CONSERVATION AGREEMENT

AND

CONSERVATION STRATEGY

FOR

BONNEVILLE CUTTHROAT TROUT
(*Oncorhynchus clarki utah*)

in the
State of Nevada

NOVEMBER 2006

ACKNOWLEDGMENTS

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We would like to thank the following individuals for their participation in efforts concerning the conservation of BCT in Nevada.

Terry Steadman	Trout Unlimited, Great Basin Chapter
Kevin Fedrizzi	Trout Unlimited, Southern Nevada Chapter
Robin Crouch	Hidden Canyon Guest Ranch, Baker, Nevada
Rich Haskins	Nevada Department of Wildlife, Reno, Nevada
Chris Crookshanks	Nevada Department of Wildlife, Ely, Nevada
Bob Layton	Nevada Department of Wildlife, Elko, Nevada (Retired)
Mark Maley	Fish and Wildlife Service, Reno, Nevada (Retired)
Chad Mellison	Fish and Wildlife Service, Reno, Nevada
Tod Williams	National Park Service, Great Basin National Park, Baker, Nevada
Neal Darby	National Park Service, Great Basin National Park, Baker, Nevada
Gretchen Baker	National Park Service, Great Basin National Park, Baker, Nevada
Kathy Billings	National Park Service, Great Basin National Park, Baker, Nevada
Cindy Nielsen	National Park Service, Great Basin National Park, Baker, Nevada
Becky Mills	National Park Service, Great Basin National Park (Retired)
Paul Podborny	Bureau of Land Management, Ely, Nevada
Mark Barber	Bureau of Land Management, Ely, Nevada (Retired)
Jim Harvey	Forest Service, Humboldt-Toiyabe National Forest, Sparks, Nevada
Patricia Irwin	Forest Service, Humboldt-Toiyabe National Forest, Ely, Nevada
Kathy Johnson	Forest Service, Humboldt-Toiyabe National Forest, Ely, Nevada
Steve Schacht	Forest Service, Gallatin National Forest, Big Timber, Montana
Jim Whelan	Forest Service, Fishlake National Forest, Richfield, Utah
Don Duff	Forest Service, Salt Lake City, Utah (Retired)

GLOSSARY OF TERMS

Allozymes - allelic forms of an enzyme that can be distinguished by electrophoresis. These are products of the genome.

BCI (USFS) - The Biotic Condition Index measures a stream against its own potential and not that of other streams. The BCI is based upon mean (aquatic macroinvertebrate) community tolerance and is a composite of the tolerances of individual taxa or species found in the community which varies in response to intensity of perturbations in the ecosystem. This condition rating is based on the USFS rating system of <72 (poor), 72-79 (fair), 80-90 (good), and 91-100 (excellent).

Confirmed Population – An actively reproducing population that has been confirmed to contain individuals that represent the historic genetic variability of BCT. This confirmation requires that the population is surveyed and must be identified as such based on at least phenotypic characteristics. This designation is intended to further aid in defining a conservation population by a quantifiable criterion.

Conservation Population - A reproducing and recruiting group of BCT, geographically isolated that is managed to sustain the existence of the BCT subspecies. Conservation populations are managed with the intention of preserving genetic integrity within specific populations and within geographic units. Populations should be further defined within geographic units by a quantifiable criterion based on molecular, meristic/morphometric, and life history characteristics or other relevant information. This criterion may vary among geographic units.

Core Population - Any population that has naturally persisted through modern development and that naturally occurs within historic range. These populations are believed to represent the genetic characterization of the subspecies prior to the impacts of modern man. This designation is intended to further aid in defining a conservation population by a quantifiable criterion (Toline and Lentsch1999).

Demographic Stochasticity - Random variation in demographic processes (birth, death and growth rates) that affect individual and population survival. These changes are strictly a result of population dynamics, not environmental change. Populations are known to inherently fluctuate regardless of environmental changes. For very small populations, periods of negative growth may lead to extinction.

Effective Population Size (Ne) - the average number of individuals in a population that contribute genes to succeeding generations. If the population size shows a cyclical variation as a function of season of the year, predation, parasitism, and other factors, the effective population size is closer to the number of individuals observed during the period of maximal contraction.

Environmental Stochasticity - Random variation in environmental processes (fire, flood, drought, and food availability) that affect individual and population survival.

GAWS General Aquatic Wildlife System is a fisheries habitat survey method developed by the Forest Service and used by NDOW. GAWS contains the basic elements necessary to survey, describe, monitor, predict habitat condition, and predict vulnerability of that habitat to impact.

Genetically Divergent Population - a population which for any number of reasons (i.e., genetic drift, local adaptation) has undergone change in the genetic make-up of the population rendering it a unique entity within the species complex. Reproduction between individuals from separate populations that have genetically diverged could potentially lead to outbreeding depression.

Genotype – The set of alleles at one or more loci in an organism; the entire set of genes carried by an individual.

Geographic Management Unit (GMU) - A distinct area defined by historic BCT range and geographic boundaries. Five GMUs have been identified within BCT historic range.

HCI (USFS) – The Habitat Condition Index. A numerical rating system used in the evaluation of suitable stream habitats for salmonids. HCI is an average of ratings made for pool / riffle ratio, pool quality, bank cover, bank vegetation stability, bank soil stability, and desirable substrate. This condition rating is based on the USFS rating system of 0-39 (poor), 40-69 (fair), 70-89 (good), and 90-100 (excellent).

Historic Range - The area that BCT is perceived to have inhabited at the time of modern exploration and settlement of the western United States (approximately 1850).

Hybrid - Considered to have crossbred with other salmonids, commonly rainbow trout or other cutthroat subspecies. The term applies to an individual fish not to a population. Populations containing hybrids offer genetic and ecological value to conservation efforts. The number of individuals and/or genes in population that are hybrids can vary from population to population. The percentage of individuals with hybrid genes expressed in populations therefore, can be used as a relative measure of hybridization. This measure can be used as a component to assess the role of those populations in the conservation of the species.

Introgressed Population - Any population that contains individuals that are believed to represent the genetic characterization of the subspecies prior to the impacts of modern man and contains individuals that represent related species, subspecies, or hybrids. This designation is intended to further aid in defining a conservation population by quantifiable criterion (e.g. Toline and Lentsch 1999).

Introduced Population - A population of BCT that has been reestablished outside the historic range of the subspecies. These populations may be reestablished using a core population, an introgressed population, a reintroduced population, or an introduced population.

Introduction - Release of BCT into historically unoccupied sites for promoting conservation or sportfishing purposes.

Lotic - Pertaining to or related to moving water; i.e. streams.

Meristic Data - data acquired from analysis of numerical variation in taxonomic characters (dorsal rays, anal rays, pelvic rays, scales above lateral line, lateral line scales, gillrakers, basibranchial teeth, pyloric caeca).

Metapopulation - a collection of populations that are genetically interconnected through natural movement of individuals among conservation populations. The effective population size of meta-populations should generally be at least 1000.

Microsatellites - Microsatellites are tandemly repeated polymorphic DNA sequences which represent a source of markers for genetic linkage, mapping and identification. Microsatellites are most commonly known in the form of dinucleotide repeats, but can also be trinucleotide and tetranucleotide repeats. The resulting markers are typically highly variable and represent variation in the nuclear genome.

Mitochondrial DNA Analysis - analysis of mitochondrial DNA is typically achieved through restriction digests of portions of or the entire mitochondrial genome. The mitochondrial genome is maternally inherited and lends itself to insight into the phylogenetic relationships among populations.

Nonnative - A fish that historically did not occur in a specific area or habitat.

Outbreeding Depression - loss of fitness due to mating two individuals that are too distantly related.

Phenotype – The detectable properties of an individual that are produced by the genotype and the environment. Specifically, the physical manifestation of the interaction of an organism's genetic information with its environment, which results in a unique physical, physiological or behavioral trait (e.g. spotting patterns or coloration of cutthroat trout).

Phylogenic - referring to the description of relationships of groups of organisms as reflected by their evolutionary history.

PINES - Paired Interspersed Elements. A type of repetitive DNA sequence found throughout a eukaryotic genome. A method of determining the degree of introgression in cutthroat trout in nuclear DNA.

Potential Conservation Population - A stream that is currently devoid of fish species or one that harbors population of non-native or undesirable fish species that contains adequate habitat and is a likely candidate for future transplant or reintroduction of BCT.

Potential Population - A population of BCT that has the potential (based on relevant information) to contain individuals that represent the historic genetic variability of the subspecies. Confirmation that the population contains these individuals requires that the population is surveyed and analyzed to describe the genetic characterization.

Population - Any water body in which BCT have been found. Populations are geographically distinct. For example, tributaries of a stream are considered separate populations.

Population Viability Analysis (PVA) - The estimation of extinction probabilities by analyses that incorporate identifiable threats to population survival into models of the extinction process. Population viability analysis determines the number of individuals or populations required to achieve a specified level of viability.

Proper Functioning Condition - The functioning condition of riparian/wetlands is a result of interactions among geology, soil, water, and vegetation. Riparian/wetland areas are functioning properly when adequate vegetation is present to dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality; filter sediment and aid floodplain development; improve floodwater retention and groundwater recharge; develop root masses that stabilize streambanks against cutting action; develop diverse pond and channel characteristics to provide habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity.

RAPDS - Randomly Amplified Polymorphic DNA - regions of the nuclear genome that are amplified using randomly generated 10-base pair primers. Markers may be resolved using this technique without any prior knowledge of the organism's genome.

Reintroduced Population - A population of BCT that has been reestablished within the historic range of the subspecies. These populations may be reestablished using a core population, an introgressed population, a reintroduced population, or an introduced population.

Reintroduction - Release of BCT into historically occupied sites for the purpose of reestablishing populations within their historic range.

SINES - Short Interspersed Elements - A type of small dispersed repetitive DNA sequence (e.g., Alu family in the human genome) found throughout a eukaryotic genome. Similar to microsatellites in that the markers are highly variable and represent variation in the nuclear genome.

Sportfishing Population - A group of BCT that is first managed as a conservation population and if conditions are compatible second as a native sport fishery with the intention of meeting a public recreational demand.

Transplant - Removal of BCT individuals from a naturally occurring population and subsequent release of these individuals into other waters.

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CONSERVATION AGREEMENT

FOR

BONNEVILLE CUTTHROAT TROUT

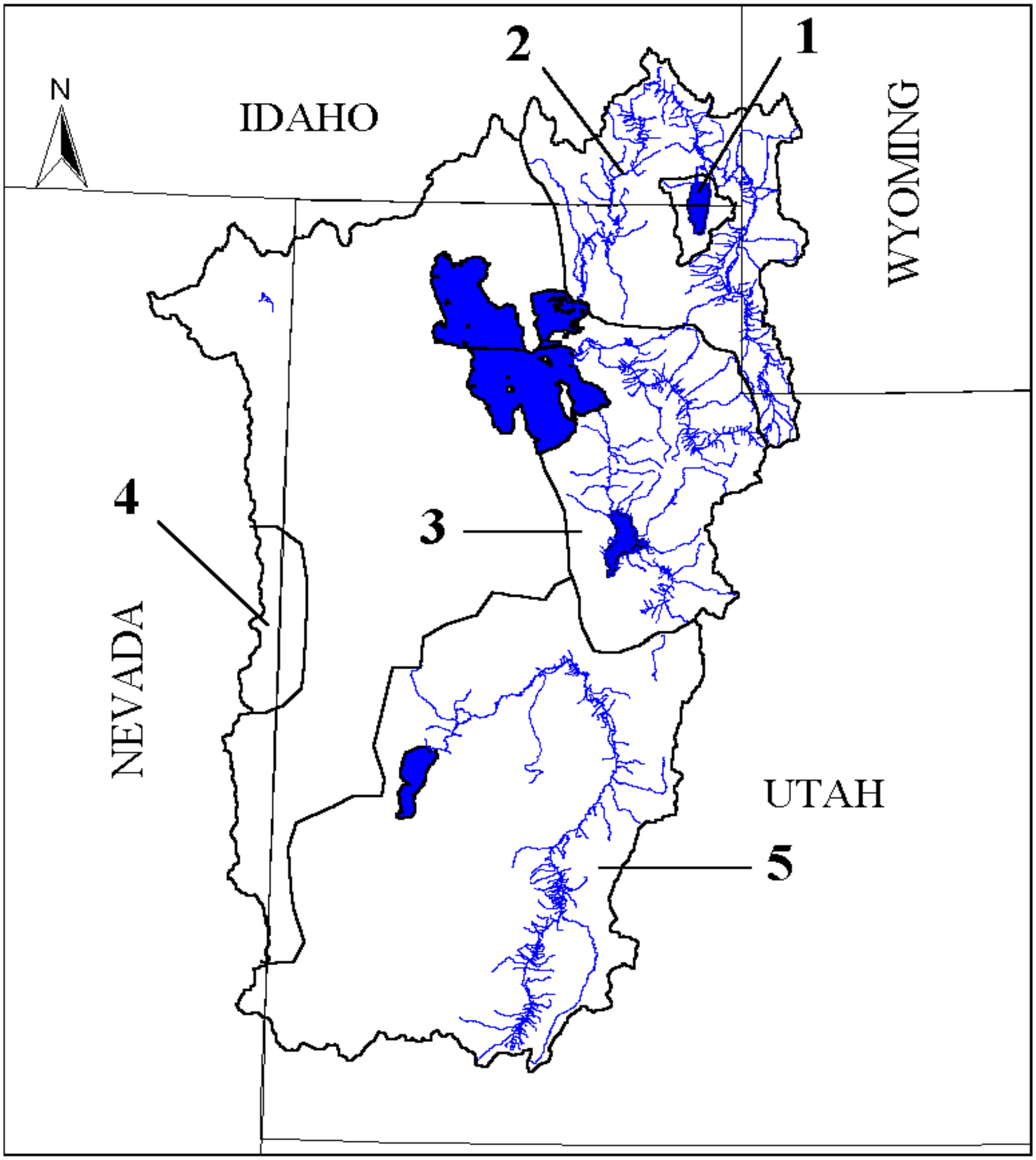
in the
State of Nevada

CONSERVATION AGREEMENT

PURPOSE

This Conservation Agreement (Agreement) has been developed to expedite implementation of conservation measures for the Bonneville cutthroat trout (BCT) in that portion of the West Desert General Management Unit (GMU) (Figure 1) located within Nevada. The development of the Agreement has been a collaborative and cooperative effort among resource agencies, governments and land owners. The desired outcome is to ensure the long-term conservation of the BCT within its historic range in Nevada, and contribute to development of range-wide conservation efforts for BCT. The parties to this Agreement also believe that by implementing the conservation measures herein defined, the need to list BCT as a threatened or endangered species may be precluded. Threats that warrant BCT listing as threatened or endangered under the Endangered Species Act of 1973, as amended (ESA), should be significantly reduced or eliminated through implementation of this Agreement and the associated Conservation Strategy (Strategy). This Agreement will provide additional measures to enhance the BCT in Nevada that would not be required under the ESA (Appendix A).

