Paiute Cutthroat Trout Restoration Project

Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California

February 2010

Final

ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT

Prepared by

ENTRIX, Inc

ENTRIX
ENVIRONMENTAL CONSULTANTS

Prepared for

U.S. Fish and Wildlife Service

California Department of Fish and Game

SILVER KING CREEK
HUMBOLDT-TOIYABE NATIONAL FOREST, ALPINE COUNTY, CALIFORNIA

Paiute Cutthroat Trout Restoration Project

FEBRUARY 2010

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ABBREVIATIONS, ACRONYMS, & UNITS OF MEASURE

%	percent
°C	degree Celsius
°F	degree Fahrenheit
µg/L	micro-grams per liter
~~AFR~~	~~Alternative Formulations Report~~
a.i.	active ingredient
~~APDE~~	~~areas of potential direct effect~~
~~APE~~	~~area of potential effect~~
~~AQCR~~	~~Mountain Counties Intrastate Air Quality Control Region~~
~~ATCMs~~	~~Air Toxics Control Measures~~
ATP	adenosine triphosphate
~~ATSDR~~	~~Agency for Toxic Substances and Disease Registry~~
BAF	Bioaccumulation factor

~~Basin Plan~~	~~Water Quality Control Plan for the Sacramento River Basin and the San Joaquin River Basin~~
Basin Plan	Water Quality Control Plan for the Lahontan Basin
BAT	Best Available Technology
BCF's	Bioconcentration Factors
BCT	Best Conventional Technology
~~BEHMA~~	~~Lake Davis Bald Eagle Habitat Management Area~~
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMP's	Best Management Practices
BOD	biochemical oxygen demand
CA	Conservation Assessment
~~CAA~~	~~Clean Air Act~~
~~CAAA~~	~~Clean Air Act Amendments~~
~~CAAQS~~	~~California Ambient Air Quality Standards~~
CalEPA	California Environmental Protection Agency
CAR	Critical Aquatic Refuge
CARB	California Air Resources Board
CCR	California Code of Regulations
~~CDEC~~	~~California Data Exchange Center~~
~~CDF~~	~~California Department of Forestry and Fire Protection~~
CDFG	California Department of Fish and Game
CDHS	California Department of Health Services
CDP	Census Designated Place
CDPR	California Department of Pesticide Regulation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
~~CHHSLs~~	~~California Human Health Screening Levels~~
~~CHP~~	~~California Highway Patrol~~
CHRIS	California Historical Resources Information System
CNDDB	California Natural Diversity Database
~~CNEL~~	~~Community Noise Equivalent~~
~~CO~~	~~Carbon Monoxide~~
COPC	Chemicals of Potential Concern
~~CRHR~~	~~California Register of Historical Resources~~
CSM	conceptual site model
~~CSUC~~	~~California State University, Chico~~
~~CSWRCB~~	~~California State Water Resources Control Board~~
CTR	California Toxics Rule

CUPA	Certified Unified Program Agency
~~CVP~~	~~Central Valley Project~~
CWA	Clean Water Act
CWC	California Water Code
~~CWD~~	~~Coarse Woody Debris~~
dB	Decibels
dBA	decibels A-weighted
~~DBDW~~	~~Department of Boating and Waterways~~
dbh	diameter of breast height
~~DBW~~	~~California Department of Boating and Waterways~~
~~DDE~~	~~Dichlorodiphenyldichloroethylene~~
DEGEE	diehtylene glycol monoethyl ether
~~DFG~~	~~California Department of Fish and Game~~
~~DFPZ~~	~~Defensible Fuel Profile Zone~~
DHS	California Department of Health Services
DPS	Distinct Population Segment
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EA	Environmental Assessment
~~EAC~~	~~Early Action Compact~~
~~EDUs~~	~~equivalent dwelling units~~
~~EHAP~~	~~Environmental Hazards Assessment Program~~
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EPC	exposure point concentration
~~ERP~~	~~Ecosystem restoration program~~
ESA	Federal Endangered Species Act
~~FAA~~	~~Federal Aviation Administration~~
~~FAR~~	~~Federal Aviation Regulation~~
FFDCA	Federal Food, Drug, and Cosmetic Act
FGC	California Fish and Game Code
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act of 1972
FONSI	Finding of No Significant Impact
FSS	Forest Sensitive Species
~~FY~~	~~Fiscal Year~~
GBUAPCD	Great Basin Unified Air Pollution Control District
GIS	Geographic Information Systems
~~GLRID~~	~~Grizzly Lake Resort Improvement District~~
~~Gpm~~	~~gallons per minute~~
GUP	General Use Pesticide

~~HAP~~	~~hazardous air pollutant~~
~~HBSL~~	~~Health Based Screening Level~~
HPLC	High Performance Liquid Chromatography
HQ	Hazard Quotient
HTNF	Humboldt-Toiyabe National Forest
~~ICS~~	~~Incident Command System~~
~~ISO~~	~~Insurance Services Office~~
~~KOP~~	~~Key Observation Point~~
~~LDSC~~	~~Lake Davis Steering Committee~~
~~Leq~~	~~equivalent noise level~~
~~LLNL~~	~~Lawrence Livermore National Laboratory~~
~~Lmax~~	~~maximum sound level~~
~~Lmin~~	~~minimum sound level~~
LNT	Leave-no-trace
LOAEL	Lowest Observable Adverse Effects Level
LOC	Level of Concern
~~LOP~~	~~Limited Operating Period~~
~~LORs~~	~~local laws, ordinances, and regulations~~
LRMP	Land and Resource Management Plan
LTBMU	Lake Tahoe Basin Management Unit
~~M&I~~	~~municipal and industrial~~
~~MACT~~	~~maximum achievable control technology~~
MBTA	Migratory Bird Treaty Act
~~MCAB~~	~~Mountain Counties Air Basin~~
MCL~~s~~	Maximum Content Level
MFO	Mixed Function Oxidase
mg	milligram
MIS	management indicator species
~~MOA~~	~~Memorandum of Agreement~~
MOU	Memorandum of Understanding
MP	methyl pyrrolidone
MSDS	material safety data sheet
msl	mean sea level
NAHC	California Native American Heritage Commission
~~NAICS~~	~~North American Industry Classification System~~
NAMC	National Aquatic Monitoring Center
~~NEIC~~	~~Northeast Information Center~~
NEPA	National Environmental Policy Act
~~NESHAPS~~	~~National Emission Standards for Hazardous Air Pollutants~~
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act of 1966

~~NIOSH~~	~~National Institute for Occupational Safety and Health~~
~~NO~~	~~nitric oxide~~
~~NO2~~	~~nitrogen dioxide~~
NOA	Notice of Availability
NOAEL	no-observed adverse effects level
NOC	Notice of Completion
NOEL	no observed effect level
NOI	Notice of Intent
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
~~NPV~~	~~net present value~~
~~NRHP~~	~~National Register of Historic Places~~
NSAQMD	Northern Sierra Air Quality Management District
~~NSPS~~	~~New Source Performance Standards~~
~~NSR~~	~~New Source Review~~
~~NVUM~~	~~National Visitor Use Monitoring~~
~~O&M~~	~~operations and maintenance~~
OEHHA	Office of Environmental Health Hazard Assessment
~~OHV~~	~~Off-highway Vehicle~~
~~OM~~	~~Operations Manual~~
~~OPR~~	~~California Office of Planning and Research~~
~~OSHA~~	~~Occupational Safety and Health Administration~~
PAC	Protected Activity Center
PAH	polycyclic aromatic hydrocarbon
~~PAOT(s)~~	~~Person(s) At One Time~~
~~PBO~~	~~piperonyl butoxide~~
PBT's	Persistent Bioaccumulative toxicants
~~PCEH~~	~~Plumas County Environmental Health~~
~~PCFCD~~	~~Plumas County Flood Control and Water Conservation District~~
PCT	Paiute cutthroat trout
PEG's	Polyethylene glycols
~~PELs~~	~~permissible exposure limits~~
~~pH~~	~~Phosphates~~
PM	Particulate Matter
~~PNF~~	~~Plumas National Forest~~
ppb	parts per billion
PPE	Personal Protective Equipment
Proposed Action	Paiute Cutthroat Trout Recovery Project
~~PSD~~	~~Prevention of Significant Deterioration~~
~~PUC~~	~~Public Utilities Code~~
~~PWC~~	~~Personal Water Craft~~

RCA	Riparian Conservation Area
RCO	Riparian Conservation Objective
RfD	reference dose
ROD	Record of Decision
RT	rainbow trout
RWQCB	Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management District
SDWA	Safe Drinking Water Act
SEIS	Supplemental EIS
Semi-VOCs	semi-volatile organic compounds
SF	slope factor
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification System
SIP	State Implementation Plan
SMS	Scenic Management System
SNEP	Sierra Nevada Ecosystem Project
SNFPA	Sierra Nevada Forest Plan Amendment
SO2	Sulfur Dioxide
SPL	sound pressure levels
SPPPC	Sierra Pacific Power Company
SUF	Site use factor
SVOC's	semi-volatile organic compounds
SWP	State Water Project
SWRCB	State Water Resources Control Board
TACs	toxic air contaminants
TCE	tetrachloroethene
TMDL	Total Maximum Daily Load
TOC	total organic carbon
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
TWA	Time-Weighted Average
UCD	University of California at Davis
UR	unit risk
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UV	Ultraviolet
VOCs	volatile organic compounds

~~VOL volatile organic liquid~~
~~VQO Visual Quality Objective~~
WDR Waste Discharge Requirements
~~WoE weight of evidence~~
WQO's Water Quality Objectives
~~WUI Wildland Urban Intermix~~

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UR	unit risk
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOCs	volatile organic compounds
VOL	volatile organic liquid
VQO	Visual Quality Objective
WoE	weight of evidence
WUI	Wildland Urban Intermix

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CHAPTER 1

Executive Summary

This Final ~~Draft~~ Environmental Impact Statement /Environmental Impact Report (EIS/EIR) has been prepared jointly by the California Department of Fish and Game (CDFG) and the U.S. Fish and Wildlife Service (USFWS) (collectively referred to hereafter as the Agencies) for the proposed Paiute Cutthroat Trout Restoration Project (proposed Action). The objective of the proposed Action is to establish native Paiute cutthroat trout (*Oncorhynchus clarkii seleniris*) as the only trout species in Silver King Creek for the purpose of preventing hybridization with other trout species. This is a critical and necessary step to preventing Paiute cutthroat trout from becoming extinct, conserving the sub-species, and restoring it to a level that could allow it to be removed from the ~~f~~Federal threatened species list. The proposed Action entails the eradication of non-native trout species from 11 stream miles of Silver King Creek~~,~~ and its tributaries ~~and Tamarack Lake~~. The Agencies propose to use the piscicide rotenone to eradicate non-native trout and to neutralize the rotenone downstream of Silver King Canyon at its confluence with Snodgrass Creek using potassium permanganate. The Agencies also propose to restock Silver King Creek with native Paiute cutthroat trout. Chapter 3.0, Project Alternatives, presents a detailed description of the proposed Action ~~Project~~ and alternatives.

The USFWS is the National Environmental Policy Act (NEPA) lead agency for Paiute Cutthroat Trout Restoration Project. The USFWS is proposing this ~~a~~Action as part of ~~in fulfillment of its responsibilities to implement~~ the Revised Paiute Cutthroat Trout Recovery Plan (USFWS 2004), which has an ultimate goal of delisting the sub-species from being threatened and/or endangered. NEPA directs that ~~f~~Federal agencies prepare an environmental evaluation for any major activity having the potential to significantly affect the environment. This EIS/EIR addresses the potential impacts of the proposed Action and will:

- Help public officials make decisions on the recovery project based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment;
- Identify ways to avoid or significantly reduce environmental impacts;
- Prevent significant, avoidable impacts to the environment by requiring changes in projects by considering alternatives and mitigation measures when the governmental agency finds the changes to be feasible;
- Disclose to the public the environmental information and analysis upon which Federal decisions is based; and
- To complete site-specific analysis of all public lands potentially affected by the proposed Action.

This document also addresses the requirements for an EIR under the California Environmental Quality Act (CEQA) and thus satisfies CDFG's CEQA lead agency responsibilities. It describes the proposed Action and a reasonable range of alternatives (including the no Action alternative) and the natural and human environments. The document presents an analysis of direct and indirect impacts on these environments for each of the alternatives~~,~~ and describes the mitigation measures to reduce adverse environmental effects. It addresses cumulative and growth-inducing effects and identifies unavoidable impacts that cannot be reduced to less than significant with mitigation. It also presents a record of consultation and coordination with others during EIS/EIR preparation.

1.1 BACKGROUND

Silver King Creek, downstream from Llewellyn Falls to Silver King Canyon and associated tributaries in Alpine County, is the native range of the Paiute cutthroat trout, one of the rarest trout sub-species (USFWS 1985, 2004). Indigenous only to Silver King Creek, Paiute cutthroat trout were listed as endangered by the USFWS under the Endangered Species Preservation Act of 1966 on March 11, 1967 (USFWS 1967) and reclassified to threatened under the Endangered Species Act (ESA) of 1973 on July 16, 1975 (USFWS 1975). Out-of-basin populations of Paiute cutthroat trout have been established by the Agencies in several California streams including the North Fork of Cottonwood Creek and Cabin Creek in the Inyo National Forest (Mono County), Sharktooth Creek (Fresno County) and Stairway Creek (Madera County) on the Sierra National Forest.

Hybridization with non-native trout species is the primary threat to Paiute cutthroat trout (USFWS 2004, 1985). When interbred with Lahontan cutthroat or rainbow trout, Paiute cutthroat trout tend to lose their distinctiveness through hybridization (USFWS 2004). The fish in the reach between Llewellyn Falls and Silver King Canyon are a genetic mixture of introduced rainbow (*O. mykiss*), Lahontan cutthroat (*O. c. henshawi*), golden trout (*O. aquabonita* sp.), and native Paiute cutthroat trout. An unauthorized introduction of rainbow trout in Paiute cutthroat trout populations required rotenone treatments and restoration efforts spanning from 1950 to present to remove hybridized fish and safeguard restored putative (commonly put forth or accepted as true) pure populations of Paiute cutthroat trout. Genetically putative pure Paiute cutthroat trout are currently found in the area upstream of Llewellyn Falls, where a sheepherder moved fish from Silver King Creek (in 1912) and from where other tributary populations have been established (i.e., Four Mile Canyon Creek, Fly Valley Creek, Coyote Valley Creek and Corral Valley Creek). Native Paiute cutthroat trout seldom move great distances within the stream system and are rarely found downstream of Llewellyn Falls in Silver King Creek. However, hybridized fish could easily be introduced inadvertently above the falls, where Paiute cutthroat trout were restored by CDFG in the early 1990s.

1.2 OBJECTIVE/PURPOSE AND NEED FOR ACTION

The objective of the proposed Action is to establish the Paiute cutthroat trout as the only salmonid fish species in Silver King Creek for the purpose of preventing hybridization with other salmonids. This is an important and necessary step in preventing Paiute cutthroat trout from going extinct and conserving the sub-species and restoring it to a level that would allow it to be removed from the ~~f~~Federal threatened species list. To accomplish this objective, the Agencies would remove all non-native trout from the project area prior to restocking with putative pure Paiute cutthroat trout. The Agencies are also evaluating the necessity of removing fish from Tamarack Lake at the headwaters of Tamarack Lake Creek, a tributary of Silver King Creek, if fish are present. Chapter 3.0, Project Alternatives presents the surveys the Agencies will complete to determine the presence or absence of fish and the criteria that would be used to determine whether treatment of the lake is necessary.

Paiute cutthroat trout are currently found upstream of Llewellyn Falls; however, easy public access between areas downstream and upstream of Llewellyn Falls may result in an unauthorized transplant of hybridized fish to areas above the falls where Paiute cutthroat trout are currently found in its genetically putative pure form (see Figure 1-1). Therefore, the Agencies are proposing to eradicate non-native trout within the historical range of Paiute cutthroat trout from areas downstream of Llewellyn Falls and restocking Paiute cutthroat trout, expanding its range to a series of six impassible fish barriers in Silver King Canyon and associated tributaries and increasing its population. These barriers, the two highest being 8 and 10 feet high, would geographically isolate Paiute cutthroat trout from other trout species and greatly reduce the likelihood of an illegal introduction.

The purpose and need for the proposed Action is to restore Paiute cutthroat trout to its historic range as stated in the Revised Recovery Plan (USFWS 2004), and thereby satisfy one critical Recovery Plan component for delisting the sub-species. The project would make Paiute cutthroat trout the only trout species in Silver King Creek above Silver King Canyon. By expanding the populations and range of the sub-species, the proposed Action would also increase the probability of long-term viability and reduce threats from genetic bottlenecking and stochastic events.

1.3 PROPOSED ACTION

Under the proposed Action, the Agencies would:

- Eradicate non-native trout from Silver King Creek and its tributaries between Llewellyn Falls and Silver King Canyon;~~, as well as Tamarack Lake (if fish are present),~~ using chemical treatment (rotenone);
- As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.
- Neutralize the rotenone downstream of Silver King Canyon to the 30-minute travel time mark ~~near~~ downstream (0.5 miles) of the confluence with Snodgrass Creek using potassium permanganate, likely resulting in a temporary purple or brown discoloration up to two miles downstream of the 30-minute station; and
- Restock the Project area with putative pure Paiute cutthroat trout from donor streams in the upper Silver King Creek Watershed (i.e., Fly Valley Creek, Four Mile Canyon Creek, Silver King Creek, or possibly Coyote Valley Creek).

~~The proposed Action would also include pre-treatment removal of fish by seeking Fish and Game Commission approval for an increase daily bag limit of 5 fish per day in an attempt to reduce existing non-native trout populations~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009; pre-treatment biological surveys and monitoring for amphibians and benthic macroinvertebrates; placement of signs to inform the public; water quality monitoring (during and post treatment); and post-treatment biological monitoring. Chapter 3.0, Project Alternatives, presents a more detailed description of the proposed Action and alternatives, including a map (Figure 3-1) depicting the components of the proposed Action, including treatment area, ~~drip stations~~ and other activities. The Agencies would apply rotenone to the project area in the summer of 2010~~09~~ and 2011~~10~~ (and 2012~~11~~ if needed). Additional treatments within the proposed timeframe would be scheduled as necessary to ensure complete removal of non-native trout from the project area.

1.4 PUBLIC INVOLVEMENT SUMMARY

The CDFG and Humboldt-Toiyabe National Forest (HTNF) originally scheduled the proposed Action for 2002 or 2003 (see Section 2.1.2). The HTNF mailed notices to approximately 700 citizens, groups, and agencies. The NEPA process requires notifying and involving affected and interested parties. Project notices were mailed to the following stakeholders:

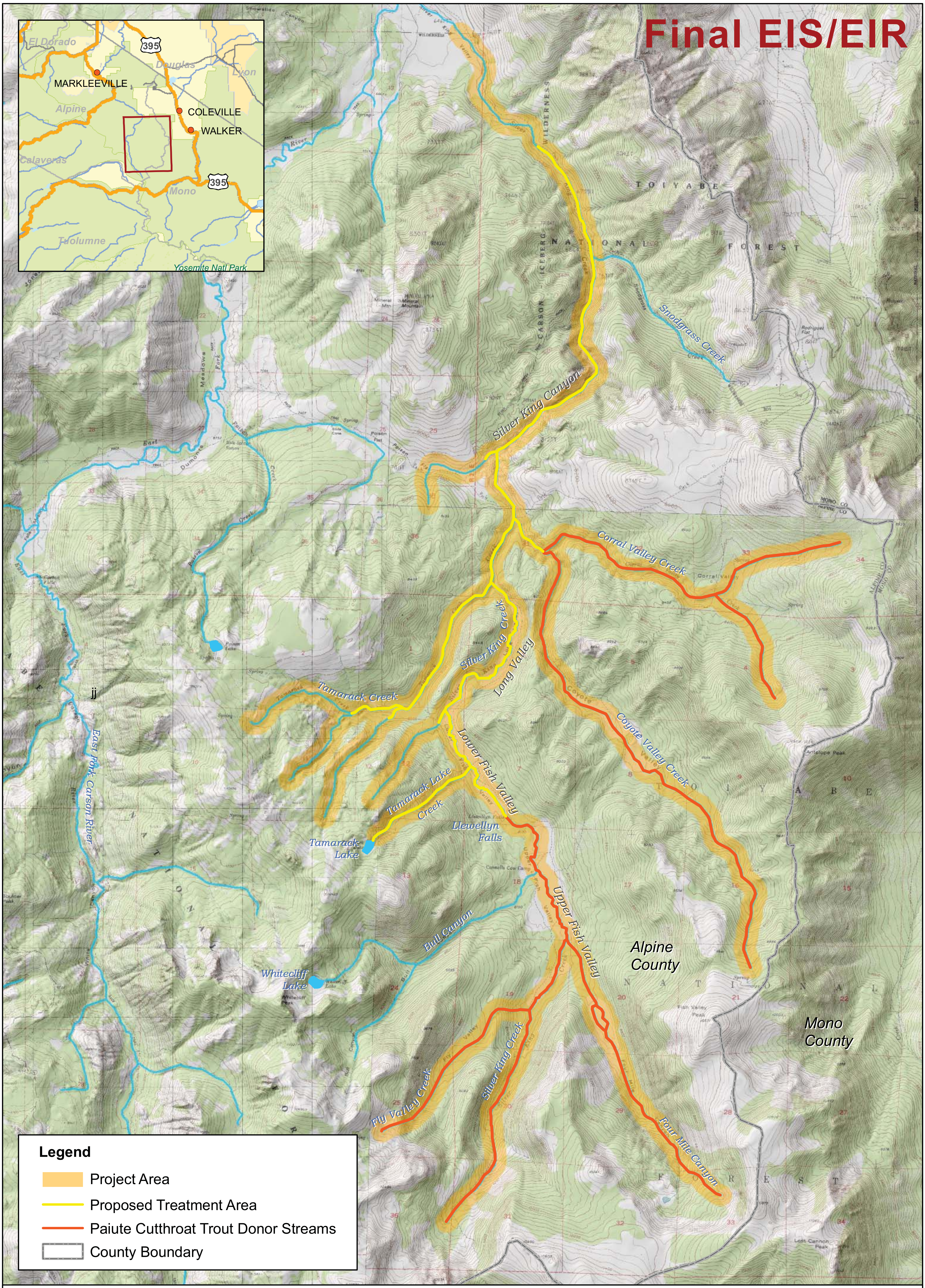
- Citizens who live, work, or recreate in the area of the proposed Action.
- Public interest groups and native communities concerned about environmental, social, or economic impacts.
- Federal, state, local, and tribal governmental agencies with public resource responsibility.
- Representatives of recreational industry conducting business in the project area.
- Scientists and other technical experts with knowledge of the natural resources in the project area.

On April 2, 2002, CDFG and HTNF staff met with the Alpine County Board of Supervisors to discuss the proposed Action. CDFG filed a CEQA Mitigated Negative Declaration on May 29, 2002, and a Notice of Determination on April 10, 2003. Public meetings were held on April 26, 2002; April 11, 2003; and April 30, 2004. CDFG also met with the Alpine County Board of Supervisors on May 20, 2002.

On April 30, 2002, HTNF issued 198 NEPA scoping letters. An additional three letters were sent upon request. Public scoping continued through May 30, 2002. Eight response letters were received. Public meetings were held at Turtle Rock Park in Alpine County on April 26, 2002 and in Markleeville on May 20, 2002. On July 31, 2002, HTNF distributed an Environmental Assessment for 30-day public review and comment. HTNF mailed the Environmental Assessment to the citizens, groups, and agencies that responded to the scoping notice or requested the Environmental Assessment. HTNF received seven comment letters. However, HTNF postponed the project on March 13, 2003 and mailed a letter informing interested parties.

The CDFG and HTNF rescheduled the proposed Action for 2004 and the HTNF Schedule of Proposed Actions was mailed to the same approximately 700 parties. On December 22, 2003, HTNF mailed 218 NEPA scoping letters to inform the public that HTNF was preparing an EA and was accepting comments until January 9, 2004. However, in 2005, the courts determined that an EIS was required so the action was postponed again.

In 2006, the USFWS determined to undertake the EIS and published a Notice of Intent (NOI) to prepare an EIS in the Federal Register (FR 71 32125 – 32126) on June 2, 2006. The NOI, included with this EIS/EIR (refer to Appendix A), requested public comment on the proposal from June 2 through July 3, 2006. In addition, as part of the public involvement process, the USFWS held a public scoping meeting in Markleeville on June 19, 2006. Approximately nine citizens attended the meeting. USFWS used the comments raised at the meeting to develop a list of issues requiring further analysis in the EIS/EIR (refer to Appendix A and Chapter 2.5~~0~~, Introduction).



ENTRIX
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0 0.5 1 2 Miles

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

Final EIS/EIR

Paiute Cutthroat Trout Restoration Project

Figure 1-1

Silver King Creek Project Area & Regional Geography

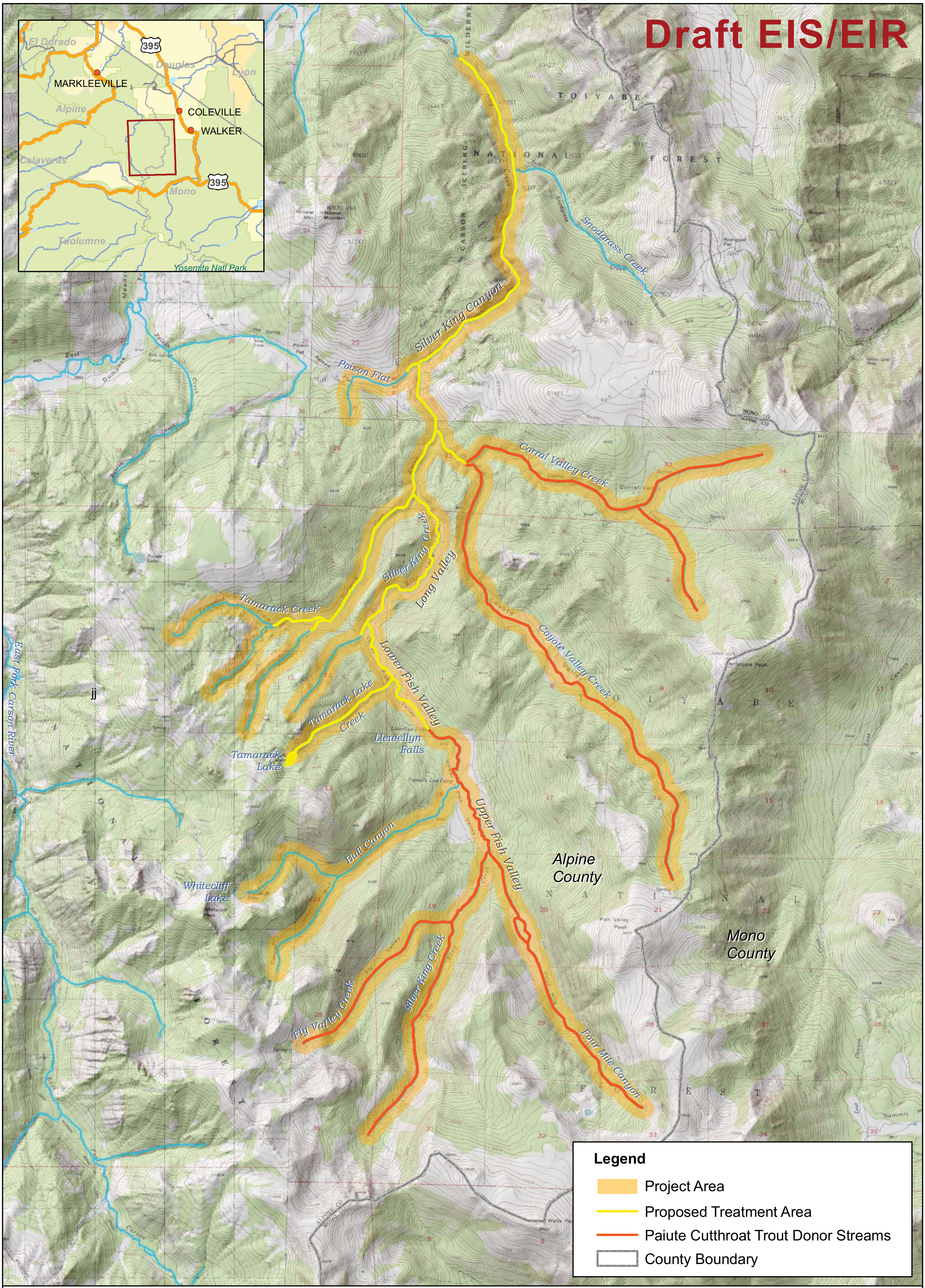

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Figure 1-1

Silver King Creek
Project Area & Regional Geography

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

CDFG prepared a CEQA Notice of Preparation (NOP) on September 16, 2008. The NOP opened the public scoping period and invited the public to offer comments on the proposed Action ~~Project~~ until October 31, 2008. The NOP is included as Appendix A herein. One public scoping meeting for the EIR was held in Alpine County at Turtle Rock Park in Markleeville, California on October 7, 2008, at 4:00 p.m. Press releases were issued to local radio, television, and print media outlets to notify the public of the meeting. CDFG sent approximately 210 direct mail notices to potentially interested parties including residents, various State, local, and Federal agencies along with existing CDFG, Regional Water Quality Control Board (RWQCB) and U.S. Forest Service (USFS) contacts. USFWS and CDFG presented information on the proposed Action and its potential effects and the role the public plays in the environmental review process. Participants were encouraged to provide verbal comments at the scoping meetings or to provide written comments. The Agencies met with the Alpine County Board of Supervisors on October 21, 2008, and November 18, 2008, and the Alpine Watershed Group on January 13, 2009, to discuss the proposed Action.

1.4.1 Agency Consultation and Coordination

The Agencies are actively consulting and coordinating with Federal, State, and local agencies, and tribes that have an interest in the proposed Action or could have a role in reviewing and/or providing permits or other approvals for aspects of the Paiute Cutthroat Trout Restoration Project. The Agencies have met with representatives of various ~~f~~Federal, ~~s~~State, and local agencies regarding the respective interests of these agencies. This section presents a list of agencies that were asked to review the portions of the document relevant to that agency's jurisdiction, responsibilities, and concerns, and provide input on the following: 1) errors and omissions; 2) significance criteria; 3) environmental effects; and 4) potential mitigation measures. The USFWS and CDFG have posted the Draft and Final EIS/EIR on their respective websites and mailed copies to the following agencies, individuals and organizations:

FEDERAL AGENCIES

- Advisory Council on Historic Preservation
- Federal Tribes
- U.S. Army Corps of Engineers (USACE)
- U.S. Army Corps of Engineers (USACE), San Francisco Division
- U.S. Department of Agriculture (USDA)
- U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service
- U.S. Department of Agriculture (USDA) National Agricultural Library
- U.S. Department of Agriculture (USDA) Natural Resources Conservation Service
- U.S. Department of Agriculture (USDA) Office of Civil Rights
- U.S. Department of Interior, Office of Environmental Policy and Compliance
- U.S. Environmental Protection Agency (USEPA)
- U.S. Environmental Protection Agency (USEPA), Region 9 San Francisco
- U.S. Fish and Wildlife Service (USFWS)

- U.S. Forest Service (USFS), Humboldt-Toiyabe National Forest (HTNF)
- U.S. Forest Service, Carson Ranger District

STATE AGENCIES

- California Department of Boating and Waterways
- California Department of Food & Agriculture
- California Department of Health Services (CDHS)
- California Department of Pesticide Regulation (CDPR)
- California Department of Toxic Substances Control (DTSC)
- California Department of Water Resources (DWR)
- California Native American Heritage Commission (NAHC)
- Office of Environmental Health Hazard Assessment (OEHHA)
- State Clearinghouse
- State Historic Preservation Officer (SHPO)
- State Water Resources Control Board (SWRCB)

REGIONAL AND LOCAL AGENCIES

- Northern Sierra Air Quality Management District (NSAQMD)
- Lahontan Regional Water Quality Control Board (Water Board)
- Alpine County Board of Supervisors
- Town of Markleeville

INDIVIDUALS AND OTHER ORGANIZATIONS

- Alpine County Chamber of Commerce
- Alpine County Clerk
- Alpine County Sheriff
- Alpine Watershed Group
- Carson River Resort
- Sorensen’s Resort
- Woodfords Station
- Washoe Tribe of Nevada and California
- Center for Collaborative Policy
- Friends of Hope Valley
- Nancy Erman
- Jim Crouse
- David Katz

- Mike Matuska
- John Regan
- Bob Rudden
- Judy Wickwire
- Dave Zelmer

The Notice of Availability (NOA), including a web link to the EIS/EIR, was sent to the project mailing list and residents of Alpine County. In addition, CDs were made available at no cost to the public.

1.4.2 Public Review of EIS/EIR

After the Draft EIS/EIR was ~~is~~ published, USFWS and CDFG sent ~~will send~~ the NOA/Notice of Completion (NOC) and a newsletter to local newspapers including the Tahoe *Tribune*, Douglas County *Record Courier*, Reno *Gazette*, the project mailing list, and the Markleeville library. ~~several libraries in the region.~~

The NOC was ~~will be~~ filed with the Office of Planning and Research, State Clearinghouse, and the USFWS sent copies to the U.S. Environmental Protection Agency (USEPA)~~will~~ and published the NOA in the Federal Register, beginning a 45-day public comment period. The Agencies received approximately 600 comments during the public comment period. Copies of the comment letters and responses to those comments are provided in Appendix F.

1.4.3 Intended Uses of the EIS/EIR

This section identifies the agencies that are expected to use the EIS/EIR in their decision-making, potential permits and approvals, and related environmental review and consultations required by Federal, State, and local laws, regulations, or policies.

As described above, the USFWS is the lead agency under NEPA. The USFWS will issue a Record of Decision (ROD) stating whether the EIS complies with NEPA requirements. CDFG is the lead agency under CEQA. CDFG will decide whether to certify the EIR and to issue a Notice of Determination (NOD), Findings of Fact, and a Statement of Overriding Considerations. The USFS will determine whether or not to approve the use of motorized equipment and whether or not to approve the use of pesticides for this Project. The Lahontan Regional Water Quality Control Board (Water Board) will decide whether to issue a discharge permit.

Other Federal, State, and local permits, approvals and consultations that may be required for the Proposed Action are identified in Table 1-1.

Table 1-1 Potential Permits, Approvals, and Consultations

Agency	Permits/Approvals/Consultations
Alpine County	Hazardous materials permit
Alpine County	Restricted Materials Permit (Restricted Pesticides)
NAHC	Coordination and consultation on Section 106 NHPA consultation
OEHHA	Consultation on risk assessment, toxicology of active and inert ingredients of rotenone formulation used, and health and safety issues
SHPO	Section 106 National Historic Preservation Act (NHPA) consultation

1.5 ALTERNATIVES CONSIDERED AND PROPOSED ACTION

In addition to the proposed Action of rotenone treatment, the alternatives evaluated in this EIS/EIR include No Action and Combined Physical Removal (a non-chemical alternative).

Alternative 1: No Action. Both NEPA and CEQA require consideration of the No Action alternative. This option includes continuing the current stream and fishery management practices into the foreseeable future. This alternative would include the continued protection of putative pure Paiute cutthroat trout populations in Upper Fish Valley by restricting recreational fishing on a small portion Silver King Creek below Llewellyn Falls.

Alternative 2: Proposed Action/Preferred Alternative (Proposed Action ~~Rotenone Treatment~~). The proposed Action includes pre-treatment biological surveys and monitoring for amphibians and benthic macroinvertebrates, placement of signs to inform the public, rotenone treatment of Silver King Creek and its tributaries ~~as well as Tamarack Lake (if fish are present)~~, neutralization downstream of the project area at Silver King Canyon using potassium permanganate, water quality monitoring, and post-treatment biological monitoring. After two to three years of treatment, the Agencies would restock the project area with putative pure Paiute cutthroat trout.

Alternative 3: Combined Physical Removal. This non-chemical alternative would include a combination of electrofishing, gill netting, seining, and other physical methods to address Silver King Creek and its tributaries, springs, and Tamarack Lake (if fish are present). Because this method could have low efficiency in a rocky stream environment, it would be implemented over multiple years (at least 10 years) (i.e., until no fish are found using physical removal techniques).

1.6 SUMMARY OF ENVIRONMENTAL IMPACTS

The proposed Action ~~Project~~ would result in the following environmental impacts as described in detail in Chapter 5.0, Environmental Consequences.

- Significant and Unavoidable ~~Biological~~ water quality impacts on species composition and potential loss of benthic macroinvertebrate species. Although, no known special-status macroinvertebrates or endemic taxa ~~species~~ (those individual taxa known to occur only within the Silver King Creek Watershed) exist in the project area, the rotenone treatment could result in loss of rare or endemic species.
- Less-than-significant impacts on amphibians present in Silver King Creek, ~~because~~ however, the Agencies would implement amphibian monitoring and relocation efforts prior to commencing chemical treatment.
- Less-than-significant impact on ~~Elimination of~~ existing non-native trout and native fishes (downstream of Silver King Canyon up to 0.5 mile downstream of confluence with Snodgrass Creek) ~~but~~ with significant beneficial effects on Paiute cutthroat trout, expanding the population and range of the sub-species and increasing the probability of long-term viability.
- Less-than-significant risk of exposure to wildlife species in the project area, including such species as the marten, yellow warbler, and willow flycatcher.
- Less-than-significant impacts to human exposure based on the remoteness of the project area, distance to any downstream human population, and the possible controls placed on human

access during and after the treatment (potential emergency closure issued by the Fish and Game Commission).

- ~~Temporary but~~ Less-than-significant water quality impact to dissolved oxygen, bacteria, turbidity, and color in Silver King Creek.
- Less-than-significant impacts on recreation, wilderness values and management, and environmental justice.
- Less-than-significant ~~Potential~~ localized economic and recreation effects with the future possibility of reopening the stream to fishing under the Fish and Game Commission.
- The proposed Action would result in cumulative beneficial effects to Paiute cutthroat trout by expanding their range and population.

Section 5.10, Comparison of Alternatives, presents a tabular comparison of the impacts of each alternative, including the No Action alternative. Section 5.10, Comparison of Alternatives, also presents a summary of the mitigation measures required to reduce the impacts of the proposed Action to less-than-significant. Impacts that are not reduced to less-than-significant are identified as significant and unavoidable.

1.7 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

CEQA requires the designation of the environmentally superior alternative, which is the alternative that would result in the fewest or least significant environmental impacts. However, if the No Action alternative is identified as the environmentally superior alternative, then CEQA requires that another alternative be identified as the environmentally superior alternative.

As demonstrated in Section 5.10, Comparison of Alternatives, and as illustrated by Table 5.10-1, the No Action alternative would be the environmentally superior alternative because it would avoid all of the potentially significant impacts of the proposed Action. However, with respect to longer-term consequences, the No Action alternative would fail to implement the Revised Recovery Plan (USFWS 2004) and Paiute cutthroat trout would not inhabit its historic range and would be vulnerable to stochastic events, further hybridization, and possible extinction. While the significant impacts of the proposed Action would be completely avoided in the short-term under the No Action alternative, the No Action would fail to protect and preserve the sub-species. In comparison, Alternative 3 (Combined Physical Removal) would result in significant, direct physical impacts, but may not be effective in the long term and would be very difficult to implement and potentially infeasible. Therefore, the proposed Action is the environmentally superior alternative.

1.8 ISSUES TO BE RESOLVED

This EIS/EIR examines the potential impacts of using the chemical rotenone and other techniques to eradicate non-native trout from 11 miles of Silver King Creek and associated tributaries. ~~as well as Tamarack Lake.~~ Potential impacts include application of pesticide to water and the resulting exposure of this stream and its aquatic receptors, within a designated wilderness area, to this chemical. Issues to be resolved include whether this impact and chemical exposure of non-target organisms, such as stream benthic macroinvertebrates (aquatic insects that live in or on the bottom sediments) outweigh the risks of inaction to the existence of Paiute cutthroat trout.

1.9 REFERENCES

Hanson, J. 2009. CDFG memo fish evaluation for Tamarack Lake, Alpine County.

Somer, W. and J. Hanson. 2009. CDFG memo chemical treatment evaluation for Tamarack Lake, Alpine County.

U.S. Fish and Wildlife Service (USFWS). 2004. Revised Recovery Plan for the Paiute cutthroat trout (*Oncorhynchus clarki seleniris*). Portland, Oregon. ix + 105 pp.

U.S. Fish and Wildlife Service (USFWS). 1985. Paiute Cutthroat Trout Recovery Plan. Portland, Oregon. ix + 68 pp.

U.S. Fish and Wildlife Service (USFWS). 1975. Threatened status for three species of trout. Federal Register 40: 29863-29864. July 16, 1975.

U.S. Fish and Wildlife Service (USFWS). 1967. Native fish and wildlife: endangered species. Federal Register 32: 4001. March 11, 1967.

CHAPTER 2

Introduction

The USFWS and CDFG are proposing the Paiute Cutthroat Trout Restoration Project in Silver King Creek in the HTNF. The proposed Action entails the eradication of non-native trout species from 11 stream miles of Silver King Creek~~,~~ and its tributaries ~~and Tamarack Lake~~. The Agencies propose to use the piscicide rotenone to eradicate non-native trout and to neutralize the rotenone downstream of Silver King Canyon at its confluence with Snodgrass Creek using potassium permanganate. The Agencies also propose to restock Silver King Creek with native Paiute cutthroat trout from donor streams in the upper watershed (i.e., Fly Valley Creek, Four Mile Canyon Creek, Silver King Creek, or possibly Coyote Valley Creek). Chapter 3.0, Project Alternatives, presents a detailed description of the proposed Action and the other alternatives.

The USFWS is the NEPA lead agency for the proposed Action and CDFG is the CEQA lead agency. The USFWS is proposing this Action as part of ~~in fulfillment of its responsibilities to implement~~ the Revised Paiute Cutthroat Trout Recovery Plan (USFWS 2004), which has an ultimate goal of delisting the sub-species. CDFG is proposing this Action in its role as trustee agency for fish and wildlife resources for the State of California, and will serve as the technical lead for this Action. The USFS is a cooperating agency under NEPA because activities within designated wilderness on National Forest Systems lands require USFS authorization (36 CFR 261.9f, 293.6c). Specifically, the proposed Action would require USFS' authorization for pesticide and motorized equipment use (see Section 2.4 below). The proposed Action would also require a discharge permit from the Lahontan Regional Water Quality Control Board (Water Board), which would be a responsible agency under CEQA. Section 2.4 below lists other permits and approvals likely to be required for this Action.

2.1 HISTORY AND BACKGROUND

Silver King Creek, downstream from Llewellyn Falls to Silver King Canyon in Alpine County, is ~~part of~~ the native range of the Paiute cutthroat trout, one of the rarest trout sub-species (USFWS 1985). Indigenous only to Silver King Creek, Paiute cutthroat trout were listed as threatened under ESA on July 16, 1975 (USFWS 1975). Out-of-basin (referring to the Silver King Creek Watershed) populations of Paiute cutthroat trout have been established by the Agencies in several California streams including the North Fork of Cottonwood Creek and Cabin Creek in the Inyo National Forest (Mono County), Sharktooth Creek (Fresno County), and Stairway Creek (Madera County) in the Sierra National Forest.

Hybridization with non-native trout is the primary threat to Paiute cutthroat trout (USFWS 2004, 1985). When interbred with Lahontan cutthroat or rainbow trout, Paiute cutthroat trout tend to lose their distinctiveness through hybridization (USFWS 2004). The fish in the reach between Llewellyn Falls and Silver King Canyon are a genetic mixture of introduced rainbow, Lahontan cutthroat, golden trout, and native Paiute cutthroat trout.

2.1.1 Conservation Planning

At the time of its listing under ESA, non-native trout were considered a threat to the Paiute cutthroat trout. When Paiute cutthroat trout were classified as threatened, a 4(d) rule was issued to facilitate management between CDFG and the USFWS. As described above, through efforts completed by CDFG, five small isolated populations of putative pure Paiute cutthroat trout have been established outside of its native range. These small populations are and will continue to be at a high risk of extinction due to the small size of the population and small habitat occupied by the sub-species.

In 1994, CDFG prepared a programmatic EIR entitled “Rotenone Use for Fisheries Management” to assess potential impacts of CDFG fisheries management programs and to outline best management practices to minimize environmental effects.

To further recovery of the sub-species, the USFWS published a Revised Recovery Plan for Paiute cutthroat trout (USFWS 2004). Criteria for delisting Paiute cutthroat trout include:

- Removal of all non-native trout in Silver King Creek and its tributaries from downstream of Llewellyn Falls to the fish barriers in Silver King Canyon;
- Restoration of a viable population to all historic habitat in Silver King Creek and its tributaries from Llewellyn Falls to the impassable barriers in Silver King Canyon;
- Maintenance of Paiute cutthroat trout in all occupied streams;
- Maintenance of out-of-basin populations as refugia; and
- Development of a long-term conservation plan and agreement.

2.1.2 Past Restoration Efforts in Silver King Creek

The Agencies have conducted numerous rotenone treatments in the Silver King Creek Watershed; however, the Agencies have not attempted eradication of non-native trout in the proposed project area. Previously treated areas are depicted on Figure 5.1-1 (see Section 5.1, Aquatic Biological Resources). The lower reaches of Four Mile Canyon Creek were treated with rotenone from 1991 through 1993. Corral Valley Creek was treated with rotenone in 1964 and 1977. Coyote Valley Creek was treated with rotenone in 1964, 1977, and 1987 through 1988. Silver King Creek above Llewellyn Falls was treated in 1964, 1976, and 1991 through 1993. As a result, Paiute cutthroat trout have been successfully reintroduced to all these streams. Population monitoring verified with genetic testing concluded that these previous efforts have been successful in eliminating non-native trout. Genetic study results indicate Paiute cutthroat trout in areas above Llewellyn Falls and in Corral Valley and Coyote Valley creeks are not hybridized with rainbow trout (Israel et al. 2002, Cordes et al. 2004).

CDFG proposed to restore Paiute cutthroat trout in the proposed project area in 2003–2004. Under CEQA, CDFG completed an Initial Study and a Mitigated Negative Declaration. CDFG also applied to the Water Board for a National Pollutant Discharge Elimination System (NPDES) permit to apply rotenone in Silver King Creek. The SWRCB granted an NPDES permit on July 6, 2005.

Because the proposed Action would occur on National Forest Service land, HTNF prepared an EA under NEPA in July 2002, followed by a Decision Notice and Finding of No Significant Impact (FONSI) in 2004. HTNF also prepared a Biological Assessment pursuant to Section 7 under ESA with USFWS and a Biological Evaluation addressing potential effects on listed species. USFWS issued a Biological Opinion on April 4, 2003.

Before the rotenone application began, a group of plaintiffs named Californians for Alternatives to Toxics filed actions in ~~f~~Federal and California courts to halt the project. On August 19, 2005, the Sacramento Superior Court declined to issue a temporary restraining order against implementation of the SWRCB permit, ruling that there was not enough evidence to decide that the "degrading impacts on the watershed and its ecosystem outweigh the public's interest in preserving the Paiute cutthroat trout." On August 23, 2005, the plaintiffs filed a request for a temporary restraining order in U.S. District Court stating that the project warranted an EIS. On August 31, 2005, the U.S. District Court granted a temporary restraining order against the project. Finally, on September 1, 2005, the U.S. District Court granted a preliminary injunction against the project, ruling that 1) the plaintiffs demonstrated a strong likelihood of irreparable harm to potential rare and endemic species, 2) the balance of interests (imminent threats to macroinvertebrates versus possible future threats to the survival of Paiute cutthroat trout) tipped sharply in favor of the plaintiffs, and 3) the plaintiffs had raised "serious questions" that the USFS had violated ~~f~~Federal environmental laws in failing to prepare an EIS and/or an adequate EA.

On September 30, 2005, CDFG requested the SWRCB to rescind its NPDES permit, and on October 20, 2005, the SWRCB rescinded the permit. The court found that the action had become moot and imposed no further requirements or restrictions.

CDFG had initially closed the area between Llewellyn Falls and Silver King Canyon prior to the planned treatment in 2005. To protect putative pure Paiute cutthroat trout above Llewellyn Falls, and in response to judicial decisions regarding the Water Board permit, CDFG closed the area to fishing for an additional 90 days on an emergency basis. This closure was modified to the current closure of Silver King Creek and tributaries from Llewellyn Falls downstream to Tamarack Lake Creek based on California Fish and Game Commission findings in May 2006. Silver King Creek also remains closed to fishing above Llewellyn Falls since the successful establishment of Paiute cutthroat trout in this area since 1993. In addition, the California Fish and Game Commission closed Corral Valley Creek and Coyote Valley Creek to fishing to protect putative pure Paiute cutthroat trout populations established in these tributaries. Section 5.6, Recreation, presents a detailed description of recent closure decisions.

2.2 OBJECTIVE/PURPOSE AND NEED FOR ACTION

The objective of the proposed Action is to establish the Paiute cutthroat trout as the only trout species in Silver King Creek for the purpose of preventing hybridization with other trout. This is an important and necessary step in preventing Paiute cutthroat trout from going extinct and conserving the sub-species and restoring it to a level that would allow it to be removed from the ~~f~~Federal threatened species list. To accomplish this objective, the Agencies would remove all non-native trout from the proposed project area prior to restocking with putative pure Paiute cutthroat trout from donor streams in the upper watershed. ~~The Agencies are also evaluating the necessity of removing fish from Tamarack Lake at the headwaters of Tamarack Lake Creek, a tributary to Silver King Creek, if fish are present. Chapter 3.0, Project Alternatives, presents the surveys the Agencies will complete to determine the presence or absence of fish in these waters and the criteria that would be used to determine whether treatment of the lake is necessary.~~

Paiute cutthroat trout are currently found upstream of Llewellyn Falls; however, easy public access between areas downstream and upstream of Llewellyn Falls (see Figure 1-1) may result in an unauthorized transplant of hybridized fish to areas above the falls where Paiute cutthroat trout are currently found in its genetically putative pure form. Therefore, the Agencies are proposing to eradicate non-native trout within the historical range of Paiute cutthroat trout from areas downstream of Llewellyn Falls and restocking Paiute cutthroat trout, expanding its range to a series of six impassible fish barriers in Silver King Canyon and associated tributaries, thereby increasing its population. These barriers, the two highest being 8 and 10 feet high, would geographically isolate Paiute cutthroat trout from other trout species and greatly reduce the likelihood of an illegal introduction.

The purpose and need for the proposed Action is to restore Paiute cutthroat trout to its historic range as stated in the Revised Recovery Plan (USFWS 2004), and thereby satisfy one critical Recovery Plan component for delisting the sub-species. The proposed Action would make Paiute cutthroat trout the only trout species in Silver King Creek above Silver King Canyon. By expanding the populations and range of the sub-species, the proposed Action would also increase the probability of long-term viability and reduce threats from genetic bottlenecking and stochastic events.

Many sections of the California Fish and Game Code (FGC) provide for the protection, conservation, and management of California fisheries and other aquatic resources, including but not limited to the following sections: 1600 et seq., 1700, 2050 et seq., 2118, 2119, 5501, and 15500 et seq. and associated regulations in Title 14 of the CCR such as 5.51, 236, 238, 238.5, and 671. In some instances, the CDFG uses chemicals (piscicides) to manage fisheries in California.

As discussed in additional detail below, the proposed Action would be consistent with USFS' responsibility to manage and restore significant values within the wilderness. Additionally, the proposed Action would further CDFG's mandate to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public.[1]

2.3 PROPOSED ACTION

Under the proposed Action, the Agencies would:

- Eradicate non-native trout from Silver King Creek and its tributaries between Llewellyn Falls and Silver King Canyon~~, as well as Tamarack Lake (if fish are present)~~, using chemical treatment (rotenone);
- As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.
- Neutralize the rotenone downstream of Silver King Canyon to the 30-minute travel time mark ~~near~~ downstream (0.5 miles) of the confluence with Snodgrass Creek using potassium permanganate, likely resulting in a temporary purple or brown discoloration up to two miles downstream of the 30-minute station; and

[1] www.dfg.ca.gov/about

- Restock the project area with putative pure Paiute cutthroat trout from donor streams in the upper Silver King Creek Watershed (i.e., Fly Valley Creek, Four Mile Canyon Creek, Silver King Creek, or possibly Coyote Valley Creek).

~~The proposed Action would also include pre-treatment removal of fish by seeking Fish and Game Commission approval for an increase daily bag limit of 5 fish per day in an attempt to reduce existing non-native trout~~ populations To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009.

Pre-treatment biological surveys and monitoring for amphibians and benthic macroinvertebrates; placement of signs to inform the public; water quality monitoring (during and post treatment); and post-treatment biological monitoring. Chapter 3.0, Project Alternatives, presents a more detailed description of the proposed Action and other alternatives, including a map (Figure 3.1) depicting the components of the proposed Action. As part of the proposed Action, the Agencies would apply rotenone to the project area in the summer of 201009 and 201110 (and 201211 if needed). Additional treatments would be scheduled as necessary to ensure complete removal of non-native fish from the project area. The Agencies would use one or a combination of two ~~three~~ commercially available rotenone formulations, including ~~such as~~ CFT Legumine™ and Noxfish®. ~~and Nusyn-Noxfish®~~. CFT Legumine™ is a recently developed “alternative” formulation that contains less potentially objectionable “inert” ingredients. The use of CFT Legumine™ is consistent with Basin Plan rotenone provisions that encourage the development of and the use of alternative formulations. Rotenone is a naturally-occurring substance derived from the roots of several tropical and subtropical plant species belonging to the genus *Lonchocarpus* or *Derris*. It has traditionally been used for fishing by indigenous tribes in South America.

Depending on the formulation used for treatment of the proposed Project area, CFT Legumine™ or ~~and~~ Noxfish® would be applied at a target concentration of 0.5 to 1.0 milligram per liter (mg/L) ~~and Nusyn-Noxfish® at a target concentration of approximately 1.0 mg/L~~ rotenone formulation. The amount of chemical applied would be based on field conditions (i.e., streamflow, etc.). The treatment process would be completed over a week timeframe (or 7 working days). Rotenone would be applied to the streams using 4 to 6-hour drip stations, with hand spraying in backwater areas as necessary. As described in Chapter 3.0, Project Alternatives, Tamarack Lake, which forms the headwaters of Tamarack Lake Creek, ~~may~~ has been deemed to be fishless and is no longer part of the project.~~and would only be treated if gillnetting and/or other survey techniques, prior to implementation of the proposed Action, showed that fish were present.~~

A neutralization station would be operated downstream of the application zone (to the 30-minute travel time mark), at the confluence of Silver King Creek and Snodgrass Creek. Potassium permanganate would be applied using a motorized auger at a rate of approximately 2 to 4 mg/L until it was no longer necessary to detoxify rotenone. Under these conditions, potassium permanganate would be reduced to manganese oxide, which would be present for less than ~~a couple of~~ two days (24-48 hours) following treatment. At these levels, potassium permanganate would not threaten human health (see Section 5.3, Human and Ecological Health Concerns) and would not violate water quality objectives (see Section 5.4, Water Resources). However, potassium permanganate would temporarily result in purple or brown discoloration up to 2 stream miles downstream of the project boundary.

Fish killed during the treatment would be gathered and buried. Any remaining fish would be washed downstream, consumed by foraging wildlife, or provide needed nutrients for repopulating aquatic invertebrates.

Post-treatment stocking of Paiute cutthroat trout would begin in early summer during the year following the final treatment, and would occur annually until the target population density is established, with guidance from ongoing fish population monitoring and historic population data (Deinstadt et al. 2004). Restocking would be conducted pursuant to guidelines and recommendations for stocking and genetic diversity management in the Revised Recovery Plan (USFWS 2004) and recent genetic studies (Cordes et al. 2004, Finger et al. 2009 ~~2008~~). Paiute cutthroat trout used for restocking would come from putative pure populations within the Silver King Creek Watershed, namely Fly Valley Creek, Four Mile Canyon Creek, Coyote Valley Creek, Corral Valley Creek, and Upper Silver King Creek (above Llewellyn Falls) (Cordes et al. 2004).

2.4 PERMITS AND APPROVALS FOR THE PROJECT

The following paragraphs describe the authority of the primary implementing and permitting Agencies for this Action. Federal laws, regulations, and policies applicable to this decision include the National Forest Management Act (NFMA), ESA, NEPA, the National Historic Preservation Act (NHPA), the Clean Water Act (CWA), the Wilderness Act, and other legal mandates.

U.S. FISH AND WILDLIFE SERVICE

The USFWS has responsibilities under ESA to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people[2] and recover threatened and endangered species. The proposed Action would implement major components of the Paiute cutthroat trout Revised Recovery Plan (USFWS 2004).

The decisions to be made include determining the method for and the extent of fish removal in Silver King Creek and its tributaries. Based on the environmental analyses presented in this Final ~~Draft~~ EIS/EIR, and comments received from other agencies and the public, USFWS will determine how to implement non-native trout eradication and would issue a NEPA ROD signed by the ~~Deputy~~ Regional Director ~~Field Office Supervisor~~.

U.S. FOREST SERVICE

The Wilderness Act of 1964 established a National Wilderness Preservation System "to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The Carson-Iceberg Wilderness became part of the National Wilderness Preservation System with passage of the California Wilderness Act of 1984. Human uses such as recreation are allowed but are subordinate to the higher purpose of maintaining wilderness values of 1) outstanding opportunities for solitude, and 2) the ability of natural processes to operate free of human influence.

[2] www.fws.gov/policy/npi99_01.html

The use of chemicals and motorized equipment in wilderness require the approval of the USFS Regional Forester (36 CFR 261.9f and 293.6c). The decision to be made by USFS is limited to whether or not to approve the use of motorized equipment and whether or not to approve the use of pesticides for this Project.

This decision helps implement the standards and guidelines of the Toiyabe National Forest Land and Resource Management Plan, specifically Wildlife and Fish standards 4 (page IV-49), 5, 6, and 11 (page IV-50), regarding threatened and endangered species and the wilderness. Forest Service Policy (FSM 2100) states that pesticide use in designated wilderness areas occur only when necessary to restore significant values within the wilderness, and to base actual use on analyses of effectiveness, specificity, environmental impacts, economic efficiency and human exposure.

Forest Service Policy (FSM 2300) also states that motorized equipment use in designated wilderness areas may occur when an essential activity is impossible to accomplish by non-motorized means because of such factors as time or season limitations, safety, or other material restrictions. All other aspects of the proposed Action fall within the jurisdiction of CDFG and USFWS.

CALIFORNIA DEPARTMENT OF FISH AND GAME

The State of California's fish and wildlife resources are held in trust for the people of the State by and through CDFG (FGC, Section 711.7). Many sections of the FGC provide for the protection and management of California fisheries and other aquatic resources, including but not limited to the following: FGC Sections 1001, 1726, 1727, 1755(a)(1), 7260, for the Wild Trout Policy and Trout policy; Sections 1600 *et seq.*, 1700, 2050 *et seq.*, 2118, 2119, 5501, and 15500 *et seq.*, and associated regulations in Title 14 of the California Code of Regulations (CCR), such as, 5.51, 236, 238, 238.5, and 671. In addition, as lead agency under CEQA, CDFG will issue a NOD, Findings of Fact, and a Statement of Overriding Considerations on the EIR.

LAHONTAN REGIONAL WATER QUALITY CONTROL BOARD

The Water Board will determine whether to grant Waste Discharge Requirements and whether the proposed Action is consistent with Basin Plan provisions for rotenone treatments. The Agencies have applied for a project-specific NPDES permit for rotenone application. The NPDES permit for the proposed Action would contain receiving water limits applicable to rotenone projects as contained in the Basin Plan. It would also require water quality monitoring to verify compliance with receiving water limits within the project area and in downstream waters both during and after the treatment.

2.5 ENVIRONMENTAL ISSUES AND CONCERNS

The paragraphs below summarize the environmental concerns raised by the public and agencies that submitted comments on the 2004 Environmental Assessment and the recently published NEPA NOI and CEQA NOP (refer to Appendix A). The issue of greatest public concern was the potential impact of rotenone on benthic macroinvertebrates or aquatic invertebrates. These species live all or part of their life cycle in or on the bottom sediments of Silver King Creek. The U.S. Environmental Protection Agency (USEPA) suggests that rotenone use for fish control, when implemented properly, does not present a significant threat of adverse effects on humans or the environment (USEPA 2006). However, there has been increasing concern regarding potential short and long-term impacts on non-target species, including aquatic macroinvertebrates and amphibians.

In response to concerns over potential effects on aquatic macroinvertebrates and pursuant to permit conditions issued by SWRCB, CDFG and HTNF implemented a pre-treatment monitoring program, including collection of benthic macroinvertebrate samples from 2003 through the present. To evaluate potential effects on benthic macroinvertebrates inhabiting Silver King Creek, the Agencies compiled all the benthic macroinvertebrate population data collected in Silver King Creek over the past 40 years to monitor the effects of rotenone on benthic macroinvertebrates in Silver King Creek and similar sites within the Watershed. The resulting technical report by Vinson and Vinson (2007) is provided as Appendix D herein. This report provides part of the basis for Section 5.1, Aquatic Biological Resources.

Several concerns were raised during the public involvement process completed in 2004 and were addressed in the Environmental Assessment. These issues are also addressed in Chapter 5.0, Environmental Consequences, and include:

- The potential effects of the proposed Action on Paiute cutthroat trout recovery and the feasibility of removing hybridized fish from the project area.
- Potential effects on non-target organisms, including aquatic invertebrates, amphibians, plankton, Forest Service Management Indicator Species and Sensitive Species, and other federally-listed species. This may include species that rely on emerging aquatic insects, such as the yellow warbler, willow flycatcher, mountain yellow-legged frog.
- Effects of rotenone formulations on water quality, including effects on human uses.
- Concern that water quality monitoring be employed to determine if applied chemicals migrate outside the proposed project area.
- Effects on wilderness values and management and the use of chemicals and motorized equipment.
- Effects on recreational fisheries resulting from temporary closure of 11 miles of stream in the ~~Iceberg-Carson~~ Carson-Iceberg Wilderness and Alpine County, including removal of a healthy non-native fishery.

Additional concerns rose during subsequent appeals of the Decision Notice and FONSI. These concerns area also addressed in Chapter 5.0, Environmental Consequences, and include:

- Potential effects on macroinvertebrate communities - specifically on any rare and endemic taxa or species that may exist in the Project area, including larval forms.
- Potential effects of rotenone application on human health – particularly potential relationships between rotenone exposure and Parkinson’s disease.
- Potential impacts of chemical treatment on other non-target species, including two amphibian candidate species, the Sierra Nevada population of the mountain yellow-legged frog and the Yosemite toad.
- Economic impacts on Alpine County and recreation-related businesses.
- Concern regarding the history of CDFG stocking of non-native trout in the area, questions regarding the effectiveness of rotenone, and the necessity of increasing Paiute cutthroat trout range.

- Inclusion of provisions to prevent future re-introduction of non-native trout through public education and outreach.
- Potential impacts on downstream water quality resulting in fish kills or violation of antidegradation policies.
- Concern regarding the content of the cumulative impact analysis.

These issues led the Agencies to explore a wide range of fish eradication technologies and to complete a detailed evaluation and screening analysis of these technologies and combinations of technologies, including optional chemicals. Through this process, the Agencies selected the alternatives evaluated in detail in this EIS/EIR, which include Alternative 1: No Action (required by NEPA and CEQA), the Alternative 2: Proposed Action (rotenone treatment), and Alternative 3: Combined Physical Removal (a non-chemical alternative). Appendix B presents the resulting “Alternatives Formulation Report.”

Major conclusions presented in this EIS/EIR regarding the potential effects of the proposed Action include:

- The proposed Action would result in significant and unavoidable ~~biological impacts, including~~ water quality impacts on species composition and potential loss of benthic macroinvertebrate taxa ~~species~~. Although, no known special-status macroinvertebrates or endemic species (occur only within the Silver King Creek Watershed) exist in the project area, the rotenone treatment could result in loss of rare or endemic species.
- The proposed Action would result in less-than-significant impacts on amphibians present in Silver King Creek, ~~because~~ however, the Agencies would implement amphibian monitoring and relocation efforts prior to commencing chemical treatment.
- The proposed Action would result in a less-than-significant impact on ~~eliminate~~ existing non-native trout ~~but~~ and would result in a significant beneficial effect on Paiute cutthroat trout populations by expanding the population and range of the sub-species and increasing the probability of long-term viability.
- The proposed Action would ~~not~~ result in less-than-significant risk of exposure to wildlife species in the project area including such species as the marten, yellow warbler, and willow flycatcher.
- The proposed Action would result in less-than-significant impacts to ~~H~~human exposure ~~pathways would be incomplete~~ based on the remoteness of the project area, distance to any downstream human population, and the possible controls placed on human access during and after the treatment (potential emergency closure issued by the Fish and Game Commission).
- The proposed Action would result in less-than-significant water quality impacts to dissolved oxygen, bacteria, turbidity, and color in Silver King Creek.
- ~~Application of rotenone formulations to Tamarack Lake would result in residual concentrations that could persist for more than two weeks.~~
- The proposed Action would ~~not~~ result in less-than-significant impacts on recreation, wilderness values and management, ~~or~~ and environmental justice.
- The proposed Action ~~c~~would result in ~~beneficial~~ less-than-significant localized economic and recreation effects with the future possibility of reopening the stream to fishing under the Fish and Game Commission.

- The proposed Action would result in cumulative beneficial effects for Paiute cutthroat trout by expanding their range and population.

2.6 DOCUMENT STRUCTURE

The Agencies prepared this EIS/EIR in compliance with NEPA, CEQA, and other relevant Federal and State laws and regulations. This EIS/EIR discloses the direct, indirect, and cumulative environmental impacts that would likely result from the proposed Action and other alternatives. The document is organized into 8 chapters as follows:

- **Chapter 1.** The Executive Summary presents project background, objectives, and purpose and need for the proposed Action. It summarizes public involvement, the alternatives considered in developing the proposed Action, agencies consulted during the EIS/EIR process, and potential environmental issues.
- **Chapter 2.** The Introduction describes the background leading to the proposed Action, the purpose and need for the ~~a~~Action, a summary of the proposal, the alternatives considered, environmental concerns, permits and approvals required for the ~~a~~Action, and document contents.
- **Chapter 3.** Project Alternatives presents a more detailed description of the proposed Action as well as alternatives for achieving the stated purpose. The alternatives were developed based on the potential impacts of the ~~a~~Action and input from the public and other agencies.
- **Chapter 4.** Scope of the Analysis lists the resource areas that will be addressed in the EIS/EIR and the scope of the analysis, including the impact significance terminology used. This section also identifies resource areas not addressed in detail (e.g. Public Services) and the reasons the Agencies determined these resources would not be affected.
- **Chapter 5.** Environmental Consequences provides a detailed analysis of the potential environmental consequences of the proposed Action and each alternative, including direct and indirect effects. This analysis is organized by resource area (e.g. 5.1 Aquatic Biological Resources), describes the environmental setting, and effects (including direct and indirect effects) of each alternative and identifies impacts requiring mitigation.
- **Chapter 6.** Other Required Disclosures addresses the relationships between short-term uses and long-term productivity, unavoidable adverse effects, irreversible or irretrievable commitments, and growth-inducing impacts. The chapter also addresses cumulative impacts, and analyzes the potential significance of the proposed Action when considered in combination with past, present, and reasonably foreseeable projects with related impacts.
- **Chapter 7.** Mitigation Measures lists and describes the mitigation measures required to address the significant impacts identified in Chapter 5.0, Environmental Consequences.
- **Chapter 8.** List of Preparers lists the agencies and consulting personnel that prepared the EIS/EIR.

2.7 REFERENCES

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CHAPTER 3

Project Alternatives

This chapter presents a summary of the proposed Action, one other action alternative, and a No Action Alternative. Additional alternatives were considered during the development of the EIS/EIR, but rejected because they did not meet stated goals or objectives of the Agencies or were not considered reasonable. These are briefly described below in Section 3.4, "Alternatives Considered but Dismissed."

The Agencies prepared an Alternatives Formulation Report (Appendix B) which describes in detail how the Agencies selected a reasonable range of alternatives for detailed evaluation in the EIS/EIR. The report discusses the range of options identified through literature reviews on fish eradication, the comments received on the USFWS NOI (Federal Register June 2, 2006) for the proposed Action (USFWS 2006), and on similar environmental documents prepared for other fish restoration projects, including the recently prepared Lake Davis Pike Eradication EIS/EIR (CDFG 2007).

3.1 ALTERNATIVES DEVELOPMENT

The EIS/EIR evaluates the potential environmental impacts of the proposed Action and a suite of other alternatives to the proposed Action that were considered during the development of the EIS/EIR. This section provides a description of the process used to develop alternative approaches to mitigating impacts on species addressed in the EIS/EIR and a comparison of alternatives selected. Reasons for rejecting specific alternatives are also explained.

The Alternatives Formulation Report (Appendix B) describes the initial identification and screening of technologies and alternatives. The technologies identified included the use of a variety of chemical agents as piscicides (fish-killing agents), fisheries management actions and fish eradication techniques, stream dewatering, and the introduction of predators. In addition to evaluating these as independent techniques, the Agencies considered combined approaches. All options were evaluated using a two-phase assessment approach.

In Phase I, the options were evaluated to determine if they would effectively and, in compliance with current laws and regulations, accomplish the initial step of eradicating all non-native trout from Silver King Creek and its tributaries between Llewellyn Falls and Silver King Canyon. The options that met this criterion were then evaluated in Phase II against a second set of criteria, including: protection of public health and safety; timely implementation; use of a proven, effective method; technical feasibility; minimization of environmental impacts; and cost-effectiveness. Using these criteria, summarized below, the remaining options were ranked and used to select the desired action as well as a reasonable range of alternatives to the desired action for consideration in the EIS/EIR. If a technology warranted further consideration as the possible basis for a comparative alternative in the EIS/EIR, potentially in combination with other strategies, it was retained.

3.1.1 Public Health and Safety

The public heath and safety criterion addresses the safety of the public and the workers implementing the proposed Action. Protection of public health includes consideration of potential impacts to air quality, drinking water, and other exposure pathways through which people could be exposed to hazards. Any proposal to use a chemical agent would require approval of the intended use and measures to protect public health. Options that posed substantial risks to public health and safety were eliminated from further consideration.

3.1.2 Speed of Implementation

Because stochastic events or rogue introduction of non-native trout could threaten putative pure populations of Paiute cutthroat trout, USFWS and CDFG believe time is of the essence. ~~and has identified a three-year schedule to remove non-native trout from Paiute cutthroat trout native habitat.~~

3.1.3 Proven Effective in the Laboratory and Field

The method must be proven by laboratory and field tests and be a known effective method of removing non-native trout in a stream environment. Because the survival of a species is at stake, any new or experimental methods were screened out. Using a method with demonstrated effectiveness dramatically increases the chance of success.

3.1.4 Technically Feasible to Implement

The technology must be technically and logistically feasible to implement. For example, it must not require a prohibitive amount of equipment or number of workers such that it would be possible to implement in a remote area.

