Programmatic Biological Assessment

Statewide Federal Aid, State and Maintenance Actions

State of Idaho
Idaho Transportation Department
Districts 1-6

Prepared by:
Idaho Transportation Department
P.O. Box 837
Lewiston, ID 83501

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Table of Contents

Tables

Figures

Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
af	acre feet
BLM	Bureau of Land Management
BMPs	Best Management Practices
BOR	Bureau of Reclamation
CDC	Conservation Data Center
cfs	cubic feet per second
COE	U.S. Army Corps of Engineers
CRABS	Cement Recycled Asphalt Base Stabilization
ESA	Endangered Species Act
ESU	Evolutionary Significant Unit
ETR	Enhanced Training Range
FHWA	Federal Highway Administration
ft	feet
HMWM	High Molecular Weight Methacrylate Seal
ICBEMP	Interior Columbia Basin Ecosystem Management Project
ICBTRT	Interior Columbia River Basin Technical Recovery Team
IDEQ	Idaho Department of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDWR	Idaho Department of Water Resources
in.	inches
ITD	Idaho Transportation Department
km	Kilometers
LAA	Likely to adversely affect
m	meters
mi	miles
MOU	Memorandum of Understanding
MSE	Mechanically Stabilized Earth
NE	No effect
NLAA	Not likely to adversely affect
NMFS	National Marine Fisheries Service
NPPC	Northwest Power Planning Council
NTU	Nephelometric turbidity units
PA	Planning Area
PBA	Programmatic Biological Assessment
RM	River Mile
s	seconds
USDA	U.S. Department of Agriculture
USEAP	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

Chapter 1: Introduction

1.1 Executive Summary

The Idaho Transportation Department, in cooperation with the Federal Highway Administration, the U.S. Army Corps of Engineers, National Marine Fisheries Service and the U.S. Fish and Wildlife Service have developed this Programmatic Biological Assessment (PBA) to document projects and consult, on a statewide level, under Section 7 of the Endangered Species Act on the ITD actions described herein. This PBA shall be utilized only by ITD Districts 1-6.

Listed species

The PBA covers species in the state of Idaho that are listed as Threatened, Endangered or Candidate. It makes a determination of effects for project actions on each species. Determination can be:

- Likely to adversely affect (LAA)
- Not likely to adversely affect (NLAA)
- No effect (NE)

Candidate species are also addressed in this document. Although candidate species have no statutory protection under the ESA the FWS encourages cooperative conservation efforts for these species because they are, by definition, species that may warrant future protection under the ESA. The ESA requires that federal actions not adversely modify the designated Critical Habitat for any listed species. A list of species and designated Critical Habitat addressed in this document is shown in Table 1.

Table 1. Species list and designated Critical Habitat for the state of Idaho

Species	Status	Determination
Listed species		
Bull trout *Salvelinus confluentus*	Threatened	LAA
Bull trout DesignatedCritical Habitat	—	LAA
Bull trout Proposed Critical Habitat	—	LAA
Fall Chinook salmon *Oncorhynchus tshawytscha*	Threatened	LAA
Fall Chinook salmon Critical Habitat	—	LAA
Spring/Summer Chinook salmon *Oncorhynchus tshawytscha*	Threatened	LAA
Spring/Summer Chinook salmon Critical Habitat	—	LAA
Sockeye salmon *Oncorhynchus nerka*	Endangered	LAA
Sockeye salmon Critical Habitat	—	LAA
Steelhead *Oncorhynchus mykiss*	Threatened	LAA
Steelhead Critical Habitat	—	LAA
Kootenai River white sturgeon *Acipenser transmontanus*	Endangered	NLAA
Kootenai River white sturgeon Critical Habitat	—	NLAA
Utah valvata snail *Valvata utahensis*	Endangered	LAA
Snake River physa snail *Haitia (Physa) natricina*	Endangered	LAA
Bliss Rapids snail *Taylorconcha serpenticola*	Threatened	LAA
Banbury Springs lanx *Lanx sp.*	Endangered	NLAA
Bruneau hot springsnail *Pyrgulopsis bruneauensis*	Endangered	NLAA
Selkirk Mountain woodland caribou *Rangifer tarandus caribou*	Endangered	NLAA
Grizzly bear *Ursus arctos*	Threatened	NLAA
Gray wolf *Canis lupus*	Threatened	NLAA
Northern Idaho ground squirrel *Spermophilus brunneus brunneus*	Threatened	LAA
Canada lynx *Lynx canadensis*	Threatened	NLAA

Species	Status	Determination
Listed species		
Canada lynx Designated Critical Habitat	—	NLAA
MacFarlane’s four-o’clock *Mirabilis macfarlanei*	Threatened	NLAA
Water howellia *Howelia aquatilus*	Threatened	NLAA
Ute ladies’-tresses *Spiranthes diluvialis*	Threatened	NLAA
Spalding’s catchfly *Silene spaldingii*	Threatened	NLAA
Slickspot peppergrass *Lepidium papilliferum*	Threatened	NLAA
Candidate species		
Christ’s paintbrush *Castilleja christii*	Candidate	NE
Columbia spotted frog *Rana luteiventris*	Candidate	NLAA
Southern Idaho ground squirrel *Spermophilus brunneus endemicus*	Candidate	LAA
Yellow-billed cuckoo *Coccyzus americanus*	Candidate	NLAA
Goose Creek milkvetch *Astragalus anserinus*	Candidate	NE
Essential Fish Habitat		
Chinook salmon (All anadromuous watersheds)	—	LAA
Coho salmon (Clearwater River Basin)	—	LAA

Note: Listed species for the State of Idaho are subject to change. If additional species become listed, they may be addressed in an addendum to this PBA.

1.2 Description of the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action." The action area identified in this document covers the State of Idaho and includes 71 subbasins (fourth-level hydrological units) that encompass all areas potentially affected directly or indirectly by this PBA (Table 2). Species occurrences within the river basins in the state are shown in Table 3.

The Salmon, Clearwater and Snake River basins serve as migratory corridors and habitat for spawning, rearing and development for ESA-listed salmonid Evolutionary Significant Units (ESUs). The area also serves as essential fish habitat for Chinook salmon and coho salmon.

Table 2. Action area subbasins

HUC. (4th level)	Subbasin Name	HUC. (4th level)	Subbasin Name
Kootenai		Salmon River Basin *(continued)*	
17010101	Upper Kootenai	17060206	Lower Middle Fork Salmon
17010104	Lower Kootenai	17060207	Middle Salmon-Chamberlain
17010105	Moyie	17060208	South Fork Salmon River
Pend Oreille		17060209	Lower Salmon
17010213	Lower Clark Fork	17060210	Little Salmon River
17010214	Pend Oreille Lake	17060101	Hells Canyon
17010215	Priest	17060103	Lower Snake River
17010216	Pend Oreille	Snake River Basin	
Coeur d'Alene		17040104	Palisades
17010301	Upper Coeur d'Alene	17040105	Salt
17010302	South Fork Coeur d'Alene	17040201	Idaho Falls
17010303	Coeur d'Alene Lake	17040202	Upper Henry's
17010304	St. Joe	17040203	Lower Henry's
17010305	Upper Spokane	17040204	Teton
17010306	Hangman	17040205	Willow
17010308	Little Spokane	17040206	American Falls
Clearwater Basin		17040207	Blackfoot
17060301	Upper Selway	17040208	Portneuf
17060302	Lower Selway	17040209	Lake Walcott
17060303	Lochsa	17040210	Raft River
17060304	Middle Fork Clearwater	17040211	Goose Creek
17060305	South Fork Clearwater	17040212	Billingsley Creek
17060306	Clearwater	17040213	Salmon Falls Creek
Salmon River Basin		17040214	Beaver-Camas
17060201	Upper Salmon	17040215	Medicine Lodge
17060202	Pahsimeroi	17040216	Birch
17060203	Middle Salmon-Panther	17040217	Little Lost
17060204	Lemhi	17040218	Big Lost
17060205	Upper Middle Fork Salmon		

Continued on next page

Table 2 – Continued

HUC. (4th level)	Subbasin Name	HUC. (4th level)	Subbasin Name
Snake River Basin *(continued)*		Snake River Basin (*continued)*	
17040212 /	Middle Snake River	17060101/	Snake River – Hells Canyon
17040213		17050103/	
17040219	Big Wood River	17050115/	
17040220	Camas Creek	17050201	
17040221	Little Wood River	17050124	Weiser River
17040212	Upper Snake Rock	17050114	Lower Boise River
17050101	King Hill to C.J. Strike Reservoir	17050122	Payette River
		17050123	Payette River-North Fork
17050102	Bruneau River	17050120	Payette River-South Fork
17050103	Mid Snake River	17050112	Boise-Mores Creek

Table 3. Occurrence of listed, and candidate species in Idaho

Basins	Mammals	Fish	Plants	Invertebrates	Candidate Species
Kootenai River Basin	Selkirk Mountains Woodland Caribou Grizzly Bear Canada lynx	Kootenai River White Sturgeon Bull trout	N/A	N/A	N/A
Pend Oreille River Basin	Selkirk Mountains Woodland Caribou Grizzly Bear Canada lynx	Bull trout	Water Howellia Spalding's Catchfly	N/A	Yellow-billed Cuckoo
Coeur d' Alene River Basin	Canada lynx	Bull trout	Water Howellia Spalding's Catchfly	N/A	Yellow-billed Cuckoo
Clearwater River Basin	Canada lynx	Bull trout Sockeye salmon Spring/summer Chinook salmon Fall Chinook salmon Steelhead trout	MacFarlane's Four-O'Clock Water Howellia Spalding's Catchfly	N/A	Yellow-billed Cuckoo
Salmon River Basin	Canada lynx	Bull trout Sockeye salmon Spring/summer Chinook salmon Fall Chinook salmon Steelhead trout	MacFarlane's Four-O'Clock Spalding's Catchfly	N/A	Yellow-billed Cuckoo
Little Lost River Basin	Canada lynx	Bull trout	N/A	N/A	Yellow-billed Cuckoo
Snake River Basin	Grizzly Bear Northern Idaho Ground squirrel Canada lynx	Bull trout Sockeye salmon Spring/summer Chinook salmon Fall Chinook salmon Steelhead trout	Slickspot Peppergrass Ute Ladies' – Tresses	Snake River physa snail Bliss Rapids snail Utah valvata snail Banbury Springs lanx Bruneau Hot Springsnail	Christ's paintbrush Goose Creek milkvetch Southern Idaho Ground Squirrel Yellow-billed Cuckoo Columbia spotted frog

1.3 Programmatic Biological Assessment Procedures

The purpose of this document is to provide a programmatic biological assessment on routine actions performed by the Idaho Transportation Department that have a federal nexus. The federal nexus may result from either federal funding of the project through the Federal Highway Administration or from a federal permit action undertaken by the U.S. Army Corps of Engineers.

As lead agency for federal aid project actions involving highway projects, the Federal Highway Administration (FHWA) is responsible for compliance with Section 7 of the Endangered Species Act. In accordance with implementing these regulations, including 50 CFR 402.08, the FHWA has delegated authority to the Idaho Transportation Department for preparation of biological evaluations and biological assessments, and to conduct informal consultation with U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS). The delegation of this authority was established via a separate Memorandum of Understanding, “Procedures Relating to Section 7 of the Endangered Species Act and Transportation Projects in Idaho,” between the ITD, FHWA, NMFS, and USFWS dated Feb. 28, 2003 (see appendix).

The U.S. Army Corps of Engineers (COE) is responsible for ensuring compliance with Section 7 of the ESA for projects that require a Clean Water Act (CWA) Section 404 permit. The COE is the lead federal agency for state-funded projects that require a Clean Water Action section 404 permit. The COE has also designated ITD as a non-federal representative for Section 7 actions covered under this programmatic biological assessment.

The process and procedures established under the 2003 MOU for formal and informal consultation and for “no effect” documentation remain in effect, and shall be implemented with this PBA. When there is no federal nexus, either as a result of use of federal funds, federal permits or other means, this document does not apply.

The project types and descriptions in this document are constructed by state forces or federal aid project contractors and subcontractors on a recurring basis. In most cases, what is described is a typical sequence for conducting the action. Any project deviation with effects measurably different from those evaluated in this document will not be covered under this programmatic biological assessment. Multiple types of projects may be approved as components of one proposed action. For example, a passing-lane construction project might also include bank stabilization and a culvert replacement. In these cases, the most restrictive best management practices (BMPs) from any one of the individual project types shall apply to the proposed action in its entirety.

Process

The process that ITD will follow while using this document is:

1. **Confirm listed species.** The ITD will confirm that each action authorized or carried out under this document will occur within the present or historical range of an ESA-listed species, designated critical habitat, or designated essential fish habitat.
2. **ITD review.** The ITD will individually review each action to ensure that all effects to listed species and their designated critical habitats are within the range of effects considered in this document. The ITD will determine if the action has a FHWA or COE federal nexus and therefore must follow the process outlined in this PBA.

3. **NMFS/USFWS/COE/FHWA review.** The ITD will ensure that all actions described within this document will be individually reviewed and approved by National Marine Fisheries Service and/or U.S. Fish and Wildlife Service. In addition:
   - COE will receive project Pre-notification forms for all actions requiring a 404 permit.
   - FHWA will receive project Pre-notification forms for all federal aid actions.
4. **Notification:** ITD HQ shall be copied on all NLAA and LAA project Pre-Notification submittals.
   a.) The ITD will initiate NMFS/USFWS' review of all Not Likely to Adversely Affect PBA projects by submitting the Project Pre-Notification Form to NMFS/USFWS with sufficient detail about the action design and construction to ensure the proposed action is consistent with all provisions of this Document. NMFS/USFWS will notify the ITD within 30 calendar days if the action is approved or disqualified and
   b.) The FHWA or the COE will initiate NMFS/USFWS' review of all Likely to Adversely to Affect projects by submitting the action notification form to NMFS/USFWS with sufficient detail about the action design and construction to ensure the proposed action is consistent with all provisions of this Document. NMFS/USFWS will notify FHWA/COE within 30 calendar days if the project is approved or disqualified. Notifications of NLAA and LAA project effects and responses to those by NMFS/USFWS may be made by electronic submission.
5. **Site access.** The ITD will retain right of access to sites authorized using this document in order to monitor the use and effectiveness of permit conditions. The NMFS and USFWS will be allowed access to project sites as requested.
6. **Salvage notice:** If a sick, injured or dead specimen of a threatened or endangered species is found, ITD must notify NMFS (208-321-2956) or USFWS (208-378-5333) Office of Law Enforcement. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility for carrying out instructions provided by the Office of Law Enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.
7. **Project Monitoring Forms.** Within 45 days of project completion, ITD will send the appropriate post-project monitoring forms to ITD HQ, the NMFS and the USFWS.
8. **Annual Coordination Meeting.** ITD will coordinate and host an annual meeting to review the projects conducted under the PBA during the previous year.
9. **Failure to provide reporting may trigger reinitiation.** If the ITD fails to provide notification of actions for NMFS/USFWS' review, project monitoring reports, or fails to organize the annual coordination meeting, NMFS/USFWS may assume the action has been modified in a way that constitutes a modification of the proposed action in a manner and to an extent not previously considered, and may recommend reinitiation of this consultation. The monitoring forms are found in the appendix of this PBA.
10. **Audits.** The ITD, NMFS, USFWS, FHWA and the COE may conduct periodic reviews or audits on the use of this PBA. As referenced above, ITD shall allow NMFS, USFWS, FHWA, or the COE the opportunity to review any actions while in progress or after completion. The purpose of this review is to ensure clearance of appropriate project types and BMP effectiveness.
11. **Training.** ITD headquarters office will provide an annual training opportunity for districts that wish to use this PBA.
12. **Reinitiation.** If the ITD chooses to continue programmatic coverage under this document, ITD will reinitiate consultation within 5 years of the date of issuance.

Chapter 2: Project Actions

2.1 Seal Coat, Tack Coat and Prime Coat

Seal, Tack and Prime Coat projects are used to seal moisture out of a roadway structure and to provide skid resistance to the roadway surface. Prior to placing these seal coats, potholes will be filled with cold mix patching material. Cracks of a specified width are filled and sealed with liquid asphalt. The process consists of spraying approximately 0.35 gallons of emulsified asphalt per square yard onto the roadway. Crushed rock chips, no larger than ½ inch in diameter, are spread evenly over the asphalt at approximately 28 lbs per square yard. Bleeding of the asphalt can occur for a number of reasons, may happen immediately, and may occur for up to several months following construction. To correct potential bleeding, blotting sand with fines is spread over the affected areas. This process will be repeated as necessary to correct the problem. The finished product will ideally produce a 0.5-in. thick layer to a width that falls within the fog lines or within the edge of oil.

A seal coat or prime coat is best constructed during the hottest weather of the year. The construction is limited by temperature and specified dates. Chips are usually produced, washed and stockpiled off-site and are trucked onto the project during construction. Liquid asphalt is also shipped by truck onto the project during construction. The asphalt is applied by distributer and the chips are spread by chip spreader. The seal is then rolled with a 10,000-lb minimum pneumatic tire roller. Traffic may use the roadway almost immediately at reduced speeds. All work will be contained within the existing roadway prism.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- While crossing bridges or culverts with installed drainage, all bridge drains and joints will be plugged to minimize the potential for introducing residual materials to the aquatic system.

2.2 Plant Mix Overlay

A plant mix overlay is the placement of one or more lifts of asphalt cement pavement over an existing roadway surface. An overlay is used to smooth a rough and/or cracked existing pavement and add structural strength to the roadway. Prior to construction of a plant mix overlay, potholes will be filled with asphalt patching material and cracks will be filled and sealed. The existing roadway surface may be ground to remove top-down cracks, or existing bulk, or for smoothness. Grinding waste is collected, removed and disposed of at an approved upland location. Occasionally transverse cracks will be ground out several feet wide to a specified depth and filled with plant mix. The roadway will receive a tack coat of emulsified asphalt to promote bonding between the surfaces of the existing road and the new plant mix. The plant mix may be produced at a staging area or off-site and trucked onto the project. The new plant mix will then be placed by dumping loose mix onto the roadway or into a paver. If the mix is dumped onto the roadway, a paver with an elevator/mixer will lift and spread the mix evenly across the roadway. A series of rollers will compact the mix at different temperatures. The new overlay is ready for traffic when the asphalt is cooled to below approximately 100° F internal temperature.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- All work will be contained within the existing roadway prism. To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- While crossing bridges or culverts with installed drainage, all bridge drains and joints will be plugged to minimize the potential for introducing residual materials to the aquatic system.

2.3 Cement Recycled Asphalt Base Stabilization (CRABS)

To construct a CRABS project, a roadway grinding mill will grind and remove existing asphalt pavement at designated areas throughout the project. This action is required to remove excess material and maintain a finished thickness for the roadway. A CRABS machine will be utilized to pulverize, till and mix approximately 10 in. of the roadway surface and underlying roadway base. A roadway grader is then utilized to blade the surface to a uniform thickness, and a construction pneumatic roller is used to smooth and prep the roadway.