Figure 1. Geographic Management Units (GMU) Designated for Bonneville Cutthroat Trout Conservation (1 = Bear Lake; 2 = Bear River; 3 = Northern Bonneville; 4 = West Desert; 5 = Southern Bonneville).



GOAL

The goal of this Agreement is to ensure the long-term existence of BCT within its historic range in Nevada by coordinating conservation efforts with the Nevada Department of Wildlife (NDOW), U.S. Forest Service (USFS), National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), and Bureau of Land Management (BLM).

OBJECTIVES

Two objectives have been identified that are required to meet the goal of this Agreement. Each general objective has specific components that must also be met.

Objective 1

Manage for a minimum of14 conservation populations of Bonneville cutthroat trout in Nevada, including the following:

- Maintain 1 core population inhabiting 11.8 stream km (7.3 miles) in the appropriate proportion and quality of lotic habitats within the West Desert GMU in Nevada (Table 2, Strategy).

- Establish and/or maintain a minimum of 10 reintroduced populations including 2 limited metapopulations inhabiting 78.0 stream km (48.4 miles) in the appropriate proportion and quality of lotic habitats within the West Desert GMU in Nevada (Table 2, Strategy).

- Maintain 3 introduced populations inhabiting 11.5 stream km (7.1 miles) in the appropriate proportion and quality of lotic habitats outside the West Desert GMU in Nevada for purposes of preserving the genetic integrity of the Snake Valley BCT for future transplants and reintroductions. (Table 2, Strategy).

- Explore opportunities for further expansion of BCT.

Objective 2

Eliminate the threats to BCT in Nevada that may warrant listing as a threatened or endangered species under the ESA.

These objectives will be accomplished through implementation of specific strategies and management actions as detailed in the Strategy. The signatories agree that the status of the BCT will be evaluated periodically to assess conservation progress. Amendments will be added to address newly identified BCT conservation issues and to ensure program effectiveness as needed.

OTHER SPECIES INVOLVED

The primary focus of this Agreement is the conservation and enhancement of the BCT and the ecosystems upon which it depends. The needs of other species of concern (Appendix B), as well as species that are native to the area will be considered in planning and designing management actions to benefit the BCT. Using an ecosystem approach could minimize or possibly eliminate threats to these native plant and animal species, which could preclude their need for federal listing under the ESA.

SIGNATORY PARTIES

Nevada Department of Wildlife, 1100 Valley Road, Reno, Nevada 89520

U.S. Fish and Wildlife Service, 1340 Financial Boulevard, Suite 234, Reno, Nevada 89502

Bureau of Land Management, Nevada State Office, 1340 Financial Boulevard, Reno, Nevada 89502-7147

National Park Service, Pacific West Region, 1111 Jackson Street, Oakland, California 94607-4807

Forest Service, Humboldt-Toiyabe National Forest, 1200 Franklin Way, Sparks, Nevada 89431

Separate Memorandum(s) of Understanding and Cooperative Agreements will be developed with additional parties and supporting entities as necessary to ensure implementation of specific conservation measures. Interested local governments (city, county, etc.), environmental organizations, sportfishing organizations, and individuals will be given an opportunity to review and provide input on specific actions.

SUPPORTING ENTITIES

Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, UT 84116

Trout Unlimited, Southern Nevada Chapter, 733 Greycliff Terrace, Henderson, NV 89015

Trout Unlimited, Great Basin Chapter, P.O. Box 117, Baker, NV 89311

Hidden Canyon Guest Ranch, P.O. Box 66, Baker, NV 89311

Deep Creek Mountain Ranch, 380 Callao Star Rt., Wendover, UT 84083

Confederated Tribes of the Goshute Reservation, Goshute Natural Resource Commission, P.O. Box 6104, Ibapah, UT 84034

AUTHORITIES

- The signatory parties hereto enter into this Agreement and attached Strategy under Federal and State laws as applicable, including but not limited to, Section 2(c)(2) of the Endangered Species Act of 1973, as amended, and sections 501.351 and 503.584 of Nevada Revised Statutes (NRS).

- Section 6(c)(1) of ESA provides encouragement to the states and other interested parties, through federal financial assistance and a system of incentives, to develop and maintain conservation programs, which meet national and international standards. This is a key to meeting the United States' international commitments and to better safeguard, for the benefit of all citizens, the Nation's heritage in wildlife and plants.

- NRS 503.351 provides authority for the Director of NDOW to enter into cooperative agreements for the purpose of the management of native wildlife. NRS 503.584 recognizes the State's obligation to conserve and protect imperiled native species.

- Nevada BLM sensitive species are designated by the BLM Nevada State Director and are protected by the policy described for candidate species as a minimum. The BLM shall carry out management consistent with the principals of multiple use, for the conservation of candidate species and their habitats and shall ensure that actions authorized, funded, or carried out do not contribute to the need to list any of the species as threatened or endangered (BLM Manual section 6840.06). Authority and direction for the conservation of fish, wildlife, and plants is found in the Federal Land Policy and Management Act of 1976 as amended (Sections 5, 6, 7, and 10), the Endangered Species Act as amended, Fish and Wildlife Coordination Act, and Fish and Wildlife Act of 1956.

- The National Forest Management Act (NFMA) requires the Secretary of Agriculture to specify guidelines for land management plans developed to achieve the goals which provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives [16 USC 1604 (g)(3)(B)].

- The Forest Service Manual provides specific direction for managing sensitive species on National Forest Lands (Forest Service Manual sections 2670.22, 2670.32). The Forest Service will develop and implement management practices to ensure that species do not become threatened or endangered because of Forest Service actions. The Forest Service will maintain ecosystem biodiversity and habitats necessary to sustain native and desired non-native species throughout their geographic range on National Forest System lands. The Forest is also directed to establish objectives for Federal candidate species, in cooperation with the U.S. Fish and Wildlife Service and the States.

- National Park Service Management Policies (2001) state, in part, that: The National Park Service will maintain as parts of the natural ecosystems of parks all native plants and animals…The NPS will achieve this maintenance by:
    - Preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
    - Restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
    - Minimizing human impacts on native plants, animal populations, communities, and ecosystems, and the process that sustain them (4.4.1).

  In addition, to maintaining all native plant and animal species and their habitats inside parks, the NPS will work with other land managers to encourage the conservation of the populations and habitats of these species outside parks whenever possible. To meet its commitments for maintaining native species in parks, the Service will cooperate with states, tribal governments, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service as appropriate (4.4.1.1).

- All parties to this Agreement recognize that they each have specific statutory responsibilities that cannot be delegated, particularly with respect to the management and conservation of these fish, their habitat, and the management, development, and allocation of water resources. Nothing in this Agreement or the Strategy is intended to abrogate any of the parties' respective responsibilities.

- This instrument in no way restricts the parties involved from participating in similar activities with other public or private agencies, organizations, or individuals.

- Modifications within the scope of this instrument shall be made by the issuance of a bilaterally-executed modification prior to any changes being performed.

- This Agreement is subject to and is intended to be consistent with all applicable federal and state laws and compacts.

CONSERVATION SCHEDULE AND ASSESSMENT

Coordinating conservation activities, implementing conservation activities, and reviewing progress will be conducted as follows:

Coordinating Conservation Activities

- Administration of the Agreement will be conducted by the Nevada Bonneville Cutthroat Trout Conservation Team (NBCTCT). The team will consist of a designated representative from each signatory to this Agreement and may include technical and legal advisors and other members as deemed necessary by the signatories.

- The designated team leader of the NBCTCT will be a representative from NDOW.

- Authority of the NBCTCT shall be limited to making recommendations for the conservation of BCT to the appropriate agency having jurisdiction over proposed actions.

- The NBCTCT will meet at least annually to review progress in implementing conservation actions, develop conservation schedules, and revise the Strategy as required.

- NBCTCT meetings will be open to the public. Meeting minutes and progress reports will be distributed to all NBCTCT members and to other interested parties upon request. The duties for taking and developing meeting minutes and developing progress reports will be rotated amongst team members or on a volunteer basis by any team member.

Implementing Conservation Schedule

- A total of 10 years is anticipated for completion of all strategies and actions identified and specified in the Strategy. Nevertheless, the parties agree that significant actions to benefit BCT will be implemented within the first five (5) years. Actions will be recommended by the NBCTCT. Where no time for completion is stated, the timing of such actions will be determined by the NBCTCT.

- Conservation actions will be scheduled and reviewed on an annual basis by the signatories on recommendations from the NBCTCT. The Strategy is a flexible document and may be revised as needed if agreed upon by the NBCTCT.

- As leader of the NBCTCT, NDOW, in concert with responsible agencies, will coordinate and monitor progress in achieving outcomes identified in the Agreement.

Funding Conservation Activities

- Funding for the Agreement will be provided by a variety of sources. Federal, state and local sources will need to provide or secure funding to initiate actions identified in this Agreement.

- Agencies will seek long-term funding for the management actions initiated and for monitoring needs and will pursue alternative funding sources and partnerships to supplement agency work programs as opportunities are identified and available.

- In-kind contributions such as personnel, field equipment, supplies etc., will be provided by participating agencies, partners, and volunteers. In addition, each agency will identify specific tasks, responsibilities and proposed actions/commitments related to their in-kind contributions, as outlined in the Strategy.

- It is understood that all funding commitments made under the Agreement are subject to budget authorization and approval by appropriate agency or government appropriation.

Conservation Progress Assessment

- An annual progress report and assessment will be completed by the NBCTCT and provided to signatories to this Agreement. The assessment will consider the effectiveness of conservation activities in achieving the desired goals and objectives of the Agreement, and whether modifications are needed.

- If threats to the survival of the BCT become known that are not or cannot be resolved through this Agreement, NDOW will immediately notify all signatories.

DURATION OF AGREEMENT

The initial term of this Agreement shall be 10 years. Prior to the end of each 5-year period, a thorough analysis of actions implemented for the species will be conducted by the NBCTCT. If all signatories agree that sufficient progress has been made towards the conservation of the BCT, this Agreement shall be extended for an additional five (5) years. During the last year in which it is valid, the Agreement will be reviewed and either modified, renewed, or terminated. Any party may withdraw from this Agreement on sixty (60) days written notice to the other parties.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

The Agreement and attached Strategy are being developed for planning purposes. Before any Federal actions can occur on USFS, BLM, or NPS administered lands, a determination must be made whether or not the Agreement and Strategy are consistent with existing land use plans and whether or not NEPA analysis is required. Certain actions by the State of Nevada are not subject to NEPA analysis, with some exceptions where Federal funding is utilized.

FEDERAL AGENCY COMPLIANCE

During the performance of the Agreement, the participants will abide by the terms of Executive Order 11246 on non-discrimination and will not discriminate against any person because of race, color, religion, gender, or national origin.

No member of, or delegate to, Congress or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise there from. Nevertheless, this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Table 1. Responsibilities by NBCTCT Team Member					
Responsibility	NBCTCT Team Members				
	NDOW	NPS	BLM	USFS	USFWS
Monitor conservation populations of BCT in Nevada.	L	C	P	P	P
Maintain and expand BCT distribution within the West Desert GMU through transplants and reintroductions from core populations, reintroduced populations, or introduced populations.	L	C	P	P	P
Genetically characterize populations of BCT in Nevada.	L	C	P	P	P
Protect the genetic integrity of the Snake Valley BCT.	L	C	P	P	P
Determine BCT metapopulation potential for BCT in Nevada.	L	P	P	P	P
Maintain and enhance BCT habitat in Nevada.	P	C	C	C	P
Monitor BCT habitat in Nevada.	C	C	C	C	P
Selectively control non-native species adversely affecting BCT in Nevada.	L	C	P	P	P
Monitor BCT utilization.	C	C	P	P	P
Enforce existing regulatory mechanisms to ensure compliance.	A				
Reduce social-political conflicts concerning BCT conservation in Nevada.	A				
Eliminate or reduce threats to BCT in Nevada associated with climatic events.	A				
Ensure funding of BCT conservation measures.	A				

L=Lead, C=Co-Lead, P=Participant/Assistant, A=All Cooperators

Note: The Great Basin National Park has jurisdiction over fish populations within its boundaries which cannot be delegated. Therefore, the NPS is the leader for all responsibilities that relate to protecting BCT within its boundaries.

SIGNATORIES

In Witness Whereof, the parties have caused this Conservation Agreement for the Nevada populations of Bonneville cutthroat trout to be executed as of the date of the last signature below:

_____________________________ Director Nevada Department of Wildlife	______________________ Date
_____________________________ Jonathan B. Jarvis, Regional Director Pacific West Region, National Park Service	______________________ Date
_____________________________ Edward C. Monnig, Forest Supervisor U.S.D.A. Forest Service Humboldt-Toiyabe National Forest	______________________ Date
_____________________________ Ron Wenker, State Director U.S.D.I. Bureau of Land Management Nevada State Office	______________________ Date
_____________________________ Robert D. Williams, Field Supervisor U.S.D.I. Fish and Wildlife Service Nevada Fish and Wildlife Office	______________________ Date

CONSERVATION STRATEGY

FOR

BONNEVILLE CUTTHROAT TROUT

in the

State of Nevada

CONSERVATION STRATEGY

INTRODUCTION

This Conservation Strategy (Strategy) has been developed to provide a framework for the long-term conservation of Bonneville cutthroat trout (*Oncorhynchus clarki utah*) (BCT) throughout its historic range in Nevada. This document will serve as a local strategy tiered under the *Range-Wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout*, which governs conservation activities the species throughout its entire historic range (Utah Division of Wildlife Resources - Publication Number 00-19). This Strategy outlines, reiterates, and summarizes the conservation measures outlined in the Nevada Species Management Plan for Bonneville Cutthroat Trout (Haskins 1987) and the Great Basin National Park (GBNP) Bonneville Cutthroat Trout Reintroduction and Recreational Fisheries Management Plan (NPS 2000). As stated in the Conservation Agreement (Agreement), implementation of the strategies and actions summarized in this document will reduce or eliminate the threats to Bonneville cutthroat trout (BCT) that may warrant listing as a threatened or endangered species under the Endangered Species Act (ESA) of 1973, as amended.

PURPOSE

The primary purpose of this Strategy is to outline a framework for management actions that will provide for the goal of long-term conservation of Bonneville cutthroat trout (BCT) and its habitat in Nevada. This Strategy identifies objectives, strategies, and actions that are necessary to eliminate or reduce threats and provide for the long-term conservation of the BCT in Nevada such that listing under ESA by the U.S. Fish and Wildlife Service (USFWS) may be precluded.

The conservation of the BCT will require the elimination or reduction of threats, improving degraded habitat conditions, and restoring many of the natural functions of associated riparian systems. Habitat protection and restoration efforts will also benefit many other species, including sensitive plants and animals that share these ecosystems. (Appendix B). Conservation activities implemented to conserve the BCT are also predicted to be beneficial to the drainages associated with BCT habitat by maintaining and improving hydrologic function and ecosystem health.