Site-specific data and reports regarding the habitat types present, stream dimensions, water temperature, and fish densities were used to make accurate determinations regarding technical feasibility. Reports included cross-section surveys (~~CDFG~~ Flint 2004), unpublished data collected during fish surveys in August of 2000, and habitat assessments completed for Upper Fish Valley, Coyote Valley Creek, and Corral Valley Creek (O'Brien 1998, 1999, 2002).

3.1.5 Wilderness Considerations

Silver King Creek lies within a designated wilderness. There are numerous restrictions on activities and equipment that can be used in wilderness areas. For example, wilderness areas restrict motor vehicles, mechanical transport, and motorized equipment. These activities require Forest Service authorization.

3.1.6 Potential for Environmental Impacts

The method should minimize significant adverse environmental impacts that cannot be mitigated to reduce their significance. Such impacts may include damage to archaeological resources, biological resources or water resources, or significant noise or air quality impacts inconsistent with adjacent land uses (i.e., wilderness). This objective was not used by itself to eliminate potential technologies or management options. The EIS/EIR would analyze potential environmental impacts to determine their significance, compare the environmental consequences of the alternatives, and identify mitigation measures.

3.1.7 Cost-Effectiveness

While cost alone was not used to screen out any technology or strategy, overall cost ~~and effectiveness~~ was used as a balancing criterion in comparing options that were approximately equal in effectiveness or environmental impact.

3.2 ALTERNATIVES CONSIDERED IN DETAIL FOR THE EIS/EIR

3.2.1 Alternative 1: No Action

Both NEPA and CEQA require consideration of the No Project or No Action alternative, referred to herein as No Action. This option involves continuing the current stream and fishery management practices into the foreseeable future. Under the No Action alternative, the Paiute cutthroat trout Revised Recovery Plan (USFWS 2004) would not be implemented. The Agencies have committed to developing informational handouts to inform anglers entering the wilderness of the sensitivity and risks associated with the Paiute cutthroat trout. The handouts will be in addition to the informational kiosks and signage currently located at the trailheads. Agency personnel will continue to have a presence in the basin as budgets allow. No eradication of non-native, hybridized trout or reintroduction of Paiute cutthroat trout below Llewellyn Falls would be implemented. Paiute cutthroat trout would not be reintroduced to its historic habitat and its ESA status of threatened would likely remain unchanged. Therefore, this alternative would include continued ESA protection of putative pure Paiute cutthroat trout populations in the Silver King Creek Watershed as well as out-of-basin populations, but the recovery of Paiute cutthroat trout would not be obtained.

3.2.2 Alternative 2: Proposed Action/Preferred Alternative ~~(Rotenone Application)~~

~~The Agencies intend that the proposed Action would include pre-treatment removal of fish and would seek Fish and Game Commission approval for an increased daily bag limit of 5 fish per day in an attempt to reduce existing non-native trout populations~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009.

Pre-treatment biological surveys and monitoring for amphibians and benthic macroinvertebrates; placement of signs to inform the public; water quality monitoring (during and post treatment); and post-treatment biological monitoring.

Potential variations on the proposed Action ~~Project~~ include the method of chemical application (i.e., CFT Legumine™ and/or Noxfish® ~~and/or Nusyn-Noxfish®~~). The use of pesticides (with rotenone) without authorization is prohibited on National Forest Service System lands. Assuming that the USFS authorizes the use of motorized equipment and pesticides and the Water Board issues a discharge permit, the Agencies would apply the rotenone using non-motorized, vacuum-operated drip stations and hand sprayers. Mini-drips and gel or sand matrices may be used on small seeps if the possibility exists that they provide a refugia source of fresh water from treated waters. To eliminate the toxic effects of rotenone downstream of the project area, potassium permanganate would be administered using generator-powered volumetric augers at a downstream neutralization detoxification station. Potassium permanganate is a powerful oxidizing chemical that quickly renders rotenone harmless to aquatic organisms. The in-stream application of potassium permanganate below Silver King Canyon would ensure that no adverse effects of rotenone are experienced downstream of the project area. After 2 to 3 years of treatment, Paiute cutthroat trout restocking and repopulation would begin.

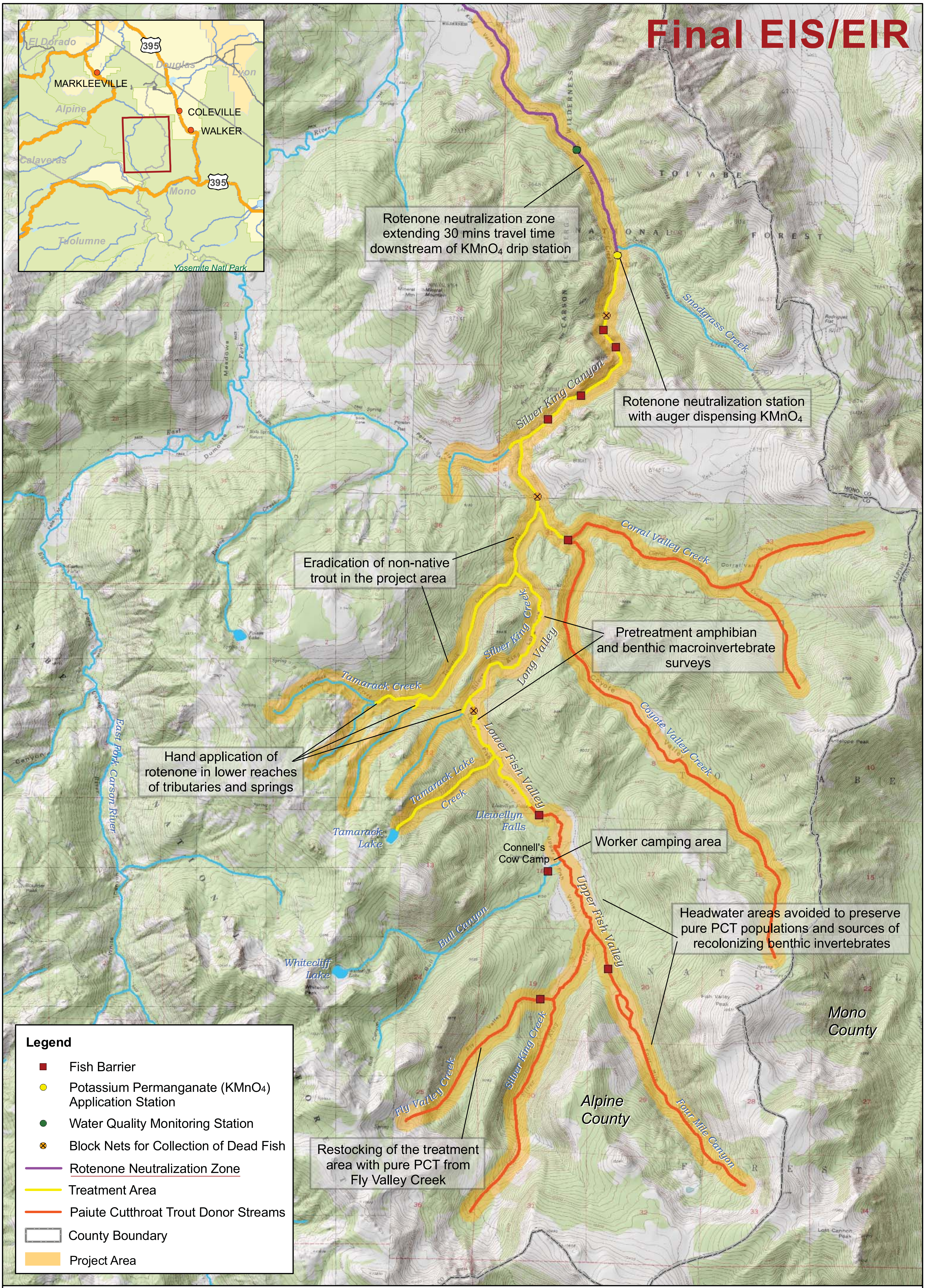
Chemical treatment of the project area is limited in timing to the period of mid- August to mid-September due to a number of biological and physical constraints. First, the waters must be treated after the non-native trout fry exit the gravels of redds (nests) which is typically late July to early August in Silver King Creek. Treatment before the fry emerge from redds would result in survival of these fish because they would not be exposed to the chemical treatment, thereby allowing their recruitment into the next year’s cohort. Second, most if not all chorus frogs and western toads should have metamorphosed into adult life forms reducing their exposure to rotenone during the proposed treatment timing. Third, conducting a chemical treatment during the prescribed period would be at base low stream flows, allowing for less chemical to be used and less water to be treated. Numerous springs and seeps would naturally dry up, reducing the complexity of the treatment. The prescribed treatment period would be during the most stable and warm weather of the year for this location in the northern Sierra Nevada. Stream water temperatures would also be at or near warmest of the year to allow more rapid chemical reaction for the action of the piscicide and for rapid neutralization.

The Agencies have applied for a project-specific NPDES permit for rotenone application. The NPDES permit for the proposed Action would outline receiving water limits applicable to rotenone projects as contained in the Basin Plan. It would also require water quality monitoring to verify compliance with receiving water limits within the project area and in downstream waters both during and after the treatment.

The following paragraphs provide a detailed description of the proposed Action, including the location, pre-treatment activities, rotenone application, neutralization, and post-treatment activities. Figure 3-1 depicts the treatment area and locations of components of the proposed Action.

3.2.2.1 Project Location

Silver King Creek, downstream from Llewellyn Falls to Silver King Canyon in Alpine County, is part of the native range of the Paiute cutthroat trout, one of the rarest trout sub-species (USFWS 1985). Silver King Creek is a tributary of the East Fork Carson River, which drains into the Lahontan Basin. Silver King Creek’s headwaters are located approximately 9,600 feet above mean sea level (msl) and the creek flows in a northerly direction through three distinct valleys where it meets the East Fork Carson River. The total length of the creek is 14 miles with an average gradient of 4.1 percent and a minimum gradient of 1.6 percent.



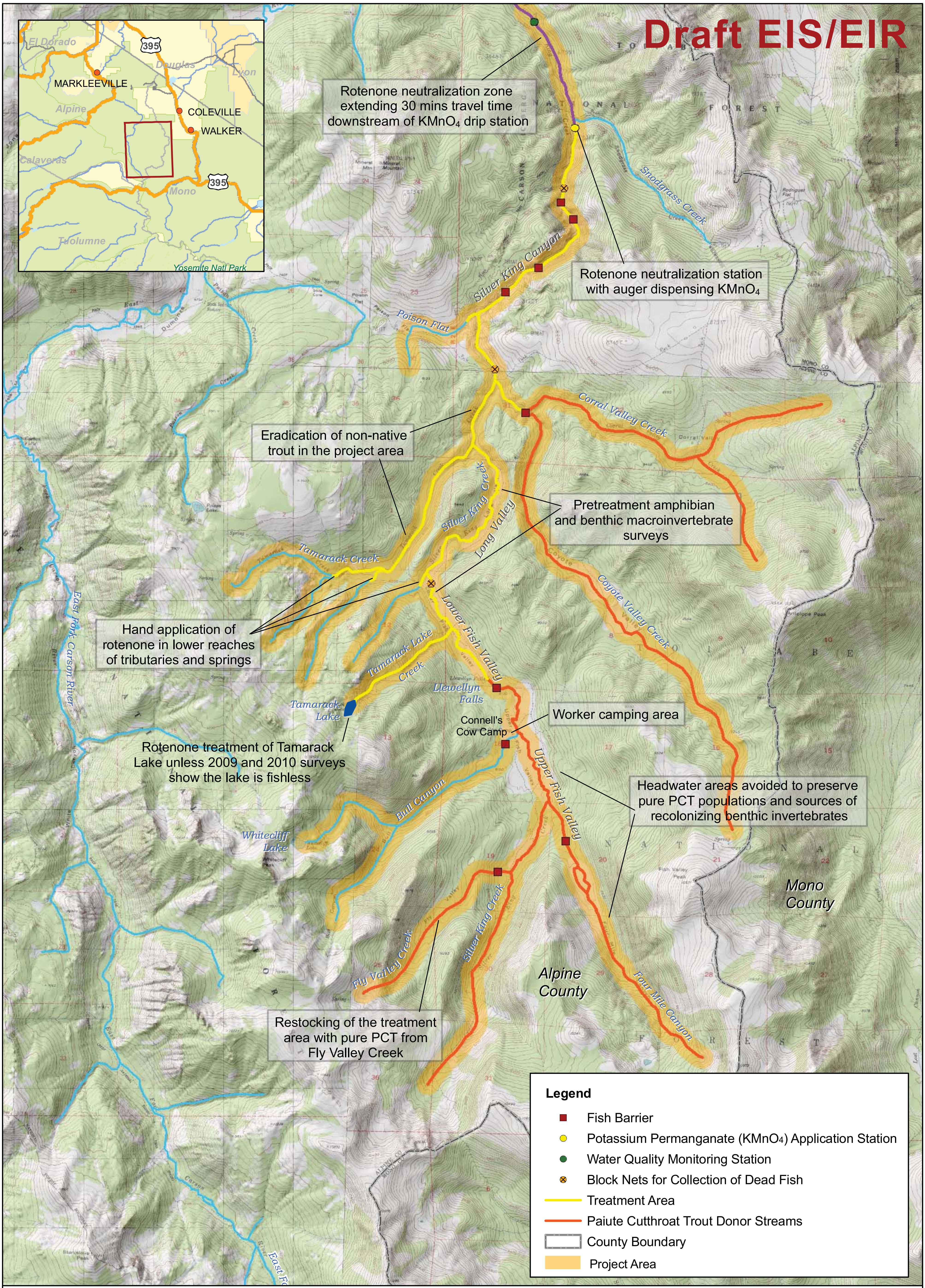
Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

Final EIS/EIR

Paiute Cutthroat Trout Restoration Project

Figure 3-1

Proposed Action Components and Description



ENTRIX
ENVIRONMENTAL CONSULTANTS

Paiute Cutthroat Trout Restoration Project

Figure 3-1

Proposed Action Components and Description

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

The project area, located within the Silver King Creek Watershed, includes the proposed treatment area, the neutralization area, and the area downstream of the neutralization station up to a 30-minute travel time, and downstream of the neutralization zone where potassium permanganate could result in purple or brown discoloration up to two miles downstream of the 30-minute station. (see Figure 3-1). The Agencies would apply rotenone formulation and potassium permanganate into Silver King Creek and associated tributaries between Llewellyn Falls and Snodgrass Creek, located downstream of Silver King Canyon. Tributaries would include Tamarack Lake Creek, an unnamed tributary, Tamarack Creek, and Coyote Valley Creek downstream of natural barriers. The Agencies would also treat the downstream reaches of tributary springs that may harbor fish including those near Llewellyn Falls and at an unnamed tributary downstream of Tamarack Creek ~~Poison Flat~~.

~~Depending on the results of presence/absence surveys planned for 2009 and 2010, if fish are present, the Agencies would also treat Tamarack Lake and downstream portions of its tributaries. Tamarack Lake is a 5-acre lake located west of Silver King Creek at the headwaters of Tamarack Lake Creek. The planned surveys, which include gillnetting, snorkeling and electrofishing, are described below.~~ Based upon fishery surveys conducted in Tamarack Lake between 2001 and 2009, Tamarack Lake is deemed to be fishless and is no longer considered for chemical treatment (Hanson 2009). Rotenone would not be applied to areas upstream of Llewellyn Falls. Fishless headwater areas within the project area would not be treated above natural barriers.

3.2.2.2 Pre-Fish Removal

The Agencies are completing ongoing biological monitoring in the study area. Amphibian surveys are completed annually and would be completed prior to treatment. If mountain yellow-legged frog and/or Yosemite toad are found, adults and tadpoles would be removed from waters to be treated, to the extent practicable, and relocated into suitable waters out of the project area but within the drainage. The Agencies would determine suitable waters for relocation.

The Agencies would also continue benthic macroinvertebrate population monitoring as part of the proposed Action. The sampling is required by the Water Board to evaluate Silver King Creek's response to treatment and follows the protocols established in the Silver King Creek Monitoring Program proposal submitted to the Water Board (refer to Appendix E, Aquatic Invertebrate Interagency Monitoring Plan).

A portion of the project area between Llewellyn Falls and Tamarack Lake Creek is currently closed to fishing by the Fish and Game Commission. Prior to the treatment, signs would be posted at trailheads and other strategic places to inform recreational users of areas to avoid during the treatment as well as areas where potable water can be accessed. Additional signs that identify the areas closed to fishing would be posted. This information would be provided by USFS Carson Ranger District office prior to treatment.

~~In January 2009, CDFG proposed modifying bag limits by submitting an Initial Statement of Reason (ISOR) for Fish and Game Commission consideration at their meeting in March 2009. If approved, the regulation would allow fishing with a relaxed bag limit in the proposed treatment area during the summer of 2009 prior to treatment. CDFG wardens would monitor bag limits and other restrictions.~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009.

3.2.2.3 Fish Removal

Prior to the rotenone application, and throughout the treatment process, public access would be restricted through the use of signs located at trailheads and other strategic places. Equipment, personnel, and chemicals would be transported to and from the project area by pack stock and on foot. All personnel assisting in the fish removal would use hardened or durable sites for camping and would be familiar with and practice Leave-No-Trace (LNT) principles. A crew of less than 50 people will be required to implement the treatment, exceeding the wilderness area limit of 15, thus requiring USFS authorization. Trails would be used whenever possible to move from one location to another to minimize soil and vegetation disturbance and to prevent establishing new trails. Sensitive plant habitat will be avoided. Treatment activities would be coordinated with wilderness management personnel.

During the fish removal phase, commercial formulations of rotenone, including CFT Legumine™ (EPA Reg. No. 75338-AA; new formulation) and/or Noxfish®[1] (EPA Reg. No. 655-805; new formulation) and/or Nusyn-Noxfish®, would be applied to 6 miles of mainstem Silver King Creek and 5 miles of associated tributary streams using methods described by Finlayson et al. (2000). Tamarack Lake would only be treated if fish are present (see decision criteria below).

Rotenone is a naturally occurring pesticide found in the roots of certain plants. It is used for insect control and for fisheries management. Rotenone acts by interfering with oxygen use. It is especially toxic to fish because it is readily absorbed through the gills. The California Department of Pesticide Regulation (CDPR) regulates rotenone as a restricted material. Commercial rotenone formulations contain certain “inert” ingredients (solvents, dispersants, emulsifiers, etc.) as well as the active ingredient rotenone. The active ingredient rotenone and some of the inert ingredients are potentially toxic chemicals. Chemical concentration, duration, and route of exposure must all be considered in determining potential risk to non-target organisms. At the concentrations proposed for the Paiute Cutthroat Trout Restoration Project, the rotenone formulations will be toxic to gill-breathing organisms such as fish as well as amphibians and benthic macroinvertebrates (aquatic insects) in their aquatic life stages. There is no evidence of adverse effects to humans or terrestrial wildlife such as deer or bears from incidental contact (for example, through drinking water or eating dead fish) with rotenone formulation ingredients applied to surface waters at concentrations typical of fishery management projects (refer to Section 5.3, Human and Ecological Health Concerns, and Appendix C).

Under normal field conditions (water temperature greater than 5°C), when applied to water, rotenone breaks down naturally within approximately 5 days. It can also be detoxified by oxidation with potassium permanganate or chlorine. It binds readily to organic matter in soil. Consequently, it does not persist as a pollutant in groundwater. Inert ingredients are generally volatile compounds that are expected to dissipate within 2 weeks.

Rotenone would be applied to flowing water at a target minimum concentration of ranging from 0.5 to 1.0 parts per million (ppm or mg/L) formulation per product label instructions for CFT

1 The new formulation of rotenone (a.k.a. CFT Legumine™, PW Rotenone®) does not use petroleum hydrocarbons as solvents and emulsifiers.

Legumine™ and Noxfish® ~~and 1.0 ppm formulation for Nusyn-Noxfish®~~. A State-licensed Agricultural Pest Control Adviser and a State-certified Qualified Applicator would supervise the application. Because drip stations are calibrated to the total stream flow and do not uniformly apply the rotenone across the entire stream width at the target concentration, rotenone may reach localized concentrations of approximately 1.0 mg/L for CFT Legumine™ and Noxfish®. Appendix C provides a more detailed rationale for the proposed treatment concentration. Application of rotenone would be done by 4 to 6-hour drip stations and hand spray backpack equipment. Mini-drips and gel or sand matrices may be used on small seeps if the possibility exists that they provide a refugia source of fresh water from treated waters. Fish would be collected prior to the treatment process from the project area and placed in net baskets just upstream of the drip stations to monitor the effectiveness of the fish toxicant. In addition, water samples would be collected throughout the project area to verify rotenone concentrations. Block nets will be placed at selected locations throughout the project area to catch the dead fish. The nets would be maintained at a frequency adequate to ensure that captured fish are not in the water long enough to decompose.

The rotenone application would be supervised by licensed applicators and in adherence to safety precautions identified on the product label. The application supervisor would be knowledgeable and experienced in state regulatory requirements regarding safe and legal use of the rotenone product and applicator safety. All personnel involved with the rotenone application would receive pre-treatment safety training specific to the formulated rotenone product. All personnel would be required to wear protective equipment to avoid unintended exposure to rotenone.

The Agencies would conduct the treatment over 2 to 3 years. CDFG experience indicates multiple treatments are necessary to eradicate non-native trout from streams (Finlayson et al. 2000). The treatments would occur between mid-August to mid-September beginning in 2010~~09~~. Treatments would be repeated during mid-August to mid-September 2011~~10~~. If hybridized fish carcasses were found during the 2011~~10~~ treatment, a third year of treatment would be necessary in 2012~~11~~. All or part of the chemical treatment may be applied twice in any given treatment year to assure complete non-native fish removal. An individual treatment would require a total of seven working days (one week) including mobilization, application, and neutralization.

~~The Agencies would treat Tamarack Lake depending on the results of pre-treatment presence/absence fish surveys.~~ Gillnetting surveys at Tamarack Lake have been conducted over the last several years (since 2001) and have found no fish. ~~However, because any fish present in the lake could enter Tamarack Lake Creek and subsequently Silver King Creek, the Agencies would conduct more extensive pre-treatment surveys.~~ ~~Tamarack Lake would not be treated concurrently with Silver King Creek in 2009.~~ In 2009, the Agencies ~~would~~ conducted extensive fish presence absence surveys including further gillnetting surveys as well as ~~snorkeling~~ visual surveys and electrofishing surveys. ~~The Agencies would continue over-winter gillnetting surveys in 2009 and 2010. This would constitute a total of 8 years of gillnetting.~~ The Agencies ~~would~~ also conducted electrofishing surveys in the tributaries and springs around the lake in the event that spawning habitat is present. As a result of extensive sampling between 2001 and 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

~~If no fish are found in 2009 and 2010, the Agencies would consider the lake fishless and withdraw treatment of Tamarack Lake from the proposed Action. However, if fish were detected, Tamarack Lake would be treated during the fall of 2010 or 2011. The Agencies would treat~~

~~Tamarack Lake with approximately 50 gallons of rotenone. The rotenone would be administered by gasoline-powered pumps and dispersed from two non-motorized rafts transported to the lake by pack horses. The lake's 5-acre surface would be treated in a single day.~~

3.2.2.4 Rotenone Neutralization

To contain the effects of rotenone within the project area and prevent a fish kill downstream of the Silver King Canyon, a neutralization station would be operated near Snodgrass Creek. The oxidizing agent potassium permanganate would be applied to Silver King Creek near Snodgrass Creek to neutralize rotenone, approximately 0.75 miles downstream of the lowest falls in Silver King Canyon.

Potassium permanganate would be applied at the resulting concentration of 2 to 4 mg/L. A generator powered auger would be used to apply the granular potassium permanganate. A back-up auger system would be on site in the event of primary auger failure. Potassium permanganate could also be applied from 30 to 55 gallon drums in a liquid form as a backup.

The project area extends approximately ~~one-quarter to~~ one-half mile downstream of the treatment area to include the stream reaches within the neutralization zone, and downstream of the neutralization zone where potassium permanganate could result in purple or brown discoloration up to two miles downstream of the 30-minute station. (refer to Figure 3-1). A 1 mg/L potassium permanganate residual would be maintained at the 30-minute travel time downstream location by increasing or decreasing the amount of permanganate to ensure complete neutralization of rotenone leaving the project area.

Block nets would be placed at selected locations throughout the project area to catch the dead fish. Dead fish collected at the block nets would be buried no closer than 300 feet from the stream and away from known camping areas to minimize bear/human interactions. The USFS would assist in selecting all burial sites before any ground disturbing activity occurred. Fish not collected at the block nets would be left in the stream to decompose and become part of the food chain.

During and after treatment, water quality will be monitored. As described in the Basin Plan, the monitoring program would assess the effects of treatment on surface waters and bottom sediments. The monitoring would determine: 1) that effective piscicide concentrations of rotenone are applied; 2) that sufficient degradation of rotenone has occurred prior to the resumption of public contact; and 3) that rotenone toxicity does not occur outside the project area. An analytical laboratory would analyze water samples for rotenone and rotenolone concentrations as well as for volatile organic compound and semi-volatile organic compound concentrations.

~~The Agencies would not neutralize Tamarack Lake with potassium permanganate. The rotenone applied to the lake would detoxify through natural degradation and breakdown.~~

As part of the proposed Action, to mitigate the potential effects of applying excess potassium permanganate to downstream fish populations, the Agencies would require placement of "sentinel" fish in cages downstream of the neutralization station. Mortality or observed stress (erratic swimming behavior, lethargic or labored gill cover movement) of these fish would alert workers to potential releases of excess chemical in the event of human or equipment error ~~and potential downstream effects~~. The Agencies will also develop and implement a spill contingency plan that addresses chemical transport and use guidelines, as well as spill prevention and containment that adequately protects water quality. This plan will also describe the use of an auger to dispense the neutralizing agent.

3.2.2.5 Post-Fish Removal (Post-Treatment)

Post-treatment stocking of Paiute cutthroat trout would begin in early summer during the year following the final treatment, and would occur annually until the target population density is established, with guidance from ongoing fish population monitoring and historic population data (Deinstadt et al. 2004). Restocking would be conducted pursuant to guidelines and recommendations for stocking and genetic diversity management in the Revised Recovery Plan (USFWS 2004) and recent genetic studies (Cordes et al. 2004, Finger et al. 2009 ~~2008~~). The approach would seek to maximize the genetic diversity of existing populations and to minimize the risks from genetic bottlenecks (USFWS 2004). Paiute cutthroat trout used for restocking would come from putative pure populations within the Silver King Creek watershed, namely Fly Valley Creek, Four Mile Canyon Creek, Coyote Valley Creek, Corral Valley Creek, and Upper Silver King Creek (above Llewellyn Falls) (Cordes et al. 2004). The number of fish to be taken from donor stream(s) would be determined based on population trends and status from all available information (Deinstadt et al. 2004 and ongoing fish population monitoring).

Fish would only be stocked in the treatment area between Llewellyn Falls downstream to Silver King Canyon ~~and Coyote Valley Creek~~. Tamarack Creek would be stocked with fish from source populations as described previously, or from the re-established fish population in the treated area. No fish would be stocked in fishless headwater streams, springs, or above natural barriers in tributaries, including Tamarack Lake. The preliminary goal proposed in the Revised Recovery Plan would be to have 2,500 fish greater than 75 mm in length occupying the historic range from Llewellyn Falls downstream to Silver King Canyon, but this goal may be revised as additional information becomes available (USFWS 2004). The Agencies would continue ongoing monitoring of Paiute cutthroat trout populations in the treated reach and index reaches of donor streams after removal of transplant stock to determine population status and track achievement of density goals in the restored reach as well as the donor streams.

The Agencies would seek to have the project area remain closed to fishing during the restocking phase. To educate the public regarding the Paiute Cutthroat Trout Restoration Project and prevent reintroduction of non-native trout, the Agencies ~~would provide~~ have placed informational signage at trailheads and will provide additional informational handouts for the public. The Agencies would continue monitoring of benthic macroinvertebrates in years 1, 2, 3, and 5 post-treatment to evaluate the response of aquatic invertebrate community to the chemical treatment, as outlined in Appendix E. The Agencies would also continue amphibian monitoring.

3.2.3 Alternative 3: Combined Physical Removal

This alternative includes the use of non-chemical means to remove non-native trout from the project area. It includes a combination of electrofishing, gill netting,[2] seining,[3] and other physical methods to remove fish from Silver King Creek and its tributaries, springs, and Tamarack Lake. The Combined Physical Removal alternative would not employ rotenone or any other chemical treatment. Because this method would ~~could~~ have low efficiency in a rocky

[2] Gillnets are set vertically so that fish swimming into it are entangled by the gills in its mesh.

[3] Seining is pulling a fishing net that hangs vertically in the water with floats at its upper edges and weights at the lower edges.

stream environment, it would need to be implemented over multiple years (at least 10 years) (i.e., until no fish are found using physical removal techniques).

This multiyear removal effort would involve large teams working for much of the summer (~~as many as~~ for a minimum of 72 consecutive days each year) over a period of several years (~~more than~~ at least 10 years). These removal efforts would eradicate a high proportion of undesirable species; however, they could fail to capture small fish and could be compromised by trout moving into the project area from untreated upstream areas. Restocking efforts would begin only when no fish are found within the project area. Thus, there could ultimately be problems with the effectiveness of this alternative if not completed in a single year. ~~After the third year of physical removal, the fish would be genetically tested to ascertain its genetic heritage. If the remaining fish were hybridized, more removal would be needed. If the remaining fish were putative pure Paiute cutthroat trout, then recolonization efforts would begin. It is not possible to differentiate pure Paiute cutthroat trout from hybridized fish in the field. Genetic testing results would not be available until tissue samples are processed in the laboratory. Thus, there could ultimately be problems with the effectiveness of this alternative if not completed in a single year.~~

3.2.3.1 Pre-Fish Removal

Pre-implementation activities would include monitoring and ~~possibly~~ fish removal through ~~relaxed~~ increased bag limits. Biological monitoring would be completed for amphibians. Similar to the proposed Action, ~~if approved by the California Fish and Game Commission, the Agencies would allow fishing in the proposed project area during the summer of 201009 prior to treatment. CDFG wardens would monitor bag limits and other restrictions.~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009.

3.2.3.2 Fish Removal

Equipment and personnel would be transported to and within the project area by horses and on foot. All personnel assisting in the fish removal would use hardened or durable sites for camping and would be familiar with and practice LNT principles. Groups would be limited in size so they would not require USFS authorization. An eleven person crew would work throughout the project area. Trails would be used whenever possible to move from one location to another to minimize soil and vegetation disturbance and to prevent establishing new trails. Sensitive plant habitat would be avoided during action implementation. Action implementation would be coordinated with wilderness management personnel. The removal would follow CDFG's standard population monitoring methods. The Agencies would electrofish approximately 116 500-foot reaches in 6 miles of mainstem Silver King Creek and 5 miles of associated tributary streams. A crew would consist of 3 personnel using backpack electrofishers, 6 netters retrieving stunned fish, 2 personnel with buckets receiving and disposing of fish. Electrofishing batteries would be recharged using small gasoline powered generators. Assuming that after five-passes, no fish would remain within the reach, it would take 580 hours to electrofish 116 reaches at 5 hours per reach (greater than 72 days) and would continue over multiple years (at least 10 years). Sampling efficiency would be substantially less in areas with heavy aquatic vegetation, root wads, woody debris, and boulder fields. Removal activities would be undertaken between late-June or early July and mid-October because of access, streamflows, and good weather.

Conceptually, an intensive multiyear removal effort could eradicate undesirable species ~~within the scheduled three-year~~ over an extended period (at least 10 years); however, these efforts could fail to capture small fish and could be confounded by trout moving into the project area from untreated upstream areas. ~~Any fish captured after the third year of physical removal would be genetically tested to ascertain its genetic heritage. If the remaining fish are hybridized, more removal would be needed. If the remaining fish are pure Paiute cutthroat trout, then stocking efforts would begin.~~

Dead fish collected would be buried no closer than 300 feet from the stream and away from known camping areas to minimize bear/human interactions. The HTNF would assist in selecting all burial sites before any ground disturbing activity occurred. Tamarack Lake ~~would~~ will be gill-netted for multiple years to confirm that the lake remains fishless ~~hybridized trout were absent~~. Nets would be placed at various depths and locations throughout the year. The nets would be inspected regularly to detect fish presence and to insure they are in good working condition.

3.2.3.3 Post-Fish Removal

Post-fish-removal activities would be the same as those described for the proposed Action. ~~Provided genetic testing of fish shows they are pure Paiute cutthroat trout that entered the project area from above Llewellyn Falls, then restocking with pure Paiute cutthroat trout would begin.~~

3.3 MITIGATION COMMON TO ACTION ALTERNATIVES

Mitigation measures that would apply to the action alternatives include:

- Pre-treatment and post-treatment amphibian population monitoring, including transfer of amphibians out of the project area.
- Pre-treatment monitoring of Tamarack Lake to determine that the lake remains fishless ~~if fish populations exist~~.
- Confining activities to existing trails and stream access points to the extent practical to minimize disturbance of vegetation and potential cultural resources.
- Using Leave-no-Trace policies.

A detailed description of avoidance measures and any project-specific mitigation measures is presented in Chapter 7.0, Mitigation Measures.

3.4 ALTERNATIVES CONSIDERED BUT DISMISSED

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the NOI/NOP provided suggestions of alternative methods for achieving the purpose and need. Some of these alternatives may have duplicated the alternatives considered in detail or the Agencies determined they would be ineffective or cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration for reasons summarized below.

3.4.1 Chemical Treatment

Powdered rotenone was removed from further consideration based on its limited effectiveness in moving water. Chlorine, chloramines, copper sulfate, and antimycin were removed because they are not registered pesticides in California, and their use would not comply with current laws and regulations.

3.4.2 Stream Dewatering

Stream dewatering by diverting stream flows to an adjacent watershed was screened out because of the major technical and logistical challenges involved as well as the environmental impacts compared to other fish removal techniques.

3.4.3 Fisheries Management Techniques

Six fisheries management techniques were evaluated in the Alternatives Formulation Report (Appendix B) such as physical removal, introducing a predator, fish-out, explosives, genetic swamping, and sonar. Most of these techniques were eliminated, because they were not expected to achieve complete removal of non-native fish in a stream environment. Introducing a highly predatory non-native fish to Silver King Creek was not seriously considered because it would only worsen the existing situation. Sonar is not sufficiently developed as a fish removal technique. The use of genetic swamping was removed because numbers of non-native trout and Paiute cutthroat trout hybrids are greater than three times that of the native Paiute cutthroat trout. With such an imbalance, it would take an enormous effort to “swamp” the hybrid population and the resulting population would never be a putative pure-strain Paiute cutthroat trout.

3.4.4 Habitat Management/Alteration

The habitat alteration options (nitrogen, carbon dioxide, oxygen depletion) were eliminated because they are unproven and considered unlikely to be effective, particularly in moving water.

3.4.5 Treatment of a Smaller Area

Smaller treatment areas would be infeasible because the absence of fish barriers within the 11-mile reach proposed for the action would allow repopulation of treated areas after treatment. The second option would install a permanent fish barrier upstream of Silver King Canyon to establish a smaller project area. Constructing an impassable barrier that would withstand all potential flow rates, such as may occur during winter storms, would be technically and logistically challenging without using heavy equipment. Implementation of this option would require a large workforce, as well as constant shuttling of workers and equipment into the project area via horseback or helicopter. Construction would also disturb the streambed and bank areas and could result in permanent geomorphologic changes in Silver King Creek. Chemical treatment of a smaller area would require a smaller amount of chemicals for the separate reaches, but would require the same amount, or more, by the time the entire project area was treated. Therefore, little benefit would be derived from reducing the size of the project area and causing potential environmental impacts from constructing an artificial fish barrier where none exists now. In addition, this scenario would not reintroduce Paiute cutthroat trout to its entire historic habitat and its success would be dependent on an artificial fish barrier that could be compromised by stochastic events (e.g., storm, seismic). For these reasons, the concept of a smaller project area is not evaluated further in this EIS/EIR.

3.4.6 Chemical Application Combined with Other Approaches

Stream dewatering followed by rotenone treatment would considerably reduce the amount of rotenone needed for treatment but would require the construction of diversion dams and other structures including pipelines to bypass the treatment area. Because of the relatively high flows in Silver King Creek, the agencies screened out this alternative based on technical and regulatory feasibility as well as the considerable environmental damage that would result including import of heavy equipment and materials, a large workforce, fill placement, water pumping, air emissions, noise, schedule and cost. Appendix B provides further discussion of dewatering techniques and impacts.

3.4.7 Combined Non-Chemical Options

The non-chemical combinations of stream dewatering strategies followed by physical removal and physical removal followed by genetic swamping were eliminated because they were not expected to achieve complete removal of undesirable fish and were not consistent with the PCT Recovery Plan.

3.4.8 Alternative Locations

Alternative locations were not considered because they would not meet the intent of the proposed Action which is to reintroduce Paiute cutthroat trout back into their historical habitat. The Revised Recovery Plan discusses exploring other additional out-of-basin locations; however, the proposed Action is intended to implement recovery actions number 1 and number 2 in the Revised Recovery Plan which are: 1) remove nonnative fish from Silver King Creek downstream from Llewellyn Falls to barriers in Silver King Canyon, and 2) reintroduce Paiute cutthroat trout into renovated stream reaches in historical habitat (USFWS 2004). Since the proposed Action occurs in the historical habitat of Paiute cutthroat trout, no other locations were considered. The introduction of putative pure Paiute cutthroat trout into other waters would not meet the criteria established in the Revised Recovery Plan (USFWS 2004) nor would it meet the criteria necessary to delist the sub-species. In addition, waters that are currently fishless have other native endemic species of amphibians or macroinvertebrates that would be impacted by the introduction of a non-native fish species. Numerous studies have shown that introduction of non-native trout into fishless waters have played a role in the decline of native amphibians (Bradford 1989, Drost and Fellers 1996, Knapp and Matthews 2000).

3.4.9 Alternate Timeframe for Implementation

Alternative timeframes to the proposed Action from mid-August to mid-September were screened out due to environmental, biological and/or logistical constraints such as high winter flows and access issues during winter and possible presence of juvenile amphibians and egg masses and the presence of salmonid fry in stream gravel during the spring. Thus, chemical treatment of the proposed project area is limited in timing to the period of mid- August to mid-September for the following reasons: 1) waters must be treated after non-native trout fry exit the gravels of redds which is typically late July to early August in Silver King Creek; 2) most if not all chorus frogs and western toads should have metamorphosed into adult life forms reducing their exposure to rotenone during the proposed treatment timing; and 3) conducting a chemical treatment during the prescribed period would be at base low stream flows, allowing for less chemical to be used and less water to be treated. The prescribed treatment period would be during the most stable and warm weather of the year for this location in the northern Sierra Nevada.

3.5 PREFERRED ALTERNATIVE

Alternative 2 (proposed Action) is the USFWS preferred alternative. This alternative would be the most effective means for implementing recovery action one and two from the Paiute cutthroat trout recovery plan. The preferred alternative would result in the removal of non-native trout thus reducing the primary threats of hybridization, genetic bottlenecking, small occupied habitat, and stochastic events.

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CHAPTER 4

Scope of the Analysis

The environmental resources investigated in depth were those determined to be potentially affected by the proposed Action and alternatives. These resource areas addressed in Sections 5.1 through 5.9 are as follows:

- Aquatic Resources
- Terrestrial Resources
- Human and Ecological Exposure
- Water Resources
- Greenhouse Gases and Climate Change
- Recreation
- Wilderness Values and Management
- Economic Resources
- Environmental Justice

For purposes of CEQA, any project-related economic or social changes would not be considered significant effects on the environment. Economic or social changes may be evaluated, however, to determine if a physical change to the environment would be significant. If the physical change causes adverse economic or social effects on people, those adverse effects may be used as a factor in determining whether the physical change is significant (CCR, Title 14, §15064(e)). Specific significant thresholds required under CEQA are described under each resource area. USFWS and the USFS have determined that these thresholds also meet the Council on Environmental Quality (CEQ) definition of significant impact (CEQ 1508.27).

The remaining CEQA and NEPA requirements, including growth-inducing effects and cumulative impacts, are addressed in subsequent chapters. The Mitigation Monitoring and Reporting Program will be prepared pursuant to California Public Resources Code Section 21081.6. ~~for the Final EIS/EIR.~~

The proposed Action and alternatives were determined through the scoping and environmental screening process to have no impacts on the following CEQA-required resources and are not addressed further in this EIS/EIR.

- **Aesthetics.** The proposed Action and alternatives would create no new structures or visual changes that could affect a scenic vista or scenic resources nor create new temporary or permanent sources of light or glare. No state scenic highways or other roadways exist within the proposed project area (refer to Figure 3-1). In addition, the proposed Action and alternatives would not substantially degrade the existing visual character or quality of the site or its surroundings because no visual changes would occur after the proposed Action or alternatives are implemented.

- **Agriculture Resources.** The proposed project area is comprised solely of wilderness area administered by the USFS. There is no land zoned or used for agriculture.
- **Air Quality.** The Great Basin Unified Air Pollution Control District's (GBUAPCD) air quality plans are site-specific and do not apply to the project area. Therefore, the proposed Action and alternatives would not conflict with or obstruct implementation of any air quality plan. The proposed Action and alternatives would not result in emissions of particulate matter; therefore, they would not result in a cumulatively considerable net increase in criteria pollutants for which the GBUAPCD is in nonattainment. No sensitive receptors to pollutants (e.g., residences, hospitals, childcare centers, etc.) exist within two miles of the proposed project area, and the proposed Action and alternatives would not result in emissions of substantial amounts of pollutants. Chemicals used for the treatment as part of the proposed Action could result in a slight odor in the proposed project area. Although access to the project area would not be restricted during implementation of the proposed Action, potential odors would likely only affect workers involved in the treatment process.
- **Archaeological Resources.** During EIS/EIR scoping, the Agencies investigated the potential for archaeological resources to occur in the proposed project area and conducted a search through the California Historical Resource Information System (CHRIS) for the area as well as a two-mile surrounding buffer area. Very few studies have been conducted in the area and included a timber sale inventory northeast of the proposed project area in 1992 and 3 other surveys within 2 miles. No archaeological sites have been recorded within the proposed project area. One prehistoric site associated with a hot spring was recorded along Silver King Creek above Llewellyn Falls. No Traditional Cultural Properties are listed within 2 miles of the proposed project area. The Agencies have determined that because the proposed Action and alternatives do not involve excavation and workers would use existing camps, trails, and access points, the proposed Action and alternatives would have no impacts on archaeological resources. Suitable locations for burial of fish would be identified by the Forest Service ~~Archaeologist~~. USFS is consulting with the Reno Sparks and Washoe tribes regarding the proposed Action as well as the Native American Heritage Commission and the State Historic Preservation Office (SHPO).
- **Historic Architectural Resources.** The CHRIS search described above identified several historic resources in the area including the cow camp in Upper Fish Valley, a Forest Service guard station, the remains of a cabin, and a wooden flume. Connell's Camp Cabin is considered eligible for the National Register of Historic Places; however, no modification of the cabin is proposed. The Silver King Mine and Mining District were situated slightly north of the northern end of the Project area. The Silver King Mine was of minor importance, even locally, and it was apparently the most substantial (or only) mine in the mining district. The Agencies have determined that because the proposed Action and alternatives would not disturb any structures, the proposed Action and alternatives would have no impacts on historic architectural resources. USFS is consulting with SHPO regarding this determination.
- **Fire Management.** The proposed Action and alternatives would not change the existing environment such that it would impair adoption of or physically impede fire management or adopted emergency response plan.
- **Geology and Soils.** The proposed Action and alternatives would not build structures that would be susceptible to unstable soils or to seismic activity. Any potential for erosion or surface water turbidity is addressed in Section 5.1, Aquatic Resources.

- **Groundwater.** The proposed Action and alternatives would not substantially deplete groundwater supplies because it would not require any water for implementation. In addition, the proposed Action and alternatives would not interfere substantially with groundwater recharge because no new impervious surfaces would be created. Under the proposed Action, workers would not apply chemicals to the ground and short-term treatment of surface water followed by neutralization would not result in groundwater contamination.
- **Hazards and Hazardous Materials.** The CEQA Guidelines outline significance criteria for evaluating impacts on human and ecological health from the transport, use and disposal of hazardous materials and/or wastes[1]. Because the proposed Action and alternatives are highly unlikely to create significant hazards, hazards and hazardous materials are not evaluated further in this EIS/EIR. The proposed Action and alternatives would not ~~transport (see spill discussion below) or~~ dispose of hazardous materials. Use of rotenone as part of the proposed Action would be carried out by licensed applicators according to label directions and the MOU between CDFG and the Water Board. An upset or accident involving the relatively small quantities of chemicals involved as part of the proposed Action is discussed below under "Hazardous Materials Spills." There are no existing or proposed schools within a one quarter-mile radius of the proposed project area and there are no airports within 2 miles of the proposed project area. Further, there are no private airstrips or hazardous materials sites; therefore, none of these criteria would apply. Finally, the area is not subject to any adopted emergency response plans or evacuation plans. Potential human and ecological exposures to rotenone and its formulation constituents, and rotenone formulation handling and application are addressed in Section 5.3, Human and Ecological Exposure and Appendix C herein.
- **Wildfire.** The CEQA Guidelines contain criteria for potential exposure of people or structures to the risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands. This criterion is not applicable to this EIS/EIR. While the proposed Action involves the use of combustible materials that could, if improperly handled, provide a combustion source, the quantities of these materials would be very small. Additionally, campfires would be needed to cook meals for work crews implementing the proposed Action and Alternative 3 (combined physical removal). However, work crews would follow applicable fire prevention precautions. Moreover, the proposed project area is located miles from any residences; therefore, neither the proposed Action nor the alternatives present risk of loss, injury, or death resulting from wildfires.
- **Hazardous Materials Spill.** The proposed Action would involve the transport of 20 gallons of rotenone formulation, between 300 and 600 pounds of granular potassium permanganate, and small quantities of fuel (approximately 30 gallons of gasoline for the generators) to the proposed project area. ~~The one exception would be the treatment scenario involving~~

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[1] A "hazardous material" is defined in Title 22, California Code of Regulations (CCR), Section 66084, as "a substance or combination of substances which, because of its quantity, concentration or physical, chemical or infectious characteristics, may either: (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating irreversible illness, or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed." In essence, any liquid, solid, gas, sludge, synthetic product, or commodity that exhibits characteristics of toxicity, ignitability, corrosivity, or reactivity has the potential to be considered a "hazardous material." A "hazardous waste," in contrast, is simply defined as "any hazardous material that is abandoned, discarded, or recycled" (Title 22, C.C.R. section 66084).

~~Tamarack Lake in which an additional 50 gallons of rotenone formulation would be needed to treat the lake.~~ Any spill could affect human or ecological receptors along the transport route. These impacts are addressed through preparation and implementation of the spill prevention, contingency and containment plan by the Agencies. To further minimize the risks of spills, transportation routes will be identified in the spill prevention, contingency and containment plan. The safest access routes would be selected for transporting hazardous materials to the proposed project area. Within the National Forest, equipment, personnel and chemicals would be transported to and within the proposed project area by pack stock and on foot and risk of spills would be minimal. With these measures in place and the small quantities of materials required for the proposed Action, spills do not present a significant risk and are not addressed further in the EIS/EIR.

- **Land Use and Management.** Because the Carson-Iceberg Wilderness does not contain any urban or residential uses, no communities exist within or near the proposed project area. The proposed Action and alternatives would not change land uses and would therefore not divide an established community. ~~or conflict with any applicable land use plan, policy or regulation.~~ In addition, no habitat conservation plans or natural community conservation plans apply to the proposed project area.
- **Noise.** The proposed Action and alternatives would not create permanent sources of noise. The proposed Action and Alternative 3 (combined physical removal) would cause a temporary increase in ambient noise levels at the treatment areas when workers are present. However, with the exception of localized noise from the mechanical auger at the neutralization station near Snodgrass Creek under the proposed Action, noise generated by crews would not exceed those normally generated by visitors to the wilderness. This additional noise would not result in a substantial temporary or periodic increase in ambient noise above existing levels. Impacts on wildlife would be localized and less-than-significant (see Section 5.2, Terrestrial Resources). The proposed Action and alternatives are not located within an airport land use plan or within 2 miles of any airport or private airstrip.
- **Wild Horses and Burros.** The proposed project area does not provide rangeland for wild horses or burros; therefore, neither the proposed Action nor the alternatives would impact these resources.
- **Livestock Grazing.** An active grazing allotment occurs in the proposed project area below Snodgrass Creek. However, the proposed Action and alternatives would not interfere with this grazing allotment or impede grazing at any of the other protected cattle or sheep grazing allotments within the Carson-Iceberg Wilderness.
- **Mineral Resources.** No known mineral resources occur in the proposed project area. The proposed Action and alternatives do not involve excavation or fill and thus no loss or commitment of mineral resources would occur.
- **Paleontological Resources.** There are no known paleontological resources in the proposed project area, and the Agencies have determined that because the proposed Action and alternatives do not involve excavation and workers would use existing camps, trails, and access points, the proposed Action and alternatives would have no impacts on fossils. Suitable locations for burial of fish would be identified by the Forest Service. ~~Archaeologist.~~
- **Population and Housing.** The proposed Action and alternatives would not add new housing or increase the resident population within the proposed project area, which is currently unpopulated.

- **Public Services.** The proposed Action and alternatives would not create a need for new or physically altered facilities related to public services because these alternatives would not create additional demand for fire protection, police protection, schools, parks, or other facilities by new residents or businesses. The proposed Action and alternatives would not induce population growth, nor would they interfere with existing public services.
- **Transportation and Traffic.** The proposed Action would generate approximately 20 automobile trips and 2 truck trips from Agency personnel and contracted workers traveling to the worksite. These vehicles would primarily use Highway 395 and Mill Creek Road and would not cause a substantial increase in traffic relative to the existing traffic load and road capacity. These vehicles would park at the trailhead until the treatment is concluded. Transport to the proposed project area would be on foot or horseback. No automobile or truck trips would occur after the treatment concludes. The proposed Action and alternatives would not exceed a level of service standard established by the county congestion management agency, and it would not result in a change in air traffic patterns. The proposed Action and alternatives involve no new construction or roadway design changes and therefore would not substantially increase hazards or impede emergency access or conflict with alternative transportation adopted policies, plans or programs.
- **Utilities and Service Systems.** The proposed Action and alternatives would not exceed the wastewater treatment requirements of the Water Board, require construction of new water or wastewater treatment facilities, create wastewater disposal needs, or require construction of new storm water drainage facilities because there would be no new impervious surfaces. The proposed Action and alternatives would produce only minimal solid waste (e.g. trash) that would be containerized and removed. The proposed Action and alternatives would comply with all ~~f~~Federal, state and local statutes and regulations related to solid waste.

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CHAPTER 5

Environmental Consequences

This chapter contains the environmental impact assessment of the proposed Action and alternatives. The assessment addresses the requirements of NEPA and CEQA. The CEQA analysis directly addresses the significance thresholds contained in Appendix G of the CEQA guidelines. The environmental impact assessment addresses the following:

- 5.1 Aquatic Biological Resources
- 5.2 Terrestrial Biological Resources
- 5.3 Human and Ecological Exposure
- 5.4 Water Resources
- 5.5 Greenhouse Gases and Climate Change
- 5.6 Recreation
- 5.7 Wilderness Values and Management
- 5.8 Economic Resources
- 5.9 Environmental Justice
- 5.10 Comparison of Alternatives

Each subsection addresses the current regulatory environment, significance thresholds, and direct and indirect impacts of each alternative selected for detailed environmental analysis. In addition, each subsection evaluates the environmental impacts of the alternatives as described in Chapter 3.0, Project Alternatives, including the No Action alternative.

Chapter 6.0, Other Required Disclosures, provides information required by NEPA and CEQA, including:

- Relationship between Short-term Uses of the Environment and Maintenance and Enhancement of Long-term Productivity (Section 6.1)
- Unavoidable Adverse Effects (Section 6.2)
- Irreversible and Irretrievable Commitments of Resources (Section 6.3)
- Growth-Inducing Impacts (Section 6.4)
- Cumulative Effects (Section 6.5)

IMPACT SIGNIFICANCE TERMINOLOGY

For each resource evaluated, the key environmental issues and criteria for determining whether an adverse impact is significant under CEQA are discussed first. Note that the USFWS does not address significance in the findings of its EIS documents, so significance language is primarily a CEQA requirement. A “significant impact” is defined as:

> *a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant*. (CEQA Guidelines §15382)

The environmental impact analysis section for each resource defines the criteria used to judge whether an impact is significant. These criteria include the “Mandatory Findings of Significance” set forth in CEQA Guidelines §15065, as well as relevant criteria set forth in the Initial Study checklist (CEQA Guidelines, Appendix G), agency regulatory standards, or other criteria relevant to the specific Action. The significance terminology for adverse impacts should only be used with the CEQA conclusion of impact. The term “beneficial” is a NEPA term, and can be used to mean a beneficial impact if applicable. Otherwise, the conclusions for impacts or effects under NEPA are “adverse” or “no impact.”

In describing the significance of adverse impacts or a beneficial effect, the following categories of significance are applied, based on the best professional judgment of the EIS/EIR preparers:

- **Significant and Unavoidable**: An impact that cannot be avoided or reduced to below the threshold level, given reasonably available and feasible mitigation measures. Such an impact is irreversible. (It requires a Statement of Overriding Considerations by CDFG, if the ~~a~~Action is to be approved).
- **Significant but Mitigable**: An impact that can be reduced to below the threshold level (i.e., to less-than-significant) given reasonably available and feasible mitigation measures. The statement is made that the particular impact is significant, but with the application of the specific mitigation measure, the impact can be reduced to less-than-significant. (Such an impact requires findings to be made by CDFG).
- **Less-than-Significant**: An impact that may be adverse but does not exceed the threshold levels and does not require mitigation measures. However, mitigation measures that could further lessen the environmental effect may be suggested if such measures are readily available and easily achievable. The appropriate use is: the impact is less-than-significant or there is a “less-than-significant impact.”
- **No Impact**: Where an impact is neutral or is clearly deemed “no effect,” the preparer uses this term.
- **Beneficial**: This is a NEPA term for an effect that would have a positive impact on the environment, such as reducing an existing environmental problem or minimizing potential hazards to animals and/or humans.

Impacts that “may be significant” or “potentially significant,” given some level of uncertainty are treated as “significant.” Furthermore, uncertainty is also expressed with “could” rather than "would" as appropriate. Uncertainty is usually attributable to the limited availability of data or limitations in the application of mathematical models. Nevertheless, this EIS/EIR takes a conservative approach under these uncertain circumstances, and the impact is identified as significant under CEQA.

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5.1 AQUATIC BIOLOGICAL RESOURCES

This section describes the existing aquatic biological resources associated with the proposed project area and assesses the potential impacts of the proposed Action and alternatives on those resources. Aquatic biological resources, for the purpose of this assessment, include fish, aquatic invertebrate taxa ~~species~~, and riparian habitats. Amphibians are addressed in Section 5.2, Terrestrial Wildlife Resources.

This impact assessment incorporates information presented in the Biological Assessment prepared by USFS (2002) and the Biological Opinion prepared by the USFWS (2003). These documents assessed the potential effects of the proposed Action on species warranting protection under ESA and other sensitive species that may occur within the proposed treatment area (refer to Figure 3-1). Specifically, aquatic species evaluated in the Biological Assessment included Paiute cutthroat trout and Lahontan cutthroat trout. Additional information was needed to provide a more comprehensive analysis of the potential effects of the proposed Action. Therefore, this impact analysis incorporates background information contained in the Revised Recovery Plan (USFWS 2004), historic USFS and CDFG reports (e.g., Behnke and Zarn 1976, Ryan and Nicola 1976), CDFG benthic macroinvertebrate studies (Trumbo et al. 2000a), and a recent USFS-commissioned report (Vinson and Vinson 2007) on the impacts of past rotenone treatments on Silver King Creek benthic macroinvertebrates.

5.1.1 Environmental Setting/Affected Environment

The Silver King Creek Watershed is located in eastern California (Figure 1-1). Aquatic habitat in the watershed includes Silver King Creek (a major tributary to the East Fork Carson River), six tributaries, and Tamarack Lake. Silver King Creek originates at approximately 9,600 feet above msl and flows approximately 14 miles to the confluence with East Fork Carson River. Silver King Creek flows through sub-alpine glacially formed meadows. Lodgepole pine forests transition to mountain mahogany and western junipers on the drier, upper slopes above the stream. Aspen groves and willows dominate the riparian zones adjacent to the stream. For the purposes of this analysis, the watershed has been divided into three major segments (Figure 5.1-1):

- Upper Silver King Creek – the watershed upstream of Llewellyn Falls, where Silver King Creek drops 20 feet. This area includes a 4 mile long reach of Silver King Creek flowing through Upper Fish Valley, and the tributaries of Fly Valley Creek, Four Mile Canyon Creek, and Bull Canyon Creek.
- Silver King Creek Valley (the treatment area) – a 6 mile long reach bounded by Llewellyn Falls at the upper end and Silver King Canyon at the lower end. Silver King Creek flows through Lower Fish Valley and Long Valley. The gradient in this reach is lower than in Upper Fish Valley. Tributaries in this reach include Tamarack Lake Creek, an unnamed tributary, Tamarack Creek, and Corral Valley/Coyote Valley Creek. Tamarack Lake is a 5-acre lake at the upper end of Tamarack Lake Creek.
- Silver King Canyon to confluence (~~also~~ includes a portion of the treatment area) - approximately 1.7 miles below the mouth of Corral Valley/Coyote Valley Creek, Silver King Creek descends through Silver King Canyon. At the bottom of the canyon, Snodgrass Creek joins Silver King Creek, which flows another 3.4 miles to its confluence with the East Fork Carson River.

The Silver King Creek Watershed lies within the boundaries of the Carson-Iceberg Wilderness. Resource uses within the wilderness area are generally restricted (see below). Historically, however, aquatic resources in the watershed have been affected by timber harvest, log transport, mining, livestock grazing, and recreational fishing. The earliest known activity in the Silver King Creek Watershed occurred during the Comstock era in the late 1800s when the area was logged (Deinstadt et al. 2004). Logs were transported downstream via Silver King Creek using splash dams, whereby the dam was breeched and the flow transported the logs downstream.

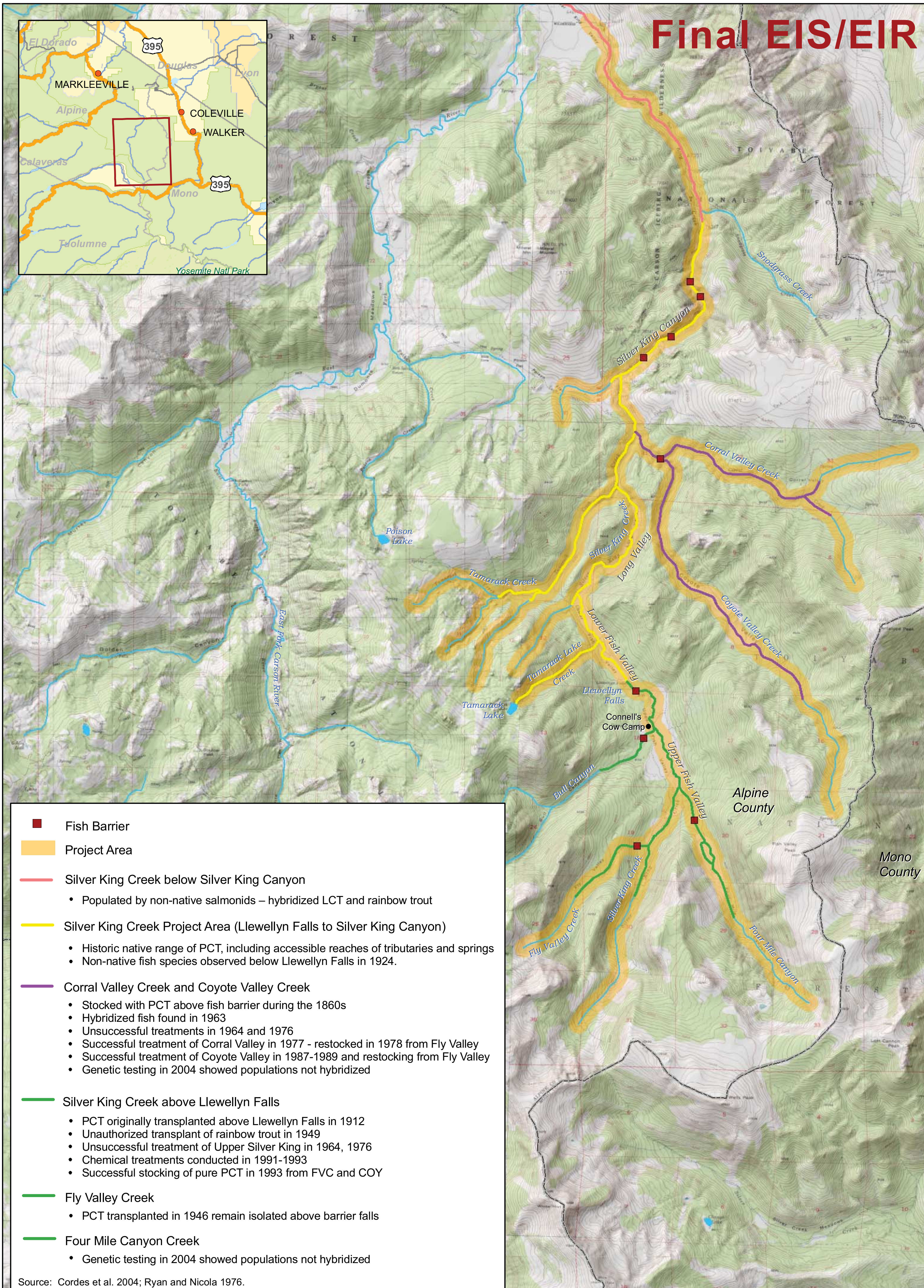
The area was used for cattle grazing from the turn of the 19th century until 1994 (Deinstadt et al. 2004). Beavers have also disturbed the hydrology and habitat in the watershed, particularly in Four Mile Canyon Creek and Fly Valley Creek. Several habitat improvement projects were completed by the Agencies in Upper Fish Valley and tributaries to Silver King Creek in the 1980s. Fish barriers were improved in Four Mile Canyon Creek and beaver dams were demolished near the mouth of Fly Valley and Silver King Creeks. In the early 1980s, the USFS re-connected an old diversion structure to a secondary channel adjacent to Silver King Creek at the upper end of Upper Fish Valley to provide additional spawning habitat for ~~Pauite~~ Paiute cutthroat trout to offset the impacts from cattle grazing and beaver dams. Designation of the Carson-Iceberg Wilderness Area in 1984 resulted in the prohibition of logging and other activities requiring vehicle access or motorized equipment. The grazing allotment has been at rest since 1994 and vegetation and habitat conditions have been improving (see Section 5.1.1.2, Riparian Habitat below). Stream width to depth ratios have continually decreased (channel narrowing) and mean stream depths have increased as a result of the lack of grazing (Overton et al. 1994, Flint 2004)~~CDFG 1998)~~.

Although logging and grazing have ceased, the proposed treatment area is still subject to natural disturbance from large storms and snowmelt that may result in occasional floods, drought, forest fires, and subsequent erosion, resulting in bank destabilization, scouring of bottom sediments, as well as transport and deposition of sediments. These effects create a mosaic of patchy, dynamic habitats that support diverse and resilient communities of aquatic and terrestrial flora and fauna.

The Silver King Creek Watershed has been affected by a long history of fish transplants and chemical treatments (reviewed by Cordes et al. 2004). Non-native fish species, including rainbow trout have been introduced in areas above and below Llewellyn Falls. The native Paiute cutthroat trout was saved by being transplanted above Llewellyn Falls (1912) and barriers in Corral Valley (1860s), Four Mile Canyon (pre-1956), and Fly Valley Creeks where they were isolated from non-native trout (1947~~6~~) (Behnke 1992, Ryan and Nicola 1976, Moyle et al. 2008). Between 1964 and 1993, rotenone treatments have been applied to several reaches and tributaries in the watershed (Flint et. al. 1998, Cordes et al. 2004, Vinson and Vinson 2007). A more detailed description of past trout management activities in Silver King Creek Watershed is provided below and summarized in Table 5.1-1.

Streams in the treatment area have been or are planned for use as unimpaired references to help the Water Board establish biocriteria for water quality standards (LRWQCB 1995). However, Silver King Creek has already been treated with rotenone multiple times in the past, as recently as 1993. In addition, throughout the majority ~~first half~~ of the 20th century, the Silver King Creek Watershed was grazed ~~by cattle~~.

The following subsections describe existing aquatic and riparian habitats and fish and benthic invertebrate populations in the proposed treatment area.



ENTRIX
ENVIRONMENTAL CONSULTANTS

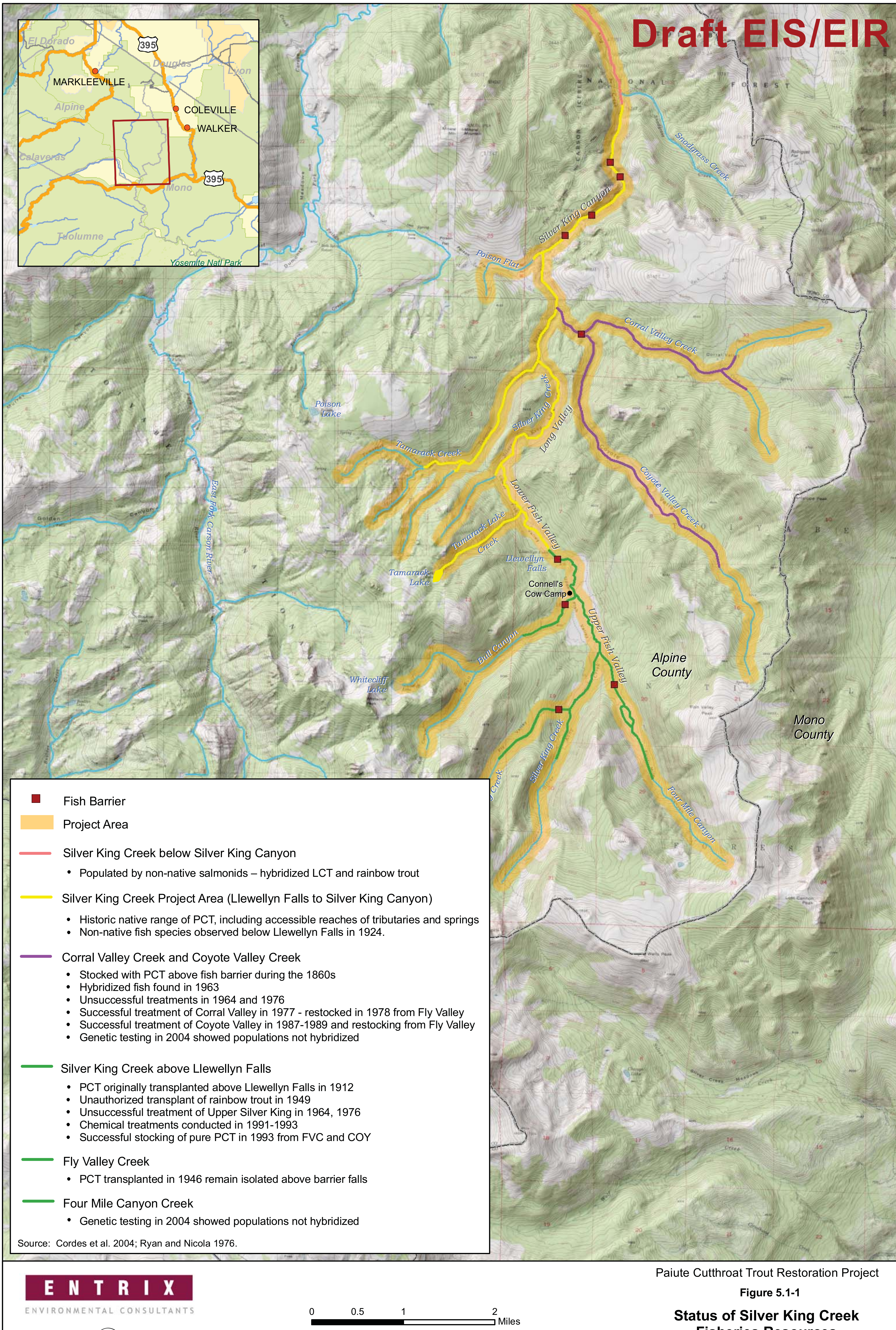
0 0.5 1 2 Miles

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

Paiute Cutthroat Trout Restoration Project

Figure 5.1-1

Status of Silver King Creek Fisheries Resources



ENTRIX ENVIRONMENTAL CONSULTANTS

Paiute Cutthroat Trout Restoration Project

Figure 5.1-1

Status of Silver King Creek Fisheries Resources

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

Table 5.1-1 History of Paiute Cutthroat Trout from mid-1800s to the Present

Year	Event	Description
Pre-1860s		Historical distribution of PCT in SKC from below Llewellyn Falls downstream to Silver King Canyon ~~Gorge~~
1860s	PCT Stock	Fishless COR and COY believed to be stocked with PCT from SKC below Llewellyn Falls
1860s to 1912	PCT Stock	Fishless FMC either stocked w/PCT or colonized from 1912 introduction above Llewellyn Falls
1912	PCT stock	PCT stocked into fishless upper SKC above Llewellyn Falls
1924		Hybrid RT/PCT and LCT/PCT noted in SKC below Llewellyn Falls
1946	PCT Stock	NFC stocked w/PCT from USKC, COR, and COY
1947	PCT Stock	Fishless FVC stocked w/PCT from COR and COY
1949	RT stock	Unauthorized introduction of RT into USKC , COR, COY
1955	LCT Stock	LCT stocked into Whitecliff Lake in Silver King watershed
1963		Hybrid RT/PCT found in COR and COY
1964	Chem	Unsuccessful chemical treatments of USKC, COR, COY, and BCC. Whitecliff Lake successfully treated. Hybrids found in NFC below a barrier
1966	Stock	Delaney Creek stocked from FVC and FMC
1968	PCT Stock	CC stocked w/PCT from NFC. Sharktooth Creek (Fresno County) stocked from Delaney Creek
1970		Unsuccessful chemical treatment of NFC
1972	PCT Stock	Stairway Creek (Madera County) stocked from Delaney Creek
1976	Chem	Unsuccessful chemical treatments of USKC and NFC
1976		RT/PCT hybrids found in USKC and NFC, but not FMC
1977	Chem	Successful chemical treatment of COR, unsuccessful in COY
1978	PCT Stock	COR stocked w/PCT from FVC
1980-83	Chem, PCT Stock	Successful chemical treatment of NFC. Restocked with NFC from above barrier
1984		CC population deemed not hybridized based on allozymes
1987-89	Chem, PCT Stock	Successful chemical treatment of COY. Restocked w/PCT from FVC
1991		COR, COY and FMC deemed not hybridized based on allozymes
1991-93	Chem	Successful chemical treatment of USKC in 3 consecutive years
1994-98	PCT Stock	USKC restocked w/PCT from FVC and COY
2004		No RT genes found in any of the PCT populations sampled by Cordes et al. (2004)

Source: Cordes et al. (2004, summarizing from Vestal (1964), Ryan and Nicola (1976), Flint (1989~~0~~), Busack and Gall (1981)) ~~and B. Somer CDFG pers. comm.~~

BCC = Bull Canyon Creek
CC = Cabin Creek (Mono County)
COR = Corral Valley Creek
COY = Coyote Valley Creek
FMC = Four Mile Canyon Creek
FVC = Fly Valley Creek
NFC = North Fork Cottonwood Creek (Mono County)
PCT = Paiute cutthroat trout
RT = Rainbow trout
SKC = Silver King Creek
USKC = Upper Silver King Creek (above Llewellyn Falls)

5.1.1.1 Aquatic Habitat

Silver King Creek and surrounding tributaries support various habitats ranging from steep canyon reaches with gradients as high as 23% (Tamarack Lake Creek) to low valley bottom meadows with gradients as low as 1% (Coyote Valley Creek) (USFWS 2004).