Dry cement is applied in a uniform ribbon across the bladed surface at an average depth of 0.5 in. Following the cement application, the CRABS machine will mix the surface again. At this point in the process, water is applied to hydrate the dry cement that is mixed with the roadway base and bond the pulverized material into a homogeneous product. A roadway grader will immediately follow this action to blade the surface smooth and a vibratory roller will be utilized to prepare the surface for pavement overlay. After the CRABS process is complete, the roadway surface is paved.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- All work will be contained within the existing roadway prism.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- BMPs shall be employed to control stormwater runoff.
- CRABs applications shall not be performed during active rain events.
- Contractor will ensure that pulverized CRABS material does not enter any adjacent waterway.

2.4 Cold In-Place Recycle (CIR)

To construct a CIR project, the existing roadway will be milled to nearly full depth of the existing asphalt pavement. The millings will be further crushed and mixed with water, 1.5 percent cutback asphalt and 1.5 percent quick lime CaO. This mixture is then placed directly onto the milled surface with a paving machine. After allowing water and the cutback to evaporate and cause the mixture to set, the new pavement will be rolled with pneumatic and steel drum rollers and fog coated. A blotter may be needed before traffic may use the new surface. Five to seven days following the recycle, the surface will be re-rolled and usually will be treated with an overlay or double sealcoat. All work will be contained within the existing roadway prism.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation
- While crossing bridges or culverts with installed drainage, all bridge drains and joints will be plugged to minimize the potential for introducing residual materials to the aquatic system.
- Contractor will ensure that quick lime CaO does not enter any adjacent waterways.

2.5 Bridge Deck Hydro-Demolition

This action consists of removal of bridge deck concrete or asphalt and is accomplished using a high-powered water jet system (i.e., hydro-demolition). To maintain traffic flow, the following steps will be completed for half of the bridge deck at a time. Once one side is completed, the steps will be repeated for the other half of the deck.

The existing 0.5 – 1.5 in. of the asphalt overlay of the bridge deck will be removed using mechanical methods or a high-powered waterjet system (i.e., hydro-demolition). The asphalt will be removed in such a way as to not damage the existing concrete deck or curbs. The deck surface will be cleaned by sandblasting, shot-blasting, sweeping or mechanical abrasion to remove all surface dirt, grease, paint, rust, and other contaminants.

In order to minimize the potential for direct impacts to listed aquatic species, all work will be completed from the existing bridge; no equipment or heavy machinery will enter the river channel. All bridge drains and joints will be sealed prior to hydro-demolition. Cleaning will be performed prior to beginning demolition with a vacuum system capable of removing wet debris and water. Runoff water and residual material will be collected within the roadway and disposed of off-site. Only potable water will be used for hydro-demolition activities.

To minimize the potential for introducing bridge debris (e.g., dirt, concrete, etc) to the aquatic system, measures will be taken to minimize the potential for debris to fall into the river channel while repairing the tops of piers.

Best Management Practices

The following BMPs will be implemented to minimize the potential for introducing runoff water and residual material to the aquatic system as a result of hydro-demolition.

- In order to minimize the potential for introducing runoff water and residual material to the aquatic system as a result of hydro demolition.
- All bridge drains and joints will be sealed.
- Cleaning will be performed prior to beginning demolition with a vacuum system capable of removing wet debris and water.
- During demolition, the hydro demolition system will include a vacuum system that will remove wet debris and water.
- Runoff water and residual material will be collected within the roadway and disposed of off-site in an approved upland location.
- Only potable water will be used for hydro demolition activities.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.
- An ITD environmental monitor will visit the site at least weekly to examine the application and effectiveness of the effects-minimization measures.

2.6 Silica Fume and Latex Modified Concrete Overlay

Silica fume and latex modified concrete overlays are concrete overlays usually constructed on bridge decks. The silica fume is a mineral filler, and latex modifier is chemical additive used to decrease the permeability of the concrete and provide a durable ride surface. Prior to construction, all bridge joints and deck drains will be plugged to keep debris on the surface where it may be removed by mechanical means. The deck may be prepared by removal of any asphalt surface and approximately 0.1 ft of the existing concrete surface. The newly exposed surface and rebar will be washed and sandblasted clean prior to application of the concrete overlay. Before paving, the surface will be covered by plastic sheeting to further keep the surface clean. Concrete trucks will be allowed onto the deck surface to place the concrete in front of a paving machine which runs on rails over the deck. The surface will then be grooved and cured by covering with wet burlap. Traffic will be kept off the new overlay for a minimum of four days and 4,500 psi compressive strength results. After curing, a multi-part methacrylate penetrant sealer will be applied to the new surface at about one gallon of methacrylate to 100 ft^2 of surface area. Sand will be used to cover the applied methacrylate to blot puddles and provide traction to the surface. A silica fume or latex modified concrete overlay will be about 3 in. thick; however, each project thickness may vary.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- To keep sand blasting materials out of the water and prevent methacrylate from entering the waterway, all bridge deck drains and joints will be sealed to prevent power wash or sand blasting debris from entering the adjacent environment.
- All water and construction debris generated during this action will be collected and removed to an approved upland location.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- Only potable water will be used during washing activities.

2.7 High Molecular Weight Methacrylate Seal (HMWM)

A High Molecular Weight Methacrylate Seal (HMWM) is a membrane used to fill and seal cracks in concrete surfaces, especially bridge decks. Care should be given to plugging and sealing deck drains and joints. The liquid HMWM fills cracks by capillary action and will seek leaks in poorly sealed deck drains and joints. Repairs to the concrete deck and removal of any asphaltic surface must occur prior to HMWM application.

The application process is preceded by shot blasting and vacuuming the deck to clean and remove any loose material. The bulk of the HMWM is shipped in 55-gal drums and boxes of jars containing catalyst and reactants. The HMWM is specified to be a two or more part chemical and shall be mixed on site. The HMWM is prepared in buckets, five gallons at a time, and is poured directly onto the deck surface. Workers push and scrub the liquid over the deck with push brooms, working the HMWM into the cracks. Workers will take care to keep the HMWM out of joints and problem drains. Less commonly, the HMWM is sprayed directly onto the deck surface. Immediately after application, sand is evenly spread onto the HMWM to provide friction and blotter. No traffic may be allowed onto the treatment until the HMWM has set into a hard membrane. Time to set is temperature dependent, which may range from approximately 3 hours in 90° temperatures to 8 hours in 60° temperatures. The application should not be attempted with the prediction of rain.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- The HMWM will only be applied when no rain is forecast for a period of 48 hours prior to the scheduled application time.
- HMWM will not be applied if rain is likely within four hours following the application.
- Spray will only be applied when winds are less than 15 miles per hour and when temperatures are between 40^{o} F and 100^{o} F (4^{o} C and 38^{o} C).
- No bridge rehabilitation activities will occur during wet weather conditions.
- In order to minimize the potential for direct impacts to listed fish, all work will be completed from the existing bridge; no equipment or heavy machinery will enter the river channel.
- In order to minimize the potential for introducing residual materials to the aquatic system as a result of this action, all bridge drains and joints will be sealed prior to application.
- In order to minimize the potential for introducing bridge debris (e.g., dirt, concrete, etc) to the aquatic system, measures will be taken to minimize the potential for debris to fall into the river channel while repairing the tops of piers. Measures may include the construction of a platform below the top of the pier or the use of a barge anchored under the pier site.
- In order to minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.

- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

2.8 Concrete Waterproofing Systems (Membrane Type A, B, C, and D)

This procedure is the application of one of four sealant types onto concrete surfaces to prevent water infiltration. Sealing is performed on both existing concrete and new concrete.

- Type A, hot-applied elastomeric liquid asphalt sealant
- Type B, fabric membrane sheet system
- Type C, penetrating water repellent
- Type D, precoated-preformed membrane sheet system

Type A

This seal consists of an emulsified asphalt prime coat membrane or a hot applied membrane layer covered by a layer of asphalt roll roofing. The concrete surface needs to be clean, dry, fully cured and finished and have sharp edges smoothed. The hot membrane material or emulsified asphalt prime coat will be evenly applied followed by a curing period from one to three hours or as recommended, depending on air temperatures. Following the curing, the entire treated surface will be covered with asphalt roll roofing. A suitable mastic or cement shall be used at all lap joints and as needed to tack the roofing to the membrane surface. The roofing shall be bonded to curbs by applying a bead of the hot membrane the full length of the curb at the edge of the roofing.

Type B

A fabric membrane seal consists of a prime coat with a layer of fabric embedded into it. The concrete surface needs be clean, dry, fully cured and finished. For rehabilitation of a structure, the concrete surface will be cleaned and have sharp edges smoothed. Primer shall be uniformly applied over all surfaces receiving the fabric. The fabric shall be applied against curb and joint faces and shall consist of a continuous sheet when possible.

Type C

Penetrating water repellent consists of a sealant (silane or siloxane) which penetrates the deck surface and forms a water-repellent layer within the concrete. The concrete will be sandblasted or hydroblasted clean prior to application. The surface moisture will be as recommended by the manufacturer of the water-repellent material. The repellent will be spray applied and used in accordance with the manufacturer’s recommendation. The repellent will not be applied when temperatures are below 40°F or above 100°F, or when wind speeds exceed 15 mph.

Type D

Pre-coated, pre-formed membrane consists of prefabricated sheets which may be self-adhesive or may require a separate bonding agent. The concrete surface needs be clean, dry, fully cured and finished and have sharp edges smoothed. The work shall consist of applying pre-coated pre-formed membrane sheets to the surface receiving the membrane. Application, surface preparation and primer (if required) shall be in accordance with manufacturer’s recommendations.

After sealing, only rubber-tired vehicles necessary for construction of overlays will be allowed on the completed membrane system. No public traffic will be allowed. During overlay work, a thin dusting coat of Portland cement may be placed by hand to prevent paver or truck tires from sticking to the membrane. If a base aggregate or borrow course is to be placed on the waterproof membrane, a 1.2-in. layer of sand shall be uniformly placed over the membrane surface. Plant mix overlays shall be constructed as soon as practicable after completion of the membrane. Rolling shall be with steel wheel rollers with no vibration.

Best Management Practices

The following BMPs will be implemented during sealing and cleaning activities to minimize the potential for impacts to listed species and their habitats.

- The sealing penetrant will be applied and used in accordance with the manufacturer's recommendation, and will be applied during appropriate environmental conditions (i.e., weather, temperature, precipitation, etc.).
- If applicable, all deck drains will be plugged to prevent water or applied materials from leaving the work area.
- Spray will only be applied when winds are less than 15 miles per hour and when temperatures are between 40° F and 100° F (4° C and 38° C).
- No bridge rehabilitation activities will occur during wet weather conditions.
- In order to minimize the potential for direct impacts to listed fish, all work will be completed from the existing bridge; no equipment or heavy machinery will enter the river channel.
- In order to minimize the potential for introducing bridge debris (e.g., dirt, concrete, etc) to the aquatic system, measures will be taken to minimize the potential for debris to fall into the river channel while repairing the tops of piers. Measures may include the construction of a platform below the top of the pier or the use of a barge anchored under the pier site.
- In order to minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.

2.9 Bridge Deck Epoxy Chip Seal

This process is an epoxy, aggregate, and application procedure designed to place an anti-icing polymer overlay. Before work begins the entire roadway surface (generally a concrete bridge deck or asphalt roadway) is thoroughly cleaned by steel shot blasting to ensure proper bonding between the epoxy and the concrete substrate. Shot blasting is meant to expose the coarse aggregate and remove asphalt material, oil, dirt, rubber, curing compounds, paint carbonation, laitance, weak surface mortar, and other potentially detrimental material, which may interfere with the bonding or curing of the overlay. Loosely bonded patches will be removed and repaired. Asphalt surfaces may be sandblasted or planed and textured to a specified depth. Moisture- and oil-free compressed air or high-volume leaf blowers shall be used to remove all dust and other loose material. Mechanical brooms, without water, may be used after a rain event to remove any residual dust that adheres to the prepared surface. The overlay will be placed as soon as possible after surface preparation is completed.

After surface preparation, the epoxy resin and hardening agent are mixed. Epoxy chip seal materials will not be applied when weather or surface conditions are such that the material cannot be properly handled, placed and cured within the specified requirements for project sequencing or traffic control, or when rain is imminent. The prepared surface will be completely dry at the time of epoxy application. The temperature of the deck surface and all epoxy and aggregate components shall be a minimum of 55°F (13°C) at the time of application. Epoxy shall not be applied if the gel time is less than five minutes or if pavement temperatures exceed 115°F (46°C).

An epoxy chip seal is applied using a double pass method. The double pass method calls for applying the epoxy and aggregate in two separate layers at the corresponding application rates. Total epoxy application rates should be no less than 10 gal per 100 ft^2 and typically range from 10 to 11 gal per 100 ft^2. Epoxy will be immediately and uniformly applied to the pavement surface. The aggregate shall be applied in such a manner as to cover the epoxy mixture while the epoxy is still fluid. Each course of epoxy overlay shall be cured before removing the excess un-bonded aggregate to prevent tearing or damaging of the surface. Oil- and moisture-free compressed air or high volume leaf blowers, vacuum or mechanical brooms are used to remove excess aggregate. When the second course is applied, aggregate is placed in such a manner as to cover the epoxy mixture before polymerization. Once the epoxy is cured, all loose aggregate will be removed from the roadway surface. After all loose aggregate is removed, and if there are any areas where the top surface of the stone has been coated with epoxy, the excess epoxy is removed using a light shot or sand blast.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- The epoxy seal will be applied and used in accordance with the manufacturer’s recommendation, and will be applied during appropriate environmental conditions (i.e., weather, temperature, precipitation, etc.).
- No bridge rehabilitation activities will occur during wet weather conditions.
- In order to minimize the potential for introducing residual materials to the aquatic system as a result of this action, all bridge drains and joints will be sealed prior to application.

- To minimize the potential for direct impacts to listed fish, all work will be completed from the existing bridge; no equipment or heavy machinery will enter the river channel.
- In order to minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.

2.10 Two-lane Bridge Construction (200cy fill or less below OHWM)

This action is to replace an existing two-lane bridge with a new single span structure. Existing structures are often supported by two piers and two abutments which are commonly located below the ordinary high water mark (OHWM) of the channel they span. This action allows for up to 200 cubic yards of rip-rap below ordinary high water mark during bridge construction. If existing structures are removed during this action, all fill located above stream bottom elevations shall be removed along with the old structure.

To construct a new two-lane bridge, the following construction sequence will typically be used:

Set up traffic control for one lane of traffic on one half of the existing bridge. The flow of traffic through the construction area will be controlled by temporary traffic signals installed on both sides of the project area or by flaggers. Removal of one half of the existing bridge including rail, girder, and deck is accomplished via saw cutting and lifting. Partial or complete removal of piers (and walls between pier columns) is accomplished down to natural stream bottom. Pier removal often requires the use of handheld concrete saws or a stinger (i.e., excavator mounted jackhammer). After pier removal, one half of the end beam abutment can be constructed.

Rail, girder, and portions of the deck and end beam abutments will be removed as one piece if possible. Portions to be removed would need to be cut free from the portion to remain, and then the piece would be lifted and removed using large or multiple construction cranes.

Temporary shoring may be installed to retain the existing embankment during the removal of one half of the existing bridge. This will allow for one way traffic to be maintained during the course of construction. While the type and approximate limits of temporary shoring are not known ahead of time, all efforts will be taken to minimize intrusion into the active stream channel.

Construction of the first half of the new bridge will begin and includes abutments, wing walls, pre-stressed concrete girders, half of the deck, the parapet, and half of the approach slabs on both ends of the bridge. Cranes are commonly used to set the new girders.

The new abutments will be located above and behind the ordinary high water mark elevation on the existing channel side slope. This elevation clearance is essential in order to construct the new abutments out of the existing river channel. Traffic control and temporary traffic signals are reset for one lane of traffic crossing over half of the new bridge and the temporary shoring is removed.

The remaining portion of the existing bridge will then be removed. Removal will be similar to that described above. The other half of new bridge will be constructed as described above. Rerouted utility lines will then be attached to the new bridge. The cast-in-place concrete closure pour strip in the deck, which connects both halves of the deck together, will then be constructed. Traffic control will then be removed.

Best Management Practices

In order to minimize the potential for introducing runoff water and residual material to the aquatic system as a result of bridge replacement, the following BMPs will be implemented.

- The Idaho Department of Fish and Game will be consulted for region and species-specific fish windows. The fish window will be documented under the construction timeframe identified on the project pre-notification form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.

- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order to pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.

- If fish handling is required, it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished with personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.

- In order to attain proper hydrologic function at the site, all bridge improvements will be above ordinary high water mark and will be designed to retain natural gradient, bottom material, bank stability, and near natural channel width through the structure.

- If rip-rap is required to ensure proper bank stabilization, it will be placed in a manner that will not further constrict the stream channel.

- If shrub removal is required, it will be done in such a way that root mass is left in place for stabilization purposes. An equivalent or greater amount of shrubs and riparian vegetation will be planted after project construction.

- All practicable measures will be taken to prevent bridge debris from entering the stream.

- If a stinger is chosen to remove piers, a sandbag barrier, or similar barrier, would be placed between the pier and live water to catch any debris before it would potentially fall into live water.

- If a wet-blade concrete saw is chosen, a catch basin would be constructed at the site to collect cutting water/slurry. A shop vacuum would be used to collect the slurry for off-site disposal.

- If a dry-blade concrete saw is chosen, an enclosed containment structure would be constructed around the site to trap airborne dust particles, and a shop vacuum or other device would be used to collect the dust for off-site disposal.

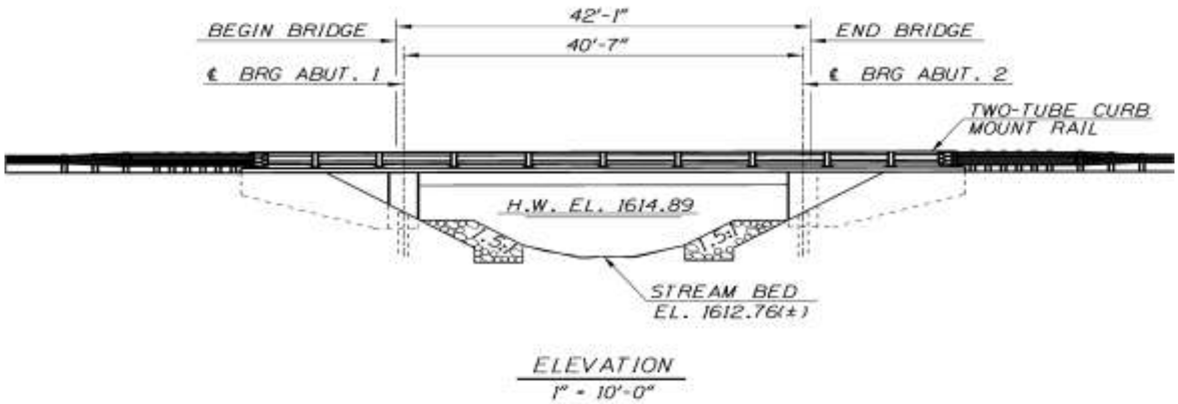
- To minimize the potential for introducing sediment to the aquatic system, sediment fences or other erosion control measures will be placed between ground disturbing activities and live water. Ground disturbance will not occur during wet conditions (i.e., during or immediately following rain events).

- No machinery or implements will enter the live stream and temporary cofferdams will be constructed, if necessary, to dewater existing pier sites during pier removal.