BACKGROUND

Cutthroat trout (*O. clarki*) have the widest distribution of any western trout species, ranging from southern Alaska to northern California and inland in the Columbia River, Missouri River, Southern Rocky Mountains, and Great Basin drainages. According to Behnke (1992), this species is comprised of fourteen separate subspecies, including the Bonneville cutthroat trout (*O. c. utah*). The BCT represents a subspecies of cutthroat trout native to pluvial Lake Bonneville. During the Pleistocene epoch, Lake Bonneville and its drainages covered a large portion of Utah and parts of Nevada, Wyoming, and Idaho. At its maximum size, Lake Bonneville extended over 51,840 km² and had a depth of over 300 m. Its drainages included the Bear, Provo, Weber, Sevier, Jordan, Black's Fork, Beaver and Snake Valley. In Nevada, Bonneville basin drainages included the extreme eastern portion of the State along the present-day Nevada-Utah border including the east slopes of the Snake, Goshute, and Pilot Ranges, and the Thousand Springs Creek drainage. The Snake Valley drainage represents the only portion of this area that is known to have been historically occupied by BCT.

It is assumed that BCT historically occupied all suitable habitats within the Pleistocene Lake Bonneville basin. Behnke (1992) suggests that the desiccation of ancient Lake Bonneville, about 8,000 years ago, fragmented the BCT into remaining streams and lakes throughout the basin, resulting in several slightly differentiated groups of BCT: the Bear River basin, Bonneville basin proper including the Wasatch Mountain and Sevier River drainages, and the Snake Valley, an arm of ancient Lake Bonneville which was isolated during an earlier desiccation event.

Bonneville Cutthroat Trout Systematics

BCT probably evolved as the top predator of minnows, suckers and whitefish predecessors in ancient Lake Bonneville. With desiccation of the large pluvial lake, cutthroat trout diversified among remaining lakes and into upstream reaches of lake tributaries. In historical (mid 1800's) times, only Panguitch Lake, Utah Lake, and Bear Lake retained lacustrine populations, and most streams with adequate habitat retained fluvial BCT populations. Currently, all natural lake populations, except that of Bear Lake, are extinct, and stream populations are mainly restricted to isolated headwater reaches.

Researchers have not reached consensus on the evolutionary history of BCT. Behnke (1979, 1992) postulated that cutthroat trout might have gained access to the Bonneville Basin at multiple times when Lake Bonneville reached varying elevations during past geologic events. Thus, some natural evolutionary differences may be evident among drainages in the Bonneville Basin that became geographically isolated at different geologic time periods. Behnke (1992) categorized BCT into three types based on slight variations in meristic characteristics: 1) a type from the Bear River drainage in northern Utah, southeast Idaho, and southwest Wyoming; 2) the Snake Valley type from the region which borders Utah and Nevada; and 3) a type from the remaining Bonneville Basin drainages which includes the Ogden, Provo, Weber, and Sevier River drainages. There is general consensus among the scientific community that all three groups represent the BCT subspecies.

Loudenslager and Gall (1980) also discussed the ancestry of BCT. They theorized that Colorado River cutthroat trout (*O. c. pleuriticus*) and BCT are closely related and share a common ancestor, but that Bear River BCT represent a subsequent invasion of Yellowstone cutthroat trout (*O. c. bouvieri*) into the Bonneville Basin. Therefore, the Bear

River BCT might be a subgroup of the Yellowstone cutthroat subspecies (YCT). Limited mitochondrial DNA (mtDNA) analysis of BCT by Williams and Shiozawa (1989) supported the idea of diverse origins or multiple, independent mtDNA mutations in the basin. Later, Shiozawa *et al.* (1993) categorized BCT into three types different from Behnke (1992). The subgroups were: (1) the Bear River type, (2) the Southern Bonneville type (from the Virgin River drainage), and (3) the main Bonneville Basin type. Shiozawa found that analysis of restriction fragment length polymorphisms (RFLPs) in mtDNA of Bear River BCT indicate this group is more closely related to YCT than to other BCT which further supports Loudenslager and Gall (1980).

Using protein electrophoresis, Wydoski *et al.* (1976) discovered a unique enzyme characteristic in BCT from the Snake Valley area, providing evidence of genetic divergence within that group. Loudenslager and Gall (1980) also detected genetic divergence among groups of BCT using protein electrophoresis. These fish were separated into two groups: the Bear River type (Bear River drainage only) and Snake Valley type. Within these groups, the Bear River type was more similar to YCT than to BCT found elsewhere, while the Snake Valley type was more similar to Colorado River cutthroat trout (CRCT) than to the Bear River type. In addition, Martin *et al.* (1985) determined that Bear River cutthroat trout were distinct from all other BCT using protein electrophoresis, which further confirmed the similarities between the Bear River type BCT and YCT.

Because of the diverse nature of the BCT subspecies, more work is required before phylogeny and intraspecific relationships can be accurately interpreted (see review in Schmidt *et al.* 1995). However, immediate attention is needed to conserve BCT as a subspecies throughout its range. Behnke and Zarn (1976) advise that the various existing types should be considered unique and should not be genetically mixed among types because much of the evolutionary history of this subspecies remains unknown. Based on current knowledge, all types of cutthroat within the Bonneville basin are considered BCT, however, management agencies respect the divergence between drainages and as a general rule, do not transfer fish between groups.

Genetic analysis conducted by the Wild Trout and Salmon Laboratory at the University of Montana (Cremins and Spruell 2003) showed BCT populations in Pine/Ridge, Mill, and Hendry's Creeks to be genetically divergent from one another. Genetic evaluation of fin samples from these streams showed little evidence to suggest that any one population was founded from another. Therefore, due to these dissimilarities, BCT from these populations should not be mixed in reintroduction activities.

For the purposes of this strategy only BCT from Nevada conservation populations, identified as pure by genetic analysis, will be used for reintroduction purposes. The relationships between Snake Valley populations found in Nevada and those in the Deep Creek Range of Utah and on the Goshute Indian Reservation need to be explored in the future. A comprehensive genetic evaluation of these populations would hopefully reveal their origin, which is confused by transplants made by early settlers of the region.

Bonneville Cutthroat Trout Morphometrics

BCT generally have large, evenly distributed spots, but there is a high degree of intra-basin variation. BCT tend to develop large pronounced spots that are more evenly distributed on the sides of the body rather than concentrated posteriorly, as in the Yellowstone subspecies. Coloration is generally dull in comparison to other cutthroat subspecies, however, coloration can vary depending on environmental conditions and local genetic composition. Vertebrae typically number 62-63, slightly higher than in other subspecies. Scales in lateral series average 150-170, with the lowest number found in the Snake Valley type of BCT and the highest number found in Bear River BCT. Pyloric caeca number between 25-55, with a mean of 35, except in the Bear River drainage, which typically average more than 40 caeca. BCT average between 16-21 gill rakers, with a mean of 18-19, except for Snake Valley BCT, which have 18-24 (mean, 20-22). Another important characteristic of all cutthroat subspecies is the presence of basibranchial teeth, which are absent in rainbow trout (Behnke 1992). Numbers of basibranchial teeth provide information about subspecies derivation and relatedness. The Snake Valley BCT has profuse basibranchial teeth, averaging 20-28, while most other BCT average 5-10 (Behnke 1992).

Bonneville Cutthroat Trout Life History

May *et al.* (1978) found that male BCT sexually matured at age 2 while females matured at 3 years of age. Both the age at maturity and the annual timing of spawning vary geographically with elevation, temperature and life history strategy (Behnke 1992, Kershner 1995). Lake resident trout may begin spawning at two years and usually continue throughout their lives, while adfluvial individuals may not spawn for several years (Kershner 1995). Annual spawning of BCT usually occurs during the spring and early summer at higher elevations (Behnke 1992) at temperatures ranging from 4° –10°C (May *et al.* 1978). May *et al.* (1978) reported BCT spawning in Birch Creek, Utah beginning in May and continuing into June. BCT in Bear Lake, Utah began spawning in late April and completed spawning in June (Nielson and Lentsch 1988). The wild broodstock at Manning Meadow Reservoir, Utah (9,500-ft. elevation) spawn from late June to early July (Hepworth and Ottenbacher 1995). In Lake Alice, Wyoming, fish were predicted to spawn from late May until mid-June (Binns 1981).

In Nevada, BCT spawning activities have been documented on numerous occasions. BCT were actively engaged in spawning at Hendry's Creek (North Snake Range, Nevada) on June 20, 1972 in water temperatures of 11°C. In 2002, BCT spawning was observed at Mill Creek (South Snake Range, Nevada) from June 26th to July 3rd at average temperatures of 12°C (NPS). In addition, BCT spawning activities were noted on July 1, 2003 at Pine Creek (South Snake Range, Nevada) in water temperatures of 12°C.

Typical of most trout, BCT require relatively cool, well-oxygenated water and the presence of clean, well-sorted gravels with minimal fine sediments for successful spawning. However, BCT have also been found to survive and be fairly robust in what is considered marginal salmonid habitat conditions (e.g. turbid water, fine sediments, warmer temperatures, poor structural habitat). This may be because BCT have evolved in a desert environment where climate can cause fluctuations in water, sediment regimes, and environmental conditions. Kershner (1995) found substrate size to be proportional to body size. For example, large adfluvial BCT typically spawn in large gravels or cobbles, while smaller, stream resident BCT spawn over coarse sand or small gravels.

Little information exists to document fecundity of wild BCT; however, trout fecundity is typically between 1800-2000 eggs per kilogram of body weight (Behnke 1992). In Birch Creek, a 147 mm female produced 99 eggs, a 158mm female produced 60 eggs, and a 176 mm female produced 176 eggs (May et at. 1978). In addition, 3 females, ranging from 124 mm to 246 mm, averaged 165 eggs in Raymond Creek, Wyoming (Binns 1981). Evidence suggests fecundity of lake-dwelling BCT is higher. Fecundity of females in Lake Alice averaged 474 eggs per female (Binns 1981), while females in Manning Meadow Reservoir averaged 994 eggs per female (D. Hepworth, UDWR unpubl. data). Platts (1957) suggested eggs hatch and fry begin to emerge approximately 45 days after spawning.

Incubation times for wild BCT have not been verified, but may be approximated from other wild cutthroat trout such as Yellowstone cutthroat trout which average 310 degree-days (the sum of mean daily temperatures above 0°C) (Gresswell and Varley 1988). For hatchery-incubated eggs from Manning Meadow Reservoir, degree-days to hatching varied from 329-345 (D. Hepworth, UDWR unpubl. data). Fry typically emerge in mid to late summer, depending on spawning times. Once emerged, fry are poor swimmers and typically migrate to stream margins.

Growth of BCT is highly dependent on stream productivity. In general, growth of trout tends to be slower in high elevation headwater drainages than in lentic environments, but is likely dependent on temperature and food base. In Birch Creek, Utah, average lengths of fish ages 1 through four were 84 mm, 119 mm, 158 mm, and 197 mm (May *et al.* 1978). In two Wyoming streams, age four fish averaged 282-320 mm (Binns 1981). In contrast, BCT in Bear Lake grow to an average size of 560 mm and 2 kg (Nielson and Lentsch 1988). Historic accounts of BCT in Utah Lake suggest fish may have reached a meter in length (notes from Yarrow and Henshaw in 1872 as described by Tanner 1936). Platts (1957) reported that some BCT taken from Utah Lake a century ago attained weights of over 11.4 kilograms (25 pounds).

For more detailed life history information, see the BCT review by Kershner (1995).

CONSERVATION GUIDELINES

Range-wide conservation efforts for BCT are based on sound principles of conservation biology (Soule and Wilcox 1980). Generally, important factors for the long-term conservation of species include conservation genetics, meta-population dynamics, and habitat restoration and preservation. Furthermore, loss of one species from a community can precipitate extinction of coexisting species if they are strongly interdependent (Terbough 1976, Gilbert 1980). A sound conservation management approach will not only support the persistence of BCT, but will also promote ecosystem health.

Conservation Genetics

Proper management of any species recognizes the existence of different levels of genetic diversity that exist both within and among populations. Among population variation is the result of geographical isolation and selection and/or drift. Populations become more divergent the longer they have been isolated and/or the more variation there is in the habitat of the populations (Toline and Lentsch 1999). Among population variation provides the basis for the establishment of Geographical Management Units (GMU), which are defined not only by genetic (nuclear and mitochondrial DNA) variation, but also by factors including geography, life history, meristic and morphological traits, and molecular data. For management purposes, five GMUs have been established across the historic range of BCT (Range-wide CA/CS). Of these, all BCT populations in Nevada are located within the West Desert GMU. To preserve among population variation and prevent the risk of outbreeding depression and resulting loss of fitness, individuals from different GMUs should not be mixed.

Maintenance of within population variation is important as well. Levels of genetic variation within populations are indicative of current and historical reductions in genetic effective population size (Ne) and can often be suggestive of the likelihood of inbreeding. Preservation of genetic variation within populations is critical to prevent inbreeding depression and resulting loss of fitness as well.

Historical stocking of nonnative salmonids (e.g. rainbow trout) over many native populations of cutthroat trout has lead to hybridization and is likely responsible for the loss of some populations. Identification of BCT conservation populations must therefore include an assessment of their genetic purity.

Identification of conservation populations in Nevada will include both an assessment of the genetic purity of the population and the relationship to other BCT populations within the West Desert GMU. Factors to be taken into consideration in the identification and designation of populations will include molecular analysis of nuclear markers (e.g. RAPDs, microsatellites, SINES, allozymes, PINES), mitochondrial DNA analysis, meristic and morphological traits, and historical stocking records. Other factors, however, will also be critical in a final assessment of what populations should be considered as potential conservation populations. All precautions should be taken into account to maintain both among population and within population variation in Nevada. Procedures outlined by Toline and Lentsch in *Guidelines and Protocols for Identification and Designation of Populations of Native Cutthroat Trout* (1999) will be strictly adhered to.

Metapopulations

Although individual populations should be managed and protected, some degree of interconnectedness among populations is also needed to maintain genetic exchange and stabilize population dynamics (Wilcox and Murphy 1985, Hanski and Gilpin 1991). Metapopulation persistence depends on the temporal and spatial dynamics of local populations connected through unobstructed migratory corridors (Wilcox and Murphy 1985; e.g., Gilpin and Hanski 1991).

Metapopulations stabilize local population dynamics in several ways: 1) migration of individuals allows genetic exchange among local populations, thereby increasing genetic heterogeneity (Simberloff and Abele 1976); 2) large, interconnected populations are less vulnerable to losses incurred through environmental and demographic stochasticity (Roff 1974, Wilcox and Murphy 1985); 3) large, interconnected populations are more resistant to changes in deterministic variables that dictate population stability, such as birth and survival rates (Connell and Sousa 1983, Rieman and McIntyre 1993).