Habitat conditions in Silver King Creek (upstream of the proposed treatment area) and several confluent tributaries within the proposed treatment area were assessed in 1984, 1987, and 1990 (Duff 1985, 1988, 1991; USFWS 2004) and classified per Rosgen (1996). Most stream reaches were classified as low gradient, meandering, alluvial riffle-pool, channels with point bars and broad, well-defined floodplains and a gravel-dominated substrate (C3 channels as per Rosgen classification). Several tributaries had similar classifications, but had a silt/clay dominant substrate (C6 channels). These studies found improving post-grazing habitat conditions at all sampling locations; however, 12 of 21 stations had a Habitat Condition Index ranking of fair to poor. Hollow core sampling of substrates in Silver King Creek was conducted in 1984 and 1990 by an inter-agency team to assess fine sediment composition less than 6.35 mm (0.2 in.) (USFWS 2004, Appendix A). Duff (1991) recommended that the minimum amount of fine sediment should not exceed 30% and that natural fine sediment amounts in Silver King Creek fluctuated between 20 and 30%. Results of the interagency sampling effort revealed that fine sediment was constant between 1984 and 1990 (39.3 and 39.4%, respectively) (USFWS 2004, Table A2).

5.1.1.2 Riparian Habitat and Wetlands

Riparian zones are floristically and structurally diverse, with relatively high species richness, biomass, and structural complexity that, in turn, support a great diversity of mammal, bird, reptile, and amphibian species. Riparian zones along river networks possess important ecological properties, far in excess of their spatial extent. They are regarded as one of the biosphere's most complex ecological systems but also one of the most important for maintaining the vitality of landscapes (Décamps et al. 2004). Riparian vegetation is an important component of Paiute cutthroat trout habitat, providing streamside cover and shade, supplying terrestrial insects, and contributing to stream bank stability and sediment routing.

The riparian vegetation along Silver King Creek (8,000 - 9,000 feet elevation) prior to grazing was likely dominated by willows along the main creek channel and various native sedges, grasses, and forbs with willows patchily distributed along abandoned side channels, high flow channels, and side seeps in the wider valley reaches (Winward ~~et al.~~ 1984). Historical livestock grazing practices have degraded the quality of the riparian habitat along the creek. During the 1980s, the numbers of livestock and time periods of grazing were restricted in an attempt to restore the riparian and in-stream habitats (Deinstadt et al. 2004~~1994~~). All grazing activities in the watershed were discontinued in the summer of 1994 (USFWS 2008 ~~2007~~).

A survey was conducted in 1984 along Silver King Creek to assess the riparian vegetation, evaluate its condition, and provide recommendations for management to improve Paiute cutthroat trout habitat (Winward ~~et al.~~ 1984). The riparian community then was dominated by sedge and grass species, including: Rocky Mountain sedge (*Carex scopulorum*), Nebraska sedge (*C. nebraskensis*), water sedge (*C. aquatilis*), rusty sedge (*C. subfusca*), winged sedge (*C. microptera*), beaked sedge (*C. rostrata*), Kentucky bluegrass (*Poa pratensis*), tufted hairgrass (*Deschampsia caespitosa*), red fescue (*Festuca rubra*) and western needlegrass (*Stipa occidentalis*). Willow species that dominated the canopy layer were interspersed (not continuously present) and included Geyer willow (*Salix geyeriana*), Lemmons willow (*S. lemmoni*), blueberry willow, (*S. boothii*), Eastwoods willow (*S. eastwoodiae*), Sierra willow (*S. crestera*) and little willow (*S. planifolia*). The quality of the riparian habitat in 1984 was clearly degraded by livestock practices, including severely grazed young willows sprouts and apparent reduced minimal successful regeneration. A transition from the native sedges to non-native species as Kentucky bluegrass and other invasive forbs had occurred along the creek. Winward ~~et al.~~ (1984) provided recommendations for changes in livestock grazing along the creek to improve the riparian habitat to benefit Paiute cutthroat trout. Willow recovery was expected within 3-5 years, with recovery of native grasses and sedges expected to take longer.

Riparian and stream channel response to modification and cessation of livestock grazing practices was assessed in Upper Fish Valley and Lower Fish Valley from 1999 through 2002 (Flint 2004). Willows were responding positively, compared with conditions in 1984. Successful expansion of the willow community and regeneration was observed on in-stream features and floodplains. Sedges and other vegetation also had established and expanded, contributing to stabilization of the stream bank and in-stream depositional features.

Limited habitat monitoring has been conducted within Silver King Creek since 1991, when USFS researchers conducted surveys of select grazed and ungrazed stream reaches (Overton et al. 1994). Their report provides grazing history, descriptions of cattle exclusion fencing, stream channel descriptions, and evaluation of bank condition and riparian vegetation. Comparisons of grazed areas with reference reaches revealed that, in 1991, the stream was still exhibiting signs of grazing effects as several stream habitat parameters were still below regional and in-basin standards. USFS concluded that changes in bank conditions should be observable within 2-4 years, as vegetation recovered from grazing (Overton et al. 1994).

5.1.1.3 Aquatic Biota

FISH

California has a great diversity of native trout (Behnke 1992). Moyle et al. (2008) lists 10 extant trout species and the extinct bull trout, a char (*Salvelinus confluentus*). These trout range from the familiar coastal rainbow trout (*O. mykiss irideus*) to the interior McCloud River redband (*O. m stoneii*) and California golden trout (*O. m. aguabonita*), and three sub-species of cutthroat trout: ~~(~~Lahontan (*O. c. henshawi*), Paiute cutthroat trout, and the coastal cutthroat (*O. c. clarkii*). Many native trout populations, however, have declined in abundance and geographical distribution during the last 200 years and are at risk of extinction. Presently, all of these trout species carry a status of state species of special concern, Federal sensitive species, state and/or federally-listed as threatened, or some combination thereof (Moyle et al. 2008). The actions evaluated in this EIS/EIR are part of a directed effort to conserve and recover federally threatened Paiute cutthroat trout within their historical range (refer to USFWS 2004). The following subsection describes the evolution of trout species in the Great Basin and the trout species that occur in the proposed treatment area, species range and status, and a brief history of their management.

Cutthroat trout became established in the Lahontan Basin long before the last glacial epoch, perhaps during the mid-Pleistocene Epoch (Behnke 1992). The Lahontan cutthroat trout arose from this epoch and has given rise to four forms, including the Humboldt and Paiute forms in the Lahontan Basin. During the last ice age, about 10,000 to 70,000 years ago, and during previous Pleistocene periods of glaciation, large lakes existed in separate basins. About 8,000 years ago, these lakes shrank, leaving behind remnant waters. The Lahontan cutthroat trout and its forms were able to persist in remnant populations until recent times, but they have shown themselves to be poorly suited to compete with non-native strains of highly stream-adapted trout with different life histories and behaviors, and most of their remnants have disappeared since non-native trout were introduced to the Great Basin (Behnke 1992).

Three Great Basin forms of cutthroat trout remain, including Paiute, Lahontan and Bonneville cutthroat trout. Paiute cutthroat trout are a recent derivative of Lahontan cutthroat trout and are meristically different from them by the near absence of spots on their body (Moyle 2002). Paiute cutthroat trout were derived in relatively recent geological times after a population was isolated in Silver King Creek ~~(Behnke 1992)~~, and likely became established as a distinct sub-species in Silver King Creek between 5,000 and 8,000 years ago (Behnke 1992).

The species currently inhabiting the proposed treatment area, including hybridized Paiute cutthroat trout and rainbow trout, mountain whitefish (*Prosopium williamsoni*), and Paiute sculpin (*Cottus beldingi*) are described below. The proposed Action seeks to remove rainbow trout and Paiute cutthroat trout/rainbow trout hybrids from ~~Silver King Creek above Silver King Canyon~~ the drainage. This would allow re-establishment of a genetically putative "pure" population of Paiute cutthroat trout and restore a species to its entire historical range as recommended in the Revised Recovery Plan (USFWS 2004). The following life history descriptions were summarized from Moyle (2002) and Moyle et al. (2008) and were presented in the Biological Assessment (USFS 2002) and Biological Opinion (USFWS 2003). Information on Paiute cutthroat trout is also presented from the Paiute cutthroat trout 5-Year Review (USFWS 2008~~7~~) and the Revised Recovery Plan (USFWS 2004).

PAIUTE CUTTHROAT TROUT (O. CLARKII SELENIRIS)

Paiute cutthroat trout were first described by Snyder (1933) as an isolated variant of Lahontan cutthroat trout. The paragraphs below describe the status, range, and habitat requirements of Paiute cutthroat trout.

STATUS AND RANGE

Paiute cutthroat trout were first listed as endangered in 1967 under the Endangered Species Preservation Act of 1966 (USFWS 1967 ~~32 FR 4001~~). They were reclassified as threatened in 1975 under the ESA of 1973 (as amended) (USFWS 1975 ~~40 FR 29863~~). Due to the small and restricted populations that continue to face threats from catastrophic events such as floods, fires and non-native fish introductions, the USFWS recently determined that Paiute cutthroat trout continues to meet the definition of threatened (USFWS 2008~~7~~). Moyle et al. (2008) concluded that Paiute cutthroat trout have a high likelihood of extinction in their native watershed within the next 50 years without continued intense monitoring and management.

The historical distribution of the Paiute cutthroat trout is limited to 9.1 miles of habitat in Silver King Creek from Llewellyn Falls downstream to Silver King Canyon as well as the accessible reaches of three small named tributaries: Tamarack Creek, Tamarack Lake Creek, and the lower reaches of Coyote Valley Creek downstream of barrier falls. The extremely limited native range of the Paiute cutthroat trout, within a single watershed, presents a unique challenge for efforts to recover the sub-species and to address population-level threats. In the early part of the 20th century, Paiute cutthroat trout were eliminated from their presumed historical habitat through displacement and hybridization with introduced rainbow trout, golden trout, and Lahontan cutthroat trout (Moyle 2002).

Currently, Paiute cutthroat trout are found only where they have been introduced outside their historic range. They occupy approximately 20.6 miles of habitat in five widely-distributed drainages. The present distribution in the Silver King Creek Watershed consists of populations in Upper Silver King Creek above Llewellyn Falls (2.7 miles total), Fly Valley Creek (1.1 miles), Four Mile Canyon Creek (1.9 miles), and Bull Canyon Creek (0.6 miles), as well as below the falls including Coyote Valley Creek (3.0 miles) and Corral Valley Creek (2.2 miles). All of these areas were historically fishless (USFWS 2004). The Agencies have established 4 self-sustaining, putative pure populations outside the native drainage in the

North Fork of Cottonwood Creek (3.4 miles), Cabin Creek (1.5 miles) (Inyo National Forest, Mono County), Stairway Creek (2 miles) (Sierra National Forest, Madera County), and Sharktooth Creek (2 miles) (Sierra National Forest, Fresno County). The range of Paiute cutthroat trout was extended into the upper reaches of Silver King Creek and its tributaries by one or more unofficial transplants of fish above Llewellyn Falls starting in 1912 (reviewed by Behnke and Zarn 1976, Ryan and Nicola 1976, Moyle 2002). The current distribution of Paiute cutthroat trout reflects decades of management efforts to expand the sub-species beyond its native range, ~~conserve the species within its native watershed,~~ but does not include their historical ~~and presumably stable~~ distribution. Cordes et al. (2004) provide a comprehensive documentation of the known history of Paiute cutthroat trout management activities with associated genetic and/or population consequences (Table 5.1-1).

Approximately 1,020 adult Paiute cutthroat trout reside in the Silver King Creek drainage, based on CDFG population assessments in 2001 (USFWS 2004). CDFG estimated approximately 424 fish in the Upper Silver King Creek above Llewellyn Falls, and an effective population size of 400-700 fish in Four Mile Canyon, Fly Valley and Corral Valley Creeks combined.

CDFG investigated the falls in Silver King Canyon to be a potential factor in isolating fish above Silver King Canyon and allowing speciation (Heise 2000). This series of falls presents a formidable barrier to upstream fish movement (Figure 5.1-2) including a high gradient channel with large boulders and numerous vertical drops in excess of five feet and one drop of approximately ten feet. CDFG concluded these features most likely constitute a total barrier to fish passage (Heise 2000). Although high flow conditions could reduce these waterfalls to heights of less than 6 feet (generally considered a total barrier to fish passage) and ideal wave conditions could seasonally occur to facilitate fish jumping performance, CDFG concluded that the magnitude of the barriers, the narrowness of the gorge, the slope of the stream channel, and the potential for inhibiting air entrainment and water turbulence would prevent fish passage at Silver King Canyon (Heise 2000).

Figure 5.1-2 Barrier Falls in Silver King Canyon (CDFG 2000)

EXISTING GENETIC STRUCTURE

Paiute cutthroat trout are genetically and meristically (physically) similar to Lahontan cutthroat trout from which they recently diverged. Behnke and Zarn (1976) concluded that the separation of Paiute cutthroat from Lahontan cutthroat trout occurred relatively recently (no more than 5,000 to 8,000 years ago), following the desiccation of Lake Lahontan.

Paiute cutthroat trout have limited genetic variability, due in part to the bottleneck and founder effects when Paiute cutthroat trout were originally isolated from a common ancestor with Lahontan trout and/or more recent bottlenecks resulting from small number of fish typically used as transplant stocks (Nielsen and Sage 2002, Cordes et al. 2004). Genetic analyses could not discriminate Paiute cutthroat trout from Lahontan cutthroat trout (Busack and Gall 1981, Finger et al. 2009 ~~2008~~). Investigations of population genetic structure of the Lahontan group of cutthroat trout (Lahontan, Paiute, and Humboldt cutthroat trout) detected no unique alleles in Paiute cutthroat trout (Nielsen and Sage 2002).

Genetic studies evaluated levels of rainbow trout hybridization and relationships among ~~9~~ nine populations of Paiute cutthroat trout (Cordes et al. 2004, Finger et al. 2009 ~~2008~~). These studies indicate that past efforts to remove trout hybrids in several creeks in the Silver King Creek Watershed have been successful. The results of Cordes et al. (2004) suggest that none of the ~~9~~ nine populations tested have undergone recent hybridization with rainbow trout. These populations of putative ~~"~~pure~~"~~ Paiute cutthroat trout include populations in the Silver King Creek Watershed (Fly Valley Creek, Upper Silver King Creek, Four Mile Canyon Creek, Bull Canyon Creek, Coyote Valley Creek, and Corral Valley Creek) and populations established in other watersheds (North Fork Cottonwood Creek (Mono County), Cabin Creek (Mono County), Stairway Creek (Madera County), and Sharktooth Creek (Fresno County). The genetic similarities among the populations reflect the past history of stocking and management (Figure 3 in Cordes et al. 2004). In contrast, the fish residing in Silver King Creek downstream of Llewellyn Falls, including Tamarack Creek are non-native hybrids of rainbow trout and California golden trout, comprised mostly of rainbow trout (Finger et al. 2009 ~~2008~~). Very little remains of cutthroat trout (Paiute or Lahontan) genetic influence in the proposed treatment reach (Finger et al. 2009 ~~2008~~). Cordes et al. (2004) concluded that all extant populations of Paiute cutthroat trout should be considered part of a single management unit with regard to restoration, and recommended that restocking should ideally consist of large numbers of fish from multiple donor populations with as much genetic variation as possible in order to minimize loss of diversity and the effects of inbreeding.

Continuing to preserve a fragmented population structure potentially reduces overall species viability (Spruell et al. 1999, Rieman and Dunham 2000). Management of small populations with low genetic diversity presents one of the most challenging conservation problems for managers. The USFWS (2004) has identified potential recovery activities to reduce the threat of genetic introgression from non-native trout by removing non-native trout in Silver King Creek from Llewellyn Falls downstream to Silver King Canyon (Priority 1 rating), and to increase population viability by reintroducing Paiute cutthroat trout to this area once non-native trout have been removed (Priority 1 rating) and protecting stream habitat in the Silver King Creek Watershed (Priority 2 rating).

HABITAT AND LIFE HISTORY REQUIREMENTS

Paiute cutthroat trout life history and habitat requirements are similar to those reported for other western stream-dwelling salmonids. All life stages require cool, well-oxygenated waters. Adult fish prefer stream pool habitat in low gradient meadows with undercut or overhanging banks and abundant riparian vegetation. Pools are important rearing habitat for juveniles and act as refuge areas during winter (Hickman and Raleigh 1982, Swales et al. 1986, Berg 1994). During the winter months, trout move into pools to avoid physical damage from ice scouring (Scrimgeour et al. 1994) and to conserve energy (Everest and Chapman 1972, Cunjak 1996). As with other salmonids, suitable winter habitat may be more restrictive than summer habitat (Jakober et al. 1998). Paiute cutthroat trout survive in lakes, but there is no evidence that they ever occurred naturally in any lakes within the Silver King Creek Watershed.

Paiute cutthroat trout spawn in flowing waters with clean gravel substrates (USFWS 2004). They reach reproductive maturity at the age of 2 years. Peak spawning activity occurs in June and July. The eggs hatch in 6 to 8 weeks and the fry emerge from the gravel in another 2 to 3 weeks. Young-of-the-year fish rear in mainstem shoals or backwaters, and often move into intermittent tributary streams until they reach about 50 mm in length. Like other trout, Paiute cutthroat trout feed mostly on drift, typically a mixture of terrestrial and aquatic insects (Moyle 2002).

EXISTING THREATS

Currently, the greatest threat facing Paiute cutthroat trout is loss of genetic diversity due to hybridization with non-native trout, compounded by its extremely limited distribution and lack of metapopulation connectivity (USFWS 2004, Moyle et al. 2008). The long-term survival of the current populations is uncertain due to the small size of the drainages and populations, limited genetic diversity, and no hydrologic connections between populations. These key threats are discussed further below.

Historic threats include habitat loss due to past livestock grazing practices, introduction of rainbow trout, unregulated angling, and habitat alteration due to introduced beavers (USFWS 2004). Although some habitat improvement has occurred in Silver King Creek due to changes in grazing management, similar threats still exist (USFWS 2004). Recreation occurs in and around Paiute cutthroat trout streams. Heavy recreation poses a risk to stream bank stability and trout habitat. Introduced trout pose the greatest risk to the sub-species. Effective fish barriers occur downstream of all remaining populations, but the threat of humans moving other trout species into these protected reaches continues. An ill intentioned angler could easily catch a rainbow trout and release it above Llewellyn Falls, involving a transport of the fish of only a few hundred feet. This action would unravel decades of restoration efforts and place the populations of Paiute cutthroat trout in Upper Fish Valley and Four Mile Canyon Creeks at risk. A similar action could also impact the Paiute cutthroat trout populations in Coyote Valley and Corral Valley Creeks. Conducting the proposed Action would substantially reduce these risks by removing non-native trout from the Silver King Creek Watershed above the Silver King Canyon and greatly increasing the distance that fish would have to be moved (Rahel 2004).

1. THREAT OF HYBRIDIZATION

Paiute cutthroat trout are threatened with loss of genetic integrity through hybridization with non-native trout. Like their Lahontan cutthroat trout ancestors, Paiute cutthroat trout are vulnerable to replacement by or hybridization with non-native trout and must be maintained in isolation if they are to be preserved (Behnke 1992). Cutthroat trout will hybridize with rainbow trout through introductions of rainbow trout into interior basins (Moyle 2002).

If Paiute cutthroat trout occurred only in currently occupied habitat, this species would remain highly vulnerable to extinction because: 1) genetic diversity could be dramatically reduced by a catastrophic event within any of the five drainages; 2) populations could become quickly introgressed as the result of an unauthorized introduction of other trout; and 3) genetic diversity could be subjected to additional severe bottlenecks due to inadequate population size. However, reintroduction of Paiute cutthroat trout to historical habitat, in combination with maintaining populations existing upstream of Llewellyn Falls and out-of-basin, will substantially reduce these extinction threats.

While some Paiute cutthroat trout populations within the Silver King Creek drainage have had immediate genetic threats lessened, the genetic threat of introgression by rainbow trout and other con-specifics persists within the historical range of Paiute cutthroat trout. Efforts to restore putative pure populations of Paiute cutthroat trout above Llewellyn Falls appear to have been successful. The population in Fly Valley Creek has remained isolated by a barrier falls. Hybridized trout have been removed by chemical treatments from Upper Silver King Creek, Four Mile Canyon Creek, Fly Valley Creek (downstream of the fish barrier), Bull Canyon Creek, Corral Valley Creek, and Coyote Valley Creek. However, trout populations in the mainstem of Silver King Creek downstream of Llewellyn Falls still present a genetic threat. Deinstadt et al. (2004) characterize the trout population in this reach as a “hybrid swarm” of Paiute cutthroat trout, Lahontan cutthroat trout, rainbow trout, and golden trout. Here, the population density was one of the highest in their regional survey of trout populations (1,478 fish per mile). A recent genetic study of the fish population downstream of Llewellyn Falls found rainbow trout and golden trout hybrids, with little evidence of cutthroat trout genetics (Finger et al. 2009 ~~2008~~). This hybrid population dominates the core area for expansion of Paiute cutthroat trout, acts as the primary mechanism isolating and fragmenting Paiute cutthroat trout populations in the Silver King Creek drainage, and remains a genetic threat to the species and a limit for recovery efforts unless removed.

2. Threat of Fragmented Populations

Isolated populations such as the remaining Paiute cutthroat trout populations are vulnerable to extinction through stochastic factors such as random fluctuations in birth and death rates variation in environmental conditions, catastrophic events such as floods and fire, loss of genetic diversity from small population size, and human disturbance including introduction of non-native species (Hedrick and Kalinowski 2000, Lande 2002, Reed and Frankham 2003, Pringle 2006, Cordes et al. 2004). Completely isolated populations are the most severe form of fragmentation, because no gene flow occurs, resulting in inbreeding and reduction of population fitness (Hedrick and Kalinowski 2000, Reed and Frankham 2003, Frankham 2005, Scribner et al. 2006, Pritchard et al. 2007, Guy et al. 2008).

3. Threat of Limited Range/Occupied Habitat

Paiute cutthroat trout were able to persist and evolve for 5,000-8,000 years in their historical range of 9.1 miles of Silver King Creek and tributaries below Llewellyn Falls (USFWS 2004). They currently occur in separate populations isolated by waterfalls and occupying shorter stream reaches ranging 1.1-3.5 miles in length (USFWS 2004). Given the current literature in trout population ecology, the existing small isolated populations of Paiute cutthroat trout are not large enough to sustain the sub-species in the long term. In general, population viability of cutthroat trout is correlated with stream length or habitat size (Hilderbrand and Kershner 2000, Hildebrand 2003, Harig and Fausch 2002, Young et al. 2005). Stream length is important because trout move throughout streams searching for necessary microhabitats for spawning, rearing, refuge, and migration (Baltz et al. 1991, Fausch and Young 1995, Young 1996, Muhlfeld et al. 2001, Schmetterling 2001, Hilderbrand and Kershner 2004, Schrank and Rahel 2004, Colyer et al. 2005, Neville et al. 2006, ~~Umak~~ Umek 2007).

Longer stream reaches have more complexity and have a higher probability of supplying sufficient amounts of microhabitats than shorter reaches (Horan et al. 2000, Harig and Fausch 2002, Dunham et al. 2003). Larger, more connected habitat patches also decreases the likelihood of stochastic events (i.e., fire, flood, drought) from negatively impacting a population.

Hilderbrand and Kershner (2000) estimated 8.2 km (5.1 mi) were required to maintain a population of 2,500 cutthroat trout when fish abundance was high [300 fish/km (484 fish/mi)]. Adding a 10% loss rate of individuals, to account for emigration and mortality, increased the required length up to 9.3 km (5.8 mi) in order to maintain 2,500 fish. For streams with smaller population sizes of 200 fish/km (320 fish/mi) and 100 fish/km (160 fish/mi), the corresponding length increased to 12.5 (7.8 mi) and 25 (15.5 mi) stream km, respectively (Hilderbrand and Kershner 2000). Young et al. (2005) found that to maintain a population of 2,500 cutthroat trout, 8.8 km (5.5 mi) of stream was needed. Therefore, implementation of the proposed Action should provide adequate habitat for the long-term viability of Paiute cutthroat trout once non-native trout have been removed from the system.

RAINBOW TROUT (O. MYKISS)

Rainbow trout are the most abundant and widespread native salmonid in western North America, and were originally native to Pacific coast streams from Alaska to Baja California (Moyle 2002). They are the most widely distributed fish in California and their natural distribution has been greatly expanded by transplants into most coldwater streams and lakes, including many waters that were originally fishless (Moyle 2002). In fact, rainbow trout have been introduced into coldwater streams throughout most of the world. Rainbow trout are present in the project area as a relic population from stocking and as introgressed hybrids with golden trout and Lahontan and Paiute cutthroat trout (Finger et al. 2009 ~~2008~~). They are not the subject of conservation efforts in the project area and are likely of mixed stock lineage used in regional hatchery programs.

Rainbow trout have adapted to a wide variety of habitats and have flexible life history patterns. They prefer streams with clear, cool, fast flowing water and ample aquatic cover such as riparian vegetation or undercut banks. In small streams and high mountain lakes, rainbow trout seldom live longer than six years of age or grow to be larger than 16 inches (40 cm) total length. Most wild rainbow trout reach sexual maturity in their second or third year. They spawn between February and June in the gravel of riffles. As fish grow in size, habitat use generally shifts from riffles for the smallest fish to runs for intermediate sized fish and pools for the largest fish. Stream dwelling fish feed mostly on drifting invertebrates, but will also feed on benthic invertebrates. Rainbow trout in lakes can feed on zooplankton, benthic invertebrates, or small fish.

Rainbow trout often dominate other salmonids. They are highly aggressive and often defend feeding territories in streams. Moyle (2002) concluded that “indiscriminate planting of rainbow trout has led to loss through hybridization of many populations of rainbow, redband, and golden trout, as well as of cutthroat trout.”

TROUT MANAGEMENT IN SILVER KING CREEK

Silver King Creek has a long and complicated history of trout management (Table 5.1-1, Cordes et al. 2004). Four different trout species have been moved into and around the proposed treatment area, including Paiute cutthroat trout, Lahontan cutthroat trout, golden trout, and rainbow trout (USFWS 2004). Ironically, Paiute cutthroat trout are now extirpated from their historic habitat due to introduced trout, but exist in formerly fishless areas of the Silver King Creek Watershed above passage barriers. This subsection presents a history of trout management in Silver King Creek, including the establishment of trout in the basin and proposed treatment area, the species stocked, the hybridization that has occurred, past rotenone treatments, and the status of the existing fish populations.

Sometime in the 1860s or 1870s, Paiute cutthroat trout were transplanted from Silver King Creek into Corral Valley and Coyote Valley Creeks by loggers. In 1890, Virgil Connell (sheepherder) observed that there were no fish present above Llewellyn Falls. In 1912, a Basque sheepherder, Joe Jaunsaras, transported fish by bucket from Lower Fish Valley to Upper Fish Valley upstream of Llewellyn Falls. In 1914, golden trout were reportedly planted downstream of Llewellyn Falls in Silver King Creek. By 1924, the Paiute cutthroat trout that had been planted upstream of Llewellyn Falls and had established a robust population and the fishery downstream had become “mixed with other kinds, probably due to stocking” (Letter from Virgil Connell in Ryan and Nicola 1976).

CDFG’s involvement in Silver King Creek began shortly after Snyder’s description of the species in 1933 and 1934. The California Fish and Game Commission closed Silver King Creek to fishing in 1934 to protect this unique fishery. The fishery remained closed until 1952 when it was reopened. At the same time as Silver King Creek was reopened to angling, the Fish and Game Commission closed Coyote Valley and Corral Valley Creeks to angling. This closure remains in effect. Opening Silver King Creek to angling was a management tool that was employed in an attempt to fish out the hybrids and the rainbow trout that were inadvertently planted in 1949. The effect of opening the fishery to angling did not have the intended effect of removing the hybridized fish and rainbow stocks due to the Paiute cutthroat trout’s vulnerability to angling harvest. The fishery remained open to angling until 1965 when it was closed again to protect the remaining putative pure fish population following the 1964 chemical treatment. During the historic closure (1934 to 1952) and current closure (1965 to present), there was regular poaching of fish within the closed reaches of Silver King Creek. Actions taken by CDFG included the posting of wardens, stream guards and outreach to the U.S. military, which reduced this activity to a minimum. In 2005, the angling closure upstream of Llewellyn Falls was expanded to include a reach of stream from Llewellyn Falls downstream to the confluence of the outlet creek from Tamarack Lake. This was done to create a buffer zone between the putative pure Paiute cutthroat trout populations upstream of Llewellyn Falls and hybridized fish populations present in Silver King Creek to reduce the risk of an illegal introduction of hybridized trout by anglers.

The first concerted attempt at restoration of Paiute cutthroat trout in Silver King Creek upstream of Llewellyn Falls following the unauthorized introduction of rainbow trout (1949) was an unsuccessful chemical treatment in 1964. Chemical treatments in 1976 and 1977 were also performed; however, only Corral Valley Creek was successful. Another chemical treatment of Coyote Valley Creek was conducted in 1987 and 1988. This treatment was successful and in 1991 genetic analysis confirmed that these populations were not hybridized. A final suite of chemical treatments were conducted in the upper Silver King Creek system in 1991, 1992, and 1993. Post-treatment sampling and genetic analysis have confirmed the successful eradication of non-native trout and the establishment of putative pure Paiute cutthroat trout populations in Upper Fish Valley and the upper tributaries to Silver King Creek upstream of Llewellyn Falls (Cordes et al. 2004).

CDFG began attempts to stock fish into previously fishless waters in 1947 by transplanting Paiute cutthroat trout into Fly Valley and Bull Canyon Creeks upstream of Llewellyn Falls (Vestal 1947, Ryan and Nicola 1976). The transplant was successful in Fly Valley Creek but not in Bull Canyon Creek. CDFG also planted Paiute cutthroat trout into Leland Lakes (El Dorado County) in 1937 and North Fork Cottonwood Creek (Mono County) in 1946. The plant in Leland Lakes was later deemed unsuccessful, but the North Fork Cottonwood Creek plant persists (Ryan and Nicola 1976, Moyle et al. 2008). Fish were planted in many other waters around the State; however, only the plants into Cabin Creek (Mono County), North Fork Cottonwood Creek, Stairway Creek (Madera County), and Sharktooth Creek (Fresno County) were successful and the progeny of the original transplanted Paiute cutthroat trout remain genetically putative pure (Cordes et al. 2004).

Other fish species were also stocked in the Silver King Creek drainage, most notably a mistaken air plant of Lahontan cutthroat trout into Whitecliff Lake in 1955 and 1956. These fish were successfully removed by the 1964 treatment of Whitecliff Lake. As previously noted, there were numerous plants of rainbow, cutthroat and golden trout into Silver King Creek as of 1924 by a variety of entities. Fish stocking by CDFG is presented in Table 5.1-2.

Table 5.1-2 Department of Fish and Game fish stocking records for Silver King Creek Watershed (1930 to present)

Date	Trout Species	Number	Hatchery Source	Stocking location
Silver King Creek				
Aug 15 1930	Rainbow	5,000	Mt. Whitney	
Aug 18 1930	Steelhead	5,000	Mt. Whitney	
Aug 27 1931	Rainbow	10,000	Alpine	
Sep 15 1932	Rainbow	10,000	Alpine	
Aug 13 1933	Rainbow	10,000	Alpine	
July 20 1935	Brook	5,000	Alpine	
Sep 12 1935	Lahontan cutthroat	10,000	Alpine	
Aug 21 1946	Lahontan cutthroat	8,700	Hot Creek	Near Poison Valley
Sep 5 1947	Lahontan cutthroat	19,600	Hot Creek	Long Valley – Forks
Sep 6 1947	Lahontan cutthroat	19,600	Hot Creek	Forks – mouth
Sep 7 1947	Lahontan cutthroat	9,800	Hot Creek	Long Valley – forks
Sep 29 1949	Rainbow	8,400	Hot Creek	Below Llewellyn Falls
Sep 30 1949	Rainbow	5,040	Hot Creek	Above Llewellyn Falls
Aug 8 1951	Rainbow	6,010	Markleeville	Snodgrass Canyon above Corral Valley Creek
Aug 13 1952	Rainbow	5,017	Markleeville	U. Bagley Valley to Llewellyn Falls
Aug 7 1953	Rainbow	4,960	Markleeville	~2 miles above Vaquero Camp
Sep 23 1976	Rainbow	960	American	Lower Fish Valley
Sep 23 1976	Rainbow	2,900	American	Lower Fish Valley
1991	Rainbow-Paiute cutthroat-hybrid**	unknown		Lower Fish Valley
Coyote Valley Creek				
Aug 21 1946	Lahontan cutthroat*	1,740	Hot Creek	Lower Stream
Sep 7 1947	Lahontan cutthroat*	4,200	Hot Creek	Mouth to barrier

Source: CDFG stocking data, B. Somer.

*Lahontan cutthroat were also called black spotted cutthroat

**In 1991 prior to chemical treatment, multiple age classes of hybrid rainbow-Paiute cutthroat were rescued from Upper Silver King Creek and transported via helicopter to Lower Fish Valley

Tamarack Lake was likely historically fishless because of the steep drop of the outlet creek into Lower Fish Valley that contains numerous waterfalls. The lake has been stocked for recreational angling of golden trout and Lahontan cutthroat trout since 1955 (Table 5.1-3). Brook trout were reportedly stocked in 1968 but the success of these plants is unknown, and this species of trout has not been caught in CDFG net surveys. Various surveys have been conducted to evaluate the fish plants over the intervening years. In September, 1955, Mr. Robert Butler visited Tamarack Lake (CDFG file note, September 13, 1956) and reported “several redds were noted along the shore”. He also observed numbers of fish in the lake and collected one “cutthroat.” Gill nets set by CDFG staff during August 1974 caught five golden trout in two sinking nets; two other nets captured no fish. Mr. Eric Gerstung sampled Tamarack Lake with gill nets in August 1978 (CDFG file note Sep 21, 1978). He caught nine golden trout of “3 or more year classes.” He also observed “the three tributaries average less than a foot wide and are accessible to fish for about 50 feet each. The substrate is largely decomposed granite. No adults or fry were observed and no pools or cover are present. Spawning, if it occurs at all, most likely occurs in the mouths of the tributaries.” Mr. Ron Rogers visited the lake during July 1985 (CDFG file note July 22, 1985) and observed no fish, but found “frogs and tadpoles were fairly abundant, indicating few, if any, fish”. Mr. Rogers observed the inlet to be flowing at 0.5 to 1 cfs and that “limited spawning may be possible here.” Preceding the chemical treatment of Upper Fish Valley during 1991, approximately 800 rainbow-Paiute cutthroat hybrids were collected by electrofishing and stocked into Lower Fish Valley and Tamarack Lake using a helicopter. These non-native trout hybrids provided good fishing for anglers during the early and mid -1990s.

Table 5.1-3 Department of Fish and Game Fish Stocking Records for Tamarack Lake (1955 to Present)

Date	Trout Species	Number
1955	Lahontan cutthroat	1,005
1957	Lahontan cutthroat	1,000
1959	Lahontan cutthroat	1,035
1962	Lahontan cutthroat	1,020
1967	Lahontan cutthroat	4,000
1968	Brook	500
1968	Lahontan cutthroat	5,000
1969	Golden	1,018
1971	Lahontan cutthroat	4,000
1972	Golden	1,000
1973	Golden	1,141
1973	Lahontan cutthroat	3,600
1974	Golden	2,250
1975	Lahontan cutthroat	3,600
1976	Golden	2,272
1976	Lahontan cutthroat	4,000
1980	Lahontan cutthroat	4,200
1982	Lahontan cutthroat	4,000
1985	Paiute cutthroat	173
1987	Lahontan cutthroat	3,000
1987	Paiute cutthroat	100
1991	Rainbow-Paiute cutthroat- hybrid*	unknown

Source: CDFG stocking data, B. Somer.

Table 5.1-3 Department of Fish and Game Fish Stocking Records for Tamarack Lake (1955 to Present)

Date	Trout Species	Number
*In 1991 prior to chemical treatment, multiple age classes of hybrid rainbow-Paiute cutthroat were rescued from Upper Silver King Creek and transported via helicopter to Tamarack Lake.		

Stocking of golden trout in Tamarack Lake has contributed to the genetic composition of fish in Silver King Creek. Genetic analysis of rainbow trout collected in 2006 at various locations in Silver King Creek (from Lower Fish Valley to Snodgrass Creek) indicate that golden trout stocked in Tamarack Lake have contributed to the genetic makeup of the rainbow trout population in Silver King Creek (Finger et al. 2009 ~~2008~~). This also demonstrates the high potential for trout to move out of Tamarack Lake into Silver King Creek.

Gill net surveys have been conducted since 2001 to assess the presence of trout in Tamarack Lake resulting from previous plantings or natural reproduction (Table 5.1-4). Floating and sinking Swedish gill nets of the standard mesh and panel sizes used by CDFG High Mountain Lake Project were used for sampling. Nets used were 36 m in length, 1.8 m in depth, with 6 panels of variable net mesh size (10 mm, 12.5 mm, 18.5 mm, 25 mm, 33 mm, and 38 mm). Gill net sets have increased in effort and duration to assess the presence of trout in Tamarack Lake. Nine nets were set over the winter of 2007-2008 and collected in summer 2008. Although these nets fished for approximately 1 year, their effectiveness through time was likely reduced by fish avoidance due to the buildup of algae, aufwuchs, sediment, and sticks which collect in nets. Knapp and Matthews (1998) stated "Rotenone is also effective on a wide range of lake sizes, while gill netting likely to be ineffective in large lakes (>3 ha), deep lakes (>10 m), lakes with self-sustaining trout populations in inlets and outlets, and lakes with abundant trout spawning habitat." Since 2001, no fish have been caught in gill nets or seen in visual surveys of the lake or tributary inlets.

Table 5.1-4 Gill Net Sets in Tamarack Lake, Silver King Creek Watershed, Alpine County, During 2001 to 2008

Year	Net Types	Date Set	Date Pulled	Total Hours	Fish Collected
2001	1 Sink, 1 Float	7/25/2001	7/26/2001	43	0
2002	12 Sink	8/21/2002	8/22/2002	255	0
2003	8 Sink, 1 Float	7/17/2003	8/17/2003	7154	0
2004	8 Sink, 3 Float	7/6/2004	8/5/2004	7650	0
2008	7 Sink, 2 Float	8/2/2007	8/14/2008	70080	0

Following the successful 1991–1993 chemical treatments, putative pure Paiute cutthroat trout were collected from Coyote Valley and Fly Valley Creeks for transplanting into the treated waters upstream of Llewellyn Falls. Table 5.1-5 presents the number, donor creek, and location of the fish that were restocked into Silver King Creek upstream of Llewellyn Falls. The area above Llewellyn Falls remained closed to fishing in 1993 to protect restocked Paiute cutthroat trout from further hybridization through inadvertent introduction of rainbow trout.

Table 5.1-5 Paiute Cutthroat Trout Reintroduction to Upper Fish Valley Following the 1991–1993 Chemical Treatment

Year	Number stocked	Donor Creek	Planting Location
1994	139	Coyote Valley Creek	Above upper exclosure fence to treeline (upper meadow)
1995	49	Fly Valley Creek	Connell's Camp at trail crossing

Table 5.1-5 Paiute Cutthroat Trout Reintroduction to Upper Fish Valley Following the 1991–1993 Chemical Treatment

Year	Number stocked	Donor Creek	Planting Location
1995	109	Coyote Valley Creek	Lower pasture fence (lower meadow)
1996	134	Coyote Valley Creek	Connell's Camp at trail crossing
1997	145	Coyote Valley Creek	Vicinity of Fly Valley Creek
1998	30	Fly Valley Creek	Above Four Mile Canyon
Total	606		

Source: CDFG

USFWS RECOVERY EFFORTS FOR PAIUTE CUTTHROAT TROUT

Under ESA section 4(f) authority, the Secretary of Interior, through the USFWS, is charged with developing and implementing recovery plans for the conservation and survival of threatened and endangered species. The approved Revised Recovery Plan (USFWS 2004) outlined the following recovery actions:

- Remove non-native fish from historical habitat (Silver King Creek downstream from Llewellyn Falls to barriers in Silver King Canyon).
- Reintroduce Paiute cutthroat trout into renovated stream reaches in historical habitat.
- Protect and enhance all occupied Paiute cutthroat trout habitat.
- Continue to monitor and manage existing and reintroduced populations.
- Develop a long-term conservation plan and conservation agreement
- Provide public information.

The proposed Action would implement the 2 highest priority recovery actions: remove non-native trout and reintroduce Paiute cutthroat trout to their historical range.

OTHER FISH SPECIES

MOUNTAIN WHITEFISH (P. WILLIAMSONI)

Mountain whitefish are one of the most widely distributed fish species in western North America. In California, they are found in streams and lakes of the Truckee, Carson, and Walker River drainages at elevations of 1,400-2,300 m (Moyle 2002). Mountain whitefish were found in Silver King Creek above the confluence with Snodgrass Creek in September 2000 (Deinstadt et al. 2004). Mountain whitefish are common in clear, cold streams with summer temperatures of 11-12°C with pools the exceed 1 m in depth. Spawning occurs in October through early December at water temperatures between 1 to 11°C. Whitefish spawn in riffles with depths greater than 75 cm with substrates of coarse gravel and cobbles less than 50 cm. The eggs are scattered over the gravels and cobbles where they sink into the interstices. Embryos hatch in 6 to10 weeks depending on temperatures and the newly hatch fish are carried downstream into shallow backwaters. As they grow, fry gradually move into deeper and faster moving water with rock or boulder bottoms. In streams, mountain whitefish feed on a variety of aquatic insects including mayflies and caddisflies (Moyle 2002).

PAIUTE SCULPIN (C. BELDINGI)

Paiute sculpin are found in the Susan, Truckee, Walker, and Carson River watersheds of the Lahontan drainage of California (Moyle 2002). Paiute sculpin were found in Silver King Creek above the confluence with Snodgrass Creek in September of 2000 (Deinstadt 2004). Their habitat is in shallow, rocky riffles in clear, cold streams. Daylight hours are spent hidden among the rocks with most of their feeding taking place at night. In streams, Paiute sculpin feed on aquatic insect larvae including mayflies, stoneflies, and caddisflies. Paiute sculpin mature during their second or third year with spawning usually occurring in May or June. After hatching, the fry drop down to the bottom of the nest where they remain for 1 to 2 weeks until they absorb the yolk sac (Moyle 2002). Dispersal of young sculpin occurs mainly at night when they leave the bottom enter the current and are carried downstream (Moyle 2002).

BENTHIC MACROINVERTEBRATES (AQUATIC INSECTS)

OVERVIEW

Benthic macroinvertebrates are aquatic animals without backbones that live on the bottom of freshwater habitats during all or part of their life cycle and that are large enough to be seen with the naked eye. Major groups of benthic macroinvertebrates include arthropods (i.e., crustaceans and insects), mollusks, sponges, and nematode worms. The most abundant are typically immature life stages (larvae) of aquatic insects such as mayflies and stoneflies. The benthic macro-invertebrate community or "assemblage" is largely determined by the range of habitat conditions, such as water quality, vegetation structure and bottom substrate. More complex habitats generally support a more diverse assemblage of groups[1] or "taxa" than more uniform habitats.

This section reviews the general ecology of benthic macroinvertebrates and the current status of benthic macroinvertebrates in the Silver King Creek Watershed. Benthic macroinvertebrates are an important biological resource for several reasons:

- Biodiversity value – they represent an extremely diverse group of aquatic animals.
- Food web support – they are an important part of the aquatic food web, including a primary food source for Paiute cutthroat trout.
- Indicators of ecological health – Benthic macroinvertebrates have diverse microhabitat requirements and ecological functions. They exhibit a wide range of responses to ecological changes and stressors, thus making them valuable indicators of water quality.

Several methods have been developed to measure and assess macroinvertebrates. Some measures are better suited to address certain questions about species and/or populations. In this analysis, we reviewed the types, uses, and limitations of these measures to provide context for interpreting the results of various macroinvertebrate surveys conducted in the Silver King Creek Watershed, as well as to guide development of mitigation measures and monitoring for the proposed Action.

GENERAL ECOLOGY

The benthic macroinvertebrate assemblage in streams encompasses a wide variety of taxa, but larvae of aquatic insects are often the most abundant. Aquatic insects are extremely diverse. Taxa

[1] The taxonomic ranks for classifying living things are (in order) Kingdom, Phylum, Class, Order, Family, Genus, and Species. Most macroinvertebrate studies typically identify samples to the genus level.

~~Species~~ with life stages that use aquatic habitats include dragonflies and damselflies (Order Odonata), stoneflies (Order Plecoptera), mayflies (Order Ephemeroptera), caddisflies (Order Trichoptera), hellgrammites (Order Megaloptera), beetles (Order Coleoptera) and true flies (Order Diptera). Important taxa in the Sierra Nevada include the larvae of three orders of insects, the Ephemeroptera, Plecoptera and Trichoptera, collectively referred to as EPT. They tend to occur in habitats with cold, clear, high quality water often associated with trout species. The absolute and relative abundance of these three taxa, the EPT Index, is often used to evaluate stream health.

Most stream invertebrates are benthic meaning that they associate with the channel bottom, such as cobble and finer sediments or other surfaces (e.g., roots, emergent aquatic vegetation) (Hauer and Resh 2006). The hyporheic zone, where stream water and ground water meet below the substrate surface, often provides a protected microhabitat. The hyporheic zone serves as a refuge for benthic insects (Ward 1992). This zone also provides a reservoir capable of recolonizing the surface benthos if depleted from floods, drought or extreme temperatures, and provides suitable conditions for immobile life stages such as eggs, pupae, diapausing nymphs, and larvae (Williams and Hynes 1976, Ward 1992). Many stonefly species spend most of their larval lives in the hyporheic zone, returning to the main stream channel to emerge as adults (Stanford et al. 1996).

The macroinvertebrate assemblage serves an important ecological function in stream food webs. They can be divided into several feeding guilds, or groups, that fill specific ecological niches (Merritt and Cummings 1996) such as shredders (feed on leaves and other organic matter), scrapers (feed on algae attached to leaves and rocks), filterers (collect food from water column), and predators. Because of their abundance and role in the aquatic food chain, benthic macro~~v~~invertebrates (insects in particular) are an important source of food for birds, mammals, amphibians, reptiles, fish and other invertebrates (Erman 1996).

Most macroinvertebrates exhibit dispersal, or movement of individuals from one area or habitat patch to another (Bilton et al. 2001, Smock 2006). Dispersal is also a key process in the recolonization of disturbed areas of streams. Drift is one of the most important mechanisms for dispersal to, and colonization of, downstream habitats. The majority of species drift at night. Macroinvertebrates may actively disperse in search of suitable substrate or food, escape from predators or competitors, avoidance of environmental conditions (including pollution), or reproduction. Other forms of dispersal include crawling and swimming both upstream and downstream. Macroinvertebrates can move between the surface strata and the hyporheic zone (Williams and Hynes 1976, Ward 1992). Streams may also be recolonized via aerial dispersal by egg-laying adults from nearby source populations. Additionally, recolonization can occur from emerging adults that fly upstream and downstream, as well as laterally to other drainages (Smock 2006).

Endemic species are species that are native to, and restricted to, a particular geographic region. Springs have been known to harbor species endemic to the Sierra Nevada (Erman 1996). Spring invertebrates can be unique because spring habitats are typically isolated from each other. Springs maintain consistent temperatures and may therefore harbor relict species that were more widespread in previous climate conditions (Erman 1996). Groups that specialize in spring habitats and contain many endemic species in the Sierra Nevada include caddisflies of the families Rhyacophilidae, Limnephilidae, Uenoidae, and Hydropsychidae as well as springsnails of the family Hydrobiidae. Very little is known about the complete ranges and populations of these species (Erman 1996).

Mangum (2005) observed that macroinvertebrate communities are remarkably consistent across great distances of the western United States, based on his 25 years of monitoring experience in Montana, Washington, California, and Utah. He attributed the similar species composition among coldwater streams to the fact that macroinvertebrate species have good dispersal mechanisms which allow them to disperse over great distances to colonize streams elsewhere.

SURVEYS OF MACROINVERTEBRATE ASSEMBLAGES

The metrics used to assess benthic macroinvertebrates depend on the question posed. There is no single perfect metric or absolute measure. Conversely, the questions that can be answered may be constrained by the measures and sampling methods used. For example, it would be difficult to detect a rare, endemic or new species without conducting a complete inventory and identifying samples down to the species level. Most surveys focus at higher taxa levels (genus or family), a subset of taxa, or certain functional groups. Few species-level inventories of macroinvertebrates exist for the Sierra, and the distribution of most species is not well known (Sierra Nevada Ecosystem Project (SNEP) 1996, Vol. I, Ch. 8).

MEASURING COMMUNITY HEALTH AND ECOLOGICAL FUNCTION

Most studies of benthic macroinvertebrates focus on measuring community characteristics or “metrics” such as abundance (number of individuals), richness (number of different kinds), diversity (number of different kinds and their relative abundance), or number of certain indicator taxa (e.g., EPT index). These metrics provide an indication of community health and ecological function. The Lahontan Basin Plan (LRWQCB 2005) refers to this generally as “species composition,” although no specific definition is provided. The species composition of a diverse, ecologically healthy benthic invertebrate community would be represented by the community metrics or indices listed above (e.g., high diversity). This analysis is focused on indices that are useful indicators of macroinvertebrate community health (e.g. EPT and total taxonomic richness) (Karr and Chu 1999). For example, higher numbers of EPT taxa typically indicate good water quality. Conversely, high numbers of Diptera (true flies), which are more tolerant of environmental stressors, typically indicate degraded water quality or other environmental stress. Table 5.1-6 provides definitions of the community metrics used to assess benthic macroinvertebrate populations in the Silver King Creek Watershed.

Table 5.1-6 Common Indices and Metrics of Macroinvertebrate Composition and Population Attributes

Community parameter	Definition
Abundance	Number of individuals
Diversity	S-W = Shannon-Weiner (sometimes called Shannon-Weaver) Index. This index takes into account the number of species and their relative abundances.
Richness Number of taxa	Number of different kinds (species, genera, or other grouping). This index makes no use of relative abundance.
Biomass or Standing crop	Community dry weight of organic matter in a sample. An index of productivity.
Biotic Condition Index (BCI)	BCI indicates as a percentage how close an aquatic ecosystem is to its own potential. Scoring: 91-100 Excellent, 80-90 Good, 72-79 Fair, <72 Poor
Percent taxon or family dominance	An assemblage dominated by a single taxon or several taxa from the same family suggests environmental stress.
Dominance and Taxa Diversity index (DAT)	The DAT combines a measure of dominant species in the community and the number of species present. Scoring: 18-26 Excellent, 11-17 Good, 6-10 Fair, 0-5 Poor
Number of EPT taxa	EPT = Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These taxa are often used as indicators because of their sensitivity to poor water quality conditions.

Table 5.1-6 Common Indices and Metrics of Macroinvertebrate Composition and Population Attributes

Community parameter	Definition
EPT Index	Proportion of EPT individuals
Number of stoneflies	Number of Plecopterans, one of the sensitive taxa.
Source: California Stream Bioassessment Procedure (CSBP) (CDFG 1999 ~~Harrington and Born 2003~~) and Surface Water Assessment Ambient Monitoring Program (SWAMP), http://www.swrcb.ca.gov/swamp/), Vinson 2007, Mangum 2005	

DETECTING RARE AND ENDEMIC SPECIES

Aquatic biologists are also concerned with rare and endemic species. There is no single definition of rarity, but measures of rarity usually consider organism abundance, habitat occupancy, and range size. The most common understanding of a rare species is one that is constantly sparse in abundance or occurs infrequently, whether over a large or small range. At local scales, abundance can vary based on the amount of preferred habitat, while at broad scales, local abundance is generally higher near the center of a species' range (Poff 1997). However, a locally abundant species could also be rare if it is restricted to a specific habitat or geographic area (Meffe et al. 1997). Taxa ~~Species~~ that occur in Silver King Creek may be defined as rare under several of these categories and at different spatial and temporal (i.e., seasonal and/or interannual) scales. Following disturbance events, like rotenone treatments, floods or fires, rarity will be related to both organism dispersal rates and community succession during the colonization phase. Poor dispersers will have slower colonization rates and thus lower incidences of occupancy, making them more difficult to collect (Vinson and Vinson 2007). Vinson and Vinson (2007) analyzed macroinvertebrate samples collected historically (between 1984 and 1996) and more recently (2003-2006) from various treated and untreated locations in the Silver King Creek Watershed. They defined rare taxa as those that accounted for less than 1% of the total number of individuals identified to genera.

Potential loss of endemic species is of particular concern. Endemic species are species that are native to, and restricted to, a particular geographic region. They have evolved in a particular area and are not naturally found elsewhere. Endemism is scale-specific (e.g., endemic to the Sierra Nevada). Any species endemic to the Silver King Creek Watershed would be considered rare because of the small size of this area. For example, Paiute cutthroat trout are endemic to the watershed. Endemic species are more likely to occur in small, isolated habitats, such as springs. However, no endemic macroinvertebrate taxa ~~species~~ have been found to date in the Silver King Creek Watershed.

There are several challenges in detecting rare and endemic species in the proposed treatment area, including:

- No complete inventories of macroinvertebrate taxa are available.
- Species-level identification is difficult and lacking.
- Requires intensive sampling effort beyond scope of the proposed Action.

The following sections discuss each of these challenges.

1. LACK OF INVENTORY DATA

Determining rarity or endemism at the species level would require that completed regional species lists and previous collections of immature and adult benthic macroinvertebrates

~~organisms~~ were available to determine rarity or endemism in Silver King Creek.~~number of expected taxa~~. Identification of a species endemic to Silver King Creek would require an inventory of species present in Silver King Creek as well as an inventory of all species present in neighboring watersheds. However, no complete inventories of macroinvertebrates have been conducted in the entire Sierra Nevada (Erman 1996), much less Silver King Creek. Species' inventories require sampling at multiple stations over different seasons and across multiple years. Obtaining this information in Silver King Creek and indeed, Sierra Nevada wide, would require an intensive effort (discussed below) that is beyond the scope of the proposed Action.

2. SPECIES-LEVEL IDENTIFICATION IS CHALLENGING

In order to detect rare or endemic species, all collections must be identified to the species level. However, for some taxa the state of the art of benthic invertebrate taxonomy is not sufficiently advanced to allow such fine resolution identification. As a result, a portion of the individuals collected in Silver King Creek, including those collected over the last few years, have only been identified to the genus level or higher level of classification, such as family (Vinson and Vinson 2007). Many individuals cannot be identified to species. The tools to accomplish this task do not exist, particularly for highly speciated groups such as mites and flies. Identification keys are not available for most immature insects, and keys are based on mature specimens (M. Vinson pers. comm. to C. Mellison, email October 10, 2006).

Because it is difficult to identify some larval stages, a more complete species inventory would also require extensive (and expensive) field surveys of emerging adults for definitive identification. Such an effort would require ~~2-4~~ years of more specialized field sampling, not including the difficult task of keying out the samples to species (which may not be possible for certain groups).

3. INTENSIVE SAMPLING EFFORT IS REQUIRED

Macroinvertebrates often have a patchy geographic and temporal distribution. Many taxa are rare to begin with, and sampling is conducted within limited space and time. In Silver King Creek, many of the rare taxa observed in recent samples (2003–2006) were not observed consistently in historical samples (between 1984 and 1996) (Vinson and Vinson 2007). A tremendous amount of sampling would be required to detect even a majority of rare species. The likelihood of observing rare or uncommon species either before or after treatment would be governed by their rarity, the sampling methods used, the number and distribution of samples collected, and sampling frequency.

Species inventories require sampling at multiple stations over different seasons and across multiple years. Complete inventory has been attempted at only a few creeks in the world (e.g. Breitenbach Stream in Germany) and after many years of collection, new species continue to be found (M. Vinson pers. comm. to C. Mellison USFWS, email October 11, 2006). CDFG completed a species inventory for Lake Davis including trapping and identification of emerged adults; however, it was not considered a "complete" inventory but rather a "one time" species inventory that did not attempt to identify new or add~~ed~~ species through subsequent repeat surveys.

Compiling a complete inventory for Silver King Creek would require a much larger effort than has been conducted to date. Most surveys have been conducted using quantitative methods to determine relative abundances, rather than qualitative sampling designed to broadly sample more varieties of habitat. Vinson and Vinson (2007) calculated a genus level collection curve using methods developed by Colwell and Coddington (1994) for recent data collected from Silver King Creek (2003–2005) and estimated that approximately 90% of the genera have been collected to date. Vinson estimated that pre-treatment surveys would only collect 80 to 90% of aquatic macroinvertebrate assemblages present (M. Vinson pers. comm. 2006 to C. Mellison, USFWS) It would be difficult to determine the number of years required to increase this percentage; however, this type of effort would require sampling of the hyporheic zone and would be logistically and economically prohibitive, and on a practical level, likely infeasible. This level of effort would far exceed the standard for what is "reasonably feasible" (CEQA Guidelines §15151) and may not be attainable.

4. LIMITS OF CERTAINTY AND THE STANDARDS FOR BEST AVAILABLE INFORMATION

Even with a complete species inventory, it would be very challenging to determine through post-treatment sampling whether a species was present or whether it was absent or eradicated by rotenone treatment. Sampling results are subject to variability. Vinson and Vinson (2007) evaluated the natural variability of macroinvertebrate assemblages, the probability of collecting rare taxa to evaluate the problem of taxa that are reported "missing" from post-treatment samples, and the likelihood of this situation occurring from rotenone treatments or sampling variability. Sampling artifacts make it difficult to determine if any individual taxon is present. Examples of potential sampling artifacts include spatial variation, temporal variation (season and year), microhabitat variation, sediment grain size, and main stem versus tributaries.

When a rare species is absent after treatment, it may not be possible to determine if the species was actually absent or if it was missed during sampling (sampling artifact). It is not unusual for individual species to be absent in any given year. Species may be rare to begin with. In addition, macroinvertebrate sampling is conducted within limited space and time. For example, sediment sampling in the proposed treatment area may only assess a small proportion of the stream bottom and may be completed over one or two days per year. Thus, when a rare species is absent after treatment, it may not be clear whether this species was simply missed during sampling or was actually absent (absence may not necessarily be a treatment outcome, but could be a stochastic natural event). Previous sampling may not establish clearly which species would be expected to occur frequently or sporadically.

The recent and ongoing surveys being completed by the Agencies are intended to assess achievement of the standard described in the Lahontan Basin Plan, which examines species composition of non-target biota as one of its water quality objectives for the use of rotenone (LRWQCB 1995).

BENTHIC MACROINVERTEBRATES IN SILVER KING CREEK WATERSHED

The proposed treatment area contains diverse aquatic microhabitats for invertebrates in lotic (flowing water) and lentic (still water) environments. Microhabitats include riffles, pools, runs, backwaters, springs, and lakes, with a variety of substrates such as boulders, cobble, gravel, sand, logs, undercut banks, vegetation. Stream habitat, substrate, and hydrology all influence macroinvertebrate community composition.

No endemic taxa ~~species~~ have been reported ~~identified~~ for the proposed treatment area or the adjacent USGS quadrangles (CNDDB 2008). In part, this may be due to the fact that recent invertebrate sampling completed by the Agencies was conducted in order to assess achievement of the standard described in the Lahontan Basin Plan, which examines species composition of non-target biota as one of its water quality objectives for the use of rotenone (LRWQCB 1995). Based on the factors discussed above, the surveys did not provide the level of resolution needed to determine presence of rare or endemic species.

The following sections describe the macroinvertebrate assemblage in the proposed treatment area and present analyses of the potential effects of past rotenone treatment. Rotenone has been applied in the watershed several times since 1964 (see Table 5.1-1).

COMMUNITY CHARACTERIZATION

The ~~proponent~~ Agencies have conducted extensive characterization of benthic macroinvertebrate communities in Silver King Creek. Historical macroinvertebrate data were collected in 1977, 1978, 1983, 1984, 1987, and 1991 through 1996 (Mangum 1984, 1987, 1992~~1~~; Trumbo et al. 2000a). In 1991, before the most recent rotenone applications in 1991–1993, Mangum (2005) sampled sites previously treated in 1964 and 1977 and found that the BCI index rated conditions at most stations as “excellent,” suggesting that the macroinvertebrate community had recovered well since 1977.

In response to permit requirements, the Agencies conducted annual monitoring of Silver King Creek benthic invertebrates from 2003 through 2006 (Vinson and Vinson 2007 provided in Appendix D herein). The monitoring and earlier surveys were conducted using quantitative sampling methods and were not designed to sample broadly to detect taxa that may have limited distribution and/or low densities. The sampling design was modified by USFS in 2007 (provided as Appendix E herein) based on recommendations in Vinson and Vinson (2007). Data collected in 2007 and 2008 used the modified sampling design (Appendix E). This design also includes qualitative sampling (i.e., sampling across all major habitat types rather than set locations) to collect as many different kinds of invertebrates living at a site as possible (USFS 2007). This will improve the likelihood of collecting rare taxa, although no program can guarantee that all taxa ~~species~~ will be collected.

The potential effects of rotenone on Silver King Creek macroinvertebrates were recently assessed by reviewing published studies and analyzing all available data (historic and recent) from Silver King Creek where rotenone has been used in various treatments over the last 40 years (Vinson and Vinson 2007). Both historical (1984–1993) and recent (2003–2006) data were evaluated for differences between treated and untreated sites, annual variation, variation among sampling sites, and rarity of taxa. The National Aquatic Monitoring Center (NAMC) calculated and analyzed several metrics of measures of abundance as well as composition and function (NAMC 2007, 2008 ~~2006~~). These included: 1) taxa richness; 2) abundance; 3) EPT richness; 4) EPT Index; 5) number of families; 6) percent dominant taxon; 7) Shannon Diversity Index; 8) mean tolerance value, and 9) Community Similarity Indices (Jaccard and/or Brillouin Index). ~~A summary of these results~~ An analysis using several of these metrics from the 2007 and 2008 survey data is presented in Appendix E. ~~is presented in Appendix A of the Vinson and Vinson (2007) report (refer to Appendix D herein).~~

Vinson and Vinson (2007) compared pre-treatment versus post-treatment data collected from the Silver King Creek Watershed. Historic data (1984-1993) was collected from 6 sites. The treatment sites included Silver King Creek above Llewellyn Falls (treated in 1964, 1976, and 1991–1993), Corral Valley Creek (1964 and 1977), and Coyote Valley Creek (treated 1964, 1976, 1977, 1987, and 1988). Control sites were located in Fly Valley Creek, Four Mile

Canyon Creek, Bull Canyon Creek, and Tamarack Creek. Recent data (2003–2006) were collected from treated streams (Coyote Valley and Corral Valley Creeks) and a control site (Tamarack Creek).

The results from this assessment are provided below.

- **Treated and untreated locations.** Statistical comparisons could not definitively establish whether significant long-term impacts of past rotenone applications on the benthic macroinvertebrate community occurred. There were few measurable differences in community metrics between locations, including samples from untreated areas. The only difference between treated and untreated locations was Coleoptera (beetles). Also, two genera were found at untreated sites that were not found at treated sites: *Ephron* (Ephemeroptera, Family Polymatarcyidae) and *Dolophilodes* (Trichoptera, Family Philopotamidae). However, 27 genera were collected at treated sites that were not found at untreated sites. The large discrepancy in the number of samples may account for these differences.
- **Annual variation.** Few discernable differences were observed in diversity or abundance between historical (1984–1996) and recent (2003–2006) data.
- **Spatial variation.** In recent samples (2003–2006), 25% of the metrics evaluated varied significantly among sites. Several metrics of measures of abundance as well as composition and function were significantly higher in tributary streams, but no metrics were highest at untreated sites.

Recent samples contained more taxa ~~species~~ than historic samples in both treated and untreated areas. However, this may be explained by the time elapsed (10 years) since the last rotenone treatment in Silver King Creek (1993) and since grazing ceased, so populations have had time to recover.

Statistical comparisons also found interannual variability in several mean aquatic invertebrate assemblage measures. There were no specific trends in diversity or abundance in historical (1984–1996) or recent (2003–2006) data, except that more taxa were observed in recent times in both treated and untreated sites.

Several factors limit data analysis:

- No samples were collected before the first rotenone treatment in 1964.
- Different treated and untreated stations were sampled, compromising any direct statistical comparison between groups of samples.
- Potential differences in laboratory methods
- Samples were collected at relatively few untreated stations, limiting comparison with treated stations.
- Confounding influences on results may have included the existence of and then cessation of cattle grazing in the watershed during the study period.

Considering the data collected and appropriate limits on analyses (listed above), Vinson and Vinson (2007) suggest that few measurable differences in community metrics were observed between historic and recent data groups, between treated and untreated sites, among years, among sampling locations, or in the frequency of rare taxa occurrence.

Vinson and Vinson (2007) also evaluated potential confounding factors in determining the effects of rotenone, including other stream ecosystem disturbances, such as fires, droughts, floods, or land management activities. Differences among sampling stations and different studies could have resulted from environmental differences including climate, elevation, hydrology, sediment grain size and other stream characteristics. Significant interannual (between years) variability as well as differences between stations in the same year may be more an artifact of these phenomena than any effects of rotenone treatment. Although these confounding factors exist, Vinson and Vinson (2007) were not able to discern the effects of rotenone in Silver King Creek.

SPECIAL STATUS MACROINVERTEBRATES

There are no federally endangered, threatened, or candidate macroinvertebrate species that are known to occur in the Silver King Basin or in the proposed treatment area (USFWS, Species List, File No. 2008-SL-0087 ~~1-5-01-SP-2002~~). In addition, no macroinvertebrates have been identified that are protected under the California Endangered Species Act and no Forest Service Region 4 sensitive macroinvertebrate species have been identified. None of the "rare" taxa have any State or Federal species status.

RARE AND ENDEMIC SPECIES

Vinson and Vinson (2007) concluded that "the majority" of the taxa found in Silver King Creek between 2003 and 2006 could be considered uncommon or rare (<1% of identified individuals). Rarity was not determined through identification of known rare taxa but through analysis of abundance data and a qualitative evaluation of the number of taxa ~~species~~ that seldom appeared in collected samples. A total of 85 genera were collected between 2003 and 2006. Of these 85 genera, 47 genera (55%) were collected in all 4 sampling years, 7 genera (8%) were collected in 3 of the years, 16 genera (19%) were collected in 2 of the years, and 15 genera (18%) were collected in only 1 year.

No benthic macroinvertebrate taxa ~~species~~ strictly endemic to the Silver King Creek Watershed have been identified (Mangum 1984~~5~~, 1987~~8~~, 1992, 2005, Vinson and Vinson 2007). However, the surveys were not designed to identify taxa down to species or detect endemic species, and thus cannot rule out the possibility that endemic species may be present. Mangum (2005) noted:

> *"The likelihood that there are rare and endemic macroinvertebrates in Silver King Creek is very low. The stream is not unique or isolated, but is typical coldwater stream habitat found through the mountains of the western United States. This stream has a similar history of logging and grazing as do many stream systems in the West and in the Sierra Nevada. Although previous monitoring was not intended to identify all species present within the project area, no unique macroinvertebrates were observed during sample processing of Silver King collections (1984, 1987, 1990-1996) that had not been found outside of the Silver King drainage in other western watersheds."*
>
> *"It is even less likely that the stretch of the Silver King Creek between Llewellyn Falls and the Silver King Canyon barrier contains a macroinvertebrate that is not present in other parts of the Silver King watershed. This section of stream does not contain any unique characteristics that make it different with respect to macroinvertebrates from other sections. Thus, even if the Silver King Creek itself harbored a rare macroinvertebrate species, it would be highly unlikely that it*

> *would exist only in the stretch of the Silver King that would be treated. The 17 miles of untreated headwaters in addition to seven miles of untreated downstream areas would provide a source for replacing any macroinvertebrates that were reduced in numbers."*

Some members of the public have expressed concern about loss of rare and endemic species and have suggested that the Agencies do more to complete a more detailed characterization of the benthic macroinvertebrate species present in Silver King Creek. Past comments raised concerns that the proposed annual monitoring of benthic macroinvertebrates would not be sufficiently detailed to identify rare or endemic species, particularly those present as larvae in bottom sediments. The Agencies have conducted extensive macroinvertebrate studies over more than 30 years in Silver King Creek (including the ongoing interagency study), and post-treatment monitoring of macroinvertebrates would continue.

Several public comments to the NOP requested that the environmental document present a complete inventory of all benthic invertebrates in Silver King Creek, including any rare or endemic species. Vinson and Vinson (2007) provide the taxa ~~species~~ list for both historic and recent data. This list is not considered a complete species inventory. However, the Agencies have determined that establishing a complete species inventory is infeasible, outside the scope of the EIS-EIR, and beyond that required to the meet the standard for what is "reasonably feasible" (CEQA Guidelines § 15151).

5.1.2 Regulatory Environment

The following subsections describe ~~f~~Federal and state laws and regulations governing aquatic resources. No local ordinances protecting aquatic resources have been identified.

5.1.2.1 Federal

ENDANGERED SPECIES ACT OF 1973 (16 USC §1531 ET SEQ.; 50 CFR PARTS 17 AND 222)

ESA is the primary Federal law providing protection for the Paiute cutthroat trout. Section 9 of the ESA prohibits the "take" of federally listed endangered species of fish or wildlife and many plant species (16 USC 1538[a][1][B]). The ESA defines take to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or attempt to engage in any such conduct" (16 USC 1532[19]). Section 7(a)(2) of the ESA requires that actions authorized, funded, or carried out by ~~f~~Federal agencies (i.e., issuing a permit pursuant to the CWA) do not "jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of lands determined by the USFWS to be 'critical habitat'" for such species (16 USC 1536[a][2] and 16 USC 1532[5]). If a ~~f~~Federal agency determines that a proposed ~~f~~Federal action (e.g., issuing a CWA Section 404 permit) "may affect" a listed species and/or designated critical habitat, the agency must consult with the USFWS in accordance with Section 7 of the ESA. USFWS is the administering agency for ESA authority for freshwater species considered in this project action.