- To minimize the potential for introducing hazardous materials to the aquatic system, a spill prevention and contingency plan will be prepared by the construction contractor and approved by ITD prior to project implementation.

- All staging, fueling, and storage areas will be located away from and adequately buffered from aquatic areas.

Figure 1. Example diagram of bridge deck replacement



2.11 Excavation and Embankment for Roadway Construction (Earthwork)

Excavation and embankment consists of stripping topsoil and vegetation from an area and either removing earth or placing and compacting earth for roadway prism construction or slope construction. The earth may be moved from or to another section on the same project, or it may come from or be wasted off site. Equipment used will include excavators, dozers, scrapers, dump trucks, and compaction equipment. Completed cut or fill prisms may then be covered by any number of treatments, rock base and pavement, rock stabilization and rip-rap or mulch and seeding. Pipe and utility work often accompany excavation and embankment.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- A 100,000 yd^3 limit will be placed on total earth movement for project.
- No more than 300 ft of stream channel below OHWM shall be affected by this action.
- Fiber wattles and/or silt fence will be placed adjacent to or below disturbance areas to prevent sediment transport into any waterway.
- Equipment shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling and storage areas will be located away from and adequately buffered from aquatic areas.

2.12 Rock Scaling

Rock scaling is removing loose or floating rock from engineered or natural slopes prior to any surface cobbles and boulders becoming a falling rock hazard. For this activity, traffic below the slope is strictly controlled and may be protected by concrete barriers and fences. Laborers with safety harnesses will tie off from above the slope and, working downward, will pry loose rock with pry bars, hydraulic rams, jack hammers, or blasting equipment. The rock will fall to the toe of the slope to be collected and used elsewhere or wasted. The slope's soil and vegetation may be disturbed as the rock comes loose and rolls down the slope.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- Temporary rock fall barriers will be employed to prevent rock and debris from reaching adjacent waterways. Type and height of temporary rock fall barriers employed will be determined on a case-by-case basis due to rock type, height of fall and slope angle.
- Power equipment used for rock scaling operations shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling and storage areas associated with the operation will be located away from and adequately buffered from aquatic areas.

2.13 Passing Lanes, Turnbays and Slow Moving Vehicle Turnouts (Wide Shoulder Notch)

The purpose of constructing passing lanes, slow moving vehicle turnouts and turnbays is to improve traffic flow and turning safety by widening the existing pavement. Traffic is maintained on the existing roadway. All of the work performed is typically within the right of way. When possible, highway widening will occur on the uphill side of the roadway.

The work consists of constructing a road embankment adjacent to the existing roadway. Construction crews will place dirt or rock (borrow material) into the bottom of the embankment. Pipes within the fill sections must extend from under the road on each side. Construction crews will place pipe extensions first if they are required. Most culverts range in size from 12 to 24 in. ITD will contact Idaho Department of Fish and Game, NMFS, and USFWS to determine if any streams for which a culvert is being extended are fish-bearing or not. If the stream is fish-bearing, ITD will replace the entire culvert with a structure (culvert, bottomless arch, or bridge) capable of fish passage. Once the extensions are in place, ITD will place granular material over the culverts.

The sub grade will be prepped by clearing and grubbing. The foundation will be compacted with a roller prior to placing borrow. Borrow material will be placed in layers and compacted uniformly to the desired elevation by making at least three passes with a roller on each layer. Construction crews will place base or surfacing aggregate, process the aggregate (adding water so that the moisture content is uniform) and compact. The surface will then be leveled to conform to the standard of the adjoining highway. A plant mix surface will be used to provide the finished surface. Ditches will be constructed or reconstructed to provide drainage from the roadway.

Grading will be accomplished by a patrol or motor grader. Dump trucks are used to haul materials to the site. A loader will pick up material and place it as needed on the ground or place excess material in dump trucks. Rollers and a water trucks are used for compaction. A paver will be used to place the plant mix surface.

Best Management Practices

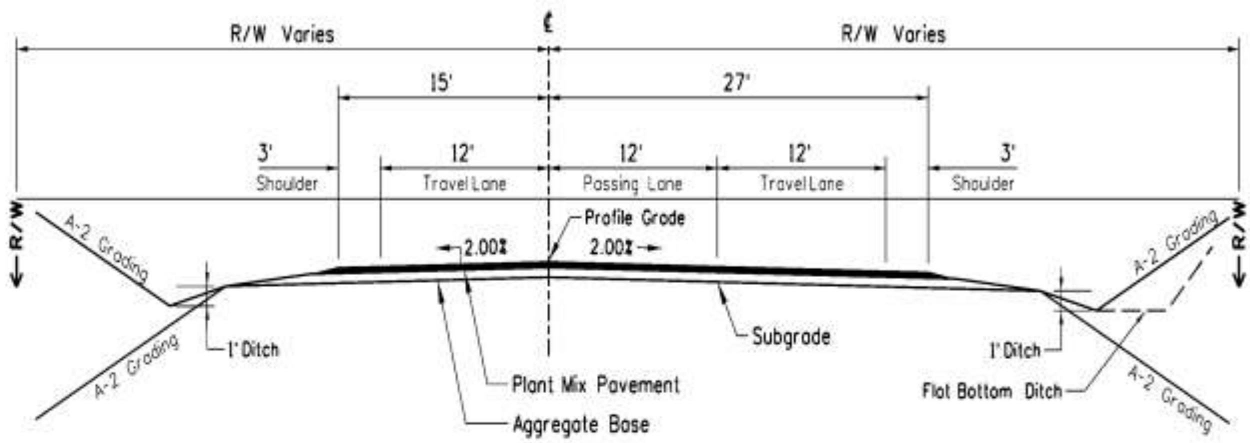
The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- Fiber wattles and/or silt fence will be placed adjacent to or below disturbance areas to prevent sediment transport into any waterway.
- Equipment shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely

dewater the work area in order to pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.

- If fish handling is required it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- NMFS water drafting criteria will be adhered to (see appendix).

Figure 2. Example diagram of a passing lane



2.14 Pavement Widening (Sliver Shoulder Notch)

This work involves the excavation of material from beneath the existing pavement, at a given distance from the centerline of the roadway, and to a depth and for a distance necessary to provide a firm foundation for widening the existing roadway and shoulder. This process will not include work below the ordinary high water mark of any waterway. Once this notch is completed, the area is backfilled with an appropriate base material and paved over to match the existing pavement and, in most cases, overlaid for more pavement depth.

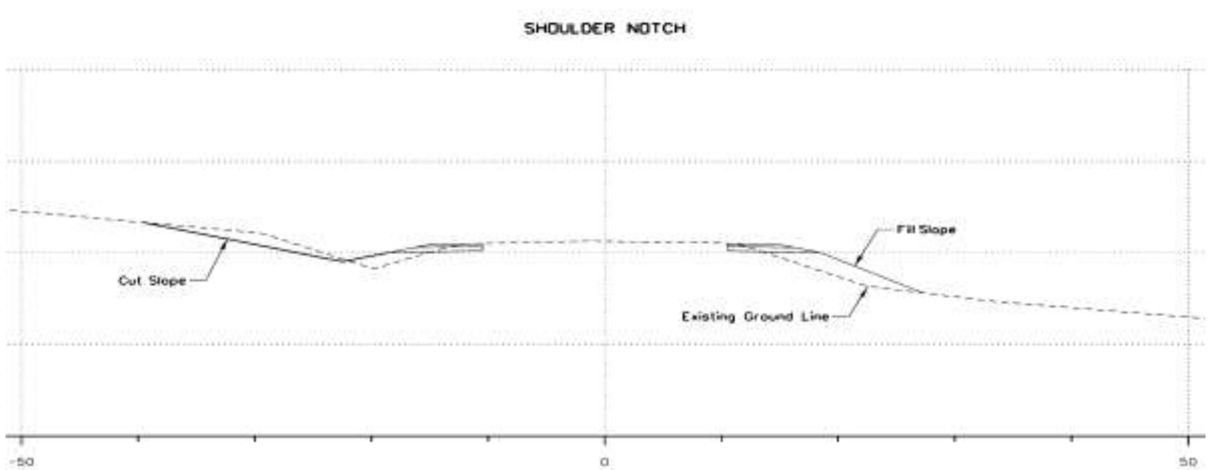
A wheel pavement saw is often used to cut through the asphalt perpendicularly to the existing surface. The base and subsurface is then excavated to the required width and depth. If the terrain permits and there are no sensitive areas immediately adjacent to the work, the excavation is done with a grader blade. When working in environmentally sensitive areas, an excavator is used to prevent material from entering the protected area. The excavated material is either used for fill material or disposed of in an approved area.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- Fiber wattles and/or silt fence will be placed adjacent to or below disturbance areas to prevent sediment transport into any waterway.
- Equipment shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

Figure 3. Example diagram of shoulder notch for pavement widening



2.15 Bank Stabilization (Rip-rap)

This action would construct a revetment to support a roadway embankment. Bank stabilization may occur either in, or immediately above, a river or waterway. The length of the revetment will vary according to the project site, but would be no longer than 300 ft below ordinary high water mark. Construction of a hard armor rip-rap revetment is done to prevent further undercutting and loss of roadway or roadway shoulder. Excavation and in-channel work are typically required to install this treatment. Excavation is sometimes required below the ordinary high water mark to establish a foundation for the structure. An excavator with thumb working from the roadway shoulder will be used for the excavation and placement of fill material and rock armoring. The excavator will create a toe trench along the washed area. Filter fabric will be used to line the toe and slope. Clean rip-rap (2 -3 ft diameter) will then be placed in the toe trench and used to armor the fill. Granular material (2 – 6 in.) will be used as fill behind the rip-rap and above the ordinary high water line. This activity is used most often to replace or repair existing embankments that have been previously armored.

Due to the poor aquatic-habitat value of rip-rap and the local and cumulative effects of rip-rap use on river morphology, non-vegetated rip-rap is only acceptable where necessary to prevent failure of a culvert, road or bridge foundation. When this method is necessary, installation will be limited to the areas identified as most highly erodible, with highest shear stress, or at greatest risk of mass-failure. Compensatory mitigation will be provided. The greatest risk of mass-failure will usually be at the toe of the slope and will not extend above ordinary high water elevation except in incised streams. Bank stabilization methods will include: (1) development of an irregular toe and bank line to increase roughness and habitat value and (2) use of large, irregular rocks to create large interstitial spaces and small alcoves to create planting spaces and habitat to mitigate for flood-refuge impacts. Geotextile fabrics will not be used as filters behind rip-rap. If filters are necessary to prevent sapping, a graduated gravel filter will be used.

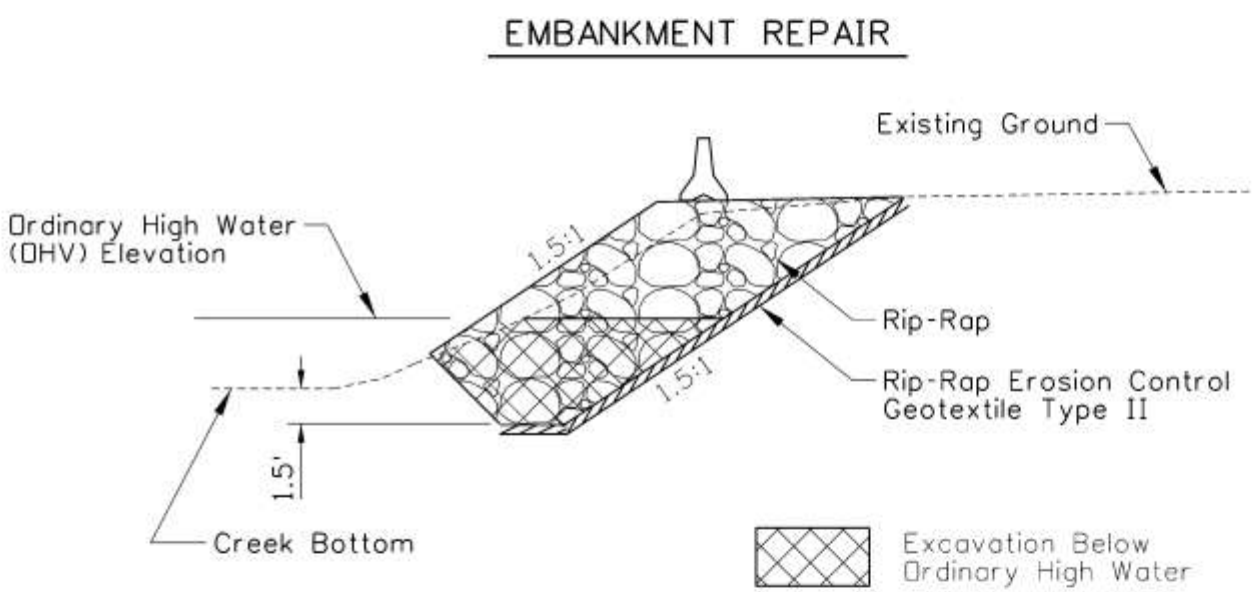
Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- No more than two bank armoring projects per watershed (4^{th} Code HUC) shall be approved annually. This determination includes construction rip-rap, gabion wall or mechanically stabilized earth (MSE) wall placement below the ordinary high water mark.
- No more than 300 ft of stream channel below the ordinary high water mark shall be affected by this action.
- All materials and equipment will be staged adjacent to the project and situated as not to disturb any adjoining slopes or vegetation.
- Straw bales or other practicable sediment control measures will be used to minimize potential sediment delivery to the aquatic resource.
- All materials removed will be placed in an approved upland location.
- Placement of rip-rap armor will occur in a way that does not constrict the channel or restrict natural hydraulics.
- The project work will take place during low flow conditions.

- The Idaho Department of Fish and Game will be consulted for region- and species specific fish windows. The fish window will be documented under the construction timeframe identified on the project pre-notification form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order to pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.
- If fish handling is required it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

Figure 4. Example diagram of bank stabilization requiring rip-rap



2.16 Bank Stabilization (Gabion Basket)

Bank stabilization may take the form of gabion baskets used as a retaining wall or as a mattress to line the existing channel. The length of gabion basket will vary according to the project site, but shall be no longer than 300 ft below ordinary high water mark. Gabions are rectangular wire baskets filled with stones used as pervious, semi-flexible building blocks to protect stream banks from the erosion while supporting a roadway. Rock-filled gabions can be used to armor the bed and/or banks of channels, divert flow away from eroding channel sections or to support a roadway section to avoid or minimize filling into a stream.

Materials for the gabions shall be fabricated in such a manner that the sides, ends, lid and diaphragms can be assembled at the construction site into rectangular baskets of a specified size. Gabions may vary in size, however generally they are 3 x 3 x 6 ft for wall construction. The type and gauge of wires is determined based on its application. Rock material for wall construction consists of a minimum of 4 in. to a maximum of 8 in., both measured in the greatest dimension. Gabion mattress rock material is 3 to 5 in. The rock shall be sound, durable, well graded and clean of all dirt and fines.

Installation of the gabion requires excavation of the footprint of the structure and preparation of the foundation material. When necessary, soft material is excavated from below the footing elevation and backfilled with granular material and compacted. Empty gabion baskets are placed on the prepared foundation and carefully filled in lifts to allow fastening to connecting baskets and to avoid deformation of the basket. All exposed surfaces will have a neat and reasonably smooth appearance. No sharp stones will project through the wire mesh. Material resulting from the excavation will be utilized in backfilling the gabion walls if suitable, or disposed of at an approved site. Care is taken during the excavation to avoid any introduction of material to adjacent waters unless permits have been obtained to allow this action. Work below ordinary high water of a stream or in a wetland will require consultation with the U.S. Army Corps of Engineers, Idaho Department of Water Resources and the Idaho Division of Environmental Quality at a minimum. If work is required in flowing water, a diversion method may be required.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- No more than two bank armoring projects per watershed (4^{th} Code HUC) shall be approved annually. This determination includes construction rip-rap, gabion wall or MSE wall placement below the OHWM.
- No more than 300 ft of stream channel below OHWM shall be affected by this action.
- All materials and equipment will be staged adjacent to the project and situated as not to disturb any adjoining slopes or vegetation.
- Straw bales or other practicable sediment control measures will be used to minimize potential sediment delivery to the aquatic resource.
- All materials removed will be placed in an approved upland location.

- Placement of rip-rap armor at the toes of the gabion will occur in a way that does not constrict the channel or restrict natural hydraulics.
- The project work will take place during low flow conditions.
- The Idaho Department of Fish and Game will be consulted for region- and species-specific fish windows. The fish window will be documented under the construction timeframe identified on the project pre-notification form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order to pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.
- If fish handling is required, it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

2.17 Mechanically Stabilized Earth Embankment (MSE Wall)

Mechanically Stabilized Earth Embankment (MSE) may be used as a retaining wall, roadway embankment, or as a mattress to line an existing channel. The length and height of an MSE wall will vary according to the project site. MSE structures consist of alternating rock or soil layers separated by wire, fabric or metal strips holding the fill in place. At times the face of the MSE wall will be lined or covered with fascia of concrete or rock. Rock-filled MSE walls can be used to armor the bed and/or banks of channels, divert flow away from eroding channel sections, or support a roadway section to avoid or minimize filling into a stream.

Installation of the MSE wall requires excavation of the footprint of the structure and preparation of the foundation material. When necessary, soft material is excavated from below the footing elevation and backfilled with granular material and compacted. The MSE layers are placed on the prepared foundation and carefully filled in lifts to allow for uniformity and to avoid deformation. All exposed surfaces will have a neat and reasonably smooth appearance. No sharp stones will project beyond the face. Material resulting from the excavation may be utilized in backfilling the wall if suitable, or disposed of at an approved site. Care is taken during the excavation to avoid any introduction of material to adjacent waters unless permits have been obtained to allow this action. If work is required in flowing water, a diversion method may be required.