In Nevada, very limited potential exists for restoration and/or enhancement of genetically pure populations within a metapopulation. Most streams are naturally isolated with no interconnections to adjacent watersheds. One stream system (Smith Creek, Deadman Creek, and Deep canyon Creek) may function as a limited metapopulation with the potential for BCT from two tributaries to migrate to the main stream, but not vice versa. Additionally, one other stream system (Snake Creek and tributaries) could also function as a limited metapopulation. BCT conservation in Nevada will be based on monitoring and active management to maintain and enhance viable population structure.

Habitat Management and Protection

Past land use activities have negatively affected habitat for BCT. Conservation measures for habitat protection should be incorporated into Resource Management Plans (BLM, NPS), Forest Plans (USFS), and land use plans (counties and states). Current guidelines exist for many agencies that should be used to direct existing and future land use activities. Examples of these guidelines might include Best Management Practices or other state water quality standards, Forest Plan Desired Conditions and Guidelines, and recommendations from related broad-scale assessments.

Sensitive Species Designation

The Regional Forester for the Intermountain Region of the U.S. Forest Service (USFS) (R4) has designated the BCT as sensitive. Sensitive Species are defined as those plant and animal species identified by a Regional Forester for which long-term sustainability should be provided. This designation as sensitive is designed to encourage decisions which may prevent a species from becoming a federally threatened or endangered species. The status of BCT was evaluated in the late 1980's and was determined to warrant regional designation as sensitive.

The Bureau of Land Management in Nevada has designated the BCT as sensitive. The BLM is mandated by policy (Manual 6840 Special Status Species Management) to “ensure that actions authorized, funded, or carried out do not contribute to the need to list any of these species as threatened or endangered.”

The National Park Service in the Great Basin National Park (GBNP) considers the BCT to be a sensitive or special status species warranting special management. The stated purpose for establishing the GBNP was to preserve a representative segment of the Great Basin of the Western United States. The recovery and maintenance of viable populations of salmonids native to the Great Basin region is consistent with the Park’s enabling legislation.

The Nevada Department of Wildlife currently classifies the BCT in Nevada Administrative Code (NAC), as a coldwater game fish. Previously classified as sensitive, it was determined that such a classification placed them in a protected status, which prohibits take according to State law. Various State laws and Department policies provide management direction for Nevada’s native wildlife species. Commission Policy Number P-33 states in part, “Native trout survival will receive priority in management prescriptions for any waters within historic distributions.”

Adaptive Management

This Strategy depends upon the successful implementation of adaptive management and its principles. Adaptive management is designed to bring new information immediately into new management direction. All cooperators agree and recognize, consistent with the goals of this Strategy, that monitoring actions and conservation measures implemented through the CA/CS will be conducted experimentally consistent with the concepts of adaptive management. The effectiveness of all conservation measures and monitoring methods will be periodically reviewed and evaluated by the NBCTCT. Based on such evaluation, appropriate modifications to strategies and actions will be made to ensure scientific rigor and the efficacy of conservation measures. It is critical that the signatories provide the resources necessary to ensure successful implementation of adaptive management and its principles.

The essential steps of the CA/CS adaptive management strategy are summarized as follows:

Step 1. Implement CA/CS conservation goals, objectives, and strategies.
Step 2. Initiate distribution and threat inventories, and habitat monitoring program.
Step 3. Review CA/CS conservation goals, objectives, and strategies and adjust as necessary based on updated information.
Step 4. Prioritize locations for implementation of conservation actions.
Step 5. Initiate site-specific actions to reduce or eliminate threats.
Step 6. Establish monitoring plan to determine effectiveness of conservation actions.
Step 7. Analyze and evaluate monitoring results to determine progress towards attainment of conservation objectives.
Step 8. Return to Step 3.

STATUS AND DISTRIBUTION OF BCT IN NEVADA

Population Status

In 1979, the USFWS was petitioned to review the status of the BCT under the ESA. The USFWS announced a status review of the BCT and requested comments in 1980 (45 *FR* 19857, March 26, 1980). In 1982, the USFWS classified the BCT as a category 2 candidate species (47 *FR* 58454, December 30, 1982) and in 1985 re-classified the BCT as a category 1 candidate species (50 *FR* 37958, September 18, 1985). The USFWS published a warranted but precluded finding for BCT because of higher priority actions in 1988 (53 *FR* 25511, July 7, 1988). In 1991, BCT was included as a category 2 candidate species in an Annual Notice of Review (56 *FR* 58804, November 21, 1991), and the USFWS re-classified the BCT as a category 2 candidate species in 1994 (59 *FR* 58982, November 15, 1994). The USFWS amended their candidate policy and removed categories in 1996 (61 *FR* 7457, February 28, 1996). As a result of this action, BCT lost its candidate status and became a species of concern. Species of concern have no status under the ESA. With the loss of candidate status the BCT also lost its 1988 warranted but precluded finding.

The USFWS received a new petition to list the BCT as a threatened species in 1998. The USFWS found that the petition presented substantial information indicating that listing this species as threatened under the ESA may be warranted, and they initiated a status review (63 *FR* 67640, December 8, 1998). A determination was made by the USFWS on October 9, 2001 that listing the Bonneville cutthroat trout as threatened throughout its range was not warranted at the time (50 *FR* 51362). Furthermore, a status review completed by the USFWS (October 2001) stated that, “The trajectory of BCT status is towards an increasing number of populations, reduced threats, and improved habitat conditions.” An additional status assessment completed in 2004 (May and Albeke) stated that, “BCT currently occupy significant portions of, and are well distributed across, their historical range.”

On February 17, 2005, the Center for Biological Diversity, Pacific Rivers Council, and Biodiversity Conservation Alliance (Plaintiffs) filed suit in U.S. District Court challenging the USFWS's October 9, 2001 determination. The Plaintiffs are asking the court to set aside the USFWS's 12-month finding and require the USFWS to reevaluate the petition to list BCT as threatened.

Conservation activities throughout the range of BCT are currently coordinated through the *Range-Wide Conservation Agreement and Strategy for Bonneville Cutthroat Trout.* Completed in 2000 and updated in 2005, its goal is to ensure the long-term existence of BCT within its historic range by coordinating conservation efforts among states, tribal governments, federal management agencies, and other involved parties.

Species Distribution and Habitat Assessment

Current information on BCT in Nevada indicates that the status of this species has been improving over the last 4 decades. There are currently thirteen confirmed conservation populations of BCT inhabiting over 52.4 km (32.5 miles) of lotic habitats in Nevada (Table 2).

Table 2. EXISTING AND POTENTIAL BONNEVILLE CUTTHROAT TROUT CONSERVATION POPULATIONS IN NEVADA								
Stream (**E**= Existing Conservation Population **P**=Potential Conservation Population **C**= Core Population)	Summer Flow (cfs)	Kilometers (Miles) of habitat currently occupied	Kilometers (Miles) of BCT Habitat				Source & Year(s) of Reintroduction / Transplant	Mountain Range
			USFS	NPS	BLM	Private		
Within Bonneville Basin								
Big Wash Creek (E)	0.2 – 1.3	8.1 (5.0)	1.6 (1.0)			6.5 (4.0)	Hendry's Creek - 2003	South Snake
Deadman Creek (E)	1.0 – 2.0	6.1 (3.8)	6.5 (4.0)				Hendry's Creek - 1997, 1998, 1999	North Snake
DeepCanyon Creek (E)	0.3 – 0.9	0.8 (0.5)	5.6 (3.5)				Hendry's Creek - 2003	North Snake
Hampton Creek (E)	0.5 – 2.5	5.6 (3.5)	4.8 (3.0)		0.8 (0.5)		Pine/Ridge Creek - 1953	North Snake
Hendry's Creek (C)	1.2 – 3.0	11.8 (7.3)	11.8 (7.3)				Core Population	North Snake
Mill Creek (E)	0.1 – 1.5	2.6 (1.6)	0.8 (0.5)	1.8 (1.1)			Unknown	South Snake
Smith Creek (E)	0.8 – 3.1	4.4 (2.7)	11.3 (7.0)				Hendry's Creek - 1999	North Snake
Snake Creek (E)	0.5 – 3.0	2.4 (1.5)		8.5 (5.3)			Hendry's Creek - 2005	South Snake
S. Fork of Big Wash (E)	1.0 - 2.0	2.6 (1.6)		4.8 (3.0)			Mill Creek - 2000	South Snake
S. Fork of Baker Creek (P)	1.0 – 2.0	0.8 (0.5)		3.5 (2.2)			Mill Creek - 2005	South Snake
Strawberry Creek (E)	0.5 – 2.0	1.6 (1.0)	0.3 (0.2)	6.3 (3.9)	1.5 (0.9)	1.6 (1.0)	Mill Creek - 2002, 2005	South Snake
Outside Bonneville Basin								
Goshute Creek (E)	0.5 – 1.8	2.4 (1.5)			6.5 (4.0)		Pine/Ridge Creek - 1960	Cherry Creek
Pine & Ridge Creeks (E)	1.0 - 2.0	2.6 (1.6)	2.6 (1.6)				Unknown	South Snake
Deep Creek (E)	0.5 - 1.5	2.4 (1.5)	2.4 (1.5)				Goshute Creek	Quinn Canyon

Current distribution and habitat conditions for existing BCT conservation populations and potential BCT conservation populations in Nevada are discussed in the following section.

Existing BCT Conservation Populations Within Historic Range

Big Wash Creek

Located in the south Snake Range, Big Wash drains the south end of the Wheeler Peak area eastward into Snake Valley (Figure 2). Because water from the South Fork of Big Wash rarely reaches the main stem of Big Wash, the two are classified as separate streams for management purposes. Big Wash was treated with rotenone in 2001 to remove a competing salmonid population. BCT reintroduction was initiated in 2003 when a total of 143 BCT from Hendry's Creek were transplanted at four locations on the stream. Past angler use has been minimal due to its remote location and private nature.

Big Wash contains approximately 8.1 km (5.0 miles) of available habitat. The majority of this habitat is currently on private land that is operated as an environmentally themed guest ranch. In 1999, the landowner on Big Wash signed a memorandum of understanding with the USFWS and Trout Unlimited to conduct a number of habitat improvement projects on the stream. One such enhancement was the construction of an artificial spawning channel at a pond that is located on land administered by the USFS adjacent to the property. It is hoped that the pond and associated spawning channel will aid in the propagation of BCT in the adjacent stream. Although grazing impacts were severe in the past, current livestock use is minimal. Overall, habitat is stable and in good condition. A GAWS Level III habitat survey was completed on Big Wash in 2000. The average Habitat Condition Index (HCI) rating was 52.6%, which is fair. However, because six of eleven stations had no water at the time of the survey, ratings for pool measure, pool structure (quality pools), and stream bottom (desirable substrates) were skewed. The major limiting factor at stations with water was a lack of quality pools. With the exception of one station, riparian habitat conditions were rated good to excellent at all survey locations. Transect data showed gravel and rubble to comprise 70% of the substrate. Average density of brook trout prior to its eradication was 678 fish per mile. In 2001 and 2002, temperature-recording thermograph data showed maximum summertime temperatures in Big Wash to be well within the thermal limits for BCT throughout the length of the stream. An additional limiting factor on Big Wash is low flows, with ephemeral reaches during dry periods. There is low potential for a partial metapopulation at Big Wash. Migration from the South Fork of Big Wash may be possible during periods of extremely high flow, however, it is doubtful that BCT from Big Wash would migrate to the South Fork of Big Wash during these periods.

Deadman Creek

Located entirely within the Mount Moriah Wilderness Area of the North Snake Range, Deadman Creek drains the east side of Mount Moriah and is a tributary to Smith Creek (Figure 3). Deadman Creek was treated with rotenone in 1993 to remove competing and/or hybridizing salmonids. A total of 229 BCT have been re-introduced into the waters of Deadman Creek from upper Hendry's Creek on three separate occasions. The headwaters and upper reaches of Deadman Creek received 125 BCT in 1997 and 1998, while the portion of stream from its confluence with Deep Canyon Creek to the Smith Creek confluence received an additional 104 BCT in 1999. An electroshocking survey conducted in 2002 showed both the persistence of original reintroduced BCT and the presence of multiple age classes spawned in the stream since reintroduction. A population survey conducted in 2005 showed average BCT densities of 576 fish per mile. Angler use is minimal due to its very remote location.

Deadman Creek contains approximately 6.5 km (4.0 miles) of habitat, of which 6.1 km (3.8 miles) is currently occupied by BCT. Grazing impacts have been evident in the headwaters of Deadman Creek in recent years however, the remainder of the stream is in stable and favorable condition. Two aquatic macroinvertebrate stations were sampled in 1993 (pre-treatment) and 1994 (post-treatment) respectively. The Biotic Condition Index (BCI) ratings ranged from 71-75, with a mean of 75 in 1993 and 71.5 in 1994, which is fair. Biomass ranged from 0.7-2.0 g/m^2 (mean = 1.28), with 11,700 to 18,700 organisms/m^2. There were 26-33 taxa present (Mangum 1995). A GAWS Level III habitat survey was completed on Deadman Creek in 2000. The average HCI rating was 69%, which is fair, but 1% below the good range. Limiting factors included pool to riffle ratio and quality pools. Riparian habitat conditions were rated fair to good across most reaches except for a poor rating in the headwaters which was a result of poor grazing practices. Pebble count data showed an adequate amount (72%) of the substrate was composed of gravel and rubble. In 2002, temperature-recording thermograph data showed maximum summertime temperatures in Deadman Creek to be well within the thermal limits for BCT throughout the length of the stream. Potential for a limited metapopulation exists on Deadman Creek. BCT will be able to migrate to Deep Canyon Creek and Smith Creek but not vice versa due to the presence of a number of natural barriers located on Deadman Creek and Deep Canyon Creek.

Deep Canyon Creek

Located entirely within the Mount Moriah Wilderness Area of the North Snake Range, Deep Canyon Creek drains the east side of Mount Moriah and is a tributary to Deadman Creek (Figure 3). The stream was treated with rotenone in 1994 to remove competing and/or hybridizing salmonid populations. Reintroduction of BCT into Deep Canyon Creek was initiated in 2003 with the transplantation of 53 BCT from Hendry's Creek. Past angler use has been low to nonexistent due to its remote and inaccessible location.

Deep Canyon Creek contains approximately 5.6 km (3.5 miles) of available habitat, of which 0.8 km (0.5 mile) is currently occupied by BCT. Current habitat conditions on the stream are stable and in excellent condition. Livestock use is minimal. Two aquatic macroinvertebrate stations were sampled in 1993 (pre-treatment). The BCI ratings ranged from 81-83 (mean = 82), which is in the good range. Biomass ranged from 0.4-2.0 g/m^2 with 10,700 to 30,400 organisms/m^2 with 32-31 taxa present (Mangum 1995). A GAWS Level III habitat survey was completed on Deep Canyon Creek in 2001. The average HCI rating was 59.0%. Excluding one station that was dry during the survey elevates the rating to 70.6%, which is in the good range. Limiting factors included percent of quality pools and pool to riffle ratio. Riparian habitat conditions were rated excellent across all stations with no limiting factors. Pebble count data showed an adequate amount (77.0%) of the substrate was composed of gravel and rubble. In 2003, temperature-recording thermograph data showed maximum summertime temperatures in Deep Canyon Creek to be well within the thermal limits for BCT throughout the length of the stream. A limiting factor of Deep Canyon Creek is low flows during dry periods. Potential for a limited metapopulation exists on Deep Canyon Creek. BCT will be able to migrate to Deadman Creek and Smith Creek but not vice versa due to the presence of a number of natural barriers located on Deadman Creek and Deep Canyon Creek.