Section 7(a)(2) requires Federal agencies to consult with USFWS prior to authorizing, funding, or carrying out activities that may affect listed species. A jeopardy determination is made for a project that is reasonably expected, either directly or indirectly, to appreciably reduce the likelihood of both the survival and recovery of a listed species in the wild or reducing its reproduction, numbers or distribution (50 CFR §402.02). A non-jeopardy opinion may include reasonable and prudent measures that minimize the amount or extent of incidental take of species from a project. Incidental take refers to taking that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by a Federal agency or applicant (50 CFR §402.02). While projects that are likely to result in adverse effects often include minimization measures, the USFWS is limited to requesting minor modifications in the project description. In instances where some incidental take is unavoidable, the USFWS requires that additional measures be performed by project proponents to compensate for adverse impacts. In cases where the USFWS is the lead Federal agency, an intra-service~~gency~~ consultation is completed.

NATIONAL FOREST MANAGEMENT ACT

The Paiute cutthroat trout is considered a rare or at-risk species by the USFS because of its Federal listing. Each National Forest is required to complete a Land and Resource Management Plan (LRMP) by the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (NFMA; 16 U.S.C. 1600). Those acts require that the LRMPs provide for multiple use and sustained yield of the products and services obtained from the National Forests, including wildlife. The Humboldt-Toiyabe Forest Plan now in effect was completed in 1986 and is in the process of being revised to accommodate the increased land base created with the combination of the Humboldt and Toiyabe National Forests into one administrative unit. Consideration of Paiute cutthroat trout by the USFS under NFMA and through ESA Section 7(a)(1) has led to Paiute cutthroat trout population and habitat surveys as well as implementation of other projects for the conservation of Paiute cutthroat trout.

5.1.2.2 State

CALIFORNIA FISH AND GAME CODE §1600, ET SEQ.

This law provides for protection and conservation of fish and wildlife resources with respect to any project or action that may substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of any river, stream, or lake. The administering agency is CDFG.

CALIFORNIA ENDANGERED SPECIES ACT OF 1984 (CALIFORNIA FISH AND GAME CODE §2050-2098)

This law provides for the protection and management of species and sub-species listed by the state of California as endangered or threatened, or designated as candidates for such listing. California plants and animals declared endangered, threatened, or rare are listed at 14 CCR 670.2 and 670.5, respectively. The act requires consultation "to ensure that any action authorized by a State lead agency is not likely to jeopardize the continued existence of any endangered or threatened species … or results in the destruction or adverse modification of habitat essential to the continued existence of the species" (Section 2053). This law prohibits "take" of state listed or candidate species, except as otherwise authorized by the Fish and Game Code (The term "take" is defined by Section 86 of the Fish and Game Code as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." This definition is different in some respects from the definition of "take" under the Federal ESA). The administering agency is CDFG; however, Paiute cutthroat trout are not listed under CESA.

CDFG may also authorize public agencies through permits or a memorandum of understanding to import, export, take, or possess any endangered species, threatened species, or candidate species for scientific, educational, or management purposes (Section 2081[a]). CDFG may also authorize, by permit, the take or endangered species, threatened species, and candidate species provided specific conditions are met (Section 2081[b]).

CALIFORNIA FISH AND GAME CODE §5501

This law authorizes CDFG to take any fish which, in its opinion, is unduly preying upon any bird, mammal, or fish.

CALIFORNIA FISH AND GAME CODE §5650

This law protects water quality from substances or materials deleterious to fish, plant life, or bird life. It prohibits such substances or materials from being placed in waters or places where it can pass into waters of the state, except as authorized pursuant to, and in compliance with, the terms and conditions of permits or authorizations of the SWRCB or a regional water quality control board such as a waste discharge requirement issued pursuant to Section 13263 of the Water Code, a waiver issued pursuant to Section 13269(a) of the Water Code, or permit pursuant to Section 13160 of the Water Code. The administering agency for FGC section 5650 is CDFG.

Other regulations administered by CDFG include Fish and Game Code Sections 1930–1933, which provide for the Significant Natural Areas program and database; the California Species Preservation Act of 1970 (California Fish and Game Code Sections 900–903) which includes provisions for the protection and enhancement of the birds, mammals, fish, amphibians, and reptiles of California; and Fish and Game Code, Sections 3511 and 5050, which prohibit the taking or possessing of birds and reptiles listed as “fully protected.”

PORTER-COLOGNE WATER QUALITY CONTROL ACT

In compliance with the Porter-Cologne Water Quality Control Act, the SWRCB adopted the Water Quality Control Plan for the Lahontan Basin Plan that became effective on March 31, 1995 (LRWQCB 1995). The Basin Plan incorporates SWRCB plans and policies by reference, contains beneficial use designations and water quality objectives for all waters of the Lahontan Region, and provides a strategy for protecting beneficial uses of surface and ground waters throughout the Lahontan Region.

ROTENONE POLICY

In 1990, the SWRCB adopted amendments to the Basin Plans to permit conditional use of rotenone by CDFG. The SWRCB and CDFG then executed an MOU to facilitate amendment implementation (see Section 5.4, Water Resources).

The Basin Plan establishes specific water quality objectives for rotenone projects, including species composition (LRWQCB 1995). This objective specifies that “non-target aquatic populations (e.g. invertebrates, amphibians) that are reduced by rotenone treatments are expected to repopulate project areas within two years. For multi-year treatments (i.e., when rotenone is applied to the same water body during two or more consecutive years), the established objective(s) shall be met for all non-target aquatic organisms within 2 years following the final rotenone application to a given water body.” These requirements include macroinvertebrate monitoring. The Basin Plan further specifies that “Threatened or endangered aquatic populations (e.g. invertebrates, amphibians) shall not be adversely affected. CDFG shall conduct pre-treatment monitoring to prevent rotenone application where threatened or endangered species may be adversely impacted.”

HERITAGE TROUT PROGRAM

Successful reintroduction of Paiute cutthroat trout could lead to creation of a California Fish and Game Commission-designated Heritage Trout Fishery. CDFG's Heritage Trout Program restores native trout populations and implements post-restoration management policies that may allow angling compatible with native trout conservation. The California Fish and Game Commission established this program in 1998, by expanding its Wild Trout Policy so that streams or lakes featuring one or more of California's native trout, and meeting other specific criteria, may be designated as Heritage Trout waters. Heritage Trout waters are a special subset of Wild Trout waters. Therefore, they are monitored and managed by CDFG's Heritage and Wild Trout Program staff. The objectives of this program are to increase public awareness, promote collaborative efforts, build public support and involvement in native trout restoration, and to diversify opportunities for observing, enjoying, and fishing for native trout in their historic habitats. The management of designated Heritage Trout waters is guided by written management plans that identify actions and policies necessary to protect native trout habitats, and maintain or enhance native trout populations.

Inclusion of Silver King Creek Paiute cutthroat trout in the Heritage Trout Program is not part of the proposed Action (or its alternatives) which focuses on restoration of the species. If Paiute cutthroat trout restoration is successful, future management action such as inclusion in the Heritage Trout Program may be proposed and/or implemented by CDFG.

5.1.3 Assessment Criteria and Methodology

5.1.3.1 Significance Thresholds

The environmental impact assessment uses specific thresholds of significance for biological resources from Appendix G of the CEQA Guidelines. Impacts were considered significant if they would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFG or by the USFWS.
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by CDFG or USFWS.
- Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with any local policies or ordinances protecting biological resources.
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

Conclusions regarding these criteria will be used to prepare CEQA-required mandatory findings of significance as outlined in CEQA, Pub. Res. Code sec. 21083; guidelines sec. 15065. These findings are included in the CEQA "Findings of Fact" and determine whether the action will:

- Substantially degrade environmental quality;
- Substantially reduce fish or wildlife habitat;
- Cause a fish or wildlife habitat to drop below self-sustaining levels;
- Threaten to eliminate a plant or animal community; or
- Substantially reduce the numbers or range of a rare, threatened, or endangered species.

For Silver King Creek, the environmental impact assessment for aquatic resources evaluates whether the proposed Action or its alternatives would have a substantial effect on fish populations, benthic macroinvertebrate populations, and wetland and riparian habitat. For benthic invertebrates, it evaluates whether the proposed Action or its alternatives would significantly affect benthic macroinvertebrate species composition for more than 2 years after the last treatment. Species composition is important for ecological function, including providing a food source for Paiute cutthroat trout after restocking. In addition, because of the inherent value of rare and endemic taxa ~~species~~, the assessment evaluates whether the proposed Action or its alternatives would result in the permanent loss of rare or endemic aquatic insect taxa ~~species~~.

5.1.3.2 Evaluation Methods and Assumptions

Impacts on aquatic resources were evaluated by considering both potential temporary and permanent impacts of the proposed Action and its alternatives. Potential impacts evaluated included direct or indirect impacts on wetlands and riparian habitats; and direct or indirect impacts on federally or state-listed rare, threatened, or endangered species or species that are candidates for listing.

The assessment cites recently published agency reports and studies. It addresses questions raised by agencies and the public in response to the NEPA NOI, ~~and~~ CEQA NOP (refer to Appendix A herein), and the draft EIS/EIR.

Several of the significance criteria listed above are not applicable to this EIS/EIR. The proposed Action would have no impact on the movement of any native resident or migratory fish. The proposed Action would not erect any structures such as fish barriers or obstruct the flow (e.g. temporary diversion dams) of waters used by native resident or migratory fish. Paiute cutthroat trout are the only native resident fish present. Therefore, no impacts on movement or migration would result and no further analysis is presented.

The proposed Action would not conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or State habitat conservation plan because no such plans have been adopted in the areas that would be affected by the action. Therefore, no impacts would occur and no mitigation measures would be required.

The impact assessment focuses on the potential impacts of the proposed Action and alternatives on special-status fish species (e.g. Paiute cutthroat trout), benthic macroinvertebrates, and riparian habitats. Potential impacts on benthic invertebrates were assessed using available literature regarding the effects of rotenone on the benthic community and data collected in Silver King Creek over the last 30 years. It evaluates whether the proposed Action would significantly affect the species composition of the benthic macroinvertebrate community for more than two years after the last treatment, which is consistent with Basin Plan criteria. Although not stated in the Basin Plan, the two-year time period would allow two seasons of re-colonization to occur. This timeframe is used to differentiate between short-term and long-term impacts under CEQA.

Potential impacts on species composition were evaluated through analysis of Silver King Creek responses to past treatments (i.e., changes in taxa ~~species~~ abundance, diversity) as well as inferring results of studies of similar streams. The evaluation considers the natural variability of these populations and the variability inherent in the indices commonly used to evaluate differences in their community structures. It also considers other factors that confound interpretation of community metrics, such as sampling artifacts or natural disturbance.

In addition, because of the inherent value of rare and endemic species, the assessment evaluates whether the proposed Action would result in the permanent loss of rare or endemic benthic macroinvertebrate species. The Agencies would view the loss of any single rare or endemic benthic macroinvertebrate species, regardless of any legal designation, as a significant impact. However, the assessment identifies several factors that would make such an impact very difficult to verify. For example, individual species may be missing from sampling data for different reasons, such as sampling artifacts.

5.1.4 Environmental Impact Assessment

This section presents the significance criteria used to evaluate the likely impacts of the proposed Action and alternatives. The significance criteria establish thresholds for determining whether an impact is environmentally significant.

5.1.4.1 Alternative 1: No Action

Under this alternative, the Agencies would not undertake actions to recover Paiute cutthroat trout by removing non-native trout and expanding the existing habitat of Paiute cutthroat trout into its historic range. The No Action alternative ~~would not meet the purpose and need for the proposed Action,~~ would not be consistent with the Revised Recovery Plan (USFWS 2004), and would increase the risk of extinction. Paiute cutthroat trout have a high likelihood of extinction in their native watershed within the next 50 years without continued intense monitoring and management (Moyle et al. 2008). Without the proposed Action, it is not certain that the species will continue to exist unless a suitable recovery action equal in effect to the proposed Action is found.

Under the No Action alternative, the main threat of hybridization would not be reduced and would likely increase. Non-native trout would remain in the treatment area, which would increase the risk of hybridization in existing putative pure populations in the Silver King Creek Watershed. In addition, under the No Action alternative, the agencies have committed to developing informational handouts to inform anglers entering the wilderness of the sensitivity and risks associated with the Paiute cutthroat trout. The handouts will be in addition to the informational kiosks and signage currently located at the trailheads. Agency personnel will continue to have a presence in the basin as budgets allow. ~~none of the additional public education aspects of the proposed Action (e.g. signage, publicity) would be implemented to reduce the threat of illegal transplants.~~ The most recent genetic study of Paiute cutthroat trout shows that past efforts to eliminate non-native trout have been successful and that putative pure populations of Paiute cutthroat trout currently exist in the Silver King Creek Watershed (Cordes et al. 2004, Finger et al. 2009 ~~2008~~). It would be relatively easy to transplant non-native trout above natural fish barriers in Corral Valley Creek and Silver King Creek (above Llewellyn Falls). New illegal transplants would unravel years of work to eradicate non-native trout in the headwaters and would compromise future restoration efforts.

In addition, the Agencies would not re-establish Paiute cutthroat trout in the proposed 11-mile-long treatment area, whose length may be ideally suited to the sub-species ~~and is part of its native range~~. Under existing conditions, Paiute cutthroat trout populations are isolated in Upper Silver King Creek and tributaries as well as the conservation populations established in small headwater reaches in Mono, Madera, and Fresno counties. The USFWS has determined that expansion of their present range is a key element in continued survival and recovery of the species (USFWS 2004). Increased habitat size enhances the size and persistence of populations (Hildebrand and Kershner 2000). An increase in effective population size and gene flow improves population viability (Lande and Barrowclough 1996, Hildebrand and Kerschner 2000, Rieman and Allendorf 2001, Pritchard et al. 2007).

Under the No Action alternative, no fish or benthic invertebrates would be affected directly or indirectly by chemical treatment, physical removal (e.g. electrofishing, netting), or transport of Paiute cutthroat trout into their historic habitat in ~~fish to~~ Silver King Creek, ~~or transport of fish from Silver King Creek to adjacent drainages~~. Thus, the No Action alternative would have no direct mortality on any threatened, endangered, proposed, or state-listed or special-status species. Woody riparian and native understory species would continue to recover in response to the elimination of grazing pressures. Compared to Alternatives 2 and 3, ~~W~~water quality would not be subject to any short-term degradation associated with rotenone treatment or mechanical removal.

5.1.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

The proposed Action would involve treating 11 miles of stream in the Silver King Creek Watershed with the piscicide rotenone to remove non-native trout and reintroduce putative pure Paiute cutthroat trout to the restored stream (Figure 3-1). The treatment area consists of approximately 6 miles of aquatic habitat in the mainstem Silver King Creek from Llewellyn Falls downstream to Silver King Canyon. Tributary streams make up the remaining 5 miles of creek habitat, including Tamarack Lake Creek, an unnamed drainage, Tamarack Creek, and the lowermost reach of Coyote Valley/Corral Valley Creek. ~~No fish have been observed in Tamarack Lake in recent years, but if any exist, they could enter Tamarack Lake Creek and subsequently Silver King Creek. Therefore, the Agencies would conduct more extensive pre-treatment surveys in 2009 and 2010; if fish were found, then the 5-acre Tamarack Lake would also be treated with rotenone.~~ As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

Following the treatment, the restored reach would be restocked with putative pure Paiute cutthroat trout from populations within the watershed (e.g. Fly Valley Creek, Four Mile Canyon Creek, Coyote Valley Creek, Corral Valley Creek, and/or Upper Silver King Creek). Restocking would be conducted pursuant to guidelines and recommendations for stocking and genetic diversity management in the Revised Recovery Plan (USFWS 2004) and recent genetic studies (Cordes et al. 2004, Finger et al. 2009 ~~2008~~).

The following subsections address the potential effects of rotenone treatment on aquatic resources in Silver King Creek, including effects on fish, benthic invertebrates, and wetland and riparian habitat.

FISH

Rotenone treatment would eradicate trout in the Silver King Creek between Llewellyn Falls and Silver King Canyon. The populations of rainbow trout, mountain whitefish, and Paiute sculpin present in Silver King Creek downstream of Silver King Canyon would be affected by the rotenone treatment and the neutralization zone downstream of Snodgrass Creek. Any fish species impacted downstream of Silver King Canyon would be able to repopulate this area from downstream sources as there are no fish barriers present.

Rotenone is highly toxic to fish because it is readily transmitted across permeable gill membranes and inhibits a biochemical process at the cellular level. This makes it impossible for fish and other aquatic organisms to use the oxygen normally absorbed in the blood and utilized in the release of energy during respiration (Finlayson et al. 2000, refer to Appendix C herein, Screening-level Ecological and Human Health Risk Assessment). Trout are particularly susceptible, allowing fisheries managers to use lower concentrations than would be required to eradicate more tolerant species such as carp or catfish.

The proposed rotenone treatment targets non-native trout that are a threat to the conservation and recovery of Paiute cutthroat trout and their loss would be a less-than-significant impact and a benefit in terms of Paiute cutthroat trout habitat. The proposed treatment may also result in mortality of an unknowable but likely low number of putative pure Paiute cutthroat trout incidentally present in the treatment area that may have passed over Llewellyn Falls or the Coyote Valley Creek or Corral Valley Creek barriers. However, genetic studies indicate that the fish in the treatment area are non-native trout (i.e., rainbow trout and/or golden trout hybrids) with very little remaining of Paiute cutthroat trout genetic influence (Finger et al. 2009 ~~2008~~). ~~There is no practical way to identify and separate, in situ, potentially putative pure Paiute cutthroat trout from hybrid individuals in treated areas.~~ The loss of these individual fish would not result in a significant impact on this species.

The proposed Action would result in a substantial benefit for the recovery of Paiute cutthroat trout. It is the highest priority action required by the Revised Recovery Plan (USFWS 2004) which provides the foundation for Paiute cutthroat trout management. The proposed rotenone treatment would greatly reduce the risk of genetic hybridization from non-native trout. As noted earlier, expansion of their present range is another key element in continued survival and recovery of the sub-species (USFWS 2004). Restocking the treated stream reach with putative pure Paiute cutthroat trout would expand the current range, restore the sub-species to all of ~~some of~~ its historic range, increase the population size and improve gene flow, which would enhance population viability (Lande and Barrowclough 1996, Hildebrand and Kerschner 2000, Rieman and Allendorf 2001, Pritchard et al. 2007). This alternative would reduce the risk of catastrophic loss of Paiute cutthroat trout due to illegal restocking or stochastic events, such as flood or drought. While non-natives will be located below the barriers in Silver King Canyon even after implementation of the proposed Action, this area is very remote and not easily accessed by the public. An illegal transfer would require the transport of fish via the high gradient stream channel which is characterized by large boulders and numerous vertical drops in excess of five feet in height and one drop in excess of ten feet. Post-treatment restocking has the potential to more than double the in-basin population of putative pure Paiute cutthroat trout. ~~numbers~~ (~~Somer pers. comm. 2003~~, Table 5.1-7).

Table 5.1-7 Stream Habitat (Miles) Occupied by Putative Pure Paiute Cutthroat Trout under Existing Conditions and with the Proposed Action

Stream / Reach	Existing Habitat (miles)	Additional Habitat after Proposed Action~~Project~~ (miles)
Upper Silver King Creek (Upper Fish Valley)	2.7	
Fly Valley Creek	1.1	
Four Mile Canyon Creek	1.9	
Bull Canyon Creek	0.6	
Coyote Valley Creek	3.0	
Corral Valley Creek	2.2	
Silver King Creek (Historic Range, Project Area)	–	5
Tamarack Lake Creek	–	~1
Unnamed Tributary		~1
Tamarack Creek	x	~2
Total	11.5	9
Total with proposed Action~~Project~~	20.5 miles	
Source: USFWS 2004		

~~Rotenone treatment of Tamarack Lake would result in impacts on fish populations, namely mortality of all fish in the lake. There would also be adverse impacts on amphibians (Section 5.2, Terrestrial Biological Resources) and aquatic invertebrates (discussed below). This lake was historically fishless, and therefore the action would ultimately benefit native amphibians and other aquatic organisms. The Agencies have conducted gill net surveys (2001 through 2008) resulting in no fish being observed or captured. If no fish are discovered in 2009 and 2010 pre-treatment surveys, Tamarack Lake would not be treated with rotenone and no impacts would occur.~~ As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

The proposed Action would eliminate all fish in the treatment area of Silver King Creek ~~and Tamarack Lake (if present)~~, which would be a less-than-significant impact. The Agencies would restock with Paiute cutthroat trout as soon as practicable following treatment in order to restore a stable fish population. Tamarack Lake was historically fishless and would not be restocked following treatment, which would benefit other aquatic biota (amphibians and invertebrates).

In Silver King Creek, fish populations would also be exposed to potassium permanganate used to neutralize applied rotenone. This inorganic chemical would be applied at the downstream boundary of the treatment area near the confluence of Snodgrass Creek, and potential effects would extend downstream of the neutralization station up to a 30-minute travel time. Potassium permanganate is toxic to gill-breathing organisms at the rate (2 to 4 mg/L) required for neutralization. The toxicity of potassium permanganate to fish ranges from 0.75 to 3.6 mg/L (96 hr LC50 values) and is about 1.8 mg/L for rainbow trout. Potassium permanganate will neutralize rotenone in 15 to 30 minutes, depending on water temperature. During oxidation, potassium permanganate is converted to manganese oxide, a biologically inactive compound (CDFG 1994). In flowing water treatments, this balance usually limits aquatic exposure to permanganate and rotenone to 0.25 to 0.5 mile downstream of the neutralization site (Hobbs et al. 2006). Any affected areas would be repopulated by fish from the downstream sources.

Application of excess potassium permanganate could adversely affect downstream fish populations. As described in Chapter 3.0, Project Alternatives, the Agencies would avoid and minimize any effects of potassium permanganate on fish populations. Therefore the neutralization would occur with less-than-significant impacts on aquatic biota and no mitigation measures would be required. Potential impacts of potassium permanganate are addressed in greater detail in Section 5.3, Human and Ecological Health Concerns; Section 5.4, Water Resources; and Appendix C, Screening-level Ecological and Human Health Risk Assessment.

In conclusion, the proposed Action would have a short term adverse but not significant impact on fish populations; however, the impact would be temporary since the area would be restocked with putative pure Paiute cutthroat trout. The proposed Action would have a long term beneficial impact on Paiute cutthroat trout by implementing priority recovery actions. The USFWS (2004) has identified potential recovery activities to reduce the threat of genetic introgression from non-native trout by removing non-native trout in Silver King Creek from Llewellyn Falls downstream to Silver King Canyon (Priority 1 rating), and to increase population viability by reintroducing Paiute cutthroat trout to this area once non-native trout have been removed (Priority 1 rating).

BENTHIC MACROINVERTEBRATES

The proposed Action would directly affect all aquatic biota in Silver King Creek, including macroinvertebrates. These impacts may include mortality and differential effects on species assemblages (composition) that are an unavoidable consequence of rotenone treatment to re-establish Paiute cutthroat trout in ~~part of~~ its historic range. Macroinvertebrates play a key role in aquatic ecosystem function, and are an important food source for trout and terrestrial fauna. The potential impact of the proposed Action on endemic species of macroinvertebrates that may occur in the Silver King Creek watershed is also a matter of public concern as reflected in public comments on the NOI and NOP.

The impact assessment evaluates potential effects on species composition as required by the Basin Plan (LRWQCB 1995). The following subsections present a literature-based and site-specific assessment of the potential effects of the rotenone treatment on benthic macroinvertebrates in Silver King Creek. It provides a detailed summary of a quantitative analysis of historical and recent macroinvertebrate population data collected in Silver King Creek (Vinson and Vinson 2007, provided as Appendix D herein and Appendix E). The assessment addresses potential short- and long-term changes in abundance, shifts in species composition during these time frames, natural in-stream disturbances that have effects similar to rotenone treatment, and time to recovery from both rotenone and natural disturbance.

SHORT-TERM EFFECTS OF ROTENONE ON MACROINVERTEBRATE ASSEMBLAGES

Rotenone can harm non-target aquatic organisms. In general, benthic macroinvertebrate communities tend to be more tolerant of rotenone than most fishes, but individual macroinvertebrate species have varying ranges of rotenone tolerance (Vinson et al. in press, Finlayson et al. 2010, Mangum and Madrigal 1999, Chandler and Marking 1982, Engstrom-Heg et al. 1978) (see Appendix C, Table C-7). Toxicity of rotenone to benthic macroinvertebrates (96 hr LC50) varies widely from 0.002 to 100 ppm (Vinson and Vinson 2007). Toxicity also varies widely both within and among taxonomic divisions. Depending on exposure time, mortality was near 100% at rotenone formulation concentrations greater than 1-1.5 ppm for lotic (stream) invertebrates and 3 ppm for lentic (lake) adult aquatic invertebrate taxa (e.g. Heteroptera, Coleoptera) (Vinson and Vinson 2007). Many of the studies reviewed, however, reported results of 96 hr exposure, far exceeding that proposed for this action. The planned treatment concentration for the proposed Action would be 0.5 to1.0 mg/L [ppm] for CFT Legumine™ or Noxfish®, or 1.0 mg/L (ppm) for Nusyn-Noxfish®. The application duration would be 4 to 6 hours per drip station.

The sensitivity of individual species and life stages to rotenone appears related to their oxygen uptake process (Engstrom-Heg et al. 1978). Smaller invertebrates appear more sensitive than larger invertebrates, and species that use gills to extract aqueous oxygen are more sensitive than species that obtain oxygen through other means (Vinson and Vinson 2007). The insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and some Trichoptera (caddisflies) (EPT taxa) are all gill breathers. These EPT taxa are a major component in the trout diet. They are less tolerant to environmental stressors than other aquatic invertebrate groups and have not been found after some rotenone treatments (Mangum and Madrigal 1999). Sensitivity to rotenone can also vary within the same taxonomic family. Whelan (2002) reported that while caddisflies (Order Trichoptera) had the highest number of species affected by rotenone, many caddisflies were tolerant.

Rotenone treatment may not be toxic to all benthic macroinvertebrates. CDFG conducted toxicity testing for exposure of benthic macroinvertebrates to Nusyn-Noxfish® and CFT Legumine™. Macroinvertebrates considered representative of the treatment area were collected from the East Fork Carson River in August 2007. Test organisms were exposed to the planned treatment concentrations. Testing showed that 4 hr LC50 values varied from 41 to 274 µg/L active ingredient rotenone and 8 hr LC50 values varied from 13 to 174 µg/L active ingredient rotenone for various species of caddisflies, mayflies and stoneflies (Table 5.1-8, CDFG unpublished data Finlayson et al., 2010). These results show that the treatment concentrations required to achieve 100% rainbow trout mortality would have differential effects on EPT and that the planned treatment concentration of 0.5 to 1.0 ppm is below the “no observed effect level” (NOEL) for some sensitive macroinvertebrate species in the proposed treatment area.

The short-term effects of rotenone can be quite marked. Rotenone treatment results in short term decreases in abundance (20–85%, Engston-Heg et al. 1978, Darby et al. 2004) and diversity (Binns 1967, Cook and Moore 1969, Engstrom-Heg et al. 1978, Maslin et al. 1988a, 1988b, Mangum and Madrigal 1999, Trumbo et al. 2000a, 2000b, Whelan 2002, Darby et al. 2004). The long-term effects as the system recovers are discussed below.

Table 5.1-8 Four- and eight-hour exposure toxicity values of two formulations of active ingredient rotenone (µg/L) for rainbow trout fry and several species of invertebrates. Unless otherwise noted, values represent survival at 48 hours

Species	4 hr LC50 Values		8 hr LC50 Values	
	CFT Legumine™	Nusyn-Noxfish®	CFT Legumine™	Nusyn-Noxfish®
Vertebrates				
Oncorhynchus mykiss	7.4	7.7	5.3	6.2
Invertebrates				
Caddisflies				
Arctopsyche grandis	ND	96*	34*	74*
Hydropsyche (tana and amblis)	274	ND	174	ND
Mayflies				
Baetis tricaudatus	ND	18	ND	23
Rhithrogena morrisoni	41	54*	40	13

Table 5.1-8 Four- and eight-hour exposure toxicity values of two formulations of active ingredient rotenone (µg/L) for rainbow trout fry and several species of invertebrates. Unless otherwise noted, values represent survival at 48 hours

Species	4 hr LC50 Values		8 hr LC50 Values	
	CFT Legumine™	Nusyn-Noxfish®	CFT Legumine™	Nusyn-Noxfish®
Stoneflies				
Claassenia sabulosa	142	ND	60	ND
Oroperla barbara `	197	70	102	57

Source: ~~CDFG unpublished data~~ Finlayson et al., 2010

*24-h observation

ND – non-detectable

LONG-TERM EFFECTS – RECOVERY OF MACROINVERTEBRATE ASSEMBLAGES

Rotenone treatment can be considered akin to a severe pulse physical disturbance such as a large, unpredictable flood (Vinson and Vinson 2007). Streams such as Silver King Creek are dynamic environments, and the organisms that inhabit them must be able to cope with disturbances. Flood, drought and fire are natural disturbances that affect streams. Understanding the recovery patterns of macroinvertebrate assemblages in response to natural disturbances provides additional context for interpreting and assessing the potential long-term effects of the proposed rotenone treatment. Disturbance can be any discrete physical event that disrupts community structure by changing the physical environment (White and Pickett 1985, Yount and Niemi 1990). Vinson and Vinson (2007) described disturbance as a discrete event that removes organisms and creates conditions for recolonization.

Disturbances, natural or anthropogenic, must be considered in any attempt to evaluate changes in benthic community taxa potentially attributable to rotenone application. Disturbances physically affect the stream environment, and their historical and contemporary occurrence would need to be considered in any investigation of the effects of the proposed Action. These phenomena can have additive or cumulative effects on stream benthos and mimic or mask short- or long-term effects hypothesized for rotenone.

The following sections review the available literature on recovery from natural disturbance and rotenone treatment.

RECOVERY FROM NATURAL DISTURBANCE: FLOOD, DROUGHT AND FIRE

A review of the extant literature on flood, fire and drought disturbances suggests the time-frames for recovery of benthic communities vary with the type of disturbance, presence and proximity of colonizer source populations, and biological characteristics of the invertebrates (i.e., life history attributes and dispersal) (Vinson and Vinson 2007). Disturbances vary by frequency, intensity, duration, geographic extent and seasonality (Lake 2003). These factors influence the ability of the stream to recover and the time required to recover to pre-disturbance levels of function.

Floods are common disturbances that change the physical environment and ultimately affect macroinvertebrate community structure and composition (Vinson and Vinson 2007). Although resistance to floods by stream biota is low, the resilience or capacity to recover is typically high (Lake 2000). The rate of substrate recolonization is usually rapid, and depends on the intensity of the disturbance, the spatial extent of the area disturbed, the availability of colonists, and the composition of the biota (Lake 2000).

Recovery of macroinvertebrate assemblages generally occur within weeks to months to years following the flood event (Niemi et al. 1990, Mackay 1992), depending on the flood regime and habitat complexity (Lepori and Hjerdt 2006). Slower recovery occurs following floods that occur at uncommon or unpredictable times of year (Giller et al. 1991), which suggests that invertebrates have adapted to the flood regimes they typically experience (Resh et al. 1988). Recovery of assemblages is also slower following floods with greater magnitude (Scrimgeour et al. 1988), which suggests that the effectiveness of small-scale refugia decreases with increasing flood magnitude and as sources of colonization become further apart. The rate of recovery after floods is also determined by intrinsic biological characteristics of the invertebrates themselves, which allows them to better adapt to unpredictable disturbances (Townsend and Hildrew 1976). Aquatic invertebrate adaptations to frequently or unpredictably disturbed environments include rapid growth and development, lack of diapause or resting stages, small size, flexible life histories, high adult mobility and longevity, and the near year-around presence of adults available for post-flood oviposition (Gray and Fisher 1981, Fisher et al. 1982, Lake 2000, Townsend et al. 1997). Local factors such as season, substrate, and geomorphology are important to benthic assemblage response to disturbance.

Droughts and wildfire are other natural disturbances that can disrupt macroinvertebrate communities. Fowler (2004 ~~1984~~) found that recovery in two~~2~~ dewatered streams was affected more by the duration, not intensity, of disturbance. In a stream dewatered by drought and treated with rotenone, invertebrate populations recovered as soon as stream flow resumed (Larimore et al. 1958). The insects that were most abundant at first apparently were winged reproductive adults, colonizers from other streams. Larval insects can also move into the hyporheic~~heos~~ zone as refugia from drought disturbance (Lake 2003).

The effects of wildfire disturbance have been studied in 20 streams in Yellowstone National Park over 10 years (Minshall 2003; Minshall et al. 1997, 2003, 2004). These fires had large scale long-lasting effects on many aspects of riparian and stream habitat (Minshall et al. 2004). The direct effects of fire on macroinvertebrate communities were minor, but indirect effects due to increased runoff and channel alteration had the greatest impact on community metrics and foodweb response (Minshall 2003). Benthic macroinvertebrate metrics such as species richness and diversity recovered substantially within the first year after the wildfires, whereas assemblage composition displayed significant changes that were apparent even five ~~5~~ years after fire. Opportunistic species, particularly those easily dispersed through drift and having short generation times (e.g. chironomids and *Baetis spp.*), were found to be especially adapted to conditions following fire. In contrast, other species decreased in abundance soon after the fire (e.g. *Cinygmula* spp.) and showed little or no recovery during the study (Minshall et al.1997). Ten years after the fire, macroinvertebrate density, biomass and richness median values remained relatively constant and did not differ from the reference streams (Minshall et al. 2003). The most pronounced differences between burned and reference streams were in taxa dominance and similarity: the relative abundances of two disturbance-adapted taxa (Chironomidae and *Baetis* [Ephemeroptera]) were higher in the burned area than in the reference streams.

In a review of 150 case studies of aquatic ecosystem recovery from disturbance (15 of which were in response to rotenone treatments), Niemi et al. (1990) found that most recovery times were less than three ~~3~~ years. Recovery of macroinvertebrate assemblages to 85% of pre-disturbance densities after pulse disturbances (including rotenone) occurred in less than 18 months. Recovery times were slightly quicker for low order (1^{st} to 3^{rd} order) streams than they were for larger rivers (4^{th} to 5^{th} order). They summarized that rates of recovery of aquatic invertebrate assemblages were influenced most by: 1) persistence of the impact, including changes in system productivity, habitat integrity, and persistence of the stressor; 2) life history of the organism, including generation time, and propensity to disperse; 3) time of year the disturbance occurs; 4) presence of refugia; and 5) distance to the recolonization source.

Niemi et al. (1990) found that assemblage densities recovered much quicker than individual taxon. Times of recovery for common insect orders following pulse disturbances that did not affect physical habitat characteristics (mostly rotenone and DDT) varied among orders. Assemblage recovery times were near 80% for Diptera after one ~~1~~ year, 70% for Ephemeroptera after one ~~1~~ year and about 60% after two ~~2~~ years for Trichoptera and Plecoptera. Coleoptera was not represented in enough studies, but they felt that Coleoptera likely recovered more slowly than Trichoptera and Plecoptera. They speculated that recovery time was primarily related to generation time, propensity to drift, and distance from colonization source. Downstream drift from unimpacted upstream areas was the critical factor in determining the recovery times for stream ecosystems following pulse disturbances that do not impact the physical characteristics of the habitat. Coincidentally, some of the species most sensitive to rotenone are also highly mobile with short life cycles; thus they may have the ability to repopulate depleted areas rapidly through dispersal and oviposition (Engstrom-Heg et al. 1978).

RECOVERY FROM ROTENONE TREATMENT

As mentioned above, rotenone treatment can be considered akin to a severe pulse physical disturbance. Various studies have evaluated recovery of the benthic community from rotenone treatment by tracking the return of taxa (family, genus, and species) to approximate pre-treatment levels. While some studies have evaluated recovery of abundance and biomass (Binns 1967, Cook and Moore 1969, Engstrom-Heg et al. 1978), others have focused on community indices such as taxa richness or other diversity indices (e.g. EPT Index, BCI) (Maslin et al. 1988a, 1988b, Trumbo et al. 2000a, 2000b, Whelan 2002, Darby et al. 2004). Mangum and Madrigal (1999) focused solely on the presence or absence of the species present before the treatment. Most other authors used some combination of these metrics.

Rapid recovery (< 1 year) to pre-treatment macroinvertebrate levels has been documented following treatment by rotenone (Ling 2003) but not in all studies. The time needed for aquatic invertebrate assemblages to recover following rotenone treatment across studies have varied from a few months to three~~3~~ years or more depending on the measure of recovery and study length. Overall, aquatic invertebrate assemblage abundances generally return to pre-treatment levels quicker than measures of biodiversity or community composition. Assemblage abundances typically return to pre-treatment levels within a few months to a year (Binns 1967, Cook and Moore 1969, Beal and Anderson 1993, Mangum and Madrigal 1999, Melaas et al. 2001, Whelan 2002). Mangum and Madrigal (1999) found that the total abundance of invertebrates returned to pre-treatment levels in 1 to 36 months across their sampling sites. In Great Basin National Park, total abundance recovered to an average of 1,167 individuals (-34% of pre-treatment average) after two ~~2~~ years. EPT group abundance recovery was slower being only 362.5 individuals (-57% of pre-treatment average) after two

~~2~~ years. Only one sample site had total abundances that exceeded pre-treatment levels over the three~~3~~-year sampling period.

The recovery times for biodiversity and community composition measures have been longer and have exceeded two ~~2~~ years in some studies (Binns 1967, Whelan 2002) and more than five ~~5~~ years for individual species (Mangum and Madrigal 1999). Unfortunately, longer-term (two ~~2~~ or more years of post-treatment sampling) studies of aquatic invertebrate assemblage recovery following rotenone treatments are limited to four ~~4~~ studies: Binn's (1967) study of the Green River, Wyoming; Mangum and Madrigal's (1999) study of the Strawberry River, Utah; Whelan's (2002) study of Manning Creek, Utah; and Darby et al. (2004) study of Snake Creek in Great Basin National Park.

In 1962, over 435 miles of the Green River were treated with rotenone prior to the closure of Fontenelle and Flaming Gorge Dams (Binns 1967). The target concentration was 5 parts per million (ppm) of 5% rotenone, but the concentration reached nearly 10 ppm at some sites due to lower than expected flows. Binns (1967) reported that two ~~2~~ years after treatment the patterns of dominant invertebrate groups were still different from pre-treatment assemblages and that two genera, Pentagenia and Hexagenia (Ephemeroptera: Ephemeridae), had not reappeared. The abundances of three ~~3~~ taxonomic groups (Ephemeroptera, Trichoptera and Chironomidae) were found to increase with time after rotenone poisoning. The abundance of each group increased more quickly upstream, perhaps reflecting colonization from upstream sources. Monitoring was not continued beyond two ~~2~~ years. The observed patterns are confounded with the effects of dam closure soon after the treatment.

In the Strawberry River Watershed, Utah, the entire drainage received a double treatment within a single year. Mangum and Madrigal (1999) found that the total abundance of invertebrates returned to pre-application levels in 1 to 36 months across their sampling sites. The authors collected 46% of the pre-treatment taxa one ~~1~~ year after treatments, and 79% of the taxa after five ~~5~~ years. This study provided evidence that macroinvertebrate community composition had significantly declined and had not fully recovered five ~~5~~ years after treatment with rotenone. The comparability of this study, however, is limited because the rotenone for that project was applied at a higher concentration of three ~~3~~ times recommended for normal stream use (150 parts per billion (ppb) active rotenone), for a longer duration (48 hours instead of 4 to 8 hours), and the entire ~~across a wider~~ watershed was treated.

Manning Creek, Utah, was treated with rotenone in 1995 and 1996 (Whelan 2002). Rotenone was applied at a target concentration of 1.5 mg/L in the stream channel for 12 to 18 hours. Utah Division of Wildlife Resources collected pre-treatment samples in 1988, 1990, and 1995, as well as post-treatment samples in 1997 and 1999. Whelan (2002) reported that about 50% of the taxa were found both pre-and post treatment, 21% taxa were collected only pre-treatment, and 30% were found only post-treatment. The author stated that the taxa found only during post–treatment surveys were due to sampling errors in detecting rare taxa, as discussed earlier in this document. The most impacted orders of aquatic insects were Trichoptera, with about 10% of the taxa missing after three ~~3~~ years. In Snake Creek, Great Basin National Park, taxa numbers recovered to an average of 42 taxa by the second year, which was 91% of the average pre-treatment richness (Darby et al. 2004). The number of EPT taxa recovered to an average of 20 taxa by the second year, which was 77% of the mean pre-treatment richness. EPT abundances had not returned to pre-treatment levels after three ~~3~~ years (Darby et al. 2004). Overall after three ~~3~~ years, 96% of the pre-treatment taxa were present, but abundances of EPT taxa had not recovered.

USFS (Trumbo et al. 2000b) evaluated the impacts of rotenone treatment on Silver Creek (located in the watershed adjacent to Silver King Creek). This study evaluated the effects of repeated treatments with 1 mg/L formulated rotenone on Plecoptera using a panel of standard metrics and three ~~3~~ indices (BCI, EPT and DAT). The results were similar to Silver King Creek. While overall abundance was not affected, large Plecopterans were mostly affected. Study limitations were similar to those described by Vinson and Vinson (2007) for Silver King Creek (i.e., few pre-treatment data). No statistical comparisons were provided; however, the response of some metrics was similar to Silver King Creek (Trumbo et al. 2000a), such as reduction in DAT (6.6%) and BCI (8.4%). Overall, this study showed that certain taxa are affected by rotenone applied at 1 mg/L and that some short term shifts in diversity occur but not to a significant degree.

These studies indicate that recovery may occur within as little as two ~~2~~ months, but could take more than five ~~5~~ years. Table 5.1-9 lists the estimated time to re-establish the benthic invertebrate community after rotenone treatment. Different studies defined recovery differently, making comparison among estimated recovery times difficult. Comparison is also confounded by the specifics of the treatment (e.g. rotenone concentration) and other factors such as insufficient pre-treatment monitoring (typically limited to one or two sampling events), the highly variable temporal and spatial nature of macroinvertebrate communities, lack of adequate control and reference sites, and other confounding factors such as dams that altered hydrologic patterns (Binns 1967, Whelan 2002, Vinson and Vinson 2007).

Table 5.1-9 Time to Re-establishment from Rotenone Treatments

Stream	Study	Time to Re-establishment
Robinson Creek	Cook and Moore (1969)	2 months
Ten Mile River	Engstrom-Heg et al. (1978)	Little effect, a few months
Big Chico Creek	Maslin et al. (1988a)	5 months
Silver King Creek. Silver Creek	Trumbo et al. (2000a, 2000b)	1 year
Green River	Binns (1967)	14 to 24 months
Manning Creek	Whelan (2002)	1 to 3 years
Strawberry Creek	Darby et al. (2004)	More than 3 years
Strawberry River	Mangum and Madrigal (1999)	More than 5 years

Discriminating between the effects of the proposed Action, the effects of natural disturbance and population variability, and the cumulative effects of historic management is complex. As Vinson and Vinson (2007) found, historical data are not easily utilized and multiple factors confound interpretation:

- Most studies have not collected adequate baseline (pre-treatment) data to allow comparison with post-treatment data.
- Most studies focused on gross measurements, such as richness or abundance, with little data on the effects of rotenone on individual taxa or post-treatment recovery.
- There were too few studies and to little comparability between studies to make broad statements about the long-term effects of rotenone.
- Sampling effort was often uneven, with more samples taken from treated sites, which affects the likelihood of sampling rare taxa and reduces comparability among sites.

- Some studies have not accounted for the natural variation that occurs in benthic macroinvertebrate communities or historic disturbances that may have affected that area.

The USFS recently adjusted the Silver King Creek monitoring methodology to address some of these concerns by incorporating more sampling stations throughout the watershed as well as additional "control" and "treatment" sites (refer to Appendix E herein). The sampling methodology was also changed to allow for additional analyses such as the River Invertebrate Prediction and Classification System (RIVPACS) analysis model (Hawkins et al. 2000). The objectives of the revised study are to: 1) analyze changes in macroinvertebrate assemblages and taxa from the use of rotenone during Paiute cutthroat trout recovery activities; 2) collect and identify taxa from the Silver King Creek Watershed; and 3) re-establish historic collection sites in selected streams (USFS 2007).

Detecting changes in rare taxa, much less ascribing cause, can be especially challenging. For example, in Manning Creek Whelan (2002) observed that: 1) most of the species absent in Manning Creek after treatment were relatively rare in samples before treatment; 2) several species observed in the treated area several years before the treatment were missing immediately prior to treatment; and 3) some species missing in post-treatment samples were known to be present through other observations. The author believed that many of the "missing" taxa could survive rotenone treatment because 10 of the 11 "missing" taxa were found following rotenone treatment at Strawberry Creek drainage or in the North Snake Range of Nevada (Whelan 2002).

In the Strawberry River, Mangum and Madrigal (1999) focused exclusively on the presence or absence of taxa and did not report the relative abundance of the missing taxa in pre-treatment samples or the potential for taxa to be absent due to other causes, such as an artifact of sampling. The rotenone for that project, however, was applied at an extremely high concentration, occurred throughout the entire watershed, and had a longer duration, which limits the comparability of this study.

Review of the available literature on rotenone impacts and disturbance ecology of aquatic invertebrates led Vinson and Vinson (2007) to the following conclusions regarding potential impacts on benthic invertebrates in Silver King Creek:

- Rotenone impacts on benthic invertebrates would be initially high as impacts appear to be greatest in mountain streams characterized by snowmelt dominated hydrologic regimes, cold water and high oxygen levels, as these streams are characteristically dominated by small, gilled invertebrates, namely EPT.
- Rotenone impacts may be greatest in streams with lower frequency of disturbance or predictable discharge patterns. Recovery will also likely be longer in streams where long reaches are treated. Increasing the distance to colonization sources will reduce the ability of species to colonize the treated reach.
- Disturbance events will have greater impacts if they occur during critical life stages or if they occur in the fall when lower winter drift rates and lack of winter reproduction will delay recovery until the following spring, particularly if the site will be dependent on downstream drift of larvae for recolonization.
- The ability of taxa to recolonize treated areas appears to be a function of treatment mortality levels, overall population sizes within the treated watershed, upstream and local habitat conditions, and the dispersal abilities of individual taxon.

- Common taxa would quickly recolonize treated areas; rarer taxa may be eradicated for a number of years or indefinitely.

ROTENONE TREATMENT AND RECOVERY AT SILVER KING CREEK

Rotenone treatments have been applied 8 times in the Silver King Creek Watershed from 1964 to 1993 (Cordes et al 2004). As discussed earlier (Section 5.1.1.3), Vinson and Vinson (2007) assessed historic and recent (2003–2006) status of benthic macroinvertebrate assemblages in treated and untreated sites in Silver King Creek. The effects of rotenone on stream invertebrates appear similar to a large unpredictable flood (Vinson and Vinson 2007). Rotenone is typically applied during low flow periods. In Silver King Creek, high flow events are typically caused by snowmelt in late spring and early summer, with occasional winter rains in 1997 and 2006. Summer thunderstorms can cause flash floods which can dramatically alter stream channels and impact aquatic macroinvertebrates. From 1991 to 1993, rotenone was applied in Silver King Creek in August and September on 2.5 to 7 miles of stream during each treatment. The greater length of treated stream reach would likely prolong recolonization of treated areas. There are intermittent tributaries and fishless headwater tributary streams along much of Silver King Creek that may supply invertebrates into the treatment area.

Overall, comparisons of treated and untreated stream sites revealed little or no difference in measures of the macroinvertebrate assemblage (Vinson and Vinson 2007). The authors noted that any current or future assessments of the effects of rotenone on aquatic biota in the Silver King Creek basin are hampered by the long history of rotenone treatments in the watershed, the lack of data on aquatic invertebrate assemblages prior to the use of rotenone, and prior land use practices, such as logging and sheep and cattle grazing. The oldest data available on aquatic invertebrate assemblages were from 1984. No data are available for the period before the initial rotenone treatments in the Silver King Creek Watershed in 1964, 1976, and 1977. Therefore, Vinson and Vinson (2007) were unable to compare the original pre-treatment and post-treatment conditions.

INVERTEBRATE RECOVERY IN LAKE ECOSYSTEMS

Field studies have focused on rotenone's impacts on lentic zooplankton communities, noting a substantial short-term adverse effect on zooplankton abundance and taxa richness. Vinson and Vinson (2007) conducted a review and summary of the literature regarding rotenone effects on lentic invertebrates, including the following studies. Almquist (1959) observed that most zooplankton were killed with the addition of 0.5 to 0.6 ppm rotenone and that the toxicity of rotenone in lakes varied in response to light, oxygen, alkalinity, temperature, and turbidity. Kiser et al. (1963) observed 100% mortality of zooplankton within 2 days after applying 0.5 ppm rotenone. Similarly, Beal and Anderson (1993) found no surviving zooplankton 2 days after treatment with 0.06 ppm of 2.5% rotenone. Reinertsen et al. (1990) found a substantial reduction in species abundance after a 0.5 ppm rotenone treatment.

However, recovery of the zooplankton community in lakes following rotenone treatment appears to be rapid and robust. After the 1997 rotenone treatment at Lake Davis, overall zooplankton abundance increased to roughly 300% of the pre-treatment abundance within 1 year after the treatment (CDFG 2006). Furthermore, all zooplankton taxa identified before the treatment were identified after treatment. In another evaluation, Kiser et al. (1963) reported that all 42 species collected before a treatment, killing all zooplankton, were subsequently present within five 5 months. Melaas et al. (2001) reported complete recovery of prairie wetland zooplankton assemblages within one 1 year of treatment.

MODERATING EFFECTS AND FACTORS FOR MACROINVERTEBRATE RECOVERY

The preceding sections establish that the proposed treatment may have an unavoidable effect on macroinvertebrate abundance and species composition. Studies show that while taxa will be differentially affected and recovery of species composition is variable, recovery can reasonably be expected. Recovery mechanisms, survival of many species, treatment technique, and areal limits on treatment would moderate the effects of the proposed Action on macroinvertebrates.

The size and location of the treatment area relative to the watershed limits the effects of the treatment on the watershed as a whole. The treatment area (11 miles) comprises approximately 30% of the total length of Silver King Creek and its tributaries (about 37 miles). The location is well downstream of the headwaters, which preserves upstream source populations and ensures that recolonization could occur within several years via downstream drift. Recolonization by aerial winged adults can also easily occur from untreated stream reaches both above and below the treatment area and adjacent drainages (Smock 2006). These factors will ensure restoration of invertebrate ecological function, including providing a food source for restocked Paiute cutthroat trout.

Previous comments on the proposal expressed concern that the proposed Action would threaten headwater ecosystems (Herbst 2005). Approximately 17 miles of tributary streams would be left untreated under the proposed Action. Some of these areas (e.g. Fly Valley Creek, Four Mile Canyon Creek, and headwaters above treated reaches) have never been affected by rotenone. Other streams have not been treated in several years (e.g. Upper Silver King Creek in 1993, Corral Valley Creek in1977, and Coyote Valley Creek in 1988). These areas would remain untreated under the proposed Action as well. These waters are presumed to have recovered from any historic effects, have healthy macroinvertebrate communities (Mangum 2005), are increasing in function from elimination of grazing and other disturbances, and now support putative pure populations of Paiute cutthroat trout.

The hyporheic zone may also accelerate recovery. The hyporheic zone serves as a refuge for benthic insects (Ward 1992, Lake 2003). While the area and complex hydrologic mechanisms that create and maintain hyporheic habitats in the treatment area have not been established for this analysis, it is reasonable to assume that hyporheic fauna will not be subject to the same effects of treatment that surface organisms will and may contribute to recolonization and recovery.

Impacts to non-target aquatic invertebrates may also be minimized by the concentration and duration of rotenone applied. ~~, a method recommended by Mangum and Madrigal~~ (Vinson et al. 2010, Finlayson et al. 2010, Whelan 2002, Mangum and Madrigal1999). The Agencies would use a rotenone concentration that would be effective for trout eradication but below the “no observed effect level” (NOEL) for some sensitive macroinvertebrate species in the treatment area (Table 5.1-8).

IMPACTS OF PROPOSED ACTION ~~PROJECT~~ ON BENTHIC MACROINVERTEBRATES

SILVER KING CREEK AND TRIBUTARIES

The Basin Plan establishes water quality objectives for rotenone projects, including re-establishment of community composition within 2 years. The proposed application of rotenone would have an adverse short-term effect on benthic macroinvertebrate community composition through mortality of sensitive species. The rotenone treatment would have a stronger effect on the small, gilled EPT taxa ~~species~~ (stoneflies, caddisflies, mayflies) that are abundant in Silver King Creek and are typical of cold-water, mountain streams.

The impacts of the proposed rotenone treatment would be less-than-significant; however, because recovery of the community composition would likely occur within 2 years. Several factors support this assessment. Despite the history of multiple rotenone treatments in the watershed, little difference can be detected in benthic macroinvertebrate community composition between treated and untreated reaches (Vinson and Vinson 2007). The system is healthy and has returned to a high level of diversity after historic treatments (Mangum 2005). Other studies demonstrate that recovery can occur within as little as 2 months, extending to more than 5 years in some streams that received more intensive treatment. As described in Chapter 3.0, Project Alternatives, the proposed Action is designed to reduce impacts by using a lower rotenone dose targeted for trout. Furthermore, headwaters and tributaries upstream of the treatment area will remain untreated, thereby providing ample source populations to recolonize the treated area. Therefore, the proposed Action would have a temporary adverse effect but not a significant impact on macroinvertebrate community composition.

Although unlikely, the proposed Action could result in loss of individual macroinvertebrate taxa, potentially including rare or as yet unidentified species endemic to Silver King Creek. No specific aquatic insect species that are classified as threatened, endangered or other special-status categories or endemic species are known to be present in the proposed treatment area. The Silver King Creek system has been treated several times in the past and some rare or endemic species present before these treatments may already be lost.

Neither existing macroinvertebrate surveys nor proposed monitoring would detect endemic species, thus the Agencies cannot rule out the possibility that endemic species may be present and could be adversely affected by rotenone application. The taxonomic resolution used to process stream bottom samples (2003 to present) by the National Aquatic Monitoring Center at Utah State University could not determine if rare or endemic species were present. Further studies at a finer resolution would be costly, inconclusive without range distribution data, and may be technically infeasible for many taxa. In conclusion, because the treatment could result in loss of rare or endemic species, this would be a significant and unavoidable impact.

Impact AR-1: The proposed Action could result in the loss of individual benthic macroinvertebrate taxa, potentially including rare (unquantified) and/or unidentified species endemic to Silver King Creek. (Significant and Unavoidable)

There are several mitigating factors. The treatment area is of limited geographic range. The proposed Action does not involve treating the headwaters above Llewellyn Falls or fishless portions of tributaries or springs; these areas would remain as important sources for recolonization efforts and could contain the same rare and endemic species that may occur in the treatment area. In addition, the Agencies would attempt to use lower formulated rotenone concentrations and the less toxic formulation (CFT Legumine™) than have been used in the past to minimize impacts on benthic invertebrates (Finlayson et al. 2010).

According to the Basin Plan rotenone policy (see Section 5.4, Water Resources), temporary effects on non-target organisms from the use of rotenone is justifiable in certain situations, including restoration and preservation of threatened and endangered species such as Paiute cutthroat trout. These species are of important economic and social value to the people of the State.

As discussed earlier, the proposed Action would neutralize rotenone by applying potassium permanganate (2 to 4 mg/L). This could adversely affect benthic macroinvertebrates in the neutralization zone extending approximately ~~0.25 to~~ 0.5 mile below the confluence of Snodgrass Creek. Potassium permanganate is considered toxic to aquatic invertebrates and zooplankton, although there is likely to be a wide tolerance range among various freshwater invertebrates. For invertebrates, the 96 hr LC50 value is 5 mg/L. Like rotenone, toxicity differs between species but is often toxic in freshwater at concentrations between 1000 and 2000 ppb (USEPA 2006). Potential impacts of potassium permanganate are addressed in greater detail in Section 5.3, Human and Ecological Exposure; Section 5.4, Water Resources; and Appendix C, Screening-level Ecological and Human Health Risk Assessment.

The Agencies would avoid and minimize the potential for overdosing the creek with potassium permanganate by implementing measures described in Chapter 3.0, Project Alternatives. The macroinvertebrate resources would be expected to re-establish within a few months after the neutralization treatment ends. Areas below this point and tributary springs would serve as sources for recolonization. As a result, no taxa are expected to be lost, and re-establishment is expected to occur within a few months, thus resulting in a less-than-significant impact.

TAMARACK LAKE

As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

~~If no fish are discovered in 2009 and 2010 during pre-treatment surveys, Tamarack Lake would not be treated with rotenone and no impacts would occur. Rotenone application in Tamarack Lake would affect the lake's invertebrate community, including benthic and planktonic invertebrates, but recovery is expected to be robust as discussed in the previous section on recovery in lake treatments. Invertebrate communities would experience a long-term benefit through restoration of the lake to its historically fishless condition. Introduction of fish to alpine/subalpine lakes in the western United States has greatly reduced large-bodied macroinvertebrates and zooplankton species (Anderson 1972, Knapp et al. 2001, 1996). The literature suggests that if the lake were maintained in a fishless condition, the invertebrate community would recover more quickly following fish removal (Knapp et al. 2005).~~

~~The effects of rotenone may not be uniform throughout the lake. Not all zones of the lake would receive the same level of exposure. Rotenone in littoral areas would likely break down faster from exposure to oxygen and light. Hyporheic refugia may be present in the littoral zone. Finally, the lake's tributaries may provide source populations and refugia.~~

~~In summary, the proposed Action would have an adverse but temporary impact on aquatic invertebrates (benthic and zooplankton) in Tamarack Lake. The treatment would have a greater impact on lentic zooplankton in the short term, but it is expected that the re-establishment of zooplankton after the proposed rotenone treatment at Tamarack Lake will occur rapidly, with significant recovery measurable within months and full recovery anticipated within 1 year of a treatment. With fewer sources of recolonization upstream, benthic invertebrates may not recover within 2 years (CDFG 2006). As discussed earlier for stream habitat, the proposed Action could result in loss of individual taxa, potentially including rare or as yet unidentified species endemic to the Silver King Creek Watershed.~~

~~**Impact AR-2: The proposed Action could result in the loss of individual benthic macroinvertebrate taxa, potentially including rare (unquantified) and/or unidentified species endemic to Tamarack Lake. (Significant and Unavoidable)**~~

~~This risk is unquantified because no sampling has been done of Tamarack Lake invertebrates. Samples would be collected and stored in 2009 and processed and identified only if fish are found in Tamarack Lake and rotenone treatment of the lake becomes necessary.~~

RIPARIAN HABITAT AND WETLANDS

Rotenone does not affect riparian or aquatic vegetation. Initially, several drip stations would be installed along the stream. Some riparian vegetation may be removed and/or trimmed to access the stream channel, install the drip stations, and apply the rotenone by hand. Light trampling of herbaceous vegetation and sprouts and seedlings on bars may also occur during installation, treatment(s), and collection and removal of fish. Vegetation loss is expected to be temporary and the affected vegetation would recover quickly. The woody riparian and native understory species will continue to recover in response to the elimination of grazing pressures. The impact would be expected to be small and could be mitigated~~ble~~.

5.1.4.3 Alternative 3: Combined Physical Removal

Under Alternative 3, intensive electrofishing would be employed in an attempt to remove all fish from Silver King Creek and its tributaries within the treatment area. This method would involve passing an electric current through the water to stun fish, which would be netted and placed in buckets (Reynolds 1983). Using this approach, sections of stream are isolated with small mesh block nets before a crew makes multiple passes through the site with electrofishing equipment until fish are no longer captured. All captured fish would be disposed of via burial. Following successful removal of non-native trout, Paiute cutthroat trout stock of known genetic lineage would be re-introduced into the treatment area following guidelines in the Revised Recovery Plan (USFWS 2004) and recent genetic studies (Cordes et al. 2004, Finger et al. 2009 ~~2008~~).

Electrofishing is a common method for capturing fish, surveying for presence, or estimating fish population size. Typically, either removal-depletion or mark-recapture methods are employed to subsample the population. In this alternative, electrofishing would be employed with the intent of removing every individual fish, requiring a more intensive procedure than typical population assessment efforts (e.g. high electrical power, multiple passes). Presumably, multiple passes would be made through stream reaches until more than 1 pass resulted in no fish captured. However, electrofishing to capture all fish would be more intensive (multiple passes until no fish are captured, higher electrical power) than typical population assessment surveys. Factors such as habitat complexity, fish cover, fish behavior, and susceptibility to the electric field would challenge technicians and make verification of complete removal difficult and uncertain. Using physical removal techniques would require many years of work (10 or more years), longer than the proposed Action (rotenone treatment) to achieve removal of all non-native trout. Physical disturbance of the streambed would occur as workers conduct sufficient passes to complete the procedure.

Tamarack Lake is too deep for electrofishing to be an effective means of fish eradication. In the event that fish are confirmed to be in Tamarack Lake, gill nets (and other physical removal methods) would be employed over several years in an attempt to eliminate any fish or their progeny that may have remained from the 1991 fish planting.

FISH POPULATIONS

Under Alternative 3, all fish in the treatment area would be removed through electrofishing and buried. Any Paiute cutthroat trout that have passed over Llewellyn Falls and the Coyote Valley/Corral Valley Creek barriers would also be removed. Captured Paiute cutthroat trout would not be transported above Llewellyn Falls or above the Coyote Valley/Corral Valley Creek barrier because their genetic origin would be uncertain. As stated earlier, genetic studies indicate that the fish in the treatment area are principally non-native trout (i.e., rainbow trout and/or golden trout hybrids) with very little Paiute cutthroat trout genetic influence (Finger et al.2009 ~~2008~~). ~~There is no practical way to identify and separate, in situ, potentially pure Paiute cutthroat trout from hybrid individuals in treated areas.~~ The loss of these fish would not result in a significant impact on this species.

Putative ~~P~~pure Paiute cutthroat trout from within the Silver King Creek drainage would be restocked into the treated reaches, where they are expected to become re-established to population levels commensurate with carrying capacity. Therefore, Alternative 3 would not have a long-term significant impact on fish populations. A short-term impact would occur as donor stocks redistribute and repopulate treated areas. This action and impact is similar for both the action alternatives.

If complete removal of non-native trout species is not achieved, the potential for re-establishment of a hybridized population remains and no net benefit to Paiute cutthroat trout viability (recovery) may be achieved.

Electrofishing or various net methods may not result in complete removal of undesired trout species in the treatment area. Therefore, this alternative may not meet the purpose and need for the proposed Action and may not be consistent with the Revised Recovery Plan (USFWS 2004). The recovery of the species may not occur and the proposed Action to recover Paiute cutthroat trout by removing non-native trout and establishing a viable population in historic habitat may not be successful. In addition, because some non-native trout would remain, the threat of an illegal introduction above Llewellyn Falls would be greater with this potential source nearby, although the threat of introduction from other out-of-basin sources remains the same for all alternatives. The genetic integrity of Paiute cutthroat trout would continue to be threatened.

Electrofishing crews would not be able to efficiently shock deep pools (waist deep or greater than 1 meter) because of safety reasons and the attenuation of the electrical field. The potential for undesirable trout species to remain in deep and/or complex habitats is likely.

If fish are present in Tamarack Lake, the lake would be gillnetted over the course of several years. Knapp and Matthews ~~et al.~~ (1998) estimated that 15 to 20% of high lakes in the Sierra have characteristics that would allow the eradication of trout by means of gill netting. He found, however, that in lakes greater than 10 meters in depth, gillnetting is likely to be ineffective. Gillnetting would be challenging in Tamarack Lake, because the maximum depth is approximately 14 meters.

MACROINVERTEBRATE COMMUNITIES

Benthic macroinvertebrate communities in Silver King Creek may be affected by electrofishing. Electrofishing may force macroinvertebrates to move from their substrate habitat to the water column and be transported downstream; a phenomenon known as drift, and in this case, electrofishing-induced drift (Elliot and Bagenal 1972, Fowles 1975, Bisson 1976, Mesick and Tash 1980, Brown et al. 2000, Kruzic et al. 2005). However, the current and voltage used during electrofishing rarely result in mortality (Bisson 1976, Mesick and Tash 1980) and any effects tend to be short-lived (Fowles 1975, Kruzic et al. 2005).

Studies have shown that macroinvertebrate populations subject to electrofishing have been reduced through drift by more than 90% when macroinvertebrates are the target organism (Taylor et al. 2001), and as much as 80% with commonly used methods (Fowles 1975). However, not all studies have shown such dramatic reductions (Elliot and Bagenal 1972). Stream macroinvertebrates are not affected equally by electrofishing. Most authors report that the members of the Ephemeroptera order are most susceptible to electrofishing-induced drift (Elliot and Bagenal 1972, Fowles 1975, Mesick and Tash 1980, Taylor et al. 2001), while members of the order Trichoptera tend to be the least susceptible (Elliot and Bagenal 1972, Fowles 1975, and Taylor et al. 2001). Mesick and Tash (1980) found that the displacement rate or the rate of induced drift of macroinvertebrate species was directly related to their normal drift behavior with slight variations in rates among species due to body size differences, stream temperature, and type of electric current used.

The overall effect of electrofishing on macroinvertebrates in streams depends on several factors including the voltage and current used, shock duration, number of passes conducted, length of stream shocked, community type (proportion of tolerant versus non-tolerant species), and the presence of more resistant or unaffected life stages (eggs or emergent adults). Kruzic et al. (2005) mentions that electrofishing later in the season, when most invertebrates have hatched, would likely minimize effects on macroinvertebrates (Kruzic et al. 2005).

Macroinvertebrates are unlikely to drift for long distances and displacement is positively correlated with water velocity. For example, Fowles (1975) noted during electrofishing that macroinvertebrates were quick to return to the streambed after drifting only 10 meters. Similar drift distances were noted by Elliot and Bagenal (1972) and McLay (1970), as cited in Fowles (1975). Kruzic et al. (2005) found that the number and weight of drifting macroinvertebrates decreased by a factor of 3 between drift distances of 2.5 and 5 meters at one site. At a second site with greater discharge and faster flows, no such decline occurred. Faster flows may have carried even those insects with highly-evolved swimming morphologies and behaviors further downstream when compared to the slower flowing sites. Indeed, many of the species with the greatest susceptibility to induced drift are the same species with a high propensity to drift naturally and, as such, have evolved high rates of compensatory upstream movements (Madsen et al. 1973 as cited in Mesick and Tash 1980) as well as high rates of recolonization from regions upstream. Kruzic et al. (2005) found the effects of electrofishing on macroinvertebrate drift to differ based on insect size and morphology. Large-bodied Plecoptera (stoneflies) were only found to drift 2.5 meters from the treatment area, while smaller and lighter taxa, such as

Chironomidae (midges) exhibited longer drift distances and comprised the majority of the most downstream (20 and 30 meter) samples. Previous studies have also noted that smaller taxa drift further downstream. Elliot (1971 as cited in Kruzic et al. 2005) found that chronomids were small, poor swimmers incapable of rapid reattachment to the substratum or aquatic vegetation.

In addition to the effects of the electrical current, electrofishing requires crews of several individuals, typically 3 or more. In stream channels where shocking from the bank is not feasible, workers would walk on the streambed, directly disturbing bottom sediments. Macroinvertebrate abundance has been shown to decrease in areas of disturbance versus undisturbed control sites in a northern Vermont stream (McCabe and Gotelli 2000). Walking on stream substrate or bottom sediments can also cause an increase in drift (Elliott and Bagenal 1972, Kruzic et al. 2005). Such disturbances may cause drift among species less likely to be affected by electrofishing alone (Elliott and Bagenal 1972), especially among species that tend to either burrow into the substrate or inhabit the underside of rocks or gravel (Elliott and Bagenal 1972). However, although Kruzic et al. (2005) noted greater numbers of invertebrates in the drift during electrofishing and trampling compared to electrofishing only, the increase was not significant ($p < 0.05$). Therefore, electrofishing conducted by crews operating within the stream may cause greater disturbance and increased drift than electrofishing from the stream banks.

The multiple passes required for fish removal (total capture) would involve repeated trampling and shocking disturbance over the survey area, potentially leading to displacement or crushing of large numbers of macroinvertebrates. Populations in disturbed areas of the stream may recolonize rapidly following the treatment, as in the studies conducted by McCabe and Gotelli (2000). However, their study evaluated routine electrofishing techniques, not the more intensive effort required to achieve project objectives.

Reductions in the macroinvertebrate populations would be temporary. Electrofishing would occur over a relatively short period (over the course of more than 72 days ~~a month~~ each late summer/fall). Headwater areas above Llewellyn Falls in Upper Fish Valley would not be affected by this alternative and would provide source populations for recolonization of electrofished areas. As described earlier, benthic macroinvertebrates have the ability to recolonize areas by drift from untreated upstream reaches in the watershed, aquatic and aerial movements of colonizers from downstream areas, and aerial colonizers from adjacent drainages (Smock 2006). It is reasonable to expect that the treatment area would be re-colonized rapidly with benthic invertebrates critical for ecological function, including a food source for restocked Paiute cutthroat trout. Recovery would be faster than under the proposed Action (Alternative 2) because the disturbance of electrofishing is likely less severe than from rotenone treatment, and therefore the macroinvertebrate community would not be as depleted. Recovery from rotenone can occur within a few months and upwards of 5 years for wide scale treatment (Vinson and Vinson 2007). Since electrofishing would occur in the fall during lower winter drift rates and lack of winter reproduction, recovery would be delayed until the following spring, particularly if the site would be dependent on downstream drift of larvae for re-colonization (Vinson and Vinson 2007).

There is also the risk that an endemic species may be eliminated, but this risk is difficult to quantify (as discussed above). ~~The probability is lower than for the rotenone treatment because electrofishing is not expected to result in complete eradication of the macroinvertebrates in the area.~~ Because electrofished areas would be re-colonized rapidly (less than 2 years) from upstream areas and a diverse community would be re-established, impacts on the benthic macroinvertebrate community from physical removal would be less-than-significant and no mitigation measures would be required.

RIPARIAN HABITAT AND WETLANDS

Intensive electrofishing would have minimal effects on the Silver King Creek Watershed. Associated activities such as the use of block nets, the application of electric current to the water column, and substrate trampling would be temporary, although it would be repeated annually for several years (at least 10 years). Water quality would quickly return to pre-treatment levels as sediment mobilized from in-stream activities would soon settle. There would be no need to construct dams or diversions. The use of gasoline to fuel the generator may pose a pollution risk to the watershed.

Electrofishing work would occur within the stream channel, with minimal activities conducted on the stream banks and bars. Some riparian vegetation may need to be removed and/or trimmed to access the stream channel and light trampling of herbaceous vegetation and seedlings on bars may occur during the collection and removal of the fish. Vegetation loss is expected to be temporary and the affected vegetation would recover quickly. The woody riparian and native understory species would continue to recover in response to the elimination of grazing pressures. The impact would be expected to be small and could be mitigated~~ble~~. Efforts would be made to minimize disturbance of the riparian zone where possible (e.g. using the same access trail each time, avoiding newly recruiting willow seedlings on bars).