Best Management Practices

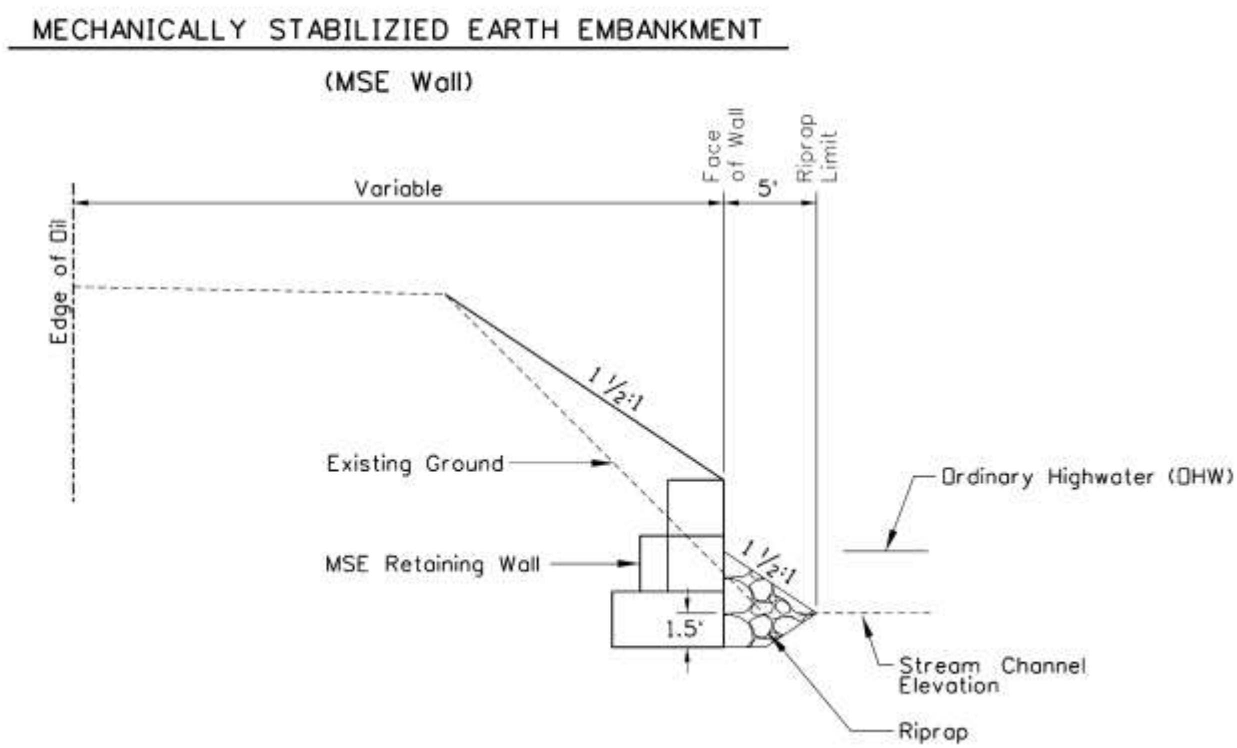
The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- No more than two bank armoring projects per watershed (4^{th} Code HUC) shall be approved annually. This determination includes construction rip-rap, gabion wall or MSE wall placement below the ordinary high water mark.
- No more than 300 ft of stream channel below ordinary high water mark shall be affected by this action.
- All materials and equipment will be staged adjacent to the project and situated as not to disturb any adjoining slopes or vegetation.
- Straw bales or other practicable sediment control measures will be used to minimize potential sediment delivery to the aquatic resource.
- All materials removed will be placed in an approved upland location.
- Placement of rip-rap armor at the toes of the gabion will occur in a way that does not constrict the channel or restrict natural hydraulics.
- The Idaho Department of Fish and Game will be consulted for region and species specific fish windows. The fish window will be documented under the Construction Timeframe identified on the Project Pre-notification Form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order to pass all the water through the work site in a culvert or

by pump. All in-stream structures will be temporary and shall be removed once construction is complete.

- If fish handling is required, it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas

Figure 5. Example diagram of bank stabilization requiring gabion baskets



2.18 Ditch Cleaning

The purpose of this activity is to restore the interceptor ditches that are located adjacent to the highway and control drainage from the highway. Ditches protect highways from drainage in order to prevent premature failure. The work consists of removing material from the roadside ditch that has been deposited over time by erosion of adjacent slopes and rock-fall. Traffic is generally maintained on the existing roadway and the activity is generally accomplished by state forces.

Highway ditches are generally small. Precautions will be made to avoid nicking the toe of the adjacent slope. Excavation and haul is required to provide the area to create a ditch to carry drainage. After ditching, the foundation will be carefully prepared and embankment properly compacted to prevent future settlement and washouts of the ditch. In some soils, it may be necessary to line the ditch with coarse gravel or other material to prevent erosion. Low spots or pockets in the flow line will be avoided or drained when possible. Special treatments, such as rock check dams may be necessary to prevent excessive erosion. Equipment that is common to this activity includes loaders, excavators and dump trucks.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- Ditching will only occur in the dry and will not involve excavation in live water.
- Fiber wattles or rock check dams will be used in areas of excessive grade to allow for deposition of sediments prior to entry into adjacent aquatic resources.
- All excavated materials will be deposited in an approved upland location where they may not reenter aquatic habitats.

2.19 Small Structure Repair

Water conveyance structures such as bridges, box culverts, stiff leg culverts, and multi-plate culverts commonly require maintenance work to repair scour or debris damage to foundation or structure footings. ITD commonly works to repair, protect, and apply preventative maintenance to these structures when this occurs.

To repair small structures, construction or maintenance crews will excavate loose material from around the undermined area. A form is then constructed around the undermined area with wood and rock; then concrete or grout is pumped into the void to completely fill the area. Scour repairs are commonly armored with rip-rap. At times, structures may have debris, such a logs or snags, catch on their piers or abutments. These snags are removed to prevent future damage.

Best Management Practices

In order to minimize the potential for introducing runoff water and residual material to the aquatic system as a result of bridge replacement, the following BMPs will be implemented.

- The Idaho Department of Fish and Game will be consulted for region and species-specific fish windows. The fish window will be documented under the construction timeframe identified on the project pre-notification form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order to pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.
- If fish handling is required it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- If rip-rap is required to ensure proper bank stabilization, it will be placed in a manner that will not further constrict the stream channel
- If shrub removal is required, it will be done in such a way that root mass is left in place for stabilization purposes. An equivalent or greater amount of shrubs and riparian vegetation will be planted after project construction.
- All practicable measures will be taken to prevent bridge debris from entering the stream.
- To minimize the potential for introducing sediment to the aquatic system, sediment fences or other erosion control measures will be placed between ground-disturbing activities and live water. Ground disturbance will not occur during wet conditions (i.e., during or immediately following rain events).
- No machinery or implements will enter the live stream and temporary cofferdams will be constructed, if necessary, to dewater existing pier sites during pier removal

- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

2.20 Culvert Installation (New Culverts and Replacement of Existing Culverts)

Installation of a culvert requires consideration for traffic management. Unless a nearby and short alternate route can be used, generally the culvert will need to be replaced in two phases. Each phase, except for short delays, must allow traffic to flow continuously and safely through the project.

Installation or replacement of a culvert involves excavating in the roadway prism to a sufficient depth to reach the flow line or grade of the waterway being conveyed. The slopes of the excavation need to be laid back such that they will not collapse and close the excavation prior to installation of the new culvert. The amount or slope that the material is laid back is dependent on the material type. Sand and gravels require the slope to be laid at a much shallower slope than rocky material. The shallower the slope, the wider the trench will be at the roadway surface. Once the material has been excavated such that personnel can safely work in the trench, the culvert installation/replacement can be conducted.

The culvert is installed/replaced either in its entirety or one half-length at a time. If it is a replacement, the area is excavated, one-half of the old culvert is removed, and the location where the new culvert is to go is bedded and half of the new culvert is installed. Material is brought in above the culvert and properly compacted to avoid future settlement of the roadway. This process is repeated on the opposite side of the highway and the two halves are connected together with a band. Material is again brought in above the culvert and properly compacted to avoid settlement in the roadway.

Culvert liner installation is another method that can be utilized to refurbish a failing or old culvert. A culvert liner is installed inside an old culvert. The liner is typically constructed of high density polyethylene and is inserted into the failing culvert. The liner generally comes in 10 – 20 ft sections that are connected together using a gasket or an O-ring. As the liner is installed, subsequent liner sections are added until the old culvert has been completely lined from the inlet to the outlet. The ends are then trimmed to conform to the ends of the old culvert and the slope and banks of the surrounding terrain. Once installed the space between the liner and the old culvert are filled with grout so that stream water stays in contact with the liner and away from the natural soil adjacent to the older pipe. Once grouting is complete both inlet and outlet ends are dressed with rip-rap, concrete, or other material.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- When replacing a culvert in a perennial stream, fish passage will be constructed into the project when regulatory agencies (USFWS, NMFS and IDFG) deem it appropriate.
- Culvert liners shall not be used in fish-bearing streams.
- The Idaho Department of Fish and Game will be consulted for region- and species-specific fish windows. The fish window will be documented under the construction timeframe identified on the project pre-notification form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.

- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.
- If fish handling is required, it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- When replacing a culvert in a perennial stream, the culvert will be designed to pass Q50 flows.
- When appropriate, ITD will contact the NMFS and USFWS to determine if fish removal is necessary.
- A cofferdam or other appropriate dewatering device will be implemented where practicable to minimize impacts to aquatic resources when working during dry conditions is not possible.
- At no time shall turbidity exceed Idaho Water Quality Standards when measured 100 ft below the area of impact.
- A rock apron inlet and outlet protection including geotextile separation fabric will be installed on all new culverts and extensions to minimize sediment delivery to the aquatic resource.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

2.21 Culvert Extension

The extension of a culvert is generally less cumbersome than culvert replacement in terms of dealing with traffic. The road can be maintained at its current width and traffic can flow uninterrupted for most of the work, except for minor delays such as when crews are working from the roadway. The extension process itself is much the same as the installation/replacement. Depending on the end of the culvert that is being extended, earthen material will likely need to be removed to accommodate the new length of culvert. Prior to placement, the excavated area is bedded and the culvert extension is installed and banded to the existing culvert. Material is then brought in to cover the culvert and properly compacted to avoid future settlement

In all installations, care must be taken in each case to properly match the flow line of the waterway to the new culvert or extension. The upstream and downstream ends of the culvert may need to have concrete aprons poured or rock brought in to avoid scour at these locations.

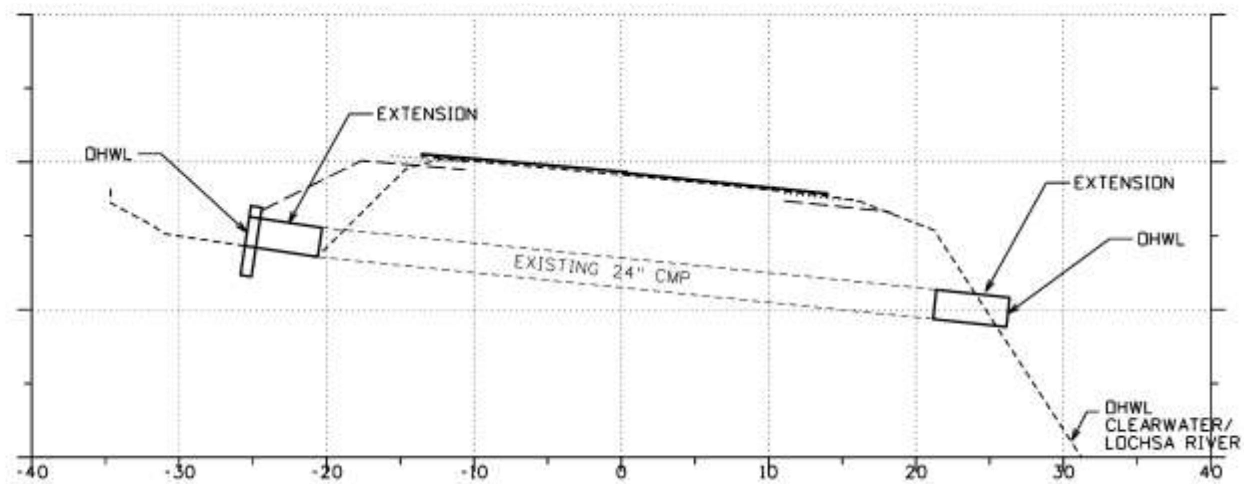
Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- Any culvert that is a barrier to fish passage is not eligible for extension under this PBA.
- A cofferdam or other appropriate dewatering device will be implemented where practicable to minimize impacts to aquatic resources when working during the dry is not possible.
- The Idaho Department of Fish and Game will be consulted for region and species specific fish windows. The fish window will be documented under the Construction Timeframe identified on the Project Pre-notification Form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.
- If fish handling is required it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- At no time shall turbidity exceed Idaho Water Quality Standards when measured 100 ft below the area of impact.
- A rock apron inlet and outlet protection including geotextile separation fabric will be installed on all new culverts and extensions to minimize sediment delivery to the aquatic resource.

- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

Figure 6. Example diagram of culvert extension



2.22 Culvert Maintenance

Drainage culverts periodically become obstructed with dirt, silt rocks and debris and require cleaning to maintain proper function. To clean culverts several methods are used depending upon culvert size, the type of obstruction, and the sensitivity of the channel or stream the culvert conveys. The following methods generally apply:

Drag Line

This method is used for small culverts where adequate room allows for a cable or chain attached to a solid rod to be threaded through the culvert. The cable or chain is then attached an object smaller than the diameter of the culvert. The cleanout object is then pulled through the culvert mechanically to clear the debris from the pipe. Adequate room needs to exist to allow for the use of an appropriate machine to pull the cleanout object through the pipe.

Hydraulic Pressure

This method is generally used for small culverts that cannot be accessed manually or mechanically. It usually involves the use of a water tank truck, a high pressure pump and a special rotating hose head, referred to as a “weasel”. The hose is fed into the culvert and the pressure causes it to rotate and spray simultaneously loosening and washing the debris out of the culvert. The debris is then removed from the channel and disposed of.

Manual Cleanout

This method is used when the culvert is of adequate size for access by laborers to remove the debris by hand. It is generally used in sensitive areas where running water is present at the time of the removal. It involves the use of picks, shovels, buckets, and wheelbarrows. Debris is carried to the ends of the culverts where it is then loaded into the scoop of a trackhoe and removed. In some cases the use of cofferdams might be required to divert the water around the work area. BMPs may be applied to capture sediment.

Mechanical Cleanout

This method is used on culverts that are large enough to use excavators or backhoes to remove obstructions. In some cases the excavator is located in or near the channel and reaches into the culvert from one or both ends to remove the debris. Large rocks that cannot be reached might be removed by use of a cable or could be broken up by drilling and using a low charge explosive, similar to a shotgun shell, and then removed manually. Small excavators such as bobcats, or walk-behind excavators that can enter the culvert may be used. Similar to the manual cleanout method, sediment control BMPs could be required.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- The Idaho Department of Fish and Game will be consulted for region and species specific fish windows. The fish window will be documented under the Construction Timeframe identified on the Project Pre-notification Form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- Dewatering may accompany this activity. Dewatering of the stream channel is often accomplished using structures such as aqua-barriers, sandbags, concrete barriers or

culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.

- If fish handling is required it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- Fiber wattles and/or silt fence will be placed adjacent to or below disturbance areas to prevent sediment transport into any waterway.
- Equipment used shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- Cofferdams or other isolation methods will be used when practicable to dewater the project area during cleaning operations to minimize sediment delivery to the aquatic system.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.
- All staging, fueling, and storage areas will be located away and adequately buffered from aquatic areas.

2.23 Guardrail Installation

The purpose of this activity is to restore or replace guardrail that is located adjacent to the highway. The activity is performed by either state forces or by contractor. Traffic is generally maintained on the existing roadway. All work is performed within the ITD right-of-way.

During guardrail replacement, a grading operation is required prior to installation of concrete or metal guardrail. This action commonly requires excavation or fill sections to be constructed within the roadway prism during the grading operation for placement of the guardrail. In many sections, the rail may have to be extended to reduce a hazard. Adding or reshaping material adjacent to roadway is common. Borrow material is placed in layers and compacted uniformly and to the desired elevation. A level gravel base is constructed that drains away from roadway. Occasionally, water conditions or soft soil conditions may require a course of aggregate base to be placed under the guardrail.

When using metal guardrail, posts are installed by pounding them into the ground or using posthole diggers. The metal lengths of guardrail are attached to the posts. The appearance of guardrail is critical. Elevation of the top of posts shall be uniform, giving a smooth transition into curves and slopes. Posts are tamped to assure vertical alignment as well as safety.

All work will be contained within the existing roadway prism. ITD will require all contractors to prepare an Erosion and Sediment Control Plan, which will, at a minimum, include a spill prevention plan that is submitted to the department prior to any work being performed.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- All work will be contained within the existing roadway prism
- BMPs shall be employed to control stormwater runoff

2.24 Striping (methyl methacrylate or paint)

Markings on the highways have important functions in providing driver information and guidance for the road user. Marking types include, but are not limited to, pavement striping, curb coloring, colored pavements, object markers, channelizing devices, delineators and raised or painted islands. In some cases, markings are used to supplement other traffic control devices such as signs and signals. In other instances, markings are used alone to effectively convey traffic regulations, warnings and/or guidance in ways not obtainable by use of other devices.

Pavement surface markings are generally applied in the form of traffic line paints. In the past, these traffic paints were typically solvent-based with a high solids composition for durability. Several years ago, the Idaho Transportation Department converted its pavement marking program to a water-based paint to minimize environmental impacts and reduce paint handling safety concerns. The waterborne paint striping and pavement markings are normally applied by a truck with a pressurized paint spraying system. The paint normally is delivered in 250-gal self-contained plastic paint totes that can be transferred by forklift from the supplier’s truck to the striping truck. Smaller 50 – 100 gal containers are provided to the stencil truck for spraying turn lane, crosswalk and railroad crossing pavement markings.

Traffic marking paints are formulated to dry rapidly (less than a minute) to minimize tracking of the paint by vehicles encountering the striping operation. Any spills from equipment failure or improper handling are normally blotted with sand or floor-dry to contain the undesired marking. Undesired markings are generally ground off the pavement surface with a pavement grinder. More recently, the Idaho Transportation Department has been investigating and experimenting with newly manufactured thermoplastic durable pavement products such as extruded methyl methacrylate materials and 3M polymer pavement marking tapes to extend the life of the pavement markings. These products are normally extruded or rolled into a shallow groove ground into the pavement surface and typically last three to five years before needing to be replaced or covered by paint.

Due to the nature of the work involved for this highway action, no effects to the natural environment are known or expected. All work will be contained within the existing roadway prism. ITD will require all contractors to prepare an Erosion and Sediment Control Plan (ESCP) which will, at a minimum, include a spill prevention plan that is submitted to the department prior to any work being performed.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- Equipment shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.

2.25 Geotechnical Drilling

Geotechnical investigation is often required on ITD projects. This task commonly consists of geotechnical borings or seismic refraction surveys.

ITD primarily uses four methods to retrieve soil and rock samples and to perform *in situ* testing. The drill method used is determined by the type of soil and rock to be penetrated, groundwater conditions and type of samples required. The four basic methods of drilling are hollow-stem augers, rotary drilling, percussive air drilling and core drilling. For drilling operations a drill rig is positioned over the boring location, hydraulic rams are used to level the rig and a derrick is raised.

Hollow-stem augers

Hollow-stem augers are commonly used in cohesive soils or in granular soil above the groundwater level. Hollow-stem auger consists of the hollow outside section with a pilot bit and drill rod on the inside. Auger sections are 5 ft in length. Augers are attached to the drive head, which turns the auger to advance it into the soil. At the desired sampling depth, the auger is disconnected from the drive head, the drill rod and pilot bit are hoisted out of the hollow section, a soil sampling device is attached to another section of drill rod, and the sampler is lowered into the hollow auger section. Raising and lowering of the drill rod into and out of the auger sections is accomplished with wire-line hoists that run up and over the derrick and are attached to the base of the drill rig. Modified hollow-stem augers with soil tubes are capable of continuous soil sampling. Continuous soil sample lengths are 5 ft long with diameters equal to the diameter of the hollow-stem auger.

Soil sampling can also be accomplished using either a Standard Penetration Test split-spoon sampler or California ring sampler. These samplers are driven into the soil at the desired depth using a hydraulically operated free-falling hammer. The tube penetrates to varying depths, depending on the length of the tube and the resistance of the soil. The tube is then retrieved and the ends are sealed for transport.

Once a soil sample is obtained at the desired depth, the drill rod and pilot bit are once again placed inside the hollow auger section, the drive head of the drill rig is reattached to the auger, and the auger is advanced to the next sampling depth. Soil samples will be obtained at select intervals. This process is repeated until the augers have been advanced and soil samples have been obtained to the specified depth of the boring.

