICALS	2

ALTERNATIVE RESTORATION TECHNIQUES

ALLOW FISHING TO REMOVE NON-NATIVES	2
USE FISH TRAPS TO REMOVE NON-NATIVES	1

CONSIDER MORE ALTERNATIVES TO REMOVE NON-NATIVES	2
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ECOSYSTEM MANAGEMENT

DESTROYING A PRODUCTIVE ECOSYSTEM	1
NOT POSSIBLE TO RETURN SMOKIES TO A PRISTINE STATE	1

MISCELLANEOUS

AGAINST REMOVING ONE FISH FOR ANOTHER	1
TWRA STOCKS FISH THAT MIGRATE INTO PARK BOUNDARY	1
BIOLOGICALLY AND ETHICALLY WRONG TO REGARD RAINBOW AND BROWN TROUT AS ALIEN	1
IF PROJECT IS SUCCESSFUL, OPEN STREAMS FOR BROOK TROUT FISHING	5

SUBSTANTIVE COMMENTS/CONCERNS

1. Evolution, in either an organism or an ecosystem can only go forward. Please reconsider the proposed plan.

RESPONSE: All feasible alternatives were considered.

2. Don't want to eliminate one fish for another.

RESPONSE: Today, many of our national parks serve as the last place people can view native species unaltered by development, habitat destruction, and introduced exotic species. We are mandated by law to "undertake such action necessary, where feasible, to remove unwanted exotic species, up to and including eradication" (NPS Management Policy, 1988).

3. There are already enough chemicals in the water and earth now, without adding antimycin.

RESPONSE: Antimycin is a large chain molecule produced by *Streptomyces* bacteria, which are both found naturally in soils. The natural tumbling action of the streams breaks down the antimycin molecules into compounds that occur naturally in nature. Antimycin must also be neutralized, according to law, using potassium permanganate, a

substance that is used throughout the world to purify drinking water. The residuals of the neutralized antimycin and potassium permanganate will be undetectable several hundred meters downstream of the treatment area. There will be no long term or permanent residual antimycin leftover from the treatment. The compounds formed because of the detoxification and break down occur naturally in the environment and pose no threat to water quality, water systems, or human health. Studies accomplished at Western Carolina University indicate that adding antimycin to the stream, at proposed concentrations, will not affect the pH or alkalinity.

4. Based upon article in Asheville Citizen Times, concerned about eliminating salamanders and all aquatic insects thus reducing trout food.

RESPONSE: Unfortunately, the newspaper article in the *Asheville Citizen Times* on March 8, 2000, included a few statements that resulted in public opinion not based on fact. There are no threatened or endangered species of salamanders or aquatic insects throughout the proposed 2.5-mile treatment area. It is true that antimycin will kill *some* of the insects throughout the treatment area. We will greatly reduce the effect on aquatic insects by timing the treatment to occur when water temperatures are below 10 ° C (50 ° F). Similar studies in Crater Lake National Park, Rocky Mountain National Park, and Cherokee National Forest indicate that the insect communities recolonize the treatment area from stream reaches outside the treatment area. The effects of antimycin on salamanders will be less severe than on aquatic insects. Salamanders were included in bioassays conducted last year and were unaffected in both larval and adult stages. Toxicity studies conducted by the Environmental Protection Agency, using much higher concentrations than those proposed for Sams Creek showed no effects on two similar salamander species.

5. State of Tennessee still releases rainbow and brown trout that surely migrate into the Park and compete with brook trout.

RESPONSE: It is true that limited numbers of rainbow and brown trout migrate into downstream reaches of Park streams from state stockings, and we cannot control that. Our data indicates that these fish do not migrate to areas where they will compete with brook trout.

6. Remove all limits from browns and rainbows and let fishermen eliminate these fish.

RESPONSE: The task of eliminating rainbow and brown trout through angling was attempted in the Park in 1980. Anglers were required to keep all trout that were caught during a nine-week period on Lynn Camp Prong, just across the ridge from Sams Creek. During that time, anglers reduced the population by about 50% but by no means eliminated it. Angling interest dropped considerably after the first few weeks in response to the depletion of adult fish. Angling alone simply cannot eliminate these fish.