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5.2 TERRESTRIAL BIOLOGICAL RESOURCES

This section describes the existing terrestrial wildlife resources that are associated with the proposed project area. Terrestrial wildlife includes all vertebrate species except fish. Fish and benthic invertebrates are addressed in Section 5.1, Aquatic Biological Resources. Amphibians are addressed under terrestrial wildlife even though they have an aquatic larval life history stage. This section provides an overview of typical terrestrial wildlife species and their habitats that are present within the proposed project area as well as information on special status species that may also occur in the area.

This impact assessment builds on assessments presented in CDFG's Programmatic EIR (CDFG 1994), the Biological Assessment prepared by USFS in 2002, the Biological Opinion prepared by the USFWS in 2003, and the Biological Evaluation prepared by the USFS in 2004. A ~~revised~~ intra-service Biological Opinion ~~Assessment~~ and Biological Evaluation are in preparation and will be completed prior to the final decision. The previous Biological Assessment (2002) and Biological Opinion (2003) addressed bald eagle (*Haliaeetus leucocephalus*), Sierra Nevada yellow-legged frog (*Rana sierrae*) (formerly Mountain yellow-legged frog, *Rana muscosa*), and Yosemite toad (*Bufo canorus*) and contained conservation recommendations for amphibians. On June 28, 2007, the bald eagle was removed from the Federal list of threatened and endangered species and is now managed as a Forest Service Sensitive Species. The Sierra Nevada yellow-legged frog and the Yosemite toad were also recently added to the Region 4 Forester's Sensitive Species list. The Biological Evaluation analyzes potential impacts to Forest Service sensitive wildlife and plant species.

5.2.1 Environmental Setting

The proposed project area is in the 160,000-acre Carson-Iceberg Wilderness located within the Humboldt-Toiyabe National Forest. This rugged area is dominated by volcanic ridges and peaks. Streams within the proposed project area flow through granitic canyons. Elevations range from 5,000 feet to over 11,000 feet. Snow pack remains into June. Summers are generally dry and mild.

5.2.1.1 Terrestrial and Riparian Vegetation

The proposed Action and surrounding area is represented by a mosaic of high elevation (7,000 to 8,000 feet) forest, upland brush communities, and a mix of riparian associated communities including aspen, willow and wet meadow habitat types. Forest cover types vary markedly from drier south-facing slopes dominated by Jeffrey pine and associated mountain mahogany and bitterbrush understories, to higher elevation forest consisting of red fir, western white pine and lodgepole pine. Extensive stands of lodgepole pine are also well represented. Small patches of late successional forest are present within or adjacent to the proposed project area; however, most of what remains is mid-seral stands that were once harvested during the Comstock era. The most significant stands of old growth are outside of the proposed project area and include the vicinity of Rodriquez Flat in the headwaters of Snodgrass Creek (near Little Antelope Pack Station) and adjacent to the project area in Corral Valley and Coyote Valley Creeks. Both dry and wet meadow community types line most of Silver King Creek. Willow and sedges are the dominant riparian species present in the Silver King Creek basin (Smith 1994). A significant willow component occurs in the wetter portions of the meadows. Habitat surrounding Tamarack

Lake is a combination of large granitic rock outcroppings, patchy brush communities, and open canopied conifer stands.

Specific geology and soil maps are not available for the proposed project area, but a general description of the Sierra Range was used. The soils are primarily formed from weathered granitic, metamorphic, and basic igneous rock with glacial deposits and alluvium present (~~Soil Conservation Service~~ USDA 2007 ~~1974~~). The soils are generally described as shallow, well drained and sandy with varying amounts of coarse fragments.

5.2.1.2 Terrestrial Wildlife

Wildlife species that occur in the Silver King Creek Watershed are typical of high elevation northern Sierra Nevada species. The list of wildlife species that potentially occur in the Humboldt-Toiyabe National Forest area includes numerous species of birds, mammals, and amphibians. The threatened, endangered, candidate, Management Indicator Species, and Forest Sensitive Species that have the potential to occur in the proposed project area are summarized below.

FEDERALLY LISTED AND CALIFORNIA STATE LISTED SPECIES

No federally listed terrestrial wildlife species are known to occur in the proposed project area. State listed species potentially present in the proposed project area include California wolverine (*Gulo gulo*). The threatened California wolverine was recorded during the 1990's within the project area (California Natural Diversity Database [CNDDB] 2008 ~~2007~~).

FEDERAL AND STATE CANDIDATE SPECIES

Three terrestrial wildlife species are considered candidates for Federal listing under the ESA; Sierra Nevada yellow-legged frog (*Rana sierrae*), Yosemite toad (*Bufo canorus*), and the Pacific fisher (*Martes pennanti*). The Sierra Nevada yellow-legged frog and the Yosemite toad were also recently added to the Region 4 Forester's Sensitive Species list and were considered for analysis in the Biological Evaluation. The Sierra Nevada willow flycatcher (*Epidonax trailii brewsteri* and *adastus*) is considered a candidate for listing in the State of California. These three ~~3~~ species were also identified in the Sierra Nevada Forest Plan Amendment (SNFPA) as regional "species at risk" and have the potential to occur in the proposed project area.

Standards and guidelines for conserving these species were developed under the Sierra Nevada Forest Plan Amendment (SNFPA) and included a mandate to complete a Conservation Assessment (CA) for each of the three ~~3~~ species. A CA synthesizes the best available information on status and distribution of a species and outlines the information necessary to develop a plan of action to conserve the species. The CA for the Sierra Nevada willow flycatcher was finalized in 2003 and draft CAs for the Yosemite toad and Sierra Nevada yellow-legged frog have been developed.

MANAGEMENT INDICATOR SPECIES

The Toiyabe National Forest Land and Resource Management Plan (LRMP) (1986) identifies USFS Management Indicator Species (MIS) as species representing a group of species with similar habitat requirements. USFS MIS are selected to represent the significant ecosystems in the forest and associated wildlife and fish that depend upon those ecosystems. USFS MIS are not federally listed (threatened, endangered, or forest sensitive) but could be affected by the proposed Action. A review was conducted to determine: 1) if the proposed Action is within the range of any MIS; 2) if habitat is present within the proposed project area; and 3) if there are potential direct, indirect or cumulative effects on habitat components. MIS associated with habitats that may be affected by the project will be analyzed below. The following terrestrial MIS were included for analysis for the Paiute Cutthroat Trout Restoration Project:

- Mule deer (*Odocoileus hemionus*)
- American marten (*Martes americana*)
- Yellow warbler (*Dendroica petechia*)
- Yellow-rumped warbler (*Dendroica coronata*)
- Hairy woodpecker (*Picoides villosus*)
- Williamson's sapsucker (*Sphyrapicus varius*)
- Northern goshawk (*Accipiter gentilis*)
- Sage grouse (Centrocercus urophasianus)

The following species were not selected for further analysis due to absence of habitat or because the project will not directly or indirectly affect the habitat:

- Palmer's Chipmunk (*Eutamias* spp.)

Pauite cutthroat trout and benthic macroinvertebrate populations are described in Section 5.1, Aquatic Resources. Lahontan cutthroat trout were not analyzed because they are not present within the project area and the project area is outside of their historic habitat.

FOREST SENSITIVE SPECIES

The Forest Sensitive Species (FSS) are based on the USFS Regional Forester's (R4) list of sensitive species (November 1995 list, updated in 1999 and 2003 and 2008 and 2010). FSS species analyzed in the Biological Evaluation include five ~~5~~ mammals (Spotted bat, Townsend's big-eared bat, pygmy rabbit, wolverine, and fisher), eight ~~8~~ birds (Northern goshawk, bald eagle, California spotted owl, flammulated owl, great gray owl, white-headed woodpecker, mountain quail, and sage grouse), two ~~2~~ amphibians (Sierra Nevada yellow-legged frog and Yosemite toad) and 10 plants (Lavin's eggvetch, upswept moonwort, dainty moonwort, slender moonwort, seaside sedge, Tahoe draba, Marsh's bluegrass, Webber ivesia, Sierra Valley ivesia, and Galena Creek rockcress).

OTHER SPECIES CONSIDERED

NEOTROPICAL MIGRATORY SONGBIRDS

The neotropical migratory songbirds (NTMB) found in North America include roughly 350 species, of which about 250 are known as "neotropical migrants." Migratory birds spend their winters in the tropics of southern Mexico, Central and South America, and the West Indies. The other 100 species, called "short-distance migrants," winter chiefly in the southern U.S., particularly along the Gulf Coast. Migratory songbirds can be found in virtually every habitat on the continent, and usually half or more of the breeding birds in any sampled area are migratory (Robinson 1997).

Executive Order (EO) 13186, signed January 10, 2001, requires Federal agencies to protect migratory birds by supporting the conservation intent of the Migratory Bird Treaty Act. Under this EO, Federal agencies must integrate bird conservation principles, measures, and practices, into agency planning and activities. Federal agencies should also, to the extent practicable, avoid or minimize adverse impacts on migratory bird resources when conducting agency actions. A Memorandum of Understanding (MOU) between the USDA Forest Service and the USDI Fish and Wildlife Service, 2009 signed January 17, 2001, identifies specific activities for bird conservation pursuant to EO 13186 including: 1) the need to identify management practices that impact populations of high priority migratory bird species; and 2) to develop management objectives or recommendations that minimize these impacts.

Meadow-riparian habitat found throughout the project area is identified as "high priority" habitat for NTMB in the 1999 Draft Avian Conservation Plan for the Sierra Nevada Bioregion (Siegel et al. and DeSante 1999). The 1999 Draft Plan lists species considered critically dependent upon meadow-riparian habitats found in the Sierra Nevada including the Carson-Iceberg Wilderness.

The two largest threats to NTMB are habitat fragmentation on breeding grounds and deforestation of wintering habitat (Finch 1991). Compared to other birds, migratory species are the most negatively affected by fragmentation, and are usually absent from small or highly isolated forests (Martin and Finch 1995SERC 2003). The distribution and diversity of birds is highly associated with structural diversity in vegetation (MacArthur and MacArthur 1961). Species such as yellow warbler, MacGillivray's warbler, Wilson's warbler, and common yellowthroat are considered high priority species and require heavy shrub or herbaceous cover for nesting and foraging (Sedgwick and Knopf 1987).

OTHER AMPHIBIANS CONSIDERED

WESTERN TOAD

The western toad (Bufo boreas) is widely distributed across western North America inhabiting a broad array of habitats including desert streams, springs, grasslands, meadows and woodlands. It is divided into two sub-species; the boreal toad and the California toad (Stebbins 2003). Within the project area only the California toad is found usually along the banks of ephemeral meadow ponds and potholes. Breeding season varies greatly by latitude, elevation and local conditions but within the project area breeding occurs during May and June. Metamorphosis occurs eight to twelve weeks after eggs are laid.

PACIFIC TREE FROG

The pacific tree frog (Pseudacris regilla) is a small chorus frog occurring in a variety of environs from sea level to subalpine throughout the western United States. It is most often found in low vegetation alongside streams, ponds, and ephemeral aquatic habitats (Stebbins 2003). Within the project area it breeds from May to June depending on local conditions and will metamorphosis by the end of summer.

5.2.2 Regulatory Setting

5.2.2.1 Federal

ENDANGERED SPECIES ACT OF 1973 (16 USC §1531 ET SEQ.; 50 CFR PARTS 17 AND 222)

This law includes provisions for protection and management of species that are federally listed as threatened or endangered and designated critical habitat for these species. This law prohibits "take" of federally listed species, except as authorized under an incidental take permit or incidental take statement. The USFWS is the administering agency for this authority.

MIGRATORY BIRD TREATY ACT OF 1918

The Migratory Bird Treaty Act (16 U.S.C. Sections 703-712, July 3, 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986 and 1989) implements various treaties and conventions between the United States and other countries, including Canada, Japan, Mexico, and the former Soviet Union, for the protection of migratory birds. Under the act, taking, killing, or possessing migratory birds or their eggs or nests is unlawful. Most species of birds are classified as migratory under the act, except for upland birds such as pheasant, chukar, and gray partridge. The act contains several exemptions, such as waterfowl hunting. Many types of development result in the taking of migratory birds: collision with windows, for example, is a leading cause of death among songbirds. Take~~ing~~ may be allowed under a scientific permit if research is deemed beneficial to migratory birds. USFWS is the administering agency for this authority.

BALD AND GOLDEN EAGLE PROTECTION ACT (BGEPA) OF 1940

On August 8, 2007, the bald eagle was removed from the ~~f~~Federal list of threatened and endangered species (72 FR 37346). Bald eagles will continue to be protected under the Bald and Golden Eagle Protection Act (BGEPA) of 1940, as amended (16 U.S.C. 668-668d) and the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. 703 et seq.). Both of these laws prohibit killing, selling or otherwise harming eagles, their nests, or their eggs.

The USFWS developed the National Bald Eagle Management Guidelines (Guidelines) to advise landowners, land managers, and others when and under what circumstances the protective provisions of the BGEPA may apply to their activities. These documents and further information about the bald eagle are available at http://www.fws.gov/migratorybirds/baldeagle.htm. A variety of human activities can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young. The Guidelines are intended to help people minimize such impacts to bald eagles, particularly where they may constitute "disturbance", which is prohibited by the BGEPA. The USFWS developed final regulations providing two mechanisms which authorize "take" under the BGEPA for those currently authorized under the Act. These final regulations are available on the website address provided above.

5.2.2.2 State

CALIFORNIA FISH AND GAME CODE, SECTION 1600, ET SEQ.

This law provides for protection and conservation of fish and wildlife resources with respect to any project that may substantially divert or obstruct the natural flow of, or substantially change or use any material from the bed, channel, or bank of any river, stream, or lake. The administering agency is CDFG.

CALIFORNIA ENDANGERED SPECIES ACT OF 1984 (CALIFORNIA FISH AND GAME CODE SECTION 2050-2098)

This law provides for the protection and management of species and sub-species listed by the state of California as endangered or threatened, or designated as candidates for such listing. They are listed at 14 CCR Section 670.5. This law prohibits take of state listed or candidate species, except as otherwise authorized by the Fish and Game Code. The term take is defined by Section 86 of the Fish and Game Code as “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” This definition is different in some respects from the definition of take under the ESA. The administering agency is CDFG.

CALIFORNIA FISH AND GAME CODE SECTION 5650

This law protects water quality from substances or materials deleterious to fish, plant life, or bird life. It prohibits such substances or materials from being placed in waters or places where it can pass into waters of the state, except as authorized pursuant to, and in compliance with, the terms and conditions of permits or authorizations of the SWRCB or a regional water quality control board such as a waste discharge requirement issued pursuant to Section 13263 of the Water Code, a waiver issued pursuant to Section 13269(a) of the Water Code, or permit pursuant to Section 13160 of the Water Code. The administering agency for Fish and Game Code Section 5650 is CDFG.

5.2.3 Assessment Criteria and Methodology

5.2.3.1 Significance Thresholds

CEQA thresholds of significance for biological resources were used in the following evaluation. Impacts were considered significant if they would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFG, USFWS or USFS;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by CDFG, USFWS or USFS;
- Have a substantial adverse effect on federally-protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means (Evaluated in Section 5.4, Water Resources);
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites (Evaluated in Section 5.1, Aquatic Resources);
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

5.2.3.2 Evaluation Methods and Assumptions

Numerous sources were used to gather existing information on terrestrial wildlife resources in the project area, including documents drafted for previous attempts to implement the Paiute cutthroat trout recovery program (USFWS 2003, USFS 2002, 2004), and unpublished data from the CDFG. Lists of special status species potentially occurring in the proposed project area were obtained from the USFWS, USFS and a review of records from the CNDDB. These data were used to establish the environmental setting.

The resources described in the environmental setting were evaluated to determine the potential impacts of activities associated with the proposed Action and alternatives and to develop mitigation measures, as appropriate. The impacts of the proposed Action and alternatives were evaluated based on the potential for impacts on terrestrial wildlife resources such as chemical impacts from rotenone treatment, disturbance during electroshocking activity, and potential reductions of prey species for terrestrial wildlife, including effects on aquatic insect and fish communities.

Impacts on biological resources were evaluated by considering potential direct, indirect and cumulative impacts of the proposed Action and alternatives on protected species and habitats. Potential impacts on biological resources include the following:

- Direct or indirect impacts on riparian habitats;
- Direct, indirect and cumulative impacts on federally- or state-listed rare, threatened, or endangered species or species that are candidates for listing;
- Direct indirect and impacts on other special status species;
- Loss of wildlife habitat; or
- Disturbance to riparian habitat.

As part of the impact assessment, the EIS/EIR team searched for and reviewed any local policies and ordinances that may contain provisions protecting biological resources to identify potential conflicts. No conflicts were identified; therefore, this threshold is not assessed further in this EIS/EIR. No local, regional, or state Habitat Conservation Plans or Natural Community Conservation Plans affecting the proposed project area were identified. Therefore, no conflicts with habitat or species conservation plans would occur and no further analysis is provided in this EIS/EIR.

5.2.4 Environmental Impact Assessment

This section analyzes the potential impacts on terrestrial wildlife resources due to the proposed Action and alternatives. The assessment evaluates direct, indirect and cumulative impacts associated with implementation (e.g., chemical application, worker activity) and indirect impacts, which are secondary effects but delayed or spatially removed from implementation (e.g. residual chemical effects, stream sedimentation, habitat impacts, etc.).

5.2.4.1 Alternative 1: No Action

WILDLIFE IMPACTS

The No Action alternative would maintain existing conditions in the proposed project area and would have no direct, indirect, or cumulative effects on any federally listed or state listed threatened, endangered, proposed or candidate species, Similarly, the No Action alternative would not have any direct, indirect, or cumulative impacts on any FSS. The No Action alternative would not affect habitat or cause a downward trend in populations for any MIS species or NTMB listed above (USFS 2004).

RIPARIAN OR OTHER SENSITIVE NATURAL HABITATS

The No Action alternative would not involve chemical application or any physical disturbance and would therefore have no direct or indirect impacts on riparian habitat or any other sensitive natural habitat identified in local or regional plans, policies, or regulations or by the CDFG or USFWS.

5.2.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

WILDLIFE IMPACTS

The proposed rotenone treatment of Silver King Creek and its tributaries could affect terrestrial wildlife through the physical disturbance that would result from presence of workers and their activities. It could also expose them to rotenone and other chemicals associated with the application and neutralization process through direct body contact, ingestion of treated water, and consumption of fish killed by rotenone. All mammals break down rotenone in their digestive tract rendering short-term exposure virtually harmless. Toxicity data for orally administered rotenone indicate that mammals would not be affected by drinking rotenone treated water or eating rotenone-killed fish (Bradbury 1986). The mammalian digestive system is not an efficient mode for rotenone entry into an animal’s body, thus limiting potential for harm. Rotenone residues in dead fish are generally very low (< 0.1ppm), unstable, and not readily absorbed through the gut of an animal eating a rotenone-killed fish (Finlayson et al. 2000). Appendix C presents a detailed screening-level ecological risk assessment.

The treatment could also affect terrestrial wildlife by temporarily reducing their food source. The proposed Action would remove all non-native trout (of all sizes), which may constitute an important prey base for several locally occurring wildlife species. The prey base for these species may be reduced until pre-treatment fish densities and size-class distributions are reestablished through stocking.

Other terrestrial wildlife that prey on the aquatic invertebrate community could be affected by the treatment. Insectivorous wildlife species in the proposed project area include yellow warbler and Williamson’s sapsucker, among others. These species prey on emerging aquatic invertebrates as they forage in and around the water. Rotenone is toxic or noxious to gill-breathing aquatic invertebrates. The resulting reduction in this prey base could impact insectivorous wildlife species. The paragraphs below assess potential exposure or food chain impacts on protected species.

Noise generated by the proposed Action would be of short duration and would not adversely affect any of the wildlife species addressed below. The proposed Action would generate only minor disturbance from workers and the small mechanical pumps that would be used to apply rotenone and potassium permanganate. Few criteria are available to assess potential noise impacts on wildlife. Some jurisdictions (including the City and County of San Diego) have adopted a 60 decibels A-weighted (dBA) significance threshold for special status bird species, based on a bird's ability to vocalize loud enough to ensure successful breeding. The low hum of the generators that would be used during the treatment process would be well below this criterion.

FEDERALLY LISTED AND STATE LISTED THREATENED, ENDANGERED, AND CANDIDATE SPECIES

CALIFORNIA WOLVERINE (STATE THREATENED)

Wolverines typically occur in high elevation, remote areas and do not inhabit grassland-chaparral or sagebrush and creosote scrublands in California (Ruggiero 1994 ~~and USDA 1991~~). In the northern Sierra Nevada, wolverines have been found in mixed conifer, red fir, and lodgepole habitats, and probably use subalpine conifer, alpine dwarf-shrub, wet meadow, and montane riparian habitats. Elevations in the northern Sierra Nevada mostly fall in the range of 4,300-7,300 feet.

Although the proposed project area contains habitat components associated with wolverines, the probability of wolverines occurring in the area is considered low. Only 1 unverified occurrence of wolverines has been recorded in the proposed project area in the early 1990s. With the exception of a recent detection on the Tahoe National Forest, only anecdotal sightings have been recorded for the rest of the Central Sierra Nevada ~~(Easton 2009)~~. No direct and indirect effects to wolverines foraging opportunities are expected from the proposed Action. Wolverines typically forage on large terrestrial animals and are not dependent on fish or other aquatic species that may be impacted from chemical treatment. No direct or indirect effects to habitat for wolverines will result from the proposed Action. No new roads or trails would be constructed and there would be no vehicular traffic throughout the area. The proposed Action would not result in removal of trees or other ground disturbance that would potentially affect wolverine habitat. Based on the above assessment, it is determined the proposed Action will have no direct, indirect or cumulative effects on wolverines or their habitat.

FISHER (FEDERAL CANDIDATE)

The Pacific fisher (West Coast Distinct Population Segment [DPS]), was placed on the ~~f~~Federal candidate list on April 8, 2004 (USFWS 2004 ~~Federal Register 69:18770-18792~~). Though the proposed project area is potential habitat for the fisher, its current range has been shown to exclude this area (Zielinski et al. 1995).

The probability of fisher occurring in the proposed project area is considered very low. According to the Sierra Nevada Forest Plan Amendment, fishers historically have never occurred in the HTNF (USFS 2004 ~~USDA 2001~~). Furthermore, fishers are closely associated with contiguous, late seral stands of dense mixed conifer which is not typical of the proposed project area. Although small patches of dense conifer occur along Silver King Creek, the most significant stands of old growth are outside of the proposed project area and include the vicinity of Rodriquez Flat in the headwaters of Snodgrass Creek. Any potential foraging and/or denning habitat for fishers would not be impacted under the proposed Action. Fishers rely primarily on terrestrial animals for prey and are not dependent on fish or other aquatic species that may be impacted from chemical treatment.

The proposed Action would not result in removal of trees or other ground disturbance that would potentially affect habitat for the fisher. Based on the above assessment, it is determined the proposed Action will have no impacts to the fisher.

AMPHIBIANS-SIERRA NEVADA YELLOW-LEGGED FROG AND YOSEMITE TOAD (FEDERAL CANDIDATE)

Sierra Nevada yellow-legged frogs and Yosemite toads are known to historically have inhabited portions of the Silver King Creek basin (USFWS 2004). However, surveys conducted by CDFG between 2001 through 2005 and again in 2008 and 2009 in the proposed project area resulted in no detections of either species.

Potential direct impacts to Sierra Nevada yellow-legged frogs and Yosemite toad include absorption of rotenone during implementation of the proposed Action. Rotenone is highly toxic to amphibians, including Sierra Nevada yellow-legged frog and Yosemite toad. A lipid-soluble chemical, rotenone is absorbed into both skin and respiratory membranes. Fontenot et al. (1994) reported that amphibian larvae with gills are most sensitive to rotenone (a detailed description of rotenone toxicity in amphibians is presented in Appendix C). Amphibians in their terrestrial life stage should not be affected by the rotenone treatment. However, gill-breathing life stages, if present, would be susceptible. Most amphibians, such as toads, present during a late summer treatment would have completed their metamorphosis and would not be affected. However the treatment could result in mortality of Sierra Nevada yellow-legged frog juveniles, which stay in the tadpole stage for up to 4 years.

However, as mentioned above, the potential for impacting Sierra Nevada yellow-legged frogs and Yosemite toads is considered very low due to the lack of detections recorded during annual surveys over the last 6 years. Furthermore, the Agencies would conduct thorough pre-treatment amphibian surveys immediately before treatment, according to protocols described in the Biological Assessment (USFS 2002) and Biological Opinion (USFWS 2003) and the previously issued NPDES permit for the Monitoring and Reporting Program. If adult or tadpole life stages of any threatened, endangered, sensitive, candidate or rare amphibians are found during pre-treatment surveys, they will be captured by net and relocated out of the proposed project area to suitable nearby habitat. The Agencies would continue to conduct the amphibian surveys until the proposed Action is completed and the area is restocked with Paiute cutthroat trout.

Potential indirect impacts on amphibians include loss of prey species from rotenone treatments. For example, reductions in emerging aquatic insects could occur over several years, particularly if multiple treatments are required. However, as described in Section 5.1, Aquatic Biological Resources, aquatic insect populations would recover quickly through drift from areas above Llewellyn Falls and untreated tributaries. In addition, based on survey and relocation activities over the past 4 years, neither Sierra Nevada yellow-legged frog nor Yosemite toads are believed to occur in the proposed project area.

Current populations of non-native trout in the proposed project area have adverse effects on amphibian populations through predation and competition for prey resources (Knapp and Matthews 2000). Therefore, removal of non-native trout and no future stocking of Whitecliff Lake and Tamarack Lake will benefit Sierra Nevada yellow-legged frogs and Yosemite toads over the long term. Paiute cutthroat trout co-evolved with these amphibian species in the Silver King Creek Watershed, and the only individuals found currently co-occur with the Paiute cutthroat trout.

Based on the above factors and because recent surveys have indicated no presence of Sierra Nevada yellow-legged frogs or Yosemite toads within the proposed project area, it is determined the proposed Action may impact individual Sierra Nevada yellow-legged frogs and Yosemite toads but will not lead to a trend toward ~~f~~Federal listing or loss of viability to the population.

FOREST SENSITIVE SPECIES

The FSS include five ~~5~~ mammals (Spotted bat, Townsend's big-eared bat, pygmy rabbit, wolverine, and fisher), eight ~~8~~ birds (Northern goshawk, bald eagle, California spotted owl, flammulated owl, great gray owl, white-headed woodpecker, mountain quail, and sage grouse), two ~~2~~ amphibians (Sierra Nevada yellow-legged frog and Yosemite toad) and 10 plants (Lavin's eggvetch, upswept moonwort, dainty moonwort, slender moonwort, seaside sedge, Tahoe draba, Marsh's bluegrass, Webber ivesia, Sierra Valley ivesia, and Galena Creek rockcress).

According to the Biological Evaluation, the proposed Action may impact individuals of the following FSS: bald eagles, Sierra Nevada yellow-legged frogs, and Yosemite toads due to disturbance from noise associated with the proposed Action and or amphibian relocation efforts (if necessary). However, impacts are expected to be minor and temporary and will not lead to a trend toward ~~f~~Federal listing or loss of viability. According to the Biological Evaluation, the proposed Action will have no impacts on any Forest Sensitive plant species.

MANAGEMENT INDICATOR SPECIES

AMERICAN MARTEN

Preferred habitat for marten denning and resting is characterized by dense (60 to 100% canopy), multi storied, multi species late seral coniferous forests with a high number of large (> 24 inch dbh) snags and downed logs. These areas are generally in close proximity to both dense riparian corridors (used as travelways), and include an interspersion of small (<1 acre) openings with good ground cover. Alterations of habitat are considered the greatest threat to marten and may even cause local extinctions. The wooded riparian corridors of Silver King Creek and conifer stands surrounding Tamarack Lake may provide suitable areas for the marten to move and rest between foraging and denning sites. Although late seral stands occur adjacent to the proposed project area, denning would be unlikely along Silver King Creek and Tamarack Lake because old growth structure is absent.

No direct effects to marten are expected from the proposed Action. Activities associated with the proposed Action will occur during the day when marten are not typically active. Furthermore, alterations to habitat could potentially disrupt marten denning or resting sites; however, workers will use existing campsites, trails and stream access points during treatment operations.

Indirectly, the proposed Action could affect marten ~~m~~by reducing available prey. Rotenone application could lead to a temporary reduction in invertebrates, amphibians, and fish within the proposed project area and a temporary reduction in marten prey availability. However, the primary food source for martens is small mammals and rodents, which would not be affected by rotenone (see Appendix C). Because martens have a diverse diet and a very large home range, a temporary decrease in fish and amphibians from the treatment process would not have a significant effect on the marten.

Martens could be exposed to rotenone and formulation constituents by feeding on dead fish. However, because rotenone residues are generally extremely low in treated fish, broken down quickly, and readily not absorbed by mammals, ingestion of prey exposed to rotenone would not affect marten (see Appendix C).

Cumulatively, martens may be impacted by an increase in recreation use in the Alpine County area. Although visitors to the Carson-Iceberg Wilderness are relatively infrequent compared to other areas in Alpine County, the number of users has increased in the last 10 years and is likely to continue ~~(Steve Hale USFS 2009 pers. comm.)~~. However, martens can generally tolerate human disturbance provided the disturbance is temporary and the marten's habitat is not impacted (Koehler et al 1975). Currently, there are no foreseeable actions, with the exception of a catastrophic wildfire, that would reduce available habitat for martens in the proposed project area. Based on the above assessment, implementation of the proposed Action may affect individual marten, but will not affect marten habitat and will not lead to a downward trend in the population.

MULE DEER

Summer range for the mule deer is present in the proposed project area. Declining habitat is considered the main reason for population declines of mule deer. The proposed Action would not remove trees or otherwise alter or reduce mule deer habitat.

Mule deer may be temporarily displaced by noise caused by workers and equipment associated with rotenone application. However, this impact would be temporary and mule deer would be expected to return to the area shortly after implementation of the proposed Action. Furthermore, the proposed Action would occur in an area where mule deer are commonly exposed to human disturbance from wilderness hikers and pack stock.

Mule deer likely use Silver King Creek and tributaries that would be treated with rotenone for drinking water. However, the low concentration of rotenone and the rapid dissipation, dilution, flushing and degradation of rotenone in the water would reduce this exposure and not harm mule deer (Appendix C presents the ecological exposure assessment showing exposure of deer and other mammals to chemicals resulting from the proposed Action).

Over the last 30 years, urban development in Carson Valley and the increased traffic on Highway 395 and Highway 88 have led to a loss of critical winter range and a subsequent decline in the Carson River deer herd (Cox 2007). The highways have fragmented migratory routes and led to numerous deer being hit by vehicles. Large scale fires such as the Cannon Fire in 2002 and the Larson Fire in 2007 burned over 30,000 acres, much of which was important winter range for mule deer. Many burned areas have been replaced by invasive or non-native species such as cheatgrass that out-compete native vegetation and provide little forage value for mule deer. Competition from livestock grazing historically may have interfered with deer foraging capability. However, grazing has not occurred in the proposed project area in approximately 15 years with most of the rangelands recovered from past grazing events. The proposed Action will not affect habitat, long term behavior, or population trends and therefore will not add to any cumulative effects to mule deer.

Based on the above assessment, it is expected that some disturbance to mule deer may occur from implementation of the proposed Action. However, the overall disturbance to mule deer is expected to be minor and temporary. Therefore, the proposed Action may affect individual mule deer, but will not affect habitat and will not contribute to a downward trend in the population of the Carson River deer herd.

YELLOW WARBLER, YELLOW-RUMPED WARBLER, HAIRY WOODPECKER, AND WILLIAMSON'S SAPSUCKER

The proposed project area supports a wide diversity of insectivorous birds, including yellow warbler, yellow-rumped warbler, hairy woodpecker, and Williamson's sapsucker. Habitat destruction is the primary threat to all of these species. Reductions in the quality of habitat can also lead to an increase in nest parasitism from brown-headed cowbirds. The proposed Action would not alter, disturb, or eliminate habitat or increase vulnerability to parasitic species, such as the brown-headed cowbird. Reductions in populations of some aquatic insect hatchings would likely result from the rotenone treatment process, which may lead to a temporary reduction in prey availability for yellow warbler, yellow-rumped warbler, and Williamson's sapsucker. This may temporarily cause these species to forage over greater distances (e.g. to untreated tributary areas and upstream of Llewellyn Falls), while insect populations recover within the proposed project area. However, because insects have rapid life cycles and the number of insects affected by the rotenone treatment would be relatively low, the temporary loss of insects from the proposed Action would not cause long term impacts on food availability for these species.

In addition, these species may not feed strictly on aquatic insects lowering their potential exposure to treatment chemicals. For example, hairy woodpeckers feed primarily on wood boring insects and insect larvae found on and in trees. Because rotenone would only be applied to water, it would not affect insects that comprise the hairy woodpecker's diet. Williamson's sapsucker primarily feeds on conifer sap and ants but will occasionally forage on other insects as well. Yellow warblers and yellow-rumped warblers feed on mayflies and damselflies; however, they have a varied diet including many terrestrial insects, such as bees, wasps, ants, moths and caterpillars.

Implementation of the proposed Action may temporarily displace yellow warblers, yellow-rumped wablers, hairy woodpecker, and Williamson's sapsucker; however, direct disturbance would be temporary and of short duration and would not have long-term effects on bird activity. Furthermore, rotenone treatment would be conducted in mid-August to mid-September, which is well outside the nesting season for yellow warblers, thereby minimizing any disturbance to reproduction activities. Based upon these reasons, the proposed Action may temporarily affect individual yellow warblers, yellow-rumped warblers, hairy woodpeckers, and Williamson's sapsuckers, but will not affect habitat and will not contribute to a downward trend in the population of these species.

NORTHERN GOSHAWK

Northern goshawks are typically associated with late seral or old growth forests, characterized by contiguous stands of large trees and large snags with closed canopies (>40%) and an understory which contains varying vertical structure but is not over crowded with "dog-hair" thickets of trees or other vegetation types. Goshawks historically occurred within and adjacent to the proposed project area near Snodgrass Creek, unnamed tributary downstream of Tamarack Creek ~~Poison Flat~~, and Corral Valley Creek. Incidental sightings were reported between 1992, 1996, and 2003 near Snodgrass Creek and unnamed tributary downstream of Tamarack Creek ~~Poison Flat~~. Although nest sites were not located, it is assumed nesting occurred due to behavior of adults and presence of juveniles. In accordance with the SNFPA, both nesting territories are protected by a designated 200 acre protected activity center (PAC). Surveys conducted in these areas and along Silver King Creek in 2006~~8~~ to 2009 resulted in no detections of goshawks. Some of the denser pockets of Jeffrey pine located adjacent to Silver King Creek provide suitable habitat for goshawks.

The major threat to goshawk populations is loss of nesting and foraging habitat through land management activities and natural events. The proposed Action will not alter or reduce goshawk habitat nor impact goshawk prey species or their habitat. Human disturbance is another potential threat to goshawk viability. Goshawks will readily abandon nest sites if disturbed during the early stages of nesting, often causing reproductive failure. The proposed Action is occurring in mid-August to mid-September, at a time when juveniles have usually reached independence and have dispersed from their natal area. Therefore, it is determined the proposed Action will have no effect on goshawk habitat and will not cause a downward trend in the population.

SAGE GROUSE

Sage grouse are largely dependent upon sagebrush ecosystems for both foraging and breeding. Breeding sites (or "leks") are usually situated on ridge tops or grassy areas surrounded by a substantial brush and herbaceous component. Nesting habitat for sage grouse is characterized primarily by Wyoming big sagebrush communities that have 15 to 38 percent canopy cover and a grass and forb understory (Terres 1980). Dense sagebrush cover is important to nesting success of sage grouse (Connelly et al. 2000). Sage grouse breed between mid-February and late August with nesting and brood-rearing occurring during May through July (SGCT ~~Neel~~ 200~~1~~4).

Sage grouse have been recorded in Bagley Valley and near Little Antelope Pack Station but are not known to occur in the proposed project area. Although sagebrush occurs along portions of Silver King Creek, the stands are discontinuous and lack sufficient density to support sage grouse. Therefore, it is determined the proposed Action will have no effect on sage grouse habitat and will not cause a downward trend in the population.

NEOTROPICAL MIGRATORY BIRDS

Habitat fragmentation is considered the major factor for population declines in migratory bird species. Urbanization and other land management activities can have short and long term impacts on foraging and nesting habitat of NTMB. Implementation of the proposed Action as described in Chapter 3.0, Project Alternatives, would not alter, disturb, or eliminate habitat for migratory birds. Reductions of some aquatic insect populations would be expected to occur following rotenone treatment applications, which may lead to a temporary reduction in prey availability for several NTMB.

The reduction in prey may temporarily force these species to forage greater distances while insect populations recover. However, it is expected that due to the rapid life cycles of insects and the relatively low numbers of insects to be affected by the proposed Action, the temporary loss of insects from the proposed Action would not be significant to migratory birds. Some bird species may be temporarily displaced from human disturbance associated with the proposed Action. However, disturbance would be temporary and short in duration and would occur outside of the normal breeding season for most NTMB.

The ecotoxicology model presented in Appendix C herein indicates that concentrations of all chemicals used for the treatment process would be well below any of the threshold levels (e.g., No Observed Adverse Effect Level). Therefore, exposure to rotenone and other chemicals would not be significant. Based on all the factors described above, the proposed Action would have less-than-significant impacts on migratory birds.

AMPHIBIANS- WESTERN TOAD AND PACIFIC TREE FROG

Western toads and pacific tree frogs are known to inhabit the Silver King Creek basin, specifically within meadow sections of Long Valley and Lower Fish Valley. Both species have consistently been observed during surveys by CDFG between 2001 through 2005 and again in 2008, and 2009.

Potential direct impacts to western toads and pacific tree frogs include absorption of rotenone during implementation of the proposed Action. Rotenone is highly toxic to amphibians, including western toad and pacific tree frog. A lipid-soluble chemical, rotenone is absorbed into both skin and respiratory membranes. Fontenot et al. (1994) reported that amphibian larvae with gills are most sensitive to rotenone (a detailed description of rotenone toxicity in amphibians is presented in Appendix C). Amphibians in their terrestrial life stage should not be affected by the rotenone treatment. However, gill-breathing life stages, if present, would be susceptible. Assuming average weather conditions, most amphibians, such as western toads and pacific tree frogs, present during a late summer treatment would have completed their metamorphosis and would not be affected.

However, the potential for impacting western toads and pacific tree frogs is considered very low due to their local abundance and the availability of breeding habitat that is not fish-bearing and therefore not considered for rotenone treatment. Furthermore, the Agencies would conduct thorough pre-treatment amphibian surveys immediately before treatment and would continue to conduct the amphibian surveys until the proposed Action is completed and the area is restocked with Paiute cutthroat trout.

Potential indirect impacts on amphibians include loss of prey species from rotenone treatments. For example, reductions in emerging aquatic insects could occur over several years, particularly if multiple treatments are required. However, as described in Section 5.1.1.3, Aquatic Biological Resources, aquatic insect populations would recover quickly through drift from areas above Llewellyn Falls and untreated tributaries.

Based on the above factors, it is determined the proposed Action may impact individual western toads and pacific tree frogs but will not lead to a trend toward Federal listing or loss of viability to the population.

RIPARIAN OR OTHER SENSITIVE NATURAL HABITATS

The proposed Action would have temporary and less-than-significant impacts on riparian habitats adjacent to the stream corridor. The proposed Action would not involve use of any heavy equipment or any excavation of trees or vegetation removal. The only disturbance would be from foot traffic of workers applying treatment chemicals from the stream banks. Workers will use existing trails to the extent possible, thus the proposed Action would not affect any other sensitive natural habitat identified in local or regional plans, policies, or regulations or by the CDFG or USFWS. Therefore, the proposed Action would have only minor direct impacts on riparian habitat and no indirect effects.

5.2.4.3 Alternative 3: Combined Physical Removal

This non-chemical alternative would include a combination of electrofishing, gill netting, seining, and other physical methods as appropriate to remove non-native trout from Silver King Creek and its tributaries, springs, and Tamarack Lake. Because this method could have low efficiency in a rocky stream environment, it would be implemented over multiple years (at least 10 years) (i.e., until no fish are found using physical removal techniques). This alternative could be compromised by trout moving into the project area from untreated upstream areas, potentially extending the project duration.

WILDLIFE IMPACTS

Potential indirect effects of electrofishing and other physical removal techniques on wildlife, including the special status species identified above, could result from reductions in aquatic invertebrate populations. These organisms provide an important food source for several indicator wildlife species, such as the willow flycatcher. Benthic macroinvertebrate species would likely be affected by the electrical currents applied to the water during electrofishing, resulting in mortality or drift. Previous studies have shown that drift caused by electrofishing can reduce benthic macroinvertebrate populations by 80 to 90 percent (Taylor et al. 2001). In addition, work crews would cause additional disturbance by walking in the channel, potentially resulting in additional drift (see Section 5.1, Aquatic Resources, for a detailed assessment of potential electrofishing effects on benthic macroinvertebrates). However, benthic macroinvertebrates would be repopulated by upstream populations. Headwater areas above Llewellyn Falls in Upper Fish Valley would not be affected by this Alternative and would provide refugia for recolonization of electroshocked areas. Because electroshocked areas would be recolonized by upstream populations in Upper Silver King Creek as well as tributaries in the project area, indirect impacts on wildlife from disturbance of the benthic macroinvertebrate community from use of physical removal techniques would be temporary and less-than-significant.

Physical removal of fish would be conducted within Silver King Creek, its tributaries, and potentially Tamarack Lake and immediately adjacent areas. Electrofishing of Silver King Creek would result in more physical disturbance from workers walking adjacent to the waterway and within the stream channel. However, electrofishing would be a continuously moving operation and would easily be avoided by most wildlife species present in the area, particularly those that inhabit upland areas, such as wolverine, fisher, American marten, mule deer, hairy woodpecker, and migratory birds.

This Alternative would result in physical disturbance within the riparian corridor adjacent to Silver King Creek and could affect riparian bird species, such as Williamson's sapsucker and willow flycatcher. Workers would conduct the electrofishing operation in the streambed or from the banks. Because the objective would be to remove all fish, crews would be present for an extended period of time compared to the proposed Action (refer to Chapter 3.0, Project Alternatives). Workers would use existing campgrounds and trails; however, the additional activity associated with this Alternative, compared to the proposed Action, could temporarily disturb some birds. However, birds would be expected to return after the fish removal activities are completed, thus this Alternative would not have significant direct impacts on wildlife or their habitat.

This Alternative would also result in more general disturbance associated with camping and movement of work crews and weekly pack stock trips coming in and out of the project area. Because electrofishing equipment would be needed for several weeks, the equipment would need to be recharged in the field or removed from the field for recharge. The Agencies would need to use gasoline-powered generators to re-charge the equipment or use existing electrical service off-site, requiring more use of pack stock. Therefore, the Agencies would use small, gasoline-powered generators that would have minimal impact on wildlife.

Physical removal techniques, including electrofishing, could have direct impacts on populations of mountain yellow-legged frog, Yosemite toad, and tadpoles if present. Worker activities would not affect enough of the streambed or banks to affect amphibian populations significantly. However, the electrical currents required to complete the removal and collection of fish could result in some mortalities. Therefore, Physical Removal would result in significant impacts on amphibians present in the project area during electrofishing.

Impact TR-1: Physical removal techniques could result in mortality of amphibians, including adults and juveniles, from exposure to electrical currents or direct mortality caused by worker activity (less-than-significant).

Similar to the proposed Action, the Agencies would conduct pre-treatment amphibian surveys. If adult or tadpole life stages of any threatened, endangered, sensitive, candidate or rare amphibians are found during pre-project surveys, they will be captured by net and relocated out of the project area to suitable nearby habitat. With implementation of this mitigation measure, impacts of the Physical Removal on mountain yellow-legged frog would be less-than-significant.

Amphibians would also be affected indirectly by the potential effects of electrofishing on aquatic invertebrate communities, as described above for wildlife. However, amphibians are opportunistic feeders and would likely supplement their diet with a variety of aquatic and terrestrial insects until benthic macroinvertebrates populations recover. Headwater areas above Llewellyn Falls in Upper Fish Valley would not be affected by electrofishing and would provide refugia for recolonization of electroshocked areas. Because electroshocked areas would be recolonized by upstream populations in Upper Silver King Creek, as well as tributaries in the project area, indirect impacts on amphibians from disturbance of the benthic macroinvertebrate community from use of physical removal techniques would be temporary and less-than-significant.

RIPARIAN OR OTHER SENSITIVE NATURAL HABITATS

Alternative 3 would have temporary impacts on riparian habitats adjacent to the stream corridor. This Alternative would not involve use of any heavy equipment or any excavation of trees or vegetation removal. The only disturbance would be from foot traffic of workers conducting electrofishing within the stream and from the stream banks. In contrast to the proposed Action, electrofishing would be conducted over a longer period (at least 10 years)(refer to Chapter 3.0, Project Alternatives). Minor indirect impacts could include effects on stream banks and sedimentation from worker activity. However, the electrofishing would be conducted by Agency personnel with responsibility to protect and conserve natural resources, minimizing any such effects. Furthermore, Alternative 3 would not affect any other sensitive natural habitat identified in local or regional plans, policies, or regulations or by the CDFG or USFWS. Therefore, Alternative 3 would have only minor direct impacts on riparian habitat and no indirect effects.

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5.3 HUMAN AND ECOLOGICAL HEALTH CONCERNS

This section addresses potential toxicological impacts on human and ecological receptors from the proposed use of commercial rotenone liquid formulations. Application of rotenone and potassium permanganate to the environment could result in toxic effects on exposed receptors. A detailed screening-level risk assessment analysis that evaluates the risks to humans, aquatic organisms and wildlife from exposure to rotenone formulations and potassium permanganate is presented in Appendix C, Screening-Level Human Health and Ecological Risk Assessment.

5.3.1 Affected Environment

The study area for the risk assessment includes the mainstem of Silver King Creek between Llewellyn Falls and Silver King Canyon, the lower reaches of tributaries and springs (that could support fish), waters immediately downstream of the proposed treatment area including Silver King Canyon and areas downstream of Snodgrass Creek. ~~and Tamarack Lake.~~ Air, surface water, groundwater, sediments and biota potentially containing rotenone or formulation constituents are considered potential exposure media in the affected environment. Beneficial uses of Silver King Creek as set forth and defined in the Water Quality Control Plan for the Lahontan Region (the Basin Plan) include municipal and domestic and agricultural water supply as well as agricultural supply, groundwater recharge, contact recreation, fishing, and habitat (see Section 5.4, Water Resources). The following sections provide a general overview of the toxicology and use of rotenone and potassium permanganate to eradicate non-native trout species as part of the proposed Action.

5.3.1.1 Rotenone Toxicity

Rotenone is a naturally occurring chemical obtained from the roots of several tropical and subtropical plant species belonging to the genus *Lonchocarpus* or *Derris*. Rotenone can be extracted with chloroform and determined by ultraviolet spectroscopy or analyzed using high performance liquid chromatography (HPLC) with UV detection. Liquid formulations of rotenone may contain petroleum hydrocarbons as solvents and emulsifiers to disperse rotenone in water (naphthalene, methylnaphthalenes, xylenes, etc.) (WDFW 2002). The proportion of these carriers varies substantially by formulation, and formulations with synergists generally contain far less petroleum-based carrier products. The potential effects on ecological receptors associated with the adjuvants and carriers in the proposed formulations are discussed below.

The proposed Action involves the use of commercial rotenone formulations containing dispersants and emulsifiers such as CFT Legumine™ or Noxfish®, ~~and Nusyn-Noxfish®,~~ which are hazardous materials as defined in Title 22, Section 66084 of the California Code of Regulations. Hazardous constituents in the rotenone formulations are summarized in Table 5.3-1 along with their expected aquatic concentrations when fully diluted in the receiving waters.

Table 5.3-1 International (CAS), National (EPA-RC) and State (CDPR) Registration Codes for Chemicals Detected in Rotenone Formulations Proposed for Use in the Silver King Creek Watershed

Chemical Name	Estimated Concentration in Water Treated with 0.5 mg/L product[1]	Estimated Concentration in Water Treated with 1.0 mg/L product[1]	CAS #	EPA-PC #	CDPR Chemical Code

Table 5.3-1 International (CAS), National (EPA-RC) and State (CDPR) Registration Codes for Chemicals Detected in Rotenone Formulations Proposed for Use in the Silver King Creek Watershed

Chemical Name	Estimated Concentration in Water Treated with 0.5 mg/L product[1]	Estimated Concentration in Water Treated with 1.0 mg/L product[1]	CAS #	EPA-PC #	CDPR Chemical Code
CFT Legumine™ Formulation					
Rotenone (active ingredient)	25.5 µg/L	50.9 µg/L	83-79-4	71003	518
Rotenolone	3.67 µg/L	7.34 µg/L	None	None	4095
1-Methyl-2-pyrrolidinone (Methyl pyrrolidone)	49.5 µg/L	98.9 µg/L	872-50-4	--	--
Diethylene glycol monoethyl ether (Diethylene glycol ethyl ether)	305 µg/L	610 µg/L	111-90-0	11504	2505
1,3,5-Trimethylbenzene (mesitylene)	0.00200 µg/L	0.00400 µg/L	108-67-8	None	5884
sec-Butylbenzene	0.00195 µg/L	0.00390 µg/L	135-98-8	--	--
1-Butylbenzene (n-Butylbenzene)	0.0120 µg/L	0.0239 µg/L	104-51-8	--	--
4-Isopropyltoluene (isopropyltoluene)	0.00255 µg/L	0.00510 µg/L	98-87-6	--	--
Methylnaphthalene	0.0700 µg/L	0.140 µg/L	1321-84-4	54002	942
Naphthalene	0.127 µg/L	0.253 µg/L	91-20-3	55801	421
Fennodefo 99	86.5 µg/L	173 µg/L	--	--	--
NoxFish® Formulation at 0.5 mg/L~~; Nussyn-Noxfish® at 1.0 mg/L~~					
Rotenone	25.0 µg/L	25.0 µg/L	83-79-4	71003	518
Piperonyl butoxide	not present	25.0 µg/L	51-03-6	067501 --	--
Rotenolone	7.50 µg/L	15.0 µg/L	None	None	4095
Trichloroethene (Trichloroethylene)	0.0365 µg/L	0.073 µg/L	79-01-6	81202	595
Toluene	0.900 µg/L	1.80 µg/L	108-88-3	80601	1281
1,3- and/or 1,4-Xylene (M/p xylene)	0.305 µg/L	0.610 µg/L	108-38-3/ 106-42-3	--	--
1,2-Xylene (o xylene)	0.0380 µg/L	0.0760 µg/L	1330-20-7	086802	622
Isopropylbenzene	0.0260 µg/L	0.0520 µg/L	98-82-8	None	3116
1-Propylbenzene(n-Propylbenzene)	0.155 µg/L	0.310 µg/L	103-65-1	--	--
1,3,5-Trimethylbenzene (mesitylene)	0.430 µg/L	0.860 µg/L	108-67-8	None	5884
1,2,4-Trimethylbenzene	5.00 µg/L	10.0 µg/L	95-63-6	None	5883
1-Butylbenzene (n-Butylbenzene)	4.50 µg/L	9.0 µg/L	104-51-8	--	--
4-Isopropyltoluene (p-Isopropyltoluene)	0.500 µg/L	1.00 µg/L	98-87-6	--	--
Naphthalene	35.0 µg/L (w/EPA 8260)	70.0 µg/L (w/EPA 8260)	91-20-3	55801	421
Potassium Permanganate (for Rotenone Neutralization)					
Potassium permanganate	2 mg/L-water	4 mg/L-water	7722-64-7	068501	498

[1] Based on chemical analysis of commercial formulations and proposed treatment concentration; concentrations will vary by lot by approximately 10 percent. Data from ENVIRON 2007; Noxfish®: report date 7/9/02, Lab Nos. P-2297, 2298, 2300, 2302). EPA Method 8260, 8270.

[2] Data listed from CDFG Pesticide Laboratory Reports (CFT Legumine®: report date 7/7/04, Lab No. P-2399)

-- No data available

Use of rotenone enables fisheries managers to eradicate entire populations and communities of fish. gGovernment agencies have conducted substantial research to determine the safety of rotenone for fisheries management applications in the re-registration approval process (Finlayson et al. 2000; USEPA 2006). Section 5.3.2, Regulatory Setting, below provides a detailed discussion regarding EPA and CDPR pesticide registration. The EPA (2006) study found that while risks to terrestrial wildlife and plants were insignificant when rotenone was applied as a piscicide, risks to non-target aquatic organisms could be significant. Because the proposed project area is located within a wilderness area populated by both terrestrial and aquatic non-target species, and because the public expressed concern regarding human exposure, the Agencies conducted a screening-level human and ecological risk assessment to help identify exposure issues and potential mitigation measures needed beyond applying the rotenone formulation according to label directions for fisheries management. Appendix C, Screening-level Human and Ecological Exposure Assessment, presents a literature review of pertinent study findings associated with rotenone toxicity to non-target organisms, including fish, and provides a site-specific assessment of potential exposure effects on aquatic invertebrates, terrestrial wildlife receptors, birds, terrestrial insects, amphibians and reptiles. It also provides a project-specific assessment of whether or not rotenone formulation constituents may have adverse human health effects while accounting for the distance between the proposed project area and human populations and the magnitude and duration of exposure.

5.3.1.2 Potassium Permanganate Toxicity

The neutralization of rotenone would involve the use of potassium permanganate ($KMnO_4$). Potassium permanganate salt, also known as “permanganate of potash,” is a strong oxidizing agent used in many industries and laboratories. It is also used as a disinfectant, especially in the treatment process of potable water. It has been used effectively as a neutralizing compound for rotenone treatments for many years (USEPA 2006; Ling 2003).

Potassium permanganate is toxic to gill-breathing organisms at the rate (2 to 4 mg/L) required for neutralization. However, as it deactivates the rotenone and oxidizes other organic materials in the water, it becomes reduced. The by-product of the oxidation of rotenone by potassium permanganate is manganese oxide, a biologically inactive (or principal detoxifier) compound (CDFG 1994). Appendix C provides a literature review of pertinent study findings associated with potassium permanganate toxicity.

5.3.2 Regulatory Setting

Under the proposed Action, rotenone formulations would be used according to regulatory requirements for the transportation of and treatment involving the use of rotenone formulations for eradicating target non-native fish species. Federal and state regulations impose requirements on the registration and use of pesticides. The regulatory framework pertaining to the use of pesticides is discussed below.

5.3.2.1 Federal Regulations

DEFINITIONS AND REGISTRATION PROCEDURES FOR PESTICIDES AND OTHER CHEMICALS

The USEPA regulates pesticides under two major statutes: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Title 7 U.S.C. section 136, et seq., and the Federal Food, Drug, and Cosmetic Act (FFDCA), Title 21 U.S.C. section 301, et seq. Pesticides are defined under FIFRA as, “any substance intended for preventing, destroying, repelling, or mitigating any pest.” FIFRA requires that pesticides be registered (licensed) by the USEPA before they may be sold or distributed for use in the United States, and that they perform their intended functions without causing unreasonable adverse effects on people and the environment when used according to USEPA-approved label directions.

USEPA requires extensive scientific research and supporting test data as part of its pesticide review and approval process before granting a registration for most pesticides. These studies allow the USEPA to assess risks to human health, domestic animals, wildlife, plants, groundwater and beneficial insects, and to assess the potential for other environmental effects. When new evidence raises questions about the safety of a registered pesticide, the USEPA may take action to suspend or cancel its registration and revoke the associated residue tolerance. The USEPA may also undertake extensive special review of a pesticide’s risks and benefits or work with manufacturers and users to implement changes in a pesticide’s use (e.g., reducing application rates, or cancellation of a pesticide’s use).

Special uses of pesticides, outside their original label specifications, can be considered on a case-by-case basis through FIFRA Section 24C (USEPA 1996). However, the use of rotenone as a piscicide is already authorized in the State of California under FIFRA, and a 24C application to the USEPA is not required. The FFDCA authorizes the USEPA to set tolerances, or maximum legal limits, for pesticide residues in food. Thus, the FFDCA does not expressly regulate pesticide use, but residue limits established by this agency may result in a change in the use pattern regulated under FIFRA.

Rotenone was first registered for aquatic use in 1947. The USEPA challenged the re-registration in 1976 (after the enactment of the Clean Water Act) when it became aware of a study that alleged rotenone might be a carcinogen. The conclusions of that study were further evaluated and subsequently disproven by the USEPA (USEPA 1985 ~~1981~~), and the USEPA concluded that the use of rotenone for fish control did not present a risk of unreasonable adverse effects to humans and non-aquatic wildlife. Notwithstanding, the action initiated a joint ~~f~~Federal-state effort to fully evaluate all environmental aspects of rotenone toxicity and environmental fate through a re-registration process. Under the re-registration process, the USEPA is systematically reviewing all pesticides registered before November 1984 to ensure that they meet current testing and safety standards. The USEPA recently released their ecological risk assessment on the re-registration of rotenone (USEPA 2006). This assessment summarized that aquatic risks to non-target aquatic organisms are significant, while risks to terrestrial wildlife and plants were determined to be insignificant when rotenone was applied as a piscicide.

TOXIC SUBSTANCES CONTROL ACT

The Toxic Substances Control Act (TSCA), Title 15 U.S.C. section 2601, et seq., requires regulation of commercial chemicals, other than pesticide products, that present a hazard to human health or to the environment. Thus, TSCA specifies the registration requirements for the rotenone formulation constituents, other than the active pesticide ingredient.

CLEAN WATER ACT AND THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

The discharge of toxic pollutants into the nation’s waters is regulated under the Clean Water Act (CWA), Title 33 U.S.C. section 1251. The CWA provides an integrated approach to protecting aquatic ecosystems and human health by regulating potentially toxic discharges to surface waters through the NPDES permit, and by regulating ambient water quality through numeric criteria and narrative ("beneficial use") water quality standards defined in the Basin Plan and California Toxics Rule, Title 40 C.F.R. section 131.38. Section 5.4 addresses the more traditional narrative water quality standards, whereas this section address water quality toxics through a screening-level risk assessment. Notably, none of the constituents in the proposed rotenone formulations have promulgated numeric criteria for the protection of aquatic life, and only two constituents, toluene and trichloroethylene, have promulgated numeric criteria under the California Toxics Rule for human health (in both cases, the maximum estimated environmental concentrations in Silver King Creek waters would fall well below the criteria). In California, the SWRCB, through the local Regional Water Quality Control Boards, administers the program and issues the NPDES permits. The release of aquatic pesticides into waters of any state may require an NPDES permit, depending on the pesticide considered, and the conditions proposed for application. The ~~f~~Federal Ninth Circuit Court of Appeals has held that an NPDES permit is not required where a pesticide is applied intentionally, in accordance with label instructions, and there is no residue or unintended effect (SWRCB 2005). However, because non-target aquatic species would be affected by the proposed rotenone treatment, an NPDES permit would be required. The NPDES permit will specify conditions to prevent the permanent degradation of beneficial use designations for waters in the Silver King Creek Watershed from rotenone treatment and neutralization if the proposed Action is selected for removal of non-native fish from the proposed project area.

The Agencies have applied for a project-specific NPDES permit for rotenone application. The NPDES permit for the proposed Action would contain receiving water limits applicable to rotenone projects as contained in the Basin Plan. It would also require water quality monitoring to verify compliance with receiving water limits within the proposed project area and in downstream waters both during and after the treatment.

SAFE DRINKING WATER ACT OF 1974

The Safe Drinking Water Act (SDWA), Title 42 U.S.C. section 300(f), et seq., was adopted in 1974 to protect the quality of public drinking water and its sources. USEPA sets standards for drinking water quality and oversees the states, localities and water suppliers who implement those standards.

5.3.2.2 State of California

STATE REGISTRATION OF PESTICIDES AND COMMERCIAL CHEMICALS

California's programs addressing product registration of pesticides and commercial chemicals, licensing and certification, data review and evaluation and pesticide residue monitoring closely parallel ~~f~~Federal programs. However, California data requirements are stricter than ~~f~~Federal requirements and are California-specific (e.g., manufacturers must prove their products are effective and can be used safely under California conditions). The registration of pesticides and commercial chemicals in California is within the jurisdiction of the California Environmental Protection Agency (CalEPA).

The California Department of Pesticide Regulation (CDPR), a department overseen by the CalEPA, coordinates a number of programs to regulate pesticides to include product evaluation and registration through use enforcement, environmental monitoring, residue testing and re-evaluation, if deemed appropriate. The CDPR works with county agricultural commissioners who act as local pesticide enforcement authorities. CDPR also evaluates, conditions, and approves or denies permits for restricted-use pesticides; certifies private applicators; conducts compliance inspections; and takes formal compliance or enforcement actions. California's pesticide regulatory program has been certified by the Secretary of Resources as meeting the requirements of CEQA (CDPR 2006). The State of California also requires commercial growers and pesticide applicators to report commercial pesticide applications to local county agricultural commissioners. The CDPR compiles this information in annual pesticide use reports. Agricultural use comprises a vast majority of the total reported annual pesticide use while nonagricultural uses, like that associated with some of the project alternatives, comprise approximately 4% of the annual use. In addition to pesticide applications for fisheries management, other nonagricultural uses of pesticides include: pest control of right-of-ways, fumigation of nonfood and non-feed materials, pesticide research and regulatory pest control in the ongoing control and/or eradication of pest infestations (CDPR 2003).

HEALTH AND SAFETY CODE SECTION 116751

Health and Safety Code section 116751 prevents CDFG from introducing a pesticide into surface or groundwater drinking supplies unless the Department of Health Services (DHS) determines the activity will not have an adverse impact. DHS is responsible for evaluating the short- and long-term effect(s) of pesticide use on water quality and for ensuring alternative water supplies are available during pesticide applications that may contaminate drinking waters. Health and Safety Code 116751 requires a standard of "non-detect" for formulation constituents for their approval of safety. DHS also has the authority to set non-regulatory advisory levels, such as the "notification levels" for some of the inert ingredients in the rotenone formulations.

THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986

The Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) was enacted as a ballot initiative in November 1986. The proposition was intended to protect California citizens and the state's drinking water sources from chemicals known to cause cancer, birth defects, or other reproductive harm and to inform citizens about exposures to such chemicals. Proposition 65 requires the governor to publish, at least annually, a list of chemicals known to the state to cause cancer or reproductive toxicity. The following chemicals are currently listed under Proposition 65 and are components of one or both of the liquid rotenone formulations: N-methyl pyrrolidone (found in CFT Legumine™ formulation), naphthalene (found in CFT Legumine™ and NoxFish® formulations), toluene (found in NoxFish® formulation), and trichloroethylene (found in NoxFish® formulation) (OEHHA 2008).

The regulation lists an allowable daily amount (presented in µg/day) that may be contacted for each listed chemical (OEHHA 2008). For the carcinogens, such as naphthalene and trichloroethylene, the allowable amounts listed are based on the assumption that daily exposure to the compound occurs continuously over a 70-year lifetime. Because the proposed Action for Silver King Creek is a short-term exposure, these ingestion values are extremely conservative, and, therefore, not appropriate for assessing exposure from this action.

PROPOSITION 65

Three inert ingredients present in one or both proposed rotenone formulations (N-methyl-2-pyrrolidone, ethylbenzene and naphthalene) are on the Proposition 65 list of chemicals known to the State of California to cause cancer or reproductive toxicity. The Proposition 65 statute is contained in California Health and Safety Code sections 25249.9-25249.13. Proposition 65 prohibits the discharge of chemicals known to cause cancer or reproductive toxicity. The State Attorney General's Office is the State agency responsible for enforcing Proposition 65. Section 25249.11(b) specifically exempts State Agencies from the statute's provisions. Therefore, as a State agency, CDFG is exempt from Proposition 65.

5.3.3 Assessment Criteria and Methodology

5.3.3.1 Significance Thresholds

Enforceable criteria established by ~~f~~Federal or state agencies to be protective of human and/or ecological health were used as the default thresholds for interpreting whether a potentially adverse impact was significant to human or ecological health. In the absence of such criteria, health-based *guidance levels* proposed by ~~f~~Federal or state agencies as protective of human and ecological health were used, when appropriate, to evaluate the short-term exposure associated with the proposed Action. Estimated environmental exposure concentrations or "doses" were compared with these criteria and guidance levels. Human and ecological exposures to rotenone, formulation constituents, and potassium permanganate were evaluated to determine if they would:

- Exceed a literature-based toxicity reference value (i.e., threshold) for aquatic toxicity in aquatic animals.
- Exceed a literature-based toxicity reference value for ingestion and/or inhalation uptake in relevant terrestrial or avian wildlife.
- Exceed regulatory guidance or human health based screening level for inhalation risk.

5.3.3.2 Evaluation Methods and Assumptions

A screening-level ecological and human risk assessment was the principal method used to evaluate human and ecological health impacts associated with the use of hazardous materials under the proposed Action (refer to Appendix C). The risk assessment includes analysis of the potential hazards of the active ingredient (rotenone), volatile and semivolatile solvents, emulsifiers and other dispersant ingredients identified in the proposed commercial rotenone formulations. It reviews hazards due to direct toxicity and bioaccumulation potential. It also includes an assessment of the environmental fate of the compounds, including their partitioning within the environment, and rates and mechanisms by which the compounds naturally biodegrade so that they do not persist in the environment over long periods.

The evaluation of human health and ecological risks followed established regulatory guidance designed to evaluate the presence of chemicals in the environment and their potential for adverse health effects when those chemicals are contacted (USEPA 1991 and 1998, CalEPA 1996). For humans, both cancer and non-cancer risks were considered. Only non-cancer risks were considered for risks to ecological receptors, as the state of the science does not permit a reliable interpretation of the effects of the environmental chemicals on cancer incidence in animals. In brief, these methods involve: (1) an analysis of the toxicity hazards identified from the scientific literature, (the "hazard assessment"); (2) an analysis of potential exposure in ecological receptors from air, sediment, water and/or food (the "exposure assessment"); and (3) a comparison of exposure to toxicity thresholds (the "risk characterization").

The environmental exposure concentrations (doses) of hazardous materials in the rotenone formulations were estimated through exposure modeling. Water concentrations were estimated based on the assumption of complete mixing of rotenone and the rotenone formulation constituents identified in the undiluted commercial products

The methodology for estimating ingestion doses in wildlife is described in Appendix C. To characterize risks to fish and wildlife species, estimated exposure doses were compared against toxicity thresholds by calculating a "hazard quotient" (HQ). The HQ is derived by dividing the estimated exposure or dose by the relevant toxicity threshold. Hazard quotients for fish and aquatic invertebrates were calculated only for rotenone, as the immediate effects of the active ingredient in the aquatic system overwhelm the potential effects of the inert dispersant ingredients. The "Level of Concern" (LOC) associated with the calculated HQ was determined based on whether the estimated dose was compared against an LD_{50} value or a No-Observed-Adverse-Effect Level (NOAEL) toxicity threshold value from the scientific literature. The LD_{50} value is the dose (usually per body weight) that is lethal to 50 percent of the test population. A more detailed discussion of these toxicity values and their significance is provided in Appendix C.

5.3.4 Environmental Impact Assessment

This section evaluates the potential impacts of the proposed Action and its alternatives on human and ecological health based on potential exposure to applied rotenone formulations and the neutralizing agent (potassium permanganate). Appendix C presents the screening-level human and ecological risk assessment of the potential toxic effects of rotenone on biological resources in the proposed project area.

5.3.4.1 Alternative 1: No Action

The No Action alternative would not involve the application of rotenone or other chemicals and therefore would not result in significant adverse impacts or risk of exposure of human or ecological receptors to rotenone or its formulation constituents or potassium permanganate. Therefore, no hazardous chemicals would be transported to the area or used in conjunction with this alternative.

5.3.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

The paragraphs below evaluate potential impacts from exposure to formulations of CFT-Legumine™ and/or Noxfish® ~~and Nusyn-Noxfish®~~ applied to waters in the proposed project area as well as the rotenone formulation constituent concentrations estimated in Table 5.3-1. This assessment also evaluates effects from exposure to potassium permanganate applied at the proposed downstream neutralization station near Snodgrass Creek.

CREATE A SIGNIFICANT HAZARD TO THE PUBLIC

USE OF HAZARDOUS MATERIALS – ROTENONE FORMULATIONS

Because the land surrounding the proposed project area is a designated wilderness, there are restrictions on land use and human activities. Human presence in the project area is limited. Prior to the rotenone application, and throughout the treatment process, the public will be notified through the use of signs located at trailheads and other strategic places of the treatment process.

Thus, the only human receptors would likely be workers applying the chemical formulations. Worker exposure would be minimized by the use of the necessary personal protective equipment (PPE) and the development of the project health and safety plan by the Agencies prior to rotenone application.

Research conducted to date on the potential effects of rotenone on public health have concluded that rotenone does not cause birth defects, reproductive dysfunction, gene mutations, or cancer (Abdo 1988). When used according to label instructions for the control of fish, rotenone poses little, if any, hazard to public health (American Fisheries Society's Task Force on Fishery Chemicals 2000).

Public comments submitted in response to the Notice of Intent expressed concern about the potential effects of rotenone on human health, specifically any causative relationship with Parkinson's disease. Parkinson's disease is a degenerative disorder of the central nervous system that often impairs the sufferer's motor skills, speech, and other functions. Symptoms of the disease usually include limb tremors and occasional rigidity. The causes of Parkinson's disease are diverse and complex. Some cases can be attributed to genetic factors and several mutations have led to familial Parkinson's disease, among members of the same family (Giasson and Lee 2000).

Public concern over links between rotenone use and Parkinson's disease likely results from an Emory University study (Betarbet et al. 2000) that demonstrated that rotenone produced Parkinson's-like anatomical, neurochemical and behavioral symptoms in some laboratory rats when administered chronically and intravenously. In the study, 25 rats were continuously exposed to 2 to 3 mg for 5 weeks by direct injection into the right jugular vein. The authors observed, however, that "rotenone seems to have little toxicity when administered orally." In fact, investigators could not administer rotenone in any other manner except intravenously to deliver rotenone to the brain; otherwise, rotenone would have been neutralized in the gut and liver (American Fisheries Society's ~~Task Force on Fishery~~ Fish Management Chemicals Subcommittee 2001~~0~~). This study did not show a cause-and-effect relationship between rotenone exposure and Parkinson's disease.

Due to the remoteness of the proposed project area, the distance to any downstream human population, and the likelihood of exposure during and after treatment (see Chapter 3.0, Project Alternatives), human exposure pathways were considered incomplete in the risk assessment (refer to Appendix C). For these reasons, no impacts from the use of rotenone formulations or the neutralizing agent would occur in humans. The application of rotenone formulations poses a less-than-significant impact on human health, and no mitigation measures would be required.

CREATE A SIGNIFICANT HAZARD TO THE ENVIRONMENT

To prevent the release of rotenone downstream of the treatment area, potassium permanganate, an oxidizing agent, will be used for neutralization. When balanced to rotenone concentrations and organic loads in the stream, in-stream neutralization poses essentially no risk to human or ecological health. Rotenone is rapidly neutralized and permanganate is subsequently reduced. Neither persists in the environment. However, neutralization presents the risk of human and equipment error that is difficult to predict. In the event of an unintentional release, monitoring at 30 minute intervals, approximate travel time for potassium permanganate residual, would reduce this risk/impact to a level of less-than-significant.

