ENVIRONMENTAL ASSESSMENT
FOR AN APACHE TROUT ENHANCEMENT PROJECT

CHAPTER I - PROJECT SCOPE

A. SPECIES HISTORY - Apache trout have been known since 1873, and were formally described nearly a century later by R.R. Miller. Historically, the Apache trout was the only resident salmonid fish in the Black, White, and Little Colorado River drainages (USFWS 1983). Based on Miller's (1972) examination of museum specimens, the 19th Century distribution of Apache trout was believed to include the White and Black River drainages, the headwaters of the Little Colorado drainage and the Blue River. These streams are all within close proximity in the White Mountains of Arizona. According to the Apache Trout Recovery Team (USFWS 1983 [Project Record]) and more recent research, the former widespread distribution of Apache trout in the Black, White, and Little Colorado River (LCR) drainages is confirmed by present hybrid populations and documented collections (Loundenslager et al. 1986, Carmichael et al. 1993). Many early White Mountain area settlers reported the abundant presence of native trout, which they referred to as yellow-bellied, speckled trout (Miller 1972, USFWS 1983). Survey records from the 1980s (Rinne 1985, Rinne and Minckley 1985, Loudenslager et al. 1986, Dowling and Childs 1992, Carmichael et al. 1993) indicated that populations of Apache trout still remained in several streams on the Fort Apache Indian Reservation (FAIR)and Apache-Sitgreaves National Forests (A-SNFs).

Predation and competition from non-native trout, habitat loss and degradation from cattle grazing, logging, mining, agriculture, road construction, water diversions and reservoir construction, and over fishing have greatly reduced Apache trout distribution and numbers. Many watersheds formerly inhabited by Apache trout have been routinely stocked with rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki* sp.), brook trout *(Salvelinus fontinalis),* or brown trout *(Salmo trutta)* since the early 1900s (Silvey 1984). Non-indigenous salmonids exhibit tendencies to out-compete Apache trout for resources such as food, cover, and other similar niche requirements, and to prey on them. Such competition with brown trout and brook trout has been identified as a cause of the decline of Apache trout (Rinne et al. 1981, Rinne and Minckley 1985, Carmichael et al. 1995). Cutthroat and rainbow trout were extensively stocked over the entire range of Apache trout. Fortunately, natural barriers prevented mixing of species in some watersheds. Hatchery and management records from Williams Creek National Fish Hatchery, the US Fish and Wildlife Service (USFWS) Arizona Fisheries Resources Office, and the Arizona Game and Fish Department (AGFD) indicate that cutthroat trout were stocked from at least 1920 to 1942. Similar records indicate that rainbow trout were widely stocked between 1934 and 1954. Some non-indigenous trout stocking still occurs today. In ensuing years, the list of known introduced fish species has grown to more than 80. Most of these species were purposeful introductions, placed in Arizona waters in an attempt to increase the diversity of sport fishing experiences.

The only pure populations of Apache trout remaining by the 1950s were those that were isolated in headwater streams where non-native trout were not stocked, most of which were upstream of natural waterfalls. These created natural barriers to upstream movement of non-native trout. By the 1960s, pure Apache trout populations had been reduced from a range of 599.6 stream miles (965 kilometers) to a low of about 29.8 stream miles (48 kilometers) (Harper 1978). The White Mountain Apache Tribe undertook first attempts at conservation of Apache trout in the late 1940s and early 1950s when the only known populations existed on the Fort Apache Indian Reservation. In 1955, all Mt. Baldy streams on the reservation were closed to fishing. In 1963, the AGFD created hatchery brood fish populations at Sterling Springs State Fish Hatchery and stocking of Apache trout began throughout Arizona for both restoration and sport fishing from this initial hatchery program. In 1983, the USFWS began rearing Apache trout at the Williams Creek National Fish Hatchery on the Fort Apache Indian Reservation and it is now the principle rearing facility.

The Apache trout was one of the original species to be listed under the Endangered Species Conservation Act of 1969. When the Endangered Species Act (ESA) of 1973 passed into law, the trout was listed as endangered. All Arizona waters were closed to "taking" (fishing) of Apache trout in 1974. A recovery team was created in 1975 and Apache trout were down-listed to "threatened"

in that same year (USFWS 1975). A special rule (50 CFR 17.44) allowed for take (sport fishing) consistent with state law.

A recovery plan was written in 1979, revised in 1983 (USFWS 1979, 1983), and is currently in the process of being revised again. De-listing of the Apache trout can be recommended when 30 discrete, self-sustaining populations of pure Apache trout exist and all threats are adequately addressed (USFWS 1983, ESA). In addition to protecting the remaining pure populations, a main goal of the Apache trout Recovery Plan was to reclaim streams within the historical range through renovations to establish new populations. Renovation means that all fish are removed from streams, either chemically or mechanically. Recovery actions have primarily focused on 1) surveying and addressing the genetic status (purity) of existing populations and protecting those populations, 2) renovating selected streams in historic habitat and reintroducing Apache trout following elimination of non-native trout species, 3) surveying populations and habitat conditions and developing and implementing habitat recovery measures, and 4) developing a hatchery brood stock and enhancing sport fisheries for the species. When recovery objectives are fully implemented, Apache trout will exist in approximately one-half the known historic range of the species across USFS and FAIR lands.

The Apache-Sitgreaves National Forests Plan (Plan, 1986) directs managers to cooperate with the Arizona Game and Fish Department (AGFD) in efforts to reintroduce extirpated [no longer present] species (pg 15) and to work toward recovery and declassification of listed species (pg 15). Seven of the 14 streams proposed for treatment are specifically listed in the Plan as streams that are to be managed for threatened and endangered species (pg 155-1). Since the adoption of the Plan, additional suitable streams have been identified for reintroduction.

Past stream renovations for Apache trout have met with varying levels of success. Over the last 50 years, of nine renovations on National Forest lands utilizing rotenone, two were successful and seven were unsuccessful. All eight streams renovated utilizing Antimycin A were successful; however, five of these stream renovations were later compromised due to barrier failure. Applying new knowledge and experience in the design and construction of barriers, and the use of Antimycin A rather than rotenone, the chances for success have substantially increased.

B. PROJECT LOCATION / ANALYSIS AREA - The proposed project lies within the A-SNFs in two watersheds, Black River (Chapter 2 - Figure 1 and Table 1) and LCR (Chapter 2 - Figure 2 and Table 2). Actions of the proposed project are located in Apache and Greenlee Counties, Arizona.

C. PROPOSED ACTION - The proposed actions are a comprehensive set of measures that would play a significant role in the recovery of Apache trout. The actions, which would occur in the Black River and LCR systems (Figures 1 & 2) are summarized in Tables 1 & 2 in Chapter 2. The following five actions are proposed to contribute to reintroducing self-sustaining populations of Apache trout on the A-SNFs. For this project, all of the LCR system work would occur on the Springerville R.D. and most of the work in the Black River system would be on the Alpine R.D. (except for Stinky and Hayground Creeks). These actions would take place over the course of about five years (2004 through 2008). Often all actions planned on a stream would occur within one calendar year, however, this would not necessarily be so on all streams (see Appendix B for the proposed schedule of work and time frames).

1. Fish Barrier Construction - Construct seven new fish barriers on target streams to prevent the continued ingress of non-native salmonids; one on the West Fork Black River and two each on the East, West and South Forks LCR.

2. Fish Barrier Improvement - Remodel (heighten) three existing fish barriers on target streams to prohibit future ingress of non-native salmonids. One each on Centerfire, Fish and Hayground Creeks.

3. Salvage of Native Fish and Macroinvertebrates – In all proposed streams, electrofish streams prior to renovation. Some portion of native fish would be temporarily held outside of the treatment area until renovations are completed and then released into the streams from which

they were salvaged. The macro invertebrates collected (via kick nets or Surber samplers) would be held in captivity, up to two-weeks if necessary, for replacement back into the streams from which they were salvaged (provided that renovation is successful). Non-native fish would be removed from the streams via renovations described below.

4. Renovation – In all proposed streams, the Forest Service would authorize the AGFD to eliminate non-native salmonids upstream of each barrier through renovation by one of two techniques (antimycin A or electrofishing). See Appendix D in regards to piscicides [pesticides intended to kill fish] and Appendix E for electrofishing. If renovation is found not to be successful prior to reintroduction of Apache trout, i.e., removal of non-natives is not complete, the renovation treatment would be re-applied.

5. Reintroduce Apache Trout and Replace Salvaged Native Fish, and Macroinvertebrates - Once fish barriers are constructed/remodeled and any renovations (non-native salmonid eradications) are completed, Apache trout of acceptable genetic lineage will be reintroduced into the designated stream reaches. Reintroduction of Apache trout into streams would follow two complete visual surveys and two complete electrofishing surveys to assess success of renovation (see Appendix G for renovation protocol). Replace salvaged native fish and macro invertebrates in all proposed streams. Currently, Apache trout (pure and/or hybrid) occur in all streams except South Fork LCR.

D. Purpose and Need for Action - The purpose and need for this project is to remove non-native fish species from some reaches of certain drainages and to reintroduce pure Apache trout into the drainages to enhance recovery effort. Specifically, the Apache trout and Little Colorado Spinedace Recovery Team through Arizona Game and Fish Department has proposed reintroduction of pure Apache trout into portions of the West Fork of the Black River; East, West, and South Forks of the Little Colorado River; Fish, Stinky, Lee Valley, Snake, Bear Wallow, Centerfire, Hayground, Wildcat, Conklin, and Boggy Creeks. Currently, Apache trout (pure and/or hybrid) occur in all streams except South Fork LCR. Lee Valley Reservoir is not part of this decision because that renovation does not require federal NEPA.

The project is needed to secure reproductive, self-sustaining populations of pure Apache trout within their historic range, as directed by the A-SNFs Plan. Reintroduction activities would include construction or reconstruction of ten (10) fish passage barriers, backfilling pools created behind the new barriers (unless water rights issues are resolved), using chemicals to eradicate non-native fish above the barriers, and reintroducing Apache trout into the treated streams and rivers. Work would occur over approximately 3-5 years to minimize impacts to fishing recreation.

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to carry out affirmative conservation programs that would recover endangered and threatened species (50 CFR 402.01). The Forest Service is directed to encourage or initiate the reintroduction of listed wildlife, fish and plants onto suitable unoccupied habitat when such actions promote recovery of the species [FSM 2674 (6/90)]. A-SNFs Forest Plan (Plan) directs managers to implement threatened and endangered (T&E) species recovery plans (pg 69), and to manage T&E species habitat to achieve declassification in a manner consistent with the goals established by the USFWS and the AGFD. The Plan also states (pg 71) that recovery activities will be pursued where pertinent.

The Plan further directs (pgs 15 & 73) cooperation with AGFD in evaluating proposals for reintroducing extirpated species into suitable habitat and on fish stocking (pg 158). The site-specific actions proposed in this environmental analysis comply with that direction and would fulfill the A-SNFs' mission to increase emphasis on fisheries resources (pgs 15, 69, 70, 71, 73, 155, 155-1, 155-2 & 158).

These actions will also be consistent with MOU 00-MU-11030121-005 in which the USFS agreed to participate in recovery actions for Apache trout. The core partners in this agreement include the A-SNFs, Arizona Game and Fish Commission, USFWS (Pinetop Fisheries Resource Office), Arizona Trout Unlimited (Old Pueblo Chapter designated lead), Federation of Fly Fishers (Eastern Rocky Mountain Council designated lead), and Wildlife Conservation Council.

The proposed actions identified in this environmental analysis (EA) have been coordinated with other Federal and State agencies including the U.S. Army Corps of Engineers (ACE), Bureau of Reclamation, USFWS, White Mountain Apache Tribe, and AGFD. In addition, contact has been initiated with individuals from the Apache Trout Recovery Team. These contacts were made to ensure compliance of any proposed actions/activities with interagency regulations, procedures, and established recovery plan goals and objectives.

1. Existing Conditions

a. Apache Trout - Apache trout are listed as threatened under the ESA. According to the most recent monitoring by USFWS (2001 draft), at least 14 known pure populations (non-hybridized) currently exist within the historic range in Apache, Gila, and Greenlee Counties, Arizona on lands administered by the A-SNFs, and on the Fort Apache Indian Reservation. These 14 populations represent 13 discrete natural genetic stocks of Apache trout. Historically, Apache trout inhabited at least an estimated 600 miles (965 km) of streams, which included most of the streams in east-central Arizona's White Mountains above 5,900 feet (1,798 meters) (Minckley 1973, Behnke and Zarn 1976, Harper 1978). Many of these streams would be considered currently suitable trout habitat. Most streams on the A-SNFs containing Apache trout also currently contain other trout species or hybridized populations.

Cooperative efforts have been ongoing since the early 1960s between the USFS, USFWS, AGFD, White Mountain Apache Tribe, and numerous conservation and sportsmen groups. The proposed actions are consistent with the 1983 Apache Trout Recovery Plan and would result in Apache trout being restored to approximately 22% of its historic range.

b. Black River System - The Black River watershed on the A-SNFs currently provides suitable habitat for six species of native fish including the threatened Apache trout, threatened loach minnow (*Tiaroga cobitis*), roundtail chub (*Gila robusta*), speckled dace (*Rhinichthys osculus*), Sonora sucker (*Catostomus insignis*), and desert sucker (*Pantosteus clarki*). The *Apache Trout Recovery Plan* identifies several headwater streams in this system containing or recommended for the recovery of Apache trout. The A-SNFs Forest Plan (pg 155 & 155-1) specifically lists Centerfire, Fish, Hayground, Double Cienega, Corduroy, Home, Bear Wallow, Snake and Stinky Creeks as streams where management emphasis will give TE&S species first priority. Coldwater fisheries streams, such as West Fork Black River, have been given second priority for management emphasis. These headwater streams contain non-native trout or trout hybrids so fish barriers are required to isolate and safeguard Apache trout populations in stream reaches above barriers. As previously mentioned, non-native trout threaten Apache trout through hybridization, predation, and competition.

c. Little Colorado River System - The LCR watershed on the A-SNFs currently provides suitable habitat for five species of native fish including the threatened Apache trout, Little Colorado spinedace (*Lepidomeda vittata*), speckled dace, bluehead sucker (*Pantosteus discobolus*), and Little Colorado sucker (*Catostomus* sp.). The East, West and South Forks LCR are three suitable tributaries for reintroduction of the Apache trout. The A-SNFs Forest Plan (pg 155 & 155-1) specifically lists Lee Valley Creek and East Fork LCR as streams where management emphasis will give TE&S species first priority. Coldwater fisheries streams, such as South and West Forks LCR, have been given second priority for management emphasis. Although headwater tributaries to the LCR provide suitable habitat for Apache trout within the historical range of the species, the current presence of Apache trout has not been documented in the South Fork LCR. However, AGFD first stocked Apache trout (EFWR hatchery stock) into the lower section of the creek near the town of Greer in 1999. These headwater streams contain non-native trout (or hybrids) so fish barriers are required to isolate and safeguard Apache trout populations in stream reaches.

2. Desired Future Condition

a. Sustainable populations of Apache trout, of appropriate genetic lineages, are established in the streams and rivers identified in Figures 1 & 2 and Tables 1 & 2 (See Chapter 2). Thus, the distribution of pure Apache trout has been expanded within the LCR and Black River systems. The West Fork Black River is secure for Apache trout. Several streams are managed for recovery and provide sport fishing opportunities for Apache trout.

b. Direct threats to Apache trout from hybridization with, and predation and competition from, non-native salmonids are eliminated.

c. The genetic integrity of reintroduced populations of Apache trout in the LCR and Black River systems is secure, increasing the likelihood that viable populations and communities of Apache trout would be self-sustaining.

d. Apache trout provide a viable recreational fishery in each system to which they are reintroduced.

e. Barriers are maintained as needed.

f. These desired conditions are achieved through a multi-agency, collaborative effort. The cooperators continue to provide the public with information/education concerning the transportation and introduction of non-native aquatic species into Arizona waters.

E. Objectives - The following objectives specify how this project would help arrive at desired conditions.

a. Establish self-sustaining populations of Apache trout in the named streams.

b. Eliminate the threat of hybridization with, and competition and predation from, non-native salmonids in each recovery stream.

c. Establish additional recreational fishing opportunities for Apache trout on public lands administered by the A-SNFs.

d. Minimize disturbance to stream dynamics during and after implementation of proposed actions.

e. Minimize adverse effects to other resources during and after implementation of proposed actions.

F. DECISIONS TO BE MADE - The decision to be made is whether or not to build and maintain barriers in the designated streams, carry out stream renovations and reintroduce pure Apache trout into suitable habitat on lands administered by the A-SNFs, and by what means it will be accomplished. Based on the analysis presented in this EA, the Responsible Official(s) will determine whether 1) significant environmental impacts would result from implementing the proposed action, thus requiring the preparation of an Environmental Impact Statement, or 2) there is a Finding of No Significant Impact. If there is a Finding of No Significant Impact the Responsible Official(s) will consider how to use a combination of fish barriers and renovation to achieve the objectives of the project. The Forest Supervisor has the authority to implement the use and construction/ remodeling of fish barriers. The EA will also evaluate the use of antimycin A (Fintrol®). The Forest Supervisor has the delegated authority to approve its use outside of wilderness; however, any decisions about its use in primitive areas is reserved to the Regional Forester who will draw on the same EA to determine if its use is warranted.

G. BACKGROUND AND PUBLIC INVOLVEMENT – An initial EA was sent out for public comment in 2002. After Decision Notices were signed (March 24, 2003 and March 27, 2003) based on that initial EA, several interested publics stated that they did not receive notice of the decision and their appeal rights. Other interested publics stated they did not receive the original scoping report. The Forest Supervisor decided to issue this revised Environmental Assessment to address concerns brought up

by the public in public meetings and letters received in response to a revised scoping report sent to over 300 organizations and individuals on August 26, 2003. Thirty-five (35) letters were received that responded to that scoping request. The Forests' replies to those letters are summarized by concern or issue below and/or in Appendix C. The Project file contains mailing lists and copies of all response letters.

H. ISSUES

1. Preliminary Issues - Eight preliminary issues were identified from discussions between agencies and interdisciplinary team members. A revised public Scoping Report was sent to more than 300 addressees soliciting comments and additional issues for this project on August 26, 2003. Thirty-five (35) responses to the scoping report were received from the public. Concerns about economic and social impacts to the fishing industry were raised, and will be addressed in the economics section in this EA. Concerns about the effects to livestock permittees were also raised and are addressed below. Key Issues are used to develop new alternatives, choose appropriate mitigation measures (to minimize impacts), or analyze environmental effects.

In order for a preliminary issue to be considered as a key issue and therefore considered in formulating alternatives, it must meet one the following criteria: a) Be within the scope of the proposed action, b) Not already be decided/required by law, regulation or other previous decisions, c) Be relevant to the decision being made, d) Not be distinctly limited in extent, duration and intensity, and e) Be supported by scientific evidence.

2. Non-significant Issues - After evaluation against the above criteria, the following preliminary issues were not considered significant issues (Project Record).

a. Likelihood of successfully establishing a viable Apache trout population in the LCR and Black River systems. *Disposition:* This does not qualify as a NEPA issue but rather is an evaluation criterion by which to evaluate each alternative. All proposed streams currently support populations of fish.

b. Possible loss of recreational fishing days and non-native fish species as a result of renovation. *Disposition:* After much consideration, this was determined not to be a key NEPA issue because impacts to recreational fishing will be limited in extent, duration, and intensity. The project was modified to extend the proposed schedule over several years (See Appendix B and the Recreation and Economics Sections in Chapter 3.

c. Coordination of other A-SNFs activities with the project implementation activities (i.e., actions needed to accomplish renovation and get fish into designated recovery sites). *Disposition:* This does not qualify as a key NEPA issue because it is not within the scope of the action. Coordination, notification, signing, safety procedures, etc. are standard operating procedure on the A-SNFs and must be followed for all management activities. Notification and signing are part of the Proposed Action (See Chapter 2).

d. Consequences of having an ESA listed fish (Apache trout) present when considering other actions, including on-going livestock grazing. *Disposition:* This is not a key NEPA issue because it is already decided under previous Decisions (A-SNFs Plan). The Apache trout is already present in all but the South Fork of the Little Colorado River; thus, they are part of the existing condition in those streams. The goal of the project is to restore self-sustaining populations of pure Apache trout into the selected streams. Present uses authorized in current management plans are compatible with recovery as long as Forest Plan direction is followed. The project actions would not result in changes to permitted livestock numbers or season of use as long as the current range, watershed, and riparian conditions remain stable to improving.

The A-SNFs Plan directs that permitted livestock be balanced with capacity, and that range, riparian and watershed conditions be maintained, or improved where needed. This direction is compatible with the current project and would not require adjustments to other resource uses. However, based on comments and concerns, the FS consulted with USFWS on several

allotments lacking current consultation. The Biological Opinion from them required continued utilization and trespass monitoring and not allowing livestock to congregate within stream corridors, as directed by the current Plan. Range specialists' reports of all on going grazing activities determined that no direct, indirect, or cumulative effects would result from the proposed action or other alternatives (Project Record).

e. Concern of water users and water right holders over water retention behind fish barriers. Dispostion: This does not qualify as a NEPA issue because it is distinctly limited in extent, duration, and intensity. In an effort to comply with applicable State laws, the Forests contacted the State administrative organizations with authority over water rights in the basins involved in this project.

Those fish barriers within the Little Colorado River basin fall within the area covered by the Norviel Judgment and Decree (April 29, 1918) of the Superior Court for Apache County. Water rights in this area are administered by the Superior Court. Early in the history of the project, in the year 2000, the Forests contacted the Superior Court to determine if the temporary storage behind the small fish barriers in the Little Colorado Basin was a use requiring a water right. The opinion of Judge Michael Nelson was that the use did require a water right and that this could be accomplished through the transfer of an existing right in the basin held by the United States of America. On March 26, 2002 the Forests filed a Little Colorado Right Transfer form (amended January 9, 2003) with the Superior Court to transfer a portion of Norviel Decree Water Right No. 1918 11A.04 for diversion from the Little Colorado River near Greer with a current point of use in Sec. 1, T7N, R27E, G&SRM to the six separate sites of the proposed fish barriers in the West, East and South Forks of the Little Colorado River.

On April 1, 2002, after review of the original transfer application, Judge Nelson requested that the Forests submit a technical analysis in support of the proposed transfer. This technical analysis was submitted to the Superior Court on January 9, 2003. The technical analysis estimated that the combined losses due to the initial filling and evaporation at all of the six fish barriers in the LCR amounted to 1.9 acre-feet/year in a normal year up to a maximum of 2.3 acre-feet/year in a dry year. Water storage and evaporation would decline after the initial fill year as the pools of water behind the fish barriers filled with sediment.