Hampton Creek

Located in the North Snake Range, Hampton Creek drains the east side of the Mount Moriah Wilderness Area into Snake Valley (Figure 3). Its BCT population was established from an introduction of 44 fish in 1953 from Pine Creek. A population survey conducted in 2004 showed average BCT densities of 194 fish per mile. Due to its remote location, angler use is minimal.

Hampton Creek contains approximately 5.6 km (3.5 miles) of habitat, all of which is occupied by BCT. Of this habitat, 1.6 km (1.0 mile) is in the Mount Moriah Wilderness Area, while 0.8 km (0.5 mile) is on BLM-administered land. BCT have been transplanted from the lower portion of the stream and relocated to the headwaters on two occasions (1996 & 1998) in effort to expand occupied habitat in the stream. Past impacts are noted from historical mining activities associated with an open pit garnet mine adjacent to the stream. The mine is currently not in production, but future activities should be monitored. Potential impact from mining activity is high if not properly designed. Habitat on Hampton Creek is currently stable and in favorable condition. One aquatic macroinvertebrate sample taken in 1987 had a BCI of 87, which indicates good quality (Mangum 1987). Five stations taken in 1995 had a BCI range of 78-83 with a mean of 80, which is in the good category. The biomass ranged from 0.1 to 0.5 g/m^2 (mean = 36), with 1,400 to 11,000 organisms/m^2. Thirty-two to 40 taxa were present (Mangum 1996). A GAWS Level III habitat survey was conducted in 2004. The average HCI rating was 63.4%, which is fair. Limiting factors included pool measure (pool / riffle ratio), pool structure (quality pools), and stream bottom, which was likely the result of extremely low discharge caused by five consecutive years of drought. Riparian habitat conditions were rated as good across all reaches, with no limiting factors noted. Pebble count data showed 91% of the substrate was composed of gravel and rubble; sufficient for BCT spawning. In 2004, temperature-recording thermograph data showed maximum summertime temperatures in Hampton Creek to be well within the thermal limits for BCT throughout the length of the stream. Limiting factors on Hampton Creek are low stream flows and high sedimentation in the lower portions of the stream during dry periods. There is no metapopulation potential at Hampton Creek.

Hendry's Creek

Located in the North Snake Range, Hendry's Creek drains the east side of the Mount Moriah Wilderness Area into Snake Valley (Figure 3). Hendry's Creek is thought to represent Nevada's lone remnant population of BCT. The lower 5.6 km (3.5 miles) has been treated three times to eliminate competing and/or hybridizing salmonids, most recently in 1992 with rotenone. Natural movement, coupled with transplants from above the natural barrier in 1996, 1997, and 1999 have reestablished a BCT population in the lower portion of the stream. BCT from above the barrier in Hendry's Creek have been used for reintroduction purposes at Deadman Creek (1997-1999), Deep Canyon Creek (2003), Smith Creek (1999), Big Wash (2003), and Snake Creek (2005). Genetic analysis (Cremins 2001) indicated all fish inhabiting the stream to be free of introgression. In addition, Hendry's Creek BCT were determined to be genetically divergent from those in Mill Creek and Pine/Ridge Creek (Cremins and Spruell 2003). A population survey conducted in 2004 showed average BCT densities of 865 fish per mile. Due to its remote location, angler use is light.

Hendry's Creek contains approximately 11.8 km (7.3 miles) of habitat, all of which is occupied by BCT. This stream is in good to excellent condition, with land use issues considered minimal. A GAWS Level III habitat survey was conducted in 1992. Overall habitat condition rated in the upper fair to good category. One aquatic macroinvertebrate sample was taken at the trailhead in 1987. It had a BCI of 67, (poor-partially due to the 1983 floods), 1.9 gm/m^2, and 24 taxa were present (Mangum 1987). The only limiting factor on Hendry's Creek is low stream flows in the lower portion of the stream during drought years. There is no metapopulation potential at Hendry's Creek.

Mill Creek

Located in the South Snake Range, Mill Creek drains the north end of the Wheeler Peak area eastward into Snake Valley (Figure 2). Although previously thought to represent a hybridized population, genetic analysis indicted them to be free of introgression from non-native salmonids (Shiozawa and Evans 2000, Cremins 2001). The origin of the Mill Creek BCT population is unknown at this time, although genetic evaluation showed the BCT in Mill Creek to be genetically divergent from BCT inhabiting both Pine/Ridge Creek and Hendry's Creek (Cremins and Spruell 2003). Mill Creek BCT have been used as a source stock for reintroduction activities at Strawberry Creek (2002 and 2005), the South Fork of Big Wash (2000), and the South Fork of Baker Creek (2005). A population survey conducted in 2004 showed average BCT densities of 950 fish per mile. Angler use is minimal due to its remote location and small size.

Mill Creek contains approximately 2.6 km (1.6 miles) of habitat, all of which is occupied by BCT. Cattle grazing practices in the Great Basin National Park ceased in 1999. Heavy sediment loads are evident during the spring runoff period in some years. Overall, the riparian area is considered to be in proper functioning condition (PFC - Greene and Mann 1997). The riparian area is very narrow and surrounded by an overstocked forest with many dead and downed trees. BCT spawning has been documented in the stream when daily average water temperatures reached 12°C. Quantitative and qualitative macroinvertebrate samples were collected from three sites in the Mill Creek watershed in 1999, with USFS BCI ratings ranging from 45-75, with a mean of 65, which is poor. Biomass ranged from 2,000-8,700 organisms/m^2. There were 11-30 taxa present (Vinson 1999). A substantial limiting factor on Mill Creek is its small size and low flow during drought periods. There is no metapopulation potential at Mill Creek.

Smith Creek

Located in the North Snake Range, Smith Creek drains the east side of the Mount Moriah Wilderness Area into Snake Valley (Figure 2). Both Deadman Creek and Deep Canyon Creek are tributaries to the stream. Smith Creek was treated with rotenone in 1996 to remove competing and/or hybridizing salmonid populations. A total of 90 BCT were re-introduced into the headwaters of Smith Creek from upper Hendry's Creek in 1999. An electroshocking survey conducted in 2002 showed both the persistence of original reintroduced BCT and the presence of multiple age classes spawned in the stream since reintroduction. A population survey conducted in 2005 showed average BCT densities of 528 fish per mile. Due to its remote location, angler use is minimal.

Smith Creek contains approximately 11.3 km (7.0 miles) of habitat, all of which is located in the Mount Moriah Wilderness Area. Approximately 4.4 km (2.7 miles) are currently occupied by BCT. Livestock use is of some concern in the headwater area of Smith Creek and intermittently along the length of the stream. Overall, habitat is stable and in good condition. Five aquatic macroinvertebrate stations were sampled in 1996 prior to its eradication. The BCI ratings ranged from 68-87, with a mean of 71, which is poor. Biomass ranged from 1.0-5.2 g/m^2 (mean = 2.92), with 2,900 to 30,000 organisms/m^2. There were 25-31 taxa present (Mangum 1996). A GAWS Level III habitat survey was completed on Smith Creek in 1999. The average HCI rating was 64.7%, which is fair. Both pool to riffle ratio and quality pool figures were rated as poor across most reaches and would normally be considered limiting factors. However, because the survey was conducted during the peak of the springtime runoff period, these ratings are not true reflections of normal parameters at Smith Creek. Riparian habitat conditions were rated fair to good across all reaches. Pebble count data showed an adequate amount (65.5%) of the substrate was composed of gravel and rubble. In 2001, temperature-recording thermograph data showed maximum summertime temperatures in Smith Creek to be well within the thermal limits for BCT throughout the length of the stream. Additional limiting factors on Smith Creek are low flows and ephemeral stretches evident during dry periods below the Rye Grass Canyon confluence. Potential for a limited metapopulation exists on Smith Creek. BCT will be able to migrate from Deadman Creek and Deep Canyon Creek but not vice versa due to the presence of a natural barrier located on lower Deadman Creek.

Snake Creek

Located in the south Snake Range, Snake Creek drains the east side of the Wheeler Peak area eastward into Snake Valley (Figure 2). The Snake Creek system is composed of North, Middle, and South Forks of Snake Creek, which combine to make up the main channel, forming a limited metapopulation. The main channel is redirected through a three-mile long pipeline installed in the 1960's. During periods of high flow, overflow can maintain connectivity between the upper and lower portions of the stream. Upper Snake Creek (above the pipeline) was treated with antimycin in 2002 to remove a competing population of non-native salmonids (brook trout). Post-treatment surveys in 2003 found a single brown trout in the treatment area. Since brown trout were not known to previously exist above the pipeline, it is believed that this fish represents an illegal introduction subsequent to the treatment project. Reintroduction was initiated in 2005 with the transplant of 104 BCT from Hendry's Creek. Population surveys conducted prior to treatment found an estimated 600 – 3,500 fish per mile with the lowest densities in the headwater area. Snake Creek is a popular recreational area that receives moderate angler use.

Above the pipeline, Snake Creek contains approximately 8.5 km (5.3 miles) of available habitat located entirely within the National Park. Of this, approximately 1.6 km (1.0 miles) is currently occupied by BCT. Habitat is stable and in good condition. Upper Snake Creek was rated to be in PFC, however, the road that runs adjacent to the stream causes some sedimentation problems along with the propensity for undercutting during flood events (Greene and Mann 1997). Macroinvertebrates have been collected in 1998 and 2000-2003. In 1998, 15-34 taxa were found at three sites. Biomass was 2,400-5,200 organisms/m^2. The USFS BCI ranged from 38-73 with a mean of 58, which is poor (Vinson 1998).

South Fork Baker Creek

Located in the South Snake Range, the South Fork of Baker Creek is a tributary to Baker Creek, which drains the eastside of the Wheeler Peak area into Snake Valley (Figure 2). The main stem of Baker Creek is home to various non-native salmonid species. It was historically stocked with Lahontan cutthroat trout and more recently, rainbow trout. The South Fork contains a very steep waterfall/cascade area, above which has been electrofished extensively to remove nonnative salmonids. In 2005, a total of 45 BCT from Mill Creek were transplanted into the South Fork of Big Wash. Overall, habitat is stable and in good condition. Due to its remote location, angler use has historically been minimal.

The South Fork Baker Creek contains approximately 3.5 km (2.2 miles) of available habitat, of which 0.8 km (0.5 miles) is currently occupied by BCT. The stream is located entirely within the GBNP. The stream is rated as PFC (Greene and Mann 1997). All previous grazing impacts have since been reduced due to the elimination of cattle grazing in the park in 1999. There is no metapopulation potential at the South Fork of Baker Creek.

South Fork of Big Wash

Located in the South Snake Range entirely within the GBNP, the South Fork of Big Wash drains the east side of Wheeler Peak eastward into Snake Valley (Figure 2). Water from the South Fork of Big Wash only reaches Big Wash proper during periods of very high flow and therefore is considered a separate stream for management purposes. Historical records indicate that all BCT in the stream were lost during a flash flood in the mid-1960's (Waite 1974). Although the main stem of Big Wash was historically stocked with non-native salmonids, no stocking records exist for the South Fork of Big Wash. Survey work completed in 1999 found the stream to be fishless. In 2000, 56 BCT from Mill Creek were reintroduced and surveys conducted in 2002 and 2004 confirmed the presence of multiple age classes. Due to its remote location, angler use is minimal to nonexistent.

The South Fork of Big Wash contains approximately 4.8 km (3.0 miles) of habitat with 2.6 km (1.6 mile) currently occupied by BCT. Grazing does not occur on the stream and habitat is currently stable and in good condition, although very overgrown. After a wildfire burned a portion of the upper South Fork of Big Wash basin in 2001, a flash flood washed a significant amount of sediment into the stream the following summer. Sediment up to 5.1 cm (2.0 inches) deep was documented in some pools and may have harmed younger age class BCT. Macroinvertebrates were collected at three locations in 2000. Biomass ranged from 850-10,600 organisms/ m^2 and the USFS BCI varied from 54 to 82 with a mean of 72, which is fair. Between 13 and 33 taxa were identified (Vinson 2001). The stream is classified as PFC and noted to have extremely dense riparian vegetation, namely made up of dogwood (Greene and Mann 1997). There is low potential for a limited metapopulation at the South Fork of Big Wash. Migration to the main portion of Big Wash may be possible during periods of extremely high flow, however, it is doubtful that BCT from Big Wash would migrate to the South Fork of Big Wash during these periods.

Strawberry Creek

Located in the South Snake Range, Strawberry Creek drains the north end of the Wheeler Peak area eastward into Snake Valley (Figure 2). The entire length of Strawberry Creek was treated with rotenone in 2000 to remove competing and/or hybridizing salmonids. Reintroduction of BCT was initiated in 2002 with the transplant of 34 fish from Mill Creek. Strawberry Creek receives moderate angler use.

Strawberry Creek contains approximately 9.7 km (6.0 miles) of habitat, of which 6.3 km (3.9 miles) is located within the GBNP. Approximately 1.6 km (1.0 miles) of this habitat is currently occupied by BCT. Livestock grazing only occurs outside the National Park boundary and is minimal. The upper portions of the watershed are relatively unimpacted. Two reaches contain historic beaver activity. On Reaches 2 (from campsite above park boundary to first culvert) and 5 (culvert below Osceola Ditch to upper canyon confluence), the road is determined to have a negative influence on the stream with excessive erosion, bank instability, and falling vegetation. These reaches are classified as functional-at-risk. All other reaches in the drainage were determined to be in PFC (Greene and Mann 1997). The road along Reach 5 was closed by GBNP in 2002. Overall, however, habitat on Strawberry Creek is stable and in good condition. Macroinvertebrates have been collected from the stream from 1998-2003 to study the effects of rotenone treatment and BCT reintroduction on them. In 2001, 5-33 taxa were found at six sites with a mean of 19. Biomass ranged from 380-20,300 organisms/ m^2. The USFS BCI ranged from 49-108 with a mean of 80, which is good. One limiting factor on the stream is low flows during dry periods. There is no metapopulation potential at Strawberry Creek.

Existing BCT Conservation Populations Outside Historic Range

Deep Creek

Located in the Quinn Canyon Range of Nye County, Deep Creek drains the west side of the Quinn Canyon Wilderness area into Railroad Valley, an internal drainage (Figure 4). Previously barren, a total of 100 BCT were transplanted from Goshute Creek into Deep Creek in 1999. This was accomplished in an effort to salvage fish from the lower reaches of Goshute Creek that exhibit poor habitat conditions and expand the range of BCT in Nevada. The project was identified in NDOW's Bonneville Cutthroat Trout Species Management Plan (Haskins 1987). Since this transplant, streams within BCT historic range have been given priority for reintroduction. A survey conducted in 2001 showed good growth on BCT as well as the presence of multiple age classes subsequent to the transplant. Angler use is minimal to nonexistent due to its remote location.