Rotary drilling

Rotary tricone drilling is most commonly used below the groundwater level or in dense soils, granular soils, or soft weathered rock that is difficult to penetrate with augers. A drill bit is used to cut the formation and drilling fluids support the borehole and lift the cuttings to the surface. The boring is advanced sequentially. Casing is advanced after the desired sample depth is reached or to a depth where the borehole can no longer be supported with drilling fluids. Casing is advanced by either being driven into the ground or rotated. Sampling is conducted in a similar manner as auger drilling. Once the borehole is cased and the samples retrieved, drilling resumes.

Percussive air drilling

Percussive air drilling is similar to rotary tricone drilling but the drill bit cutting action is aided with a down-hole hammer operated by air. Cuttings are blown to the surface by the air. The borehole is supported by advancing casing simultaneous with the drill rod. Percussive air drilling is favored in alluvial gravels.

Core drilling

Core drilling is primarily used to bore through rock. Diamond bits are rotated through rock while circulating drilling fluids to cool the bit and lift cuttings to the surface. The bits are circular allowing the cut rock to pass into a 5-ft long hollow barrel. After every 5-ft interval is drilled halted and the barrel holding the rock is retrieved by wire line. Wire line is used to run an empty barrel back down the inside of the drill rod to the bit where it is latched into place and drilling resumes until the barrel again becomes full.

Drilling fluids may be water, mud, compressed air, or compressed air with foam additive. Drilling fluids are used to cool the cutting surface of the bit and to lift the rock cuttings to the surface. Drilling liquids help stabilize the borehole wall to prevent collapse and to seal zones to prevent loss of drilling fluids into the formation. Drill mud is water and additives. The additives are not toxic and are commonly betonite clay and polymers. While drilling, fluids are pumped through the drill rod and drill bit, up the annulus and back to the surface. Drilling fluids can be discharged onto the ground surface. Water flow over the ground surface is avoided as much as possible. Where discharge on the ground surface is not permitted, drill fluids that reach the surface are contained in tubs where the rock cuttings are removed before being recirculated. While circulating down hole partial or complete fluids loss can occur into the formation. This indicates zones where open joints, fractures or voids are present. When drill fluids become contaminated with oil or other substances, special handling and precautions may require containment and disposal off-site.

For in-water drilling, the drilling platform is typically placed on a barge or wheeled vehicle which is positioned over the desired location. A casing is lowered to the streambed and set. Drilling takes place inside the casing. Drilling fluids will be non-toxic and recycled in a closed system. There will only be a brief pulse of sediment when the casing is first set; after that, all material is contained within the casing and fluid system.

Best Management Practices

The following BMPs will be implemented during project activities to minimize the potential for impacts to listed species and their habitats.

- When appropriate, fiber wattles and/or silt fence will be placed adjacent to or below disturbance areas to prevent sediment transport into any waterway.
- Equipment shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- To minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation.

2.26 Best Management Practices (BMPs) and Mitigations Common to all Construction Project Activities

- All associated permit conditions will be met during construction operations.
- Idaho State Water Quality Standards will be met during construction operations.
- The Idaho Department of Fish and Game will be consulted for region- and species-specific fish windows. The fish window will be documented under the Construction Timeframe identified on the Project Pre-notification Form. Fish windows established by IDFG/ITD and/or NMFS and USFWS will be utilized during project construction.
- If dewatering of the stream channel is required, it will be accomplished using structures such as aqua-barriers, sandbags, concrete barriers or culverts placed within the active channel. These structures will either divert water to a portion of the channel away from active construction, or dam the channel and completely dewater the work area in order to pass all the water through the work site in a culvert or by pump. All in-stream structures will be temporary and shall be removed once construction is complete.
- If fish handling is required, it will be done by either electro-fishing or hand-netting after dewatering has occurred. Fish handling will be accomplished utilizing personnel from agencies such as the FS, IDFG, tribes or other qualified personnel with appropriate training and experience. A Scientific Collection Permit issued by the IDFG is required to handle bull trout.
- Fiber wattles and/or silt fence will be placed adjacent to or below disturbance areas to prevent sediment transport into any waterway.
- Equipment used shall not have damaged hoses, fittings, lines, or tanks that have the potential to release pollutants into any waterway.
- Cofferdams or other isolation methods will be used when practicable to dewater the project area during in water work.
- In order to minimize the potential for direct impacts to listed fish, when possible, all work will be completed from the existing bridge or roadway shoulder and equipment and/or heavy machinery will not enter the river channel
- In order to minimize the potential for introducing hazardous material to the aquatic system, a spill prevention and control countermeasures plan will be prepared by the construction contractor and approved by ITD prior to project implementation. All staging, fueling, and storage areas will be located away and adequately buffered from riparian zones and aquatic areas.
- When appropriate, ITD will monitor turbidity. Water quality samples will be collected and NTU measurements will be recorded on the Construction Monitoring form. Measurements will be taken 100 ft above and below discharge points, or as directed by appropriate resource agency or ITD personnel.
- No bridge rehabilitation activities will occur during wet weather conditions.
- Disturbed areas within riparian zones will be reclaimed with riparian vegetation similar to the existing plant communities.

- Spill kits and cleanup materials shall be available at all locations during operations.
- Equipment that is used in streambeds or on other structures adjacent to or over water bodies shall be kept leak-free.
- Park equipment over plastic sheeting or equivalent where possible. Plastic is not a substitute for drip pans or absorbent pads.
- When not in use, construction equipment will be stored away from concentrated flows of stormwater, drainage courses, and inlets.
- Borrow and fill areas shall be located outside of the 100-year floodplain or greater than 300 ft from fish-bearing streams.
- To reduce the potential for the invasion and/or expansion of noxious weeds, all earth-disturbing equipment used on projects with contracts administered by the Idaho Transportation Department shall be cleaned of all plant materials, dirt and material that may carry noxious weed seeds prior to use on the project.
- Prior to arriving at the construction site, construction equipment shall be washed and treated to remove seeds, plants, and plant fragments. Use of a high-pressure washing system is recommended in order to remove all seeds, plants, plant fragments dirt, and debris from the construction equipment taking care to wash the sides, tops, and undercarriages.
- The contractor shall provide the engineer with an opportunity to inspect the equipment prior to unloading the equipment at the construction site. If upon inspection, dirt, debris, and seeds are visible, the equipment shall be immediately removed and rewashed. The equipment shall then be re-inspected at the site to ensure the equipment is clean.

2.27 BMPs Associated with the Preservation and Retention of Existing Vegetation

General Description

Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and/or grasses that serve as erosion controls.

Applications

These techniques are applicable to all types of sites. Areas where preserving vegetation can be particularly beneficial are floodplains, wetlands, stream banks, steep slopes, and other areas where erosion controls would be difficult to establish, install, or maintain.

Installation/application criteria

- Clearly mark, flag, or fence vegetation or areas where vegetation should be preserved.
- Prepare landscaping plans which include as much existing vegetation as possible and state proper care during and after construction.
- Define and protect with berms, fencing, signs, etc. a setback area from vegetation to be preserved.

- Propose landscaping plans which include and utilize native plant species that minimize competition with the existing vegetation.
- Do not locate construction staging areas, waste areas, etc. where significant adverse impact on existing vegetation may occur.
- Establish appropriate buffer zones to protect riparian corridors and natural drainage paths; maintain and protect dense vegetation in these areas and retain vegetated buffers in their natural state wherever possible.
- Minimize the number and width of stream crossings and cross at direct rather than oblique angles.
- Maximize the undisturbed area within project boundaries whenever possible to retain vegetation for erosion control purposes.
- Preserve native site vegetation and plant communities when practicable. Choose native vegetation when applicable for revegetation efforts.

Chapter 3: Species Accounts

3.1 Selkirk Mountain Woodland Caribou *(Rangifer tarandus caribou)*

Species Description and Life History

The woodland caribou is restricted to North America and is further broken down into two ecotypes: mountain and northern (Scott 1985, Stevenson and Hatler 1985). Ecotypic differentiation is based on habitat use and behavior patterns and is not a genetic consideration. The mountain ecotype of the woodland caribou is found in eastern British Columbia (B.C.) and western Alberta south of Prince George, British Columbia. The Selkirk Mountain woodland caribou ecosystem is within the range of the mountain ecotype. Northern ecotype caribou range over much of the remainder of Canada.

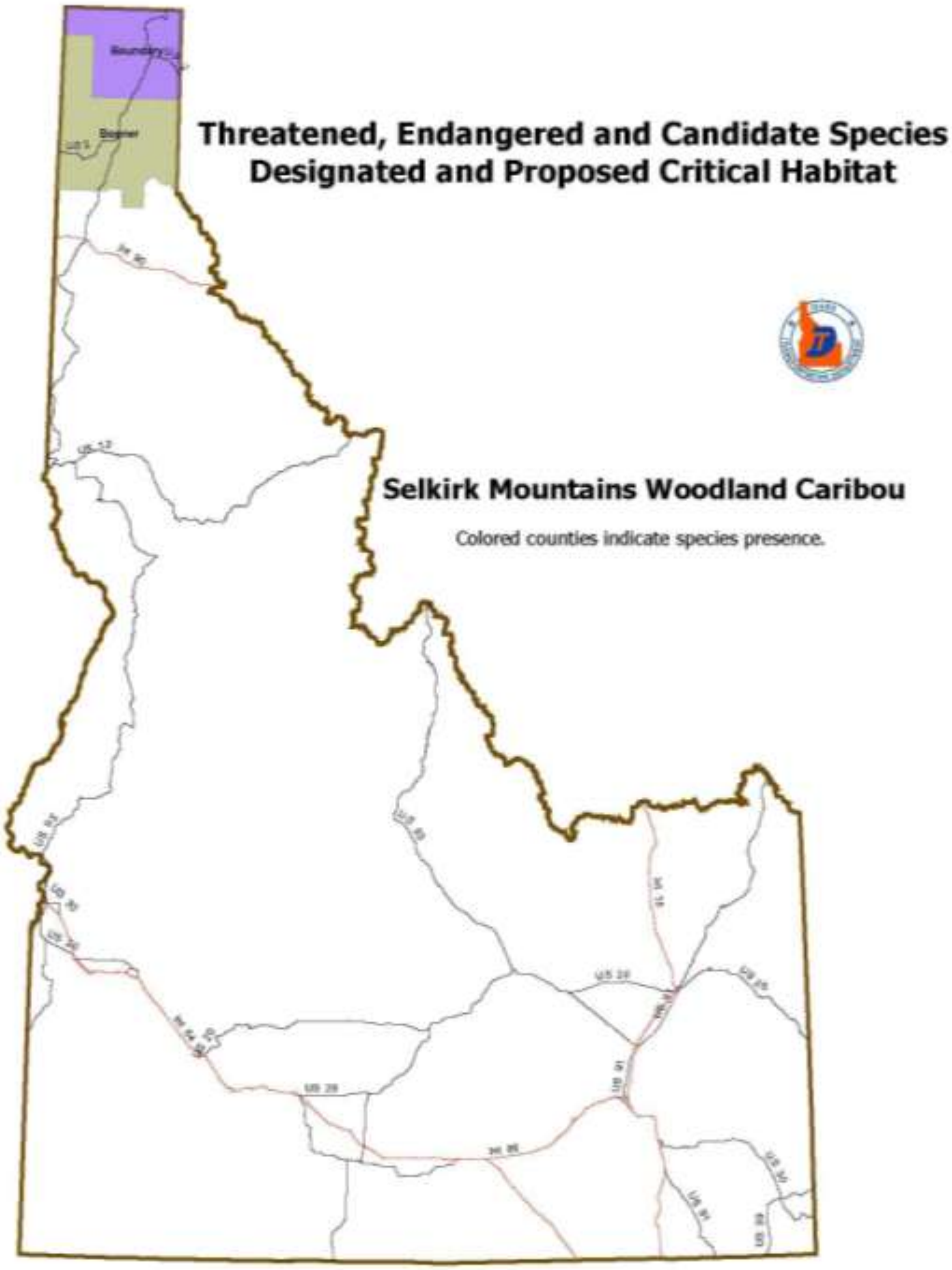
Woodland caribou are medium-sized members of the deer family with males approaching 600 lbs and females 300 lbs. Caribou are distinguished from other members of the deer family by their large hooves, broad muscles, and distinctive antlers that both sexes develop annually. Selkirk caribou are unique in the deer family because they forage almost exclusively in the winter on arboreal lichens. Males drop their antlers from November to April and females in May and June. The pelage of the woodland caribou ranges from deep chocolate brown in midsummer to grayish-tan during the spring. Adult males develop a distinctive white mane during the rut.

Prior to 1900, woodland caribou were distributed throughout much of Canada, and the northeastern, northcentral, and northwestern conterminous United States. Caribou are occasionally sighted in Minnesota (Mech et al. 1982), but have disappeared from Maine, Vermont, Michigan, and Wisconsin (Fashingbauer 1965, McCollough 1990). There was an unsuccessful attempt to reintroduce caribou to Maine in the 1980s (McCullough 1991).

The last confirmed report of caribou in Montana occurred in 1958 (Manley 1986). Since then several unconfirmed sightings have been reported and tracks were documented in northwestern Montana in the mid-1980s (Manly 1986).

Caribou in Idaho historically occurred as far south as the Salmon River (Evan 1960). Since the 1960s, the last remaining woodland caribou population in the United States has restricted its range to the Selkirk Mountains of northeastern Washington, northern Idaho and southeastern British Columbia. As recently as the 1950s, the Selkirk population consisted of approximately 100 animals (Flinn 1956, Evans 1960). However, by the early 1980s this population had dwindled to 25-30 individuals whose distribution centered around Stagleap Provincial Park, British Columbia (Scott and Servheen 1985).

The recovery area for caribou in the Selkirk Mountains is composed of approximately 5,700 km^2 in northern Idaho, northeastern Washington, and southern British Columbia. About 47 percent of the area lies in British Columbia and 53 percent lies in the U.S. The U.S. portion includes the Salmo-Priest Wilderness and other portions of the Colville and Idaho Panhandle National Forests, Idaho Department of Lands holdings, and scattered private parcels.



The area is dominated by cedar/hemlock and spruce/fir forests. Historically wildfire was the primary disturbance factor in the Selkirks. Timber management and recreation are currently the principal land uses. Habitat use and movement patterns of the Woodland caribou in the Selkirk Mountains are different from caribou to the north in that woodland caribou in general, do not make the long mass migrations for which caribou on the northern tundra of Canada are famous.

Generally, the mountain ecotype of woodland caribou exhibit five distinct seasonal movements. In the early winter, caribou shift to lower elevation habitats best characterized by mature to old-growth subalpine fir/Englemann spruce and western hemlock/western red cedar forest types and the ecotones between these on moderate slopes with a high density of recently windthrown arboreal lichen-bearing trees (Rominger unpubl. Rpt.). These habitats occur generally between 4,000 and 6,200 ft in elevation.

The movement from early winter to late winter (mid-January) occurs as snow accumulates and hardens, allowing easier movement and lifting the caribou into the lichen-bearing forest canopy typical of old growth Engleman spruce/subalpine fir habitat situated on moderate slopes above 6000 ft in elevation.

In the spring Selkirk mountain woodland caribou remain at mid-elevation where they use open-canopied areas often adjacent to mature forest (Scott and Servheen 1985, Servheen and Lyon 1989). Pregnant females move to typical spring habitat in April or May, then move back onto snow-covered areas often at higher elevations to calve in early June. This behavior may function to avoid predators and therefore increase calf survival (Bergerud et al. 1984, Simpson et al. 1985, Servheen and Lyon 1989). The areas selected for calving by Selkirk caribou typically support old noncommercial forests with high lichen densities, open canopies, small trees and low road densities.

In the early summer, as snow melts, the caribou bulls and immature animals return to higher elevations of the alpine and subalpine vegetative zones with high forage availability. As summer progresses caribou move from more open-canopied to more closed-canopied forest stands supporting forbs that mature later in the season.

Movements from summer to fall habitat may occur as a result of early frost effects on vascular forage. Caribou shift to lower elevations and more densely canopied forest in the southern Selkirks. Western hemlock habitats with a high snag density are used extensively at this time which is probably related to the availability of windthrown and deadfalls that increase lichen availability. Habitat selection during this period focuses on vascular plant availability and increasing amounts of lichen as winter nears and the annual cycle repeats (Servheen and Lyon 1989).

Caribou generally have a low reproductive rate and high calf mortality. Causes of mortality of the Selkirk caribou include natural, predation, poaching and motor vehicle collisions. Most hunting-related mortality was documented before 1985, presumably due to the high profile of caribou, their status, and extensive education and enforcement efforts. Vehicle collisions have also declined markedly since 1985, though the potential remains. Today the principal source of caribou mortality is thought to be natural.

Effects

In general, woodland caribou appear relatively sensitive to the effects of roads, particularly the activities they facilitate. Roads contribute to changes in habitat quality and availability by fragmenting habitats in previously intact landscapes. As road densities increase, edge habitats increase and interior patches decrease, reducing habitat available to species requiring interior habitats. As fragmentation increases, patches of remaining habitat may become sufficiently small in size and/or isolated to the point that they are no longer used by these wildlife species, thus resulting in effective habitat loss. This has been demonstrated in numerous species, including woodland caribou (Joly et al. 2006).

Reduced use of habitat in response to roads has been exhibited in numerous ungulate species, including woodland caribou. Woodland caribou can be displaced from important habitats like calving grounds (Joly et al. 2006) due to their avoidance of roads (Dyer et al. 2002). Weir et al. (2007) documented avoidance by caribou in response to construction and operation of a mine during five seasons, illustrating the exceptional sensitivity of caribou to anthropogenic activities. Apps and McLellan (2006) found that "remoteness from human presence, low road densities, and limited motorized access" were important factors in explaining habitat occupancy in current caribou subpopulations.

Research conducted on woodland caribou suggest the high sensitivity of this species to human disturbance through a number of mechanisms, which is frequently facilitated by the presence of roads.

Determination of Effects on Selkirk Mountain Woodland Caribou

The project types proposed under this PBA will have *no effect* on woodland caribou.

Rationale for Determination –With the last remaining woodland caribou population in the U.S. present in the Selkirk Mountains of northern Idaho, the potential for impacts from human disturbance exists. The recovery area for caribou in the Selkirk Mountains includes the Salmo-Priest Wilderness, parts of the Colville and Idaho Panhandle national forests, State of Idaho land, and private land. Given that ITD cannot predict exact locations of future projects an analysis of existing ITD-administered roads in relation to existing woodland caribou habitat and recovery area is needed to assess the potential effects on this species.

ITD maintains and administers several highways in Boundary and Bonner Counties (U.S. 2/95, S.H. 57, S.H. 1 where woodland caribou occur. Discussions with the Bonners Ferry Ranger District (B. Lyndaker, Wildlife Biologist USFS, personal communication) indicate there is no relation to woodland caribou habitat and ITD roads. S.H. 57 is along the western edge of Idaho but there is no woodland caribou habitat (high elevation > 4,000 feet, cedar-hemlock-spruce forests) within 10 miles of Nordman, Idaho, which is the end of S.H. 57. In addition, woodland caribou habitat occurs 6 to 7 miles west of S.H. 1 and U.S. 2/95, across the Kootenai River Valley which is a broad wide open treeless area. The location of ITD roads and woodland caribou habitat do not overlap and there will be no effect on woodland caribou habitat or individuals from road maintenance activities covered in this PBA.