Because potassium permanganate can be toxic, care must be applied when using it to make sure the rotenone is neutralized, while minimizing the amount of excess potassium permanganate in the water. Overdosing with potassium permanganate occurred in 1992 on Silver King Creek (CDFG 1994) and in Big Grizzly Creek following the 1997 Lake Davis treatment. This resulted in unintentional fish kills on both systems. The Agencies do not believe that this will occur under the proposed Action, because they will be employing the monitoring methodologies as outlined in ~~Parmentor~~ Parmenter and Fuujimura (1995) and further refined by Fujimura (2006 ~~2007~~) that have greater precision for measuring potassium permanganate. These methodologies utilize field colorimeters and chlorine meters to measure the concentration of potassium permanganate and residual potassium permanganate after colloidal material is removed (~~Parmentor~~ Parmenter and Fujimura 1995, Fujimura 2006). As part of the proposed Action, to mitigate the potential effects of applying excess potassium permanganate to downstream fish populations, the Agencies will place "sentinel" fish in cages downstream of the neutralization station. Mortality of these fish would alert workers to potential releases of excess chemical in the event of human or equipment error and potential downstream effects.

AQUATIC INVERTEBRATES

The screening-level risk assessment (Appendix C) evaluated exposure of aquatic invertebrates to rotenone and formulation constituents applied to stream water. Because of the known toxicity of rotenone to benthic macroinvertebrates, water exposure was considered a reasonable worst case exposure scenario. The concentrations of the other formulation ingredients at their respective application rates (refer to Appendix C) were several orders of magnitude than the acute lethal (LC_{50}) concentrations, so additional assessment of the inactive ingredients were not specifically evaluated. Because of the degree of direct exposure to water-borne rotenone, exposure to rotenone-absorbed sediment was not considered a significant exposure pathway. The risk assessment found that at the proposed treatment concentrations, the proposed Action would not expose most aquatic invertebrate taxa to lethal concentrations of rotenone. Cladocerans and several other invertebrate species could be affected by the treatment (see Table C-19, Appendix C).

Although many aquatic invertebrate taxa would likely survive the proposed chemical treatment, benthic population levels would be affected in the short term. The proposed Action would likely result in changes in benthic invertebrate community composition through treatment induced downstream drift and mortality of sensitive species. However, because upstream areas would not be treated, aquatic invertebrates from these areas would speed re-colonization of the treated area and restoration of species composition and ecological function. Recovery of populations particularly sensitive to rotenone would depend on the individual species' ability to re-colonize from nearby habitats. Sections 5.1, Aquatic Resources, and Section 5.4, Water Resources, present detailed evaluations of the potential effects of rotenone treatment on species composition of sensitive, rare, and endemic species, and on the challenges associated with distinguishing between the effects of rotenone treatments and other phenomena, including natural disturbances and sampling artifacts, including those related to natural variability.

~~If the Agencies treat Tamarack Lake, impacts on invertebrates including limnetic zooplankton and benthic invertebrates could be significant in the short term. However, after the 1997 rotenone treatment of Lake Davis, California, overall zooplankton abundance recovered to approximately 300 percent of pre-treatment levels within one year (CDFG 2006). Further, all zooplankton taxa observed before the treatments were identified after population recovery. Recovery of zooplankton populations after treatment is similar to the response seen when grazing by fish is~~

~~removed. Therefore, zooplankton populations would likely return within months, with full recovery within 1 year.~~ As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

Impact HEH-1: The proposed Action will result in temporary changes in species composition in non-target aquatic invertebrate communities (Significant and Unavoidable).

There are several mitigating factors. The treatment area is of limited geographic range. The proposed Action does not involve treating the headwaters above Llewellyn Falls or fishless portions of tributaries or springs; these areas would remain as important sources for recolonization and could contain the same rare and endemic species that may occur in the proposed project area. In addition, the Agencies ~~would~~ will attempt to use lower formulated rotenone concentrations and the less toxic formulation (CFT Legumine™) than have been used in the past to minimize impacts on benthic invertebrates (Finlayson et al. 2010). However, this impact would remain significant and unavoidable after mitigation.

AQUATIC INVERTEBRATES

No special-status benthic macroinvertebrate species are known to occur in Silver King Creek; therefore, the proposed Action would have no impact on state or federally listed species. However, rotenone treatment could potentially result in the temporary or permanent loss of rare or endemic species existing in Silver King Creek that have not been identified or described. Therefore, this potential impact cannot be quantified because of a number of factors that hamper full characterization of the stream community (see Section 5.1, Aquatic Biological Resources) and no mitigation or post-treatment monitoring is available beyond those moderating factors and other measures presented in Section 5.1, Aquatic Biological Resources. Therefore, as described in Section 5.1, Aquatic Biological Resources, this impact would remain significant and unavoidable after mitigation.

AMPHIBIANS

Amphibians, particularly gilled larvae, if present, could be adversely impacted through uptake of rotenone from the water across their gills (Fontenot et al. 1994). Risks to larval stages of amphibians were considered potentially significant (refer to Table C-19 in Appendix C). Impacts to amphibians would be significant if gill breathing life stages are present in Silver King Creek, its tributary streams and springs at the time of treatment (i.e., late August). Special-status amphibian species that could occur in the proposed project area are the Sierra Nevada ~~mountain~~ yellow-legged frog and the Yosemite toad (refer to Section 5.2, Terrestrial Biological Resources, regarding the potential for occurrence of Yosemite toad in the proposed project area).

Dietary uptake was also considered a complete pathway (refer to Appendix C). Risks to amphibians from ingestion of food and water were considered potentially significant for rotenone, if CFT Legumine™ were to be applied at the maximum 1.0 mg/L formulation rate. The ingestion pathway did not indicate a significant risk for Noxfish® ~~Nusyn-Noxfish®~~ or the 0.5 mg/L application rate for CFT Legumine™ (refer to Appendix C).

Based on an analysis of the treatment concentrations relative to species' sensitivity, amphibians could be significantly impacted by the proposed Action through direct rotenone exposure and uptake with food and water (refer to Appendix C). Mortality of Yosemite toads from the treatment is not considered likely because by mid-August gill breathing juveniles, that may be present in the creek and its tributary streams and springs earlier in the year, would be absent. Juvenile Sierra Nevada ~~mountain~~ yellow-legged frog tadpoles may reside in the stream at the time of treatment. In addition, although this species could occur in the proposed treatment ~~project~~ area, it has not been documented in recent surveys (2001 to present); thus, the potential for its occurrence would be low. Further, during the pre-treatment ~~these annual~~ surveys, the Agencies will relocate juvenile amphibians that are found, to outside the proposed treatment area. Therefore, any impacts from rotenone treatment on Sierra Nevada ~~mountain~~ yellow-legged or Yosemite toad would be less-than-significant.

TERRESTRIAL AND AVIAN WILDLIFE

In contrast to the potential impacts on fish, aquatic invertebrates, and amphibians, the risk assessment concluded that rotenone formulation exposure for all terrestrial and most avian wildlife species through food chain exposure, primarily through ingestion, would be less-than-significant. The exception was the marsh wren. The NOAEL for the marsh wren was exceeded for CFT Legumine™ applied at the 1.0 mg/L application rate; however, the LOAEL-based HQs were all far less than 1 for the avian species. All LD_{50}-based HQs were far less than 0.1. These results indicate that adverse affects to birds from the proposed Action are very unlikely (refer to Appendix C).

Along with rotenone, the primary constituents of CFT Legumine™ and Noxfish® and Nusyn-Noxfish® were evaluated for toxicity to birds and mammals through the ingestion pathway. The three most concentrated constituents in CFT Legumine™ evaluated were diethylamide monoethyl ether, 1-methyl-2-pyrrolidinone and Fennodefo 99™. The primary chemicals evaluated for Noxfish® were naphthalene, toluene and 1, 2, 4-trimethylbenzene. None of the calculated ingestion doses exceeded relevant toxicity thresholds for any of these constituents, nor did any calculated HQs exceed the more conservative LOCs developed by the USEPA (1998) (refer to Table C-17 in Appendix C). Similarly, exposure to the most concentrated rotenone formulation constituents (i.e., the “inert” ingredients) did not pose a risk to terrestrial or avifauna.

The terrestrial and avian risk assessment used a conservative food web modeling process to estimate exposures via the ingestion of water, food and sediment or soil. The daily ingestion rates of water, food and soil or sediment from the Wildlife Exposure Factors handbook (USEPA 1993). All water consumed was assumed to contain the maximum concentration of the ingredient being assessed. For carnivorous receptors (marsh wren, bald eagle, California wolverine, Sierra Nevada red fox, black bear, Yosemite toad and Sierra Nevada ~~mountain~~ yellow-legged frog), all food was assumed to be aquatic organisms that were in equilibrium with the water. Simple bioconcentration factors (BCFs) were used to estimate the ingredient concentrations in food (i.e., fish and invertebrates). Equilibrium partitioning was used to estimate the ingredient concentrations in sediments. For herbivores and other upland-foraging receptors (northern bobwhite quail, hairy woodpecker, mouse, pygmy rabbit, and mule deer), all food and ingested soil was assumed to contain the ingredients being assessed at concentrations equal to the water (bioaccumulation factors = 1) to address the possibility that streamside vegetation received overspray during application. Essentially, all wildlife were assumed to drink and eat only from the stream and banks, which is a very conservative approach; since wild animals are mobile and forage over a large range, thus increasing their likelihood of ingesting uncontaminated food.

Based on conservative food web modeling, wildlife exposure to rotenone formulation constituents would not result in adverse affects to most terrestrial or avian wildlife. Only birds such as marsh wren nestlings and adult amphibians could be exposed to rotenone at concentrations of concern, and then only at the highest application rate (1.0 mg/L) of CFT Legumine™, and only if they ate a diet consisting solely of aquatic insects that were in equilibrium with the maximum possible concentration of rotenone.

5.3.4.3 Alternative 3: Combined Physical Removal

Alternative 3 would employ mechanical removal methods instead of chemical methods to eradicate the non-native trout from Silver King Creek. Therefore, Alternative 3 would not result in any toxicological hazard to human or ecological receptors.

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5.4 WATER RESOURCES

This section describes the hydrology and water quality of the proposed treatment area and addresses potential hydrologic and water quality impacts of the proposed Action and its alternatives, including impacts from application of rotenone and potassium permanganate and the implementation of the proposed Action on water toxicity, turbidity, dissolved oxygen, bacteria concentrations, and color. Potential toxic effects from human and ecological exposure to rotenone formulation constituents and the neutralization agent, potassium permanganate, are addressed in Section 5.3, Human and Ecological Health Concerns.

5.4.1 Affected Environment

Silver King Creek is located on the eastern slope of the Sierra Nevada Range in Alpine County, California. The proposed project area occurs within the Carson-Iceberg Wilderness on National Forest System lands administered by the Carson Ranger District, Humboldt-Toiyabe National Forest (see Figure 1-1). This section describes existing hydrology and surface water quality in Silver King Creek and its tributaries based on data and information collected during previous stream surveys and monitoring programs.

5.4.1.1 Physical Conditions

Silver King Creek is a tributary of the East Fork Carson River, which drains into the Lahontan Basin. Silver King Creek's headwaters are located approximately 9,600 feet above msl and the creek flows in a northerly direction through three distinct valleys where it meets the East Fork Carson River. The total length of the creek is 14 miles with an average gradient of 4.1% and a minimum gradient of 1.6%.

Figures 1-1 and 3-1 depict the reaches of Silver King Creek, including the valleys and tributary features described below. The upper reaches of the creek flow through stringer meadows and Upper Fish Valley. The stream is a typical meandering meadow creek approximately 12 feet wide and 1 foot deep in the summer. Several soda springs and tributaries (Four Mile Canyon Creek, Bull Canyon Creek, and Fly Valley Creek) flow into the upper reaches of Silver King Creek. Fly Valley Creek forms the southwestern portion of the headwaters. From the southeast, Four Mile Canyon Creek enters 1.2 miles (2.0 kilometers) above Llewellyn Falls, while Bull Canyon Creek joins the mainstem from the west 0.5 mile (0.8 kilometer) above Llewellyn Falls (USFWS 2004).

The proposed treatment area begins at Llewellyn Falls, at an elevation of 8,000 feet (2,348 meters), is located at the head of Lower Fish Valley, some 10 miles (16.2 kilometers) above the confluence with the East Fork of the Carson River (USFWS 2004). The vertical drop of Llewellyn Falls is approximately 20 feet.

The stream gradient increases downstream of Llewellyn Falls and into the treatment area. Several tributaries join Silver King Creek between Llewellyn Falls and its confluence with the East Fork of the Carson River as follows. Tamarack Lake Creek and an unnamed creek flow into Lower Fish Valley. Tamarack Creek and Coyote Valley Creek join Silver King Creek below the steeply-sloped Long Valley. An unnamed tributary from the Poison Flat area flows into Silver King Creek just above Silver King Canyon.

Approximately two ~~2~~ miles downstream of the confluence with Coyote Valley Creek, Silver King Creek flows through Silver King Canyon. Through this canyon, a series of falls pose a natural barrier to upstream fish passage. At the bottom of the canyon, Snodgrass Creek joins Silver King Creek, which flows another 3.4 miles to its confluence with the East Fork Carson River at an elevation of 6,400 feet.

Three small lakes occur in the drainage; 1) Tamarack Lake, 2) Whitecliff Lake, and 3) an unnamed lake in the headwaters of Four Mile Canyon Creek~~. Tamarack Lake is the only lake in the treatment area. It has a surface area of approximately 5 acres and is located in the southwest portion of the treatment area at the head of Tamarack Lake Creek~~ (refer to Figure 3-1).

The climate of the proposed project area is influenced by its proximity to the Pacific Ocean. The seasonal weather patterns consist of wet winter and spring months and dry summer months. The majority of the precipitation falls as snow during the winter. Individual storms may produce more than five feet of snow. The variability in precipitation influences flows in Silver King Creek, with low flow periods during the summer months and higher flows during the winter and spring months (see Section 5.4.1.2, Hydrology, below).

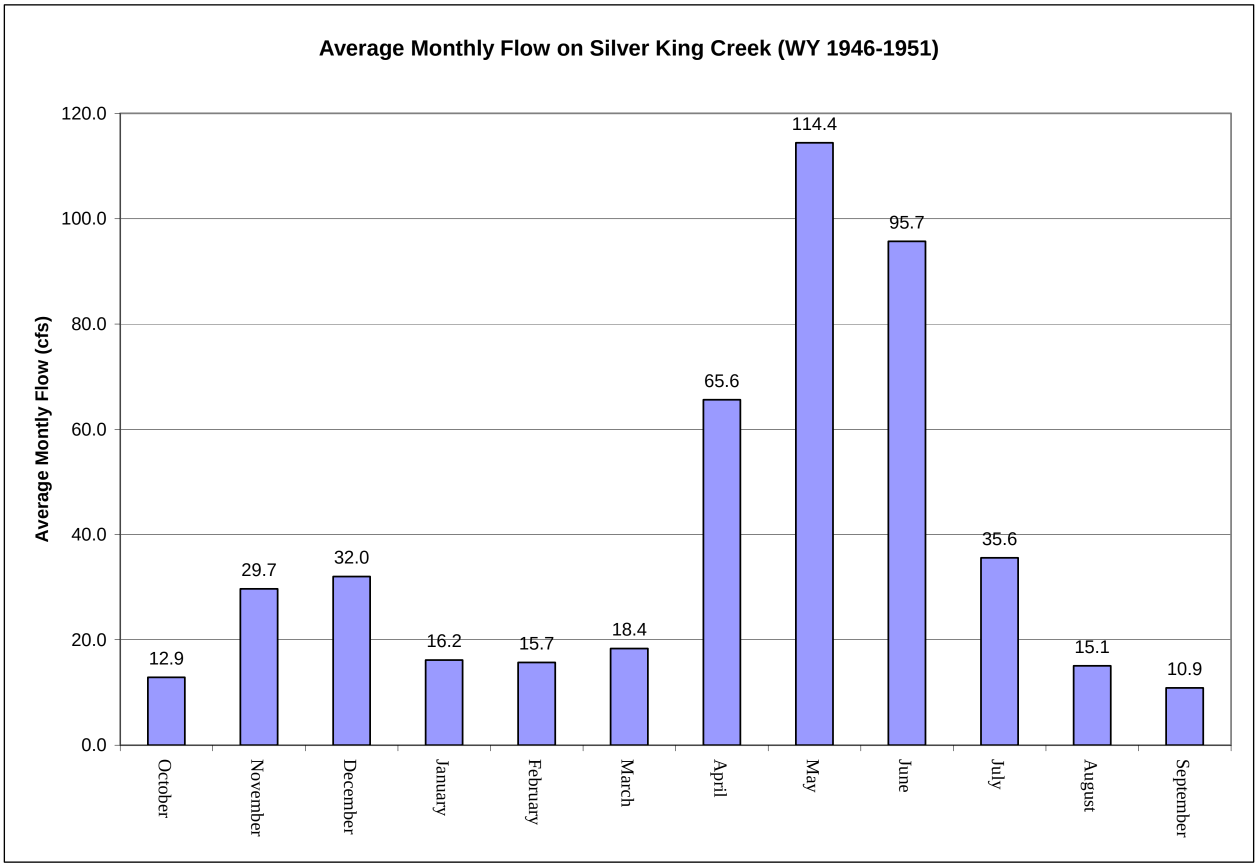
5.4.1.2 Hydrology

Flow data for Silver King Creek and its tributaries are limited. The U.S. Geological Survey (USGS) operated one stream gage on Silver King Creek from October 1, 1946, through September 30, 1951. The gage was located approximately 1.6 miles upstream from the confluence with Snodgrass Creek, within the proposed treatment area. Although the elimination of grazing has allowed vegetation to recover and potentially mute flows, land use within this area has not altered significantly (e.g. additional of impervious surfaces, stream diversions) since the early 1950s. Therefore, excluding other factors such as climate change, these historical flow records approximate current seasonal stream flow fluctuation patterns. The mean annual flow on Silver King Creek was 37 cubic feet per second (cfs) for the period of record. Figure 5.4-1 depicts the average monthly flows. These historical flow records indicate flows are dominated by snowmelt, which begins in March and peaks in April and May, then gradually decreases throughout the summer. During mid-August to mid-September, the planned treatment period, average monthly flow was approximately 15 cfs and 10.9 cfs, respectively. Because limited data are available, stream flows in August and September in any particular year could be higher or lower.

5.4.1.3 Water Quality

The Water Board considers water quality in Silver King Creek to be 'exceptional' (LRWQCB 1995). Silver King Creek Watershed is within a designated wilderness area and is undeveloped.

The beneficial uses of Silver King Creek, as set forth and defined in the Water Quality Control Plan for the Lahontan Region (the Basin Plan), are: Municipal and Domestic Supply; Agricultural Supply; Groundwater Recharge; Water Contact Recreation; Non-contact Recreation; Commercial and Sport Fishing; Cold Freshwater Habitat; Wildlife Habitat; Rare, Threatened, or Endangered Species; and Spawning, Reproduction and Development (LRWQCB 1995).

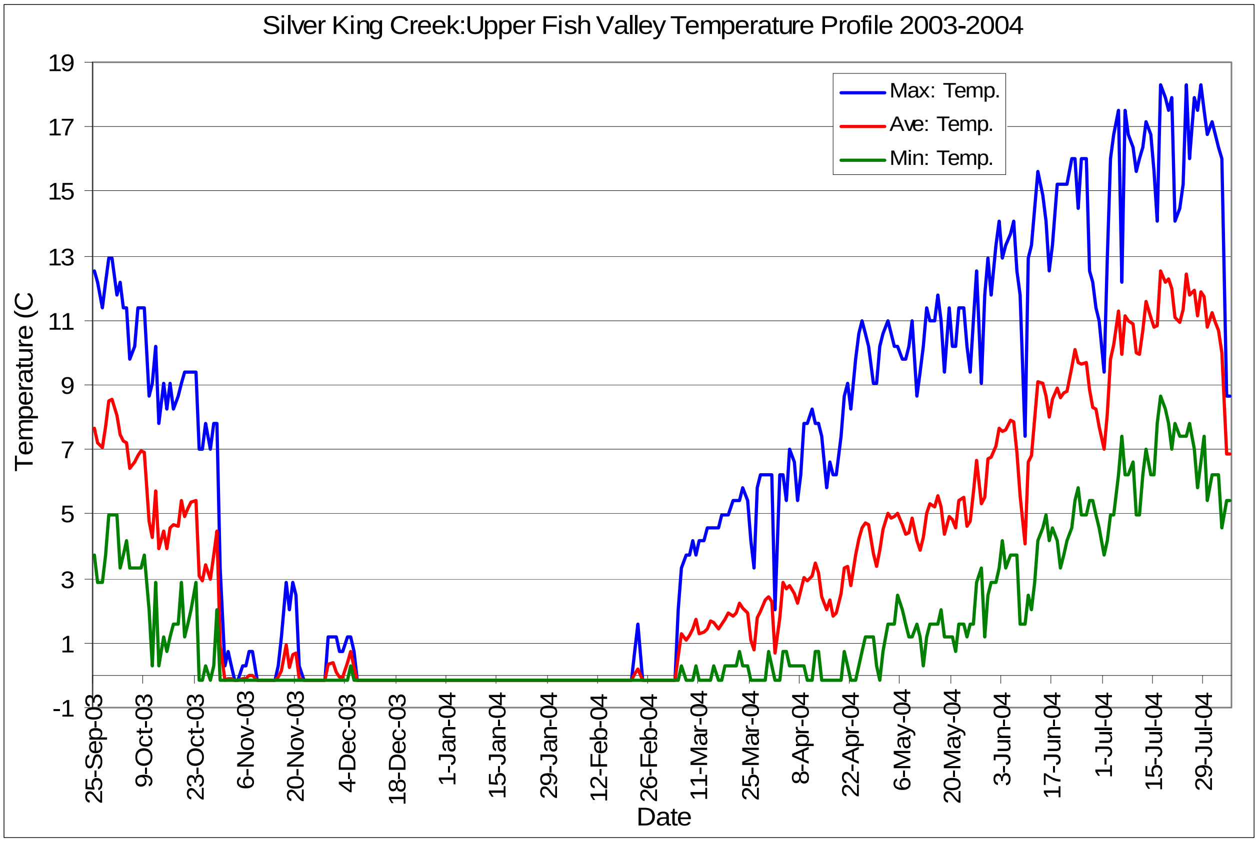


Source: USGS

Figure 5.4-1 Average Monthly Flows Recorded on Silver King Creek (1945-1951)

Water temperature data were recorded in Silver King Creek at Upper Fish Valley (elevation 8,088 feet) between September 25, 2003 and August 5, 2004 (Figure 5.4-2). Average daily summer stream temperature was less than 13 degrees Celsius (°C). The highest maximum daily water temperature was 18.3°C, reached in mid-July. These data suggest that July may be the month of peak temperatures with gradual cooling through August and September. The stream was iced over from early December through February. A similar temperature regime can reasonably be expected during implementation of the proposed Action or its alternatives.

Dissolved oxygen (DO) and pH (measure of acidity or alkalinity) were measured at 14 stream sites within or proximal to the treatment area during annual biological surveys conducted by the Agencies in July and August 2003 (Table 5.4-1). Dissolved oxygen ranged from 9.9 to 12.8 milligrams per liter (mg/L) (close to saturation), and pH ranged from 5.7 to 7.1. The majority of the measurements were below 7.0. These data are reasonably representative of water quality in the treatment area, and indicate neutral, highly oxygenated waters are predominant in the entire project area.



Source: Humboldt-Toiyabe National Forest

Figure 5.4-2 2003-2004 Temperature Profile for Silver King Creek: Upper Fish Valley, Carson Ranger District.

Table 5.4-1 Dissolved Oxygen and pH in Silver King Creek and Tributaries. Single Measurements at Each Site, July and August 2003

Water Body Name	pH	DO (mg/L)
Silver King Creek (Upper Fish Valley)	6.0	12.8
Silver King Creek (Upper Fish Valley)	5.7	12.4
Silver King Creek (Upper Fish Valley)	6.1	11.8
Silver King Creek (Upper Fish Valley)	6.6	11.9
Silver King Creek (Lower Fish Valley, Upstream)	6.8	11.0
Silver King Creek (Lower Fish Valley, Downstream)	7.1	11.5
Silver King Creek (Long Valley, Upstream)	6.5	10.1
Silver King Creek (Long Valley, Downstream)	6.8	10.1
Corral Valley Creek (Downstream)	7.0	11.7
Corral Valley Creek (Upstream)	6.8	11.0
Coyote Valley Creek (Downstream)	6.5	10.4
Coyote Valley Creek (Upstream)	6.7	9.9
Tamarack Creek (Upstream)	6.6	11.2
Tamarack Creek (Downstream)	6.6	11.4

5.4.2 Regulatory Setting

5.4.2.1 Federal

The fFederal agencies with jurisdiction over surface and subsurface hydrology and water quality include the USEPA, and U.S. Army Corps of Engineers (USACE)., USFWS, and USFS. Specific regulations that relate to inland and coastal water resources are described below.

CLEAN WATER ACT OF 1972

Enacted in 1972, the Federal Clean Water Act (CWA), Title 33 U.S.C. section 1251, et seq., and subsequent amendments outline the basic protocol for regulating discharges of pollutants to waters of the United States. It is the primary fFederal law regulating water quality of the nation’s surface waters, including lakes, rivers, and coastal wetlands. Enforced by the USEPA, it was enacted “… to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters.” CWA authorizes states to adopt water quality standards and includes programs addressing both point and non-point pollution sources. It gives the USEPA the authority to implement pollution control programs, such as setting wastewater standards for industry and water quality standards for surface waters, and established the NPDES. Under Section 402 of CWA, a discharge of pollutants to navigable waters is prohibited unless the discharge is in compliance with an NPDES permit. The USEPA and other agencies have developed numeric and narrative water quality criteria to protect aquatic life and to protect aesthetic water quality. The following subsections describe the portions of CWA applicable to the proposed Action and its alternatives.

SECTION 303(D)–IMPAIRED WATER BODIES AND TOTAL MAXIMUM DAILY LOADS

Section 303(d) of CWA requires states to identify waters where the permit standards, any other enforceable limits, or adopted water quality standards are still unattained. These lists of prioritized impaired water bodies, known as the “303(d) lists,” are submitted to the USEPA every two years. Once a stream is placed on the list, CWA requires that the state develop a plan to reduce pollution. States must submit this list to the USEPA every two years. The law requires the development of total maximum daily loads (TMDLs) to improve water quality of impaired water bodies. TMDLs are the quantities of pollutants that can be safely assimilated by a water body without violating water quality standards. States are developing TMDLs for impaired water bodies to maintain beneficial uses, achieve water quality objectives, and reduce the potential for future water quality degradation.

SECTION 402–NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

The USEPA determined that California’s water pollution control program has sufficient authority to manage the NPDES program under state law in a manner consistent with CWA. Therefore, the SWRCB and 9 RWQCBs implement and enforce the NPDES program. These agencies also implement the Waste Discharge Requirements (WDR) Program, which regulates discharges of waste to land or groundwater under the California Water Code (CWC).

Issued in 1972, the NPDES regulations initially focused on municipal and industrial wastewater discharges, followed by storm water discharge regulations, which became effective in November 1990. NPDES permits for wastewater and industrial discharges specify discharge prohibitions, effluent limitations, monitoring and reporting.

In implementing the NPDES program, the RWQCB protect beneficial uses of waters, including the resources, services and qualities of aquatic ecosystems and underground aquifers that benefit the State of California. Numerous beneficial uses have been identified, including agricultural supply, wildlife habitat, recreation, groundwater recharge and municipal and domestic water supply. In most cases, the RWQCBs protect beneficial uses by requiring water quality control measures (see Water Board Rotenone Policy described below). The discharge permit provides 2 levels of control: technology-based limits and water-quality-based limits. Technology-based limits are based on the ability of dischargers in the same category to treat wastewater, while water-quality-based limits are required if technology-based limits are not sufficient to protect the water body.

Dischargers with water-quality-based effluent limitations must achieve water quality standards in the receiving water. The provisions of sections 301 and 402 of CWA require controls that use best available technology economically achievable (BAT), best conventional pollutant control technology (BCT) and any more stringent controls necessary to reduce pollutant discharges and meet water quality standards. NPDES permits must also incorporate TMDL waste load allocations when they are developed.

Title 40, section 122.44 of the Code of Federal Regulations (CFR) states that if a discharge causes, has the reasonable potential to cause, or contributes to an excursion above a numeric or narrative water quality criterion, the permitting authority must develop effluent limits as necessary to meet water quality standards. Best Management Practices (BMPs) may be required in NPDES permits in lieu of numeric effluent limits to control or abate the discharge of pollutants when numeric effluent limits are infeasible.

WILD AND SCENIC RIVERS ACT OF 1968

No waters in the proposed treatment area or downstream are designated under the Wild and Scenic Rivers Act of 1968, Title 16 U.S.C. section 1271, et seq. Therefore, the proposed Action and its alternatives would not compromise any protections afforded by the Wild and Scenic Rivers Act.

5.4.2.2 State

California's surface water quality is regulated under the Porter-Cologne Water Quality Control Act. This law established the SWRCB and 9 RWQCBs. As described above, the USEPA has delegated the discharge permitting provisions of the CWA to these boards. Surface water and groundwater are also managed by CDFG. The following subsections describe state water resources regulations.

PORTER-COLOGNE WATER QUALITY CONTROL ACT

The RWQCBs regulate water quality under the Porter-Cologne Water Quality Control Act through the regulatory standards and objectives set forth in water quality control plans prepared for each region. These plans identify existing and potential beneficial uses and provide numerical and narrative water quality objectives to protect those uses.

In compliance with the Porter-Cologne Water Quality Control Act, the Water Board adopted a Basin Plan that became effective on March 31, 1995 (LRWQCB 1995). The Basin Plan incorporates SWRCB plans and policies by reference, contains beneficial use designations, contains water quality objectives for all waters of the Lahontan Region, in which Silver King

Creek is located, and provides a strategy for protecting beneficial uses of surface and ground waters throughout the Lahontan Region.

The Agencies have applied for a project-specific NPDES permit for rotenone application. The NPDES permit for the proposed Action would contain receiving water limits applicable to rotenone projects as contained in the Basin Plan. It would also require water quality monitoring to verify compliance with receiving water limits within the treatment area and in downstream waters both during and after the treatment.

WATER QUALITY STANDARDS

CWA defines water quality standards as “provisions of State or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Act” (Title 40 C.F.R. Section 131.3(i)) In California, Basin Plans designate the beneficial uses of waters of the state and water quality objectives (WQOs) to protect those uses. The SWRCB and RWQCBs adopt Basin Plans through a formal administrative rulemaking process, and, upon approval by the USEPA, the WQOs for waters of the United States (generally surface waters) become state water quality standards.

ROTENONE POLICY

In 1990, the Water Board adopted amendments to the Basin Plan to permit conditional use of rotenone by CDFG. The Water Board and CDFG then executed a Memorandum of Understanding (MOU) to facilitate amendment implementation. The MOU specifies the detailed information to be provided by CDFG before undertaking a rotenone application project and the monitoring required. It also lists the criteria the Water Board Executive Officer will use to evaluate rotenone application projects. These include whether:

- The proposed Action will meet the Basin Plan limits on chemical residue levels.
- The planned treatment protocol will result in the minimum discharge of chemical substances that can reasonably be expected for an effective treatment.
- Chemical transport, spill contingency plans and application methods will adequately provide for protection of water quality.
- Suitable measures will be taken to notify the public and potentially affected residents.
- Suitable measures will be taken to identify potentially affected sources of potable surface and groundwater intakes and to provide potable drinking water if necessary.
- A suitable monitoring program will be followed to assess the effects of treatment on surface and groundwater and on bottom sediments.

Application of rotenone solutions and the neutralization agent potassium permanganate can cause several water quality objectives to be temporarily exceeded, both inside and outside of project boundaries. The Basin Plan defines the project boundaries as the treatment area, the neutralization area, and the area downstream of the neutralization station up to a 30-minute travel time. It also establishes the following specific water quality objectives for rotenone projects including color, pesticides, toxicity and species composition. The Water Board Executive Officer may grant CDFG conditional variances to these objectives if the action meets certain conditions.

Water quality objectives for CDFG rotenone projects are as follows:

- Color: The characteristic purple discoloration resulting from the discharge of potassium permanganate shall not be discernible more than two miles downstream of project boundaries at any time. Twenty-four hours after shutdown of the neutralization ~~detoxification~~ operation, no color alteration(s) resulting from the discharge of potassium permanganate shall be discernible within or downstream of project boundaries.
- Pesticides: Chemical residues resulting from rotenone treatment must not exceed the following limitations:
  - The concentration of naphthalene outside of project boundaries shall not exceed 25 µg/liter [parts per billion (ppb)] at any time.
  - The concentration of rotenone, rotenolone, trichloroethylene (TCE), xylene, acetone, or potential trace contaminants such as benzene or ethylbenzene outside of project boundaries shall not exceed the detection levels for these respective compounds at any time. “Detection level” is defined as the minimum level that can be reasonably detected using state-of-the-art equipment and methodology.
  - After a two-week period has elapsed from the date that rotenone application was completed, no chemical residues resulting from the treatment shall be present at detectable levels within or downstream of project boundaries.
  - No chemical residues resulting from rotenone treatments shall exceed detection levels in groundwater at any time.
- Species Composition: The reduction in fish diversity associated with the elimination of non-native fish or exotic species may be part of the proposed Action, and may therefore be unavoidable. However, non-target aquatic populations (e.g. invertebrates, amphibians) that are reduced by rotenone treatments are expected to repopulate the treatment area within 2 years. Where species composition objectives are established for specific water bodies or hydrologic units, the established objective(s) shall be met for all non-target aquatic organisms within one ~~1~~ year following rotenone treatment. For multi-year treatments (i.e., when rotenone is applied to the same water body during two ~~2~~ or more consecutive years), the established objective(s) shall be met for all non-target aquatic organisms within two ~~2~~ years following the final rotenone application to a given water body. An assessment of potential impacts on benthic macroinvertebrates and post-treatment recovery of aquatic species composition is addressed in Section 5.1, Aquatic Biological Resources.

  Threatened or endangered aquatic populations (e.g. invertebrates, amphibians) shall not be adversely affected. The Agencies shall conduct pre-treatment monitoring to prevent rotenone application where threatened or endangered species may be adversely impacted.
- Toxicity: Chemical residues resulting from rotenone treatment must not exceed the limitations listed above for pesticides.

PROPOSITION 65 CONSIDERATIONS

Three inert ingredients present in one or both proposed rotenone formulations (N-methyl-2-pyrrolidone, ethylbenzene and naphthalene) are on the Proposition 65 list of chemicals known to the State of California to cause cancer or reproductive toxicity. The Proposition 65 statute is contained in California Health and Safety Code sections 25249.9-25249.13. Proposition 65 prohibits the discharge of chemicals known to cause cancer or reproductive toxicity. The State Attorney General’s Office is the State agency responsible for enforcing Proposition 65. Section

25249.11(b) specifically exempts State Agencies from the statute's provisions. Therefore, as a State agency, CDFG is exempt from Proposition 65.

CALIFORNIA TOXICS RULE

USEPA promulgated the California Toxics Rule (CTR), Title 40 C.F.R. section 131.38, establishing numeric criteria for priority toxic pollutants for the State of California. The SWRCB adopted the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, also known as the State Implementation Policy (SIP), which established procedures for implementing water quality standards in NPDES permits. Section 5.3 of the SIP allows the SWRCB and RWQCBs to grant short-term or seasonal categorical exceptions from meeting the CTR priority pollutant criteria for resource or pest management projects conducted by public entities. To qualify for this exception from meeting priority pollutant standards, a public entity must fulfill the requirements listed in Section 5.3, Human and Ecological Health Concerns, and among other requirements, comply with CEQA, Public Resources Code section 21000, et seq.

CEQA EXEMPTION

Pursuant to Section 13389 of CWA, the SWRCB is exempt from the requirement to comply with CEQA when adopting NPDES permits. While adoption of this NPDES permit is exempt from preparation of a CEQA document, public entities receiving exceptions pursuant to Section 5.3 of the SIP are required to prepare a CEQA document, as discussed below.

STATE IMPLEMENTATION POLICY EXCEPTION

SIP was adopted by the SWRCB on March 2, 2000, and became fully effective on May 22, 2000 (SWRCB 2000). SIP's goal is to standardize the permitting of discharges of toxic pollutants to non-ocean surface waters in a manner that promotes statewide consistency. As such, the SIP is used in conjunction with watershed management approaches and, where appropriate, the development of TMDLs to ensure compliance with water quality standards.

The SIP provides that categorical exceptions may be granted to allow short-term or seasonal exceptions from meeting the priority pollutant criteria/objectives if "necessary to implement control measures … for resource or pest management … conducted by public entities to fulfill statutory requirements." The SIP specifically refers to fishery management as a basis for a categorical exception. The exceptions are available only to public entities that have adequately provided the following, as listed in the SIP:

- CEQA documentation including notifying potentially affected public and government agencies;
- A detailed description of the proposed Action which includes the proposed method of completing the action;
- A time schedule;
- A discharge and receiving water monitoring plan that specifies monitoring prior to application events, during application events, and after completion with the appropriate quality control procedures;
- Contingency plans; and
- Residual waste disposal plans.

WASTE DISCHARGE REQUIREMENTS

Waste discharge prohibitions applicable to the Lahontan Basin include:

- The discharge of waste which causes violation of any narrative water quality objective contained in the Basin Plan, including the "Nondegradation Objective," is prohibited.
- The discharge of waste which causes violation of any numeric water quality objective contained in the Basin Plan is prohibited.
- Where any numeric or narrative water quality objective contained in the Basin Plan is already being violated, the discharge of waste which causes further degradation or pollution is prohibited.
- Direct discharge of wastes, including sewage, garbage and litter into surface waters of the region is prohibited.

"Waste" is defined to include any waste or deleterious material, including, but not limited to, waste earthen materials (such as soil, silt, sand, clay, rock, or other organic or mineral material) and any other waste as defined in the California Water Code section 13050(d).

5.4.3 Assessment Criteria and Methodology

5.4.3.1 Significance Thresholds

The following CEQA significance thresholds were used in the environmental impact assessment. Impacts were considered significant if they would:

- Violate any water quality standards or waste discharge requirements.
- Otherwise substantially degrade water quality.

Evaluation of these significance criteria will be used to evaluate CEQA Mandatory Findings of Significance, including whether the proposed Action would violate any water quality standards or waste discharge requirements or substantially degrade environmental quality.

As described in Chapter 4.0, Scope of the Analysis, this section does not address groundwater supplies or recharge. In addition, CEQA significance criteria related to potential impacts on water quality or flooding resulting from alteration of drainage patterns, creation of runoff, placement of housing or other structures, or flooding are not evaluated in detail because neither the proposed Action nor its alternatives would change existing conditions related to these issues. Neither the proposed rotenone treatment nor the alternatives would involve any activity (e.g. dams, levees, diversions, drainage structures) that would alter the stream course or drainage patterns or construct housing or any other structure. Further, the proposed Action and its alternatives would not expose people to a seiche, tsunami, or mudflow.

This section also does not provide a detailed assessment of impacts on drinking water for the following reasons. The proposed Action would not affect a sole-source aquifer. No new injection wells would be required and no pollutants would be expected to reach drinking water supplies as defined by the Safe Drinking Water Act. The nearest drinking water supply is in the town of Markleeville, located approximately 10 miles downstream. These and other potential downstream users are addressed in Section 5.3, Human and Ecological Health Concerns. Under the proposed Action, neutralization with potassium permanganate occurs near the downstream end of the treatment area (refer to Figure 3-1), thus there would be no adverse impacts to municipal drinking water supplies. Drinking water issues are also addressed in detail in Appendix C.

The water quality concerns addressed below include:

- Reduced DO concentrations resulting from chemical oxygen demand as a result of rotenone degradation;
- Reduced DO concentrations resulting from biological oxygen demand as a result of the decomposition of dead fish;
- Elevated bacterial levels associated with the decomposition of dead fish;
- Elevated turbidity resulting from physical disturbance in and near waterways;
- Effects on water color, specifically the persistence of purple discoloration resulting from application of potassium permanganate; and
- Toxic concentrations of rotenone and formulation constituents.

5.4.3.2 Evaluation Methods and Assumptions

This assessment evaluates and identifies short-term or temporary water quality impacts, long-term impacts that could persist for years, and residual impacts. Analysis was based on review of the activities associated with the proposed Action (Alternative 2) and Combined Physical Removal (Alternative 3) and water quality concerns identified in the Basin Plan rotenone policy including color, pesticides, bacteria, species composition and toxicity.

The Basin Plan definitions of these water quality objectives include:

- **Color.** Waters shall be free of coloration that causes nuisance[1] or adversely affects the water for beneficial uses.
- **DO.** The DO concentration, as percent saturation, shall not be depressed by more than 10%, nor shall the minimum DO concentration be less than 80% of saturation. For waters with the beneficial use designation of COLD with SPWN[2], the minimum DO concentration shall not be less than 8.0 mg/l (1-day minimum).
- **Bacteria.** Waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes.
- **Turbidity.** Waters shall be free of changes in turbidity that cause nuisance or adversely affect the water for beneficial uses. Increases in turbidity shall not exceed natural levels by more than 10%.

[1] The Lahontan Basin Plan defines nuisance as anything which meets all of the following requirements: 1) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property; 2) Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal. 3) Occurs during or as a result of the treatment or disposal of wastes.

[2] The Basin Plan beneficial use designation of COLD with SPWN require water column dissolved oxygen concentrations not less than 8.0 mg/l to achieve the required intergravel concentrations (5.0 mg/l) to maintain all embryonic and larval stages and all juvenile forms to 30days following hatching (SPWN).

- **Toxicity.** All waters shall be maintained free of toxic substances in concentrations that are toxic to or that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by use of indicator organisms, analyses of species diversity, population density, growth anomalies, bioassays of appropriate duration and/or other appropriate methods as specified by the Water Board. The survival of aquatic life in surface waters subjected to a waste discharge, or other controllable water quality factors, shall not be less than that for the same water body in areas unaffected by the waste discharge, or when necessary, for other control water that is consistent with the requirements for "experimental water" as defined in Standard Methods for the Examination of Water and Wastewater (American Public Health Association, et al. 1998).

Toxicity is addressed in several sections of this EIS/EIR. Section 5.1, Aquatic Biological Resources, addresses potential impacts on benthic invertebrate species composition. Section 5.3, Human and Ecological Exposure, addresses the potential toxicity of rotenone and its formulation constituents and potassium permanganate, including evaluation of bioassay data and comparison with toxicity benchmarks. Both of these sections refer to toxicity data presented in Appendix C. This section specifically addresses the toxicity criteria in the Water Board rotenone policy that address chemical concentrations outside project boundaries, and presence of chemical residues in water, sediment and groundwater.

5.4.4 Environmental Impact Assessment

This section analyzes the potential water quality impacts of the proposed Action and its alternatives. It evaluates direct impacts associated with implementation (e.g. chemical application, worker activity) and indirect impacts, which are secondary effects but delayed or spatially removed from implementation (e.g. residual chemical effects). It addresses potential impacts on water toxicity, color, turbidity, and impacts on DO concentrations (resulting from added chemical or biological oxygen demand) and bacteria concentrations.

5.4.4.1 Alternative 1: No Action

The No Action alternative would have no impact on the water quality of Silver King Creek. No workers would enter this area and no chemicals would be applied to surface waters of Silver King Creek or its tributaries.

5.4.4.2 Alternative 2: Proposed Action ~~(Rotenone Application)~~

The Agencies propose to use rotenone to eradicate non-native trout and to use potassium permanganate as a neutralization agent. The application of rotenone solution and the neutralization ~~detoxification~~ agent potassium permanganate could cause several water quality objectives to be temporarily exceeded, both within and downstream of the treatment area, including the neutralization area (the area downstream of the neutralization station up to a 30-minute travel time).

SILVER KING CREEK AND TRIBUTARIES

ROTENONE, FORMULATION CONSTITUENTS AND NEUTRALIZATION AGENT

The rotenone formulations proposed for application are Noxfish® ~~Nusyn-Noxfish®,~~ and CFT Legumine™. The specific components and toxicities of these ~~3~~ formulations are discussed in detail in Appendix C. Application of rotenone would result in immediate but temporary and localized adverse impacts on water quality in the treatment area, including presence of rotenone and its formulation ingredients, and potassium permanganate in the neutralization area.

To eliminate the toxic effects of rotenone, potassium permanganate would be administered at a downstream neutralization station. Potassium permanganate is a powerful oxidizing chemical that quickly renders rotenone harmless to aquatic organisms. Potassium permanganate is toxic to gill-breathing organisms at the rate required for neutralization (2 to 4 mg/L). However, as it oxidizes the rotenone and other degradable materials in the water, it becomes reduced. The by-product of the oxidation of rotenone by potassium permanganate is manganese oxide, a biologically inactive compound (CDFG 1994). In flowing water treatments, this balance usually limits aquatic exposure to permanganate and rotenone to 0.25 to 0.5 mile downstream of the neutralization site (Hobbs et al. 2006). As described in the Basin Plan (LRWQCB 1995), water quality impacts outside the project boundaries are expected to be minimal. Trace amounts of rotenone and formulation constituents may persist beyond the project boundaries. However, as described in the Basin Plan, these residues generally do not persist beyond 1 or 2 days, and beneficial uses are not expected to be impaired in the long-term.

In addition to rotenone, liquid rotenone formulations also contain “inert” ingredients (e.g. carriers, solvents, dispersants, and emulsifiers). ~~Synergized formulations (e.g. Nusyn-Noxfish®) also contain synergists such as piperonyl butoxide.~~ The organic solvents, depending on the formulation may include naphthalene, methylnaphthalene, xylene, acetone, trichloroethylene (TCE), benzene and ethylbenzene. According to the Basin Plan, concentrations of these compounds in rotenone-treated water are expected to meet current drinking water standards. Water quality impacts from these chemicals would be short-term as the compounds would rapidly decompose or volatilize within hours. According to the Basin Plan, some chemical residues may be detectable for up to two weeks. The Basin Plan also states that short-term impacts can adversely affect aesthetics, recreation (see Section 5.6), and water supply; however, because visitors to the area will be advised to avoid the proposed treatment area during the treatment process, these beneficial uses would not be affected.

Appendix C provides a detailed discussion of the environmental transport and degradation of rotenone and persistence of residues. In summary, rotenone dissipates rapidly in soil and water. It adheres to soil and is unlikely to be found in groundwater. Rotenone degrades rapidly in the presence of sunlight and warm temperatures and may persist in natural water bodies from between a few days to several weeks depending on the season. Similarly, dispersant concentrations, such as volatile and semi-volatile compounds dissipated rapidly. Therefore, according to the data contained in Appendix C, particularly during summertime treatment in shallow waters, the proposed Action would not result in residual concentrations in water, sediment, or groundwater.

The proposed Action would result in a temporary degradation of water quality. The SWRCB’s policy for maintaining high quality water directs that whenever the existing quality of waters is better than standards established in water quality objectives, the existing level of quality shall be maintained (SWRCB 1968). Accordingly, the proposed Action would require the Water Board to determine that this temporary deterioration in water quality would result in a benefit. Similarly, the Federal Antidegradation Policy, Title 40 C.F.R. section 131.12, dictates that water quality shall be preserved unless deterioration is necessary to accommodate important economic or social development. The Water Board has determined that certain situations justify the use of rotenone.

The temporary deterioration of water quality due to the use of rotenone by CDFG is justifiable in certain situations, including restoration and preservation of threatened and endangered species. These species are of important economic and social value to the people of the State, and the transitory degradation of water quality and short-term impairment of beneficial uses that would result from rotenone application is therefore justified, provided suitable measures are taken to protect water quality within and downstream of the treatment area. The ~~refore,~~ application of rotenone would result in significant and unavoidable water quality impacts to benthic macroinvertebrates as described in Section 5.1.4.2 (Impact AR-1) and 5.3.4.2 (Impact HEH-1). ~~significant and unavoidable impacts on water quality~~

To minimize potential water quality impacts, the rotenone application would be supervised by licensed applicators in adherence to safety precautions identified on the product label. The application supervisor would be knowledgeable and experienced in state regulatory requirements regarding safe and legal use of the rotenone product and applicator safety. All personnel involved with the rotenone application would have received, before treatment, safety training specific to the formulated rotenone product that would be used. In addition the Agencies would conduct water quality monitoring to ensure that: 1) rotenone concentrations do not exceed the effective concentration required for eradication of non-native trout; 2) sufficient degradation of rotenone has occurred before the area is opened to the public; and 3) rotenone toxicity does not occur outside the treatment area. As described in the Basin Plan conditions, the monitoring program would assess the effects of treatment on surface waters and bottom sediments. An analytical laboratory would analyze water samples for rotenone and rotenolone concentrations, as well as for volatile organic compound and semi-volatile organic compound concentrations. Further, the Agencies would minimize water quality impacts by limiting the treatment concentration applied and the duration of rotenone activity to the shortest time period needed to meet the fish removal objective. By following these procedures, the direct effects from the treatment on water quality would be confined to the treatment area and would result in short-term effects on water quality that would be less-than-significant (other than impacts to benthic macroinvertebrates described above, see Impact AR-1 and Impact HEH-1) and ~~that~~ mitigation measures are not required.

However, during the routine application of these chemicals, there exists a potentially significant risk of an accidental spill during travel to the treatment site or at the site. The impacts of a potential spill could be significant; however, these impacts would be significantly reduced by the inclusion of a spill contingency plan, site safety plan, and site security plan. These plans would address chemical transport and use guidelines, procedures for maintenance and calibration of dispensing equipment, handling of small quantities of chemical, as well as spill prevention and containment that adequately protects water quality. The plans would require application of rotenone supervised by licensed applicators and in adherence to safety precautions identified on the product label. It would require the application supervisor to be knowledgeable and experienced in state regulatory requirements regarding safe and legal use of the rotenone product and applicator safety. All personnel involved with the rotenone application would receive safety training specific to the selected rotenone formulation. The plan would also describe the use of an auger to dispense the neutralizing agent while minimizing the risk of an inadvertent release. Potential visitors would be advised regarding the availability of comparable recreation areas. The safest access routes need be selected for transporting hazardous materials to the treatment site. The impact of spills under the proposed Action would therefore be less-than-significant and no further mitigation would be required.

DISSOLVED OXYGEN

The proposed Action could affect DO concentrations in Silver King Creek and its tributaries. Aerobic degradation of rotenone in the water column could result in reduced DO concentrations; however, this effect was not observed during the recent treatment of Lake Davis (Lehr 2009). Additionally, decomposition of dead fish could also reduce DO concentrations and elevate bacteria levels in the water. Low DO concentrations can result in stress, reduced growth, or death of fish and other gill-breathing aquatic organisms. The Basin Plan specifies that the DO concentration, as percent saturation, shall not be depressed by more than 10%, nor shall the minimum DO concentration be less than 80% of saturation. To address this issue, block nets would be placed at selected locations throughout the treatment area to catch the dead fish. The nets would be maintained at a frequency adequate to ensure that captured fish are not in the water long enough to decompose.

In addition, the natural geomorphology of Silver King Creek will help prevent the persistence of low oxygen levels in the stream. Silver King Creek is shallow and stream riffles would rapidly reoxygenate stream flows. In addition, waterfalls in Silver King Canyon would reoxygenate waters immediately downstream of the treatment area. Therefore, any reduction in DO would be temporary and would be quickly offset by entrainment of atmospheric oxygen. Because of this, effects on DO would not substantially degrade environmental or water quality in Silver King Creek. Any reduction in DO below the Basin Plan criteria would be of short duration (<24 hours) and DO levels would recover as described above.

Collection of fish using block nets as well as additional gathering by hand as practicable would reduce the impacts of the proposed Action on DO to less-than-significant.

BACTERIA LEVELS

Following the rotenone treatment, the decomposition of dead fish may result in elevated bacteria levels in the water, particularly in pools or backwater areas where carcasses may collect. The proposed Action would involve removing fish carcasses using block nets and by gathering additional fish by hand to the extent practicable (see description above). Thus, there would be few areas with elevated bacterial levels.

While the Basin Plan includes bacterial levels as a water quality objective, the bacteria criteria are focused on levels of fecal coliform bacteria. Specifically, page 3-4 of the Basin Plan states "*that waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes*." Fecal coliform bacteria can enter rivers through direct discharge of waste from mammals and birds, from agricultural and storm runoff, and from untreated human sewage. However, this bacterial indicator is not associated with fish decay and no other indicators are specified by the Basin Plan. Therefore, elevated bacteria levels resulting from fish decomposition would not violate water quality standards and this temporary effect on water quality would have less-than-significant adverse impacts.

ELEVATED TURBIDITY

The Basin Plan specifies that increases in turbidity shall not exceed natural levels by more than 10%. Turbidity could be increased during the application of chemicals due to the transport of equipment, personnel and chemicals to and within the treatment area by pack stock and on foot. Elevations in turbidity would be temporary and would not substantially degrade environmental or water quality in the long-term. Rotenone would be applied by drip stations and if by hand sprayers, primarily from stream banks. Because of the sand and gravel content of the stream's bottom sediments, any temporary increases in turbidity resulting from workers walking in the stream during application of rotenone formulation to reach backwater areas would not exceed the Basin Plan standard and thus this impact would be less-than-significant.

EFFECTS ON COLOR

The rotenone treatment would be followed by the addition of potassium permanganate at a neutralization site downstream from the rotenone application area (Figure 3-1). Potassium permanganate causes a characteristic temporary purple discoloration when discharged into water. The Basin Plan recognizes that the color change caused by this agent can be visible up to two ~~2o~~ miles downstream (LRWQCB 1995). Therefore, the Basin Plan water quality objectives for color specify that discolorations shall not be discernable more than 2 miles downstream of the project boundaries at any time, nor shall any color be discernable within or downstream of project boundaries 24 hours after the potassium permanganate application.

Potassium permanganate would be discharged into treatment-area streams at an effective rate of 2 to 4 mg/L as the detoxifying agent. At this concentration, the potassium permanganate is expected to result in a noticeable purple color for less than one ~~1~~ mile downstream from the neutralization site. Under these conditions, potassium permanganate would quickly be reduced to manganese oxide and would not persist for more than a day following neutralization ~~detoxification~~ (LRWQCB 1995). Because the public would be advised to avoid the treatment area during treatment and for two ~~2~~ weeks afterward, the purple color would not interfere with human beneficial uses such as fishing, nor would these low concentrations of short duration adversely affect wildlife habitat, special status species, or water quality needed for fish to spawn, reproduce and develop. Therefore, potassium permanganate would not violate water quality objectives for color at these levels and the application of rotenone would result in less-than-significant impacts on color.

TAMARACK LAKE

ROTENONE, FORMULATION CONSTITUENTS AND NEUTRALIZATION AGENT

As a result of extensive sampling in 2009 the agencies have deemed Tamarack Lake to be fishless (Somer and Hanson 2009, Hanson 2009). The result of this determination is that Tamarack Lake will not be chemically treated and is no longer considered part of this project.

~~If rotenone formulations are applied to Tamarack Lake, breakdown residues may persist beyond 24 hours. No potassium permanganate would be used to neutralize rotenone in the lake. When applied to water, rotenone breaks down naturally within approximately 5 days depending on pH, alkalinity, temperature, dilution, and exposure to sunlight (Schnick 1974). According to Appendix C, rotenone dissipates rapidly in water, particularly in the presence of sunlight and warm temperatures and may persist in natural water bodies from between a few days to several weeks depending on the season. In addition, the lake's depth may affect rotenone's persistence. As described in Appendix C, rotenone half-lives range up to over a week. After the 2007 rotenone treatment of Lake Davis, rotenone persisted for approximately 30 days and had a half-life of 5.6 days. In addition, although most volatile and semi-volatile compounds in the formulations would dissipate rapidly, several of the dispersants contained in CFT Legumine™ persisted longer than rotenone after the 2007 Lake Davis treatment. Therefore, given the measured persistence of rotenone and formulation dispersants in Lake Davis, the depth of Tamarack Lake, and its colder temperatures compared with Lake Davis, residual levels of~~

rotenone and formulation dispersants in Tamarack Lake would potentially result in short term but significant impacts on water quality standards and beneficial uses.

Impact WQ-1: Application of rotenone formulations to Tamarack Lake would result in residual concentrations that could persist for more than two weeks, resulting in significant adverse impacts on water quality.

Because no mitigation measures are available to accelerate the degradation of rotenone and its formulation constituents in the lake, this impact could be significant and unavoidable.

REDUCED DISSOLVED OXYGEN

During the natural rotenone degradation process, oxidation could result in lower DO concentrations in the lake. However, because of the high oxygen saturation levels in oligotrophic high-elevation lakes such as Tamarack Lake, this phenomenon is not expected to be significant. DO levels were not affected significantly during the recent treatment of Lake Davis. Even with the high fish densities in Lake Davis, post-treatment water quality monitoring found no depression in DO (Lehr 2009).

Tamarack Lake would produce very few fish, if any, during a rotenone treatment. In addition, any effects on DO would be moderated by natural processes including surface water oxygenation by wave action in littoral areas and removal of fish carcasses by carrion-feeding wildlife. Any dead fish would be removed from the lake to the extent practicable and buried. Any dead fish not collected would provide nutrients for recolonizing benthic and planktonic invertebrates.

Therefore, the slight reduction in DO in Tamarack Lake that could result from the proposed Action would not violate water quality standards. Background DO concentrations in this high, oligotrophic, alpine lake would likely be well above the minimum water quality standard. Any reductions in oxygen concentrations should be localized and less than significant.

ELEVATED BACTERIAL LEVELS

Following rotenone treatment, the decomposition of dead fish could result in elevated bacteria levels in the water, particularly in near-shore areas. There are a small number of fish, if any in Tamarack Lake, and the Agencies would remove dead fish to the extent practicable as described above.

As described above for Silver King Creek, the Basin Plan includes criteria specific to fecal coliform bacteria. Because these bacteria are primarily an indicator of human and livestock wastes, the decomposition of fish in Tamarack Lake would not result in violation of the Basin Plan water quality standards. Moreover, any elevated bacteria levels resulting from fish decomposition would be temporary and would not cause water quality criteria to be exceeded. Therefore, application of rotenone would result in less-than-significant impacts on bacteria levels in Tamarack Lake.

TURBIDITY

The proposed Action would have little or no impact on turbidity in Tamarack Lake. Localized turbidity could result from shoreline foot traffic during chemical application. However, this effect would be temporary and would not substantially degrade water quality. The Basin Plan specifies that increases in turbidity shall not exceed natural levels by more than 10%. Because of the rocky nature of the lake's shoreline, temporary increases in turbidity resulting from workers

~~would be unlikely to increase turbidity by 10%. Therefore, the proposed Action would result in less-than-significant impacts on Tamarack Lake turbidity levels.~~

~~*COLOR*~~

~~The Agencies are not planning to use potassium permanganate in Tamarack Lake. If required to address residual rotenone concentrations, rotenone would be quickly reduced to manganese oxide under these conditions and according to the Basin Plan would not persist for more than a day following the end of detoxification. Because visitors would be advised to avoid the treatment area during treatment and for 2 weeks afterward, the purple color would not interfere with human beneficial uses such as fishing, nor would these low concentrations of short duration adversely affect wildlife habitat, special status species, or water quality. Therefore, at the low application rate that would be used as a contingency if rotenone remains in the lake, potassium permanganate would not violate water quality objectives for color and the application of rotenone would result in less than significant impacts on color.~~

5.4.4.3 Alternative 3: Combined Physical Removal

Alternative 3 would employ electrofishing, seining and gill netting to achieve fish removal. No chemicals would be applied. The following paragraphs evaluate potential water quality impacts in Silver King Creek and Tamarack Lake from such activities.

SILVER KING CREEK AND TRIBUTARIES

DISSOLVED OXYGEN

Because no chemicals or other sources of oxygen demand would be added to the stream, Alternative 3 would have no chemical oxygen demand impacts on DO concentrations in proposed treatment areas. However, decomposition of dead fish could result in reduced DO concentrations and elevate bacteria levels in the water. Low DO concentrations can result in stress, reduced growth, or death of fish and other gill-breathing aquatic organisms. The Basin Plan specifies that the DO concentration, as percent saturation, shall not be depressed by more than 10%, nor shall the minimum DO concentration be less than 80% of saturation.

As described above for the proposed Action, the natural geomorphology of Silver King Creek would help prevent the persistence of low oxygen levels in the stream. Stream riffles and waterfalls would rapidly reoxygenate stream flows. Therefore, any reduction in DO would be temporary and would not substantially degrade environmental or water quality in Silver King Creek.

Collection of fish using electrofishing and gill nets would reduce the impacts of this alternative on DO to less-than-significant.

BACTERIA LEVELS

Decomposition of dead fish following electrofishing could result in elevated bacteria levels in the water, particularly in pools or backwater areas where carcasses may collect. This alternative would involve removing fish during the electrofishing operation and capture of further carcasses using block nets and by gathering additional fish by hand to the extent practicable. Thus, there would be few areas with elevated bacterial levels.

As described above for the proposed Action, while the Basin Plan includes bacterial levels as a water quality objective, the bacteria criteria are focused on levels of fecal coliform bacteria. Specifically, page 3-4 of the Basin Plan states "that waters shall not contain concentrations of coliform organisms attributable to anthropogenic sources, including human and livestock wastes." This bacterial indicator is not associated with fish decay and no other indicators are specified by the Basin Plan. Therefore, elevated bacteria levels resulting from fish decomposition would not violate water quality standards and this temporary effect on water quality would have less-than-significant adverse impacts.

ELEVATED TURBIDITY

The Basin Plan specifies that increases in turbidity shall not exceed natural levels by more than 10%. However, given the coarse material present in the stream and the limited number of depositional areas where silt could be disturbed by electrofishing crews, any disturbance of sediments would be temporary and sediments would be re-deposited within a short distance. Therefore, any impacts on stream turbidity would be less-than-significant and no mitigation measures would be required.

TAMARACK LAKE

Because no chemicals or other sources of oxygen demand would be added to the lake and no motorized watercraft would be used to dispense rotenone, Alternative 3 would have no impacts on DO concentrations. Although very few fish would be expected, any fish captured using physical techniques (i.e., gillnetting) would be gathered and buried to the extent practicable as described above and therefore bacteria levels would not be affected. Remaining fish would provide nutrients for repopulating benthic and planktonic invertebrates. Because gillnetting and electrofishing from the shoreline would not cause the level of disturbance that the intensive electrofishing efforts associated with Alternative 3 would cause in streams proposed for treatment, lake turbidity would not be affected significantly. Therefore, Alternative 3 would result in less-than-significant impacts on water quality in Tamarack Lake.

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5.5 GREENHOUSE GASES AND CLIMATE CHANGE

This section evaluates the potential impacts of the proposed Action and alternatives on global climate change in terms of its contribution to state and national greenhouse gas emissions.

5.5.1 Environmental Setting

Gases that trap heat in the atmosphere are often called greenhouse gases. Common greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, ozone, and aerosols. Greenhouse gases are emitted by both natural processes and human activities. The accumulation of greenhouse gas in the atmosphere can increase the earth's temperature over time. Greenhouse gas emissions from human activities, such as fossil-fueled generation of electricity and vehicle use, have elevated the concentration of these gases in the atmosphere, causing global warming (Association of Environmental Professionals 2007). The principal greenhouse gases that enter the atmosphere due to human activities are as follows:

- **Carbon dioxide** enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions. Carbon dioxide also is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- **Methane** is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.
- **Nitrous oxide** is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Nitrous oxide comprises a small fraction of nitrogen oxide emissions from combustion sources, which are mainly nitric oxide and nitrogen dioxide.[1]
- **Fluorinated gases** such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are often used as substitutes for ozone-depleting substances (i.e., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases typically are emitted in smaller quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (USEPA 2005~~6~~).

The greenhouse gas of greatest concern is carbon dioxide, because it is released by the burning of fossil fuels (coal, oil, and gas) and is therefore the most common greenhouse gas emission from human activities. It can last in the atmosphere for centuries and, due to its prevalence in the atmosphere, contributes more to climate change than any other greenhouse gas. The California Energy Commission has estimated that in 2004 the state emitted 492 million metric tons of carbon dioxide-equivalent greenhouse gas emissions. Eighty-one percent were emissions of carbon dioxide from fossil fuel combustion, 2.8% were from other sources of carbon dioxide, 5.7% were from methane, and 6.8% were from nitrous oxide. The remaining source of greenhouse gas emissions was high-Global Warming Potential gases at 2.9% (California Energy Commission 2006).

[1] Nitrogen oxides from high-temperature sources are about 85 to 90 percent nitric oxide, about 9 to 14 percent nitrogen dioxide, and less than 1 percent nitrous oxide.

5.5.2 Regulatory Setting

5.5.2.1 Federal

CLEAN AIR ACT

The Clean Air Act of 1970 (42 USC 7401 et seq. as amended in 1977 and 1990) is the ~~f~~Federal law that regulates air emissions from area, stationary, and mobile sources. The law authorizes the USEPA to set National Ambient Air Quality Standards to regulate the quantity of pollutants that can be in the air. Standards have been established for six criteria pollutants that have been linked to potential health concerns.

The goal of the Clean Air Act was to set and achieve National Ambient Air Quality Standards in every state by 1975. States were directed to develop state implementation plans to achieve attainment of National Ambient Air Quality Standards. The Clean Air Act was amended in 1977 to set new dates for attainment (since many areas of the country had failed to meet the deadlines) and again in 1990 to meet unaddressed or insufficiently addressed problems such as acid rain, ground-level ozone, stratospheric ozone depletion, and air toxics.

MASSACHUSETTS VS. ENVIRONMENTAL PROTECTION AGENCY

In Massachusetts v. Environmental Protection Agency, 549 U.S. 497 (2007), the U.S. Supreme Court held that not only did USEPA have authority to regulate greenhouse gases, but that USEPA's reasons for not regulating greenhouse gas emissions did not fit the statutory requirements. The U.S. Supreme Court ruled that carbon dioxide and other greenhouse gas emissions are pollutants under the ~~f~~Federal Clean Air Act, which USEPA must regulate if it determines they cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. To date, USEPA has not made such a finding or developed a regulatory program for greenhouse gas emissions.

5.5.2.2 State

ASSEMBLY BILL 1493

In September 2002, Governor Davis signed Assembly Bill (AB) 1493, requiring the development and adoption of regulations to achieve "the maximum feasible reduction of greenhouse gases" emitted by noncommercial passenger vehicles, light-duty trucks, and other vehicles used primarily for personal transportation in the state. Setting emission standards on automobiles is normally the responsibility of USEPA. The ~~f~~Federal Clean Air Act, however, allows states to set a state-specific emission standard on automobiles if they first obtain a waiver from USEPA. In December 2007, USEPA denied California's request for a waiver. In response, California sued USEPA claiming that the denial was not based on the scientific data.

EXECUTIVE ORDER S-3-05

In June 2005, Governor Schwarzenegger signed Executive Order S-3-05, which established greenhouse gas emissions reduction targets for the state as well as a process to ensure that the targets are met. As a result of this executive order, the Climate Action Team, led by the Secretary of the California State Environmental Protection Agency (CalEPA), was formed. The Climate Action Team published a March 2006 report that laid out several recommendations and strategies for reducing greenhouse gas emissions and reaching the targets established in the executive order (CalEPA 2006). The greenhouse gas targets are:

- By 2010, reduce emissions to 2000 levels;
- By 2020, reduce emissions to 1990 levels; and
- By 2050, reduce emissions to 80 percent below 1990 levels.

GLOBAL WARMING SOLUTIONS ACT

In September 2006, Governor Schwarzenegger signed California's Global Warming Solutions Act of 2006 (AB 32). AB 32 requires the California Air Resources Board (CARB) to:

- Establish a statewide greenhouse gas emissions cap for 2020, based on 1990 emissions, by January 1, 2008;
- Adopt mandatory reporting rules for significant sources of greenhouse gas emissions by January 1, 2008;
- Adopt an emissions reduction plan by January 1, 2009, indicating how emissions reductions will be achieved via regulations, market mechanisms, and other actions; and
- Adopt regulations to achieve the maximum technologically feasible and cost effective reductions of greenhouse gases by January 1, 2011.

SENATE BILL 97

California Senate Bill (SB) 97, passed in August 2007, is designed to work in conjunction with CEQA and AB 32. SB 97 requires the California Office of Planning and Research to prepare and develop guidelines for the mitigation of greenhouse gas emissions or the effects thereof, including but not limited to, effects associated with transportation and energy consumption. These guidelines must be transmitted to the Resources Agency by July 1, 2009, to be certified and adopted by January 1, 2010. The Office of Planning and Research and the Resources Agency shall periodically update these guidelines to incorporate new information or criteria established by CARB pursuant to AB 32. SB 97 will apply to any EIR, negative declaration, mitigated negative declaration, or other document required by CEQA, prepared for a limited number of types of projects, which has not been finalized. SB 97 will be automatically repealed January 1, 2010.

In summary, no rules or regulations have been promulgated by CARB or any other state agency that define a "significant" source of greenhouse gas emissions. In addition, there are no applicable project-specific emission limitations or caps for greenhouse gas emissions, either statewide or at the local air district level. Thus, at this time, there are no thresholds of significance for greenhouse gas impacts that can be applied under CEQA.

5.5.3 Assessment Criteria and Methodology

Direct impacts on climate change were evaluated by estimating greenhouse gas emissions from implementation of the proposed Action.

5.5.3.1 Significance Thresholds

For NEPA compliance, there are no readily available significance thresholds for climate change-related impacts. CEQA significance criteria for greenhouse gas emissions are presented in the CEQA Guidelines (Appendix G). Specifically, the proposed Action would have a significant impact if it would:

- Individually or cumulatively impede the state's ability to meet its 2020 greenhouse gas emission reduction goal.

5.5.3.2 Evaluation Methods and Assumptions

The significance criterion listed above was used to assess potential impacts from the release of greenhouse gases from the proposed Action and alternatives.

5.5.4 Environmental Impact Assessment

5.5.4.1 Alternative 1: No Action

Under the No Action alternative, no piscicides would be applied to Silver King Creek and no generators would be used. Thus, the No Action alternative would not result in emissions of greenhouse gases.

5.5.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

Implementation of the proposed Action would result in minor greenhouse gas emissions from vehicle and generator emissions as well as the degradation of rotenone in the environment. Rotenone, which occurs naturally in the roots and stems of several plants, breaks down naturally when exposed to sunlight and would be oxidized by potassium permanganate. The ultimate breakdown products of rotenone are carbon dioxide and water. Based on the chemical formula of rotenone ($C_{23}H_{22}O_6$), each kilogram of rotenone released could potentially result in emissions of about 2.5 kilograms of carbon dioxide after complete breakdown. The required 120 gallons of 5% rotenone solution contain approximately 25 kilograms of rotenone. Combined with vehicle and generator exhaust, the proposed Action would emit less than 100 kilograms of carbon dioxide. As discussed above, 2.8% of the 492 million metric tons of greenhouse gases emitted in California in 2004, or about 14 million metric tons, were from non-fossil fuel sources. Carbon dioxide emissions from the proposed Action would represent less than one millionth of this portion of the State's greenhouse gas emissions. Because the proposed Action would only result in emissions during the treatment process and would not be an on-going new source of greenhouse gas emissions, it would not impede the State's ability to meet its 2020 greenhouse gas emission reduction goal.