The technical analysis also indicated that Norviel Decree right holders in the West, East and South Forks of the LCR as well as the mainstem above the current point of use of the water right might possibly be impacted by the proposed transfer, particularly during the initial fill period. However, Norviel Decree water right holders in the reaches below the existing diversion would likely receive *benefit* from conversion of a portion of the consumptive use claim to a non-consumptive use.

The Superior Court accepted the Technical Analysis and directed the Forests to advertise the transfer application and technical analysis and to inform certain downstream irrigation companies. Legal counsel for one of the downstream irrigation companies, the Lyman Water Company, filed an objection to the application with the Superior Court dated March 7, 2003. The stated reason for the protest was to "protect Lyman Water Company's rights under A.R.S. §45-172." This statute essentially requires approval of downstream irrigation districts, agricultural improvement districts, and water user' associations before an application to sever or transfer a water right can be accepted for filing by the Director of ADWR. Under this state statute, it is not necessary for the protestor to show cause in order to withhold approval of the proposed severance or transfer. Subsequent negotiations with the legal counsel for Lyman Water Company have not resulted in resolution of the protest.

In view of the unresolved water rights issue with the Lyman Water Company, the proponents of the Apache Trout Enhancement project, with the agreement of the A-SNFs, proposed that the design of the fish barriers in the Little Colorado River basin under all action alternatives be altered so that no temporary storage pools are created behind them. This could be accomplished by physically backfilling behind the barriers at the time of construction with rock materials to be found near the site, through design alterations that would result in permeable

structures, or a combination of these construction techniques. Although backfilling would eliminate the need for a water right, it would significantly increase the cost of the fish barriers. In order to construct the backfilled barriers on a cost efficient basis, it may be necessary to move the location of the lower barriers in the East Fork and West Fork of the LCR from the preferred locations lower in the drainages to a location nearer to the upper barriers. The stream gradient and valley shape characteristics in the upper barrier locations allow for a smaller structure to be built. Moving the location of the lower barriers would result in tradeoffs in terms of potential restored Apache Trout habitat lost to the project. This would amount to a loss of as much as 6700 to 8000 feet of stream (depending on the final site selection for the lower barrier) in the West Fork of the LCR being renovated for Apache trout. In the East Fork of the Little Colorado it would amount to between 1900 and 4500 feet of stream. The fish barriers on the South Fork of the LCR would remain at the preferred locations under the backfilling option. In the event that future negotiations with the Lyman Water Company resolve the water rights issues for the barriers in the Little Colorado River basin, the fish barriers would be built in the original preferred locations without physical backfilling. Nonetheless, backfilling would be accomplished naturally over time as bedload and sediment accumulates behind the structures during peak flows.

On March 27, 2002, the Forests submitted an Application for Permit to Appropriate Public Water to the Arizona Department of Water Resources for the fish barrier on the West Fork of the Black River. This application was amended by the Forests on May 13, 2002 and subsequently advertised and posted in accordance with State Law. The application requested authorization to store 1.66 acre-feet of water. The Salt River Valley Water Users' Association (SRP) protested this application. The Forests are currently negotiating with SRP to resolve the water rights issue through a compensatory arrangement. If these negotiations are not successful, backfilling and possible alteration in design to make the barrier permeable would be considered, similar to the situation discussed for the barriers in the LCR basin. Backfilling of this structure, however, would greatly increase its cost.

3. Key Issues - After evaluation of preliminary issues against the above criteria the following are the key issues identified through scoping and are the basis for alternative development for this project:

a. Effects of renovation and neutralization chemicals on water quality.

b. Effects of fish barrier construction/remodeling on water quality.

c. Effects of fish barrier construction/remodeling on stream dynamics.

I. EVALUATION CRITERIA - The following initial Evaluation Criteria have been selected to assess issues resolution, evaluate attainment of objectives, and describe environmental impacts. Where the Evaluation Criteria are not quantifiable, a narrative discussing specific effects will be presented in the environmental document. The Evaluation Criteria anticipated for use in this analysis are (numerically correspond with the preliminary issues mentioned above):

1. Extent (linear feet) of antimycin A (Fintrol® liquid or sand formulation at 10 to 20 parts per billion [ppb]) movement in drainages below the treatment area using bioassay, i.e., biological indicators (trout). Addresses Issue 1 (antimycin A and water quality).

2. Estimated volume (cubic feet) of displaced sediment entering the system during barrier(s) construction/remodeling. Addresses Issue 2 (sediment and water quality).

3. Sediment storage behind (upstream of) barrier(s). Measure by estimated volume of sediment (acre feet) and narrative in watershed section. Addresses Issue 3 (stream dynamics).

4. Qualitative assessment of the chance of success in establishing a viable Apache trout population in the LCR and Black River systems. Addresses accomplishment of project objectives (Page 5).

CHAPTER 2 – ALTERNATIVES

A. DEVELOPMENT OF ALTERNATIVES

Reasonable alternatives are developed to explore different ways to accomplish the purpose and need in response to the significant issues. A reasonable alternative is one that responds to a significant issue and substantially accomplishes the purpose and need (see FSH 1909.15, chapter 14). An alternative that does not substantially accomplish the purpose and need is not reasonable, even if it does respond to an argument presented in a significant issue (FSH 1909.15, chapter 14.3).

B. ALTERNATIVES DROPPED FROM DETAILED STUDY

1. Fish Removal by Entanglement Gear (Gill and Trammel Nets) with all Else Being the Same as ALTERNATIVES 3 and 4 - Entanglement gear for fish removal rather than antimycin A renovation would be used. Initially considered to address Issue 1. However, these methods are not generally suitable for use in shallow stream habitats and would be ineffective at removing all target fish from the treatment areas so the methodology would not be expected to be successful for removing non-native salmonids.

Entanglement gear is a passive capture technique, highly dependent upon fish activity (fish must swim into the net). Since, typically, little movement occurs between pools on a regular basis, nets would need to be set in virtually all pools along the length of the treatment area. Nets are size selective, as well. Small fish can swim through the mesh, while very large fish cannot penetrate the mesh to become entangled. Since capture efficiency of gill and trammel nets decrease as fish accumulate, and saturation generally occurs when only a small percentage of the net is occupied, nets would need to be checked and entangled fish removed every few hours depending on catch rate. Nets not continuously attended could also pose a hazard to non-target species. Therefore, this alternative was dropped from further consideration because the first three project objectives would not be met (Project Record).

2. Conduct Renovation and Restoration without Fish Barrier Construction/Remodeling - Initially considered to address Issues 2 and 3. However, with no barriers, Apache trout populations would not be secured from competition or hybridization with non-native trout. Non-native trout could migrate into renovated stream reaches, thereby threatening the integrity of the reintroduced Apache trout populations. Hybridization with non-native trout is cited in the *Apache Trout Recovery Plan* (USFWS 1983) as one of the reasons for the listing of the species. Therefore, this alternative was dropped from further consideration because the first three project objectives would not be met (Project Record).

3. Construct Barriers and/or Renovate Only Some of the Streams – This alternative does not meet the stated purpose and need, because the streams included in the proposed action are considered essential for enhancing the recovery effort. In order to meet the project objective of minimizing impacts to other resources, the Team decided to distribute the renovations through several years instead of reducing the total stream miles renovated.

4. Declare All Renovated Streams Non-Essential Experimental Populations – This alternative was suggested by one of the respondents. Even though the Forest Service cannot declare the population non-essential, the respondent notes that we can evaluate an alternative that is outside our jurisdiction. Jurisdiction for 10-J designation lies with USFWS, and not AGFD or the USFS. The Endangered Species Act (ESA) allows for the establishment of non-essential experimental populations *outside the current range of the species* that do not require the same protection considerations under ESA as listed species. However, this section can only be used "…when, and at such times as, the population is wholly separate geographically from non-experimental populations of the same species." Protected Apache trout currently reside in both the LCR and Black River systems on FAIR and USFS lands. Establishing a non-essential experimental population would not be applicable because the trout could mix with currently protected populations. Furthermore, the designation to 10-J does not release the USFS from

commitments under Section 7(a)(1) of ESA and the ASNFs Forest Plan, described in the Purpose and Need section. Therefore, this alternative was not considered in detail because it is not feasible.

B. ALTERNATIVES CONSIDERED IN DETAIL

1. Mitigation Common to All Action Alternatives - Seven mitigation measures were developed as follows and are common to all action alternatives:

a. Timing restrictions to limit sediment generated by barrier construction or remodeling. **Any** instream work will be conducted only during low flows. This is typically May, June, 1st half of July, October, and November. However, work will be completed whenever the stream conditions are appropriate and labor is available.

b. Possible timing restrictions to minimize impacts to recreationalists. Possibly no work on South Fork LCR barrier(s) around Memorial Day and Labor Day.

c. Timing to avoid the possibility of impacts to livestock grazing. Antimycin A will not be used when livestock are present AND have access to the stream corridor. Livestock will be kept away from the stream corridor during renovation.

d. Backfill structures and/or construct permeable structures to eliminate storage pools in the event that protest by downstream users over the transfer of the federal government's water use from a consumptive to a non-consumptive use is not resolved prior to construction.

e. Surveys for California floater, White Mountains water penny beetle and false ameletus mayfly will be conducted prior to barrier construction. Individuals found will be collected and relocated to stream reaches that will not be affected by barrier construction.

f. Surveys for Chiricahua Leopard frog will be conducted prior to treatments. Although not expected because of its rarity and lack of previous finds, if there are any detections, site-specific activities will cease until reconsultation is concluded. This mitigation will reduce the likelihood of incidental take of Chiricahua leopard frog.

g. Best Management Practices (See Appendix F) will be applied to all Action Alternatives (Alternatives 2, 3, and 4).

2. Alternative Descriptions - The alternatives include a "no action" alternative and three action alternatives that respond to the need for action and issues described in Chapter 1.

a. ALTERNATIVE 1 - (No Action): No new fish barriers would be constructed or existing barriers remodeled; streams would not be renovated (non-native trout would not be removed), and Apache trout would not be reintroduced into the streams listed in this EA.

b. ALTERNATIVE 2 - (Proposed Action): New fish barrier construction, existing fish barrier remodeling, piscicide renovation of streams, and reintroduction of Apache trout. Remove non-native and hybrid trout from the subject streams with an EPA registered fish toxicant (antimycin A [Fintrol®] liquid and/or sand formulation.

This alternative encompasses the following activities:

1) The A-SNFs will construct seven new fish barriers on three LCR system streams (East, South and West Forks) and one Black River system stream (West Fork) and remodel three existing fish barriers on three Black River system streams (Centerfire, Fish and Hayground Creeks) (see Appendix C for barrier specifications). Barriers are constructed in areas where the substrate is stable and gradient allows for a sufficient fall of water. Some previous attempts have failed due to floods washing around the barrier, deterioration of the barrier, or

ineffective design or construction of the barrier. Because of these factors, site selection, barrier design, and maintenance are very important.

2) AGFD personnel will salvage a portion of the resident native fish and macro invertebrates through electrofishing and kick nets and/or Surber samplers, respectively, prior to antimycin A treatment, and temporarily hold them outside of the treatment area for release. Salvaged native fish and macroinvertebrates will be restocked within 2 weeks if possible (see Appendices B & E for stream renovation protocol). Non-native sport fish will be released downstream of barriers, if possible.

3) The Forest Service will authorize the use of antimycin A (liquid and sand formulation) and potassium permanganate by AGFD personnel for the piscicide renovation of Bear Wallow (includes both North and South Forks), Centerfire (includes Boggy and Wildcat), Conklin, Fish (includes Corduroy and Double Cienega Creeks and Ackre Lake), Hayground, Lee Valley, Snake and Stinky Creeks, and East Fork LCR (includes Colter Reservoir), South Fork LCR (includes Bill Riley Creek and Joe Baca Draw), West Fork Black River and West Fork LCR (includes lower portion of Home Creek). Renovation is required in certain low flowing streams, such as Bear Wallow and parts of the South Fork LCR, to insure non-natives are not present. These stretches of streams may not support self-sustaining populations of apache trout.

a) AGFD personnel will chemically treat waters (upstream from barrier sites back downstream to the fish barrier) above fish barriers with an EPA registered piscicide (Antimycin A ; e.g. Fintrol®) at a target concentration of 10 to 20 parts per billion (ppb) to remove all non-native fish. The applicator will be experienced in Antimycin A use and certified by the Arizona Department of Agriculture (ADA) through an EPA endorsed program to apply restricted use pesticides (Project Record). All pesticide applications will be conducted using applicable guidance as outlined in USFS FSM 2150 and FSH 2109.14. All manufacturers' label instructions for the piscicide will be complied with (Project Record).

b) AGFD personnel will set up detoxification sites at each fish barrier and one approximately 300 meters down stream of each fish barrier. Antimycin A will be detoxified at the barrier sites with potassium permanganate ($KMnO_4$) at a concentration of 1 milligram/liter. The secondary detoxification station will be activated only in the event of incomplete detoxification at the primary detoxification station. Effectiveness of detoxification will be determined by use of a bioassay (a live "car", or cage of fish) at the secondary station. Dead fish will be removed from the immediate treatment area.

c) AGFD personnel will provide public notice to downstream users and homeowners who are within three miles of the treatment areas and will sign access areas to notify the public of the treatment. Signs will be posted at all trailheads advising recreationists that the stream has been treated with a fish toxicant, and providing additional information about the treatment and explaining restocking efforts.

d) All wilderness regulations will be complied with.

e) Prior to reintroduction of Apache trout, AGFD personnel will assess the effectiveness of the treatment by performing two complete visual surveys looking for live fish and, if warranted, two complete electrofish surveys.

f) AGFD personnel will chemically treat streams again, if necessary, using the same protocol.

g) AGFD personnel will reintroduce the appropriate stock of Apache trout and salvaged native fish and maroinvertebrates following confirmation of a successful renovation.

c. ALTERNATIVE 3. New fish barrier construction, existing fish barrier remodeling, electrofish renovation and Apache trout reintroduction. Remove non-native and hybrid trout from the subject streams with backpack electrofishers (see Appendix D for stream renovation protocol).

This alternative encompasses the following:

1) The A-SNFs will construct seven new fish barriers on three LCR system streams (East, South and West Forks) and one Black River system stream (West Fork) and remodel three existing fish barriers on three Black River system streams (Centerfire, Fish and Hayground Creeks) (see Appendix C for barrier specifications).

2) AGFD personnel will treat waters upstream from fish barrier sites back downstream to the fish barrier utilizing backpack electrofishers and ⅛ inch mesh dip nets to remove all non-native fish [The use of multiple electrofish removals to completely eliminate non-native trout from a small Appalachian stream was documented by Kulp and Moor (2000)].

a) Each pass (a complete effort from the downstream end of the treatment area to the upstream end) will consist of one to three personnel with backpack electrofishers, working abreast of one another (depending on stream width), and two to four personnel with dip nets (depending on stream width) to remove shocked fish from the water. Additional personnel carrying five gallon buckets will be required to collect non native fish from the dip netters.

b) A minimum of three, three-pass removals will be required the first year (minimum of nine complete passes) to remove all adult fish and prevent subsequent spawning. Two or more three-pass removals will be required the second season (if the previous year's efforts were successful at eliminating reproduction and no target fish are collected during the final pass). If reproduction occurred, two or more three-pass removals will required during the third season. Two or more three-pass removals will occur each subsequent season until reproduction has been eliminated and all target fish have been removed from the treatment area.

c) Initial removals will occur at least two months after emergence of fry to maximize capture probability of age-0 fish.

d) Second and third removals, during each subsequent year's field season, will occur several weeks or months after that year's season's initial removal.

e) Both live non-native and all dead fish will be collected and removed from the immediate treatment area.

f) AGFD personnel will sign access areas to notify the public of the treatment.

g) Resident native fish will not be removed from the treatment area but left in the stream.

h) All wilderness regulations will be complied with.

i) Prior to reintroduction of Apache trout, AGFD personnel will assess effectiveness of treatment by performing two complete visual surveys looking for live fish and, if warranted, two complete electrofish surveys.

j) AGFD personnel will reintroduce appropriate stock of Apache trout following confirmation of a successful renovation.

ALTERNATIVE 4. Construct a single fish barrier on East, South and West Forks LCR. All other proposed activities would be the same as in ALTERNATIVE 2.

This alternative encompasses the following activities:

1. The A-SNFs will construct four new fish barriers on three LCR system streams (East, South and West Forks) and one Black River system stream (West Fork) and remodel three existing

fish barriers on three Black River system streams (Centerfire, Fish and Hayground Creeks) (see Appendix C for barrier specifications).

2. The A-SNFs will authorize the use of antimycin A and potassium permanganate by AGFD personnel for the antimycin A renovation of Bear Wallow (includes both North and South Forks), Centerfire (Includes Boggy and Wildcat), Conklin, Fish (includes both Corduroy and Double Cienega Creeks and Ackre Lake), Hayground, Lee Valley, Snake and Stinky Creeks, and East Fork LCR (includes Colter Reservoir), South Fork LCR (includes Bill Riley Creek and Joe Baca Draw), West Fork Black River and West Fork LCR. Renovation is required in certain low flowing streams, such as Bear Wallow, and parts of the South Fork LCR, to insure non-natives are not present. These stretches of streams may not support self-sustaining populations of apache trout.

3. AGFD personnel will salvage a portion of the resident native fish and macroinvertebrates through electrofishing, prior to antimycin A treatment, and temporarily hold them outside of the treatment area for re-release. Salvaged native fish and macroinvertebrates will be restocked within 2 weeks (Appendix D for stream renovation protocol).

a) AGFD personnel will chemically treat waters (upstream from barrier sites back downstream to the fish barrier) above fish barriers with an EPA registered piscicide (Antimycin A ; e.g. Fintrol®) at a target concentration of 10 to 20 parts per billion (ppb) to remove all non-native fish. The applicator will be experienced in Antimycin A use and certified by the Arizona Department of Agriculture (ADA) through an EPA endorsed program to apply restricted use pesticides (Project Record). All pesticide applications will be conducted using applicable guidance as outlined in USFS FSM 2150 and FSH 2109.14. All manufacturers' label instructions for the piscicide will be complied with (Project Record).

b) AGFD personnel will setup detoxification sites at each fish barrier and one approximately 300 meters down stream of each fish barrier. Antimycin A will be detoxified at the fish barrier sites with potassium permanganate at a concentration of 1 milligram/liter. A secondary detoxification station will be established further downstream, and activated only in the event of incomplete detoxification at the primary detoxification station. Effectiveness of detoxification will be determined by use of a bioassy (a live car) performed 300 meters below the primary detoxification station. Dead fish will be removed from the immediate treatment area.

c) AGFD personnel will provide public notice to downstream users and homeowners who are within three miles of the treatment areas and will sign access areas to notify the public of the treatment. Signs will be posted at all trailheads advising recreationalists that the stream has been treated with a fish toxicant, and providing about the treatment, and explaining restocking efforts.

d) All wilderness regulations will be complied with.

e) Prior to reintroduction of Apache trout, AGFD personnel will assess effectiveness of treatment by performing two complete visual surveys looking for live fish and, if warranted, two complete electrofish surveys.

f) AGFD personnel will chemically treat streams again, within one year, if necessary.

g) AGFD personnel will reintroduce appropriate stock of Apache trout and salvaged native fish following confirmation of a successful renovation.

C. Comparison Of Alternatives – Compares alternatives, including evaluation criteria (EC) 1 through 3.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Number of Barriers Constructed	0	7	7	4
Number of Barriers repaired	0	3	3	3
Miles of Stream Reno-vated with Antimycin A	0	149.6	0	149.6
EC1. Miles of Stream Renovated by Electrofishing	0	0	149.6	
EC2. Displaced Sediment (cu.yd)*	0	<2.6 (<4.1)	<2.6 (<4.1)	<1.9 (<3.2)
EC3. Sediment Storage (ac ft)*	0	1.96 (0)	1.96 (0)	1.87 (0)

* Figures in parentheses () represent findings under the backfill construction option.

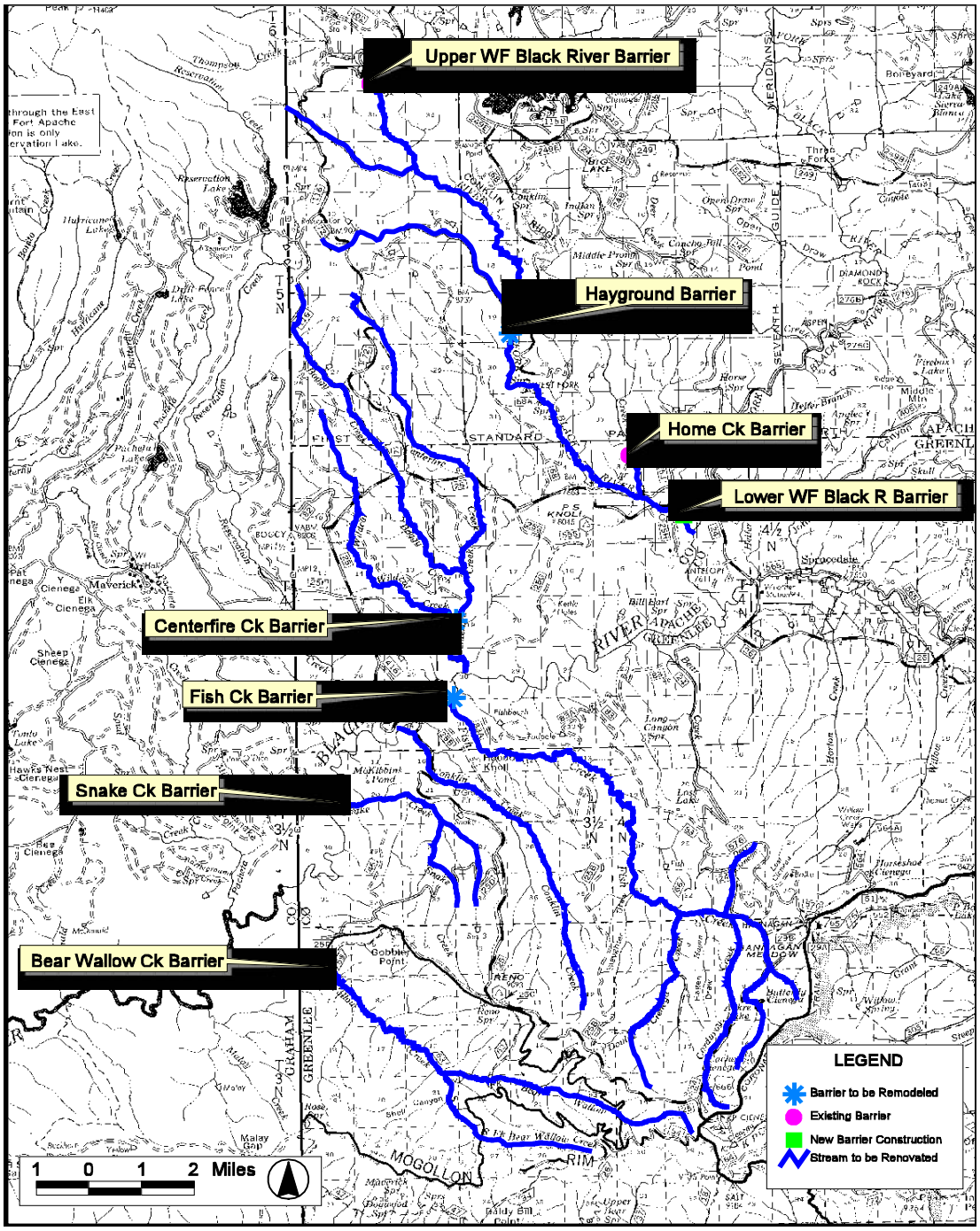

FIGURE 1. ALTERNATIVES 2, 3 and 4 proposed Apache trout enhancement project locations within the Black River system on the A-SNFs. Stream renovation (removal of non-native salmonids species above barriers) under ALTERNATIVES 2 and 4 would be accomplished by the use of Fintrol® (antimycin A) with neutralization by potassium permanganate ($KMnO_4$), and under ALTERNATIVE 3, renovation would be accomplished by electrofishing techniques.