Deep Creek contains approximately 2.4 km (1.5 miles) of habitat, all of which is occupied by BCT. The entire portion of the stream is situated within the Quinn Canyon Wilderness Area. Habitat is stable and in good condition. There is no metapopulation potential at Deep Creek.

Goshute Creek

Located in the Cherry Creek Range, Goshute Creek flows eastward into Steptoe Valley, an internal drainage (Figure 4). Its BCT population was established with 54 fish transplanted from Pine/Ridge Creek in 1960. All of Goshute Creek and its associated watershed are either in BLM Wilderness Study Area or Instant Study Area (functional WSA). Goshute Creek was used as a source for BCT transplanted into Deep Creek (Quinn Canyon Range) in 1999. A population survey of Goshute Creek conducted in 2000 showed average BCT densities of 1,214 fish per mile. However, the majority of the Goshute Creek BCT population was lost in July of 2001 when a high intensity summertime thunderstorm caused severe flash flooding in the basin. Surveys conducted in 2002 found a total of thirteen fish distributed in approximately 2.4 km (1.5 miles) of habitat. Past angler use has been low to moderate.

Goshute Creek contains approximately 6.5 km (4.0 miles) of available habitat of which 2.4 km (1.5 miles) is currently occupied by BCT. The stream has had a long history of grazing impacts, most notably from sheep. Grazing on the stream was ceased in 1982, however, cattle and sheep grazing still occurs in the upper portion of the watershed. Current habitat throughout most of the stream itself is stable and in fair to good condition. Some concerns still exist regarding livestock grazing and roads adjacent to the stream in the upper basin, however the major limiting factor on Goshute Creek is its propensity for flash flooding. Because the stream drains such a high gradient watershed, this potential will always exist. Due to the poor condition of riparian meadows in the upper watershed and flooding potential due to geological conditions of the area, the stream is still considered as functional-at-risk condition. There is no metapopulation potential at Goshute Creek.

Pine/Ridge Creek

Located in the South Snake Range, Pine and Ridge Creeks drain the west side of the Mount Wheeler into Spring Valley, an internal drainage (Figure 2). Ridge Creek is a tributary to Pine Creek and, for management purposes, both streams are classified as one BCT population. The origin of the Pine/Ridge BCT population remains unknown. One of two current theories is that early settlers of the area transplanted BCT from Lehman Creek or Trout Creek (Utah), which both were known to once hold BCT populations. The other theory is that the BCT in Pine/Ridge Creek traveled from Lehman Creek to Pine Creek via the Osceola Ditch, which carried water around the north end of the Wheeler Peak area for mining activities in the 1890's. This theory was discredited to some extent when genetic analysis revealed BCT inhabiting Pine/Ridge Creek to be genetically divergent from BCT in both Mill Creek and Hendry's Creek (Cremins and Spruell 2003). BCT from Pine/Ridge Creek were used as source stock for the establishment of both Hampton Creek (1953) and Goshute Creek (1960). In addition, a total of 26 BCT were transplanted from lower Pine Creek to Ridge Creek in 1996 in an effort to expand the population. Genetic analysis of BCT collected from Pine/Ridge Creek revealed them to be free of introgression with non-native salmonids (Cremins 2001). A population survey conducted in 2004 showed BCT at average densities of 827 fish per mile. Due to its remote location, angler use is minimal.

Pine/Ridge Creek contains approximately 2.6 km (1.6 miles) of habitat, all of which is currently occupied by BCT. Current habitat conditions on the stream are stable and in good condition, although concerns exist regarding ongoing sheep grazing in the area. A GAWS Level III habitat survey was conducted in 1987 and the data was summarized, but no final report was prepared. Habitat conditions appear to be good based on the data summarized. No macroinvertebrate samples have been taken on this creek, but habitat appears similar to adjacent Shingle Creek, which has been sampled. Mid to late summer samples on Shingle Creek had BCI ratings that ranged from 77-85, which is in the fair to good range. Biomass ranged from 0.8 to 3.8 g/m^2 (mean = 2.13), with about 14,600 to 20,900 organisms/m^2 and 28 to 30 taxa present. The high runoff spring values were a BCI of 69, biomass of 0.1gm/m^2, 1,528 organisms/m^2, and 19 taxa present (Mangum 1992). A limiting factor on Pine/Ridge Creek is its short length and unusually high gradient that results in a lack of quality pools. As previously discussed, a small metapopulation currently exists between Pine Creek and Ridge Creek.

Potential BCT Conservation Populations

Note:

A series of streams located on the west side of the Snake Range outside of BCT historic range have been proposed for eradication at various times in the past. These streams are adjacent to Pine/Ridge Creek, which contains a conservation population of BCT. Willard Creek, Shingle Creek and Williams Creek, will be given a low priority for treatment at this time due to an emphasis on streams located within historic range for BCT. The need for BCT introduction in these streams as well as others may be reevaluated by the NBCTCT in the future.

Figure 2. South Snake Range Streams

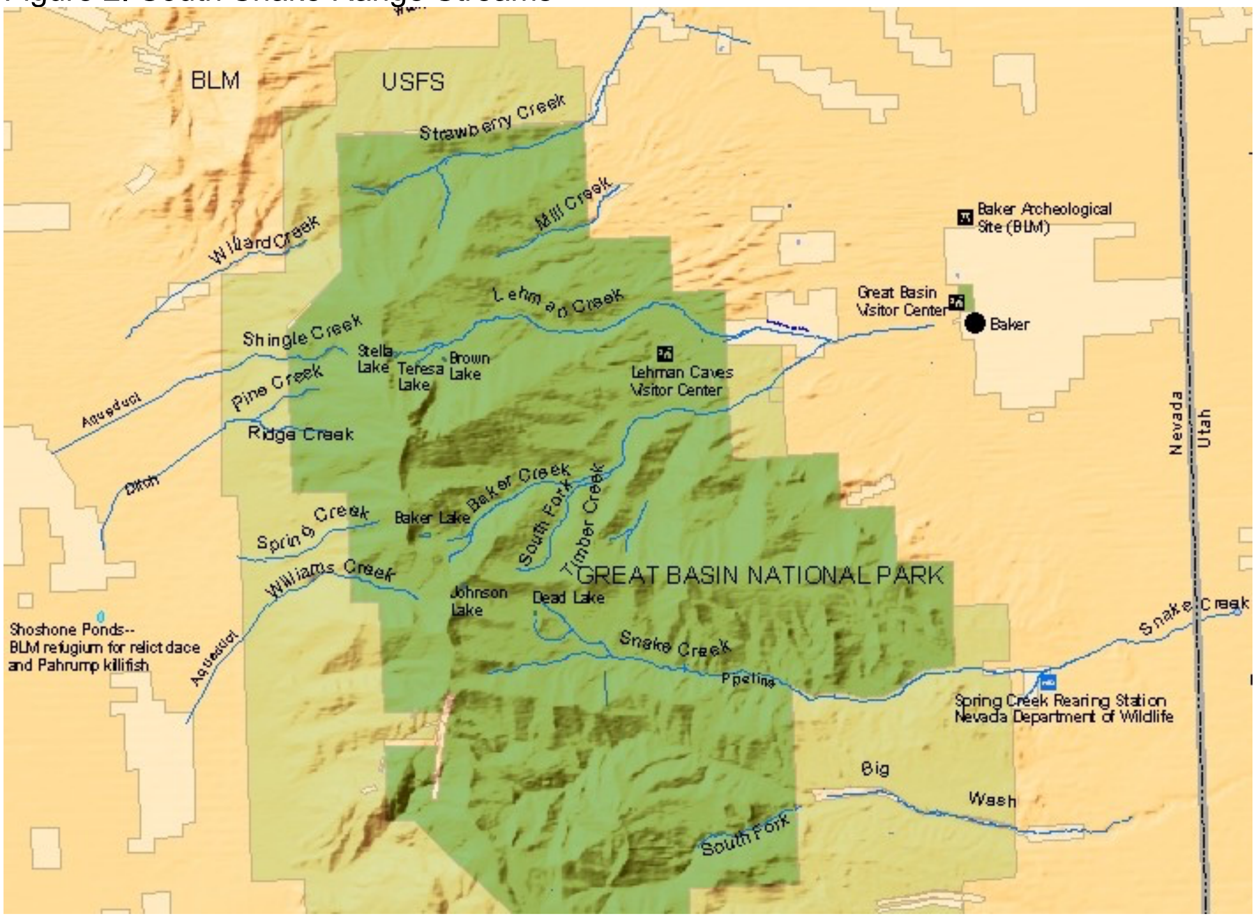


Figure 3. North Snake Range Streams

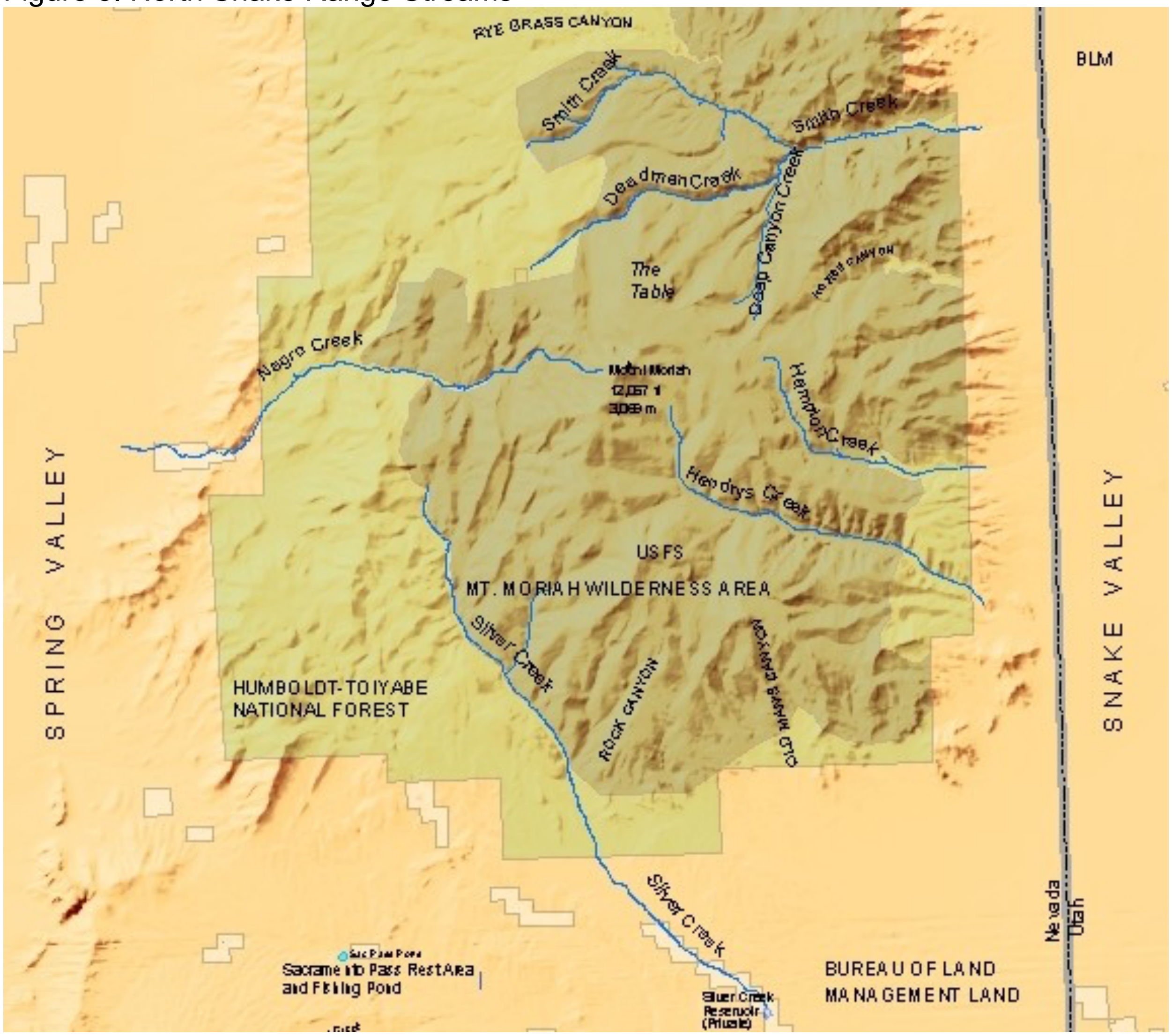
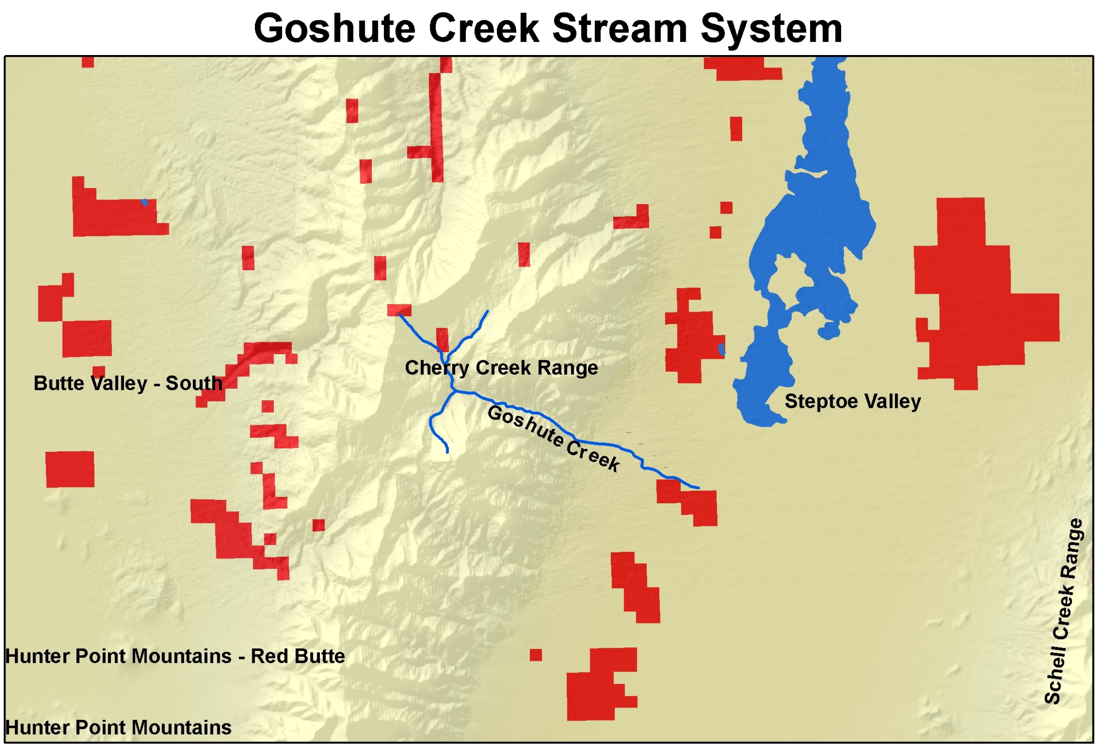
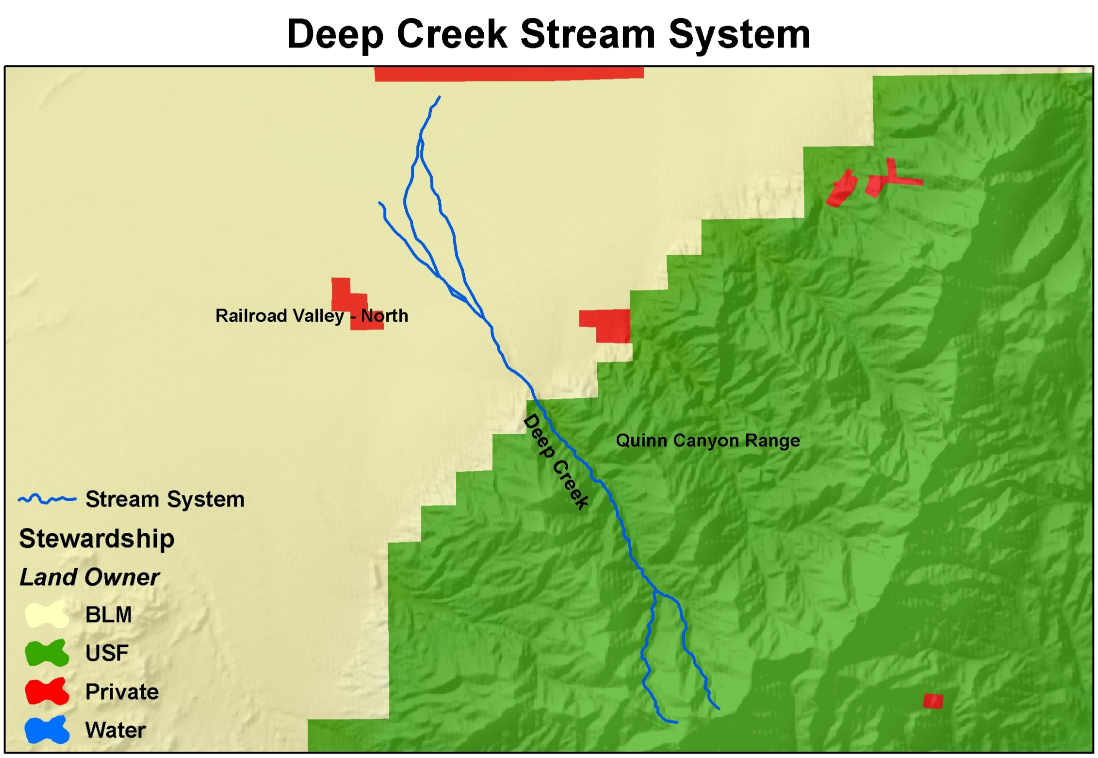