5.5.4.3 Alternative 3: Combined Physical Removal

Implementation of Alternative 3 would avoid the use of rotenone and therefore would only result in vehicle and generator emissions as discussed under the proposed Action. However, this alternative would involve more extensive use of small, gasoline-powered generators to recharge batteries used for electrofishing. Approximately 100 gallons of gasoline would be used for electrofishing over the course of this Alternative as well as approximately 500 gallons of gasoline for vehicles transporting workers to the treatment site. The USEPA estimates that on average, combustion of one gallon of gasoline emits 8.8 kilograms of carbon dioxide; thus, 100 gallons would result in emissions of over 5,000 kilograms. As discussed above, 81% of the 492 million metric tons of greenhouse gases emitted in California in 2004, or about 400 million metric tons, were from fossil fuel sources. Carbon dioxide emissions from Alternative 3 would represent less than one millionth of this portion of the State's greenhouse gas emissions. Because this Alternative would only result in short-term emissions during fish eradication and would not be an on-going new source of greenhouse gas emissions, it would not impede the State's ability to meet its 2020 greenhouse gas emission reduction goal.

5.5.5 References

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5.6 RECREATION

This section evaluates the potential impacts of the proposed Action and alternatives on recreation resources in the proposed project area which is part of the Carson-Iceberg Wilderness Area (Wilderness Area).

5.6.1 Environmental Setting

The proposed project ~~treatment~~ area is located within the 160,000-acre Carson-Iceberg Wilderness Area. This area straddles the crest of the central Sierra Nevada, within the Stanislaus and Humboldt-Toiyabe National Forests. The proposed project area is within Alpine County and is bordered by State Highway 108 on the south and State Highway 4 on the north. It is used for a number of recreational activities including hiking, camping, angling, hunting, and horseback riding. Nearly 200 miles of trails exist throughout the wilderness area with 10 major trailheads (USFS 1986). No motorized vehicles are allowed within the wilderness area per Section 4(c) of the Wilderness Act (see Section 5.7, Wilderness Values and Management).

Angling is a popular activity along Silver King Creek in the stream reaches open to fishing. The recreational fishery in Silver King Creek is composed of a genetic mixture of introduced rainbow, golden, and Lahontan cutthroat trout. Rarely, a putative pure Paiute cutthroat trout will wash below one of the barrier falls and be available to sport anglers. The fishery is self-sustaining and is popular with local angling groups. Fishing is allowed in Silver King Creek below the confluence with Tamarack Lake Creek downstream to the confluence with the East Fork of the Carson River. Currently, the areas closed to fishing within the proposed project area are the reach above Llewellyn Falls, including the tributaries Corral and Coyote Creeks, and the 3,600-foot reach from Llewellyn Falls downstream to Tamarack Lake Creek. Fishing season is open from the last Saturday in April through November 15.

Different reaches of Silver King Creek have been closed to fishing in recent years. Figure 5.6-1 depicts the reaches of the creek and their recreational status. Paiute cutthroat trout were restored to the area above Llewellyn Falls and for this reason the area is currently closed to fishing. CDFG initially closed the area between Llewellyn Falls and Silver King Canyon prior to the planned treatment in 2005. To protect putative pure Paiute cutthroat trout above Llewellyn Falls, CDFG adopted emergency regulations on August 18, 2005, to close Silver King Creek between Llewellyn Falls and Snodgrass Creek (see Figure 3-1) until December 22, 2005. The reach reopened at the beginning of the fishing season in April 2006.

CDFG subsequently proposed a regulatory change to permanently close 6 miles of Silver King Creek above Snodgrass Creek in order to reduce the threat of non-native trout being introduced upstream of Llewellyn Falls and compromising over 50 years of restoration efforts. The California Fish and Game Commission (hereinafter referred to as the Fish and Game Commission) held hearings on the proposal. At the May 4, 2006, meeting, representatives of the Alpine County Board of Supervisors and other interested parties concerned about the potential economic impact of the closure, proposed an alternative closure. To address potential economic effects, these parties proposed closing only the area between Llewellyn Falls downstream to the confluence of Tamarack Lake Creek, reducing the length of the stream closure to approximately 3,600 feet. The Fish and Game Commission adopted the modified proposal on June 23, 2006 (Fish and Game Commission 2006). Fishing is allowed in Silver King Creek below the confluence with Tamarack Lake Creek downstream to the confluence with the East Fork of the Carson River.

Wilderness permit data show a total of 2 visitor days in 2006 and 32 visitor days in 2007 (Kling 2008a). In both cases, these visits represent less than 1 percent of the total recreational use in the Carson-Iceberg Wilderness Area. However, actual recreation use in the area is higher because the available permit data does not account for all of the wilderness use (Kling 2008b).

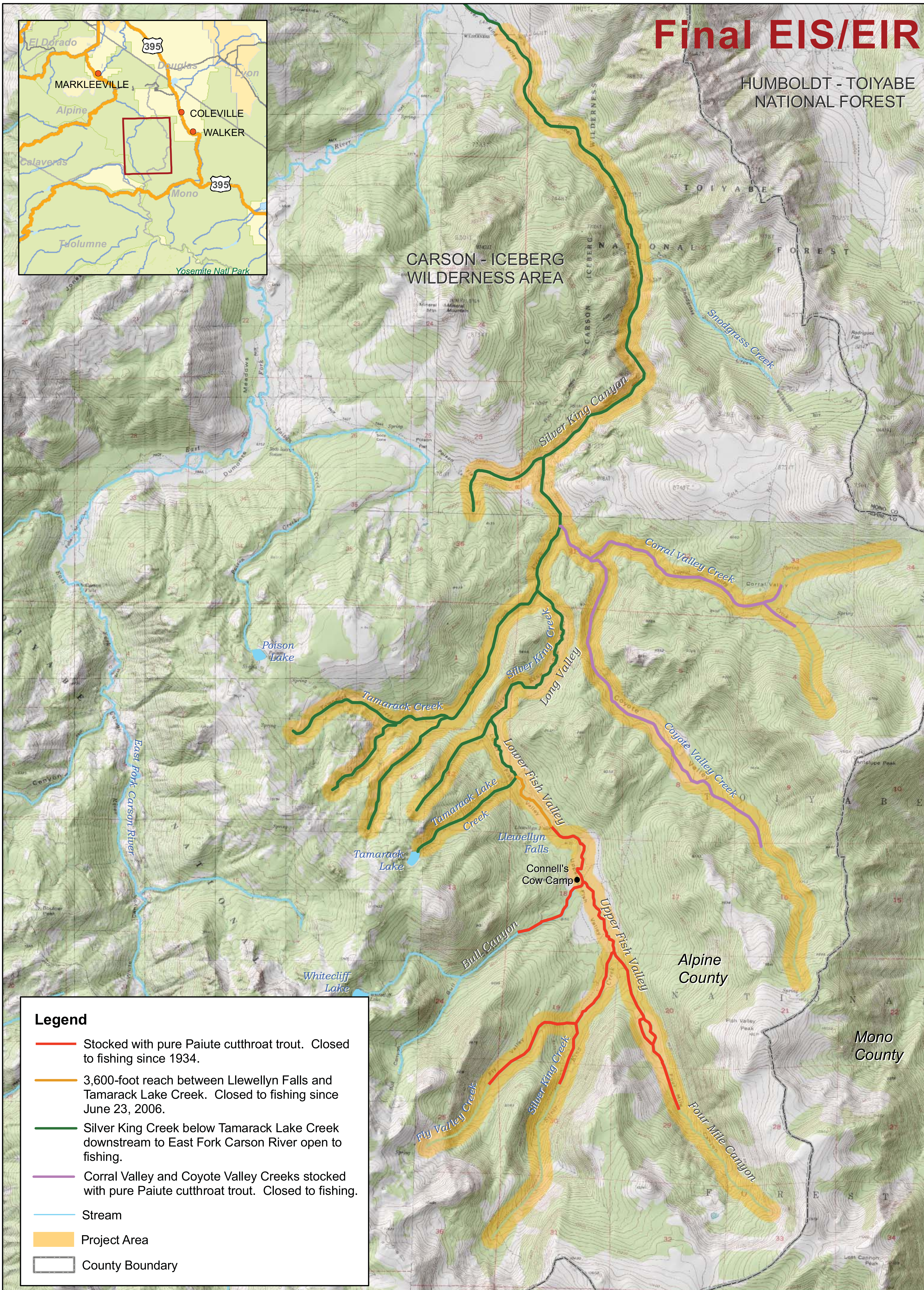
5.6.2 Regulatory Setting

The California Fish and Game Code (Section 200) authorizes the Fish and Game Commission to regulate the taking or possession of birds, mammals, fish, amphibians, and reptiles. The Fish and Game Commission's regulations may establish, extend, shorten, or abolish open and closed seasons; establish and change areas or territorial limits for their taking; and/or prescribe the manner and means of taking (Section 205). Current law (Section 315) further states that the Fish and Game Commission may, at any time, close any stream, lake, or other inland waters, or portions thereof, to the taking of any species or sub-species of fish to protect and properly conserve the fish.

5.6.2.1 California Fish and Game Code

Applicable excerpts from the Fish and Game Code (Sections 200, 205, 220 and 315) are listed below.

> *200. There is hereby delegated to the commission the power to regulate the taking or possession of birds, mammals, fish, amphibia, and reptiles to the extent and in the manner prescribed in this article.*
>
> *205. Any regulation of the commission pursuant to this article which relates to fish, amphibia, and reptiles, may apply to all or any areas, districts, or portion thereof, at the discretion of the commission, and may do any or all of the following as to any or all species or sub-species:*
>
>> *(a) Establish, extend, shorten, or abolish open seasons and closed seasons.*
>>
>> *(b) Establish, change, or abolish bag limits, possession limits, and size limits.*
>>
>> *(c) Establish and change areas or territorial limits for their taking.*
>>
>> *(d) Prescribe the manner and the means of taking.*
>
> *220. (a) Any regulation of the commission added or amended pursuant to this article shall remain in effect for the period specified therein or until superseded by subsequent regulation of the commission or by statute.*
>
>> *(b) Notwithstanding this article, the commission may add, amend, or repeal regulations at any regular or special meeting if facts are presented to the commission which were not presented at the time the original regulations were adopted and if the commission determines that those regulations added, amended, or repealed are necessary to provide proper utilization, protection, or conservation of fish and wildlife species or sub-species.*



ENTRIX
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0 0.5 1 2 Miles

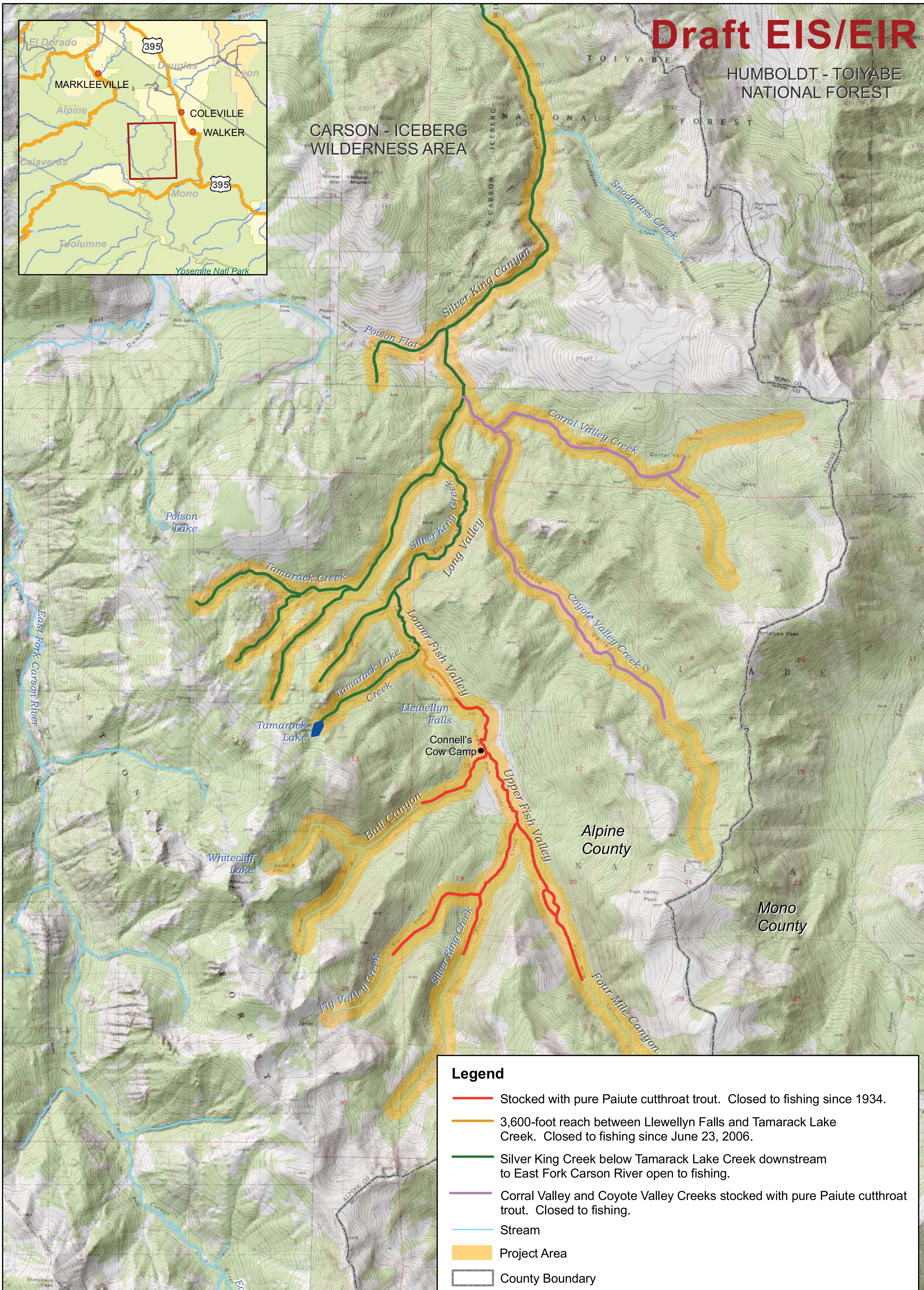
Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

Final EIS/EIR

Paiute Cutthroat Trout Restoration Project

Figure 5.6-1

Silver King Creek Recreational Resources



ENTRIX
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Paiute Cutthroat Trout Restoration Project

Figure 5.6-1

Silver King Creek Recreational Resources

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

315. The commission may at any time close any stream, lake, or other inland waters, or portions thereof, to the taking of any species or sub-species of fish to protect and properly conserve the fish, except for the taking of fish otherwise permitted by this code under a commercial fishing license, for such time as the commission may designate, or until such time as new legislation thereon enacted by the Legislature may become effective.

5.6.2.2 Title 14, California Code of Regulations, Rulemaking

The Fish and Game Commission issued a Final Statement of Reasons for Regulatory Action. This action amended subsection (b)(178), Section 7.50, Title 14, California Code of Regulations, as follows:

7.50. Alphabetical List of Waters with Special Fishing Regulations (b)

Area or Body of Water: (178) Silver King Creek and tributaries (Alpine Co.) including lakes above Tamarack Lake Creek (within section 7 T7N R22E).

Open Season: Closed to all fishing all year

A rulemaking file with attached file index is maintained at the Fish and Game Commission, 1416 Ninth Street, Sacramento, California 95814. There is also a 4d rule 40 FR 29863; 50 CFR 17.44(a) which states that a violation of state law is also a violation of ESA.

5.6.3 Assessment Criteria and Methodology

Direct impacts on recreation were evaluated by estimating changes in the use or quality of existing parks or other recreational facilities in or near the affected areas. No new recreational facilities would be constructed and/or expanded as a result of the proposed Action or implementation of the alternatives.

5.6.3.1 Significance Thresholds

For NEPA compliance, there are no readily available significance thresholds for recreational resources. CEQA significance criteria for recreation are presented in the CEQA Guidelines (Appendix G). Specifically, the action would have a significant impact if it would:

- Increase the use of existing parks or other recreational facilities such that a substantial physical deterioration of the facility would occur or be accelerated.
- Include recreational facilities or requires the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

For CEQA, only the former criterion was examined because the proposed Action does not propose or require the construction of additional recreational facilities.

5.6.3.2 Evaluation Methods and Assumptions

The significance criterion listed above was used to assess potential impacts on recreational resources in the proposed project area. For purposes of this environmental impact assessment, components of the proposed Action were evaluated to determine whether implementation would cause a physical deterioration of the Carson-Iceberg Wilderness Area and if so, the level of deterioration was quantified relative to the entire recreational resource.

5.6.4 Environmental Impact Assessment

5.6.4.1 Alternative 1: No Action

Under the No Action alternative, the existing non-native trout fishery in Silver King Creek below Tamarack Lake Creek and the closure of 3,600 feet of stream from Llewellyn Falls to Tamarack Lake Creek would continue indefinitely. The No Action alternative would not affect hiking, camping, hunting or horseback riding. This alternative would not contribute to any direct physical deterioration of the area or the larger Carson-Iceberg Wilderness Area.

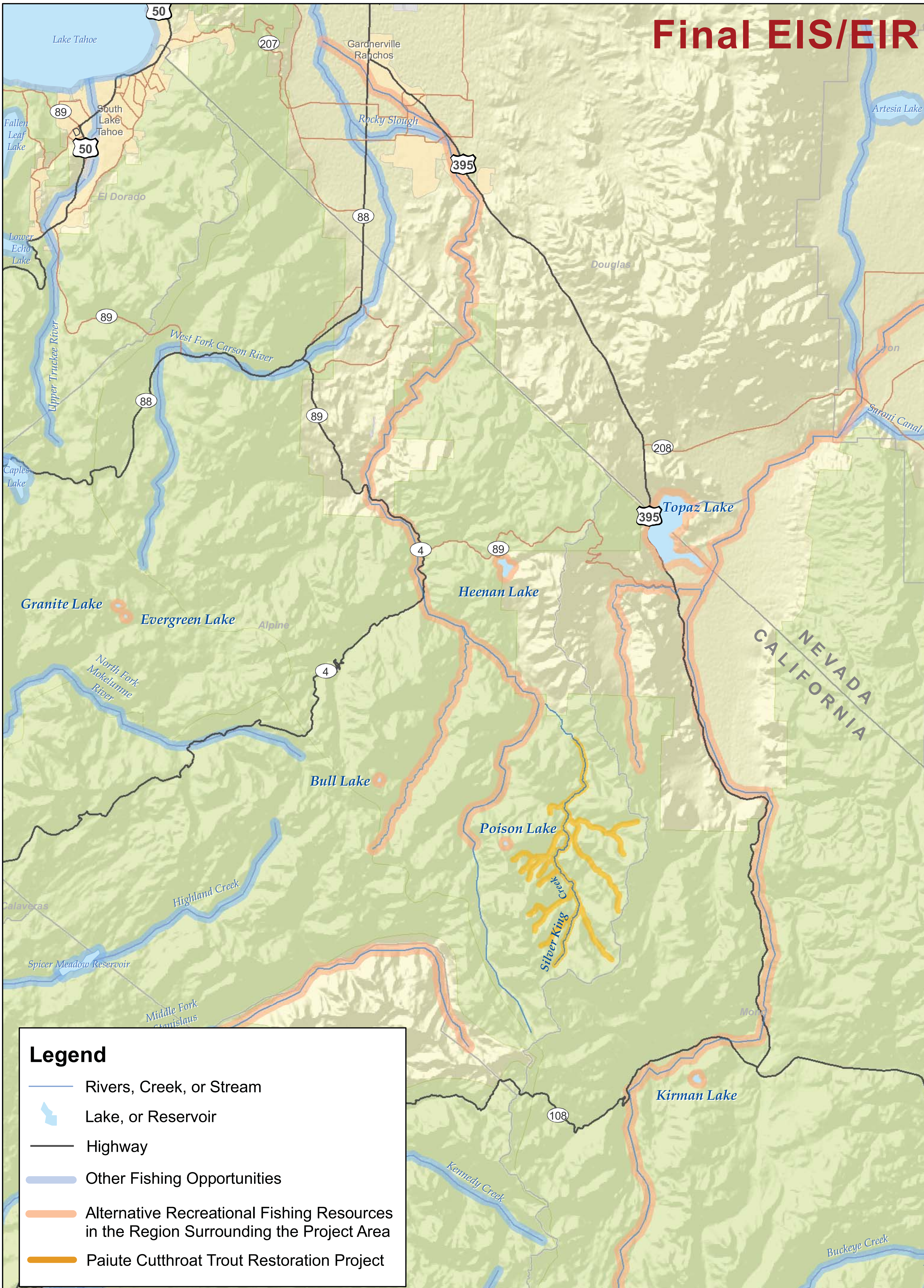
5.6.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

Implementation of the proposed Action would have a direct adverse short term impact on visitors and recreational fishing in Silver King Creek. The entire treatment area from Llewellyn Falls to Silver King Canyon would ~~not~~ be closed to fishing during the chemical treatment process; thus, potential visitors who seek this fishing opportunity could be impacted during implementation of the proposed Action. However, there are other recreational fishing opportunities in a number of nearby waters, including the East Fork Carson River, Wolf Creek, Bull Lake, Silver King Creek below the treatment area, and Poison Lake.

The possible diversion of recreational fishing activity resulting from this area would not appreciably increase the use of other areas such that substantial physical deterioration would occur or be accelerated. The region provides a broad range of recreational opportunities and similar recreation experiences to those provided by Silver King Creek. As shown on Figures 5.6-1 and 5.6-2, the East Fork Carson River and greater Alpine County have a wide range of recreational fishing opportunities. Similarly, because visitors would be advised to avoid the treatment area and directed to other opportunities in the wilderness, and because workers would only be present for 7 working days and only in areas directly adjacent to the stream, the proposed Action would not significantly affect hiking, camping, hunting or horseback riding.

After Paiute cutthroat trout are successfully reintroduced into their historic habitat (adequate numbers of all age classes represented), the Fish and Game Commission could re-open the area to angling for native trout, which has not occurred in this area for over 50 years (prior to Wilderness designation). However, re-opening the area to fishing is not part of the proposed Action and would depend on separate decisions by the California Fish and Game Commission.

Similarly, if restoration is successful, Silver King Creek could be considered for designation as a California “Heritage Trout Water” by the Fish and Game Commission. The state’s Legislature recognized the special value of native trout by passage of an act (Fish and Game Code Sections 7260 and 7261) that acknowledges the importance of designating Heritage Trout waters to provide angling for forms of California native trout. The Heritage Trout Program is a feature of the Wild Trout Program that highlights restoration, education, and angling activities relating specifically to California’s native trout.



ENTRIX
ENVIRONMENTAL CONSULTANTS

0 2 4 8 Miles

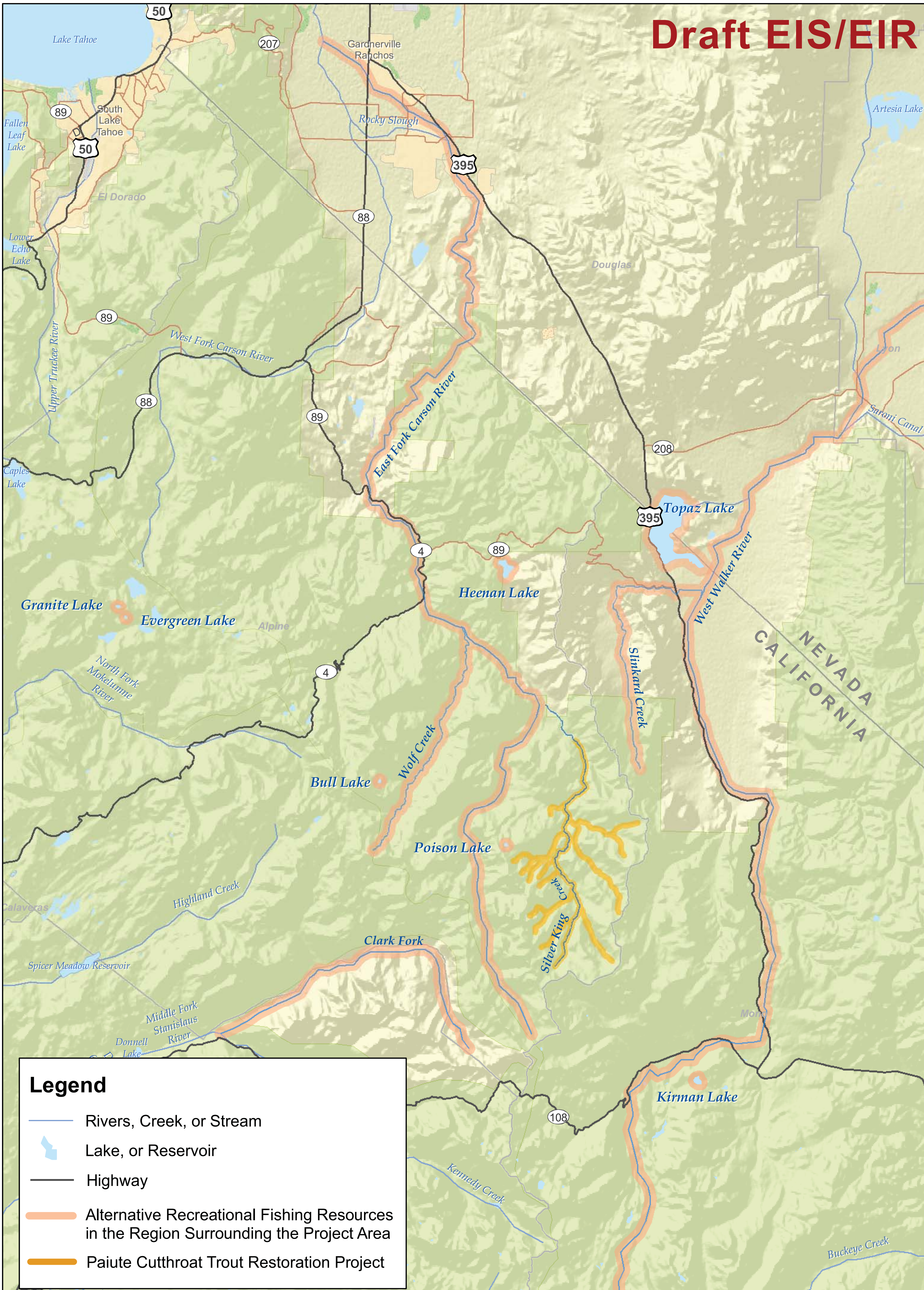
Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

Final EIS/EIR

Paiute Cutthroat Trout Restoration Project

Figure 5.6-2

Silver King Creek
Regional Recreational Fishing Resources



ENTRIX ENVIRONMENTAL CONSULTANTS

0 2 4 8 Miles

Paiute Cutthroat Trout Restoration Project

Figure 5.6-2

Silver King Creek
Regional Recreational Fishing Resources

Project area showing trout habitat in Silver King Creek, Humboldt-Toiyabe National Forest, Alpine County, California.

The objectives of this program are to:

- Increase public awareness about the beauty, diversity, historical significance, and special values of California's native trout and their habitats.
- Build public support and increase public involvement in native trout restoration efforts.
- Promote collaborative efforts with organizations and individuals involved with native trout restoration and management.
- Diversify opportunities to fish for, observe, and enjoy native trout in their historic habitats.

The Fish and Game Commission established this program in 1998, by expanding its Wild Trout Policy so that streams or lakes featuring one or more of the State's native trout, and meeting other specific criteria, may be designated as Heritage Trout waters. Heritage Trout waters are a special subset of Wild Trout waters. Therefore, they are monitored and managed by the Department's Heritage and Wild Trout Program staff. In addition, the management of designated Heritage Trout waters will be guided by written management plans which identify actions and policies necessary to protect native trout habitats, and maintain or enhance native trout populations. Designation of Silver King Creek as a "Heritage Trout Water" would require a separate decision by the Fish and Game Commission that would not be part of the proposed Action.

5.6.4.3 Alternative 3: Combined Physical Removal

Implementation of Alternative 3 would not include chemical treatment during eradication efforts. As with the proposed Action, implementation of this Alternative would affect the area between Tamarack Lake Creek and Silver King Canyon; however, because visits to Silver King Creek account for less than 1% of the total recreational visits to the Carson-Iceberg Wilderness Area, implementation of this Alternative would not result in a significant impact on recreational fishing.

As such, any diversion of recreational fishing activity resulting from implementation of this Alternative would not increase the use of other areas such that substantial physical deterioration would occur or be accelerated. As shown on Figure 5.6-2, the East Fork Carson River and greater Alpine County have a wide range of recreational fishing opportunities.

~~Similar to the proposed Action, because visitors would be advised to avoid the project area and directed to other opportunities in the wilderness, and because w~~Workers would only be present in areas directly adjacent to the stream, Alternative 3 would not significantly affect hiking, camping, hunting or horseback riding.

As described above for the proposed Action, after Paiute cutthroat trout are successfully reintroduced into their historic habitat, the Fish and Game Commission could re-open the area to angling for native trout, providing a unique recreational fishery. In addition, if Paiute cutthroat trout were restored, Silver King Creek could be designated as a California "Heritage Trout Water." However, neither re-opening the area to fishing nor establishing a specially designated fishery are part of the proposed Action and would depend on separate decisions of the Fish and Game Commission.

Implementation of Alternative 3 would not result in significant impacts on recreational fishing. Individuals seeking a wilderness permit to fish in Silver King Creek would be directed to other areas in the wilderness. Because of the low number of visits to Silver King Creek, displacement of this activity to the areas depicted on Figure 5.6-2 would not result in their deterioration. For these reasons, the Combined Physical Removal alternative would result in less-than-significant impacts on recreational use and no mitigation measures would be required.

5.6.5 References

Fish and Game Commission. 2006. Final Statement of Reasons for Regulatory Action. Silver King Creek. June 23.

Kling J. 2008a. Visitor Permit Destination Use Summaries for 2005 – 2007. U.S. Forest Service.

Kling J. 2008b. USDA-FS Personal Communication with Bill Spain, ENTRIX Inc. November 5, 2008.

U.S. Forest Service (USFS). 1986. Humboldt National Forest Land and Resource Management Plan. http://www.fs.fed.us/r4/htnf/projects/forestplan/revision_documents/hfp/humb-fp.shtml. August

5.7 WILDERNESS VALUES AND MANAGEMENT

This section evaluates the potential impacts of the proposed Action and alternatives on wilderness values and management in the proposed project area. As described in Section 5.6, Recreation, the treatment area is located within the 161,181-acre Carson-Iceberg Wilderness Area (Wilderness Area).

5.7.1 Environmental Setting

The U.S. Congress designated the Carson-Iceberg Wilderness as a part of the California Wilderness Act of 1984. The Wilderness Area is managed in California by both the Humboldt-Toiyabe and Stanislaus National Forests. Various human uses, such as recreation, grazing, and mining, are allowed by the Wilderness Act, but all activities are managed or carried out subordinate to the higher purpose of maintaining wilderness values. These overriding values are 1) outstanding opportunities for solitude, and 2) the ability of natural processes to operate free of human influence.

The Pacific Crest Trail runs the length of this area for over 26 miles in the nearby Carson River drainage, while 200 total miles of foot and horse trails provide access. Recreation use is light to moderate especially on the eastern (Humboldt-Toiyabe) side (Wilderness.net 2007). In recent years, overnight recreation use in the Silver King Creek area has been low; wilderness permit data show a total of two visitor days in 2006 and 32 visitor days in 2007 (Kling 2008a). However, actual recreation use in the area is higher because the available permit data does not account for all of the wilderness use (Kling 2008b). The Paiute cutthroat trout is native to Silver King Creek. The historic range of the sub-species is between Llewellyn Falls and the Silver King Canyon (USFWS 2004). Restoring the native trout to it native range is consistent with the Wilderness Act.

5.7.2 Regulatory Setting

The Wilderness Act of 1964 established a National Wilderness Preservation System "to secure for the American people of present and future generations the benefits of an enduring resource of wilderness." The Wilderness Act allows for activities within wilderness boundaries that involve the protection and propagation of federally Threatened and Endangered Species. Section 4(b) of the Wilderness Act and House Report 98-40, which supplements the California Wilderness Act of 1984, establishing the Carson-Iceberg Wilderness, specifically states that "certain wildlife management activities, designed to enhance or restore fish populations, are permissible and often desirable in wilderness areas to aid in achieving the goal of preserving the wilderness character of the area."

The USFS may authorize occupancy and use of National Forest land to carry out the purposes of the Wilderness Act. In general, it is desirable to not allow motorized use in designated wilderness areas. However, the USFS can prescribe conditions under which motorized equipment, mechanical transport, aircraft, aircraft landing strips, heliports, helispots, installations, or structures may be used, transported, or installed by the USFS and its agents and by other Federal, State, or county Agencies or their agents, to meet the minimum requirements for authorized activities to protect and administer the Wilderness Area (36 CFR 293.6c).

5.7.3 Assessment Criteria and Methodology

5.7.3.1 Significance Thresholds

In general, potential impacts on wilderness values could be classified as either biophysical or social. Biophysical impacts include those that may be detrimental to the ecosystem such as large-scale erosion leading to increased turbidity. Social impacts include those that may be detrimental to the wilderness recreation experience. Wilderness Areas are intended to provide opportunities for solitude and wilderness visitors seek environments with limited evidence of human use. Therefore, allowing large groups in the wilderness or building large structures would be inconsistent with wilderness values.

5.7.3.2 Evaluation Methods and Assumptions

The proposed Action and its alternatives were assessed to determine if biophysical or social conditions in the Wilderness would be affected. The analysis assumes that activities to protect native fish species are consistent with wilderness values and management pursuant to the Wilderness Act of 1964. It assumes, however, that actions that would cause substantial biophysical impacts would be inconsistent.

5.7.4 Environmental Impact Assessment

5.7.4.1 Alternative 1: No Action

The No Action alternative would have no immediate effects on wilderness character in the Silver King Creek area. Paiute cutthroat trout would not be restored to its native range. All other aspects of the wilderness character would remain the same. The No Action alternative would not affect the ecological component of wilderness value; however, Paiute cutthroat trout, a native sub-species, would not be restored to its historic habitat. There would be no disturbance of the human environment as camping, hiking, and other wilderness activities would not be affected. The No Action alternative could be detrimental to the uniqueness that Paiute cutthroat trout provides in this wilderness area. Transfer of fish above Llewellyn Falls could result in the loss of this unique wilderness element.

5.7.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

Under Alternative 2, rotenone treatment of Silver King Creek would have short- and long-term effects on wilderness character. An assessment of potential effects on specific wilderness qualities or attributes is presented below.

UNTRAMMELED

Silver King Creek has a long history of human manipulation of ecological systems. Paiute cutthroat trout were introduced into historically fishless areas within the Silver King Creek basin in the late 1800s. Non-native trout were introduced into Silver King Creek in the early 1900s. CDFG have been managing fisheries, including Paiute cutthroat trout in Silver King Creek, since the early 1930s. Rotenone treatments occurred in the Silver King Creek Watershed upstream from the proposed project area beginning in 1964, with the latest treatment occurring in 1993 after the Wilderness Designation in 1984. Efforts have established putative pure populations throughout the watershed; however, Paiute cutthroat trout has not yet been restored to its native range.

The proposed Action would impair the untrammeled quality of wilderness as it is an intentional human caused manipulation of ecological systems inside wilderness. The proposed Action would result in short-term impacts on ecological processes one week, each year as non-native trout are removed through rotenone treatment and Paiute cutthroat trout are reintroduced to its historic habitat. The chemical treatment would reduce macroinvertebrate populations and displace wildlife during implementation (see sections 5.1 and 5.2). Under the proposed Action, the genetic diversity of the sub-species would be enhanced. If the action is completed, Paiute cutthroat trout populations would require less management by the Agencies in the future. In the long-term, wilderness values would be maintained as species recover. The proposed Action would also improve the ecological value of the system by restoring a native species to its historic habitat.

NATURAL

The proposed Action would impair the natural quality of wilderness. During implementation, a crew would consist of less than 50 people; however, camping and meals would concentrate around Connells Cow Camp and at the neutralization station near Snodgrass Creek. Workers would follow the LNT policy and low impact outdoor ethics. In the short term, workers would be highly visible to visitors using the area. Camps would be located on hardened or durable sites. Connells Cow Camp is located just upstream of the treatment area. The small cabin at this administrative site historically provided lodging for those managing livestock in the area. The site is currently used by Forest Service personnel conducting management activities in the wilderness.

During treatment, human occupation of the area would also impair the natural quality of wilderness. The Agencies would conduct the treatment over 2 to 3 years. CDFG experience indicates multiple treatments are necessary to eradicate non-native trout from streams (Finlayson et al. 2000). The treatments would occur between mid-August and mid-September beginning in 2010~~09~~. Treatments would be repeated during mid-August and mid-September in 2011~~10~~. If non-native trout carcasses were found during the 2011~~10~~ treatment, a third year of treatment would be necessary in 2012~~11~~. All or part of the chemical treatment may be applied twice in any given treatment year to assure complete non-native trout removal. The~~reatment~~ proposed Action is expected to occur over a week-long period (7 working days) each year.

Concentrations of rotenone would create a slight milky white color in the water immediately adjacent to the drip station but would not persist for a significant period.

UNDEVELOPED

The proposed Action would impair the undeveloped quality of wilderness as it includes the use of motorized equipment and the use of pesticides within wilderness. ~~Tamarack Lake would be treated with rotenone dispensed by gasoline-powered pumps on two non-motorized rafts.~~ In addition, chemical application would require the use of motorized volumetric augers powered by generators to dispense the neutralizing agent, potassium permanganate. Although small, the motorized equipment (generator and pumps) would be visible and audible to any visitors, and these sites and sounds may be associated with civilization.

A battery- or generator-powered auger at the neutralization site would be used to apply potassium permanganate at the neutralization site (refer to Figure 3-1). The auger would be operated for several hours during the treatment process and would increase the effectiveness of the neutralization in Silver King Creek, minimizing human and ecological exposure to potassium permanganate. The potassium permanganate would turn the water purple for up to less than 1two miles downstream of the neutralization site.

Some fencing material formerly used to manage livestock is still present in the proposed project area. The proposed Action does not include removing or altering any of these existing fences or erecting any structures. Because the proposed Action would consist only of the use of drip stations to apply rotenone and a generator-powered auger to apply potassium permanganate, the proposed Action would have less-than-significant effects on scenic integrity.

The Agencies would install signs at the trailheads to inform visitors of treatment activities as well as areas outside of the proposed project area where water is available. Most of the dead fish would be caught with block nets and disposed of quickly by burial. The proposed Action would result in no long-term visual impacts and no permanent structures would be erected during implementation of the proposed Action.

OUTSTANDING OPPORTUNITIES FOR SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

The proposed Action would be implemented within a small portion of the Carson-Iceberg Wilderness. There are numerous nearby areas within the wilderness available to visitors to provide solitude opportunities. However, during the treatment process (1 week per year over 2 to 3 years), workers would be present throughout the proposed project area, hindering the ability for visitors to experience solitude. Camping and meals for approximately 35 individuals would concentrate around Connells Cow Camp. During actual application of rotenone, small teams from Connells Cow Camp (1-4 individuals) will be spread throughout the project area during the day. Approximately 15 workers are expected to concentrate around the neutralization site below Snodgrass Creek.Visitor impacts would be managed by providing visitors with alternative destinations within the wilderness. The ability for visitors to experience solitude after the proposed Action is completed would be similar to pre-treatment levels. The proposed project area currently provides anglers the opportunity to fish for non-native trout with little disturbance from other anglers or visitors. Eradication of non-native trout and reintroduction of Paiute cutthroat trout would result in short-term impacts on solitary fishing opportunities. Re-opening the area to fishing would depend on the success of restored Paiute cutthroat trout and future decisions of the California Fish and Game Commission that are not part of the proposed Action.

The proposed Action would result in a short-term reduction in angling opportunities as non-native trout are removed from Silver King Creek. After Paiute cutthroat trout are successfully reintroduced into their historic habitat (adequate numbers of all age classes represented), the California Fish and Game Commission could re-open the area to angling for native trout, which has not occurred in this area for over 50 years (prior to Wilderness designation). However, re-opening the area to fishing is not part of the proposed Action and would depend on separate decisions of the California Fish and Game Commission.

SPECIAL ECOLOGICAL VALUES

The area proposed for treatment is the historic range for Paiute cutthroat trout, which is considered among the rarest trout in North America. The sub-species is federally listed as threatened under ESA. Implementation of the proposed Action is a major component of the

Revised Recovery Plan (USFWS 2004). Successful implementation of the proposed Action ~~would likely result in~~ could lead to delisting of the sub-species in the near future.

The area has a rich history of livestock management and many aspen stands in the surrounding area contain arboglyphs dating back to the early 1900s. Because the proposed Action would not affect these aspen stands, no impacts on the historic value of this special feature would occur.

5.7.4.3 Alternative 3: Combined Physical Removal

Similar to the proposed Action, Alternative 3 would have short and long-term effects on wilderness character. The impacts associated with physical removal of fish on specific wilderness qualities or attributes are described below.

UNTRAMMELED

This alternative would impair the untrammeled quality of wilderness as it is an intentional human caused manipulation of ecological systems inside wilderness. This alternative would result in short to long-term impacts on ecological processes, for a minimum of 72 days for multiple years (at least 10 years), as non-native trout are removed physical methods and Paiute cutthroat trout are reintroduced to its historic habitat. Under this alternative, the genetic diversity of the species would be enhanced. If this alternative is completed, Paiute cutthroat trout populations would require less management by the Agencies in the future. In the long-term, wilderness values would be maintained as species recover. This alternative would also improve the ecological value of the system by restoring a native species to its historic habitat.

Although the trout that are present in the area are non-native, this alternative would disrupt ecological processes by removing a high proportion of trout residing in Silver King Creek and tributaries over several years. Restocking would restore ecological processes in the area to pre-treatment conditions.

NATURAL

This alternative would impair the natural quality of wilderness. Under Alternative 3, Agency personnel would electrofish approximately 6 miles of mainstem Silver King Creek and 5 miles of associated tributary streams until all non-native trout were removed from the area. Fish removal crews would consist of approximately 11 individuals. The Agencies also expect that electrofishing would continue over multiple years (at least 10 years) due to poor removal efficiency in areas with heavy aquatic vegetation, root wads, woody debris, and boulder fields. Removal activities would be undertaken between late-June or early July and mid-October due to suitable access and weather conditions. Workers would follow the LNT policy and low impact outdoor ethics. In the short term, workers would be highly visible to visitors using the area. Camps would be located on hardened or durable sites. Connells Cow Camp is located just upstream of the area to be electrofished under this alternative. The small cabin at this administrative site historically provided lodging for those managing livestock in the area. The site is currently used by Forest Service personnel conducting management activities in the wilderness.

UNDEVELOPED

Electrofishing is expected to continue over multiple years (at least 10 years). Furthermore, generators would be required to recharge electrofishing equipment, resulting in localized noise and air quality impacts. A small generator would be used on a daily basis throughout the field season (a minimum of 72 days) to recharge batteries. Most of the fish stunned during electrofishing would be caught with nets and disposed of quickly through burial. No long-term visual impacts would occur.

Some fencing material formerly used to manage livestock is still present in the area. This alternative does not including removing or altering any of these existing fences or erecting any structures. Similar to the proposed Action, the Agencies would install signs at the trailheads to inform visitors of electrofishing activities. This alternative would result in no long-term visual impacts and no permanent structures would be erected during implementation.

OUTSTANDING OPPORTUNITIES FOR SOLITUDE OR A PRIMITIVE AND UNCONFINED TYPE OF RECREATION

An 11-person work crew would be present throughout the area for most of the summer season and over multiple years hindering the ability for visitors to experience solitude. Camping and meals for approximately 11 individuals would concentrate around Connells Cow Camp. Other camping sites would be used on a less frequent basis as crews move further away from Connells Cow Camp. However, the ability of a visitor to experience solitude would return to pre-treatment levels after this alternative is completed.

Alternative 3 would result in a reduction in angling opportunities as non-native trout are removed from Silver King Creek. Removal of non-native trout would require multiple years (at least 10 years), resulting in reduced opportunity for primitive recreation. After Paiute cutthroat trout are reintroduced to their historic habitat, the area could be re-opened to angling. However, after Paiute cutthroat trout are successfully reintroduced into their historic habitat (adequate numbers of all age classes represented), the California Fish and Game Commission could re-open the area to angling for native trout, which has not occurred in this area for over 50 years (prior to Wilderness designation). However, re-opening the area to fishing is not part of Alternative 3 and would depend on separate decisions of the California Fish and Game Commission.

SPECIAL ECOLOGICAL VALUES

If successful, ~~this alternative would restore a federally threatened species to its native range and would likely result in the delisting of Paiute cutthroat trout.~~ the effects under this Alternative are the same as the proposed Action. However, the resultant benefits from this alternative are expected to take at least 10 years.

5.7.5 References

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

Kling J. 2008a. Visitor Permit Destination Use Summaries for 2005–2007. U.S. Forest Service.

Kling J. 2008b. USDA-FS Personal Communication with Bill Spain, ENTRIX Inc. November 5.

U.S. Fish and Wildlife Service (USFWS). 2004. Revised Recovery Plan for the Paiute cutthroat trout (*Oncorhynchus clarki seleniris*). Portland, Oregon. ix + 105 pp.

Wilderness.net. 2007. Carson-Iceberg Wilderness. http://www.wilderness.net/index.cfm?fuse=NWPS&sec=wildView&wname=Carson-Iceberg

5.8 ECONOMIC RESOURCES

This section describes socioeconomic conditions in the treatment area and assesses potential economic impacts of the proposed Action and alternatives. The section focuses on economic resources most likely affected by the proposed Action and alternatives, namely local economic activity, related measures of economic welfare (i.e., income and employment), and recreation-based economic values. Each of these measures can be affected by changes in recreation use and visitation to the region resulting from the proposed Action. Potential impacts on population and housing, particularly growth-inducing effects are discussed in Section 6.4, Growth-Inducing Impacts.

5.8.1 Environmental Setting

The local socioeconomic conditions in the area are described in this section to provide context for analysis of potential economic impacts and to serve as the baseline against which economic impacts are measured. Socioeconomic conditions described are population and housing, economic base, and the economic role and value of recreation and tourism. For the economic analysis, the proposed treatment area (or impact region) includes Alpine County (within which Silver King Creek is located) and northern Mono County, located east of Silver King Creek. The closest communities to the area are Markleeville in Alpine County; and Walker, Coleville, and Bridgeport in northern Mono County. Information on these communities is considered where appropriate and data are available.[1]

5.8.1.1 Population

Alpine County is located along the crest of the Sierra Nevada mountain range on the California-Nevada border. It is a predominantly rural county, and with a population of 1,222 in 2008, it has the smallest population of all counties in California. Most of the population is concentrated in a few mountain communities, including Markleeville, Woodfords, Bear Valley, and Kirkwood (DOF 2008a). The nearest community to Silver King Creek in Alpine County is the town of Markleeville, approximately 14 miles northwest of the area proposed for treatment. Markleeville is a census-designated place (CDP) and the county seat of Alpine County. The 2000 population of Markleeville was 197 (U.S. Census Bureau 2000).

Mono County is situated southeast of Alpine County along the California-Nevada border. Similar to Alpine County, it is largely a rural county, with a population of 13,759 in 2008. There is one incorporated city in Mono County, the City of Mammoth Lakes, but it is not located near the proposed project area. As described above, there are several small communities in Mono County located near the treatment site, including Walker (population: 558), Coleville (population: 77), and Bridgeport (population: 794) (Mono County 2008).[2]

Silver King Creek is within the Carson-Iceberg Wilderness Area, which is public land managed by the USFS. As public land, it is not open for urban development, and accordingly, there are no permanent residents in the immediate vicinity.

1 Economic data for the local communities are presented wherever possible; however, certain economic data are not available for unincorporated areas.
2 Population based on 2000 Census data. Population for individual communities tallied by census blocks.

5.8.1.2 Economic Base

The economy of Alpine County depends substantially on tourism and related recreation industries, as well as government expenditures on public lands throughout the region. In total, there are approximately 860 jobs in Alpine County (EDD 2007). The public sector represents a key source of employment in Alpine County, accounting for about 270 jobs (or nearly one-third of the job base), most of which are in state and local government. Private employment in Alpine County totals roughly 580 jobs, primarily in service-oriented industries, many of which are tied directly to tourism and recreation, which are key contributors to the Alpine County economy.

Mono County has a relatively larger employment base. In total, local industries in Mono County support about 6,920 jobs. Employment in the public sector (i.e., ~~f~~Federal, state and local government) totals approximately 1,530 jobs (nearly one-quarter of employment). Private employment totals 5,360, with service-related industries accounting for most of the employment in Mono County with 4,710 jobs. Of this total, 2,830 jobs are in the leisure and hospitality sector.

At the community level, Markleeville is home to a mix of local, state and ~~f~~Federal government employees, ranging from the USFS to Caltrans, as well as small businesses catering to the tourist trade and visitors to the nearby Grover Hot Springs State Park and other recreation destinations (Alpine Chamber of Commerce 2007). Likewise, local communities in northern Mono County, including Walker, Coleville and Bridgeport, are home to a range of recreation-serving business, such as recreation outfitters, local retailers, lodging, and restaurants.

5.8.1.3 Role of Recreation and Tourism in the Economy

The role of recreation and tourism in the economies of Alpine and Mono counties is significant. As indicated in Section 5.6, Recreation), the primary recreation and tourism activities in these counties are fishing, hunting, camping, hiking, rafting, skiing, snowmobiling, and other winter snow sports. The existing economic benefits of recreation in the proposed treatment area are tied to expenditures made en route and in the region, as well as permit fees. Typical recreation expenditures include gas, food, lodging, other trip costs (e.g. pack trip fees, bait and ice), as well as recreation equipment (e.g. fishing tackle and camping gear).

Total annual travel spending in Alpine County rose from $17.4 million in 1992 to $27.6 million in 2006, a 59 percent increase over the 10-year period (or an average of 3.1 percent annually) (Dean Runyon Associates 2008). Based on 2006 figures, travel spending is estimated to generate approximately $6.7 million in labor earnings and support 340 jobs in Alpine County (39 percent of total county employment), as well as produce $1.3 million in state and local tax receipts annually.

In Mono County, total annual travel spending was estimated at $394.3 million in 2006, up from $197.6 million in 1992. The economic benefits attributed to 2006 travel spending in Mono County include roughly $119.1 million in labor earnings and 5,070 jobs for local residents.[3] In addition, visitor spending also produces approximately $24.1 million annually in state and local tax revenue, part of which directly benefits local municipalities. A large portion of the economic benefits of travel spending in Mono County is attributed to the Mammoth Mountain Ski Area, which is located over 100 miles south of the proposed treatment site.

[3] This estimate of tourism-related employment appears high relative to countywide employment data published by the California Employment Development Department; however, travel spending appears to support a large proportion of employment in Mono County.

5.8.1.4 Existing Economic Benefits of Recreation in Silver King Creek Watershed

Visitors are drawn to the proposed treatment area, and therefore support the local economy, largely due to the attractions of the Carson-Iceberg Wilderness Area. Based on permit data maintained by the USFS, a conservative estimate of visitation to the Carson-Iceberg Wilderness Area indicates that approximately 3,600 overnight visitors recreated in the area during the 2007 season, which accounted for a total of nearly 8,300 visitor days (USFS 2007).[4] Information on day use visitation was unavailable. The same 2007 permit data indicate that recreation activity in the Silver King Creek area (the location of proposed fishery restoration efforts) was limited and accounted for only about 0.4% of permitted recreation in the wilderness area, with 16 overnight visitors generating 32 visitor days.

The small number of recorded visitors to the Silver King Creek area is likely due to its remote nature and lack of accessibility (motorized vehicles are not permitted in wilderness areas). Instead, visitors either backpack long distances into the area or utilize the services of a local pack station operator who transports recreational equipment and supplies by pack horse for visitors. In addition, low visitation levels can also be attributed to the lack of nearby population centers and other more accessible recreation opportunities in the region. Lastly, recreation use in the proposed treatment area could be curtailed by the current fishing closure of the 3,600 feet of stream located between Llewellyn Falls and Tamarack Creek Lake. This closure was implemented by the California Fish and Game Commission to preserve native Paiute cutthroat trout above Llewellyn Falls. However, because no survey data are available, any impacts resulting directly from the closure cannot be quantified.

The existing economic benefits of recreation in this area are based on expenditures made in local communities by visitors while traveling to and from their destination, which is typically related to the number of visitors and type of recreation activity undertaken. Recreation by activity is not directly tracked in the USFS permit data, but backpacking/hiking and fishing are likely the primary activities in the Carson-Iceberg Wilderness Area. Similarly, since no direct information is available on recreation-related expenditures made by visitors to the wilderness area, the information is inferred from other data sources. Based on information provided in the USFWS' 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, people participating in freshwater fishing activities spend approximately $60.80 per visitor day on trip and equipment related purchases (USFWS 2006). If it is assumed that all visitors to the Carson-Iceberg Wilderness Area make all of their purchases locally and engage in fishing as their principle activity,[5] then permitted recreation visitation throughout the wilderness area generates a conservative estimate of $504,000 in recreation spending annually in Alpine and Mono counties. These expenditures directly support jobs and generate income for local workers, and to the extent that inter-industry linkages exist in the region, additional indirect[6] and induced[7] economic benefits are generated. Because little data are available, these additional economic effects have not been quantified.

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4 Because these permit data are likely incomplete and because permits are not required for day users, this estimate of the number of visitors is considered low and represents a lower-bound estimate of recreation use in the area. On average, overnight visitors stayed 2.3 days in the wilderness area.

5 Visitors to the Carson-Iceberg Wilderness Area engage in a range of recreation uses; however, without specific information on recreation levels across activities, this assessment conservatively assumed all visitors were freshwater fishing, which typically generates higher spending levels than other wilderness activities, such as backpacking.

6 Indirect economic effects refer to changes in output, income, and employment resulting from the iterations of businesses in some industries purchasing from businesses in other industries and initially caused by the direct economic effects.

7 Induced economic effects refer to changes in output, income, and employment caused by the expenditures associated with new household income generated by direct and indirect economic effects.

Similarly, recreation spending by visitors to the Silver King Creek area is also unknown. Based on USFWS spending data, it is estimated that the 32 visitor days to the proposed treatment area only generates about $1,900 per year in travel spending. However, total travel spending is believed to be substantially higher for several reasons. First, the permit data are incomplete and do not account for day-use visitors, which according to a local pack station operation, represent approximately 50~~25~~% to 78% of its total business between 2006 to 2008 (Cereghino 2008). Next, this estimate does not consider the unique characteristics and tourism draw of the Silver King Creek area. Because of the high-quality recreation opportunities this area provides, including the potential opportunity to catch Paiute cutthroat trout (below Tamarack Lake Creek), it draws visitors from outside the region, who typically have higher recreation expenditures than locals. Finally, the USFWS spending data do not account for trip-related expenditures on guide and outfitting services commonly used to access the Silver King Creek area. Accordingly, travel spending associated with recreation in the Silver King Creek area is likely to be substantially higher than the estimate above and attributed primarily to fishing activity downstream of Tamarack Lake Creek (below the existing closure area); however, the associated economic benefits are still expected to be minimal.

5.8.1.5 Other Economic Values of Recreation

In addition to regional economic benefits for local communities in jobs and income, recreation provides economic value to those individuals engaged in the recreation activity. These economic benefits are measured by consumer surplus values (or willingness-to-pay) for different types of recreation activities. Consumer surplus values capture the amount that a recreation user is willing to pay to engage in a recreation activity above and beyond what is actually paid, and are typically estimated using survey information and statistical techniques. There is no information available on the recreation-based economic value attributed specifically to the Carson-Iceberg Wilderness Area, but representative values are available from other sources. A summary of representative consumer surplus values per day for various types of recreation occurring in the proposed project area is presented below (Loomis 2005):[8]

- Backpacking: $52.10
- Camping: $104.35
- Fishing: $44.36
- Hunting: $46.92
- General Recreation: $32.35
- Hiking: $23.24
- Sightseeing: $20.27
- Wildlife Viewing: $72.48

To utilize these values to estimate the consumer surplus in the area, numerous conditions must be fulfilled according to benefits-transfer methodology. The applicability of the values requires information regarding recreation participation by activity, and numerous details regarding the types of users and their trip characteristics. Without this knowledge, which is unavailable for the

[8] Average consumer surplus values are for the Pacific region, and are measured on a per-person per-day basis; values in dollars (2004).

area, it is difficult to estimate the consumer surplus values of recreation specific to the proposed treatment area. However, assuming that these values could be applied to the this area and all recreation takes the form of fishing, recreation activity in the wilderness area is conservatively estimated to generate approximately $367,900 in consumer surplus values annually based on existing permit data, while recreation near Silver King Creek only generates an estimated $1,400 per year.

5.8.2 Regulatory Setting

NEPA recognizes that projects can result in ecological, aesthetic, historic, cultural, economic, social, or health effects (NEPA regulations, Title 40 C.F.R. § 1508.8); therefore, social and economic values need to be considered in the NEPA process. NEPA regulations (Title 40 C.F.R. § 1508.14) also state that "economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic, social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment."

Economic considerations are treated differently under CEQA (1970). Section 15131 of the CEQA Guidelines (Guidelines) state that: "Economic or social effects of a project shall not be treated as significant effects on the environment. An EIR may trace a chain of cause and effect from a proposed decision on a project through anticipated economic or social changes resulting from the project to physical changes caused in turn by the economic or social changes. The intermediate economic or social changes need not be analyzed in any detail greater than necessary to trace the chain of cause and effect. The focus of the analysis shall be on the physical changes." The Guidelines also state that: "Economic or social effects of a project may be used to determine the significance of physical changes caused by the project."

5.8.3 Assessment Criteria and Methodology

5.8.3.1 Significance Thresholds

The use of significance thresholds for economic resources varies under NEPA and CEQA. For NEPA, there are no readily available significance thresholds for economic resources. Generally, the proposed economic benefits and impacts of the proposed ~~a~~Action are evaluated independently and professional judgment is used to determine the significance of impacts. There are no CEQA significance thresholds for economic resources.

5.8.3.2 Evaluation Methods and Assumptions

The assessment of economic impacts focuses on those resources that would be potentially affected by the proposed Action and alternatives. For the proposed Action, potential economic impacts include changes in regional economic activity (e.g. economic production, income, and jobs) and recreation-based economic values. These changes are tied directly to potential changes in recreation visitation and spending in the proposed treatment area. Projected changes in recreation visitation and related economic benefits have not been quantified. However, project-related economic impacts were assessed qualitatively based on the period that the area would be closed for the treatment.

5.8.4 Environmental Impact Assessment

This section describes the potential impacts of the proposed Action and alternatives in the context of economic resources. Economic impacts are organized by alternative, and include both direct and indirect economic effects of the ~~a~~Action.

5.8.4.1 Alternative 1: No Action

The No Action alternative would indefinitely continue the existing fishing closure along Silver King Creek from Llewellyn Falls to the confluence with Tamarack Lake Creek (approximately 3,600 feet). To the extent that current fishing restrictions have adversely affected visitation to the wilderness area, local businesses in the region that provide recreation-related goods and services to visitors would continue to realize lower revenues relative to pre-closure conditions.[9] Similarly, the economic (consumer surplus) value realized by recreationists visiting Silver King Creek would continue to be lower compared to pre-closure conditions based on the foregone recreation opportunities resulting from ongoing fishing restrictions just below Llewellyn Falls, where high-quality recreation opportunities exist. Although the magnitude of these economic impacts has not been quantified they are minor because of the small number of visitors that have historically visited the area, availability of (and demand for) alternative fishing opportunities below Tamarack Lake Creek, opportunities for visitors to recreate in other parts of the wilderness area, and the small size of the area closed to fishing.[10] Further, when considered relative to existing conditions (with fishing restrictions in place), no changes in economic activity or consumer surplus values would occur under the No Action alternative and no adverse economic impacts would result. Instead, the No Action alternative would effectively preclude any future recreation and related economic benefits associated with potential re-opening the closed portion of the area to fishing, as described below for the action alternatives. However, as described below, re-opening the proposed project area to fishing would depend on separate decisions of the California Fish and Game Commission that are not part of the proposed Action or Alternative 3.

5.8.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

The proposed Action would require a minimum of two possibly three ~~1-3~~ years of rotenone application depending on the success of initial treatments (see Chapter 3.0, Project Alternatives). During the implementation period (i.e., approximately one week annually including mobilization, treatment, and post-treatment water quality monitoring), all visitors would be advised to avoid the treatment area. The area closed to fishing would include areas downstream of the existing closure.[11] However, visitors would still be able to access and recreate in other parts of the wilderness area.

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9 Data are not available to determine the effect that existing fishing restrictions have had on recreation levels in the project area and recreation-related spending in the local economy.

10 The proposed fishing closure of Silver King Creek below Llewellyn Falls was reduced from six miles (to Snodgrass Creek) to 3,600 feet (to Tamarack Lake Creek) by the Fish and Game Commission in an effort to reduce the potential economic hardship to local businesses. See the Final Statement of Reasons for Regulatory Action amending Title 14, Section 7.50(b)(178) of the California Code of Regulations.

11 The closure area would include Silver King Creek and tributaries between Llewellyn Falls and Silver King Creek Canyon, as well as the neutralization area downstream of Snodgrass Creek. This area is substantially larger than the area subject to existing fishing restrictions.

Subsequent to treatment, Silver King Creek would be subject to extensive fishery monitoring efforts. When monitoring demonstrates eradication of non-native trout, the Agencies would restock the stream with native Paiute cutthroat trout (see Chapter 3.0, Project Alternatives). During the restocking period, the treatment area would be open to public access, but closed to fishing. The area closed to fishing during restocking would be determined by the California Fish and Game Commission. It would likely be substantially larger than the 3,600-foot reach currently closed, and would likely extend from Llewellyn Falls downstream to Snodgrass Creek. The duration required for the Agencies to establish a self-sustaining population of Paiute cutthroat trout is unknown and would be determined by population monitoring.

The economic impacts of the proposed Action are dependent on the effect it has on recreation visitation and spending in the area, as well as action-induced expenditures during implementation. In terms of recreation-based impacts, until fishing opportunities are fully restored along Silver King Creek to existing levels, economic activity and consumer surplus values under the proposed Action may be lower than baseline conditions if there are declines in fishing activity and associated visitation to the region. More specifically, local businesses that have historically served anglers recreating in the Silver Creek King area would likely experience a decline in revenue, which could also have ripple effects throughout the local economy based on inter-industry linkages and household spending patterns. However, the magnitude of these adverse economic impacts is expected to be minimal because these recreation-serving businesses would continue to serve anglers visiting alternative fishing sites in other parts of the wilderness area (e.g. East Carson River) and Stanislaus National Forest, which are not affected by the proposed Action, and therefore, recreation activity and spending would likely remain in the region. Moreover, wilderness angling use is relatively low, and therefore, related spending impacts would be negligible from a regional perspective. Lastly, there exists few economic linkages between sectors in the local economy based on its small size and the lack of a local manufacturing base; accordingly, the potential for regional economic impacts would be low.

Conversely, the proposed Action has the potential to generate local economic benefits during implementation. Local businesses may experience an increase in revenues associated with Agency personnel and work crews travel within the region and the need for transport to and from the proposed treatment site. These expenditures would likely include gas, food, and lodging by workers in local communities, as well as payments to the local pack station operator for the transport of equipment and staff to the treatment area.

The net short-term economic effect of the proposed Action is difficult to ascertain because neither the potential adverse, nor beneficial, economic impacts of the action have been quantified. However, based on a qualitative assessment of economic resources, the proposed Action could likely result in a significant economic impact on local businesses during the period after treatment. This applies particularly to those businesses that attribute a large proportion of their business to fishing activity in the Silver King Creek basin. Short-term impacts would likely be offset by action-related expenditures that would generate revenues for many of these same businesses. In comparison, from a regional perspective, based on the small number of visitors to the proposed treatment area relative to the region and the availability of alternative recreation opportunities, the regional economic impacts of the proposed closure of Silver King Creek would be less-than-significant when compared to future No Action conditions.

In the long term, the proposed Action could result in a full re-opening of Silver King Creek to fishing after treatment and successful fishery restoration. However, potential future re-opening of the proposed project area to fishing would depend on separate decisions of the California Fish and Game Commission that are not part of the proposed Action.

If the area were re-opened to fishing, particularly with a high-quality native trout fishery, local businesses and recreationists would likely benefit from the increased visitation. Under this scenario, local economic benefits would consist of increased sales of recreation goods and services and related increases in income and jobs. Small recreation-serving businesses would realize the greatest economic benefits, including those that cater to anglers that would choose to fish Silver King Creek. Benefits to recreationists would occur in the form of increased consumer surplus values.

In summary, the proposed Action would likely result in adverse economic effects on specialized local businesses (i.e., business that rely on angling activity in the proposed treatment area) during treatment and restoration, which may be offset by the beneficial economic impacts associated with implementation of the proposed Action realized by these same businesses. However, these impacts on economic resources would not be significant when evaluated at the regional level based on the abundant recreational opportunities available in the area, including other parts of the Carson-Iceberg Wilderness Area, which would remain open to recreation use. In the long term, the proposed Action would have a beneficial regional impact on economic resources if the trout fishery were re-established, particularly with native Paiute cutthroat trout. These benefits would entail increases in business sales, jobs and income, as well as recreation-based economic values, relative to existing and future No Action conditions.

5.8.4.3 Alternative 3: Combined Physical Removal

Alternative 3, Combined Physical Removal, would be implemented over a period of multiple years (at least 10 years). Visitors would be advised of the project; however, Alternative 3 may not require closing the area to fishing during fish removal. Therefore, this alternative would not significantly reduce recreational visitation during electrofishing. However, as with the proposed Action, this alternative could result in a significant economic impact on local businesses during the restocking period when the area would be closed to fishing, particularly for businesses that attribute a large proportion of their business to fishing activity in the Silver King Creek basin. Similarly, short-term impacts would likely be offset by project-related expenditures that would generate revenues for many of these same businesses. In comparison, from a regional perspective, based on the small number of visitors to the area relative to the region and the availability of alternative recreation opportunities, the regional economic impacts of the proposed closure of Silver King Creek would be less-than-significant when compared to future No Action conditions.

In the long term, this alternative could result in a full re-opening of Silver King Creek to fishing after multiple years of electrofishing and successful fishery restoration. However, potential future re-opening of the area to fishing would depend on separate decisions of the California Fish and Game Commission that are not part of Alternative 3. As for the proposed Action, re-opening the area would likely benefit local businesses.

In summary, Alternative 3 would likely result in adverse economic effects on specialized local businesses during the multi-year electrofishing and restoration period. However, these effects may be offset by the beneficial economic impacts associated with project implementation. In addition, these impacts would be less-than-significant at the regional level based on the abundant recreational opportunities available in the area, including other parts of the Carson-Iceberg

Wilderness Area, which would remain open to recreation use. In the long term, Alternative 3 would have a beneficial regional impact on economic resources if a native trout fishery were re-established pending future California Fish and Game Commission decisions that are not part of this alternative.

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5.9 ENVIRONMENTAL JUSTICE

This section describes the existing social environment in the region around the area proposed for treatment and assesses the potential social impacts of the proposed Action and alternatives on Alpine County and the Markleeville community, as well as neighboring Mono County (refer to Figure 1-1). The focus of this section is an analysis of environmental justice, which refers to the fair and equitable treatment of individuals regardless of race, ethnicity, or income level in the development and implementation of environmental management policies and actions. Therefore, the key socioeconomic parameters addressed here are local demographics, including population and race/ethnicity, and measures of social and economic well-being, including per capita income and poverty rates.

5.9.1 Environmental Setting

This section provides a demographic overview of the local area residents, which will be used in an analysis of environmental justice impacts. The geographic scope of the information presented is Alpine County, including Markleeville (the county seat and the nearest community in proximity to the proposed Action) and Mono County.

5.9.1.1 Population Trends and Projections

Alpine County borders Nevada in northeast California and is sparsely populated. As shown in Table 5.9-1, the current population in Alpine County is 1,222 persons, ranking it the least populous county in the State (California Department of Finance [DOF] 2008a). There are no incorporated cities in Alpine County, but 4 townships in which the small population is concentrated (Markleeville, Woodfords, Bear Valley and Kirkwood). Within those areas, there are no supermarkets, emergency care facilities, or banks. Of the 727 square miles in Alpine County, 96% is under public ownership. Markleeville had a population of 197 persons in 2000 (U.S. Census Bureau 2000). The total population in Alpine County accounts for less than 0.1% of the State's total population of just over 37.6 million.

Table 5.9-1 Population and Population Growth (2000–2007)

Area	Population			Population Growth (%)	
	2000	2005	2007	2000–2005	2005–2007
Alpine County	1,208	1,243	1,261	2.9%	1.5%
Mono County	12,853	13,666	13,985	6.3%	2.3%
State of California	33,873,086	36,743,186	37,662,518	8.5%	2.5%
Sources: California Department of Finance (Demographic Research Unit) 2007a.					

Mono County borders Alpine County to the southeast and is somewhat more densely populated than Alpine County. As shown in Table 5.9-1, the total population in Mono County in 2007 was 13,985 persons. There is one incorporated city in the county, Mammoth Lakes, where about half of the population is located (7,560 people in 2007) (DOF 2007a).

Population growth in the vicinity of the proposed Action has been limited over the past couple of decades. In Alpine County, population increased by a total of 2.9% between 2000 and 2005, and 1.5% between 2005 and 2007. Population trends are not available for Markleeville. In Mono

County, population increased by a total of 6.3% between 2000 and 2005, and 2.3% between 2005 and 2007. Population growth at the State level has been substantially higher than that of Alpine County and somewhat more similar to that of Mono County, increasing by over 11% cumulatively since 2000 (DOF 2007a).

Population projections through 2030 for Alpine County, Mono County, and the State of California are shown in Table 5.9-2. Population projections are not available for Markleeville. It is projected that the population in Alpine County will increase through 2030, mostly by 2020, and Mono County's population will increase steadily through 2030. More specifically, Alpine County's population is expected to increase by 8.6% between 2000 and 2010 and by 6.1% between 2010 and 2020, while Mono County's population is expected to increase by 15.4% between 2000 and 2010, by 21.9% between 2010 and 2020, and by 26.6% between 2020 and 2030 (DOF 2007b). At the State level, high growth rates are expected, with population projected to grow consistently over the next three decades, increasing by 42% cumulatively through 2030 (relative to 2000 levels).