TABLE 1. ALTERNATIVES 2, 3 and 4 proposed Apache trout enhancement project locations within the Black River system on the A-SNFs. Stream renovation (removal of non-native salmonids species above barriers) under ALTERNATIVES 2 and 4 would be accomplished by the use of Fintrol® (antimycin A, liquid and/or sand formulation) with neutralization by potassium permanganate ($KMnO_4$), and under ALTERNATIVE 3 renovation would be accomplished by electrofishing techniques.

STREAM	PROPOSED ACTIVITY	GENERAL LOCATION OF PROPOSED ACTIVITY (*Apache & Greenlee Co.*)	LENGTH (*mi*)
Bear Wallow Creek (includes 3.9 mi South Fork Bear Wallow Creek)	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 7, 8, 15 - 17 & 21 - 27, T3N, R28E; and Sec 19, 20, 29 & 30, T3N, R29E; Greenlee Co.	12.9
Centerfire Ck. (includes 7.0 mi Boggy Ck & 7.9 mi Wildcat Ck.	Remodel 1 existing barrier	SE¼NE¼NW¼ Sec 19, T4N, R28E; Greenlee Co.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec. 6, 7, 18, 19, T4N, R28E; and Sec. 1-3, 11-14, 24, T4N, R27E; and Sec. 30, 31, T5N, R28E; and Sec. 21, 23-28, 34-36, T5N, R27E, Apache Co.	29.1
Fish Creek (includes 4.2 mi Corduroy & 4.1 mi Double Cienega Creeks, & Ackre Lake)	Remodel 1 existing barrier	SE¼SE¼NW¼ Sec 3, T4N, R28E; Greenlee Co.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 13, T3N, R28E; Sec 3 - 5, 7 - 10, 16 - 18 & 20, T3N, R29E; Sec 13 - 15 & 24, T3½N, R28E; Sec 32 & 33, T3½N, R29E; Sec 30 & 31, T4N, R28E; and Sec 19, 28 & 30 - 33, T4N, R29E; Greenlee Co.	24.5
Hayground Creek	Remodel 1 existing barrier	SE¼NW¼SE¼ Sec 19, T5N, R28E; Apache Co.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 10 - 12, T5N, R27E; and Sec 7, 18 & 19, T5N, R28E; Apache Co.	5.4
Snake Creek	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 3, 4 & 10, T3N, R28E; and Sec 19 - 21, 27, 28, 33 & 34, T3½N, R28E; Greenlee Co.	6.2
Stinky Creek	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 1 - 3, T5N, R27E; and Sec 33 & 34, T6N, R27E; Apache Co.	3.2
West Fork Black River (includes 1.1 mi Home Creek)	Construct 1 new barrier	NW¼SE¼NW¼ Sec 11, T4N, R28E; Greenlee Co.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 3, 4, 10 & 11, T4N, R28E; Greenlee Co.; and Sec 1 - 3, 10 - 12 & 15, T5N, R27E; Sec 7, 17 - 20, 29, 30 & 32, T5N, R28E; and Sec 33 - 35, T6N, R27E; Apache Co.	15.6
Conklin Creek	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec. 21-23, 26, 35, T3 1/2N, R28E; and Sec. 1, 2, 11, 12 T3N, R28E, Greenlee Co.	8.6
Total			105.5

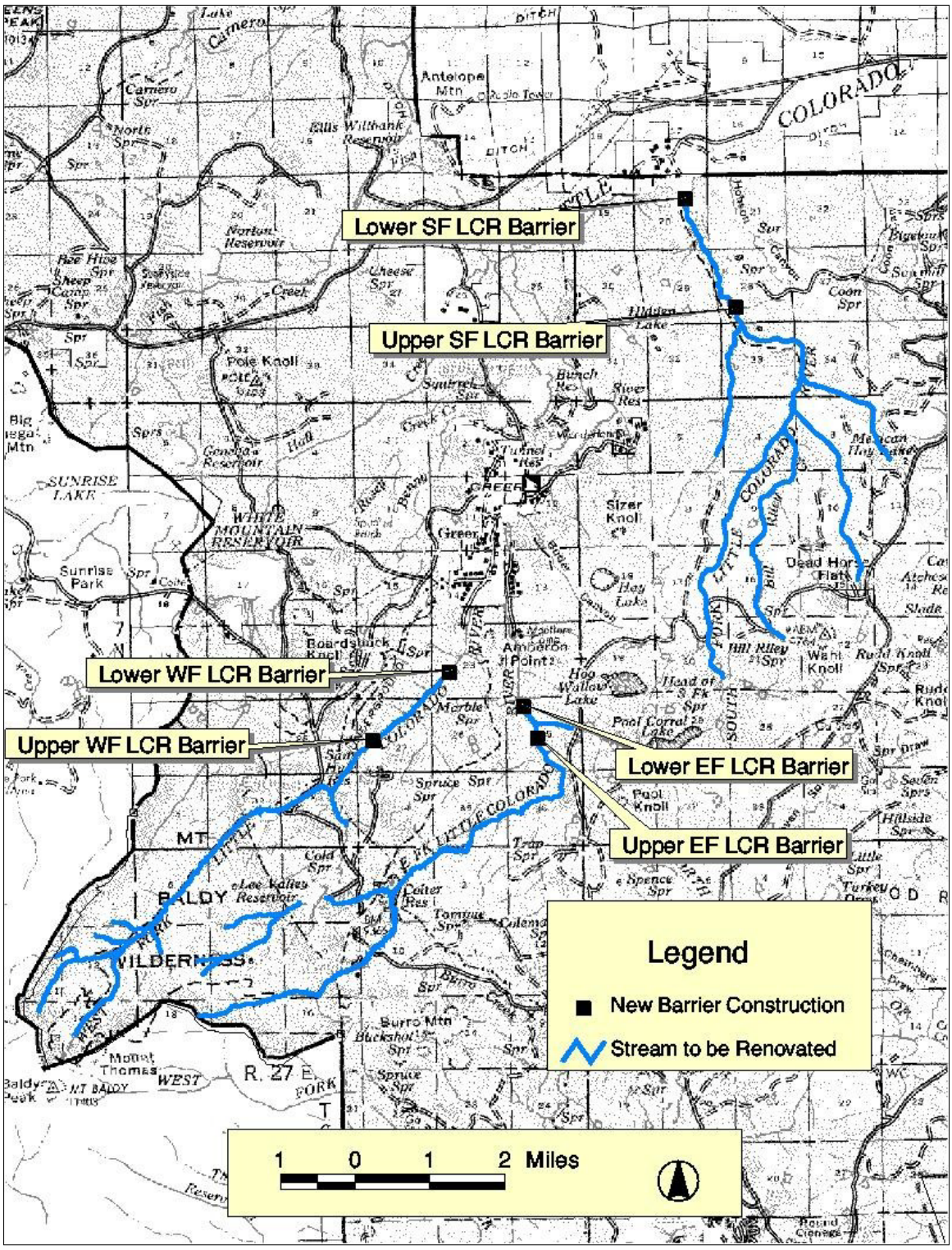

FIGURE 2. ALTERNATIVES 2, and 3 proposed Apache trout enhancement project locations within the Little Colorado River system on the A-SNFs. Stream renovation (removal of non-native salmonids species above barriers) under ALTERNATIVE 2 would be accomplished by the use of Fintrol® (antimycin A) with neutralization by potassium permanganate ($KMnO_4$), and under ALTERNATIVE 3 renovation would be accomplished by electrofishing techniques.

TABLE 2. ALTERNATIVES 2, and 3 proposed Apache trout enhancement project locations within the Little Colorado River system on the A-SNFs. Stream renovation (removal of non-native salmonids species above barriers) under ALTERNATIVE 2 would be accomplished by the use of Fintrol® (antimycin A, liquid and/or sand formulation) with neutralization by potassium permanganate ($KMnO_4$), and under ALTERNATIVE 3, renovation would be accomplished by electrofishing techniques.

STREAM	PROPOSED ACTIVITY	GENERAL LOCATION OF PROPOSED ACTIVITY (*Apache Co.*)	LENGTH (*mi*)
East Fork LCR (includes Colter Reservoir)	Construct 2 new barriers	1 in the SE¼SW¼SE¼ Sec 25, T7N, R27E; and 1 in the NE¼NE¼SW¼ Sec 25, T7N, R27E	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 2, 3, 8, 10, 17 & 18, T6N, R27E; and Sec 25, 35 & 36, T7N, R27E	9.4
Lee Valley Creek (does not include Lee Valley Reservoir)	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 3 - 5, 7 & 8, T6N, R27E	4.2
South Fork LCR (includes 3.4 mi Bill Riley Creek & 1.9 mi Joe Baca Draw)	Construct 2 new barriers	1 in the NE¼SW¼SW¼ Sec 28, T8N, R28E; and 1 in the SE¼NW¼NE¼ Sec 20, T8N, R28E	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 2 - 4, 8 - 10, 15 - 17, 20 - 22 & 29, T7N, R28E; and Sec 20, 28, 29, 33 & 34, T8N, R28E	18.3
West Fork LCR	Construct 2 new barriers	1 in the NW¼NE¼SW¼ Sec 23, T7N, R27E; and 1 in the SW¼NW¼SW¼ Sec 27, T7N, R27E	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 11 - 14, T6N, R26E; Sec 5 - 7, T6N, R27E, Sec 1, T7N, R26E; and Sec 22, 23, 27, 28, 32 & 33, T7N, R27E	12.2
Total			44.1

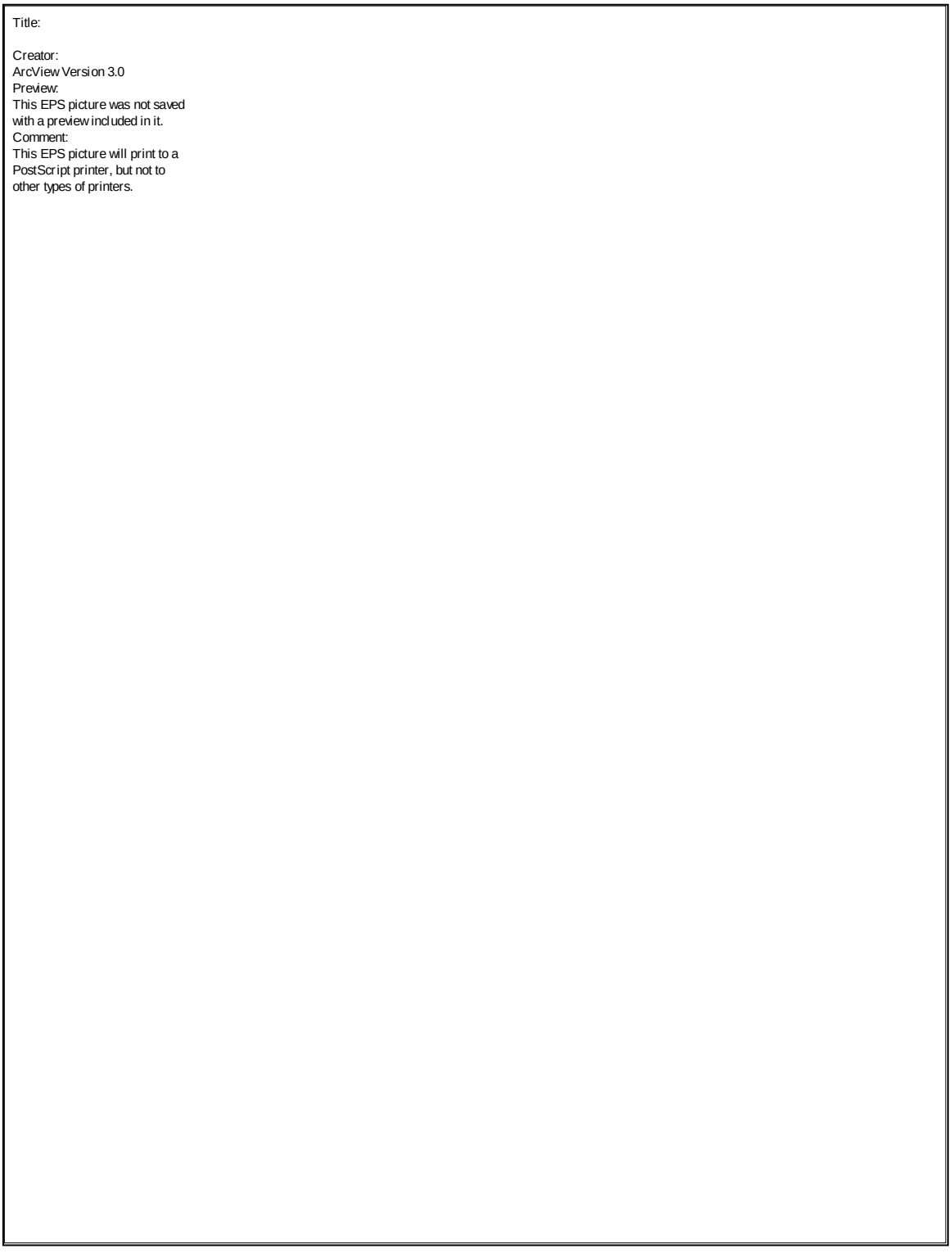

FIGURE 3. ALTERNATIVE 4 proposed Apache trout enhancement projects within the Little Colorado River system on the A-SNFs. Construct one barrier per stream, and stream renovation (removal of non-native salmonids species above barriers) would be accomplished by the use of Fintrol® (antimycin A) with neutralization by potassium permanganate ($KMnO_4$).

TABLE 3. ALTERNATIVE 4 proposed Apache trout enhancement projects within the Little Colorado River system on the A-SNFs. Construct one barrier per stream, and stream renovation (removal of non-native salmonids species above barriers) would be accomplished by the use of Fintrol® (antimycin A) with neutralization by potassium permanganate ($KMnO_4$).

STREAM	PROPOSED ACTIVITY	GENERAL LOCATION OF PROPOSED ACTIVITY (*Apache Co.*)	LENGTH (*mi*)
East Fork LCR (includes Colter Reservoir)	Construct 1 new barrier	NE¼NE¼SW¼ Sec 25, T.7N, R.27E.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 3, 9, 10, 17 & 18, T.6N, R.27E; and Sec25, 35 & 36, T.7N, R.27E.	9.4
Lee Valley Creek (does not include Lee Valley Reservoir)	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 3 - 5 & 8, T.6N, R.27E.	4.2
South Fork LCR (includes 3.4 mi Bill Riley Creek & 1.9 mi Joe Baca Draw)	Construct 1 new barrier	SE¼NW¼NE¼ Sec 20, T.8N, R.28E.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 2 - 4, 8 - 10, 15 - 17, 20 - 22 & 29, T7N, R28E; and Sec 20, 28, 29, 33 & 34, T8N, R28E	18.3
West Fork LCR	Construct 1 new barrier	NW¼NE¼SW¼ Sec 23, T.7N, R.27E.	n/a
	Renovation, fish reintroduction & replace salvaged native sport & non-sport fish, & macroinvertebrates	Sec 11 - 14, T6N, R26E; Sec 5 - 7, T6N, R27E; Sec 1, T7N, R26E; and Sec 22, 23, 27, 28, 32 & 33, T7N, R27E.	12.2
Total			44.1

CHAPTER 3 - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter presents existing conditions (i.e., affected environment) within the project area and the changes that can be expected from implementing the action alternatives or taking no action at this time. The no action alternative sets the environmental base line for comparing effects of the action alternatives. See page 45, Table 15, for a summary of environmental effects, including the evaluation criteria.

A. VEGETATION

1. AFFECTED ENVIRONMENT

a. **BLACK RIVER SYSTEM** - The overstory vegetation in the area of the proposed barrier site on the West Fork is dominated by ponderosa pine (*Pinus ponderosa*) ranging in height from 20 to 30 feet with diameters from 10 to 12 inches. Other woody species include alder (*Alnus oblongifolia* Torr.), dogwood (*Cornus stolonifera* Michx.), cinquefoil (*Potentilla fruticosa* L.), willow (*Salix* spp. L.)[1] and rose (*Rosa arizonica* Rydb.) ranging in height from 1 to 10 feet. The understory is composed of mesic graminoids and forbs.

The overstory vegetation in the areas of the proposed barrier improvement sites on Centerfire, Fish and Hayground Creeks is dominated by spruce (*Picea engelmannii*) and fir (*Abies lasiocarpa* var. *arizonica*) (Centerfire) and spruce-fir and riparian hardwood (Fish and Hayground). Other woody vegetation includes Douglas-fir, alder, willow, dogwood, and buckbrush. The understory is composed of mesic graminoids and forbs.

b. LITTLE COLORADO RIVER SYSTEM - The overstory vegetation in the area of the proposed barrier sites on the West Fork is dominated by spruce (*Picea* spp. Link.) ranging in height from 3 to 35 feet with diameters from 2 to 10 inches. Other woody species include alder, common juniper (*Juniperus communis* L.), dogwood and rose ranging in height from 1 to 10 feet. The understory is composed of mesic graminoids and forbs.

The overstory vegetation in the area of the proposed barrier sites on the East Fork is dominated by spruce and corkbark fir (*Abies lasiocarpa* var. *arizonica* Lemmon) ranging in height from 8 to 30 feet with diameters from 2 to 10 inches. Other woody species include common juniper, dogwood, rose and currant (*Ribes* spp. L.) ranging in height from 1 to 15 feet. The understory is composed of mesic graminoids and forbs.

The overstory vegetation in the area of the proposed barrier sites South Fork is dominated by ponderosa pine and cottonwood (*Populus angustifolia* James) ranging in height from 3 to 40 feet with diameters from 1 to 20 inches. Other woody species include, dogwood, rose, alder and willow ranging in height from 1 to 15 feet. The understory is composed of mesic graminoids and forbs.

2. Environmental Consequences

a. ALTERNATIVE 1 - (No Action) No environmental consequences to vegetation under this alternative.

b. ALTERNATIVE 2 - (Proposed Action)

Activities associated with barrier work and backfilling would include trampling of vegetation at and near barrier sites along stream bottoms, banks, and floodplains. In addition, for some barrier sites (Centerfire, Fish and Hayground Creeks, West Fork Black River, and upper West Fork LCR) trails may develop as a considerable amount of material would be needed at each

[1] No Arizona willows (*Salix arizonica* Dorn) were found in the proposed new barrier construction and remodeling project areas.

site and numerous personnel (in some instances, pack stock), numerous times, would travel back and forth to barrier sites. In the near term, vegetation would be impacted along these trails but within a year or after the next growing season, most trail impacts would be expected to be undetectable as vegetation recovers. At other barrier sites, existing developed or user-made trails would be used.

The direct and indirect impacts to the vegetation will be focused at the barrier construction sites, and be short-term. Any inundated areas upstream of the barriers may provide a slightly higher water table in the localized area, which should result in localized increases in riparian vegetation such as willows and alders.

1) Black River System - As a direct result of barrier construction on the West Fork, 6 alders, 3 roses, 10 cinquefoils and an unknown number of grasses and forbs would be removed. As an additional consequence, the pool created by the barrier would inundate 120 alders, 31 roses, 40 cinquefoils, 3 ponderosa pines, 3 willows and an unknown number of graminoids and forbs.

As a direct result of barrier improvement on Centerfire, Fish and Hayground Creeks - 1 Douglas-fir and 1 willow (Centerfire), 5 dogwoods, 1 buckbrush (Fish) and 1 alder (Hayground), and unknown amount of grasses and forbs would have to be removed at each site. As an additional consequence, the increased pool size created by the barrier improvements would inundate 7 alders (6 at Fish and 1 at Hayground) and an unknown amount of grasses and forbs at each site.

2) Little Colorado River System - As a direct result of barrier construction on the West Fork, 7 spruce and an unknown amount of grasses and forbs would be removed. As an additional consequence, the pools created by the barriers would inundate 16 spruce, 6 junipers, 5 dogwoods, 21 alders, 25 roses and an unknown number of graminoids and forbs.

As a direct result of barrier construction on the East Fork, 7 spruce, 4 fir, 9 willows and an unknown amount of grasses and forbs would be removed. As an additional consequence, the pools created by the barriers would inundate 1 spruce, 2 fir, 2 junipers, 6 dogwoods, 1 currant, 42 willows, 6 roses and an unknown amount of grasses and forbs.

As a direct result of barrier construction on the South Fork, 6 alders, 3 willows and an unknown amount of grasses and forbs would be removed. As an additional consequence, the pools created by the barriers would inundate 24 alders, 9 willows, 8 cottonwoods, 10 roses, 1 ponderosa pine, 11 dogwoods and an unknown amount of grasses and forbs.

c. ALTERNATIVE 3. - (Electrofishing renovation, double barriers on LCR). The environmental consequences to vegetation under this alternative would be greater than under ALTERNATIVES 1, 2, and 4 because additional trailing would result from continued walking along and within the streams during electrofishing operations.

d. ALTERNATIVE 4 - (Antimycin A renovation, single barriers on LCR).