7. Try to alleviate the amount of pollution drifting into the Park, which gives rise to acid rain, instead of adding to it using antimycin.

RESPONSE: Many high-elevation areas (above 5,000 ft) in the Smokies are undergoing severe acidification through the loading of nitrates and sulfates found in acid precipitation. During the last 60 years, acid deposition has been implicated in the demise of several brook trout populations throughout the Park. The goal of historical brook trout restoration efforts was to reduce rainbow trout encroachment from downstream areas. However, acidification at the higher elevations has started to affect some populations at the upper ends of their range. Because of this “squeeze” from the top and bottom, and the fact that many populations are in marginal habitat, Park managers would like to restore some lower elevation habitat once occupied by brook trout. Since acidification is worse at the upper end of many populations, any lower elevation, larger stream segments we can restore to brook trout will help to ensure the long term recovery of this species into its native range. It will take several decades for the effects of acidification to have a major impact on these larger stream segments. The NPS is currently using all the tools within the Clean Air Act and through public education to reduce air pollution. It is hoped that future legislation will help reduce the output of harmful compounds that cause acidification.

See response to #3 for addressing issue of applying antimycin to the stream.

8. It is biologically and ethically wrong to regard rainbow and brown trout as alien species to be eradicated.

RESPONSE: Thank you for your correspondence concerning the proposed restoration of Sams Creek. A copy will be placed in the public record and taken into consideration when evaluating all the comments we have received.

9. Monitor the situation, with regard to acid deposition, and attack the pollution at its source by cutting down on the number of autos allowed in the park and working for more legislation to restrict harmful emissions from TVA (and other) smokestacks.

RESPONSE: See response to # 7.

10. Aren't the closed streams for brook trout fishing enough to protect them?

RESPONSE: See response to # 7.

11. I understand that if something isn't done about the acidification of these streams, nothing will live in them any way, in several years. To me, this is the problem and trying to restore brookies in a few streams isn't doing a thing to help this problem.

RESPONSE: See response to #7.

12. Use electrofishing, with help from Trout Unlimited, instead of toxin to eradicate the stream of rainbow trout.

RESPONSE: This method was attempted in Sams Creek in 1978 and 1979 but failed. The primary reason for this failure was the high number of large deep pools in the lower sections of Sams Creek. Deep pools cannot be effectively electrofished, therefore, all rainbow trout cannot be collected and removed using this method. Alternative 3, on pages 8 and 9 of the Environmental Assessment, addresses this issue.

13. The need to do what we can to insure the future of the Southern Appalachian brook trout makes this an acceptable risk.

RESPONSE: Comment noted.

14. I believe that the adverse environmental effects of the proposed project are minimal, temporary, and outweighed by the benefits of restoring the native brook trout to a relatively large, low-elevation stream.

RESPONSE: Comment noted.

15. How are restoration streams being selected?

RESPONSE: We are proposing chemical restoration of one stream segment as a trial. If this method works, five additional stream segments will be restored and seven more will be evaluated for restoration. If these seven streams prove to have barriers, they will also be restored. A stream segment can only be restored if 1) it currently or historically contained brook trout, 2) it has an existing barrier to rainbow trout re-invasion and 3) it is feasible to complete.

16. There must be every effort made to mitigate the impact of acid deposition within the Smokies and the entire southern Appalachian region. Further, liming of the affected streams within the Smokies to provide point source neutralization of the deposited acidifying agents should also be implemented, and immediately.

RESPONSE: See response to #7 for acid deposition. Liming is not a practice utilized by the Park service to mitigate acidification.

17. I have concerns that the use of antimycin will kill non-target species, and that the restoration does not address much of the underlying problem (habitat degradation by acid deposition).