Figure 4. Goshute Creek Stream System & Deep Creek Stream System





POTENTIAL THREATS TO THE CONTINUED EXISTENCE OF BCT IN NEVADA

The success of any conservation or recovery program depends on eliminating or reducing the threats to the species' existence. The following list of potential threats to BCT in the State of Nevada is based on the five listing factors for federal listing of a species in Section 4(a)(1) of the ESA. For each of these factors, specific activities potentially threatening the persistence of BCT populations are described (Table 3).

Factor 1. Habitat Degradation: The present or potential destruction, modification, or curtailment of BCT habitat or range.

Water Diversions and Development. Diversions of stream flows that alter natural flow patterns have been one of the greatest causes of habitat loss. Water diversions can interrupt historic flow timing, duration and magnitude or completely de-water stream segments. Diversions can fragment stream habitats and disconnect tributary streams from main stem rivers. In addition, unscreened diversions can attract migrating fish that can be lost during irrigation (Spence *et al.* 1996, Bain *et al.* 1988). Most diversions on streams in Nevada occur below preferred BCT habitat. Existing water diversions are present on Hampton Creek, Hendry's Creek, Mill Creek, Strawberry Creek, Smith Creek, Goshute Creek, Pine/Ridge Creek, Big Wash and Snake Creek. Diversions within BCT habitat are present on Big Wash and Snake Creek.

Livestock Grazing. Grazing has been shown to negatively influence stream habitats and stream communities (Keller and Burnham 1982, Platts and Nelson 1985). Some past and current livestock grazing practices adversely impact BCT and their habitat. Poor grazing practices can alter sediment regimes and decrease streambank stability. Grazing can also detrimentally affect water quality, substrate composition and channel structure. Specific ramifications include loss of pool habitat, reduced instream cover, increased water temperature, and loss of quality substrate required for spawning and food production (Platts 1991, Belsky 1999). Livestock grazing is currently present in riparian habitats along Smith Creek, Deadman Creek, Strawberry Creek, Goshute Creek, Deep Creek, Big Wash, and Pine/Ridge Creeks.

Timber Harvest. Logging has been reported to significantly affect salmonids, however, timber harvest does not pose a threat to BCT habitat in Nevada (Chamberlin *et al.* 1991).

Road Construction and Maintenance. Road construction and maintenance may adversely affect BCT in more than one way. Roads located in close proximity to streams can cause increased sedimentation and hasten erosion processes, especially during runoff periods. Another influence is the blockage of BCT migration in streams by poorly designed and placed road culverts. Road culverts can hinder upstream passage of trout, effectively isolating small populations (Furniss *et al.* 1991, Forman *et al.* 2003, Gucinski *et al.* 2001). Roads adjacent to and crossing stream channels currently exist along Big Wash, Hampton

Creek, Hendry's Creek, Snake Creek, Pine/Ridge Creek, and Strawberry Creek. Stream crossing culverts currently exist on Strawberry Creek.

Mining Activities. Potential threats from mining include sediment from mining operations, road building with associated sedimentation and migration corridor blockage, water depletions for dust control and maintenance activities, and hazardous material spills (Nelson *et al.* 1991). Historically, mining severely affected many streams in the West. Potential mining effects currently pose threats on Hendry's Creek and Hampton Creek.

Factor 2. Detrimental Interactions: Disease, predation, competition and hybridization.

Disease. Whirling disease is known to occur within the Bonneville Basin in some Utah river systems. Although it is know to occur in certain Nevada waters, it does not pose a threat to BCT populations in Nevada at the present time.

Predation. Predation is a potential threat where other predaceous fish occupy the same habitat area as BCT, especially to early life stages. This is not a factor in BCT conservation populations in Nevada, which are managed for the historic assemblage of aquatic species.

Competition. Several studies suggest that non-native salmonids will competitively replace native cutthroat species (Griffith 1988, Kershner 1995). It is suggested that nonnative salmonid species out-compete BCT for available food and space. To date, competition has not been a factor in BCT conservation populations in Nevada, which are managed for the historic assemblage of aquatic species. The removal of competing species prior to BCT reintroduction is a key activity to BCT conservation in Nevada. Fish barriers can also be a consideration to prevent competition. Barriers can be constructed to prevent the movement of potentially competing species upstream. Barriers are economically limited to areas where streams run through bedrock and access is attainable. In many cases, it may be more cost effective to treat the entire stream length rather than construct a barrier. Although unlikely, competition poses a risk at Snake Creek only during periods of high flow when connectivity is maintained between the upper and lower portions of the stream. Competition may also pose a threat at the South Fork of Baker Creek.

Hybridization. Because both native (Behnke 1992) and nonnative (Duff 1988) salmonids have been stocked in Nevada, hybridization poses a significant threat to the genetic integrity of the Snake Valley BCT populations. BCT can hybridize with rainbow trout and other cutthroat subspecies in some situations. Hybridization with nonnative fish leads to a loss of the native BCT genotype. Hybridization among cutthroat trout subspecies can result in the loss of the characteristic BCT phenotype (Kershner 1995). This has not been a significant factor in BCT conservation populations in Nevada which, to date, have been managed for the historic assemblage of aquatic species. As discussed above, barriers can also be successful in the prevention of hybridization between BCT and other salmonid species. Barriers should not be constructed on streams that offer metapopulation potential.

The removal of hybridizing species prior to BCT reintroduction is a key activity to BCT conservation in Nevada. However, there still exists a risk of unintentional, accidental, or illegal introduction of non-native species in BCT waters. Although unlikely, hybridization poses a risk at Snake Creek only during periods of high flow when connectivity is maintained between the upper and lower portion of the stream. It may also pose a threat at the South Fork of Baker Creek.

Factor 3. Overutilization: Over harvesting for commercial, recreational, scientific, or educational purposes.

Angling. Angling has been shown to depress populations of cutthroat trout (Behnke 1992). Unrestricted angling can effectively displace cutthroat trout populations where they coexist with other salmonids because cutthroat trout are generally easier to catch and may be more susceptible to angling than other trout species (Behnke 1992, Clark 1991). Existing regulations allow anglers to harvest 10 BCT per day. Due to the remote location of most Nevada BCT streams, overharvesting of BCT by sportfish anglers is not an existing threat in Nevada. Harvest of BCT will be closely monitored to assure detrimental impacts caused by angling do not occur.

Factor 4. Inadequate Regulation: The inadequacy of existing regulatory mechanisms.

A review of the existing laws and regulations has determined that regulatory mechanisms are currently adequate to protect BCT in combination with the actions defined in the Strategy. Classification as a sensitive species by the BLM, USFS, and NPS affords the species an enhanced level of review and consultation relative to proposed actions by Federal agencies. Further federal protection is contained in the Clean Water Act, NEPA, and other Federal Mandates for the USFS and BLM Sensitive Species and Wilderness Area and Wilderness Study Areas. Protection of BCT and its habitat is afforded under state laws as well. The Nevada Division of Environmental Protection governs all water appropriations and diversions while the Department of Wildlife regulates take, transport, and introduction of the species. Inadequate regulatory mechanisms are not a threat to BCT streams in Nevada.

Factor 5. Other Factors: Other natural or human induced factors affecting the continued existence of BCT.

Stochastic Events. Natural climatic events such as flood, fire and drought may threaten specific populations of BCT, especially where BCT range remains fragmented and populations are small and isolated. These forces pose increased threats when combined with poor land use practices that result in degraded habitat conditions. Small, isolated populations are more susceptible to catastrophic loss and impacts from demographic stochasticity (Dunham *et al.* 1997, Dunham *et al.* 2003).

Socio-Political Pressure. Another threat to the persistence of BCT is the socio-political pressure associated with managing a species recognized as sensitive by federal agencies. Existing or potential sensitive recognition has endowed BCT with a perceived status that can elicit public and governmental resistance to BCT management activities. This socio-political pressure can interfere with conservation efforts at the state and local levels.

Table 3. **POTENTIAL THREATS TO BCT IN NEVADA**

STREAM	HABITAT DEGREDATION	DETRIMENTAL INTERACTIONS	OVERUTILIZATION	INADEQUATE REGULATIONS	OTHER FACTORS
Big Wash Creek	Grazing Diversion Roads				Stochastic Events Socio-political pressure
Deadman Creek	Grazing				Stochastic Events
Deep Canyon Creek					Stochastic Events
Hampton Creek	Roads Mining				Stochastic Events
Hendry's Creek	Roads Mining				Stochastic Events
Mill Creek					Stochastic Events
Smith Creek	Grazing				Stochastic Events
Snake Creek	Diversion Roads	Competition* Hybridization*			Stochastic Events Socio-political pressure
S. Fork of Big Wash					Stochastic Events
S. Fork of Baker Creek		Competition* Hybridization*			Stochastic Events Socio-political pressure
Strawberry Creek	Grazing Roads				Stochastic Events Socio-political pressure
Goshute Creek	Grazing				Stochastic Events
Pine/Ridge Creek	Grazing				Stochastic Events
Deep Creek					Stochastic Events

* Population isolated from non-native salmonid population.

CONSERVATION GOALS, OBJECTIVES, STRATEGIES, AND ACTIONS

Conservation Goal

To ensure the long-term existence of BCT within its historic range in Nevada by coordinating conservation efforts with the Nevada Department of Wildlife (NDOW), U.S. Forest Service (USFS), National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), and Bureau of Land Management (BLM).

Conservation Objectives, Strategies, and Actions to be Implemented

The following conservation objectives, strategies, and actions must be implemented to achieve the conservation goal for BCT in Nevada. Conservation objectives, strategies, and actions are listed in a step-down format in which the objectives are stepped down to strategies and strategies are stepped down to specific actions.

OBJECTIVE 1

Manage for a minimum of 14 conservation populations of Bonneville cutthroat trout in Nevada, including the following:

- Maintain 1 core population (Hendry's Creek) inhabiting 11.8 stream km (7.3 miles) in the appropriate proportion and quality of lotic habitats within the West Desert GMU in Nevada.

- Establish and/or maintain a minimum of 10 reintroduced populations including 2 limited metapopulations inhabiting 78.0 stream km (48.4 miles) in the appropriate proportion and quality of lotic habitats within the West Desert GMU in Nevada.

- Maintain 3 introduced populations (Goshute Creek, Pine/Ridge Creek, and Deep Creek) inhabiting 11.5 stream km (7.1 miles) in the appropriate proportion and quality of lotic habitats outside the West Desert GMU in Nevada for purposes of preserving the genetic integrity of the Snake Valley BCT for future transplants and reintroductions.

- Explore opportunities for further expansion of BCT.

Strategy 1. Monitor conservation populations of BCT in Nevada.

Action 1. Conduct standardized surveys employing agency-approved or peer reviewed methodologies to assess the status of BCT populations on a periodic basis.

Action 2. Conduct comparative analyses of BCT populations over time to determine trends and detect potential adverse impacts.

Strategy 2. Maintain and expand BCT distribution in Nevada through transplants and reintroduction from core populations, reintroduced populations, or introduced populations.

Action 1. Establish procedures for transplants and reintroductions including the use of broodstock sources, disease certification, and protocols for taking wild fish and eggs.

Action 2. Expand distribution of BCT in available but unoccupied habitat within current conservation populations.

Action 3. Reintroduce BCT into potential streams as identified in this Strategy. At this time, streams within historic range will be given priority for reintroduction purposes.

Action 4. Redistribute BCT that will otherwise be lost into more favorable habitat during periods of low flow. Salvaged fish will be redistributed into streams with existing BCT conservation populations of similar genetic origin or into those areas that are identified as potential conservation populations. BCT will not be moved into stream habitats currently occupied by non-native salmonids.

Action 5. Identify and survey additional habitats for future BCT transplants.

Strategy 3. Genetically characterize populations of BCT in Nevada.

Action 1. Conduct standardized genetic analysis of BCT conservation populations on a periodic basis to determine both purity and phylogenic relationships to other BCT populations and within metapopulations.