Effects would be greater under this alternative than under ALTERNATIVE 1. Direct and indirect environmental consequences to vegetation within the LCR system would be somewhat less under ALTERNATIVE 4 than Alternative 2 because only one, not two, barriers would be constructed on the East, West and South Forks LCR under this alternative. Because of the trailing created under Alternative 3, Alternative 4 has less direct and indirect effects than Alternative 3.

1) Black River System - Environmental consequences to vegetation under this alternative would be greater than under ALTERNATIVE 1, less than under Alternative 3, but equal to those under ALTERNATIVE 2.

2) Little Colorado River System - As a direct result of barrier construction on the West Fork, 3 spruce and an unknown amount of grasses and forbs would have to be removed. As an additional consequence, the pool created by the barrier would inundate 8 spruce, 1 dogwood, 21 alders, 25 roses and an unknown amount of grasses and forbs.

As a direct result of barrier construction on the East Fork, 1 spruce, 1 fir, 9 willows and an unknown amount of grasses and forbs would have to be removed. As an additional consequence, the pool created by the barrier would inundate 2 junipers, 42 willows, 6 roses and an unknown amount of grasses and forbs.

As a direct result of barrier construction on the South Fork, an unknown amount of grasses and forbs would have to be removed. As an additional consequence, the pool created by the barrier would inundate 10 alders, 6 willows, 7 cottonwoods, 1 ponderosa pine, 11 dogwoods and an unknown amount of grasses and forbs.

3. Cumulative Effects Under all Alternatives - Cumulative effects are the impacts to the (human and natural) environment resulting from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions. These include federal (FS, Fed. Highways), tribal, state (AGFD, ADOT), and private (private water diversions, campground expansion, recreation) actions. Past actions that have impacted the analysis area include impoundments/diversions, livestock grazing, timber harvest, recreational development, introduction of exotic species (ie., rainbow and brown trout, crayfish), and road building. Such actions adversely affected the vegetation along most of the streams in the project area. Direct loss of vegetation, especially riparian trees and shrubs, caused changes to stream dynamics that may persist today in some streams. Change in vegetative species composition is also evident, with the exotic Kentucky bluegrass being a dominant streamside grass. Indirect impacts from these past actions (bank shearing, stream downcutting, less shade and warmer temperatures, introduction of exotic salmonid fish) helped lead to the decline of the Apache Trout, which resulted in its listing under the Endangered Species Act.

Recent and current actions include improvements to the stream corridors through better livestock and vegetation management practices that have resulted in overall improved riparian conditions in many stream reaches. Exotic aquatic species are still widespread in the systems, however, and have contributed to the need for these proposed actions. Because the existing condition of the streams was evaluated to be of sufficient quality to provide habitat for the Apache Trout, the current conditions are an improvement over those of the past.

Future actions include road improvements, riparian restoration projects, and livestock grazing management that will result in static or improved range and riparian conditions. The current proposed actions of building fish barriers, renovating streams, and reintroducing natives should continue to improve the status of the Apache Trout. Direct effects will be short term. Indirect effects will tend to be positive for vegetation. Thus, the project should not add to any cumulative adverse impacts to the riparian vegetation. If sporting fishing increases along the stream reaches, some areas may have localized compaction and trailing that could impact streamside vegetation. Such conflicts would be addressed by site-specific proposed actions. Because direct and indirect effects are short-term and minimal, no cumulative effects will accrue.

B. Soil

1. Affected Environment - Soil type at each barrier site and along stream lengths where renovation, salvage and reintroduction activities would occur is discussed below. Note that a very dominant feature of soils along these streams and at barrier sites is the high level of rockiness.

a. Black River System

1) West Fork - Typic Hapludolls, extremely stony clay loams - Udic Haplustalfs, very gravelly loams - rock outcrop complex dominate the soils in the area of the proposed barrier construction site (Laing et al. 1989). Specifically at the barrier site, soils consist of 80%

boulders, 15% cobble, and 5% gravel and fines. Along the stream reaches undergoing treatments, rock fragment content ranges from 20 to 60% and the texture of the fine earth fraction is loam, clay loam, sandy clay loam, sandy clay or clay. Soils associated with alluvial plains are Cumulic Hapludolls, fine-loamy, well drained on terraces and or Aquic Cumulic Hapludolls, fine, mixed associated with wetter stream banks.

2) Centerfire, Wildcat, Boggy, Conklin, Fish and Hayground Creeks - Typic Hapludolls, very cobbly loams - rock outcrop complex dominate the soils in the area of the proposed barrier improvement sites (Laing et al. 1989). The rock fragment content ranges from 30 to 65% and the texture of the fine earth fraction is loam, clay loam, sandy clay loam, or clay. Soil classifications of the alluvial plains are similar to those at the West Fork Black River site.

b. Little Colorado River System

1) West and East Forks - Udic Haplustalfs, very gravelly loams - rock outcrop complex, and Mollic Haplocryalfs, very gravelly loams dominate the upland soils in the area of both proposed barrier construction sites (Laing et al. 1989). At the proposed barrier sites on the West Fork, for the upper and lower sites, respectively, the soils consist of 90% boulder and bedrock, and 10% cobble; and 60% boulder, 30% cobble, and 10% gravel. At the proposed barrier sites on the East Fork, for the upper and lower sites, respectively, the soils consist of 90% boulder and bedrock, and 10% cobble; and 50% boulder, 40% cobble, and 10% gravel. The rock fragment content for both the West and East Forks ranges from 5 to 55% with the texture of the fine earth fraction is loam, silt loam, clay loam, or sandy clay loam. Soils of the alluvial plains are generally Aquic Cumulic Hapludolls, and Aquic Haplocryolls.

2) South Fork - Upland soils at the lower barrier site are Lithic Udic Argiustolls, clayey-skeletal, mixed, shallow, very cobbly loams and Udic Haplustalfs, very cobbly loams - extremely stony loams rock outcrop complex; at the upper site--Typic Argiustolls, clayey-skeletal, mixed, moderately deep, extremely cobbly silty loams - extremely cobbly silty loams - rock outcrop complex (Laing et al. 1989). At the proposed barrier sites, for the upper and lower sites, respectively, the soil consists of 60% boulder, 30% cobble, and 10% gravel; and 20% boulder, 70% cobble, and 10% gravel. The rock fragment content ranges from 10 to 55% on the Lithic Udic Argiustolls and from 10 to 55% on the Udic Argiustolls. The texture of the fine earth fraction is loam, sandy loam, clay loam, or clay on the former; and loam, sandy loam, clay loam, or clay on the latter. Soils of the alluvial plain are classified as Aquic Cumulic Hapludolls and Cumulic Hapludolls.

2. Environmental Consequences

a. ALTERNATIVE 1 - (No Action) No environmental consequences to soil under this alternative.

b. ALTERNATIVE 2 - (Proposed Action)

1) Black River System - West Fork, Centerfire, Fish and Hayground Creeks: As a direct result of barrier construction or improvement, there would be some soil disturbance. However, the effects would be localized, as fugitive sediment settles out relatively quickly. The expected overall impacts are negligible, as the sediment source is limited to short-term pulses during barrier work, and no problematic conditions are expected as long as Soil and Water Conservation Practices (see Appendix I) are followed. As an additional consequence at the West Fork site, the entire barrier (102 feet) would be constructed without tying into existing boulders and the permanent pool created by the barrier would submerge roughly 3,300 square feet of soil surface area. Protective vegetation or riprap materials are needed to reduce the amount soil exposed to higher flows (see Appendix I). Similar mitigation would be required under the permeable structure construction option where the resultant pool would be temporary in nature but may, nonetheless effect the existing vegetation. Under the backfilling construction option for this structure, 3,300 square feet of surface area would be overlain with rock backfill material. No protective vegetation or riprap materials would be required under this construction option.

2) Little Colorado River System - West, East and South Forks: As a direct result of barrier construction, there would be some soil disturbance. However, the effects would be localized, as this sediment settles out relatively quickly. The expected overall impacts are negligible, as the sediment source is limited to short-term pulses during construction, and no problematic conditions are expected as long as Soil and Water Conservation Practices (Appendix I) are followed. Table 4 shows for each barrier site what percent of the total barrier length will consist of existing boulders and bedrock (as opposed to gabions), the area inundated by the permanent pool, and the area that will be inundated at bankfull discharge, which is a short-term event.

TABLE 4. Percent total barrier length consisting of existing boulders and bedrock, the expected area inundated by the permanent pool, and the expected area that will be inundated at bank-full discharge, Little Colorado River.

PREFERRED LOCATIONS

	WEST FORK		EAST FORK		SOUTH FORK	
	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
% of Barrier consisting of existing boulder/bedrock	16	44	9	43	0	89
Increased Inundated area (ft^2)	4,000	1,500	3,000	500	2,000	2,000
Bankfull inundated area (ft^2)	6,300	2,000	5,208	675	2,376	3,250

ALTERNATIVE CONSTRUCTION/LOCATIONS

	WEST FORK		EAST FORK		SOUTH FORK	
	LOWER	UPPER	LOWER	UPPER	LOWER	UPPER
% of Barrier consisting of existing boulder/bedrock	~40	44	~40	43	0	89
Increased Inundated area (ft^2)	0	0	0	0	0	0
Bankfull inundated area (ft^2)	~2000	2000	~675	675	2,376	3,250

Overall for streams in both river systems, soil impacts from barrier construction and improvement would be limited. This is because of the very rocky and bouldery nature of most of the barrier sites. The amount of inundated or backfilled area is very limited given the area of the entire floodplain for each stream. Fine earth textures are susceptible to movement with disturbance and subsequent runoff, however, trailing and trampling effects from work associated with renovation, salvage and reintroduction would be limited by the rock fragment content of soils. Environmental consequences to soil under this alternative would be greater than under ALTERNATIVES 1 and 4, but equal to those under ALTERNATIVE 3.

c. ALTERNATIVE 3. - (Electrofishing renovation, double barriers on LCR). The environmental consequences to soil under this alternative would be greater than under ALTERNATIVES 1 and 4, but equal to those under ALTERNATIVE 2, as there would be no difference in number, size or timing of constructing or remodeling barriers.

d. ALTERNATIVE 4 - (Antimycin A renovation, single barriers on LCR).

1) Black River System - Environmental consequences to soil under this alternative would be greater than under ALTERNATIVE 1, but equal to those under ALTERNATIVES 2 and 3, as the action of constructing and remodeling fish barriers for ALTERNATIVES 2, 3 and 4 in the Black River system are identical.

2) Little Colorado River System - Only the lower barriers in each of the three project streams would be constructed under this alternative (see Table 4). The amount of inundated or backfilled area disturbed through barrier construction is therefore less than under ALTERNATIVES 2 and 3. This alternative is the same as ALTERNATIVE 2 in terms of trampling and

fine earth impacts associated with renovation, salvage and reintroduction. Hence, overall, environmental consequences to soil under this alternative would be greater than under ALTERNATIVE 1, but less than under ALTERNATIVES 2 and 3.

3. Cumulative Effects Under all Alternatives - Effects on soils created by this project would be limited primarily to aquatic, riparian and adjacent valley bottomlands. These areas had been impacted in the first half of the 20th century by high levels of livestock use. In the second half of the 20th century, timber harvest and associated road and rail construction had contributed locally to soil impacts in these areas. Over the last twenty years, reductions in livestock numbers, and lower levels of road construction have resulted in overall improvements in soils conditions in the area of this project. Recreation use along streams, primarily related to fishing, hunting, hiking and camping remains important. Future developments that may impact soils in the project watersheds include the planned improvements and realignment of Arizona State Highway 273 (locally negative), future allotment management plan revisions (broadly positive), and planned watershed/riparian restoration projects (locally positive). The actions contemplated under all action alternatives would not significantly add to the cumulative impacts of other past, present and anticipated soil impacting activities since they are small in scale relative to these other impacts, very localized in area, and of short duration.

B. WATER AND WATERSHED

1. Affected Environment

a. Black River System - The Project Record contains stream descriptions of West Fork Black River, Bear Wallow, Centerfire, Fish, Snake, Hayground, Stinky, Conklin, Boggy, and Wildcat Creeks.

As a result of Arizona Department Environmental Quality's (ADEQ) triennial review, which is reported in the Arizona Administrative Register, Notice of Final Rule Making, Bear Wallow, North Fork Bear Wallow, South Fork Bear Wallow, Snake, Stinky and Hayground (Hay) Creeks, and West Fork Black River have been classified as Unique Waters under Title 18. Environmental Quality, Chapter 11. ADEQ Water Quality Standards, Article 1. Water Quality Standards for Surface Waters, R18-11-112. Unique Waters, 3/29/02, 8 (13): 1413-1490 (Project Record). The surface waters have been given Tier 3 antidegradation status. Tier 3 states that no degradation is allowed in waters listed in rule as Unique Waters, which is interpreted to mean "no new or expanded point source discharges" will be allowed in Unique Waters. "A direct or upstream source that would result in a temporary and limited effect on Unique Waters water quality may be authorized on a case-by-case basis. As a non-binding reference, activities with durations less than one month and resulting in less than a 5% change in ambient concentration will be deemed to have temporary and limited effects" (Implementation Guidelines for the State of Arizona Antidegradation Standard).

The Forest is working cooperatively with the ACE and ADEQ to insure that the project complies with Section 404 of the Clean Water Act. ACE will oversee the building contracts, and determine which barrier sites will require 404 permitting and subsequent 401 permitting by ADEQ, particularly in streams designated as "Unique Waters." Renovation activities are given exception to the Unique Waters rule under R18-11-116, where "nothing in this Article shall be construed to prohibit fisheries management activities by the AGFD or the USFWS." A 404 Permit was issued by ACE on April 29, 2002 (revised June 12, 2002) for all barrier construction/remodeling activities associated with this project proposal including the structure on the West Fork of the Black River. 401 Certification application was submitted on April 1, 2002, for the proposed barrier remodeling activities on Hayground Creek due to its unique water designation (Project Record). On May 9, 2002, 401 Certification was issued by ADEQ for activities associated with this remodeling in Hayground Creek. An additional or amended 401 Certification and 404 Permit application will be submitted to cover changes in barrier design (primarily backfilling) if this construction option is used in the West Fork of the Black River.

The West Fork of the Black River together with the East Fork of the Black River (which also arises on the A-SNF) are major headwater sources of water to the Salt River watershed. The waters of the Salt River have been extensively developed downstream of the National Forest and form a principal source of water for users in the Phoenix area. There is one private land parcel with appurtenant water rights within the boundaries of the National Forest located downstream of the existing barriers on Hayground and Home Creeks. There are no private land parcels nor are there any private diversions in the reaches of the West Fork of the Black River below the proposed new fish barrier or along the main stem of the Black River within A-SNF boundaries. Applications to appropriate water rights in the Black River Basin are administered by the Arizona Department of Water Resources.

b. Little Colorado River System – The Project Record contains stream descriptions of East, West and South Forks LCR, and Lee Valley Creek.

The West Fork LCR above Government Springs and Lee Valley Creek above Lee Valley Reservoir are designated by ADEQ as a Unique Waters. Refer to comments regarding Unique Waters in the above Black River system discussion. A 401 Permit application was submitted on April 1, 2002, for the proposed barrier construction on the West Fork LCR due to its unique water designation (Project Record). On May 9, 2002, 401 Certification was issued by ADEQ for activities associated with the proposed barrier construction activities on the West Fork of the Little Colorado River. As described in the above discussion on the Black River system, a 404 Permit (with subsequent revisions) was also issued by ACE covering barrier construction activities which the Little Colorado River Basin. Additional or amended 401 Certification and 404 Permit applications will be submitted to cover changes in barrier design (primarily backfilling) and change in location of the lower barrier if these construction options are used in the West, East and South Forks of the LCR.

The East and West Forks of the Little Colorado River are principal sources of water to private water users in the area of Greer. These water users are downstream of four proposed fish barrier locations. All three forks of the Little Colorado River involved in this project are major headwater sources for water users in the Eager/Springerville and St. John's region of the Little Colorado River basin. All streams involved in this project within the Little Colorado River basin are within the Norviel Decree area. Applications to appropriate water within the Norviel Decree area are under the jurisdiction of the Superior Court for Apache County.

2. Environmental Consequences

a. ALTERNATIVE 1 - (No Action) No environmental consequences to water or watershed under this alternative.

b. ALTERNATIVE 2 - (Proposed Action)

1) Black River System

a) West Fork Black River - This site is adjacent to an existing forest road, therefore vehicles and equipment will have direct access to this site. Materials will be placed primarily by hand, but some (approximately 40%) will be placed with equipment (backhoe, front-end loader, excavator, etc.). No material is available in the immediate project area, so the material will be transported to the site from one Forest Service rock pit located approximately 22 miles from the barrier site. A rock and mortar and/or cement layer may be placed over the gabion core of this barrier. A total of 220 cubic yards of material will be needed for this project; and approximately 65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and mortar and/or cement, and 5% will be gravel and sand.

As a direct result of barrier construction, a physical change in stream gradient will occur where water overtops the spillway. The fish barrier design will include an adequate splash pad that will prevent stream destabilization from down cutting below the dam due to the

increased energy of water flowing over the barrier. As boulders dominate the channel substrate at the proposed barrier location, down cutting will not be likely. However, if down cutting does occur, it will gradually increase the effectiveness of the dam as a barrier to upstream fish dispersal. A barrier in the main stream, under bankfull flow conditions, will create a pool of less than 0.9 acre surface area. Initial storage volume will be approximately 1.66 acre-feet. This pool will likely require 10-15 years of natural bedload and sediment transport to the structure before it is backfilled naturally. Removal of the barrier at any time in the future will mobilize the silt component stored above the barrier, which could cause downstream siltation problems for several years. If a backfilling alternative construction option were used, there would be little siltation effect since the storage area above the barrier would be physically backfilled with rock at the time of construction.

Some riparian woody vegetation will be inundated after barrier completion, resulting in a loss of vegetation along the new channel banks. This woody vegetation and its root mass currently provide bank stabilization, particularly during high flow events. Bank armoring, using woody vegetation and/or riprap, will be re-established after construction to prevent bank cutting during extreme events. (This bank armoring would not be required under the backfill construction option.) Best Management Practices (BMPs) (Appendix I) will be implemented prior to construction that will address specific methods to be used in preventing bank erosion at the barrier sites. Short-term effects include the movement of fine sediments downstream of the barrier during construction. As construction will occur during low flow periods (approximately 5-10 cfs), any increase in sediment movement should be short-lived. Bank trampling and connected disturbed areas will increase during construction, however the above-mentioned BMPs will additionally address such issues. These BMPs are designed to insure that erosion processes are held in check and that rehabilitation of disturbed areas occurs immediately following completion of the barrier. Estimated input of additional sediment to the West Fork Black River due to construction activities is less than 1 cubic yard. Under the backfilling construction option, this amount would increase to less than 2 cubic yards due to the silt size particles inevitably associated with the rock fill material, which would be obtained offsite at rock quarries and transported to the construction site by truck.

Effects from the use of antimycin A, the fish toxicant proposed for renovating the stream, at recommended concentrations is generally restricted to fish (Herr et al. 1967). It has low toxicity to mice, rats, rabbit and quail, and no effects to turtles, salamanders, frogs (tadpoles) snakes, herons, ducks and terns at concentrations toxic to fish (Walker et al. 1964; Gilderhus et al. 1969). The effects of the toxicant on aquatic invertebrates are not clear-cut. No loss of taxa was reported in one study, while significant differences were found in relative abundances of some species in another study (Kiner et al. 2000; Lopez 1991). Adding to the overall safety of using Antimycin A are the facts that it degrades rapidly and remaining byproducts after neutralization are not harmful to fish or other organisms (Berger et al, 1969; Gilderhus et al. 1969; Lee et al. 1971; and Marking and Dawson 1972). For further information regarding effects of antimycin A on other species, see Appendix A.

b) Centerfire, Fish and Hayground Creeks

01. Centerfire Creek - This site is only accessible by foot, and all materials will be placed by hand. Modification of the existing barrier will include raising the level of the spillway and wings, and placement of material immediately below and above the barrier. There is no concentrated rock source near the barrier, so the material for this project will be gathered from the adjacent uplands and placed by hand. A total of 9 cubic yards of material will be needed for this project; and approximately 75% will be cobble material (4-10 inches), 20% will be small boulders (10-16 inches), and 5% will be gravel and sand. The gravel and sand will be brought to the site on foot and placed by hand.

02. Fish Creek - This site is only accessible by foot or horseback, and all materials will be placed by hand. Modification of the existing barrier will include raising the level of the spillway and wings, and placement of material immediately below and above the barrier. There is no concentrated rock source near the barrier, so the material for this project will

be gathered from the adjacent uplands and placed by hand. A total of 9 cubic yards of material will be needed for this project; and approximately 65% will be cobble material (4-10 inches), 30% will be small boulders (10-16 inches), and 5% will be gravel and sand. The gravel and sand will be brought to the site on foot or horseback and placed by hand.

03. Hayground Creek - This site is only accessible by foot or horseback, and all materials will be placed by hand. Modification of the existing barrier will include raising the level of the spillway and wings, and placement of material immediately below and above the barrier. Immediately adjacent to the existing barrier is a natural rock flow, and this will be the source of material for this project. A total of 22 cubic yards of material will be needed for this project; and approximately 80% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), and 5% will be gravel and sand. The gravel and sand will be brought to the site on foot or horseback.

As a direct result of barrier remodeling, there would be minor disturbance in the creek as construction workers cross the stream channel to reach both ends of each work site. These effects will be localized as fugitive sediment settles out relatively quickly. The expected overall impacts are negligible, as the source is limited to short-term pulses during reconstruction, and no problematic conditions are expected. The added gabion layer will remain permeable resulting in no increase in upstream storage under normal flow conditions. However, the size of the bankfull pool will increase slightly – by approximately 0.04 acre-feet at each of these structures. Since the original structures have backfilled naturally, only portions of the bankfull pool volume will be available for additional bedload or sediment storage. The total amount of volume available for bedload and sediment retention will total less than 0.12 acre feet. Impacts to the stream banks with larger bankfull pools are expected to be negligible, as riparian vegetation has previously been inundated at these sites, with only minor additional loss due to temporary inundation during high stream flow events. Bank armoring (see West Fork Black River) will be re-established to prevent bank cutting during these high flow events. Additional sediment inputs to the streams due to remodeling will be negligible.

See West Fork Black River (above) for discussion of effects from the use of antimycin A on other species.

04. Wildcat, Boggy, Conklin, Stinky, and Home Creeks - No barrier construction or remodeling activities will occur in these streams. Therefore the only effects on water will be associated with renovation activities. See West Fork Black River (above) for discussion of effects from the use of antimycin A on other species.