3.2 Grizzly bear (Ursus arctos horribilis)

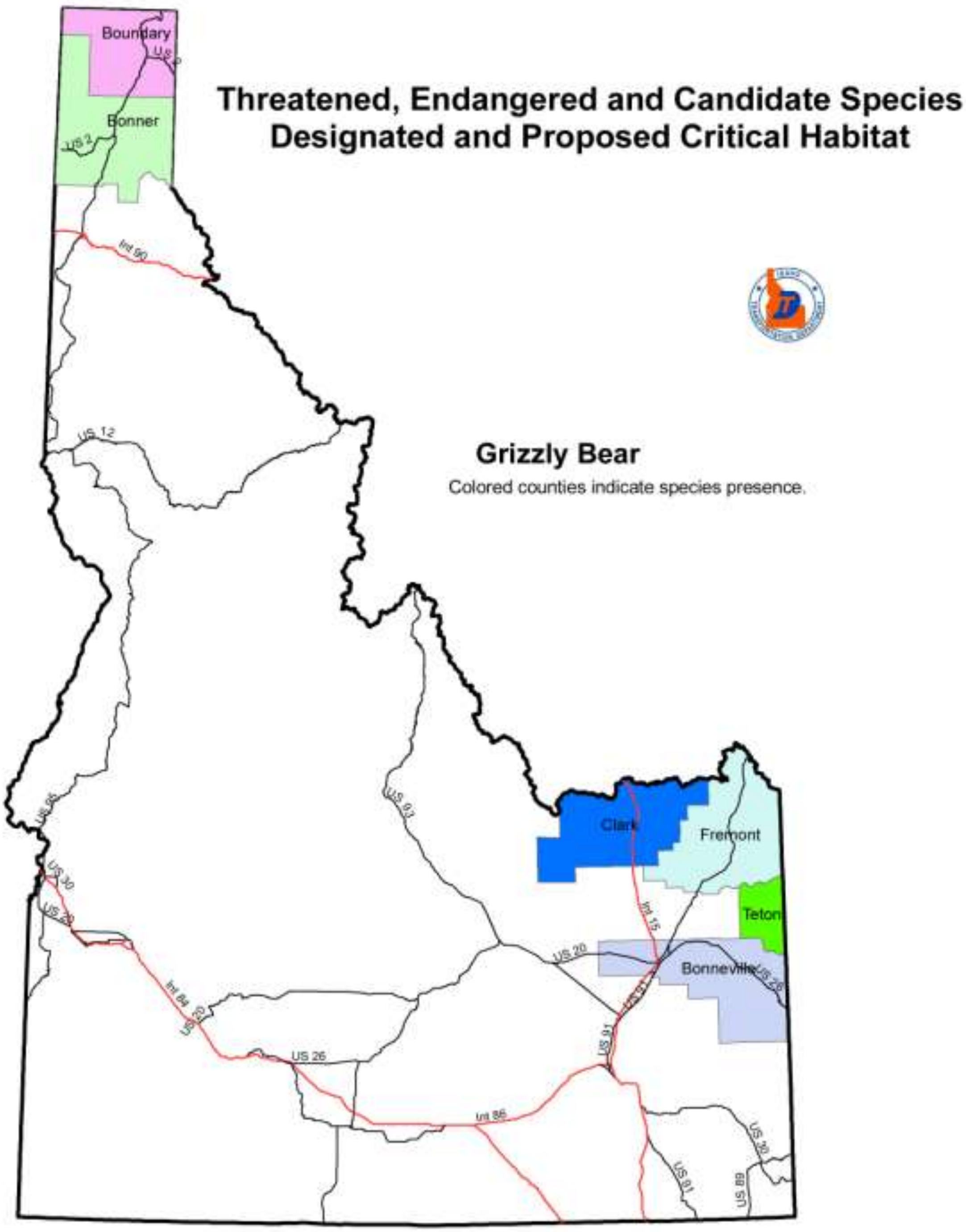
Species Description and Life History

The grizzly bear is one of two subspecies of the brown bear (*Ursus arctos*) that occupy North America. Coloration varies from light brown to almost black. Grizzly bears are generally larger than black bears (*Ursus americanus*), ranging between 200 and 600 lbs. Although relatively long-lived (20-25 years in the wild), the grizzly bear has a low reproductive rate due to the late age of first reproduction (4-7 years), small litter size (two cubs), long intervals between litters (three years), and limited cub survival (less than 50 percent). Grizzly bears are a wide-ranging species with individualistic behavior, although there is little evidence that they are territorial. Home range sizes vary, and the home ranges of adult bears frequently overlap. Most areas currently inhabited by the species are represented by contiguous, relatively undisturbed mountainous habitat exhibiting high topographic and vegetative diversity. Availability of spring habitat is a concern throughout the current range of the species. A more complete discussion of the biology and ecology of this species may be found in the 1993 Grizzly Bear Recovery Plan (USFWS 1993).

Originally distributed in various habitats throughout North America from central Mexico to the Arctic Ocean, grizzly bears were thought to number approximately 50,000 in the early 1800s. However, westward human expansion and development in the 1800s led to a rapid distributional recession of grizzly bear populations. Bear numbers and distribution in the lower 48 States dropped precipitously during this period due to a combination of habitat deterioration, commercial trapping, unregulated hunting, and livestock depredation control. On July 28, 1975, the grizzly bear was listed as threatened in the conterminous U.S., at which time the species occupied less than 2 percent of its former range south of Canada and was distributed in five small populations totaling an estimated 800-1,000 bears (40 FR 31734). The five remaining self-perpetuating or remnant populations occur primarily in mountainous regions, national parks, and wilderness areas of Washington, Idaho, Montana, and Wyoming.

A Grizzly Bear Recovery Plan was approved on January 29, 1982, and a revised plan was completed on September 10, 1993 (USFWS 1993). Recovery needs for the grizzly bear are described in the recovery plan, which outlines a series of goals and objectives necessary to provide for conservation and recovery of the grizzly bear in selected areas of the conterminous 48 states. One of these objectives is to recover grizzly bear populations in all of the ecosystems known to have suitable space and habitat. The recovery plan identifies six separate recovery zones or ecosystems:

- Yellowstone (GYA)
- Northern Continental Divide (NCDE)
- Cabinet-Yaak (CYE)
- Selkirk (SE)
- North Cascades (NCE)
- Bitterroot (BE)



The recovery plan identifies three indicators of population status, based on reproduction, numbers, and distribution, to be used as the basis for recovery in each ecosystem:

- sufficient reproduction to offset the existing levels of human-caused mortality
- adequate distribution of breeding animals throughout the area
- a limit on total human-caused mortality

Based on these indicators, three specific parameters have been developed to monitor the status of grizzlies in each ecosystem:

- the number of unduplicated females with cubs seen annually
- the distribution of females with young or family groups throughout the ecosystem
- the annual number of known human-caused mortalities

To facilitate population monitoring and habitat evaluation within each ecosystem, the recovery zones are divided into areas designated as Bear Management Units. These units, designed to approximate the average home range of a female grizzly (approximately 100 square miles), assist in characterizing grizzly bear numbers and distribution within each ecosystem and in tracking cumulative effects (Christensen and Madel 1982).

In 1991, the USFWS received petitions to reclassify the five existing grizzly bear populations (GYA, NCDE, CYE, SE, and NCE) from threatened to endangered. On April 20, 1992, the USFWS issued a “not warranted for reclassification” finding for the GYA and NCDE populations (57 FR 14372). On May 17, 1999 (64 FR 26725), the USFWS found that reclassification of grizzly bears in the CYE and SE from threatened to endangered was warranted but precluded by work on higher-priority species. The USFWS will consider formally recognizing a distinct population segment that would encompass both of these ecosystems in the near future. Until a final determination is made on a distinct population segment, USFWS still considers the ecosystems to be separate.

The grizzly bear population within the CYE continues to increase and expand its range. Currently, the population is estimated to range from 280 – 610 bears and occupy approximately 7,574,244 acres in the GYA (USFWS 2002b). All population recovery parameters were first achieved in 1994. However, for the next three years (1995-97) grizzly bear mortality limits were exceeded. Beginning in 1998 and continuing through 2001, all grizzly bear recovery parameters have been achieved (USFWS 2002c). Habitat based recovery criteria, a conservation strategy, and state management plans are currently in development.

The exact size of the grizzly bear population in the NCDE is unknown, but recent data from the northern third of this ecosystem indicates that there are more bears than previously thought. Grizzly bears occupy approximately 6,128,129 acres within this ecosystem. Monitoring results indicate that though 1999 recovery criteria for several parameters were met, including: 1) numbers of females with cubs; 2) numbers of BMUs with family groups; 3) occupancy requirements for BMUs; and 4) total human-caused grizzly bear mortality. However, the female grizzly bear mortality recovery criterion was not met (USFWS 2001c).

The status of the North Cascades population is unknown, but bear numbers are suspected to be very low and probably less than 15 grizzly bears. The Bitterroot Ecosystem is not occupied by grizzly bears at this time, but USFWS recently released a final environmental impact statement (FEIS) addressing the restoration of grizzly bears to this ecosystem (USFWS 2000d).

The Cabinet-Yaak Ecosystem represents approximately 8 percent of the total occupied grizzly bear range remaining within the conterminous 48 states. Grizzly bear numbers in this ecosystem are estimated at 30-40 animals. Until recently, USFWS believed that this population was stable to increasing. This belief was based on perceptions of grizzly bear researchers familiar with this ecosystem, and population trend analyses. Grizzly bear biologists working in this ecosystem perceived that the population had increased due to more reported grizzly bear sightings, and sightings in areas not previously known to be used by grizzly bears in this ecosystem. Population trend analyses, using data from 1993 to 1998, although statistically inconclusive, indicated that the grizzly bear population was experiencing annual growth (FR 64:26725). To conduct population trend analyses, the USFWS utilizes the “Booter” computer model developed by Fred Hovey (Hovey and McLellan 1996, Mace and Waller 1998). The “Booter” program utilizes the survival and reproduction of female radio-collared bears to calculate population trend estimates and confidence intervals. In 1999 and 2000, an unusually high number of grizzly bear mortalities were sustained in this population; there were five grizzly bear mortalities in 1999 and four in 2000. Of the nine grizzly bear mortalities in 1999 and 2000, three were females and five were cubs. Thus, due to the mortalities of these females and cubs, upon which the trend estimate is based, the trend analysis incorporating data from 1983 to 2000, although again statistically inconclusive, indicated an annual decline in the grizzly bear population (USFWS 2001b). Additionally, recovery plan criteria for grizzly bear numbers, reproduction, distribution, and mortality have not been met (USFWS 2001b).

The Selkirk Ecosystem represents approximately 6 percent of the total occupied grizzly bear range remaining within the conterminous 48 States. The Selkirk grizzly bear population is contiguous with Canadian populations. This recovery zone is the only one that includes part of Canada because the habitat in the U.S. portion is not of sufficient size to support a minimum population. Approximately 47 percent of the recovery zone lies within British Columbia, where land ownership is 65 percent crown (public) land and 35 percent is private. Grizzly bear numbers in this Ecosystem are estimated at 46 animals. Unlike the Cabinet-Yaak population, the Selkirk population is thought to be increasing, although a recent population trend analysis for this Ecosystem was also inconclusive. Additionally, recovery plan criteria for bear reproduction, distribution, and mortality have not been met (USFWS 2001b). Furthermore, population modeling indicated that one additional subadult female mortality in the sampled Selkirk population could push the trend into a decline (FR 64:26725).

Effects

The relationship between grizzly bears and roads has been extensively studied (Mace et al. 1996, Mace and Waller 1997, Wakkinen and Kasworm 1997, McLellan and Shackleton 1988). Roads can have several effects on grizzly bears, including contributing to direct mortality. For grizzly bears, the primary mechanism through which roads impact this species is through the human activities they facilitate. Human use of motorized roads within occupied grizzly bear habitat have the potential to adversely affect grizzly bears in a number of ways, including the following:

- Some bears may become conditioned to the presence of vehicles and humans on roads and thus become more vulnerable to direct mortality through the means identified above.
- Bears may be displaced from preferred habitat by the human disturbance associated with road use, with a resultant reduction in habitat availability and quality and potential effects on nutrition and reproduction.
- Attractants (human and animal foods and garbage) that arrive in grizzly bear habitat in motorized vehicles may result in habituated bears that must eventually be destroyed.

Determination of Effects on Grizzly Bear

The project types proposed under this BA *may affect, but are not likely to adversely affect* the grizzly bear.

Rationale for Determination – Road construction and maintenance activities have the potential to affect grizzly bears via habitat alteration, increased human disturbance, and bears becoming habituated to human and animal foods and garbage. Motorized access is one of the most influential factors affecting grizzly bear use of habitats (ICST 2003). Grizzly bears are highly sensitive to disturbances associated with roads and developments, and they avoid areas within 3 km of developments and within 4 km of roads (Mattson et al. 1986). While roads can affect grizzly bears, bears have proven to be very adaptable and have expanded to areas with many human influences including roads, houses, and utility and transportation corridors.

ITD cannot predict exact locations of future projects, nor are there restrictions on the distribution of effects spatially or temporally. The effects of ITD maintenance activities described in this BA will be discountable or insignificant for the following reasons.

- No potential for an increase in roads with added human-bear interactions
- No disposal or transfer of public land within grizzly bear habitat
- Limited issuance of right-of-way and/or leases for utility transportation corridors, ditches and canals, and roads
- Limited increases in direct mortality as a consequence of interactions with humans during construction activities
- Limited fencing of project areas and re-vegetation sites that would disturb grizzly bear behavior, affect their ability to use suitable habitat and travel corridors between habitats
- Very low likelihood potential for increased human access and development within grizzly bear habitat at the higher elevations favored by the bears and need for a right-of-way for access, etc., as project management activities typically occur outside of grizzly bear habitat
- Extremely low likelihood that right-of-way acquisition or use permits will occur in or destroy suitable grizzly bear habitat
- Extremely low likelihood that project construction activities will disturb grizzly bear behavior or affect their ability to use suitable habitat and travel corridors between habitats, due to the application of grizzly bear conservation measures.
- Construction activities within or near grizzly bear habitat may affect the grizzly bear if the associated construction is within the vicinity of travel corridors or areas between different seasonal foraging sites. This may cause short-term behavioral avoidance of these areas by the grizzly bear due to the presence of human activity.

The acquisition of access easements as well as rights-of-way/leases including utility lines, pipelines, ditches and canals, roads (includes stream crossings), temporary use permits, and fence re-vegetation sites may cause short-term behavioral avoidance of these areas during construction/maintenance operations and would have an insignificant effect on the grizzly bear.

ITD Projects in the Yellowstone Ecosystem:

- There will be no effect on the four key food sources for the grizzly bear.
- ITD projects will not result in any changes in cover that would be of significance to the grizzly bear.
- ITD projects will not have any effects on denning habitat.
- There is a slight chance that an individual grizzly bear may be displaced by the construction activities. This displacement will occur in site specific area where the construction activity is taking place and only for the duration of the project.

All projects will be subject to existing BMPs designed to avoid or minimize adverse effects. In addition, all ITD projects that occur within or adjacent to USFS administered lands will be required to consult with the USFS concerning appropriate conservation measures that need to be administered during project construction activities in order to minimize impacts to grizzly bears.

3.3 Canada lynx (Lynx canadensis)

Species Description and Life History

The lynx is a medium-sized, short-bodied cat with long legs and an overall stocky build (Clark and Stromberg 1987). Paws are large and well-furred, ears tufted, tail blunt and short, and the head has a flared facial ruff. Adult males average 22 lbs in weight and 33.5 inches in length (head to tail), and females average 19 lbs and 32 in. (Quinn and Parker 1987). Winter coloring is typically grizzled brownish-gray mixed with buff or pale brown on the top and grayish-white or buff-white on the underside (Koehler and Aubry 1994). In summer, the pelage is more reddish to gray-brown. The tail is black-tipped all the way around. The lynx differs from the bobcat in having paws that have twice the surface area (Quinn and Parker 1987), enabling them to forage in deep snow; a black-tipped tail whereas the bobcat's tail is black only on the top surface; a less spotted coat; and a tail shorter than one-half the length of the hind foot (Tumlison 1987).

The size of lynx home ranges vary by the animal's gender, abundance of prey, season, and the density of lynx populations (Hatler 1988, Koehler 1990, Poole 1994, Slough and Mowat 1996, Aubry et al. 1999, Mowat et al. 1999). Documented home ranges vary from 3 to 300 mi^2 (Saunders 1963, Brand et al. 1976, Mech 1980, Parker et al. 1983, Koehler and Aubry 1994, Apps 1999, Mowat et al. 1999, Squires and Laurion 1999). Preliminary research supports the hypothesis that lynx home ranges at the southern extent of the species' range are generally large compared to those in the northern portion of the range in Canada (Koehler and Aubry 1994, Apps 1999, Squires and Laurion 1999).

Daily movements of lynx vary, but they do have a need to move both within and outside their home range to hunt, move kittens between alternate dens, defend their home range, and disperse to new habitats. Studies in Montana, Wyoming, and British Columbia have also documented exploratory movements by resident lynx during the summer months (Apps 1999; Squires and Laurion 1999). Exploratory movements in Montana ranged from 9 to 25 mi and for periods of one week up to several months outside of the home range (Squires and Laurion 1999).

Lynx are highly mobile and generally move long distances (greater than 60 mi). (Aubry et al. 2000, Mowat et al. 2000). Lynx disperse primarily when snowshoe hare populations decline (Ward and Krebs 1985, O'Donoghue et al. 1997, Poole 1997). Subadult lynx disperse even when prey is abundant (Poole 1997), presumably to establish new home ranges. Lynx are capable of dispersing extremely long distances (Mech 1977, Brainerd 1985, Washington Department of Wildlife 1993); for example, a male was documented traveling 370 mi (Brainerd 1985). An extreme example of the apparent emigration of lynx from Canada to the contiguous United States is the numerous occurrences of lynx that were frequently documented in atypical habitat, such as in North Dakota, during the early 1960s and 1970s. In these years harvest returns indicated unprecedented cyclic lynx highs for the twentieth century in Canada (Adams 1963, Harger 1965, Mech 1973, Gunderson 1978, Thiel 1987, McKelvey et al. 1999b). We believe that many of these animals were dispersing and were either lost from the population because they were in areas that are unable to support lynx, or they were able to return to suitable habitat.

Lynx are specialized predators whose primary prey is the snowshoe hare (*Lepus americanus*), which has evolved to survive in areas that receive deep snow (Bittner and Rongstad 1982). In studies from Canada, Alaska, and Washington, snowshoe hares comprised 35-97 percent of the diet (Koehler and Aubry 1994). Alternate prey includes red squirrels (*Tamiasciurus hudsonicus*) and other squirrels (*Spermophilus* sp.), porcupine (*Erethizon dorsatum*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), mice and voles (*Peromyscus* spp. and *Microtus* spp.), shrews (*Sorex* spp.), fish, deer (*Odocoileus* sp.) and moose (*Alces alces*), mostly as carrion (Ruediger et al. 2000, Tumlison 1987). In Washington, the only state in the contiguous U.S. for which data are available, the annual diet was 79 percent hares, 24 percent tree squirrels, 3 percent ungulates, and 3 percent grouse (Koehler 1990).