Action 2. Follow collection procedures and recommendations as outlined in *Guidelines and Protocols for Identification and Designation of Populations of Native Cutthroat Trout* (Toline and Lentsch, 1999).

Strategy 4. Protect the genetic integrity of the Snake Valley BCT.

Action 1. Establish reintroduction guidelines and protocols based on criteria of maximizing genetic integrity of the Snake Valley BCT within the West Desert GMU.

Action 2. Identify source stocks for transplants and reintroductions based on sound genetic principles.

Action 3. Preserve unique genetic variation among conservation populations.

The mixing of BCT populations that have been proven to be genetically divergent from one another will be prohibited.

OBJECTIVE 2

Eliminate the threats to BCT in Nevada that may warrant listing as a threatened or endangered species under the ESA.

Note:
ESA listing factors associated with potential threats to BCT in Nevada are indicated in parentheses.

Strategy 1. Maintain and enhance BCT habitat in Nevada (Habitat Degradation).

Action 1. Enhance and/or restore connectedness and opportunities for migration to disjunct populations where possible. Migratory corridors should retain some degree of their natural physical and biological condition to enable migration and gene flow.

Action 2. Enhance and/or restore habitat conditions in designated streams. Actions may include bank stabilization and runoff control structures, road closure and restoration or road relocation, riparian fencing and implementation of sustainable grazing practices that are conducive to restoring and maintaining riparian health.

Action 3. Maintain and restore natural hydrologic characteristics such as flow quantity, timing, and duration to maintain active channel and floodplain features (e.g., riparian vegetation, undercut bank, bed structure, and sediment transport regimes). This action includes securing instream flow needs through water acquisition or regulation.

Action 4. Actively encourage and promote cooperative agreements with private landowners to maximize BCT habitat on their property.

Strategy 2. Monitor BCT habitat in Nevada (Habitat Degradation).

Action 1. Utilize agency-approved or peer reviewed methodologies and techniques to evaluate habitat conditions on a periodic basis. Surveys will include, but are not limited to, transect methodology habitat surveys, macroinvertebrate monitoring, pebble counts, temperature monitoring, and PFC surveys.

Action 2. Monitor detrimental impacts on BCT populations caused by road construction and maintenance, water diversions, livestock grazing, and mining activities on a regular basis.

Action 3. Establish trends based on long-term habitat monitoring to identify and rectify detrimental impacts.

Strategy 3. Control non-native species adversely affecting BCT in Nevada (Detrimental Interactions).

Action 1. Eradicate or control undesirable fish populations. Targeted species include non-native and hybridized salmonid populations. This includes construction of fish barriers to prevent fish movement as well as the use of piscicides (i.e. rotenone and antimycin) to remove competing and/or hybridizing salmonids with the intent to restore and maintain BCT populations. Standard procedures and protocols for stream chemical treatment will be employed.

Action 2. Utilize agency-approved or peer-reviewed methodologies for post-treatment monitoring of streams prior to transplant of BCT.

Action 3. Utilize agency-approved or peer-reviewed methodologies for pre-treatment of streams selected for eradication to assess distribution and densities of fish populations prior to treatment.

Strategy 4. Monitor BCT utilization (Overutilization).

Action 1. Monitor angler use on current and potential BCT conservation populations to assess angler impacts.

Action 2. Monitor frequency and extent of scientific collections to ensure compliance and preclude overharvest.

Strategy 5. Enforce existing regulatory mechanisms to ensure compliance (Inadequate Regulation).

Action 1. Maintain and enforce regulatory mechanisms that prevent or curtail destruction of BCT habitat including laws and regulations associated with road construction and maintenance, water diversions, livestock grazing, and mining activities

Action 2. Maintain and enforce regulatory mechanisms that prevent the introduction or spread of non-native species that exhibit detrimental interactions (disease, hybridization, competition, predation) with BCT.

Action 3. Maintain and enforce regulatory mechanisms that prevent overutilization of BCT through scientific collection or angling.

Strategy 6. Reduce social-political conflicts concerning BCT conservation in Nevada (Other Factors).

Action 1. Develop informational and educational materials concerning BCT conservation for dissemination to the public.

Action 2. Actively promote and publicize successes in BCT conservation through various media channels.

Action3. Encourage citizen volunteer assistance and landowner participation in conservation activities.

Strategy 7. Eliminate or reduce threats to BCT in Nevada associated with climatic events (Other factors).

Action 1. Evaluate the risk from stochastic events such as fires, floods, and drought to BCT populations. Work with responsible landowners to implement activities to reduce potential effects.

Action 2. Develop and maintain a contingency plan regarding catastrophic loss of BCT populations associated with stochastic events.

Table 4. Conservation Strategy Implementation Schedule

Objectives, Strategies, and Actions	Window for Completion		Target Completion Year(s)	Responsible Parties
	Years 1-5	Years 5-10		
OBJECTIVE 1 Manage for a minimum of 14 conservation populations of Bonneville cutthroat trout in Nevada, including the following: • Maintain 1 core population inhabiting 11.8 stream km (7.3 miles) in the appropriate proportion and quality of lotic habitats within the West Desert GMU in Nevada. • Establish and/or maintain a minimum of 10 reintroduced populations including 2 limited metapopulation inhabiting 78.0 stream km (48.4 miles) in the appropriate proportion and quality of lotic habitats within the West Desert GMU Nevada. • Maintain 3 introduced populations (Goshute Creek, Pine/Ridge Creek, Deep Creek) inhabiting 11.5 stream km (7.1 miles) in the appropriate proportion and quality of lotic habitats outside the West Desert GMU in Nevada for purposes of securing Snake Valley genetic stocks for BCT transplants and reintroductions. • Explore opportunities for further expansion of BCT.	✔	✔		NBCTCT
Strategy 1. Monitor conservation populations of BCT in Nevada.				
Action 1. Conduct standardized surveys employing agency-approved or peer reviewed methodologies to assess the status of BCT populations on a periodic basis.	✔	✔	1-10	NDOW, NPS
Action 2. Conduct comparative analyses of BCT populations over time to determine trends and detect potential adverse impacts.	✔	✔	1,6	NDOW, NPS
Strategy 2. Maintain and expand BCT distribution in Nevada through transplants and reintroduction from core populations, reintroduced populations, or introduced populations.				
Action 1. Establish procedures for transplants and reintroductions including the use of broodstock sources, disease certification, and protocols for taking wild fish and eggs.	✔		1-2	NBCTCT
Action 2. Expand distribution of BCT in available but unoccupied habitat within current conservation populations.	✔	✔	1-10	NDOW, NPS
Action 3. Reintroduce BCT into potential streams as identified in this Strategy. At this time, streams within historic range will be given priority for reintroduction purposes.	✔	✔	1-10	NDOW, NPS
Action 4. Redistribute BCT that will otherwise be lost into more favorable habitat during periods of low flow. Salvaged fish will be redistributed into streams with existing BCT conservation populations of similar genetic origin or into those areas that are identified as potential conservation populations. BCT will not be moved into stream habitats currently occupied by non-native salmonids.	✔	✔	1-10	NDOW, NPS
Action 5. Identify and survey additional habitats for future BCT transplants.	✔	✔	1-10	
Strategy 3. Genetically characterize populations of BCT in Nevada.				
Action 1. Conduct standardized genetic analysis of BCT conservation populations on a periodic basis to determine both purity and phylogenic relationships to other BCT populations and within metapopulations.	✔		1-3	NDOW, NPS
Action 2. Follow collection procedures and recommendations as outlined in *Guidelines and Protocols for Identification and Designation of Populations of Native Cutthroat Trout* (Toline and Lentsch, 1999).	✔		1-3	NDOW, NPS
Strategy 4. Protect the genetic integrity of the Snake Valley BCT.				
Action 1. Establish reintroduction guidelines and protocols based on criteria of maximizing genetic integrity of the Snake Valley BCT within the West Desert GMU.	✔		1	NBCTCT

Action 2. Identify source stocks for transplants and reintroductions based on sound genetic principles.	✔		1	NBCTCT
Action 3. Preserve unique genetic variation among conservation populations. The mixing of BCT populations that have been proven to be genetically divergent from one another will be prohibited.	✔	✔	1-10	NDOW, NPS
OBJECTIVE 2 Eliminate the threats to BCT in Nevada that may warrant listing as a threatened or endangered species under the ESA.	✔	✔		NBCTCT
Strategy 1. Maintain and enhance BCT habitat in Nevada (Habitat Degradation).				
Action 1. Enhance and/or restore connectedness and opportunities for migration to disjunct populations where possible. Migratory corridors should retain some degree of their natural physical and biological condition to enable migration and gene flow.	✔	✔	3-7	NDOW, BLM, USFS, NPS
Action 2. Enhance and/or restore habitat conditions in designated streams. Actions may include bank stabilization and runoff control structures, road closure and restoration or road relocation, riparian fencing and implementation of sustainable grazing practices that are conducive to restoring and maintaining riparian health.	✔	✔	1-10	NDOW, BLM, USFS, NPS
Action 3. Maintain and restore natural hydrologic characteristics such as flow quantity, timing, and duration to maintain active channel and floodplain features (e.g., riparian vegetation, undercut bank, bed structure, and sediment transport regimes). This action includes securing instream flow needs through water acquisition or regulation.	✔	✔	1-10	NDOW, BLM, USFS, NPS
Action 4. Actively encourage and promote cooperative agreements with private landowners to maximize BCT habitat on their property.	✔	✔	1-10	NBCTCT
Strategy 2. Monitor BCT habitat in Nevada (Habitat Degradation).				
Action 1. Utilize agency-approved or peer reviewed methodologies and techniques to evaluate habitat conditions on a periodic basis. Surveys will include, but are not limited to, transect methodology habitat surveys, macroinvertebrate monitoring, pebble counts, temperature monitoring, and PFC surveys.	✔	✔	1-10	NDOW, BLM, USFS, NPS
Action 2. Monitor detrimental impacts on BCT populations caused by road construction and maintenance, water diversions, livestock grazing, and mining activities on a regular basis.	✔	✔	1-10	NDOW, BLM, USFS, NPS
Action 3. Establish trends based on long-term habitat monitoring to identify and rectify detrimental impacts.		✔	5-10	NDOW, BLM, USFS, NPS
Strategy 3. Control non-native species adversely affecting BCT in Nevada (Detrimental Interactions).				
Action 1. Eradicate or control undesirable fish populations. Targeted species include non-native and hybridized salmonid populations. This includes construction of fish barriers to prevent fish movement as well as the use of piscicides (i.e. rotenone and antimycin) to remove competing and/or hybridizing salmonids with the intent to restore and maintain BCT populations. Standard procedures and protocols for stream chemical treatment will be employed.	✔		1-5	NDOW, NPS
Action 2. Utilize agency-approved or peer reviewed methodologies for post-treatment monitoring of streams prior to transplant of BCT.	✔		1-2	NBCTCT
Action 3. Utilize agency-approved or peer reviewed methodologies for pre-treatment of streams selected for eradication to assess distribution and densities of fish populations prior to treatment.	✔		**1-2**	NBCTCT
Strategy 4. Monitor BCT utilization (Overutilization).				
Action 1. Monitor angler use on current and potential BCT conservation populations to assess angler impacts.	✔	✔	1-10	NDOW, NPS
Action 2. Monitor frequency and extent of scientific collections to ensure compliance and preclude overharvest.	✔	✔	1-10	NDOW, NPS

Strategy 5. Enforce existing regulatory mechanisms to ensure compliance (Inadequate Regulation).				
Action 1. Maintain and enforce regulatory mechanisms that prevent or curtail destruction of BCT habitat including laws and regulations associated with road construction and maintenance, water diversions, livestock grazing, and mining activities.	✔	✔	1-10	NDOW, BLM, USFS
Action 2. Maintain and enforce regulatory mechanisms that prevent the introduction or spread of non-native species that exhibit detrimental interactions (disease, hybridization, competition, predation) with BCT.	✔	✔	1-10	NDOW, BLM, USFS, NPS
Action 3. Maintain and enforce regulatory mechanisms that prevent overutilization of BCT through scientific collection or angling.	✔	✔	1-10	NDOW, NPS
Strategy 6. Reduce social-political conflicts concerning BCT conservation in Nevada (Other Factors).				
Action 1. Develop informational and educational materials concerning BCT conservation for dissemination to the public.	✔		1-3	NBCTCT
Action 2. Actively promote and publicize successes in BCT conservation through various media channels.	✔	✔	1-10	NBCTCT
Action3. Encourage citizen volunteer assistance and landowner participation in conservation activities.	✔	✔	1-10	NBCTCT
Strategy 7. Eliminate or reduce threats to BCT in Nevada associated with climatic events (Other Factors).				
Action 1. Evaluate the risk from stochastic events such as fires, floods, and drought to BCT populations. Work with responsible landowners to implement activities to reduce potential effects.	✔		1-3	BLM, USFS, USFWS
Action 2. Develop and maintain a contingency plan regarding catastrophic loss of BCT populations associated with stochastic events.	✔		2-3	NBCTCT

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APPENDIX A

SPECIES OF CONCERN AND OTHER IMPORTANT SPECIES THAT MAY OCCUR IN THE VICINITY OF OR BE AFFECTED BY BONNEVILLE CUTTHROAT TROUT (*ONCORHYNCHUS CLARKI UTAH)* CONSERVATION ACTIVITIES IN NEVADA

Mammals	
Pygmy rabbit	*Brachylagus idahoensis*
Spotted bat	*Euderma maculatum*
Pale Townsend's big-eared bat	*Corynorhinus townsendii pallescens*
Small-footed myotis	*Myotis ciliolabrum*
Long-eared myotis	*Myotis evotis*
Fringed myotis	*Myotis thysanodes*
Long-legged myotis	*Myotis volans*
Birds	
Northern goshawk	*Accipiter gentilis*
Western burrowing owl	*Athene cunicularia hypugea*
Ferruginous hawk	*Buteo regalis*
Calliope hummingbird	*Stellula calliope*
Red-naped sapsucker	*Sphyrapicus nuchalis*
MacGillivray’s warbler	*Oporornis tolmiei*
Wilson’s warbler	*Wilsonia pusilla*
Virginia’s warbler	*Vermivora virginiae*
Cooper’s hawk	*Accipiter cooperii*
Yellow-breasted chat	
Fishes	
Mottled sculpin	*Cottus bairdi*
Speckled dace	*Rhinichthys osculus*
Redside shiner	*Richardsonius balteatus*
Utah sucker	*Catostomus ardens*
Utah chub	*Gila atraria*
Amphibians	
Tiger salamander	*Ambystoma tigrinum*
Great Basin spadefoot toad	*Scaphiopus intermontanus*
Western toad	*Bufo boreas boreas*
Woodhouse toad	*Bufo woodhousei woodhousei*
Pacific tree frog	*Hyla regilla*
West Desert Columbia spotted frog	*Rana luteiventris*
Western leopard frog	*Rana pipiens brachycephala*
Northern leopard frog	*Rana pipiens*

Mollusks

Great Basin springsnail	*Pyrgulopsis spp.*