2) Little Colorado River System

a) East Fork

01. Upper Barrier - This site is only accessible by foot or horseback, and all materials will be placed by hand. Adjacent to the construction site of this fish barrier are several natural rock flows, which will be the source of materials for this site. A rock and mortar and/or cement layer may be placed over the gabion core of this barrier. A total of 24 cubic yards of material will be needed for this project; and approximately 65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and mortar and/or cement, and 5% will be gravel and sand. The mortar, cement, gravel and sand will be brought to the site on foot or horseback and placed by hand.

02. Lower Barrier - This site is only accessible by foot or horseback, and all materials will be placed by hand. Immediately adjacent to the construction site of this fish barrier is a natural rock flow, which will be the source of material for this site. A rock and mortar and/or cement layer will be placed over the gabion core of this barrier. A total of 56 cubic yards of material will be needed for this project; and approximately 65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and

mortar and/or cement, and 5% will be gravel and sand. The mortar, cement, gravel and sand will be brought to the site on foot or horseback and placed by hand.

As a direct result of barrier construction, impacts to this stream system will be similar to effects expected on the West Fork Black River, with the major difference being the construction of two barriers in this drainage, creating a two-fold effect. The upper barrier is located in a steep-gradient (10%+), boulder-dominated section of the channel, thus limiting the likelihood of down cutting. Few riparian plants will be inundated at the upper site, however any bank armoring lost should be re-established to prevent bank cutting during extreme events. The preferred location of the lower barrier is also in a fairly steep (5% gradient) section of the channel, with boulders and cobbles co-dominating the channel substrate. Probability of down cutting is more likely at this lower site with less armoring in the channel bottom. Some riparian woody vegetation will be inundated after barrier completion at the lower site, resulting in a loss of protective vegetation along the immediate channel. This woody vegetation and its root mass currently provide bank stabilization, particularly during high flow events. Bank armoring will be re-established to prevent bank cutting during extreme events. Under the backfilling construction option, the location of the lower barrier would be close to and have similar characteristics as the upper structure. Effects would be similar to those at the upper structure.

Short-term effects will closely resemble those expected at the West Fork of the LCR, with construction again occurring during low flow periods (approximately 2-5 cfs). Construction of the downstream barrier first is recommended to help trap fugitive sediment that may be mobilized by construction at the upstream site. BMPs will be established and adhered to prior to project implementation. Estimated input of additional sediment to the East Fork LCR due to construction activities is less than 0.3 cubic yard under all construction options.

Under bankfull flow conditions, the upper barrier will create a pool estimated at slightly less than 0.02 acre surface area. Initial storage volume will be less than 0.04 acre-feet. This pool will likely require 1-3 years of natural bedload and sediment transport to the structure before it is backfilled naturally. Removal of the barrier at any time in the future will mobilize the silt component stored above the barrier, which could cause downstream siltation problems for a similar length of time. If a backfilling alternative construction option were used, there would be little siltation effect since the storage area above the barrier would be physically backfilled with rock at the time of construction.

Under bankfull conditions, the lower barrier at the preferred location will create a pool estimated at approximately 0.12 acre surface area. Initial storage volume will be approximately 0.2 acre-feet. This pool will likely require 1-5 years of natural bedload and sediment transport to the structure before it is backfilled naturally. Removal of the barrier at any time in the future will mobilize the silt component stored above the barrier, which could cause downstream siltation problems for a similar length of time. If a backfilling alternative construction option were used, there would be little siltation effect since the storage area above the relocated lower barrier would be physically backfilled with rock at the time of construction.

See West Fork Black River (above) for discussion of effects from the use of Antimycin A on other species.

b) South Fork

01. Upper Barrier - This site is adjacent to an existing forest road, therefore vehicles and equipment will have direct access to this site. Pre-cast L-shaped concrete structures will be used to form the barrier. Materials will be placed primarily by equipment (backhoe, front-end loader, excavator, etc.), but some (approximately 30%) will be placed by hand. No material is available in the immediate project area, so the material will be transported to the site from two Forest Service locations. One source is located approximately 2 miles from the barrier site, and the other source is approximately 26 mile from the fish barrier site. A total of 41 cubic yards of material will be needed for this project; approximately

65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and mortar and/or cement, and about 5% will be gravel and sand.

02. Lower Barrier - This site is adjacent to an existing forest road, therefore vehicles and equipment will have direct access to this site. Pre-cast L-shaped concrete structures will be used to form the barrier. Materials will be placed primarily by equipment (backhoe, front-end loader, excavator, etc.) but some (approximately 30%) will be placed by hand. No material is available in the immediate project area, so the material will be transported to the site from two Forest Service locations. One source is located approximately 9 miles from the barrier site, and the other source is approximately 27 miles from the fish barrier site. A total of about 52 cubic yards of material will be needed for this project; approximately 65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and mortar and/or cement, and 5% will be gravel and sand.

As a direct result of barrier construction, impacts to this stream system will be similar to effects expected on the West Fork Black River, with the major difference being the construction of two barriers in this drainage, creating a two-fold effect. The upper barrier is located in a fairly steep-gradient (6%), boulder-dominated section of the channel, with limited likelihood of down cutting. A significant amount of riparian woody vegetation will be inundated after barrier completion at the upper site, resulting in a loss of protective vegetation along the immediate channel. This woody vegetation and its root mass currently provide bank stabilization, particularly during high flow events. Bank armoring will be re-established to prevent bank cutting during extreme events. (Under the backfilling option, bank armoring would not be necessary.) The lower barrier is also located in a fairly steep (5% gradient) section of the channel, with cobbles dominating the channel substrate. Probability of down cutting is more likely at the lower site with less armoring in the channel bottom. Some riparian woody vegetation will be inundated at this site, also, with effects similar to the upper site. (Again, under the backfilling option, bank armoring would not be necessary.)

Short-term effects will closely resemble those expected at the West and East Forks LCR, with construction again occurring during low flow periods (approximately 2-3 cfs). Construction of the downstream barrier first is recommended to help trap fugitive sediment that may be mobilized by construction at the upstream site. BMPs will be established and adhered to prior to project implementation. Estimated input of additional sediment to the South Fork LCR due to construction activities is less than 1 cubic yard. Under the backfilling construction option, this amount would increase to less than 1.5 cubic yards due to the silt size particles inevitably associated with the rock fill material that would be obtained off site at rock quarries and transported to the construction site by truck.

Under bankfull flow conditions, the upper barrier will create a pool of less than 0.08 acre surface area and the lower barrier will create a pool estimated at less than 0.06 acre surface area. Initial storage volumes of both pools will be less than 0.14 acre-feet each. These pools will likely require 1-3 years of natural bedload and sediment transport to the structures before they are backfilled naturally. Removal of the barriers at any time in the future will mobilize the silt component stored above the barriers, which could cause downstream siltation problems for a similar length of time. If a backfilling alternative construction option were used, there would be little siltation effect since the storage area above the barriers would be physically backfilled with rock at the time of construction.

See West Fork Black River (above) for discussion of effects from the use of antimycin A.

c) West Fork

01. Upper Barrier - This site is only accessible by foot or horseback, and all materials will be placed by hand. Adjacent to the construction site of this fish barrier are several natural rock flows, which will be the source of materials for this site. A rock and mortar and/or cement layer may be placed over the gabion core of this barrier. A total of 28 cubic yards

of material will be needed for this project; and approximately 65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and mortar and/or cement, and 5% will be gravel and sand. The mortar, cement, gravel and sand will be brought to the site on foot or horseback and placed by hand.

02. Lower Barrier - This site is only accessible by foot or horseback, and all materials will be placed by hand. Adjacent to the construction site of this fish barrier are several natural rock flows, which will be the source of material for this site. A rock and mortar and/or cement layer may be placed over the gabion core of this barrier. A total of 80 cubic yards of material will be needed for this project; and approximately 65% will be cobble material (4-10 inches), 15% will be small boulders (10-16 inches), 15% will be rock and mortar and/or cement, and 5% will be gravel and sand. The mortar, cement, gravel and sand will be brought to the site on foot or horseback and placed by hand.

As a direct result of barrier construction, impacts to this stream system will be similar to effects expected on the West Fork Black River, with the major difference being the construction of two barriers in this drainage, creating a two-fold effect. The upper barrier site is located in a steep-gradient (9%), boulder-dominated section of the channel, thus limiting the likelihood of down cutting. Few riparian plants will be inundated at the upper site, however any bank armoring lost should be re-established to prevent bank cutting during extreme events. The preferred location of the lower barrier is also in a fairly steep (6% gradient) section of the channel, with boulders dominating more than half of the channel substrate. Some riparian woody vegetation above this site will be inundated after barrier completion, resulting in a loss of vegetation along the new channel banks. This woody vegetation and its root mass currently provide bank stabilization, particularly during high flow events. Bank armoring (see West Fork Black River) will be re-established to aid in preventing bank cutting during extreme events. Under the backfilling construction option, the location of the lower barrier would be close to and have similar characteristics as the upper structure. Effects would be similar to those at the upper structure.

Short-term effects will closely resemble those expected at the West Fork Black River, with construction again occurring during low flow periods (approximately 2-5 cfs). Construction of the downstream barrier first is recommended to help trap fugitive sediment that may be mobilized by construction at the upstream site. BMPs will be established and adhered to prior to project implementation. Estimated input of additional sediment to the East Fork LCR due to construction activities is less than 0.3 cubic yard under all construction options.

Under bankfull flow conditions, the upper barrier will create a pool estimated at slightly less than 0.02 acre surface area. Initial storage volume will be less than 0.04 acre-feet. This pool will likely require 1-3 years of natural bedload and sediment transport to the structure before it is backfilled naturally. Removal of the barrier at any time in the future will mobilize the silt component stored above the barrier, which could cause downstream siltation problems for a similar length of time. If a backfilling alternative construction option were used, there would be little siltation effect since the storage area above the barrier would be physically backfilled with rock at the time of construction.

Under bankfull conditions, the lower barrier at the preferred location will create a pool estimated at approximately 0.12 acre surface area. Initial storage volume will be approximately 0.2 acre-feet. This pool will likely require 1-5 years of natural bedload and sediment transport to the structure before it is backfilled naturally. Removal of the barrier at any time in the future will mobilize the silt component stored above the barrier, which could cause downstream siltation problems for a similar length of time. If a backfilling alternative construction option were used, there would be little siltation effect since the storage area above the relocated lower barrier would be physically backfilled with rock at the time of construction.

See West Fork Black River (above) for discussion of effects from the use of antimycin A on other species.

c. ALTERNATIVE 3. - (Electrofishing renovation, double barriers on LCR). The environmental consequences to water and watershed under this alternative would be greater than under ALTERNATIVES 1 and 4, but equal to those under ALTERNATIVE 2.

d. ALTERNATIVE 4 - (antimycin A renovation, single barriers on LCR).

1) Black River System - Environmental consequences to water and watershed under this alternative would be greater than under ALTERNATIVE 1, but equal to those under ALTERNATIVES 2 and 3.

2) Little Colorado River System

a) East Fork - Environmental consequences to water and watershed under this alternative are the same as those of the lower barrier, under ALTERNATIVE 2. Impacts would be greater than ALTERNATIVE 1, but less than those under ALTERNATIVES 2 and 3.

b) South Fork - Environmental consequences to water and watershed under this alternative are the same as those of the lower barrier, under ALTERNATIVE 2. Impacts would be greater than ALTERNATIVE 1, but less than those under ALTERNATIVES 2 and 3.

c) West Fork - Environmental consequences to water and watershed under this alternative are the same as those of the lower barrier, under ALTERNATIVE 2. Impacts would be greater than ALTERNATIVE 1, but less than those under ALTERNATIVES 2 and 3.

As a direct result of barrier construction, impacts to this stream system will be similar to effects expected on the West Fork Black River, with the major difference being the construction of two barriers in this drainage, creating a two-fold effect. The upper barrier is located in a fairly steep-gradient (6%), boulder-dominated section of the channel, with limited likelihood of down cutting. A significant amount of riparian woody vegetation will be inundated after barrier completion at the upper site, resulting in a loss of protective vegetation along the immediate channel. This woody vegetation and its root mass currently provide bank stabilization, particularly during high flow events. Bank armoring will be re-established to prevent bank cutting during extreme events. (Under the backfilling option, bank armoring would not be necessary.) The lower barrier is also located in a fairly steep (5% gradient) section of the channel, with cobbles dominating the channel substrate. Probability of down cutting is more likely at the lower site with less armoring in the channel bottom. Some riparian woody vegetation will be inundated at this site, also, with effects similar to the upper site. (Again, under the backfilling option, bank armoring would not be necessary.)

3. Cumulative Effects Under all Alternatives – Water quality and quantity, stream dynamics and watershed condition in the watersheds involved in this project have been significantly impacted by past activities. High levels of livestock grazing in the first half of the 20th century led to increases in sedimentation (broad in extent) and declines in stream bank stability (local in extent). Timber harvest and road/rail construction activities primarily in the latter half of the 20th century contributed towards increased sedimentation and runoff. Construction of reservoirs and water diversion facilities around the turn of the 20th century, particularly in the Little Colorado River basin, significantly impacted hydrologic regimes and dependent stream dynamics. Stream channels in the project area, particularly those reaches where bed and bank armoring are limited, are still adjusting to the perturbations of these past activities.

The National Forest has developed some water sources for consumptive use for grazing, recreation, wildlife and administrative purposes. But this usage is minor compared to irrigation and municipal water use on private land within and below National Forest boundaries. Over the last 20 years, reductions in livestock numbers, timber harvest activities and new road construction have tended to reverse the impacts of past resource use activities, especially as related to water quality and streambank stability. Recreation use primarily related to fishing, hunting, hiking, and camping have been important in the project watersheds and has caused relatively minor impacts related to water quality and streambank stability. The existing road

network, particularly where it follows stream corridors, and livestock grazing, particularly in certain riparian areas, continue to impact water quality and streambank stability on a local basis. Generally, however, streams in the project watersheds have been meeting state water quality standards.

Future developments that may impact water quality, stream dynamics, streambank stability and watershed condition in the project watersheds include the planned improvements and realignment of Arizona State Highway 273 (locally negative), future allotment management plan revisions (broadly positive), and planned watershed/riparian restoration projects (locally positive). The actions contemplated under all action alternatives would not significantly add to the cumulative impacts of other past, present and anticipated water impacting activities because they are small in scale relative to these other impacts, very localized in area, and of short duration.

D. WILDLIFE

1. Affected Environment - Project effects on species in various categories were assessed. There are twelve species, four with critical habitat and one with proposed critical habitat, associated with this project and considered under the ESA. These species are either threatened (T), endangered (E), proposed (P) or experimental, non-essential (XN), the latter treated as proposed. There are nineteen sensitive species (S) and three management indicator species (MIS) also associated with the project. Based on scoping input, two other species (O) were also included. The present condition of these many species is discussed in various wildlife documents, grouped by terrestrial or aquatic species. The following documents are found in the Project Record: Biological Assessments, Biological Evaluations and Specialist's Reports. Those documents are summarized below.

2. Environmental Consequences

a. Project activities that have potential to affect wildlife, both aquatic and terrestrial species, are discussed in the following paragraphs. These form the basis for the biological determinations made in the various wildlife documents found in the Project Record.

Alternative 1 (No Action Alternative) would result in populations of Apache trout on the A-SNFs continuing to be negatively impacted by non-native trout. Activities on the A-SNFs necessary to aid recovery would not occur; therefore, de-listing could not be achieved. This is not consistent with the A-SNFs Plan.

Without the ability to maintain current Apache trout populations through barrier remodeling and use of antimycin A to remove non-native trout that might invade areas above barriers in disrepair, the status of Apache trout could degrade to endangered by the loss of existing populations. An endangered status would stop sport fishing for Apache trout and could include more management limitations associated with a higher level of protection. No action could possibly lead to the eventual extirpation of all wild Apache trout populations on the A-SNFs.

Actions such as stream renovation, fish reintroduction, and fish barrier construction would isolate Apache trout in portions of the LCR and West Fork of the Black River system from the threat of hybridization, competition, and predation from non-native salmonids and would contribute to their recovery.

Overall, actions would: 1) eliminate direct threats of hybridization with, and predation and competition from non-native salmonids, 2) increase the amount of aquatic habitats devoid of non-native salmonids, 3) increase the extent of occupied habitat for Apache trout, 4) increase the likelihood that viable populations and communities of Apache trout would be self-sustaining, 5) increase the number and expand the distribution of unhybridized Apache trout in the LCR and Black River systems, and 6) contribute to the recovery and de-listing of Apache trout.

As discussed in the Vegetation Section, project activities associated with barrier work would adversely impact vegetation. ALTERNATIVES 2, 3 and 4 would have these same effects. Alternative 3 would have somewhat more vegetation trampled by trailing, and the level of impacts would be somewhat less under ALTERNATIVE 4 since only one, not two, barriers would be constructed on the East, West and South Forks LCR under this alternative.

Project activities associated with salvaging natives (electrofishing) and with renovation work (electrofishing or antimycin A application) would also include trampling of bank vegetation along the length of streams to be treated (see Tables 1 and 2 for affected lengths). This would require numerous passes along one or both sides of the streams. Some streams have developed or user-made trails along their banks in some places, otherwise new trailing would occur to accomplish salvage and renovation. Vegetative impact and recovery is expected as described above. Because salvaging and renovation by electrofishing requires walking through streams, vegetation and benthos would also be disturbed or crushed.

Barrier work would disturb the stream bottom and banks at these sites, which would lead to at least short-term increased sediment in the stream. Existing trails already represent a "connected disturbed area" (CDA) that is, in a number of places, channeling sediment to the stream. New trailing may do this in other places as well. However, any additional sediment into channels as a result of this project is expected to occur primarily during the period of work. Vegetation recovery in trailing areas would be expected within a year or after the next growing season. The timing mitigation for working during drier periods would help to alleviate the amount of sediment produced by this project.

Removal of fish biomass through salvage of natives prior to treatment and through application of antimycin A (ALTERNATIVES 2 and 4) and through electrofishing (ALTERNATIVE 3) may impact the stream biota, at least in the short term. With the reintroduction of Apache trout and the return to the stream of salvaged natives, some of the fish biomass loss would be replaced. It is expected to take a minimum of three years for fish populations to reach pre-treatment levels in all streams except WF Black and WF LCR, which will receive hatchery-reared fish to repatriate the streams.

Macroinvertebrates serve as a food source to other species. Biomass, number and diversity of macroinvertebrates may or may not be impacted. Typically, intolerant species are more impacted while tolerant species may increase, and intermediate species may experience no change (Lopez 1991). Recovery of macro invertebrate biomass, number and diversity typically recovers over time but rates are highly variable. Lopez (1991) reported no loss of taxa within one month of treatment. McKinley and Mihalick (1981) found that some species did not recover to pre-antimycin A treatment levels and they surmise that some taxa may have been eliminated. Kinner et al. (2000) found significant differences in relative abundances of some invertebrate groups, but found no significant differences in species abundance for pre- and post-treatment sites. For more information about antimycin A effects, see Appendix A.

Disturbance to terrestrial wildlife species could occur while crews are present and working as wildlife often avoiding areas of concentrated human activity. Disturbance during breeding or young rearing periods is usually more negative than at other times. With the activities proposed in all the action alternatives, short-term disturbance impacts are expected for the Mexican spotted owl, bald eagle, osprey, and northern water shrew. These impacts are not expected to jeopardize the continued existence or the viability of any species.

While it is not certain to occur, the development of pools behind new barriers could become an attraction for recreational users for fishing, swimming or possibly bird watching. If this occurs, the above-bank and instream trampling effects, along with wildlife disturbance effects, could increase, although lower reaches along the LCR streams currently receive heavy recreational use.

b. **Summary of Biological Determinations** - The following tables (Tables 5 through 10) summarize biological determinations for each alternative and category of species. Note that terminology of determinations is different for different categories. This is due to specific law

and regulation that apply to each category. For more detail and rationale for determinations, see the various wildlife documents in the Project Record.

1. ALTERNATIVE 1 - (No Action) Tables 5 through 7.

TABLE 5. ALTERNATIVE 1 - (No Action) Threatened (T), endangered (E), proposed (P), and experimental non-essential (XN) species.

	SPECIES	NO EFFECT	MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT	MAY AFFECT, LIKELY TO ADVERSELY AFFECT
AQUATIC	Apache trout (T)	X		
	Loach minnow (T)	X		
	Loach minnow critical habitat	X		
	Spikedace (T)	X		
	Spikedace critical habitat	X		
	Gila trout (T)	X		
	Little Colorado River spinedace (T)	X		
	Little Colorado River spinedace critical habitat	X		
	Razorback sucker (E)	X		
	Razorback sucker critical habitat	X		
	Chiricahua leopard frog (T)	X		
		NO EFFECT	MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT	MAY AFFECT, LIKELY TO ADVERSELY AFFECT
TERRESTRIAL	Bald Eagle (T)	X		
	Mexican Spotted Owl (T)	X		
	Jaguar (E)	X		
	Southwest Willow Flycatcher (E)	X		
		NO EFFECT	NOT LIKELY TO JEOPARDIZE	LIKELY TO JEOPARDIZE
	Mexican gray wolf (XN)	X		

TABLE 6. ALTERNATIVE 1 - (No Action) Sensitive species.

	SPECIES	NO IMPACT	INDIVIDUAL IMPACTS BUT NO TREND TO LIST NOR LOSS OF POPULATION VIABILITY	TREND TO LIST AND/OR LOSS OF POPULATION VIABILITY
AQUATIC	Mexican garter snake	X		
	Narrowheaded garter snake	X		
	Arizona southwestern toad	X		
	Northern leopard frog	X		
	Roundtail chub	X		
	Little Colorado River sucker	X		
	California floater	X		
	Three Fork springsnail	X		
	White Mountain water penny beetle	X		
	False ameletus mayfly	X		

TABLE 6. ALTERNATIVE 1 - (No Action) Continued.

	SPECIES	NO IMPACT	INDIVIDUAL IMPACTS BUT NO TREND TO LIST NOR LOSS OF POPULATION VIABILITY	TREND TO LIST AND/OR LOSS OF POPULATION VIABILITY
TERRESTRIAL	Southwest river otter	X		
	New Mexico jumping mouse	X		
	Northern Goshawk	X		
	Common Black-hawk	X		
	Peregrine Falcon	X		
	Arizona copper butterfly	X		
	Spotted skipperling	X		
	Mountain silverspot butterfly	X		
	Goodding's onion	X		
	Mogollon paintbrush	X		
	Blumer's dock	X		
	Arizona willow	X		
	Gila groundsel	X		
	White Mountain clover	X		

TABLE 7. ALTERNATIVE 1 - (No Action) Management indicator (MIS) and other (O) species.