In northern populations, red squirrels, voles, and other small mammals are a larger component of summer and fall diets compared with the winter diet focus on snowshoe hares (Anderson and Lovallo 2003). In the Yukon, lynx shifted to red squirrels when hare numbers began to decline

(O'Donoghue et al. 1998a, 1998b). However, a shift to alternate food sources may not compensate for the decrease in hares consumed (Koehler and Aubry 1994). In northern regions, when hare densities decline, the lower quality diet causes sudden decreases in the productivity of adult female lynx and decreased survival of kittens, which causes the numbers of breeding lynx to level off or decrease (Nellis et al. 1972, Brand et al. 1976, Brand and Keith 1979, Poole 1994, Slough and Mowat 1996, O'Donoghue et al. 1997).

Lynx populations in southern portions of the range must take other prey to a greater degree than in northern populations, due to the lower density of snowshoe hares (Hodges 2000). Lynx also use alternative prey to a greater degree in summer than in winter in both northern and southern boreal forests, although data are scarce (Aubry et al. 2000). In areas with patchy lynx habitat, lynx are more opportunistic and may feed occasionally on white-tailed jackrabbits (*Lepus townsendii*), black-tailed jackrabbits (*Lepus californicus*), sage grouse (*Centrocercus urophasianus*), and Columbian sharp-tailed grouse (*Tympanichus phasianellus*) (Quinn and Parker 1987, Ruediger et al. 2000).

Range

The historical and present range of the lynx north of the contiguous United States includes Alaska and that part of Canada that extends from the Yukon and Northwest territories south across the U.S. border and east to New Brunswick and Nova Scotia (65 FR 16051). In the contiguous U.S., lynx historically occurred in the Cascades Range of Washington and Oregon; the Rocky Mountain Range in Montana, Wyoming, Idaho, eastern Washington, eastern Oregon, northern Utah, and Colorado; the western Great Lakes Region; and the northeastern U.S. region from Maine southwest to New York (McCord and Cardoza 1982, Quinn and Parker 1987).

Lynx in the contiguous U.S. may be considered biologically and ecologically significant simply because of the climatic, vegetational, and ecological differences between lynx habitat in the contiguous U.S. and that in northern latitudes in Canada and Alaska (Buskirk et al. 1999).

In the contiguous U.S., the distribution of the lynx is associated with the southern boreal forest, comprising of subalpine coniferous forest in the West and primarily mixed coniferous/deciduous forest in the East (Aubry et al. 1999); whereas in Canada and Alaska, lynx inhabit the classic boreal forest ecosystem known as the taiga (McCord and Cardoza 1982, Quinn and Parker 1987, Agee 1999, McKelvey et al. 1999b). Within these general forest types, lynx are most likely to persist in areas that receive deep snow, for which the lynx is highly adapted (Ruggiero et al. 1999).

The USFWS concluded that lynx densities at the southern part of the range never achieve the high densities that occur in the northern boreal forest (Aubry et al. 1999). Comparisons between Canadian and contiguous U.S. lynx harvest returns and snowshoe hare densities over time suggest lynx numbers and snowshoe hare densities for the contiguous U.S. are substantially lower than those for Canadian provinces (Hodges 1999a, 1999b, McKelvey et al. 1999b). The USFWS concluded that historic and current lynx densities in the contiguous U.S. also are naturally low relative to lynx densities in the northern boreal forest (65 FR 16051).

In Idaho, according to Rust (1946), lynx were not abundant but were distributed throughout northern Idaho in the early 1940s, occurring in 8 of the 10 northern and north-central counties. Harvest records for Idaho are unreliable because no distinction was made between lynx and bobcats until 1982 when Idaho Department of Fish and Game (IDFG) initiated a mandatory pelt tagging program (65 FR 16051). Between 1960 and 1991, 35 verified records exist for Idaho, with 13 of these from 1982 to 1991; and from 1991 until recently, there had been no verified records of lynx from Idaho (McKelvey et al. 1999b). Until recently, no lynx surveys were conducted in Idaho. Preliminary results from recent DNA surveys suggest the presence of lynx in northern and north-central Idaho (Weaver and Amato 1999).

Prior to 1977, the lynx was considered a predator, subject to unrestricted harvest with no closed season and no bag limit (65 FR 16051). In 1990, in response to concern over the status of lynx in Idaho, the IDFG instituted a statewide harvest quota of three lynx per year. In 1997/1998, Idaho closed the lynx trapping/hunting season because no lynx had been captured in several years. Although records of lynx in Idaho are relatively common and boreal forest habitat is contiguous with adjacent states and Canada where lynx populations are known to exist, the USFWS (2000) could not clearly substantiate either the historic or current presence of resident lynx populations in Idaho, nor could they identify population changes or trends. Hash (1990) also found that the lynx populations in Idaho appeared to be small, with a stable or declining population trend. The only critical habitat located in Idaho is found in one unit, the Northern Rocky Mountains (northwestern Montana/northeastern Idaho), with a small portion of habitat found in Boundary County of northeastern Idaho (73 FR 10859).

Habitat

Cool, moist boreal forests with cold, snowy winters and abundant snowshoe hares define the required habitat of lynx. Primary vegetation in lynx habitat is lodgepole pine, subalpine fir, and Engelmann spruce (Aubry et al. 2000). Secondary habitat includes cool, moist Douglas fir, grand fir, western larch, and aspen forests. Dry forests such as ponderosa pine and climax lodgepole pine do not provide habitat for lynx (Ruediger et al. 2000). In the western U.S., 70 percent of lynx occurrences were at elevations of 4,920 – 6,560 ft (McKelvey et al. 2000). Snow conditions in northern boreal forests are consistent, cold, and dry; in contrast, southern boreal forests have snow depths that are more variable and may be subjected to more freezing and thawing, causing crusting on the snow which may reduce the competitive advantage that lynx have in soft snow with their long legs and low foot loadings (Buskirk et al. 2000a, 2000b). Lynx require a complex mosaic within their home range to meet the different habitat needs. They prey on snowshoe hares in areas with high stem density and dense shrubby and coniferous growth with stems and branches that protrude above the snow, and they den in areas with large woody debris in the form of down logs or root wads (Koehler 1990, Ruediger et al. 2000, Squires and Laurion 2000). Older and mixed-age forests with a patchwork of well-developed shrubs and young trees provide the dense understory and large downed logs required for both foraging and denning habitats. These forest types provide snowshoe hare habitat over a longer period of time and also support red squirrel populations, another prey species of lynx (Buskirk et al. 2000b).

Lynx are morphologically and physiologically adapted for hunting snowshoe hares and surviving in areas that have cold winters with deep, fluffy snow for extended periods. These adaptations provide lynx a competitive advantage over potential competitors, such as bobcats (*Lynx rufus*) or coyotes (*Canis latrans*) (McCord and Cardoza 1982, Buskirk et al. 2000a, Ruediger et al. 2000). Bobcats and coyotes have a higher foot load (more weight per surface area of foot), which causes them to sink into the snow more than lynx. Therefore, bobcats and coyotes cannot efficiently hunt in fluffy or deep snow and are at a competitive disadvantage to lynx. Long-term snow conditions presumably limit the winter distribution of potential lynx competitors such as bobcats (McCord and Cardoza 1982) or coyotes.

Lynx densities at the southern part of the range never achieve the high densities that occur in the northern boreal forest (Aubry et al. 1999). Comparisons between Canadian and contiguous U.S. lynx harvest returns and snowshoe hare densities over time suggest lynx numbers and snowshoe hare densities for the contiguous U.S. are substantially lower than those for Canadian provinces (Hodges 1999a, 1999b, McKelvey et al. 1999b). Lynx in southern boreal forests live in island habitats of mountains surrounded by less suitable lowland habitats. These lowlands are typically shrub-steppe habitats of sagebrush. Movement between islands of coniferous forest is poorly understood, but occurs on two scales. Large-scale movements are probably prompted by low hare abundance and, for subadults, the need to disperse from their natal home range. Smaller-scale movements occur as animals travel between hunting grounds within a home range. Because of the patchiness of lynx habitats in the southern portion of the distributional range, lynx may include areas used primarily for traveling between hunting sites within a home range (Koehler and Brittell 1990). Lynx have been documented in shrub-steppe habitat, within 25 mi of forested habitat, during peaks in jackrabbit populations and it is possible that the occasional availability of such alternate prey may attract lynx to these habitats (Ruediger et al. 2000). These shrub-steppe habitats, especially with riparian corridors, facilitate lynx movement from one forested island to another.

The Canada Lynx Conservation Assessment Strategy (LCAS) was developed to provide a consistent and effective approach to conserve lynx on federal lands in the conterminous U.S. (Ruediger et al. 2000). The document was initiated by the U.S. Forest Service, Bureau of Land Management and U.S. Fish and Wildlife Service. Because of the guidance set forth in the LCAS, there are now clear objectives, standards, and guidelines to follow in the delineation, mapping, and management of lynx and their habitats. Lynx Analysis Units (LAUs) have been selected as the unit to use for evaluation of the effects of management actions on the lynx (Ruediger et al. 2000).

> LAUs are not intended to depict actual lynx home ranges, but are intended to provide analysis units of the appropriate scale with which to begin the analysis of potential direct and indirect effects of projects or activities on individual lynx, and to monitor habitat changes. LAUs should approximate the size of a female's annual home range and encompass all seasonal habitats. LAUs will also likely contain areas of non-lynx habitat, such as lower elevation drier sites, especially in mountainous regions. Generally, lynx conservation measures apply only to lynx habitat within LAUs, although considerations related to connectivity may be appropriate for other areas (Ruediger et al. 2000).

Lynx generally make their dens in mature, dense forests that contain coarse woody debris such as blowdown, upturned stumps, and windthrown trees. Younger, regenerating forests can provide suitable denning habitat if adequate deadfall is present. Other important features of den sites are minimal human disturbance, proximity to foraging habitat (early seral stands), and mature stands that are between one and five acres in size (Koehler and Brittell 1990). Stand structure appears to be more important than forest cover type (Mowat et al. 1999). For denning habitat to be functional, it must be in or adjacent to foraging habitat (Ruediger et al. 2000).

While overhead cover appears to be important for lynx in meeting various life requisites, the extent to which cover influences broad-scale movements of lynx is uncertain. Schwartz et al. (2002) found high gene flow among distant populations of lynx separated by distances greater than 1,900 miles, including those in Montana's Seeley Lake, Banff National Park in Alberta, Watson Lake in the Yukon Territory, and Alaska's Kenai Peninsula. On this basis, Schwartz et al. (2002) suggested that management actions in the contiguous U.S. should focus on maintaining connectivity with the core of the lynx's geographic range, thought to be in northern Canada (McKelvey et al.1999a). Servheen et al. (2001) identified linkage zones for grizzly bears between the large blocks of public land in the northern Rocky Mountains of Idaho and Montana. This effort has recently expanded to include linkage considerations for a variety of other species likely to be influenced by habitat fracture zones associated with human development. Habitat fracture zones are identified through evaluation of road densities, developed sites, visual cover and riparian zones.

Effects

The main factor threatening the distinct population segment of lynx in the contiguous U.S. is the inadequacy of existing regulatory mechanisms (65 FR 16051). There appear to be some notable differences in lynx ecology between southern and northern boreal forests. Snowshoe hare densities are lower and lynx populations appear less stable and at higher risk in the south. The ecological differences between latitudes are likely due to use of alternative prey species; the effect of habitat patchiness on movements, reproduction, and survival; and the potential effects of different communities of predators and competitors (Aubry 2000 et al.). Persistence of lynx in the contiguous U.S. appears to rely upon dispersal from larger populations and maintenance of connectivity between northern and southern populations (Schwartz et al. 2002). For lynx in Wyoming and Colorado, this translates into maintaining connectivity between populations in those two states, Canada and Montana, and Montana and Wyoming.

Forest management activities that reduce habitat for snowshoe hares and/or red squirrels will negatively affect lynx. Retention of live and dead trees and coarse woody debris are important factors for maintenance of lynx. In the creation of early successional habitat for snowshoe hares, considerations to include are harvest unit design, selection of sites that can regenerate quickly, choice of fuels practices, retention of coarse woody debris, and maintenance of high stem densities (Koehler and Brittell 1990). Clearcuts, shelterwood cuts, seed tree cuts, and diameter-limit prescriptions that result in distance to cover greater than 325 ft may restrict lynx movement and use patterns until forest regeneration occurs (Koehler 1990). In the west, it takes approximately 15 to 30 years for conifers and/or brush species to regenerate to the point where vegetation is available above average winter snow depths and thus provide forage for snowshoe hares, after forest management practices or fire (Ruediger et al. 2000). As the forest canopy develops and shades out the understory, hare populations again decrease. Certain timber harvest practices increase edges and openings within forest stands, which may improve foraging conditions for generalist predators such as mountain lions, coyotes, bobcats, and great-horned owls. Both exploitation and interference competition with lynx may result (Ruediger et al. 2000).

It appears that lynx have some degree of tolerance to human activities (Aubry et al. 2000). However, during denning in the spring, lynx are more vulnerable and require more secure habitat and less disturbance than might be tolerated at other times of year. This type of vulnerability to human disturbance may also be exacerbated during periods when food is scarce. Starvation is not uncommon (Aubrey et al. 2000). Developed recreation such as a ski area concentrates the human activity in specific areas and is deserted at night, when lynx would be active (Ruediger et al. 2000).

Little information is available on the effects of roads and trails on lynx or their prey (Apps 1999, Ruggiero et al. 1999). Construction of roads may reduce lynx habitat by removing forest cover. In areas with deep snow pack, snow compaction of roads from vehicles, snowmobiles, may enable potential lynx competitors or predators to enter areas that would otherwise be inaccessible (Buskirk et al. 1999). Conversely, in some instances, along less-traveled roads, where vegetation provides good snowshoe hare habitat, lynx may use the roadbed for travel and foraging (Koehler and Brittell 1990, 65 FR 16051). No sensitivity to road maintenance was found in the literature review for the lynx.

Roads into areas occupied by lynx may pose a threat to lynx from incidental harvest or poaching, increased access during winter for competing carnivores, especially coyotes, disturbance or mortality from vehicles, and loss of habitat (Aubry et al. 2000, Buskirk 2000a, Koehler and Brittell 1990). However, lynx are also known to follow road edges for considerable distances, and also have home ranges that encompass roads or sometimes use them to define the boundary. They seem to not avoid roads, although high traffic volume deters them (Apps et al. 1999). The size, type, and amount of use of the road are all likely factors affecting the degree and types of impacts on lynx, as well as the increased vulnerability during denning. In aspen stands and high-elevation riparian willow communities, extensive grazing by domestic livestock or wild ungulates may reduce forage and cover availability for snowshoe hares, in some cases dramatically. This may also be true for high elevation shrub steppe habitat (high elevation sagebrush communities) that lynx may need and use in highly fragmented forest stands.

Development of oil wells can be harmful to lynx, mostly as a consequence of new roads created to access areas for exploration and development. The result is increased human use and competing predator use. Mining may directly impact habitat and also promote recreational activities as a consequence of new roads (Ruediger et al. 2000).

Determination of Effect on Canada lynx

The project types proposed under this PBA *may affect but are not likely to adversely* affect Canada lynx.

Rationale for Determination - No sensitivity to road maintenance was found in the literature reviewed for the lynx. Designated critical habitat does not exist in Idaho near any state or federal highways, so construction, maintenance, and use of roads will not occur near critical habitat. The potential for any projects addressed in this PBA to disturb lynx is discountable. It is unlikely that lynx will occur in the immediate project area. Adjacent habitat is available for lynx to use for avoiding any disturbance caused by project implementation. If lynx are present, they could be disturbed by the activities described in this document, if the project occurs in or adjacent to lynx habitat. Because the overall probability of lynx to occur within a project area will likely remain the same as existing conditions (low probability), such potential impacts are considered insignificant. Effects from such a disturbance would be negligible because they would be short term in duration and small in scale. Activities through segments of potential lynx foraging and denning habitat will cause little if any alteration of habitat components. Prey densities for lynx will not be altered from current conditions.

3.4 Canada lynx Designated Critical Habitat

On February 28, 2008, the USFWS proposed to revise designated critical habitat for the contiguous United States distinct population segment of the Canada lynx under the Endangered

Species Act (73 FR 10859). The final rule for designation of critical habitat was published on February 25, 2009 (74 FR 8616). Designated critical habitat in Idaho is described in Unit 3 (Northern Rocky Mountains) and exists in the extreme northeast corner of the state, in portions of Boundary County. ITD has two highways (U.S. 2 and U.S. 95) in the general area and neither highway approaches the designated critical habitat nor are the highways within drainages contained by designated critical habitat. U.S. 2 is to the south of the designated critical habitat by more than ten miles and U.S. 95 is to the west of the designated critical habitat approximately five miles. The designated critical habitat is east of the Moyie River basin at elevations several thousand feet higher than the river basin.

Determination of Effect on Critical Habitat for Canada lynx

The project types proposed under this PBA will have *no effect* on designated critical habitat, and will not lead to adverse modification of the designated critical habitat.

Rationale for Determination **-** No sensitivity to road maintenance was found in the literature reviewed for the lynx. Designated critical habitat does not exist in Idaho near any state or federal highways so construction, maintenance, and use of roads will not occur near critical habitat. Roads will not function as barriers to movement of lynx within or between designated critical habitat in Idaho or within the Northern Rocky Mountains.

With so few acres of land designated in Idaho and with those lands being on U.S. Forest Service and Bureau of Land Management, any action undertaken in Idaho will have *no effect* on designated critical habitat as a whole, and will not lead to adverse modification of the designated critical habitat.

3.5 Northern Idaho ground squirrel (Spermophilus brunneus)

Species Description and Life History

The northern Idaho ground squirrel (*Spermophilus brunneus brunneus*) belongs to the small-eared group of true ground squirrels. Yensen (1991) described the northern Idaho ground squirrel as taxonomically distinct from the southern Idaho subspecies (*Spermophilus brunneus endemicus*) based on morphology, fur, and apparent life-history differences, including biogeographical evidence of separation. The northern Idaho subspecies occurs only in west-central Idaho in Adams and Valley counties. It has a reddish brown back with faint light spots and a cream-colored belly. The back of the legs, top of the nose, and underside of the base of the tail are all reddish brown. Ear pinnae project slightly above the crown of the head (Yensen and Sherman 2003). The northern Idaho ground squirrel can be distinguished from the other subspecies, the southern Idaho ground squirrel, and other small-eared ground squirrels, by its smaller size and rustier fur color.