RESPONSE: See response to # 7.

18. Why isn't burning considered at the higher elevations to reduce acidification? You are treating a symptom rather than the problem.

RESPONSE: Burning to reduce acidification is not a practice utilized by the National Park Service. See response to # 7 for acid deposition. Burning likewise only treats the symptom and not the underlying problem.

19. It is critical, for the survival of brook trout, that we expand the range and habitat where they can weather acidification without competition from other exotic trout species.

RESPONSE: We concur.

20. Inventories for benthic macroinvertebrates should clearly indicate that density and diversity have reached close to pre-treatment levels prior to restocking the treated section of stream.

RESPONSE: Comment noted.

21. I strongly urge the approval of this project. To allow the only native trout in the park to eventually become extinct, without doing all within its power to prevent it, would be a gross failure of responsibility by the Park Service.

RESPONSE: We are doing everything possible to protect and preserve brook trout. Only a small number of streams can be restored however, that will meet the goals of the program.

22. The amount of research that has been done examining the relationship between brook trout and rainbow trout shows, with little doubt, the detrimental effect on the native salmonid species.

RESPONSE: Comment noted.

23. While I was active in trout research in Tennessee for many years, I currently am no longer involved, so recommending this project is based on my genuine belief on what is the best for the resource without any bias related to vested interest.

RESPONSE: Comment noted.

24. I would like for my grandchildren and great grandchildren to be able to come to the park to see these fish many years from now and not have to hear or read about the way they used to be.

RESPONSE: Comment noted.

25. The Sams Creek project is only an experiment and a demonstration, and I think it has been well thought out and planned. Only with the lessons learned by this trial, will we be able to evaluate its effectiveness and its potential for use in other park streams.

RESPONSE: We concur. Comment noted.

26. To not proceed with the restoration of brook trout in suitable streams within Great Smoky Mountains National Park would violate the mandate given to the National Park Service to preserve and protect the natural resources of the park for present and future generations.

RESPONSE: Comment noted.

27. Why can't the park service allow fishermen to come in and freely catch as many rainbow and brown trout as they can to try to over fish the stream to the point that those species are not sustainable any more?

RESPONSE: See response to #6.

28. Are any of the salamanders on "endangered" lists?

RESPONSE: There are no threatened or endangered species of salamanders throughout the proposed four-kilometer treatment area. The effects of antimycin on salamanders will be less severe than on aquatic insects. Salamanders were included in bioassays conducted last year and were unaffected in both larval and adult stages. Toxicity studies conducted by the Environmental Protection Agency, using much higher concentrations than those proposed for Sams Creek, showed no effects on two similar salamander species.

29. What is the budget for this effort?

RESPONSE: The results of this study will not only be used within the Great Smoky Mountains National Park, but also by agencies throughout the country who are interested in similar techniques. Therefore, several state and federal agencies have been involved not only as advisory team members, but also in providing physical and financial support. The National Park Service will be providing the labor, supplies, travel, and monitoring funds not only to carry out the project, but also to monitor recovery and evaluate the overall success. Total projected costs incurred by the National Park Service will be \$80,000 during year one, \$70,000 in year two, and \$60,000 in year three. In-kind contributions from state and federal cooperating agencies, universities, and private organizations are projected to be \$89,990 in year one, \$87,900 in year two, and \$86,900 in year three.

30. I support brook trout restoration but I would not support wholesale elimination of rainbow and brown trout in the Great Smoky Mountains National Park for the sake of returning the eastern brook trout to all streams where it once thrived.

RESPONSE: We, here in the Park, do not support the wholesale elimination of rainbow and brown trout since it is not logical nor feasible. For a stream segment to be considered for brook trout restoration it must have a barrier to prevent non-native trout from

returning, a history of brook trout being present in the stream, and be feasible to accomplish. Under the best of circumstances, thirteen stream segments could *possibly* be restored in the Park. This represents approximately 40 miles out of over a 1000 miles of fishable streams.