	SPECIES	NO IMPACT	INDIVIDUAL IMPACTS BUT NO LOSS OF POPULATION VIABILITY	LOSS OF POPULATION VIABILITY
AQUATIC	Macroinvertebrates (MIS)	X		
TERRESTRIAL	Yellow-breasted Chat (MIS)	X		
	Lincoln's Sparrow (MIS)	X		
		NO IMPACT	DETRIMENT	—
	Osprey (O)	X		
	Northern water shrew (O)	X		

2. ALTERNATIVES 2, 3, AND 4 – (Action Alternatives) Tables 8 through 10.

TABLE 8. ALTERNATIVES 2, 3, AND 4 - (Action Alternatives) Antimycin A renovation, single (Alt. 4) or double barriers (Alt. 2 and 3) on Little Colorado River. Threatened (T), endangered (E), proposed (P), and experimental non-essential (XN) species.

	SPECIES	NO EFFECT	MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT	MAY AFFECT, LIKELY TO ADVERSELY AFFECT
AQUATIC	Apache trout (T)			X
	Loach minnow (T)	X		
	Loach minnow critical habitat			X
	Spikedace (T)	X		
	Spikedace critical habitat	X		
	Gila trout (T)	X		
	Little Colorado River spinedace (T)			X
	Little Colorado River spinedace critical habitat	X		
	Razorback sucker (E)	X		
	Razorback sucker critical habitat	X		
	Chiricahua leopard frog (T)		X	

TABLE 8. ALTERNATIVES 2, 3, AND 4 - (Action Alternatives) Continued.

	SPECIES	NO EFFECT	MAY EFFECT, NOT LIKELY TO ADVERSELY AFFECT	MAY AFFECT, LIKELY TO ADVERSELY AFFECT
TERRESTRIAL	Bald Eagle (T)			X
	Mexican Spotted Owl (T)			X
	Jaguar (E)		X	
	Southwest Willow Flycatcher (E)		X	
		NO EFFECT	NOT LIKELY TO JEOPARDIZE	LIKELY TO JEOPARDIZE
	Mexican gray wolf (XN)		X	

TABLE 9. ALTERNATIVES 2, 3, AND 4 - (Action Alternatives) Antimycin A renovation, single (Alt. 4), or double barriers (Alt. 2 and 3) on Little Colorado River. Sensitive species.

	SPECIES	NO IMPACT	INDIVIDUAL IMPACTS BUT NO TREND TO LIST NOR LOSS OF POPULATION VIABILITY	TREND TO LIST AND/OR LOSS OF POPULATION VIABILITY
AQUATIC	Mexican garter snake		X	
	Narrowheaded garter snake		X	
	Arizona southwestern toad		X	
	Northern leopard frog		X	
	Roundtail chub		X	
	Little Colorado River sucker		X	
	California floater		X	
	Three Fork springsnail		X	
	White Mountain water penny beetle		X	
	False ameletus mayfly		X	
TERRESTRIAL	Southwest river otter		X	
	New Mexico jumping mouse		X	
	Northern Goshawk		X	
	Common Black-hawk		X	
	Peregrine Falcon		X	
	Arizona copper butterfly		X	
	Spotted skipperling		X	
	Mountain silverspot butterfly		X	
	Goodding's onion		X	
	Mogollon paintbrush		X	
	Blumer's dock		X	
	Arizona willow		X	
	Gila groundsel		X	
	White Mountain clover		X	

TABLE 10. ALTERNATIVE S 2, 3, AND 4 - (Action Alternatives) Antimycin A renovation, single (Alt. 4) or double barriers (Alt. 2 and 3) on Little Colorado River. Management indicator (MIS) and other (O) species.

	SPECIES	NO IMPACT	INDIVIDUAL IMPACTS BUT NO LOSS OF POPULATION VIABILITY	LOSS OF POPULATION VIABILITY
AQUATIC	Macroinvertebrates (MIS)		X	
TERRESTRIAL	Yellow-breasted Chat (MIS)		X	
	Lincoln's Sparrow (MIS)		X	
		NO IMPACT	DETRIMENT	—
	Osprey (O)		X[1]	
	Northern water shrew (O)		X[1]	

[1]Level of detriment is uncertain for these species, see the Terrestrial Wildlife Specialist's Report for more details (Project Record).

c. ALTERNATIVE 3 - (Electrofishing renovation, double barriers on LCR). Even though the total impacts to macroinvertebrates would be less with renovation by electrofishing, as compared to renovation with antimycin A, individual macroinvertebrates would still be impacted from other activities for this alternative. Therefore ALTERNATIVE 3 determinations for all aquatic species would be the same as under ALTERNATIVE 2. For terrestrial species that are threatened, endangered, proposed or experimental, non-essential, the effects under this alternative would likely be similar to ALTERNATIVE 2, although some effects, those associated with human disturbance and longer period of temporary fish removal could be greater. Some direct mortality could occur if water shrews are present in the stream when electroshocking takes place. But, given reduced impacts to macroinvertebrates (food), the level of detriment should be less for the Northern water shrew under this alternative as compared to ALTERNATIVE 2. However, the determination of effects for the shrew and all terrestrial sensitive, MIS and other species would be the same under ALTERNATIVE 3 as ALTERNATIVE 2.

d. ALTERNATIVE 4 - (Antimycin A renovation, single barriers on LCR). Determinations for all aquatic species for this alternative would be the same as under ALTERNATIVE 2. For terrestrial species that are threatened, endangered, proposed or experimental, non-essential, the effects for this alternative would likely be similar to ALTERNATIVE 2, although with fewer barriers, disturbance levels would likely be reduced along the East, West and South Forks LCR with this alternative. The determination of effects for terrestrial sensitive, MIS and other species would be the same as ALTERNATIVE 2, although impacts from barrier construction would be less.

3. Cumulative Effects Under all Alternatives - Adverse effects to aquatic sensitive and MIS species could occur from a number of actions not considered as part of the current project proposal, for example: road maintenance and/or construction, recreation impacts, livestock and wild ungulate grazing in riparian bottoms, introduction or maintenance of non-indigenous aquatic species. These actions can singly or cumulatively affect aquatic species through alterations in aquatic habitat parameters such as stream channel morphology or habitat features such as pool:riffle ratios, and through changes in aquatic species assemblages which may promote increases in interspecific competition with or predation by non-indigenous, introduced species. There are no known past, present, or future actions by state or private entities within the action area of the project. Impacts to species resulting from cumulative affects, discussed above, will not be of such significance as to result in a trend toward Federal listing or loss of viability of any species.

Barrier created pools, along with the opportunity to fish for the native Apache trout, could cause an increase in the level of recreational use on project streams to above current levels. If this occurs, alterations in aquatic and streamside parameters, along with disturbance to wildlife, could increase. However, as noted previously, some stream reaches are already receiving heavy recreation use levels. Streams not now heavily used by recreationalists are not likely to see an increase in use because of their relatively isolated locations and limited access.

E. AIR

1. Affected Environment

a. Existing Conditions - The project areas are in close proximity to the Mtn. Baldy Class 1 airshed. Air quality is currently impacted somewhat from long or medium range transport from heavy industries, such as power plants and mining operations found south and west of the project areas, as the prevailing winds originate from the southwest. Within the immediate project areas, impacts to visibility may occur from sources such as dust, and smoke from wild or prescribed fire. A visibility monitoring station has recently been established near Greer to help determine the sources and quantity of pollutants affecting the airshed.

2. Environmental Consequences

a. ALTERNATIVE 1 - (No Action) – No environmental impacts will be incurred from this alternative.

b. ALTERNATIVES 2, 3 and 4

1) Direct Effects - The majority of direct effect to air quality from all action alternatives is from dust generated from hauling materials to the sites. The effects are localized, as fugitive dust from roads settles out relatively quickly. The expected overall impacts are negligible, as the source is limited to short-term pulses during hauling, and no problematic conditions are expected.

No direct issues were raised on impacts to air quality as a result of project scoping. The project area is not within a recognized area of non-attainment for particulate matter-10, CO, SO_2, Ozone or TSP. Therefore, no analysis is necessary or provided to determine conformity with the State Implementation Plan for these areas.

Environmental consequences to air under ALTERNATIVES 2, 3 and 4 would be greater than under ALTERNATIVE 1.

2) Cumulative Effects Under All Alternatives - Industries and human presence (recreational use) would continue to affect the airsheds in the analysis areas, but the effects under the control of the Forest Service would not be significant and would be within ADEQ and EPA standards. Potential effects from wild fires could cause short-term negative effects to air quality within the airsheds.

F. HERITAGE RESOURCES - Data regarding Heritage Resources surveys and inventoried sites were derived from updated themes in the Forests' geographic information system files and physical files maintained in the Supervisor's Office. The files indicate that each of the proposed barrier locations is along river segments previously covered by sample surveys conducted for timber sales and other proposed activities in the area. Access routes and areas above the proposed barrier locations were included in the surveys; the river channels were excluded due to steep slopes and the likelihood that cultural resources would not be found either along the slopes or within the active channel. No historic properties were identified in or near the proposed project locations. Per exceptions listed in the Region 3 Programmatic Agreement, no additional survey is required. Should sites be discovered during project implementation, all work in that locale shall be halted and the Forest or Zone Archeologist notified immediately.

No concerns have been expressed by Indian tribes or other interested parties regarding traditional uses or significant places within the project area. Regardless of the alternative selected, the proposed project activities are not expected to result in negative effects to heritage resources. This project is in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, and with Section 101 (b)(4) of the National Environmental Policy Act of 1969. Project-specific concurrence by the Arizona State Historic Preservation Officer is not required, per SHPO letter to Regional Forester dated June 1, 1993.

G. RECREATION - According to AGFD data, fishing recreation as measured by angler days is significant at two of the streams proposed for renovation (West Fork Black River and West Fork LCR). Total angler days for the lower West Fork Black River was estimated at approximately 3,000 in 1996(AGFD, unpublished data). More recently, total use for West Fork Black River was estimated at 21,566 angler days in 2001. Most use occurs in the vicinity of the campground where catchable size Apache trout are stocked at weekly intervals from mid-May through mid-September. Use averaged approximately 10,100 angler days at the West Fork of LCR when surveyed in 1998 and 1999, and was estimated at 10,358 in 2001. Most use occurs in the vicinity of Sheeps Crossing. This area is also stocked with catchable size Apache trout from mid-May through mid-September.

Use at all of the other streams proposed for renovation was unmeasured but considered light. These are all wild trout waters and they currently do not attract as many anglers as do stocked waters. Since both the West Fork Black River and West Fork LCR are scheduled to be restocked with hatchery-reared Apache trout it will be possible to restock both locations with large numbers of catchable size trout after verifying the success of renovation treatments. Anglers may be

temporarily displaced by renovation treatments to other nearby waters on the A-SNFs. Because the A-SNFs and nearby FAIR provide numerous opportunities to fish for trout, and the impacts will be short term in nature on affected streams, the overall impact to anglers should not be significant.

By creating pools of water, especially near South Fork Campground the proposed project may be creating a potential swimming hole in the area.

1. SPORTFISHING DIVERSITY – THE EFFECT ON THE FISHING PUBLIC FROM STOCKING APACHE TROUT

As proposed, recovery actions for Apache trout will result in the renovation of several streams that contain either hybrid Apache trout or non-native brook and brown trout in combination with Apache trout. Most of the streams are small in size or are difficult to access and thus do not contribute much to the angling economics of the area. However, removal of non-natives from the two most utilized streams has created some concern. We disclose where angling opportunities for non-natives (rainbow, brook, and brown trout) will remain unchanged in the regional area once these recovery actions are fully implemented. We focus on the coldwater fishing opportunities that are offered throughout the Forests, with consideration of angling opportunities on FAIR, and others across the Mogollon Rim and White Mountains.

Silberman (2003) reported a total of 648,111 angler user days (AUDs) for Apache County and 910,748 for the 4-county region. In all four counties, most angler user days were from Arizona residents that travel, and most AZ travelers came from Maricopa and Pima counties (Table 12). That indicates anglers frequently drive considerable distances to engage in fishing activities in the area.

Table 12. Number of Angler User Days (AUDs) by residents within each county, residents that travel from outside each county, and non-residents that fish within each county. In addition, the number of residents that travel to each respective county from either Maricopa or Pima counties.

County	County resident AUDs	AZ residents traveling AUDs	Non-resident AUDs	AUDs of Maricopa County residents	AUDs of Pima County residents
Apache	39,304	579,874	28,933	275,763	155,538
Graham	6,515	28,755	2,282	10,581	13,009
Greenlee	324	245	910	86	257
Navajo	82,191	140,566	849	70,133	8,149

There are about sixty-five (65) streams within the regional area (42 within A-SNFs) where anglers can fish for rainbow trout, brown trout, cutthroat trout, Apache trout, or combinations of the species. There are at least 29 lakes/reservoirs (21 on A-SNFs) that are managed for coldwater fishing opportunities, and those account for approximately 75% of the AUDs for the 4-county regional area and approximately 86% of the total AUDs for Apache County. Approximately 30% of the AUDs for A-SNFs reservoirs were documented on waters that contain Apache trout (i.e., Big Lake and Lee Valley Lake). That indicates that anglers are very willing to utilize waters that contain Apache trout. By comparison, only 17% of the AUDs were documented on A-SNFs waters that contain brown trout and 98% that contain rainbow trout, because rainbows are stocked in almost every reservoir.

Following completion of any of the action alternatives, Apache trout streams will comprise less than half of the stream miles that rainbow or brown trout occupy. Thus, diverse cold-water fishing opportunities will remain abundant even during renovations. We anticipate that anglers will divert their fishing activities from recently renovated streams to other nearby areas that remain open. The recovery actions should create a more balanced diversity of trout fishing opportunities than presently exists. Once streams with pure Apache trout populations are created, new fishing and guiding opportunities should arise similar to those in other states that anglers have found appealing.

H. ECONOMIC IMPACT - EFFECTS OF RENOVATION AND REINTRODUCTION OF NATIVE TROUT ON LOCAL ECONOMICS.

The analysis presented here looked at statewide angler survey data from 2001, existing creel data, and licensed guiding service data that was reported for specific water bodies within a four county area potentially affected by the Proposed Action or Alternatives. All of the specific streams mentioned in this document were examined to attempt to define fishing and related economic data.

Recreational fishing activities provide a substantial boost to the local economy. A recent study by Silberman (2003) found that fishing and hunting in 2001 generated nearly one billion dollars in retail sales for Arizona. For local counties including Apache, Greenlee, Graham, and Navajo Counties, fishing related expenditures were estimated at $93.7 million in 2001. For Apache County alone, fishing expenditures totaled slightly more than $60 million dollars and supported approximately 1,000 full-time and part-time jobs (Silberman 2003). Including an economic multiplier (calculated for fishing-related expenses only), total economic benefit from fishing was estimated to be approximately $107.3 million for the four counties combined (Apache, Greenlee, Graham, and Navajo Counties) (Silberman 2003).

Fishing intensity (angler user days (AUD) - one angler fishing any part of a day) was examined using the latest statewide survey (AGFD in 2001). In 2001, there were an estimated total of 648,111 angler user days (AUDs) for Apache County and 910,748 for the 4-county region (Silberman 2003). A closer look at the survey numbers revealed that of the streams proposed herein, only four streams had documented use in the 2001 Statewide Angler survey (Table 13). Although there was no reported fishing for other proposed activity streams, it is likely that some angling occurs at various intensities. Most of the angler use (~ 75%) occurs on the lakes/reservoirs and certain streams where abundant and diverse fishing opportunities will remain unchanged as a result of these proposed actions.

Table 13. Number of angler user days (AUD) by water body for 2001. Data was collected via statewide angler survey of licensed anglers. A total of 46,149 surveys were mailed out March 8, 2002, and the Department received 8,637 responses (19% return rate).

Location	Trout	Non-trout	Total
*East Fork Little Colorado River	8		8
*Fish Creek	1		1
West Fork Black River	15,559	6,007	21,566
West Fork Little Colorado River at Sheeps Crossing	10,358	-	10,358
Totals	25,926	6,007	31,933

*East Fork LCR and Fish Creek were included in the write-in part of the survey.

To calculate an economic impact as a result of implementing Apache trout recovery actions, the total number of AUDs reported for the four water bodies (East Fork LCR, Fish Creek, West Fork LCR, and West Fork Black River) 31,933 (Table 13) was multiplied by the average AUD expenditure ($118) to get approximately $3.7 million annually or 3.5% of $107.3 million regional economic benefits from fishing. However, that figure assumes a total loss of fishing opportunity in the above-mentioned streams.

There are two reasons that the proposed actions will not impact the economy to that extent. First, the majority of fishing pressure in the West Fork LCR and West Fork Black River are concentrated around the stocked areas (Sheeps Crossing and West Fork Campground). Those areas receive hatchery-reared catchable-size Apache trout on a weekly basis from May through September to support the intensive angler use, and that stocking is planned to continue the summer following renovation(s). Secondly, the proposed action includes leaving West Fork LCR and West Fork Black River open following renovation using hatchery-reared fish (East Fork White River lineage) for repatriation (See Appendix E for a tentative schedule). The other remaining streams would likely be closed for approximately three years following renovation to allow the new populations to become established. Thus, total impact to the local economy is expected to be far less than stated above.

Although the West Fork LCR and West Fork Black River may experience some loss of fishing opportunity, it will only be for a small portion of the year, mostly over the winter season when

access is difficult or non-existent. If we assumed all proposed streams were to be closed at the same time for three years, total economic impact would be approximately $11.1 million (3.5 %) out of a potential $321 million over three years.

It is assumed that some angling occurs on all the streams at various levels; however, the intensity and specific locations can only be estimated. According to the 2001 Statewide survey, the East Fork LCR and Fish Creek received approximately eight AUDs of use in 2001 (Table 12). For discussion purposes, if we used an average of eight AUDs for all streams proposed for closure (Bear Wallow, Boggy, Centerfire, Conklin, East Fork LCR, Fish, Hayground, Stinky, Snake, South Fork LCR, and Wildcat) annually, and the streams remained closed for three years, the total economic impact would be approximately $31,152 or approximately 0.03 percent of the regional economic benefits. To put this proposed action in perspective, in order to have a one percent (1%) impact to regional economics, there would need to be approximately 9,100 AUDs among the recovery portions of the following streams (Bear Wallow, Boggy, Centerfire, Conklin, East Fork LCR, Fish, Hayground, Stinky, Snake, South Fork LCR, and Wildcat). That would be equivalent to 827 AUDs per stream per year, well above any estimates of current use in the above streams recommended for renovation.

A creel survey is typically conducted by asking anglers specific questions about such things as their target species, total catch, time spent fishing, and various other questions that are used to quantify or evaluate a fishery. As mentioned above, it is possible that AUDs will decrease following stream renovations. However, AGFD creel surveys indicated that for the upper West Fork Black River, fishing intensity did not decrease following conversion to only Apache trout. Apache trout were first stocked into West Fork Black River in 1996 following a renovation above the two existing barriers.

AGFD creel surveys were conducted in 1993, 1995, and 1998 on the upper portions of West Fork Black River, upstream of Hayground Creek. The 1993 survey documented 2,917 AUDs. The 1998 survey documented 3,001 AUDs, representing a slight increase (approximately 3 %) in use following the reintroduction of Apache trout (AGFD, unpublished data). Similarly, licensed fishing guide reports showed no activity in the West Fork Black River in 1995 and 1996, but reported guiding efforts from 1997 through 2002, after renovation and reintroduction of pure Apache trout (Table 14).

Table 14. Number of people that fished water bodies as reported by fishing guides from 1995 to 2002 (Data Source, Arizona Game and Fish Department, Region 1, Pinetop, Arizona). Guiding fees ranged from $100 to $500 (Data Source, Apache Sitgreaves National Forest, Springerville, Arizona).

	Year							
Location	1995	1996	1997	1998	1999	2000	2001	2002
Becker Lake	2	3		1				
Big Lake	6	1	1					
Black River	2	4						
Crescent Lake	2	1						
Concho Lake	1							
East Fork Black River						6	6	16
Greer Lakes				1				
Lee Valley Reservoir				6	2			
Little Colorado River	3	5					2	
Reservation Creek			1					
Silver Creek							7	8
**West Fork Black River			2	6	3	14	26	8
X-Diamond				2				
Totals	16	14	4	16	5	20	41	32

** Indicates streams that will be affected by the proposed recovery actions.

To calculate an estimated impact to local fishing guides, AGFD used all data from licensed fishing guides. By law, all guides must report information to the AGFD. Although we must assume

compliance with State law, it is possible that some guiding activity goes unreported. Compliance rate for anglers was over 96.5% from 2000 to 2002 on West Fork Black River (AGFD, unpublished data). Specifically, Arizona Revised Statute 17-362(B) reads:

> *By January 10, or at the request of the commission, guides shall report to the department, on forms provided therefor, the name and address of each person guided, the number of days he has been so employed and the number and species of game animals taken. No guide license shall be issued to any person who has failed to deliver the report to the department for his preceding license year, or until meeting such requirements as the commission may prescribe.*

From 1995 to 2002, AGFD data indicated the number of people guided ranged from a low of four (4) people in 1997 to a high of 41 people in 2001. Of the site-specific locations where guiding activity was reported, only one location (West Fork Black River) was identified and would be impacted by the recovery actions proposed (Table 14). Fishing guide fees in the White Mountains ranged from approximately $100 per day to approximately $500 per day (USFS data, Springerville). To estimate economic impact to guides we used $300 per day per person as an average. We used a rounded average of 8 people (total of 59 people divided by eight years) guided per year for West Fork Black River for calculations (Table 14, West Fork Black River) as that was the only stream proposed for renovation where guiding activity was reported from 1995 to 2002.

Accordingly, total impact on guiding services is estimated at $2,400 annually ($300 per person multiplied by eight people) if the stream would be closed following renovation. As mentioned above, the proposed actions are to keep the streams with heaviest use (West Fork Black River and West Fork LCR) open following renovation, as hatchery-reared fish will be used to repatriate the streams and re-establish populations. Thus, we can reasonably assume that impacts to guiding as a result of these proposed actions may temporarily result in impacts of about 0.001 percent of the $107.3 million dollar regional economy. If 2001 represented an “average year” for guiding, then the impact would be approximately $7,800 annually ($300 multiplied by 26 people) or 0.005 percent of the regional economy. Again, to put this in perspective, a loss of approximately 3,578 guided days (at $300 per day) would impact one percent (1 %) of the local economy, which is 137 times greater than the number of guiding days reported in 2001. The proposed actions are expected to benefit guides by adding more diversity to fishing opportunities.