Table 5.9-2 Population Projections (2000–2030)

Area	Population			Population Growth (%)		
	2010	2020	2030	2000–2010	2010–2020	2020– 2030
Alpine County	1,369	1,453	1,462	8.6%	6.1%	0.6%
Mono County	14,833	18,080	22,894	15.4%	21.9%	26.6%
State of California	39,246,767	43,851,741	48,110,671	15.9%	11.7%	9.7%
Sources: California Department of Finance (Demographic Research Unit) 2007b.						

5.9.1.2 Race/Ethnicity

Race (or ethnicity) is an important consideration for evaluating potential environmental justice-related effects of the action alternatives. The racial and ethnic composition of the Alpine County, Mono County, and statewide populations are presented in Table 5.9-3. Generally, the racial/ethnic makeup of the local vicinity of the proposed Action is much less diverse than statewide conditions. The predominant racial group in both Alpine and Mono counties is White (Caucasian), comprising roughly 70% of the countywide population (DOF 2007c). In Alpine County, the other racial groups, combined, represent 30% of the local population, led by American Indians/Alaska Natives (17%) and Hispanics/Latinos (9% of the total population). In Mono County, the other racial groups, combined, represent 29% of the local population, led by Hispanics/Latinos (24%). Statewide, Whites account for only 44% of total population, while Hispanics/Latinos account for about 35%.

Table 5.9-3 Race/Ethnicity (2006)

Area	Race (Percent of Total Population)						
	White	Black/ African American	American Indian/ Alaska Native	Asian	Native Hawaiian/ Pacific Islander	Multi-Race	Hispanic/ Latino
Alpine County	70%	1%	17%	0%	0%	4%	9%
Mono County	71%	0%	2%	1%	0%	2%	24%
State of California	44%	6%	1%	12%	0%	2%	35%

Sources: California Department of Finance (Demographic Research Unit) 2007c.

5.9.1.3 Income-Related Measures of Social Well-Being

As derivatives of total personal income, per capita and median household income and poverty rates represent widely used economic indicators of social well-being. Table 5.9-4 presents these socioeconomic data for the vicinity of the proposed Action and California. In 2004, per capita personal income in Alpine County was $30,768, which is about 13% less than the statewide level of $35,219, while per capita personal income in Mono County was $35,082, roughly the same as statewide income (DOF 2007d). Based on these figures, per capita personal income in Alpine County ranked 23rd in the State and Mono County ranked 16th. The disparity between local and statewide conditions is greater in the context of median household income. Based on 2000 Census data (1999 dollars), median household incomes in Alpine County, Mono County, and the State of California were $41,875, $44,992 and $47,493, respectively. Median household income levels are not available for Markleeville. Finally, poverty rates represent the percentage of an area's total population living at or below the poverty threshold established by the U.S. Census Bureau. Based on 2000 Census data, the poverty rate was 19.5% in Alpine County, 11.5% in Mono County, and 10.6% in the State of California.

Table 5.9-4 Income and Poverty Rates

Area/Region	Per Capita Income (2004)	Median Household Income (1999)	Poverty Rate (1999)
Alpine County	$30,768	$41,875	19.5%
Mono County	$35,082	$44,992	11.5%
State of California	$35,219	$47,493	10.6%

Sources: California Department of Finance (Demographic Research Unit) 2007d.

5.9.2 Regulatory Setting

The USEPA Office of Environmental Justice offers the following definition of environmental justice:

> *"The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from*

> *industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies."*

Executive Order 12898, "*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*," requires each ~~f~~Federal agency to incorporate environmental justice into its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects, including social or economic effects, of its programs, policies, and activities on minority populations and low-income populations of the United States (Council on Environmental Quality 1997). As such, environmental justice is considered part of the NEPA (1969) process.

The U.S. Department of Interior (DOI) provides direction to its agencies, including the USFWS, for integrating environmental justice considerations into their programs and activities in compliance with Executive Order 12898. The mission of DOI to environmental justice is "to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes." DOI's Environmental Justice Strategic Plan (1995) contains the following four goals:

- **Goal 1.** The Department will involve minority and low-income communities as we make environmental decisions and assure public access to our environmental information.
- **Goal 2.** The Department will provide its employees environmental justice guidance and with the help of minority and low-income communities develop training which will reduce their exposure to environmental health and safety hazards.
- **Goal 3.** The Department will use and expand its science, research, and data collection capabilities on innovative solutions to environmental justice-related issues (for example, assisting in the identification of different consumption patterns of populations who rely principally on fish and/or wildlife for subsistence).
- **Goal 4.** The Department will use our public partnership opportunities with environmental and grassroots groups, business, academic, labor organizations, and Federal, Tribal, and local governments to advance environmental justice.

To achieve Goal 1, USFWS has implemented programs to reach inner-city and other indigent groups to assure public access to information. Through the USFWS' Office of Training Education, a variety of training courses are offered to USFWS managers that include elements of conflict resolution and deal specifically with inter-cultural and minority conflicts for Goal 2. For Goal 3, the USFWS conducts short-term and some long-term studies and research related to various environmental issues, such as the management of refuges, fisheries, and environmental contaminant issues. Lastly, the USFWS is involved in a variety of agreements and partnerships with other ~~f~~Federal agencies, the states, and other non-federal entities, such as the Interorganizational Committee on Guidelines and Principles for Social Impact Assessment to implement Goal 4.

5.9.3 Assessment Criteria and Methodology

5.9.3.1 Significance Thresholds

In the following analysis, an assessment is made regarding the magnitude of changes in different economic variables. Under NEPA, an analysis of social, economic, and environmental justice effects is required; however, there is no standard set of criteria to evaluate economic impacts (see Section 5.8.2). Under CEQA, economic and social impacts are not considered significant effects on the environment. Therefore, there is no guidance in the Initial Study checklist included in the CEQA Guidelines and no "significance determinations" are made or mitigations required in the impact analyses.

5.9.3.2 Evaluation Methods and Assumptions

The main issue in the context of environmental justice is whether implementation of the proposed Action and alternatives would result in adverse environmental or economic impacts that fall disproportionately on low-income or minority populations in the proposed treatment area. For this analysis, and based on ~~f~~Federal guidance and professional judgment, the following criteria are used to evaluate potential impacts and their magnitude (i.e., substantial or not).

- Are affected resources used by a minority or low-income community.
- Are minorities or low-income communities disproportionately subject to environmental, human health, or economic impacts.

Background material was reviewed to understand whether low-income or minority populations in Alpine and Mono Counties could be disproportionately adversely affected by the proposed Action. Using data from the U.S. Census Bureau (2000), an analysis was carried out to compare the ethnic/racial compositions and poverty levels in the communities near the proposed treatment site with those in Alpine and Mono counties. Markleeville is a CDP in Alpine County; however there were no other CDPs in the vicinity of the proposed Action or Alpine and Mono counties in the 2000 Census.

5.9.4 Environmental Impact Assessment

5.9.4.1 Alternative 1: No Action

The No Action alternative would not affect resources used by a minority or low-income community or disproportionately affect minorities or low-income communities to environmental, human health, or economic impacts, because this alternative would not change existing conditions. Therefore, this alternative would have no impact on environmental justice issues.

5.9.4.2 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

As discussed in the environmental setting section of Section 5.8, Economic Resources, the nearest community to the proposed treatment area is the town of Markleeville, approximately 14 miles (22,531 meters) northeast of the treatment area. Therefore, risks to human health of the residents of Markleeville from implementation of the proposed Action are likely non-existent and would not disproportionately affect a minority or ethnic population group.

5.9.4.3 Alternative 3: Combined Physical Removal

Similar to the proposed Action, the distance from the proposed treatment area to the nearest community is approximately 14 miles (22,531 meters) to the northeast. No chemicals would be applied under this alternative and risks from fuel releases would be minor and localized and would be addressed through spill contingency planning. Therefore, potential risks to human health would not disproportionately affect a minority or ethnic population group.

5.9.5 References

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5.10 COMPARISON OF THE ALTERNATIVES

This section provides an overview description of the 3 alternatives (“No Action”, “Proposed Action,” and “Combined Physical Removal”) evaluated in the EIS/EIR. Chapter 3.0, Project Alternatives, presents a more detailed description of the proposed Action and alternatives, including a map (Figure 3.1) depicting the components of the proposed Action. This section then presents the alternatives in comparative form; defining the differences between each alternative and providing information for decision makers and the public (refer to Table 5.10-1). The alternatives comparison is based on each alternative’s components and technical merit as well as the environmental, social and economic effects of implementation.

5.10.1 Overview of Alternatives

ALTERNATIVE 1: NO ACTION

The No Action alternative includes continuing the current stream and fishery management practices into the foreseeable future without implementing the Revised Recovery Plan (USFWS 2004). Under the No Action alternative, no eradication of non-native trout or reintroduction of Paiute cutthroat trout below Llewellyn Falls would be implemented, the sub-species would not be reintroduced to its historic range, and its ESA status of threatened would likely remain unchanged. This alternative would include the continued protection of putative pure Paiute cutthroat trout populations in Upper Fish Valley, other tributaries in the Silver King Creek Watershed, and out-of-basin populations, including continued restrictions on recreational fishing.

ALTERNATIVE 2: PROPOSED ACTION ~~(ROTENONE TREATMENT)~~

The proposed Action includes rotenone treatment of Silver King Creek and tributaries. ~~as well as Tamarack Lake if fish are present. The proposed Action would include pre-treatment removal of fish by seeking California Fish and Game Commission approval for an increase daily bag limit of 5 fish per day in the proposed treatment area in an attempt to reduce existing non-native trout populations~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009; pre-treatment biological surveys and monitoring for amphibians and benthic macroinvertebrates; placement of signs to inform the public; water quality monitoring (during and post treatment); and post-treatment biological monitoring.

ALTERNATIVE 3: COMBINED PHYSICAL REMOVAL

This alternative includes the use of a non-chemical alternative, a combination of electrofishing, gill netting, seining, and other physical methods to address the removal of non-native trout in Silver King Creek and its tributaries, springs, and Tamarack Lake. Because this method could have low efficiency in a rocky stream environment, it would be implemented over multiple years (at least 10 years) (i.e., until no fish are found using physical removal techniques).

Conceptually, an intensive multiyear (at least 10 years) removal effort could eradicate non-native trout; however, these efforts could fail to capture small fish and could be compromised by trout moving into the proposed treatment area from untreated upstream areas. Thus, there could ultimately be problems with the effectiveness of this alternative if not completed in a single year.Any fish captured after the third year of physical removal would be genetically tested to ascertain its genetic heritage. If the remaining fish were hybridized, more removal would be needed. If the remaining fish were pure Paiute cutthroat trout, then recolonization efforts would begin.

5.10.2 Alternatives Comparison

The following paragraphs provide a comparison of the alternatives, including the differences between them and their technical, environmental, social and economic merits.

ALTERNATIVE 1: NO ACTION

The No Action alternative would avoid all the direct impacts associated with implementation of the proposed Action, including chemical application and impacts on non-target species and water quality. However, the No Action alternative would not accomplish the objectives of establishing Paiute cutthroat trout as the only trout species in Silver King Creek under the proposed Action. It would not further the Agencies' mandate to prevent Paiute cutthroat trout from going extinct. Specifically, it would not implement the central component of the Revised Recovery Plan (USFWS 2004). It would not provide additional protection of existing populations from transplantation of fish, would not expand its numbers and habitat size by restoring the sub-species to its historic range, and would not reduce threats from genetic bottlenecking and stochastic events. The No Action alternative would not provide potential recreational or economic benefits should the California Fish and Game Commission make future decisions not part of the proposed Action to re-open the area to recreational fishing.

ALTERNATIVE 2: PROPOSED ACTION (ROTENONE TREATMENT)

The proposed Action would include rotenone treatment of Silver King Creek and tributaries. as well as Tamarack Lake, if fish are present. The treatment would could result in potential loss of rare benthic macroinvertebrate species or species unique to Silver King Creek. and Tamarack Lake (i.e., endemic species). These effects would be significant and unavoidable because their intensity and duration is not easily defined and no feasible mitigation measures are readily available. They would also be cumulatively significant when considered together with past rotenone treatments in the Silver King Creek Watershed (see Chapter 6.0, Other Required Decisions). The proximity of untreated headwaters and upstream portions of tributaries and springs would reduce this impact by providing sources for recolonization.

Chemical application would result in less-than-significant impacts on stream water quality, human health, amphibians, non-native trout, terrestrial wildlife, recreation, wilderness values and management and environmental justice. Rotenone would have significant short-term and unavoidable impacts on water quality in Tamarack Lake. The potential for fishing closures could result in localized recreational and economic effects; however, should the California Fish and Game Commission make future decisions to re-open the area to fishing, the proposed Action could provide beneficial long-term recreational and economic effects through elimination of non-native trout and restoration of a unique rare trout species.

The Agencies believe the proposed rotenone treatment and restocking of putative pure Paiute cutthroat trout would meet all objectives of the proposed Action including: establishing Paiute cutthroat trout as the only trout species in Silver King Creek, significantly reducing the probability of Paiute cutthroat trout extinction, implementing the Revised Recovery Plan, reducing the probability of inadvertent introduction of non-native trout, expanding the area occupied by Paiute cutthroat trout including restoring Paiute cutthroat trout to its historic range, and increasing the probability of long-term viability.

ALTERNATIVE 3: COMBINED PHYSICAL REMOVAL

This alternative would employ electrofishing, gill netting, seining, and other physical methods to address the removal of undesirable non-native trout species within Silver King Creek and its tributaries, springs, and Tamarack Lake. Physical removal would avoid the effects of chemical treatment but would result in other direct impacts because this method would need to be implemented over multiple years (at least 10 years, refer to Chapter 3.0, Project Alternatives). Crews would likely be in the wilderness for most of the summer for several years. The electrical current could adversely affect amphibian populations. Overall, the Agencies are concerned that this approach, while resulting in fewer environmental impacts, could ultimately be unsuccessful. Electrofishing is proven as a survey method but is not proven as a method to remove all fish. This method would likely fail to capture small fish, which would continue to populate the area proposed for treatment. In addition, trout from upstream of this area would likely move into the area during the multiple years of electrofishing and would confound effects to determine the success of fish eradication efforts.

5.10.3 Comparison of Environmental Effects of Alternatives

As specified in Chapter 4.0, Scope of the Analysis, none of the alternatives would affect aesthetics, agricultural resources, air emissions of particulates, archaeological and historic architectural resources, fire management, geological and mineral resources, groundwater, hazards and hazardous materials management and spills, wildfire, land use and management, noise, wild horses and burros, grazing, paleontological resources, population and housing public services, traffic and transportation, and utilities. Therefore, these resource areas are not evaluated in the comparative analysis presented below.

Table 5.10-1 provides a summary and comparison of the impacts of the 3 alternatives and resource areas evaluated in detail in this chapter. It shows that the proposed Action would have the greatest impact on aquatic and water resources because the chemical treatment would affect water quality objectives and stream invertebrates in Silver King Creek ~~and Tamarack Lake~~, potentially resulting in the loss of individual species. In comparison, Alternative 3 would have less impact on benthic invertebrates but would result in greater impacts on terrestrial species. In addition, because Alternative 3 would take much longer than the proposed Action, it would result in more disruption of wilderness values.

The No Action alternative would have no direct environmental effects but would not achieve the objectives of the proposed Action. Alternative 3 would have greater social effects (e.g. extended effects on recreational access, diminished wilderness values); however, because these techniques may not be effective for fish eradication, this alternative may not achieve the objectives of the proposed Action. The proposed Action would have the least upland impacts and the least recreational and wilderness impacts because of the relatively short implementation time. In contrast, it would have the greatest in-stream impacts because of the chemical treatment. However, the proposed Action would achieve all objectives.

Table 5.10-1 Comparison of Environmental Effects of Silver King Creek Paiute Cutthroat Trout Restoration Project Alternatives

Affected Resource	Alternative 1 No Action		Alternative 2 Proposed Action		Alternative 3 Combined Physical Removal	
Aquatic Biological Resources (Section 5.1)	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Paiute cutthroat trout	—	Adverse	Adverse	Beneficial	Adverse	Beneficial
Non-native trout	—	—	Adverse	Adverse	Adverse	Adverse
Benthic macroinvertebrates (aquatic insects)	—	—	Adverse	Unknown	Adverse	Unknown
Riparian habitat	—	—	—	—	—	—
SUMMARY	Adverse: Paiute cutthroat trout would remain at risk of extirpation through hybridization with non-native fish and inadequate amount of habitat being occupied.		Adverse: Mortality of Paiute cutthroat trout (if present). Potentially significant and unavoidable impacts on rare and endemic benthic macroinvertebrate species in Silver King Creek. ~~Potentially significant impacts on invertebrate populations in Tamarack Lake~~. Fish transfers during Paiute cutthroat trout restocking could reduce populations in donor areas. Potential impacts on fish and benthic macroinvertebrates downstream of the neutralization station near Snodgrass Creek would be mitigated to less- than-significant. Beneficial: The proposed Action would nearly double the number of stream miles of habitat occupied by Paiute cutthroat trout over existing conditions. Unknown: Loss of undiscovered rare or endemic species would not be quantifiable.		Adverse: Mortality of non-native fish and Paiute cutthroat trout (if present). Less-than-significant impacts on benthic macroinvertebrates in Silver King Creek and Tamarack Lake. Physical disturbance by work crews would be greater than proposed Action, in duration and intensity, but less-than-significant because populations would recover rapidly. Beneficial: If successful, this alternative would nearly double the number of stream miles of habitat occupied by Paiute cutthroat trout over existing conditions. Unknown: Loss of undiscovered rare or endemic species would be less likely under the non-chemical alternative but would not be quantifiable.	
Terrestrial Biological Resources	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Wildlife (Threatened, Endangered, Candidate, Forest Sensitive, Management Indicator, and Neotropical Migratory Birds)	—	—	—	—	—	—
Amphibians	—	—	—	Beneficial	—	Beneficial
Riparian and other Sensitive Habitats	—	—	—	—	—	—

Table 5.10-1 Comparison of Environmental Effects of Silver King Creek Paiute Cutthroat Trout Restoration Project Alternatives

Affected Resource	Alternative 1 No Action		Alternative 2 Proposed Action		Alternative 3 Combined Physical Removal	
Terrestrial Biological Resources (continued)	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
SUMMARY	No effect.		Effects on terrestrial wildlife species dependent on fish or stream invertebrates as food would be less-than-significant. Rotenone toxicity to amphibians in aquatic life stages would be avoided by relocating adult and tadpole life stages out of the treatment area. Habitat disturbance by work crews would be less-than-significant. Beneficial: Removal of predatory non-native trout species would benefit amphibian populations.		Effects on terrestrial wildlife species dependent on fish or stream invertebrates as food would be less-than-significant. Electrofishing injury to amphibians in aquatic life stages would be avoided by relocating adult and tadpole life stages out of the treatment area. Physical disturbance by work crews would be greater than proposed Action, in duration and intensity, but less-than-significant. Beneficial: Removal of predatory non-native fish species would benefit amphibian populations.	
Human Toxicological Concerns	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Hazards to the Public	—	—	—	—	—	—
Hazards to the Environment	—	—	Adverse	—	—	—
SUMMARY	No effect.		Human exposure to chemicals would be less-than-significant because exposure pathways are incomplete. Rotenone application would result in temporary impacts on species composition of benthic invertebrate populations. Potassium permanganate could result in mortality in downstream fish populations.		No effect.	
Water Quality	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Silver King Creek	—	—	Adverse	—	—	—
Tamarack Lake	—	—	~~Adverse~~	—	—	—
SUMMARY	No effect.		Adverse: ~~Chemical application would result in significant water quality impacts in Tamarack Lake~~. The proposed Action would result in less-than-significant impacts on dissolved oxygen, bacteria, turbidity and color in the treatment area.		This alternative would have less–than-significant impacts on turbidity, bacteria and dissolved oxygen concentrations.	

Table 5.10-1 Comparison of Environmental Effects of Silver King Creek Paiute Cutthroat Trout Restoration Project Alternatives

Affected Resource	Alternative 1 No Action		Alternative 2 Proposed Action		Alternative 3 Combined Physical Removal	
Greenhouse Gases and Climate Change	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
California's GHG emission reduction goal	—	—	—	—	—	—
SUMMARY	No effect.		Emissions from rotenone degradation would be less-than-significant.		Emissions from portable generators would be less-than-significant.	
Recreation Resources	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Treatment area	—	Adverse	—	—	—	—
Other recreational areas	—	—	—	—	—	—
SUMMARY	Adverse: Angling would remain closed above the confluence of Silver King Creek and Tamarack Lake Creek indefinitely.		Visitors would be advised to avoid the treatment area during implementation of the proposed Action. Impacts would be less-than-significant given access to alternate areas. Other local streams may experience increased use; however, the low number of diverted users would result in less-than-significant impacts on alternate sites. Physical impacts of workers would be minimized by using existing camps and trails.		Visitors would be advised to avoid the treatment area. Impacts would be less-than-significant given access to alternate areas. Other local streams may experience increased use; however, the low number of diverted users would result in less-than-significant impacts on alternate sites. Physical impacts of crews and workers would be greater than proposed Action but minimized by using existing camps and trails.	
Wilderness Values and Management	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Wilderness experience	—	—	Adverse—	—	Adverse—	Adverse—
Protection of native species	—	Adverse	Adverse	Beneficial	Adverse	Beneficial
SUMMARY	Adverse: The native Paiute cutthroat trout would remain at risk of extirpation through hybridization with non-native trout.		Adverse: Short-term use of chemicals and generators, and the presence of workers (less than 50 personnel for one week for 2 to 3 years)would affect and also be inconsistent with wilderness values but would be limited by using existing camps and trails. Beneficial: Elimination of non-native trout and restocking of a native species would be consistent with wilderness values.		Adverse: Extended use of generators and the presence of workers (up to 11 personnel for minimum of 72 days for a minimum of 10 years) ~~for successive years~~ would affect and also be inconsistent with wilderness values but would be limited by using existing camps and trails. Beneficial: Elimination of non-native trout and restocking of a native species would be consistent with wilderness values.	

Table 5.10-1 Comparison of Environmental Effects of Silver King Creek Paiute Cutthroat Trout Restoration Project Alternatives

Affected Resource	Alternative 1 No Action		Alternative 2 Proposed Action		Alternative 3 Combined Physical Removal	
Economics	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Local and regional economic activity	—	Adverse	—	Unknown	—	Unknown
SUMMARY	Precludes potential future recreation and economic benefits from expanded fishing opportunities.		Potential short-term reduction in local angling-related economic activity would be offset by the potential increase in action-related economic activity. Unknown: Possible long-term increase in angling-related economic activity due to increased visitation by anglers seeking to catch Paiute cutthroat trout in its native habitat depending on future California Fish and Game Commission decisions not part of the proposed Action.		Potential short-term reduction in local angling-related economic activity would be offset by the potential increase in action-related economic activity. Unknown: Possible long-term increase in angling-related economic activity due to increased visitation by anglers seeking to catch Paiute cutthroat trout in its native habitat depending on future California Fish and Game Commission decisions not part of Alternative 3.	
Environmental Justice	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Minorities or low-income communities	—	—	—	—	—	—
Resources used by minority or low-income communities	—	—	—	—	—	—
SUMMARY	No effect.		No effect.		No effect	

5.10.4 Designation of the Environmentally Superior Alternative

CEQA requires the designation of the environmentally superior alternative, which is the alternative that would result in the fewest or least significant environmental impacts. However, if the No Action alternative is identified as the environmentally superior alternative, then CEQA requires that another alternative be identified as the environmentally superior alternative.

As illustrated by Table 5.10-1, the No Action alternative would be the environmentally superior alternative because it would avoid all of the potentially significant impacts of the proposed Action. However, with respect to longer-term consequences, the No Action alternative would fail to achieve the objectives of the proposed Action. The No Action would not implement the Revised Recovery Plan (USFWS 2004). Paiute cutthroat trout would not inhabit its historic range and would remain vulnerable to stochastic events and further hybridization. In addition, should non-native trout be introduced upstream of Llewellyn Falls into putative pure Paiute cutthroat trout populations, decades of restoration efforts would be unraveled and may result in uplisting of Paiute cutthroat trout to endangered. While the significant impacts of the proposed Action would be completely avoided in the short-term under the No Action alternative, the No Action would fail to protect and preserve the sub-species. In comparison, Alternative 3 (Combined Physical Removal) would result in significant, direct impacts on amphibians as well as extended effects on recreation and wilderness values. The effectiveness of Alternative 3 could be difficult to verify and therefore would be challenging to implement and may not accomplish the objectives of the proposed Action. Therefore, the proposed Action is the environmentally superior alternative.

5.10.5 References

U.S. Fish and Wildlife Service (USFWS). 2004. Revised Recovery Plan for the Paiute cutthroat trout (*Oncorhynchus clarki seleniris*). Portland, Oregon. ix + 105 pp.

CHAPTER 6

Other Required Disclosures

6.1 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity of the affected resources (identified below) for the proposed Action is described below. Short-term impacts, primarily resulting from treatment with rotenone, are associated with the implementation of the proposed Action. However, the maintenance of long-term biological and economic resource productivity and the benefits for Paiute cutthroat trout populations and status outweigh short-term adverse impacts on individual resources. The short-term uses of the environment for the proposed treatment are addressed below by resource category.

6.1.1 Aquatic Resources

The proposed Action would result in the short-term loss of any Paiute cutthroat trout present in the treatment area as well as all non-native trout. However, these losses are part of the objectives of the proposed Action and would be offset by restocking Paiute cutthroat trout beginning the year after the final rotenone treatment, the long-term enhancement of ecological and other wilderness values, and the direct long-term benefit for Paiute cutthroat trout from removing hybridized fish that are incompatible with recovery.

The proposed Action would result in short-term impacts on benthic macroinvertebrate species composition and potentially long-term impacts on rare and endemic benthic macroinvertebrates. Species composition would be expected to recover substantially within 2 years of the final treatment as required by the Basin Plan rotenone policy. There are no known special-status or endemic species currently inhabiting the proposed treatment area. However, loss of any rare or endemic species would be an adverse consequence of the proposed Action with unknown and unquantifiable effects on long-term productivity.

The proposed Action would have temporary and less-than-significant impacts on riparian habitats adjacent to the stream corridor. The proposed Action would not involve use of any heavy equipment or any excavation or tree or vegetation removal. The only disturbance would be from foot traffic of workers applying treatment chemicals from the stream banks. Therefore, the proposed Action would have only minor short-term direct impacts on riparian habitat and no indirect or long-term effects on productivity or re-establishment of riparian habitat.

6.1.2 Terrestrial Resources

The proposed Action could have short-term effects on terrestrial wildlife (i.e., riparian bird species) by temporarily removing some benthic macroinvertebrate species from the proposed treatment area, thereby reducing a major food source. The temporary loss of benthic macroinvertebrates and their terrestrial forms may impact insectivorous wildlife. However, this short-term effect of the rotenone treatment would be offset by recolonizing Paiute cutthroat trout, and benthic invertebrates, from headwater and tributary areas to the proposed treatment area.

6.1.3 Human and Ecological Exposure

There would be no short-term or long-term impacts on human health due to the remoteness of the area proposed for treatment, the distance to any downstream human population, procedures employed to minimize worker exposure, and the visitor advisory that would be put in place during the treatment process (see Chapter 3.0, Project Alternatives). Human exposure pathways were considered incomplete in the risk assessment (refer to Appendix C). As described in Section 5.3, Human and Ecological Health Concerns, the proposed Action would have short-term, less-than-significant impacts on amphibians, terrestrial and avian wildlife that would not affect long-term productivity.

6.1.4 Water Resources

Short-term impacts of the proposed Action from chemical treatment, neutralization and other activities on surface water quality, hydrology and geomorphology would include potential temporary impacts of rotenone toxicity. Rotenone degrades rapidly in the presence of sunlight and warm temperatures and may persist in natural water bodies from between a few days to several weeks, making this a short-term effect. These short-term effects would have no long-term effect on the productivity of Silver King Creek.

6.1.5 Greenhouse Gases and Climate Change

Implementation of the proposed Action would result in minor greenhouse gas emissions from vehicle trips, use of generators, and degradation of rotenone in the environment. As described in Section 5.5, Greenhouse Gases and Climate Change, the carbon dioxide that would be emitted during implementation of the proposed Action would represent less than one millionth of this portion of the State’s greenhouse gas emissions. Because the proposed Action would only result in emissions during rotenone treatment and would not represent an ongoing new source of greenhouse gas emissions, it would not impede the State’s ability to meet its 2020 greenhouse gas emission reduction goal or have long-term impacts on ecological productivity.

6.1.6 Recreation Resources

The proposed Action would have a direct, adverse short-term impact on recreational fishing in Silver King Creek. In addition to the current closure area between Llewellyn Falls and Tamarack Lake Creek, the entire treatment area from Llewellyn Falls to Silver King Canyon would be closed to fishing during chemical treatment and subsequent restocking. Future re-opening of the area would depend on future California Fish and Game Commission decisions, not part of the proposed Action. Although potential visitors who seek this fishing opportunity would be affected during the closure, the region provides a broad range of recreational opportunities and recreation experiences similar to those provided by Silver King Creek. For example, similar opportunities exist in the East Fork Carson River, Wolf Creek, Bull Lake, Silver King Creek below the treatment area, and Poison Lake (refer to figure 5.6-2). While recreational fishing activity could be diverted to other recreation areas, the amount of use is such that it would not increase the use of other areas to a degree that substantial physical deterioration would occur or be accelerated.

6.1.7 Wilderness Values

The proposed Action would result in some short-term effects on wilderness experiences. The rotenone treatment of Silver King Creek would likely temporarily detract from the wilderness environment while the treatment is occurring. Some wilderness visitors could find the use of chemicals inconsistent with their assumptions about wilderness. In addition, chemical application would require the use of motorized volumetric augers powered by generators to dispense the neutralizing agent, potassium permanganate. Further, some visitors may view the potential loss of non-target species (specifically benthic macroinvertebrates or aquatic insects), due to the chemical treatment, as inconsistent with wilderness values. These impacts would be minimized by using the lowest effective chemical concentration and through the application of low-impact outdoor ethics. In addition, the longer-term effect of the treatment would be beneficial, resulting in elimination of non-native fish and restoration of the Paiute cutthroat trout, a native keystone predator, to its native habitat within the wilderness area.

6.1.8 Economic Resources

During the short term implementation of the proposed Action, HTNF would advise visitors to avoid the proposed treatment area, which would be closed to fishing. Local businesses that have historically served anglers recreating in the Silver Creek King area would likely experience a decline in revenue. However, the proposed Action has the potential to generate local economic benefits during implementation of the proposed Action.

Although not part of the proposed Action, future re-opening of Silver King Creek to fishing after treatment, particularly with a high-quality native trout fishery, could benefit local businesses and recreationists from increased visitation. Under this scenario, local economic benefits would consist of increased sales of recreation goods and services and related increases in income and jobs. Small recreation-serving businesses would realize the greatest economic benefits, including those that cater to anglers who choose to fish Silver King Creek. Benefits to recreationists would occur in the form of increased consumer surplus values. The long-term economic impacts of the proposed Action at Silver King Creek could be beneficial. However, future re-opening of Silver King Creek depends on separate decisions of the California Fish and Game Commission, not part of the proposed Action.

6.1.9 Environmental Justice

In the short term, there would be no health risks to the residents of Markleeville from implementation of the proposed Action. The proposed Action would not disproportionately affect a minority or ethnic population group. Also, the potential beneficial impact on local economic conditions in the long term should the treatment area be re-opened to fishing would likewise be beneficial for environmental justice factors.

6.2 UNAVOIDABLE ADVERSE EFFECTS

The following paragraphs identify the proposed Action’s impacts that would be significant and unavoidable because no practicable mitigation measures were available. The No Action alternative would not result in unavoidable impacts but would not achieve the objectives of expanding Paiute cutthroat trout into its native range. Alternative 3 would not result in significant and unavoidable impacts.

- **Impacts on Potential Rare or Endemic Species in Silver King Creek (Impact AR-1).** The proposed Action could result in the loss of individual benthic macroinvertebrate taxa, potentially including rare (unquantified) and/or unidentified species endemic to Silver King Creek. Although no specific aquatic insect species that are classified as threatened, endangered or other special-status categories are known to be present in the proposed treatment area, the treatment could result in loss of rare or endemic species that may be present in Silver King Creek. However, it must be recognized that the Silver King Creek system has been treated several times in the past and therefore, some rare or endemic species present before those treatments may already be lost. Because the treatment could result in loss of rare or endemic species, this would be a significant impact. However, this impact cannot be verified. No reasonable sampling program can conclusively determine the non-existence of any endemic species. Therefore, no additional mitigation measures are available to reduce this impact to less-than-significant. This impact cannot be monitored or verified because of the variety of factors that hamper full characterization of the stream community and thus identifying or detecting the loss of rare or endemic species is infeasible. This impact would remain significant and unavoidable after mitigation.
- ~~**Impacts on Potential Rare or Endemic Species in Tamarack Lake (Impact AR-2).** As described above for Silver King Creek, the proposed Action could result in the loss of individual benthic macroinvertebrate taxa, potentially including rare (unquantified) and/or unidentified species endemic to Tamarack Lake. This would be a significant but unverifiable impact. No reasonable sampling program can conclusively determine the non-existence of any endemic species. Therefore, no additional mitigation measures are available to reduce this impact to less-than-significant. This impact cannot be monitored or verified because of the variety of factors that hamper full characterization of the stream community and thus identifying or detecting the loss of rare or endemic species is infeasible. This impact would remain significant and unavoidable after mitigation.~~
- ~~**Impacts on Chemical Residues in Tamarack Lake (WQ-1).** If rotenone formulations are applied to Tamarack Lake, breakdown residues may persist beyond the period allowed by the Basin Plan. The Basin Plan specifies that no chemical residues resulting from rotenone treatment shall be present at detectable levels within project boundaries after a two-week period has elapsed from the date that rotenone application was completed. No potassium permanganate would be used to neutralize rotenone in the lake. In addition, the lake’s depth may affect the rotenone’s persistence. After the 2007 rotenone treatment of Lake Davis, rotenone persisted for approximately 30 days and had a half-life of 5.6 days. Therefore, given the measured persistence of rotenone in Lake Davis, the depth of Tamarack Lake, and its colder temperatures compared with Lake Davis, residual levels of rotenone in Tamarack Lake would potentially result in significant impacts on water quality standards and beneficial~~

~~uses that would be unavoidable because no mitigation measures are available to accelerate the degradation of rotenone in the lake.~~

6.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

IRREVERSIBLE COMMITMENTS

Irreversible commitments are those that cause either directly or indirectly the use of natural resources so that they cannot be restored or returned to their original condition. Irreversible decisions affect renewable resources such as soils, wetlands, and waterfowl habitats. They are considered irreversible because their implementation would affect a resource that has deteriorated such that renewal takes extensive time or financial resources or because they would destroy a resource.

IRRETRIEVABLE COMMITMENTS OF NATURAL RESOURCES

Irretrievable commitments of natural resources mean the decision would result in loss of production or use of the resources. They represent opportunities forgone for a substantial period of time that the resources cannot be used.

6.3.1 Alternative 2: Proposed Action ~~(Rotenone Treatment)~~

The proposed Action would not result in an irreversible commitment of resources. The proposed Action would not involve erection of any structures, loss of habitat, or removal or mining of resources. However, there would be irretrievable commitments of recreational resources.

6.3.1.1 Biological Resources

A potential irreversible loss of resources would be mortality of the non-native fish that currently occupy the 11 miles of stream reaches in the proposed treatment area (see Section 5.1, Aquatic Biological Resources). However, these fish would be replaced with putative pure Paiute cutthroat trout and fish populations would be restored through restocking. Therefore, because restoration of fish populations would use nearby, existing source populations, restocking would not require extensive time or financial resources, thus their loss would not constitute an irreversible loss of resources.

6.3.1.2 Energy

The proposed Action would use energy resources in the process of driving to and from the trailhead leading to the proposed treatment area and to operate the auger for dispensing the neutralization agent.

6.3.1.3 Recreation

Under the proposed Action, the treatment area would be closed to fishing during treatment and restocking. Potential re-opening would be subject to future California Fish and Game Commission decisions not part of the proposed Action. Closure of the area would constitute an irretrievable commitment of a recreational resource to non-recreational use because it represents an opportunity forgone for a substantial period during which the resource cannot be used.

6.3.2 Alternative 3: Combined Physical Removal

Similar to the proposed Action, this alternative would not result in an irreversible commitment of resources. This alternative does not involve erection of any structures, loss of habitat, or removal or mining of resources. However, there would be irretrievable commitments of recreational resources.

6.3.2.1 Biological Resources

This alternative would remove non-native trout that currently occupy the 11 miles of stream in the proposed treatment area (see Section 5.1, Aquatic Biological Resources). However, these fish would be replaced with putative pure Paiute cutthroat trout and fish populations would be restored through restocking.

6.3.2.2 Energy

This alternative would use energy resources in the process of driving to and from parking area and for the generators that would be used to recharge electrofishing backpack units.

6.3.2.3 Recreation

Under this alternative, the stream would be closed to fishing during the restocking period. Potential re-opening would be subject to future California Fish and Game Commission decisions not part of this alternative. Closure of the area would constitute an irretrievable commitment of a recreational resource to non-recreational use because it represents an opportunity forgone for a substantial period during which the resource cannot be used.

6.4 GROWTH-INDUCING IMPACTS

Section 21100(b)(5) of CEQA requires that an EIR discuss the growth-inducing impacts of a proposed project. This requirement is further explained in the CEQA Guidelines Section 15126(g), which states that an EIR must address "the ways in which the proposed action could foster economic or population growth, or the construction of additional housing, either directly or indirectly in the surrounding environment." Pursuant to CEQA, growth per se is not assumed to be necessarily beneficial, detrimental, or of little significance to the environment; it is the secondary, or indirect, effects of growth that can cause adverse changes to the physical environment. The indirect effects of population and/or economic growth and accompanying development can include increased demand on community services and public service infrastructure; increased traffic and noise; degradation of air and water quality; and conversion of agricultural land and open space to urban uses. Local land use plans (e.g., general plans and specific plans) establish land use development patterns and growth policies that are intended to allow for the orderly expansion of urban development supported by adequate public services, including water supply, roadway infrastructure, sewer service, and solid waste service. Local jurisdictions conduct CEQA environmental review on their general and specific plans to assess the secondary effects of their planned growth. An action that would induce growth that is inconsistent with local land use plans and policies could indirectly cause adverse environmental impacts, as well as impacts on public services, that the local land use jurisdictions have not previously addressed in the CEQA review of their land use plans and development proposals. Removing a potential obstacle to growth is considered an indirect growth-inducing impact.

Under NEPA, growth-inducing impacts are addressed as potential indirect effects. Indirect effects include those that occur later in time or that remove obstacles to population growth or encourage and facilitate other activities that could stimulate subsequent growth. In addition, CEQA requires that the direct and indirect impacts on population and housing are analyzed.

6.4.1 Environmental Setting

The local socioeconomic conditions in the proposed treatment area are described in this section to provide context for analysis of potential growth-inducing impacts, as well as to serve as the baseline against which population and housing impacts are measured. For this analysis, the proposed treatment area includes Alpine County (within which Silver King Creek is located) and northern Mono County, located east of Silver King Creek. The closest communities to this area are Markleeville in Alpine County; and Walker, Coleville, and Bridgeport in northern Mono County. Information on population is included in Section 5.8.1.1, Population; and information on population trends is outlined in Section 5.9.1.1, Population Trends and Projection. Housing information is presented below.

6.4.2 Housing

According to 2000 Census data, there were approximately 1,500 housing units in Alpine County. Of the 1,500 units, 880 were single-family homes (about 60% of the total housing stock), though only 213 (approximately 24%) were considered owner-occupied. Therefore, most of the housing stock in Alpine County consists of second homes, vacation homes and rental units (U.S. Census 2000). In Mono County, about 1,800 (approximately 40%) of the 4,600 single-family homes were owner-occupied. However, those single-family homes made up less than 40% of the total 12,000 housing units (U.S. Census 2000). Similar to Alpine County, Mono County contains more second homes, vacation homes and rental units than the United States on average (approximately 60% of the housing stock is single-family homes; 80% of which are owner-occupied).

6.4.3 Assessment Criteria and Methodology

6.4.3.1 Significance Thresholds

The CEQA Guidelines (Appendix G) outline criteria for evaluating impacts on population and housing. Specifically, the action would have a significant impact if it would:

- Induce substantial population growth in an area, either directly or indirectly.
- Displace substantial numbers of existing housing units, necessitating the construction of replacement housing elsewhere.
- Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

There are no specific significance thresholds under NEPA for growth-inducing or population and housing impacts; however, NEPA requires evaluation of indirect effects, which may include growth-inducing and other effects related to induced changes in the pattern of land use, population density or growth rate, and the related effects on air and water and other natural systems, including ecosystems (40 CFR Section 1508.8).

6.4.3.2 *Evaluation Methods and Assumptions*

The assessment of growth-inducing and population and housing impacts focuses on those resources that would be potentially affected by the proposed Action and alternatives. For the proposed Action, growth-inducing impacts could include directly constructing housing, encouraging additional jobs in the area, and removing an obstacle to growth.

6.4.4 Environmental Impact Assessment

This section describes the potential impacts of the proposed Action and alternatives in the context of growth-inducing impacts and population and housing resources. Growth-inducing impacts are organized by alternative, and include both direct and indirect effects of the ~~a~~Action on population and housing.

6.4.4.1 *Alternative 1: No Action*

The No Action alternative would result in no growth-inducing or population and housing impacts because no housing would be built, no new jobs would be created, and no obstacles to growth would be removed.

6.4.4.2 *Alternative 2: Proposed Action ~~(Rotenone Treatment)~~*

Under the proposed Action, if the proposed treatment area is to be re-opened to fishing after treatment, particularly with a high-quality native trout fishery, local economic benefits could consist of increased sales of recreation goods and services and related increases in income and jobs for the local economy. However, potential re-opening of the area to recreational fishing would be subject to future California Fish and Game Commission decisions, not part of the proposed Action.

In the context of population and housing, the proposed Action would not increase visitation to a degree that would affect population growth through an influx of workers. Because the proposed treatment area is in a wilderness area with no houses, the proposed Action would not displace housing or people. In addition, the proposed Action would not induce population growth directly or indirectly because it would not construct new homes, nor would it remove an obstacle to growth, thus no impacts would result.

6.4.4.3 *Alternative 3: Combined Physical Removal*

Similar to the proposed Action, Alternative 3, if successful, could result in re-opening the native trout fishery once the treatment and re-stocking period is complete. However, as described above for the proposed Action, potential re-opening of the area to recreational fishing would be subject to future California Fish and Game Commission decisions, not part of Alternative 3. This alternative would not induce population growth directly or indirectly because it would not construct new homes, create new jobs or remove an obstacle to growth and no adverse impacts would result.

6.5 CUMULATIVE EFFECTS

6.5.1 Introduction

The Council on Environmental Quality's regulations (40 CFR Sections 1500-1508) implementing the procedural provisions of NEPA of 1969, as amended (42 U.S.C. Sections 4321 et seq.), define cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR Section 1508.7). Pursuant to these regulations, an EIS must analyze cumulative impacts of the action.

Also, as defined in Section 15355 of the CEQA Guidelines, a cumulative impact is the impact that results from implementing a proposed action together with other projects causing related impacts. The CEQA Guidelines require that EIRs discuss the cumulative impacts of a project when the project's incremental effect is "cumulatively considerable," meaning that the project's incremental effects are significant when viewed in connection with the effects of past, present, and reasonably foreseeable (i.e., probable) future projects.

6.5.2 Approach

Based on the NEPA and CEQA Guidelines, the discussion of cumulative impacts should include either:

- A list of past, present, and probable future projects producing related or cumulative impacts, or
- A summary of projections contained in an adopted general plan or similar document, or in an adopted or certified environmental document, that described or evaluated conditions contributing to a cumulative impact.

The following discussion of cumulative impacts consists of:

- A discussion of the geographic scope of the area affected by the cumulative impact;
- A summary of the environmental impacts that would result from these projects; and
- Reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative impacts.

This analysis uses the list approach and addresses the direct cumulative impacts associated with the proposed Action. Projects included in the cumulative impact analysis were identified by several methods, including telephone and email correspondence with agency personnel from surrounding jurisdictions, internet research, and review of potential cumulative impacts analyses from environmental reports prepared for other projects in the same geographic area as the proposed Action. The evaluation considered projects within an approximate 20-mile radius, such that projects within Alpine County and the Carson-Iceberg Wilderness Area were considered.

Table 6-1 lists the recently completed past projects, projects currently under construction, and probable future projects that would overlap with the treatment schedule of the proposed Action and that could affect the same resources. This table provides a brief description of the projects included in the cumulative impact analysis, their locations, estimated construction schedules, access roadways and nearby waterways, and potential types of cumulative impacts that could occur in combination with those of the proposed Action. For future projects, the analysis was based on estimated construction schedules. Where construction schedules were unavailable, it was conservatively assumed that construction periods would overlap with those of the proposed Action.

6.5.3 Significance Criteria

The cumulative impact analysis evaluates whether impacts would be individually limited but cumulatively considerable. Cumulatively considerable means that the incremental effects of an action are significant when viewed in connection with the effects of past, present, and reasonably foreseeable future projects.

Impacts of the proposed Action that would be "individually limited" are based on the impact analysis presented in Chapter 5.0, Environmental Consequences. Based on that analysis, the proposed Action would have significant or less-than-significant impacts on aquatic resources, terrestrial resources, human and ecological exposure, greenhouse gas emissions, water resources, recreation, wilderness values and management, economic resources, and environmental justice.

6.5.4 Impact Analysis

This subsection evaluates the potential environmental impacts of the proposed Action when considered together with the projects listed in Table 6-1. The analysis addresses only the types of impacts that could occur as a result of the proposed Action based on the significance criteria included in each resource discussion in Chapter 5.0, Environmental Consequences. Areas where no impact would occur, as identified in Chapter 4.0, Scope of the Analysis, are not addressed because the proposed Action would not contribute to a cumulative impact (e.g. the proposed Action would not affect scenic vistas, therefore this topic is not analyzed for cumulative impacts).

The potential for the proposed Action to contribute to cumulative impacts would primarily result from the chemical treatment, including during treatment and from potential long term effects on individual benthic macroinvertebrate species. Long-term effects would include benefits for Paiute cutthroat trout populations and the potential for improved recreational and economic opportunities.

As described above, Table 6-1 lists all types of projects within 20 miles of the proposed treatment area. The Agencies were initially inclusive in identifying potential cumulative projects. However, because the proposed Action results in only in-stream impacts, most of the projects listed in Table 6-1 would not result in impacts that could occur in combination with the proposed Action. For example, development and fuel reduction projects would result in local land disturbance and storm water runoff issues that are not in the basin and would not occur in combination with the proposed Action. In contrast, although they occurred in the past, the prior treatments of Silver King Creek and its tributaries listed on Table 6-1 would result in the same types of impacts in the basin and are the focus of the cumulative impact analysis.

Table 6-1 Projects Considered in Cumulative Impacts Analysis for the Proposed Action

#	Project	Project Description	Jurisdiction / Lead Agency	Location	Nearby Waterways	Potential Cumulative Impact Issues
1	Previous Silver King Creek treatments	CDFG conducted prior rotenone treatments in the basin in 1964, 1976, 1977, 1987, 1988, 1991, 1992, and 1993.	CDFG (Trumbo et al. 2000a)	Silver King Creek	East Fork Carson River	Aquatic biological resources, water quality
2	Upper Silver King Creek	CDFG conducted prior rotenone treatments in Upper Silver King Creek (see Table 5.1-1). This area was successfully restocked with Paiute cutthroat trout but is closed to fishing.	CDFG	Upper Silver King Creek	Silver King Creek below Llewellyn Falls (the proposed treatment area)	Aquatic biological resources and water quality
3	Marine Corps Mountain Warfare Training Center	The center occupies 46,000 acres of Toiyabe National Forest. The center conducts training in mountain operations in summer and winter. Personnel live in military housing in adjacent Coleville.	USMC	Outside Coleville, California		Economic resources
5	141 Line Rebuild Project	Sierra Pacific proposes to reconstruct an existing 120 kilovolt electric transmission line on Peavine Mountain, from Lemmon Drive to the area south of Hoge Road, including the Keystone non-motorized area	USFS	Washoe County, Nevada	Truckee River	Water quality
6	Alpine County Aspen Enhancement Personal Use Fuelwood Fuels Reduction Project	USFS proposes to remove encroaching conifers on 250 acres near aspen stands along Scotts Lake Road to enhance and expand aspen and reduce fuels. Personal use fuelwood permits would be used for implementation.	USFS	Alpine County, California	Scotts Lake, Carson River	Water and terrestrial resources
7	Clear Creek Fuels Reduction and Ecosystem Enhancement Project	USFS proposes to reduce hazardous fuels and the risk of catastrophic wildland fire, improve forest health, and enhance and expand existing aspen stands by thinning trees and brush on approximately 1,500 acres.	USFS	Douglas County, Nevada (5 mi southeast of Carson City within the Clear Creek Landscape Assessment Area)	Carson River and tributaries	Water resources
8	Dog Valley Fuels Reduction and Ecosystem Enhancement Project	USFS proposes to improve timber stand and wildlife habitat on 6,000 acres, as authorized under HFRA Title 1 (Wildland-Urban interface), using mastication, mowing, hand thinning, chipping, animal grazing and prescribed fire.	USFS	Sierra County, California	Truckee River	Terrestrial resources and recreation
11	Special Use Permit Renewal – Lake Tahoe Adventures	Lake Tahoe Adventures has requested renewal of its outfitter/guide permit for guided snowmobile tours in the Hope Valley area of the Carson Ranger District. New permit would be eligible for a term of 10 years.	USFS	Alpine County, California	Carson River	Water and economic resources
12	West Carson Habitat Improvement and Fuels Reduction Project	USFS proposes to improve critical deer winter range, reduce the risk of a fast moving wildland fire, and change the fire regime by reducing cheatgrass density and allowing regrowth of native grasses and scrubs through domestic sheep grazing.	USFS	Carson City, Nevada	Carson River	Water and terrestrial resources

Table 6-1 Projects Considered in Cumulative Impacts Analysis for the Proposed Action

#	Project	Project Description	Jurisdiction / Lead Agency	Location	Nearby Waterways	Potential Cumulative Impact Issues
13	Bear Valley Village	Construct 486 lodging units (51 with lock-off units), approximately 24,400 square feet of retail floor area, 9,000 square feet of restaurant floor area, and 30,000 square feet of amenity/service space.	Alpine County	Bear Valley, Alpine County, California	Stanislaus River and tributaries	Economic resources
14	White Mountain Estates	Subdivision of a total of 70.38 acres into 45 single family residential lots, one utility lot (0.78 acres) for water and propane tanks, three lots for open space uses (1.46 acres, 3.81 acres, and 9.08 acres), and a remainder parcel (19.23 acres) that allows one single-family residence.	Mono County	Chalfant Valley, Mono County, California	Crowley Lake	Economic resources
15	Crowley Lake Estates	Construct 55 multi-family and 5 single-family homes, and develop 10,000 square feet of retail space.	Mono County	Crowley Lake, Mono County, California	Crowley Lake	Economic resources
16	Mountain Gate Fishing Access project	Create an ADA-accessible parkway for fishing, hiking, exercising, picnicking or relaxing. ADA accessible fishing and an ADA accessible trail along the West Walker River; picnic and resting spots, day use areas, therapeutic exercise stations (a “par course”) for senior citizens and disabled persons, accessible restrooms, a side channel restoration, a nature trail, and an interpretive kiosk.	Mono County	Walker, CA	Walker River	Recreation and economic resources

Sources: USMC 2008; ~~CDFG/USFS 2007~~; USFS 2008; SCWA Environmental Consultants 2008; Mono County 2007; Mono County 2006a; Mono County 2006b.

Notes:

ADA = Americans with Disabilities Act
CDFG = California Department of Fish and Game
HFRA = Healthy Forest Restoration Act
USFS = U.S. Forest Service
USMC = U.S. Marine Corps

6.5.4.1 Aquatic Resources

The geographic scope for the aquatic resources cumulative impact analysis encompasses areas that could be affected by the projects identified in Table 6-1. This region is appropriate because the aquatic species that would be affected by the proposed Action are part of a broader ecosystem, and the potential disturbance of individual areas has repercussions for a wider region than the immediate treatment area.

FISH

As described in detail in Section 5.1, Aquatic Biological Resources, rainbow trout and Lahontan cutthroat trout were introduced into Paiute cutthroat trout habitat above Silver King Canyon (USFWS 1985). Sometime after 1950, non-native trout were introduced into the Paiute cutthroat trout population in Silver King Creek above Llewellyn Falls (USFWS 1985). These introductions eliminated genetically putative pure Paiute cutthroat trout from its existing ~~historic~~ habitat. The proposed Action would not include any transfers of fish removed from Silver King Creek to other areas. ~~Some of these fish could be removed by anglers during the pre-treatment period through increased bag limits if approved by the California Fish and Game Commission~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009. Fish removed by other means would be gathered and buried.

Previous chemical treatments occurred between 1964 and 1993 to eradicate non-native trout in Silver King Creek and tributaries upstream of Llewellyn Falls and in Corral Valley and Coyote Valley Creeks. During these treatments, it is likely that genetically putative pure Paiute cutthroat trout were killed.

Genetic studies indicate that putative pure Paiute cutthroat trout have been successfully reintroduced into treated areas in Silver King Creek and tributaries above Llewellyn Falls, and in Corral Valley and Coyote Valley Creeks (Israel et al. 2002, Cordes et al. 2004).

The proposed Action would minimize the threat of introduction of non-native trout into areas occupied by Paiute cutthroat trout. The population of Paiute cutthroat trout would be isolated by a series of inaccessible barriers in Silver King Canyon, which would greatly reduce the likelihood of inadvertent introduction. The Agencies do not expect that the small numbers of putative pure Paiute cutthroat trout that could be killed during the chemical application (e.g. fish that may have come over Llewellyn Falls) or during the process of restocking would have long-term negative effects on the overall viability of Paiute cutthroat trout populations.

On a cumulative basis, implementation of the proposed Action when combined with past and reasonably foreseeable activities would result in beneficial effects that include preserving the genetic integrity of Paiute cutthroat trout populations within the Silver King Creek Watershed, restoring the sub-species to its historic range, and the eventual recovery and delisting of a federally listed species.

MACROINVERTEBRATES

Historic impacts on benthic macroinvertebrates in the Silver King Creek basin include logging, livestock grazing, and chemical treatments. The basin was logged in the 1860s. The proposed treatment area was used as pasture for sheep in the early 1900s through the late 1930s, and for cattle from the 1940s through 1994. Previous rotenone treatments occurred between 1964 and 1993 to eradicate non-native trout from Silver King Creek upstream from Llewellyn Falls and tributaries, and in Corral Valley and Coyote Valley Creeks. Four Mile Canyon Creek was treated with rotenone from 1991 to 1993. Corral Valley Creek was treated with rotenone in 1964 and 1977. Coyote Valley Creek was treated with rotenone in 1964, 1977, and 1987 to 1988. Silver King Creek above Llewellyn Falls was treated in 1964, 1976, and 1991 to 1993. The paragraphs below address potential cumulative impacts of these treatments on benthic macroinvertebrate species composition and the potential loss of species.

SPECIES COMPOSITION

The rotenone treatments described above have likely affected benthic macroinvertebrate species composition in the Silver King Creek basin, including short-term effects on species biomass and diversity, EPT, and related water quality objectives. However, as described above, these treatments would not have affected fishless headwaters, tributaries, or neighboring watersheds that play a critical role in repopulating treated areas, potentially resulting in recovery of macroinvertebrate ~~species~~ abundance within months and population increases within 2 years. Given the time elapsed since these historical treatments, and based on the data presented by Vinson and Vinson (2007), there is little difference between existing benthic macroinvertebrate population (species composition) between treated and untreated reaches. The system is healthy and has returned to a high level of diversity after historic treatments.

The proposed treatment would have similar effects on species composition as historic treatments. However, as described in Section 5.1, Aquatic Biological Resources, the Agencies would attempt to use lower formulated rotenone and the less toxic formulation (CFT Legumine™) ~~chemical~~ concentrations to achieve fish eradication compared with past treatments (Finlayson et al. 2010). Although many aquatic invertebrate taxa would likely survive the proposed chemical treatment, benthic population levels would be affected in the short term, including changes in species composition and potential mortality of sensitive species (e.g. small, gilled EPT species [stoneflies, caddisflies and mayflies]). Drift from upstream areas, survival of eggs, life stages present in the hyperheos and colonizers from adjacent areas would contribute to recovery. Recent data show that historic treatments in the watershed are too far removed in time to have present-day effects that could combine with the effects of the proposed Action. Therefore, any cumulative impacts on benthic invertebrate species composition in Silver King Creek are less-than-significant. ~~Further, because none of the historic treatments were conducted in Tamarack Lake, any treatment of the lake would have project-specific effects but no cumulative effects.~~

LOSS OF RARE OR ENDEMIC SPECIES

As described in Section 5.1, Aquatic Biological Resources, both the historic and proposed rotenone treatments could result in loss of species in Silver King Creek, including rare and/or endemic species. Although no such species are known to occur in Silver King Creek, they may have been present prior to historic treatments and lost as a result. Such species may still be present and could be lost as a result of the proposed Action. Although this impact cannot be described or quantified, the cumulative effect of the historic and proposed treatments would be cumulatively considerable, and could be cumulatively significant.

As described in Section 5.1, Aquatic Biological Resources, one factor that minimizes this potential cumulative effect is the limited geographic range of the treatment area. The same rare or endemic species that may inhabit the treatment area may also be present in the headwaters, tributaries and springs and would likely recolonize the area along with more common species. In addition, the Agencies would attempt to use lower formulated rotenone concentrations and the less toxic formulation (CFT Legumine™) than have been used previously to minimize impacts on benthic invertebrates (Finlayson et al. 2010). However, because it is beyond the scope of the EIS/EIR to determine conclusively the presence or absence of rare or endemic species, and because this may be technically infeasible, the evaluation of aquatic resources for the proposed Action found that the treatment could result in loss of rare or endemic species. Because historic treatments may have resulted in similar impacts in Silver King Creek, this impact would be cumulatively significant. ~~However, because none of the historic treatments were conducted in Tamarack Lake, any treatment of the lake would have project-specific effects but no cumulative effects.~~

Therefore, the proposed Action's effects on species composition would not be cumulatively considerable and, when viewed in combination with those of other reasonably foreseeable projects, would result in less-than-significant cumulative impacts. The proposed Action's effects on rare or endemic species could be cumulatively considerable, and because of the lack of data regarding the presence or absence of these species, this impact could be cumulatively significant.

6.5.4.2 Terrestrial Resources

The geographic scope for the terrestrial resources cumulative impact analysis encompasses areas (including wetlands and sensitive habitats) that could be affected by the projects identified in Table 6-1. This region is appropriate because the habitats and wildlife species that would be affected by the proposed Action are part of a broader ecosystem, and the potential disturbance of individual areas has repercussions for a wider region than the immediate treatment area.

The proposed Action could affect terrestrial wildlife through the physical disturbance that would result from presence of workers and their activities. The treatment could also affect terrestrial wildlife by temporarily reducing benthic macroinvertebrate populations in the stream as a food source. Insectivorous wildlife species in the proposed treatment area include, among others, yellow warbler and Williamson's sapsucker. The proposed Action would also remove all non-native trout, which could constitute an important prey base for several wildlife species and could be reduced until pre-treatment fish densities and size-class distributions are reestablished through restocking. This would not, however, be a significant impact.

The proposed Action would have less-than-significant impacts on protected species including California wolverine, fisher, bald eagle, American marten, mule deer, insectivorous birds, neotropical migratory birds, Forest Sensitive Species, and riparian habitats adjacent to the stream corridor.

Because other projects listed in Table 6-1 could affect terrestrial resources (e.g. fuel reduction, land development), these projects are localized and distant from the proposed treatment area. Furthermore, because institutional controls are in place that limits activity in the Wilderness Area, none of these projects, when viewed in combination with the proposed Action, would result in cumulative impacts on terrestrial resources.

6.5.4.3 Human and Ecological Exposure

The geographic scope for the human and ecological exposure cumulative impact analysis encompasses waterways that could be affected by the projects identified in Table 6-1. This would include Silver King Creek and the East Fork Carson River.

As described in Section 5.3, the proposed Action would have less-than-significant impacts on non-target fish species, wildlife, and human health. The wildlife impact assessment was based on estimates of surface water and other exposure of avian and terrestrial wildlife to rotenone and formulation constituents based on conservative food web modeling of doses and comparison to effects thresholds. In addition, because of the remoteness of the proposed treatment area, the distance to any downstream human population, and the controls that would be placed on human access during and after treatment (see Chapter 3.0, Project Alternatives), human exposure pathways were considered incomplete (refer to Appendix C herein). For these reasons, the application of rotenone formulations poses a less-than-significant impact on human health. None of the projects listed in Table 6-1 propose the use of chemicals that could enter area waterways, and therefore no cumulative ecological or human health exposure impacts would occur. The only projects involving rotenone application are past projects and as described in detail in Appendix C, neither rotenone, its formulation constituents nor potassium permanganate persist in the environment. The proposed Action would not therefore contribute to a cumulatively considerable impact on human or ecological health.

6.5.4.4 Greenhouse Gases and Climate Change

The geographic scope for greenhouse gases and climate change cumulative impacts encompasses the State of California, because the State has implemented greenhouse gas emissions reductions measures and because the effects of the proposed Action on global climate change would be too speculative.

The proposed Action would result in short-term emissions representing less than one millionth of the State’s annual greenhouse gas emissions. This would have a less-than-significant impact on the ability of the State to meet its 2020 greenhouse gas reduction goals. Most of the projects listed in Table 6-1, as well as projects throughout California, would contribute to the State’s overall greenhouse gas emissions. Although small, when viewed in combination with other projects, the proposed Action’s emissions would contribute to a cumulative impact on greenhouse gas emissions and climate change.

6.5.4.5 Water Resources

The geographic scope for water resources cumulative impacts encompasses the Silver King Creek and its tributaries and springs and downstream waterways including the East Fork Carson River.

The proposed Action would result in less-than-significant water quality impacts on Silver King Creek that would not be cumulatively considerable in combination with historic treatments of area streams. However, treatments would have significant impacts on water quality in Tamarack Lake, if fish are present. However, these impacts would not be cumulatively considerable when viewed in combination with previous rotenone treatments, which have been conducted only in area streams such as Corral Valley Creek, Coyote Valley Creek and Silver King Creek above Llewellyn Falls. ~~Because there would be no geographical overlap, any treatment of Tamarack~~

~~Lake would result in cumulative water resource impacts.~~ None of the other projects listed on Table 6-1 involve chemical treatment.

6.5.4.6 Recreation

The geographic scope for cumulative impacts on recreational resources includes areas within 20 miles of the Humboldt-Toiyabe National Forest and Carson-Iceberg Wilderness Area. This region is appropriate because the displacement of recreational uses from one area can result in the increased use of recreational facilities in another.

The proposed Action would have a direct adverse impact on recreational fishing in Silver King Creek because the proposed treatment area from Llewellyn Falls to Silver King Canyon would be closed to fishing during treatment and restocking. Re-opening thereafter would depend on future decisions of the California Fish and Game Commission not part of the proposed Action. However, existing restrictions on group size and the low number of diverted users for recreational fishing and other recreational activities (hiking, backpacking, etc.) resulting from the closure would not increase the use of other areas such that substantial physical deterioration would occur or be accelerated. The Sierra Nevada region provides a broad range of recreational opportunities and similar recreation experiences to those provided by Silver King Creek. Among the projects listed in Table 6-1, only the previous Silver King Creek treatments have resulted in restricted access to recreational areas. The Mountain Gate Fishing Access project would enhance recreational opportunities at a nearby facility. Therefore, the proposed Action would have no cumulative impact on recreational access.

6.5.4.7 Wilderness Values and Management

Under the proposed Action, the rotenone treatment of Silver King Creek would likely temporarily detract from the wilderness environment during the treatment process. However, the longer term effect of the treatment would be beneficial, resulting in the restoration of the Paiute cutthroat trout to its native habitat within the wilderness area. Wilderness experiences may be slightly diminished in the short term; however, restoration of Paiute cutthroat trout to its native habitat would have a beneficial effect on wilderness values. Projects listed on Table 6-1, including fuel reduction projects, would result in only minor, short-term access restrictions. Therefore, the proposed Action, in combination with other projects, would not result in cumulatively considerable impacts on wilderness values and management.

6.5.4.8 Economic Resources

The proposed Action is not expected to have short-term adverse effects on economic resources in the region. Much of Silver King Creek is currently closed to fishing and other parts of the wilderness area would remain open to fishing and other recreational activities. In the long term, the proposed Action could have a beneficial impact on economic resources from increased visitation to the wilderness area should the native trout fishery be restored. However, re-opening of the proposed treatment area to fishing would depend on future California Fish and Game Commission decisions not part of the proposed Action. Other cumulative projects would have similar beneficial impacts, such as the Mountain Gate Fishing Access project. Therefore, the proposed Action would not have a cumulatively considerable impact on economic resources.

6.5.4.9 *Environmental Justice*

The proposed Action would not disproportionately affect a minority or ethnic population group from risks to human health. Therefore, the proposed Action would not contribute to a cumulatively considerable impact on environmental justice.

6.6 REFERENCES

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C H A P T E R 7

Mitigation Measures

Chapter 7 presents the avoidance and minimization measures the Agencies would employ to reduce environmental effects from implementation of the proposed Action.

7.1 AVOIDANCE AND MINIMIZATION MEASURES

This section outlines features of the proposed Action that avoid and minimize impacts. These measures may be regulatory requirement or other policies or standard measures implemented pursuant to agency policies or practices designed to avoid or minimize environmental impacts. Several of these requirements are not considered discretionary and are implemented in response to regulations or legal requirements.

7.1.1 Aquatic Resources

~~To reduce the number of fish lost during the treatment process, the Agencies would request that the California Fish and Game Commission increase the bag limit from 5 fish daily to 10 fish daily during the summer of 2009 prior to treatment. CDFG wardens would monitor bag limits and other restrictions.~~ To facilitate pre-treatment removal of fish, on April 9, 2009 the California Fish and Game Commission adopted new regulations that increased the daily bag limit on the section of Silver King Creek and tributaries from the confluence with Tamarack Lake Creek downstream to the confluence with Snodgrass Creek from five fish per day to ten fish per day. This regulation became effective May 21, 2009

Aquatic and water quality impacts would be minimized by limiting the treatment concentration applied and the duration of rotenone activity to the shortest time period needed to meet the fish removal objective.

Block nets would be placed at selected locations throughout the proposed treatment area to catch dead fish (refer to Figure 3-1). The nets would be maintained at a frequency adequate to minimize decomposition of captured fish.

~~Treatment of Tamarack Lake would be avoided if possible. The Agencies will conduct extensive surveys to determine the presence or absence of fish in the lake.~~

To eliminate the toxic effects of rotenone downstream of the proposed treatment area, potassium permanganate would be administered using generator-powered volumetric augers at a downstream neutralization ~~detoxification~~ station. The in-stream application of potassium permanganate below Silver King Canyon would ensure that no adverse effects of rotenone are experienced downstream of the 30-minute water quality station ~~treatment area~~.

The Agencies would monitor restocked fish populations as well as donor populations for changes in productivity and abundance that would contraindicate further transfers from donor stock.

The proposed Action would not involve treating Silver King Creek's headwaters or the upper fishless reaches of tributaries or springs. The headwaters, including Upper Fish Valley and other areas above Llewellyn Falls, have not been treated since the early 1990s. Approximately

17 miles of tributary streams would be left untreated under the proposed Action. Some of these areas have never been treated with rotenone (e.g. Fly Valley Creek). Extreme ~~H~~headwater areas, upstream and outside of the proposed treatment area, including Bull Canyon Creek, Corral Valley Creek, Coyote Valley Creek, and Four Mile Canyon Creek, have never been treated with rotenone. Headwater areas of many streams would not be treated under the proposed Action because they are above natural barriers and do not support trout populations. These areas would provide source populations of benthic macroinvertebrates for recolonizing treatment areas.

Consistent with the NPDES permit for the previously proposed treatment, the Agencies would conduct pre-treatment and post-treatment monitoring of benthic macroinvertebrate communities in the treatment areas and "control" sites. The monitoring program would be designed to assess the duration of short-term treatment impacts and long-term species composition recovery.

To educate the public regarding the Paiute Cutthroat Trout Restoration Project and reduce the threat of ~~prevent~~ reintroduction of non-native fish to the area, the Agencies have placed informational kiosks and signs at trailheads that discuss Pauite cutthroat trout and cite the California Department of Fish and Game fishing regulations (this completed action is common to all alternatives). Although a greater agency presence may reduce the threat of an illegal transfer of nonnative fish, it would not expand the population and range of the sub-species, or increase the probability of long-term viability and reduce threats from genetic bottlenecking and stochastic events. As part of the proposed Action, the agencies have committed to developing informational handouts to inform anglers entering the wilderness of the sensitivity and risks associated with the Paiute cutthroat trout. The handouts will be in addition to the informational kiosks and signage currently located at the trailheads. Agency personnel will continue to have a presence in the basin as budgets allow.~~would erect an educational kiosk and signs at trailheads.~~

7.1.2 Terrestrial Resources

All personnel assisting in fish removal activities would use hardened or durable sites for camping and would be familiar with and practice the LNT principles. Crews would work in small groups (of one ~~four~~ to six people, approximately 50 people total) spread throughout the proposed treatment area. Trails would be used whenever possible to move from one location to another to minimize soil and vegetation disturbance and to prevent the establishment of new trails.

To prevent impacts on amphibian species, the Agencies would continue to conduct annual amphibian surveys. The Agencies would also conduct amphibian surveys immediately before treatment. If adult or tadpole life stages of any ~~threatened, endangered,~~ sensitive, candidate or rare amphibians are found during the pre-treatment surveys, then they will be captured by nets and relocated out of the treatment area to suitable nearby habitat.

7.1.3 Human and Ecological Exposure

The rotenone application would be supervised by licensed applicators and in adherence to safety precautions identified on the product label. The application supervisor would be knowledgeable and experienced in state regulatory requirements regarding safe and legal use of the rotenone product and applicator safety. All personnel involved with the rotenone application would receive pre-treatment safety training specific to the formulated rotenone product. All personnel would be required to wear protective equipment to avoid unintended exposure to rotenone.

Prior to rotenone application, and throughout the treatment process, visitors would be advised to avoid the treatment area and the Agencies would post signs at trailheads and other strategic places.

7.1.4 Archaeological and Paleontological Resources

The Forest Service ~~Archaeologist~~ would identify suitable locations for burial of fish and placement of signs.

7.1.5 Hazardous Materials and Spills

The use of rotenone would be supervised by licensed applicators according to label directions and the MOU between CDFG and the Water Board. Transport of chemicals to the proposed treatment area would be addressed through preparation and implementation of a spill prevention, contingency and containment plan; a site safety plan; and a site security plan. Public access to the treatment area would be restricted during implementation of the proposed Action, and restrictions would be enforced by the Humboldt-Toiyabe National Forest and CDFG.

7.1.6 Wildfire

Work crews would follow all fire prevention precautions.

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CHAPTER 8

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