Featured species such as Apache trout cannot be found anywhere else in the world, and thus should draw greater attention from anglers. Moreover, Apache trout already reside in every proposed stream except South Fork LCR. Overall, the establishment of more fishable populations of Apache trout will complement the existing recreational fishing opportunities in the area by adding diversity, and should maintain or increase the overall economic benefits. Sportfishing opportunities will be lost temporarily in smaller streams, but angler use is extremely small relative to surrounding larger streams and reservoirs.

To summarize how the action alternatives impacts to the local economy were minimized:

- Proposed actions will be implemented over a more gradual timeframe as opposed to all at once or as fast as logistically possible;
- The most intensely used streams (West Fork LCR and West Fork Black River) account for about 3.5 percent of the regional fishing economy, and will remain open following renovations. Moreover, these streams will be stocked using hatchery-reared fish to promote rapid repatriation and minimize loss of angler user days;
- Angling opportunities in downstream portions (below barriers) of the streams will remain unchanged as a result of the actions.

I. Summary Of Environmental Impacts

Table 15. Tabular summary of environmental consequences (EC) to the affected environment, meeting Forest Plan direction (FP), and project evaluation criteria under the four alternatives.

AFFECTED ENVIRONMENTS/FOREST PLAN/PROJECT OBJECTIVES	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2* (PROPOSED ACTION)	ALTERNATIVE 3†	ALTERNATIVE 4‡
Vegetation	No EC	> 1, = 3, > 4	> 1, = 2, > 4	> 1, < 2, < 3
Soil	No EC	> 1, = 3, > 4	> 1, = 2, > 4	> 1, < 2, < 3
Water and Watershed	No EC	> 1, ≥ 3, > 4	> 1, ≤ 2, > 4	> 1, < 2, < 3
a. Barrier Construction	No EC	> 1, = 3, > 4	> 1, = 2, > 4	> 1, < 2, < 3
b. Renovation	No EC	> 1, > 3, = 4	= 1, < 2, < 4	> 1, = 2, > 3
Wildlife	No EC (except to Apache trout)	> 1, ≥ 3, ≥ 4	> 1, ≤ 2, ≤ 4	> 1, ≤ 2, ≤ 3
Air	No EC	≥ 1, = 3, = 4	≥ 1, = 2, = 4	≥ 1, = 2, = 3
Heritage Resources	No EC	No EC	No EC	No EC
Recreation	No EC	≥ 1, = 3, = 4	≥ 1, = 2, = 4	≥ 1, = 2, = 3
a. Establish additional recreational fishing opportunities for Apache trout on the A-SNFs	No AO	> 1, ≥ 3, > 4	> 1, ≤ 2, < 4	> 1, < 2, > 3
Economic Impact	No EC	>1, < 3, < 4	≥1, > 2, > 4	> 1, > 2, < 3
Meeting Forest Plan Direction	Not	≥ 1, ≥ 3, > 4	≥ 1, ≤ 2, = 4	≥ 1, < 2, = 3
Evaluation Criteria				
a. Linear ft. movement of Antimycin C below treatment area	NO EC	0-300 ft.	0	0-300 ft.
b. Volume (Cu. Yd.) displaced sediment entering system during construction **	NA	<2.6 (<4.1)	<2.6 (<4.1)	<1.9 (<3.2)
c. Sediment Storage behind barriers (Ac. Ft.)**	NA	1.96 (0)	1.96 (0)	1.87 (0)
d. Eliminate threat of hybridization, competition, and predation from non-native salmonids in each recovery stream to Apache trout	Not meeting PO	≥ 1, ≥ 3, > 4	> 1, ≤ 2, = 4	> 1, < 2, = 3

*Single fish barrier construction on the West Fork Black River, construction of two barriers each on the East, West and South Forks Little Colorado River, single fish barrier remodeling on Centerfire, Fish and Hayground Creeks, antimycin A renovation, and Apache trout re-introduction.

†Single fish barrier construction on the West Fork Black River, construction of two barriers each on the East, West and South Forks Little Colorado River, single fish barrier remodeling on Centerfire, Fish and Hayground Creeks, electrofish renovation, and Apache trout reintroduction.

‡Single fish barrier construction on each of the West, East and South Forks Little Colorado River (rather than double barriers each), construction of a single barrier on the West Fork Black River, single fish barrier remodeling on Centerfire, Fish and Hayground Creeks, antimycin A renovation, and Apache trout re-introduction.

**Sediment volumes under no backfill and backfill (in parentheses) options

CHAPTER 4 - The Forest Service consulted the following individuals, Federal, state and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

A. ID TEAM MEMBERS

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B. FEDERAL, STATE, AND LOCAL AGENCY PERSONNEL

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Terry Myers, USDA FS, Rare Species Coordinator, A-SNFs Supervisors' Office
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Kirk Young, AGFD

C. TRIBES

Navajo Nat. Hist. Preser. Dept. (Attn: Timothy Begay), Window Rock, AZ
San Carlos Game & Fish Dept., San Carlos Apache Tribe, San Carlos, AZ
Tribal Chmn., San Carlos Apache Tribe, San Carlos, AZ
Tribal Chmn, White Mtn. Apache Tribe, White River, AZ
White Mtn. Apache Game & Fish, White Mtn. Apache Tribe, White River, AZ
SR Pima-Maricopa Indian Comm., Scottsdale, AZ
Fort McDowell Yavapai Nation, Fountain Hills, AZ
Tonto Apache Tribe, Payson, AZ
Pueblo of Zuni, Zuni, NM
Navajo Nation, Window Rock, AZ
Hopi Tribe, Winslow, AZ
Hopi Three Canyon Ranch LLC, Winslow, AZ

D. LIST OF PERSONS / ORGANIZATIONS CONTACTED

A complete list of the over 300 persons contacted is included in the Project file.

APPENDICES

I. APPENDIX A

APPENDIX A – Literature Cited

II. APPENDIX B –

APPENDIX B - Schedule of Proposed Actions

III. APPENDIX C

APPENDIX C - Response to public comments on the Scoping Report

IV. APPENDIX D -

APPENDIX D - Antimycin A and Potassium Permanganate

V. APPENDIX E

APPENDIX E - Evaluation of Electrofishing as an Alternative to Piscicide Renovation (Arizona Department Game and Fish, Pinetop Region, 2001)

VI. APPENDIX F

APPENDIX F - Specifications for New Barrier Construction Proposed Under Alternatives 2 and 3, and Specifications for Remodeling of Existing Barriers Proposed Under Alternatives 2, 3 and 4

VII. APPENDIX G

APPENDIX G - Apache Trout Enhancement Project Stream Renovation Protocol (Arizona Game and Fish Department, Pinetop Region, 2001)

VIII. APPENDIX H

APPENDIX H - New Barrier Construction Specifications Proposed Under ALTERNATIVE 4

IX. Appendix I

APPENDIX I – Soil and Water Conservation Practices (Best Management Practices [BMPs])

X. APPENDIX J

APPENDIX J – Monitoring Plan

APPENDIX A - LITERATURE CITED

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Supplement to the Environmental Assessment for an Apache Trout Enhancement Project: Considerations for Addition of CFT Legumine™ (Rotenone) and Sodium Permanganate treatments to the Previous NEPA Decision of 2004

July 2013
For the Apache-Sitgreaves National Forests
and the Arizona Game and Fish Department

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Adapted from "Supplement to the Environmental Assessment for Gila Trout Restoration in the Upper West Fork Gila River, Catron County, New Mexico: Considerations for addition of rotenone to the previous NEPA decision of 2003" by Jerry Monzingo and Amy Unthank

Background

The Decision Notice and Finding of No Significant Impact (DN/FONSI) for the 2004 Environmental Assessment (EA) of the Apache Trout Enhancement Project (referred to hereafter as the Apache Trout EA) was signed by James Anderson, Acting Forest Supervisor, on March 2, 2004. The decision was to authorize actions to help recover Apache trout populations through removal of non-native fish, salvaging of native fish and macro-invertebrates, and improvement of existing and construction of new fish barriers. Non-native fish would be removed using electro-fishing and the application of a piscicide, Fintrol® (antimycin A). A second DN/FONSI for the Apache Trout Enhancement Project specifically authorized piscicide use inside of wilderness areas and established, or candidate, research natural areas (RNAs) was signed by Abel Camarena, Acting Regional Forester, on March 29, 2004.

Within and outside the wilderness areas the chemical applicator would be experienced in antimycin A use and certified by the Arizona Department of Agriculture. Detoxification of streams would be implemented following piscicide application with an approved neutralizing agent, potassium permanganate. If necessary, a secondary detoxification station would be used prior to Apache trout reintroduction and the effectiveness of fish removal would be evaluated. If needed, streams would be chemically treated again using the same protocol. Downstream water users and homeowners within 3 miles of the project area would be notified; signs would also be posted at trailheads and stream access points.

Purpose and Need for the Supplement to the Apache Trout EA

The 2004 decision for the Apache Trout EA includes the piscicide antimycin A as a method of non-native fish removal in the stream renovation process. Two chemicals, rotenone and antimycin A, are commonly used by fisheries managers to remove non-native fish. Rotenone is manufactured in a number of formulations by two chemical companies, whereas antimycin A is only available as Fintrol®, produced and distributed by Aquabiotics Corporation.

Bioassays completed in 2007 in preparation for the renovation of the South Fork of the Little Colorado River for Apache trout revealed that the strength of the Fintrol® piscicide was variable and in some cases, compromised (Meyer and Lopez 2008). Biologists with the Arizona Game and Fish Department (AZGF) sent several samples of Fintrol® to the Upper Midwest Environmental Sciences Center, United States Geological Service, in LaCrosse, Wisconsin, for analysis. Results indicated a large amount of variance in the strength of the active ingredient, with 4.6 percent being the maximum strength of the Fintrol® samples submitted by AZGF compared to the full strength which is 23 percent by volume (Meyer 2008). Much of the Fintrol® purchased for use in Apache and Gila trout renovation projects from 2005 through 2008 is suspected to be poor quality, and biologists are trying to locate Fintrol® made and purchased prior to 2005. At this time no new Fintrol® has been forthcoming from Aquabiotics Corporation.

During the analysis of effects disclosed within the Apache Trout EA and its DN/FONSIs, it was expected that Fintrol® would be available at full concentrations. Rotenone was not originally considered because older formulations included noxious chemicals such as

petroleum and benzene requiring additional protective gear and hazards for field personnel (Unthank 2008). A formulation of rotenone, CFT Legumine™, which is newer to the United States, has been used in Europe for over a decade and is designed to reduce or eliminate petroleum hydrocarbon solvents such as toluene, xylene, benzene, and naphthalene. The reduction of these petroleum solvents reduces concerns over issues such as water quality, chemical odor, public health, and applicator safety as well as decreased detectability of the chemical by fish (Monzingo and Unthank 2008). CFT Legumine™ was the formulation chosen by the California Department of Fish and Game and the Forest Service after analysis of ecological and human health risks in a joint environmental impact report/impact statement for treatment of Lake Davis (Fisher 2007).

CFT Legumine™ is currently registered by EPA, registration number 655-899. Currently, AZGF has authorization from the Arizona Department of Agriculture to use CFT Legumine™ as a piscicide (Carter pers. comm. 2009). The state of Arizona has legislated a new process for approval of piscicide projects that was developed by the piscicide advisory panel (AZGFD 2012). This process must be completed separately from the NEPA process and prior to implementation of piscicide application. In addition to these requirements, beginning October 31, 2011, rotenone treatments require a Pesticide General Permit under the AZPDES permit issued by the Arizona Department of Environmental Quality (ADEQ) for the regulation of surface water pollutants and to be in compliance with the Clean Water Act and EPA. The permit application will contain information currently included in project planning documents such as the project specific NEPA and EAC, and individual preliminary treatment plans.

This supplement provides new information on the status and use of the two existing piscicides and two neutralizing agents, and reviews the adequacy of the existing EA to determine if the use of CFT Legumine™ and the neutralizing agent sodium permanganate is consistent with the previous analysis.

Project Description and Significant Issues of the Apache Trout EA

In cooperation with AZGFD and USFWS the project decisions allow for restoration of Apache trout to fourteen streams within the Black River and Little Colorado River systems. Specific actions include construction/renovation of barriers to prevent movement of non-native fish into renovated streams, removal of non-native fish, and re-introduction of Apache trout. The significant issues identified in the EA (Page 11) were: 1) the effects of renovation and neutralization chemicals on water quality, 2) the effects of fish barrier construction/remodeling, on water quality and 3) the effects of fish barrier construction/remodeling on stream dynamics. This supplement will focus primarily on the first significant issue in relation to CFT Legumine™ use and will also address the issue in relation to the neutralizing agent sodium permanganate. There are no changes to the barrier proposed action (issues 2 and 3) beyond that analyzed in the original EA and barrier construction and maintenance have been addressed in previous consultations with the Fish and Wildlife Service.

Apache Trout EA Proposed Actions with Supplemental Information

The Proposed Action is identical to that described and analyzed in the Apache Trout EA of 2004 and authorized under the DN/FONSI of 2004. Supplemental actions that would be additionally included are 1) the use of rotenone in the formulation of CFT Legumine™, as one choice for chemical renovation of streams within the Black River and Little Colorado River systems, and 2) sodium permanganate as a neutralizing agent for rotenone. Fintrol®, should it become available at the needed quality, will also remain available as an option for renovation to restore native fish in the project area. Antimycin A and rotenone are both effective in removal of fish. However, they differ in effectiveness in some habitat types. Therefore, one may be used in a given stream, the other used in a different stream, or both may be used in the stream at some time based on habitat types within a treatment area.

Apache Trout EA Alternatives with New Information

The alternatives considered in the 2004 DN (no action and proposed action) have not been changed with the exception of the use of rotenone, and the neutralizing agent, sodium permanganate, for eliminating non-native fish. A Biological Assessment and Evaluation has been prepared to determine effects from the additional use of these agents on these and other species. Those effects are summarized in the Environmental Consequences section below. Consultation for Apache trout, Little Colorado spinedace, Chiricahua leopard frog, and Mexican spotted owl, was initiated and a final Biological Opinion was issued on March 11, 2010. Mitigation and monitoring measures identified in the original EA will remain in place and the minimization measures and conservation recommendations described in the BO will be incorporated into project implementation.

Environmental Consequences

This section discusses the environmental effects of CFT Legumine™ to various resources and other considerations first, followed by the environmental effects of sodium permanganate.

(1) The Addition of CFT Legumine™

Piscicide Background: Rotenone is a naturally occurring substance derived from roots of certain tropical plants in the Leguminosae (bean) family; antimycin A is a chemical structure isolated from the bacteria *Streptomyces*. Both products interfere with mitochondrial electron transport and are potent inhibitors of aerobic respiration in fishes and other gill-bearing animals. In a comparison of antimycin A and rotenone, rotenone has to be applied at a relatively higher dose (parts per million [ppm] vs. parts per billion [ppb]), has longer degradation time when not detoxified by potassium or sodium permanganate, and can be detected by fish (and thus evaded without proper mixing). Extensive research has been conducted by the U.S. Fish and Wildlife Service (USFWS) and the U.S. Environmental Protection Agency (EPA) on rotenone to determine the safety of rotenone use in fisheries management. The results of this research demonstrated that when rotenone is applied according to the label instructions it is an environmental and human safe product (USEPA 2006). The American Fisheries Society has published a Planning and Standard Operating Procedures for the Use of Rotenone in Fish

Management (SOP) to provide guidance to fisheries personnel in the application of this piscicide (Finlayson et al. 2010).

The proposed application of rotenone for this supplemental decision would be a 5 percent formulation of CFT Legumine™ applied at a rate equal to or less than 1 ppm (<0.05 ppm pure rotenone) based on bioassays, and would be neutralized with sodium or potassium permanganate at each barrier. The application methods, the mitigation and monitoring measures and the method of neutralization are similar for both antimycin A and rotenone (Apache Trout EA, page 11). Research has shown that dissolved electrolytes and suspended organic matter have a major influence on the amount of potassium permanganate required to neutralize a given concentration of rotenone (Engstrom-Heg 1971, 1972). The rotenone use manual recommends using a ratio from 2:1 to 4:1 (potassium permanganate: formulated rotenone) for neutralization compared to the 1:1 ratio for antimycin (Finlayson 2000). Two neutralization stations will be utilized for rotenone treatments as with antimycin, however placement will differ. For rotenone, a primary detoxification station will be at the fish barrier and the secondary will be set a half hour travel time downstream (determined by discharge). As in the EA (page 11), the secondary station will be activated only in the event of incomplete detoxification at the primary station and effectiveness of detoxification will be determined using a bioassay of live, caged fish. As with antimycin A (Apache Trout EA, page 11), the application of rotenone would occur under the supervision of a certified pesticide applicator and with biologists experienced in the application of piscicides.

Vegetation: There will no change in the effects to vegetation as analyzed (Apache Trout EA, page 21). Effects to vegetation, such as trampling, increased water tables, and increased trail use, from the Apache Trout Enhancement Project would come from activities associated with barrier construction/enhancement and backfilling. The addition of CFT Legumine™ would not alter these effects.

Soil: There will no change in the effects to soils as analyzed (Apache Trout EA, page 24 and 25). Effects to soils, associated with the Apache Trout Enhancement Project, would come from activities related to barrier construction or improvement. The addition of CFT Legumine™ would not alter these effects.

Water and Watershed:
Water Yield and Quality: There will be no change to water yield or hydrograph as analyzed (Apache Trout EA, page 26-34). Some impacts to water quality would occur with CFT Legumine™, including longer degradation time of the chemical (on the order of a few days if not neutralized by potassium permanganate or sodium permanganate, as opposed to hours for non-neutralized antimycin A applied to streams). As with antimycin A, detoxification at temperatures below 50°F may require longer contact time between the treated water and the application of potassium permanganate (CFT Legumine™ label). Rotenone readily binds with organic matter and is unlikely to reach groundwater (Dawson 1991). It is uncommon to find rotenone in stream sediments (Finlayson 2000). Rotenone, specifically CFT Legumine™, has a number of other ingredients including methyl pyrrolidone, diethylene glycol, monoethyl ether, fatty acid esters, and polyethylene glycols which help the product mix with water. A number of trace

compounds have also been detected, including naphthalene, substituted benzenes, and hexanol (Fisher 2007). None of the compounds identified are considered persistent in the environment nor will they bio-accumulate. They also rapidly biodegrade, hydrolyze, and/or are broken down by sunlight. None of the constituents identified in extensive lab analysis (Fisher 2007) appear to be at concentrations that suggest human health risks through water or ingestion exposure scenarios, and none of the regulatory criteria were exceeded in estimated exposure concentrations in the study conducted for treatment of Lake Davis in California. New Mexico Game and Fish Department detected no rotenone, benzenes, toluenes, naphthalenes, or other inerts during standard water quality sampling downstream of CFT Legumine™ treatment sites in Comanche and Costilla Creeks in 2007 and 2008 (Patten pers. comm. 2009). In comparison to the Noxfish™ formulation, another rotenone formulation not analyzed for this project, substituted benzene concentrations were 0.091 ppb in CFT Legumine™ to 23.14 ppb in Noxfish™ (Fisher 2007).

Wetlands, Riparian, and Aquatic Habitat and Biota: As provided in Appendix A previous studies of the effects of antimycin A and rotenone on aquatic macroinvertebrates indicates varied impacts, with some species being highly sensitive. The formulation of rotenone proposed for use in this project area (CFT Legumine™), a formulation chosen partly based on recent human health and ecological risk assessments done by California Department of Fish and Game (CDFG) and the U.S. Forest Service (USFS) in 2004 (CDFG and USFS 2005) for various formulations of rotenone (Fisher 2007), is expected to show similar varied effects in aquatic invertebrate communities, with the reduction of certain groups of macroinvertebrates, but no long term elimination of existing taxa. Based on rapid biodegradation and/or photolysis of the constituents in CFT Legumine™, no additional ecological impacts are expected beyond those previously described for antimycin A (Apache Trout EA, page 34). As noted in the existing EA, aquatic invertebrate communities may be affected by the use of piscicides, but they also undergo natural variation in community composition due to other events such as fires and high run off.

As previously analyzed there will be no effects to wetland, riparian, or aquatic habitat, other than those analyzed under Water Quality (Apache Trout EA, page 27). Additional information is provided below in Appendix A specific to water quality and rotenone.

Wildlife:

Threatened and Endangered Species: A Biological Assessment and Evaluation (BAE) was submitted to U.S. Fish and Wildlife Service in 2002 and the Service provided a Biological Opinion (B.O.), dated April 19, 2002), for five species for which formal consultation was required, the Apache trout, Little Colorado spinedace, loach minnow critical habitat, Bald eagle, and Mexican spotted owl. Consultation was reinitiated in May 2003 for Mexican spotted owl (withdrawal of timing restrictions) and Bald eagle (new nesting pair) and the Service provided a B.O. (July 2, 2003). Consultation was reinitiated again in December 2003 for changes in the proposed action (additional renovations, variable barrier locations, and backfill option) and the Service provided another B.O. (February 23, 2004).

During this timeframe, the status of the Chiricahua leopard frog changed from proposed to listed as threatened. The Service provided a B.O. (July 19, 2002) concurring with the "not likely to adversely affect" determination in an earlier conferencing opinion (April 14, 2002). Consultation was reinitiated in February 2004 for the Chiricahua leopard frog (change in likelihood of occurrence) and the Service included this species in its February 23, 2004 B.O.

Specific project actions that likely adversely affect the Mexican spotted owl and the (now sensitive species) Bald eagle are related to disturbance by the presence of humans during treatment and not related to the type of piscicide used. As such, no additional impacts from the use of rotenone are expected beyond those previously described for antimycin A (Apache Trout EA, page 34-35). Therefore, previous determinations for the Mexican spotted owl and Bald eagle, as well as for the Mexican gray wolf, jaguar and Southwestern willow flycatcher, would not change with the use of CFT Legumine™.

In 2009, the ASNF requested reinitiation of consultation regarding the addition of CFT Legumine™ as a piscicide and sodium permanganate as a piscicide neutralizing agent to the project. The ASNF also requested to remove the Little Colorado spinedace from consideration for the consultation and to change the "May Affect, Likely to Adversely Affect" determination for MSO to "May Affect, Not Likely to Adversely Affect". In their March 11, 2010 Final BO, the Service concurred with the change for MSO and agreed to delete the Little Colorado spinedace from consultation on the basis they do occur in the action area.

Sensitive, Management Indicator and Other Species: Individual species affected by the use of antimycin A are aquatic macroinvertebrates including the Three Forks springsnail and California floater, fish species such as Sonoran and Desert suckers and Longfin Dace, and the northern water shrew. These species would be affected in the same manner with the use of rotenone as described for antimycin A, see Appendix A. However, as with antimycin A (Apache Trout EA, page 34), while individuals of these species may be affected by the use of rotenone, its use will not result in a loss of species viability or lead to a trend for federal listing.

In addition, impacts to these species would be reduced as follows. The 2/15/02 Specialist's Report for Aquatic Forest Sensitive [and MIS] Species states (page 9) that "…as part of the proposed action, aquatic macroinvertebrates will be salvaged pre-treatment and be reintroduced post-treatment to mitigate possible macroinvertebrate losses during piscicide treatments." The Report also recommends mitigation to reduce impacts to the California floater, and other sensitive aquatic species. This would be the survey and collection and temporary relocation to untreated stream reaches or held at the Pinetop Fish Hatchery until successful renovation is completed. After this they would be returned to stream reaches they were collected in (page 10).

Therefore, previous determinations for the above species, as well as all other sensitive, management indicator, and other species would not change with the use of CFT Legumine™.

In summary, the review of all biological documents, the effects determinations, mitigation measures (including survey and removal/replacement), and reasonable and prudent measures with their terms and conditions concludes that these actions are still adequate to protect the species within the action area of project effects relative to the use of antimycin. However, due to changes in status under the Endangered Species Act for Three Forks Spring Snail (listed as endangered in 2012 with designated critical habitat), consultation will be reinitiated.

Air: There will be no changes in the effects to air resources as analyzed in the Apache Trout EA (page 40) with the use of CFT Legumine™ instead of Fintrol®. Effects to air quality would come from trucks hauling materials to sites (Apache Trout EA, page 40). This would not change with the addition of CFT Legumine™.

Heritage Resources: There will be no change in the effects to heritage resources as analyzed (Apache Trout EA, page 40). No historic properties or cultural resources have been found near the proposed river segments or along access routes. No concerns have been expressed by Native American tribes or other parties concerning traditional uses or significant places within the project area (Apache Trout EA, page 40).

Wilderness: The Wilderness Act (P.L. 88-577) states that wilderness areas "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so to provide for the protection of these areas, the preservation of their wilderness character….." (Sec.2a). Forest Service Handbook (FSH) and Manual (FSM) sets overall policy for wildlife and fisheries management in wilderness. FSM 2323.32 states fish management shall be consistent with wilderness values; that wilderness will be managed to provide for the perpetuation and aid in the recovery of federally listed threatened and endangered species; and that alternative areas that offer equal or better protection outside of wilderness will be used first. FSM 2323.34f explicitly recognizes that chemical treatment may be used to prepare waters to reestablish indigenous, threatened, endangered, or native species, or to correct undesirable conditions caused by human influence.

For piscicide treatments proposed in designated wilderness areas, a Minimum Requirements Decision Guide (MRDG) analysis will be completed pursuant to the intent of the Wilderness Act. The MRDG process helps identify, analyze and select management actions that are the minimum necessary for wilderness administration. Each MRDG will be approved by the Regional Forester prior to renovation treatment implementation.

Recreation and Economic Impact: Recreational fishing concerns were analyzed in the Apache Trout EA (page 42). This analysis found that most of the streams designated for renovation are difficult to access for fishing and therefore renovation would have little impact on recreational fishing. Two of the streams designated for renovation, the West Fork Little Colorado River and West Fork Black River, receive the majority of the fishing pressure. While there would be some loss of fishing opportunities and guiding income during renovation, re-introduction of Apache trout will provide new opportunities for fishing and guiding for Apache trout. Other measures such as implementation over a gradual timeframe, stocking, and angling opportunities downstream of the renovation barriers would also help mitigate the effect of fishing closures during renovation. The degradation time of CFT Legumine™ will not increase the length of fishing closures therefore the analysis from the EA would not change with the use of CFT Legumine™ instead of Fintrol® as the piscicide used for renovation.

(2) The Addition of Sodium Permanganate as a Neutralizing Agent for Stream Treatment

Neutralization Agent Background: The EA includes provisions for neutralization of the antimycin A stream treatment with potassium permanganate (Apache Trout EA, page 11 and DN, page 3), which is a strong oxidizing agent commonly used in both rotenone and antimycin A fish projects. Potassium permanganate for piscicide neutralization is activated by the mixing of a powdered form in water to reach a desired aqueous concentration or comes in a liquid formulation. Either formulation can then be applied to the treated water to provide a desired concentration for neutralization. Recent renovations of Fossil Creek and Bonito Creek by AZGF using sodium permanganate as a neutralizing agent for both rotenone and antimycin A led to the conclusion that sodium permanganate was a more effective neutralizing agent than potassium permanganate (Lopez 2008a.). In 2008 the Arizona Department of Agriculture issued a letter to the AZGF stating that sodium permanganate may be used with CFT Legumine™ for neutralization. The new formulation of rotenone includes sodium permanganate as a neutralizing agent on its Material Safety Data Sheet (MSDS) label. Sodium permanganate is used as a substitute for potassium permanganate in industrial uses when a strong oxidizer is required.

In review of the MSDS, sodium permanganate has no significant difference from potassium permanganate in terms of its substitution as an oxidizer. It has no differences in health hazard rating, first aid measures, or conditions for storage and handling; but does have a higher solubility in water, which allows much less solution to be used for stream neutralization as compared to potassium permanganate. Furthermore, sodium as the spectator ion in the chemical oxidation process is more common in natural stream settings than is potassium (Weedman et al. 2005).

Vegetation: There will no change in the effects to vegetation as analyzed (Apache Trout EA, page 21). Effects to vegetation, such as trampling, increased water tables, and increased trail use, from the Apache Trout Enhancement Project would come from activities associated with barrier construction/enhancement and backfilling. The addition of sodium permanganate would not alter these effects.

Soil: There will no change in the effects to soils as analyzed (Apache Trout EA, page 24 and 25). Effects to soils, associated with the Apache Trout Enhancement Project, would come from activities related to barrier construction or improvement. The addition of sodium permanganate would not alter these effects.

Water and Watershed:

Water Yield and Quality: There will be no change to water yield or hydrograph. Some impacts to water quality would occur with sodium permanganate as they would with potassium permanganate as discussed in the EA, Appendix D. While permanganate can be toxic to fish under sustained lab conditions (Apache Trout EA, page 68), it breaks down quickly under stream conditions, including the interaction with antimycin A. Additionally, potassium permanganate reduces the half-life of antimycin A from 4.6 to 9.5 hours to 7 to 11 minutes. Both potassium and sodium permanganate have a low estimated lifetime in the environment (MSDS). The lifetime is short because of the reaction with the piscicide and the organic matter within the stream. During the Fossil Creek Native Fish Restoration Project, AZGF staff observed no effect to fish that were below the neutralization station where sodium permanganate was used to neutralize antimycin A (Weedman et al. 2005)

Generally, potassium permanganate comes in granular form. Under field conditions, AZGF personnel have only been successful in mixing granular potassium permanganate with stream water to yield concentrations of 2.5%. Sodium permanganate is available in liquid form at much higher concentration and is easier to mix. Concentrations of up to 40% sodium permanganate are possible in the field (Lopez 2008b). The relative ease of use associated with sodium permanganate would be beneficial for reduced workloads and improved work conditions on small and large flow streams. Greater concentration in solution means less mixing by field staff allowing for safer work conditions in remote locations, especially at night (Lopez 2008b).

Wetlands, Riparian, and Aquatic Habitat and Biota: As previously analyzed there will be no effects to wetland, riparian, or aquatic habitat other than those analyzed under Water and Watersheds-Environmental Consequences (Apache Trout EA, page 28).

Wildlife:

Threatened and Endangered Species: Impacts to the aquatic species and their critical habitat as analyzed in the BAE and Apache Trout EA (page 37) would remain the same with the addition of sodium permanganate as a neutralizing agent. Bioassays conducted by AZGFD found that sodium permanganate had a similar effect to potassium permanganate when used as a neutralizing agent (Meyers and Lopez 2008). Therefore, previous determinations would remain the same for the threatened and endangered aquatic species identified in the Apache Trout EA (page 33). Specific project actions that likely adversely affect the Mexican spotted owl and the (now sensitive species) Bald eagle are related to disturbance by the presence of humans during treatment and not related to the type of neutralizing agent used. As such, no additional impacts from the use of sodium permanganate are expected beyond those previously described (Apache Trout EA, page 34-35). Therefore, previous determinations for the Mexican spotted owl

and Bald eagle, as well as for the Mexican gray wolf, jaguar and Southwestern willow flycatcher, would not change with the use of sodium permanganate.

Sensitive, Management Indicator and Other Species**:** Individual species that could be affected by the use of sodium permanganate are aquatic macroinvertebrates including the Three Forks springsnail, fish species such as Sonoran and Desert suckers and Longfin Dace, and the northern water shrew. As noted above, sodium permanganate has no significant difference from potassium permanganate in terms of its substitution as an oxidizer and sodium in the oxidation process is more common in natural stream settings than is potassium (Weedman et al. 2005). As with potassium permanganate (Apache Trout EA page34), while individuals of these species may be affected by the use of sodium permanganate, its use will not result in a loss of species viability or lead to a trend for federal listing. Therefore, previous determinations for the above species, as well as all other sensitive, management indicator and other species would not change with the use of sodium permanganate as a neutralizing agent.

In summary, the review of all biological documents (including specialist reports, BAEs and B.O.s), effects determinations, and mitigation measures (including survey and removal/replacement), concludes that these actions are still adequate to protect the species within the action area of project effects relative to the use of sodium permanganate. However, due to changes in status under the Endangered Species Act for Three Forks Spring Snail (listed as endangered in 2012 with designated critical habitat), consultation will be reinitiated.

Air: There will be no changes in the effects to air resources as analyzed in the Apache Trout EA (page 40) with the use of sodium permanganate instead of potassium permanganate.

Heritage Resources: There will be no change in the effects to heritage resources as analyzed (Apache Trout EA, page 40). No historic properties or cultural resources have been found near the proposed river segments or along access routes. No concerns have been expressed by Native American tribes or other parties concerning traditional uses or significant places within the project area.

Wilderness: For neutralization of piscicides applied in designated wilderness areas, a Minimum Requirements Decision Guide (MRDG) analysis will be completed pursuant to the intent of the Wilderness Act. The MRDG process helps identify, analyze and select management actions that are the minimum necessary for wilderness administration. Each MRDG will be approved by the Regional Forester prior to renovation treatment implementation.

Recreation and Economic Impacts: Recreational fishing concerns were analyzed in the Apache Trout EA (page 42). The EA analysis found that most of the streams designated for renovation are difficult to access for fishing and therefore renovation would have little impact on recreational fishing. Two of the streams designated for renovation, the West Fork Little Colorado River and West Fork Black River, receive the majority of the fishing pressure. While there would be some loss of fishing opportunities and guiding

income during renovation, re-introduction of Apache trout will provide new opportunities for fishing and guiding for Apache trout. Other measures such as implementation over a gradual timeframe, stocking, and angling opportunities downstream of the renovation barriers would also help mitigate the effect of fishing closures during renovation. This analysis from the EA would not change with the use of sodium permanganate instead of potassium permanganate as the neutralizing agent used during renovation.

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APPENDIX A: Comparison of Effects to Non-Target Organisms and Human Health for Rotenone and Antimycin

from "Supplement to the Environmental Assessment for Gila Trout Restoration in the Upper West Fork Gila River, Catron County, New Mexico: Considerations for addition of rotenone to the previous NEPA decision of 2003" by Jerry Monzingo, USDA Forest Service, Gila National Forest

Aquatic macroinvertebrates

Rotenone- After laboratory based tests, Chandler & Marking (1982), concluded that: apart from an Ostracod (*Cypridopsis sp*.), aquatic invertebrates are much more tolerant of rotenone than most fishes and amphibian larval stages. In their study the most resistant organisms exposed were a snail (*Helisoma sp.*) and the Asiatic clam (*Corbicula manilensis*) for which the LC50 96h concentrations were 50 times greater than those Marking & Bills (1976) reported for the Black bullhead (*Ictalurus melas*), one of their most resistant fishes. Sanders & Cope (1968) also conducted lab tests examining the effect of rotenone to the nymph or naiad stage of a stonefly (*Pteronarcys californica*). They found that the LC50 24h was 2,900 µg/L and the LC50 96h was 380 µg/L. These values are greater by an order of magnitude to those found by Marking & Bills (1976) for the black bullhead (*Ictalurus melas*) indicating that aquatic invertebrates are much less sensitive to rotenone than fish. Larger, later instar naiads were less susceptible to given concentrations of toxin than were smaller, earlier instars of the same species (Sanders & Cope, 1968**)**. Field studies examining the effect of rotenone on aquatic macroinvertebrate communities have provided varied results. Whereas some workers noticed dramatic, long-term effects (Mangum & Madrigal, 1999; Binns, 1967), others observed rotenone has a negligible effect on most aquatic macroinvertebrates (Demong, 2001; Melaas et al, 2001). Most researchers would agree, however, that the effects of rotenone are less pronounced and more variable to macroinvertebrates than the effects of the chemical on zooplankton. Like the range of sensitivities demonstrated by various fish species to rotenone, different species of aquatic macroinvertebrates also exhibit a range of tolerances (Mangum & Madrigal, 1999; Chandler & Marking, 1982; Engstrom-Heg et al., 1978) again perhaps based on their oxygen requirements.

Invertebrates in the orders Ephemeroptera (Mayflies), Plecoptera (Stoneflies), and some members of Trichoptera (Caddisflies) are highly sensitive and have been completely eliminated by rotenone treatments in the past (Mangum & Madrigal, 1999). These sensitive species tend to be highly mobile with short life cycles, and may thus have the ability to repopulate depleted areas rapidly through dispersal and oviposition (Engstrom-Heg et al., 1978). Certain escape behaviors such as burrowing into benthos, associating with aquatic vegetation or the ability to trap air bubbles with appendages may reduce rotenone exposure to many benthic invertebrates. Of note, many studies have shown rapid population explosions of invertebrates following initial reductions in their biomass from rotenone treatment (Neves 1975, Cook and Moore 1969).

Antimycin- Reduction in abundance of certain groups of aquatic invertebrates is likely following antimycin treatments (Minckley and Mihalick, 1981). However, no invertebrate taxa are likely to be eliminated by antimycin treatments and abundance typically recovers with one to two years (Mangum1985, Mangum 1986, Jacobi 1988, Brooks and Propst 2001). Toxicity tests using antimycin found that Cladocera, Copepoda, Amphipoda, Ephemeroptera, and Trichoptera may experience marked declines in abundance following antimycin treatments and that Amphipoda are particularly sensitive (Schnick, 1974). Antimycin typically does not adversely affect Protozoa, Rotatoria, Nematoda, Nematomorpha, Annelida, Ostacoda, Decapoda, Plecoptera, Odonata, Hemiptera, Coleoptera, Diptera, Gastropoda, and Pelecypoda (Schnick 1974).

Amphibians

Rotenone- Rotenone is toxic to amphibians, but generally less toxic than to fish. Rotenone may be absorbed into both skin and respiratory membranes, but skin may prevent more of a barrier due to a greater distance for the chemical to diffuse across (Fontenot et al., 1994), and a smaller surface area relative to gill structure. Indeed, Fontenot et al. (1994) reported that amphibian larvae with gills are most sensitive to rotenone. In standard laboratory 24-hour and 96-hour aquatic rotenone toxicity tests, the LC_{50} values for tadpoles and larval amphibians have ranged between 5 µg/L and 580 µg/L (24-hour tests and 25 µg/L to 500 µg/L in 96-hour tests (Fontenot et al. 1994, Chandler 1982). The adult Northern Leopard Frog demonstrated a much greater resistance with LC_{50} concentrations ranging from 240 µg/L and 1,580 µg/L (24 hours) and 240 µg/L and 920 µg/L (96 hours). This highlights the fact that tadpoles and other larval forms of amphibians that utilize gills for respiration are just as sensitive to rotenone as fishes while adult forms, no longer having to utilize gills, have a much lower susceptibility to rotenone. Larval amphibians appear to have resistance roughly equivalent to the most tolerant fish species. Rotenone is variably toxic to amphibians, depending on their mode of respiration (i.e. gills, skin, buccopharyngeal, or lungs). Differences in sensitivity occur among taxa and lifestages. Adults that are obligatory aquatic or have high rates of cutaneous respiration are more sensitive as well.

Antimycin-Field studies of Fintrol® application found no effect on frogs or tadpoles (genera not specified) at an application rate of 10 ppb (Berger 1965, Berger 1965b, Berger 1966a, Berger 1966a). Frogs and tadpoles in these studies were exposed for an indefinite amount of time (i.e. longer than 96 hours). The field tests were conducted in ponds and Streams. Water temperatures ranged form 6°C to 21°C (43 to 70°F) and pH ranged from 7.9 to 8.8. Other field tests found no effect of 10 ppb antimycin over an indefinite period of time on Ranidae tadpoles (Gilderhus et al. 1969). Lab exposure studies found Fintrol-Concentrate to have no effect on leopard frog (R. pipiens) at concentration up to 48 ppb (**Lesser 1972**). However, bullfrog tadpoles were killed within 24 hours when exposed to antimycin at a concentration up to 40 ppb (Berger 1966c; Walker et al. 1964).

Mammals

Rotenone-Mammalian acute oral toxicity LD_{50} values for rotenone range from 39.5 mg/kg for female rats to 1,500 mg/kg for rabbits. For most lab mammals, rotenone is much more toxic when introduced intravenously or inhaled rather than taken orally. For example, the average oral LD_{50} for rats is 60 mg/kg compared with just 0.2 mg/kg for rotenone introduced directly into the bloodstream. Efficient breakdown of rotenone by the liver, oxidation of rotenone in the gut, and slow absorption in the stomach and intestines account for this significant difference in toxicity (Narongchai et al. 2005, Ling 2003). This explanation may also account for the significant difference in rotenone sensitivity between mammals and fishes, and not from a difference in the primary site of action between fishes and mammals (Fukami et al. 1969).

Antimycin- Extremely high levels of antimycin are required to produce toxic effects in carnivorous mammals similar to those that may occur in the project area. The oral LD_{50} for domestic dog is 5,000 mg antimycin/kg body weight. Thus, a domestic dog weighing 4.5 kg (10 lbs) would have to consume 57,900 kg (127,800 lbs) of antimycin-killed fish, using Ritter and Strong's (1966**)** maximum tissue concentration of 388 µg/kg. Field trials of 10 ppb antimycin treatments found no effects on raccoons.

Birds

Rotenone- Rotenone has a very low toxicity to wildfowl, and birds are extremely unlikely to be affected by 'normal' usage in fisheries management practices (Ling, 2003). Avian acute toxicity LD_{50} values range from 130mg/kg for the nestling English song sparrow (Cutcomp 1943) to 2200mg/kg for an adult mallard duck (USEPA 1988). In general, young birds are about 10 times more sensitive to rotenone poisoning (CDFG 1994) and, like mammals, birds have a much-reduced tolerance to rotenone when it is introduced intravenously. Ling (2003) also examined rotenone poisoning and sublethal toxicity in birds as a result of consuming fish or even fish management baits. Ling concluded that "rotenone is slightly toxic to wildfowl, and birds are extremely unlikely to be affected by normal fisheries management programmes." For example, baits used to kill carp for management purposes have around 0.01 g of rotenone each. Ling calculated that a duck would need to consume approximately 200 baits to receive a fatal dose. It is very unlikely that birds would consume baits but they could consume fish killed by rotenone. The concentration of rotenone in poisoned fish is usually 25,000 times lower than that found in baits.

Antimycin- Vezina (1967) studied the toxicity of antimycin to mallard duck (Anas platyrhyncos) and found that ingestion of 2,900 mg/kg of antimycin was required to cause mortality of 50% of the test organisms. Using the highest residual concentration in dead trout of 338 µg/kg Reported by Ritter and Strong (1966**),** this translates to consumption of 7,474 kg (16,480 lbs) of dead trout. The amount of fish biomass that the treatment would generate (i.e. the total weight of all fish killed in the project area) would only be a fraction of this quantity. Field investigations found not effect on pelicans, cormorants, herons, surface-feeding ducks or diving ducks, or osprey from consumption of fish killed by antimycin (Berger et al., 1967; Gilderhus et al.,1969). Berger and Lennon (1967**)** found no effect on osprey, gulls, or terns exposed to antimycin in dead fish and water after antimycin treatment.

Human Health

Rotenone- Millions of dollars have been spent on research to determine the safety of rotenone before approval of use from the U.S. Environmental Protection Agency. Much of this research has been directed toward potential effects on public health. This research has established that rotenone does not cause birth defects (Hazelton Raltech Laboratories 1982), reproductive dysfunction (Spencer and Sing 1982), gene mutations (Biotech Research 1981;Goethem et al. 1981; NAS 1983), or cancer (USEPA 1981, Tisdel 1985). When used according to label instructions for the control of fish, rotenone poses little, if any, hazard to public health. The USEPA has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment.

Antimycin- Antimycin is an organic compound, discovered in 1945, that was isolated form Streptomyces griseus at the Department of Plant Pathology at the University of Wisconsin (Leben and Keitt 1948, Dunshee et al. 1949, Lehninger 1979). Degredation compounds of antimycin include blatmycic acid and antimycin lactone. These degredation compounds have very low toxicity for either fish or mammals (Herr et al. 1967). Direct ingestion of normal quantities of water containing 10 ppb anticycin during the peak of the treatment would have no effect on humans or livestock. Oral LD_{50} values for mammals range from 1.0 mg antimycin/kg body weight for lambs to 55 mg antimycin/kg body weight for mice (Herr et al. 1967). Oral LD_{50} is defined as the amount of antimycin that, when administered orally over a specified period of time, is expected to cause death of 50% of the group of test animals. For example, if a person weighing 70 kg (154.3 lbs) drank 1.5 liters (0.39 gallons) from a stream during treatment, he would ingest 15µg of antimycin, or 0.00021 mg antimycin/kg body weight. A 70 kg person would have to drink 12,600 liters (3,329 gallons) of treated water during the six-hour period that antimycin is active in the project area to ingest the amount required to achieve the LD50 for the most sensitive mammal tested (Guinea pig, LD_{50} = 1.8 mg antimycin/kg body weight). This translates to a water consumption rate of about 2,100 liters (555 gallons) per hour, which is physically impossible. Similarly, a 363 kg (800 lbs) horse would have to ingest about 65,300 liters (17,250 gallons) of treated water to reach the oral LD_{50} value of 1.8 mg antimycin/kg body weight for Guinea pigs. Numerous studies have been conducted on the effects of antimycin at the cellular level. None have reported any carcinogenic effects.

Appendix A: Literature Cited

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