Habitat

This ground squirrel occupies dry, rocky, sparsely vegetated meadows surrounded by forests of ponderosa pine or Douglas fir at elevations of 3,800 to 5,200 ft (Yensen 1991, Dyni and Yensen 1996). Nearly all the meadow sites used by this ground squirrel are on dry, shallow soils with no young tree invasion (Sherman and Yensen 1994). Nest burrows are located in adjacent small patches of well-drained deeper soils (Yensen et al. 1991). Surface features, such as logs or rocks, make a site more attractive to this species. Ponderosa pine-shrub steppe habitat associations on south-facing slopes at less than 30 percent and at elevations below 6,000 ft are considered to be potentially suitable habitat (USFWS 2003a). The majority of suitable habitat occurs in areas below 6,000 ft, however, in 2005 a population was found at an elevation of 7,500 ft along the Lick Creek Lookout ridge. Documentation of northern Idaho ground squirrels at the Lick Creek Lookout expanded probable historical distribution to the north and documented additional suitable habitats which may be utilized (open, rocky, moderately sloped sub-alpine habitats). Documentation of the Lick Creek Lookout population is approximately 2,000 ft higher than any other known northern Idaho ground squirrel population. The Lick Creek Lookout occurs in the headwater area of Rapid River, and is also a divide ridge for Bear, Lick, Lost, and Boulder Creek drainages.

Northern Idaho ground squirrels have a long annual seasonal torpor that continues for seven to eight months from late July or early August to late March or early April (Yensen 1991, Yensen and Sherman 2003). Adult males emerge first, followed by adult females, then yearlings.

This species needs large quantities of native grass seed and other green leafy vegetation to store enough body energy for the long hibernation period. Their diet consists of grasses, forb leaves, flowers, roots, and bulbs, and, as the summer progresses, seeds (Yensen and Sherman 1997). If vegetation grows too high, so that both the tender growing parts of the plants and the energetically important seed head are out of reach of this ground squirrel, these ground squirrels do not fatten properly and are likely to suffer increased mortality during their long hibernation (Sherman and Yensen 1994).

Most northern Idaho ground squirrel populations are found in areas with shallow reddish parent soils of basaltic origin (Yensen 1991). Nesting burrows are in well-drained soils greater than 3 ft deep in areas not covered with trees or used by Columbian ground squirrels (*Spermophilus* *columbianus*). The lack of extensive use of the same areas by the two species is probably a result of competition rather than different habitat requirements (Sherman and Yensen 1994). There are dietary similarities between these two species that make competition more likely (Dyni and Yensen 1996).

Historic and Current Distribution

The northern Idaho ground squirrel is found only in Idaho. It has the smallest geographic range of any squirrel subspecies and one of the smallest mammal ranges in North America (Gill and Yensen 1992). Its present range is north of Council, Idaho, and covers an area of about 230,000 acres. Historically, its range probably was much larger and extended southeast to Round Valley near Cascade, Idaho. There are no known historic sites located on BLM land in the Cottonwood

Planning Area (PA). However, there are two historic sites on BLM land in the Cascade PA (south of the Cottonwood PA) that once were occupied by northern Idaho ground squirrels, but those sites have become overgrown with mountain big sagebrush (*Artemisia tridentata vaseyana*) and bitterbrush (*Purshia tridentata*). It may be possible to burn these stands to open them and recreate habitat with a suitable herbaceous component for this ground squirrel.

Current Population, Habitat Condition, and Trends

Unlike many ground squirrel species, this subspecies is not truly colonial. Population occurrence sites range in area from three to 40 acres. A major portion of the northern Idaho ground squirrel population is centered approximately three miles west of New Meadows. In 1997 and 1998, 91 northern Idaho ground squirrels were relocated to sites on federal land (Gavin et al. 1998). As recently as 1985, there were as many as 5,000 northern Idaho ground squirrels in Adams and Valley counties. By 1998, fewer than 1,000 were found (Gavin et al. 1998). The Squirrel Valley population decreased from a high of approximately 130 adult ground squirrels in 1987 to only 12 in 1997 (Sherman and Yensen 1994). By 2000, the population was estimated at about 350 (Haak 2000). Biologists estimate the population to be less than 500 animals distributed in small, isolated populations groups (USFWS 2002e).

Fire suppression is believed to contribute significantly to the declining status of this species, because periodic fire keeps openings in forest stands intact. Fire suppression has allowed natural succession to close openings, thereby degrading meadow habitat quality. In addition, unbroken forests isolate the northern Idaho ground squirrel into shrinking openings that are too far from each other for the ground squirrel to move among them in times of seed failure (Sherman and Yensen 1994). They are not known to disperse more than one or two miles.

The IDFG Conservation Data Center reports 26 occurrences for this species within Idaho. Only a single occurrence is known on BLM land (Cascade PA). The current (2004) status of northern Idaho ground squirrel at this site is not known because appropriate surveys have not been conducted. Of the 25 remaining occurrences, nine are on USFS land, four are on State of Idaho land, and 12 are on private lands.

Threats

The majority of the following text is from the threats analysis contained in the Recovery Plan for the Northern Idaho Ground Squirrel (USFWS 2003a). Additional information or potential threats are identified by specific citation.

The primary threat to northern Idaho ground squirrel is from habitat loss as a result of forest encroachment into former suitable meadow habitats (Truksa and Yensen 1990). Forest encroachment results in fewer openings, eliminates dispersal corridors, and confines the northern Idaho ground squirrel populations into small isolated habitat islands. Habitat loss from weed and exotic species invasion is also a concern. The invasion and expansion of exotic plant species, not limited to noxious weeds, is likely to limit the forage value of vegetation, thus limiting the amount of stored fat needed for hibernation. Because of the lengthy hibernation period, the squirrels are likely to starve to death if they cannot store enough fat because of declining forage values, whether the decline is because of forest encroachment or weed invasion. This is particularly true for young northern Idaho ground squirrels. Within this age group, only 6 to 12 percent survive to spring (Sherman and Yensen 1994). Adult males are more likely to die during the mating period because they are more likely to expose themselves to predators during that time. More adult males die during the two-week mating period than during the entire remainder of the 12- to 14-week period when they are above ground (Sherman and Yensen 1994).

This ground squirrel is also threatened by land-use changes other than weed or exotic species invasion such as recreational shooting, poisoning, genetic isolation and genetic drift, random naturally occurring events, and competition from the larger Columbian ground squirrel (*S. columbianus*).

Genetic studies of remaining populations of northern Idaho ground squirrels indicate that genetic variation is not exceptionally low, but there is a measurable effect of genetic drift because of the small effective population size and isolation among populations (Gavin et al. 1999). This suggests there may be reason for serious concern for the long-term survival of this species if habitat restoration and connectivity are not established in time to improve population numbers significantly.

When populations are low, many incidental factors may also affect populations to a severe degree. Northern Idaho ground squirrels host four flea species, one tick species, and an eyeworm. The proportion of individuals with these ectoparasites and the loads per individual were significantly lower than with either southern Idaho ground squirrel (*Spermophilus brunneus endemicus*) or Townsend's ground squirrel (*Spermophilus townsendii*), probably because the populations are so small, isolated, and remote from each other (Yensen et al. 1996).

Effects

Construction, maintenance, and use of roads have the potential to impact northern Idaho ground squirrel through a number of mechanisms. Habitat can become inaccessible to individuals where roads function as a barrier to movement. Avoidance behavior can result in substantial amounts of suitable habitat being unavailable to these species. Further, such habitat loss can fragment populations into smaller subpopulations through loss of connectivity between populations, which can lead to demography fluctuations, inbreeding, loss of genetic variability, and local population extinctions (USFS 2000).

Where roads function as barriers to movement, travel and dispersal, they can significantly alter population demographics and genetics of a species. Rico et al. (2007) found that whereas individual voles and mice were observed crossing narrow highways, wide highways served as complete barrier to movement, effectively separating populations on either side of the highway demographically. Increased habitat fragmentation between colonies could impact dispersal between these populations, which could lead to demographic consequences should such separation be maintained.

Roads facilitate human activities that could contribute to direct and indirect mortality. Given the isolated nature of existing northern Idaho ground squirrel colonies and the relatively low population numbers, loss of just a few individuals, particularly adult breeding females, may have demographic consequences (Sherman and Runge 2002).

Determination of Effects on Northern Idaho Ground Squirrel

The project types proposed under this PBA are *likely to adversely affect* the northern Idaho ground squirrel.

Rationale for determination - Road construction and maintenance have the potential to adversely affect the northern Idaho ground squirrel. Adverse effects might occur due to short-term habitat degradation or increased chance for mortality where roads are constructed. At the project level, all activities that include excavation or disturbance outside of the roadway prism and within occupied habitat or potentially suitable habits will be subject to the following BMPs, which are designed to avoid or minimize adverse effects to the species.

- Determine if a project is within or near known occupied northern Idaho ground squirrel sites or modeled suitable habitat. Northern Idaho ground squirrel occurrence is dynamic across the landscape, and this distribution likely will change over time.
- As of February 2010, known occupied sites occur along:
    - S.H. 55 from Round Valley Road (north of Smith's Ferry) north to Herrick Hills Subdivision, mileposts 102 to 105.
    - U.S. 95 from Tamarack (north of Lost Valley Road) north/east to almost the New Meadows city limits, mileposts 154 to 158.75.
- Conduct project-specific presence/absence surveys for northern Idaho ground squirrel within occupied sites or modeled suitable habitat prior to any ground-disturbing activities. Surveys should follow the protocol established by the U.S. Fish and Wildlife Service and Idaho Department of Fish and Game, which specifies qualified individuals, timing, number of visits, weather considerations, etc. The prime survey periods are (1) shortly after adult/yearling emergence in spring when squirrels are breeding and not obscured by growing vegetation (beginning early April at lower elevations and adjusted accordingly by elevation and snow pack), and (2) after pup emergence in summer (beginning early June at lowest elevations). Ability to hear and recognize a northern Idaho ground squirrel call is important, as many times that is the first detection. This high-frequency call can be confused with grassland sparrow species, so it takes experience and no high-frequency hearing loss. Coordination with the Idaho Department of Fish and Game is helpful prior to conducting surveys.
- At locations determined to be occupied (from project-specific surveys), schedule construction activities to reduce conflicts. Projects that involve excavation (e.g., working beyond the existing roadway, replacing culvers, widening, etc.) at or near occupied sites should be scheduled after pups have emerged and before adults retreat below ground to hibernate. This window occurs early June through first week of July at lower elevations and is adjusted accordingly for higher elevations.
- At locations determined to be occupied, monitor squirrel behavior during construction using a qualified individual. On-site monitoring during construction allows for adaptive modifications.
- At locations determined to be occupied, restrict indiscriminate parking of vehicles and heavy machinery to existing disturbed areas. Conduct clearance surveys to designate parking and staging areas. Vegetated road edges should be avoided.
- Conduct presence/absence surveys at material source sites and waste sites associated with projects if these locations occur in modeled habitat.

3.6 Kootenai River white sturgeon *(Acipenser transmontanus)*

Species Description and Life History

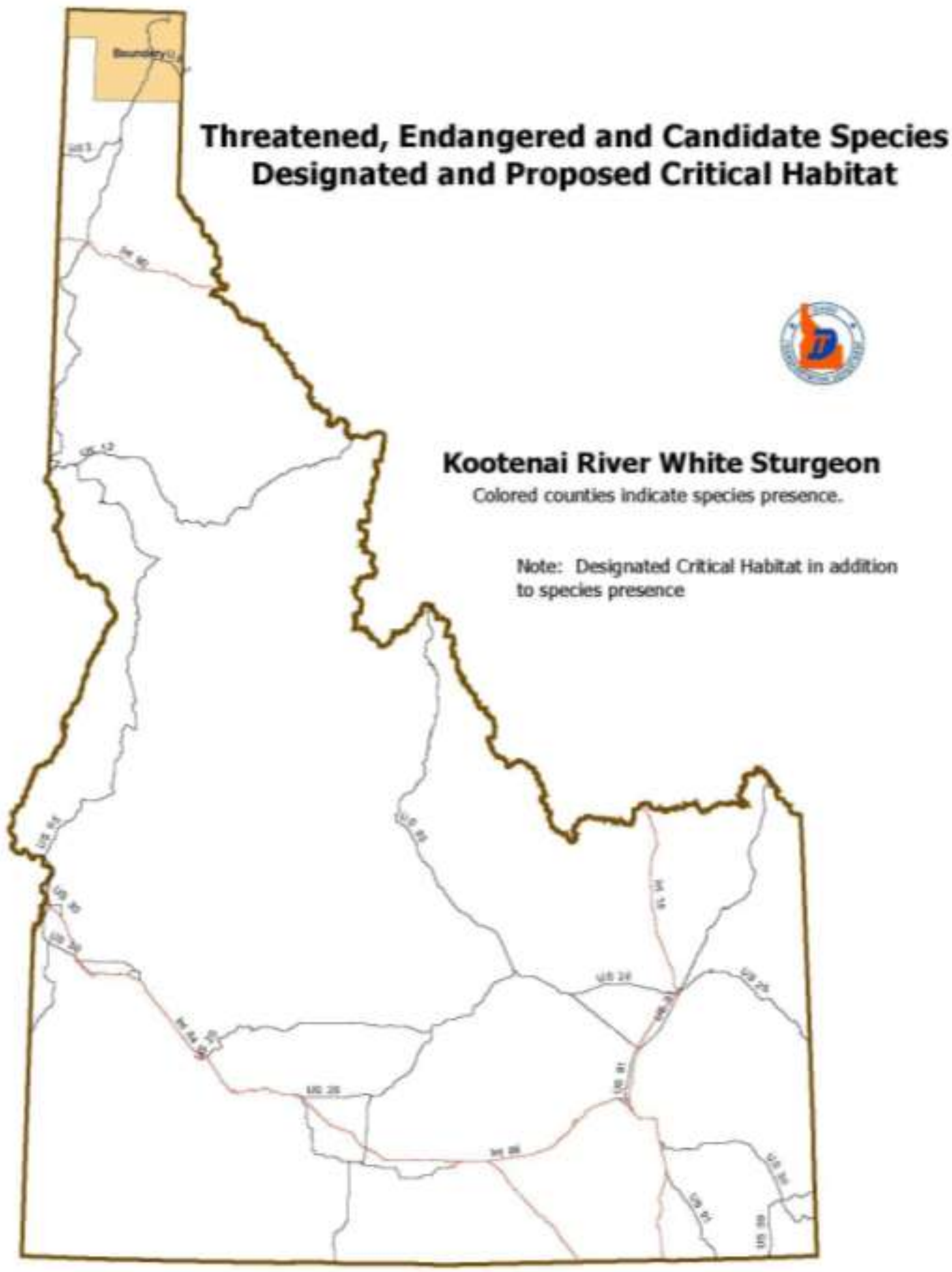
White sturgeon were once widely distributed in the Columbia River basin. Along the Pacific coast, white sturgeon are found in accessible freshwater from the Aleutian Islands south to central California. The Columbia River is one of the three large river basins in the Pacific Northwest where white sturgeon reproduces. Historically, prior to dam construction on the Columbia River, white sturgeon were anadromous and migrated within the basin up to impassable falls. The Kootenai River white sturgeon has been isolated from other white sturgeon populations since the last glacial age (Apperson and Anders 1991). The white sturgeon is restricted to 695 river miles in the Kootenai River basin, between Kootenai Falls, Montana downstream to Cora Linn Dam at Kootenai Lake, British Columbia, Canada. The Kootenai River white sturgeon have not successfully spawned in recent years and this population, which has a no harvest regulation, has decreased to about 880 fish (Apperson and Anders 1991). The Kootenai River population of white sturgeon in Idaho was listed as endangered by the USFWS.

Dams on the Kootenai River have prevented migration, fragmented riverine populations, and reduced the effectiveness of natural propagation (Hanson et al. 1992). Dams have also decreased spawning success, by decreasing the amount of suitable spawning areas or creating poor incubation environments. In general, length of time required to reach sexual maturity, typically 10 to 15 years, results in low rates of natural recruitment.

Substrate sizes and water velocity influence selection of spawning areas by white sturgeon. Spawning occurs in water over 3 m deep and over cobble substrate. In the Columbia River system, reproduction has been greater during years of high flows compared with years of low flows (Hanson et al. 1992). Spawning occurs earlier and at lower temperatures during high flow years (Hanson et al. 1992). Adults and juveniles prefer deep-pool habitat with a fine bottom substrate and adults tend to move downstream in the summer and fall months. Fish tend to stay in shallow water during the spring and summer and move to deep waters during the winter.

Effects

There are no actions that occur in-water in designated sturgeon critical habitat or occupied sturgeon habitat. The only place that ITD roads are close to sturgeon habitat is where the bridge on U.S. 95 crosses the Kootenai River and the bridge is too large to be considered in the bridge-replacement part of this action. There are bridge repair actions which could occur but they would not likely adversely affect sturgeon or their critical habitat because of the effects minimization measures proposed. Any other actions proposed would occur on road segments that are greater than 400 yards from designated sturgeon critical habitat. These road segments, however, do cross tributaries to the Kootenai River. The effects which need to be considered are sediment and chemical contamination because these would be the most likely pathways for potential effects to sturgeon or sturgeon critical habitat.



There are sufficient erosion control measures proposed to minimize the risk of sediment delivery from any out-of-water activities. These include the use of coir logs and sediment fences. There are also sufficient effects minimization measures to protect against chemical contamination (spill plans, staging areas away from streams, etc.). The most likely avenue for adverse effects would be from in-water activities in the tributaries to the Kootenai River. The chemical contamination measures which include cleaning of all equipment before it enters the river would render the likelihood of chemical contamination discountable. The primary source for sediment delivery would be the re-suspension of sediments already in the river substrate. Sediment that is re-suspended from in-water work typically re-deposits within 300-400 yards of where the activity took place. Any additional sediment which might be delivered to the Kootenai River would be insignificant relative to the size of the river and its existing sediment load.

Determination of Effects on Kootenai River white sturgeon

The project types proposed under this PBA *may affect, but are not likely to adversely affect* the Kootenai River white sturgeon.

Rationale for Determination – Effects to Kootenai River white sturgeon will be insignificant and discountable because in-water work proposed under this PBA within occupied habitat will be limited to bridge maintenance only.

3.7 Kootenai River white sturgeon Designated Critical Habitat

An approximately 18.3 RM stretch of the Kootenai River is designated as critical habitat within Boundary County, Idaho. This designation maintains as critical habitat the 7.1 RM "braided reach," and the 11.2 RM "meander reach''. Included within this designation is the 0.9-mi transition zone that joins the meander and braided reaches at Bonners Ferry. The braided reach begins at RM 159.7, below the confluence with the Moyie River, and extends downstream within the Kootenai River to RM 152.6 below Bonners Ferry. The meander reach begins at RM 152.6 below Bonners Ferry, and extends downstream to RM 141.4 below Shorty's Island.

The presence of PCE components related to flow, temperature, and depth are dependent in large part on the amount and timing of precipitation in any given year. These parameters vary during and between years, and at times some or all of the parameters are not present in the area designated as critical habitat. Within the critical habitat reaches, the specific conditions are variable due to a number of factors such as snowmelt, runoff, and precipitation. The critical habitat designation recognizes the natural variability of these factors, and does not require that the PCEs be available year-round, or even every year during the spawning period. At present, the PCEs are achieved only infrequently.

Primary Constituent Elements (PCEs) for the Kootenai Sturgeon

1. A flow regime, during the spawning season of May through June that approximates natural variable conditions and is capable of producing depths of 23 ft or greater when natural conditions (e.g., weather patterns, water year, etc.) allow. The depths must occur at multiple sites throughout, but not uniformly within, the Kootenai River designated critical habitat.

2. A flow regime, during the spawning season of May through June, that approximates natural variable conditions and is capable of producing mean water column velocities of 3.3 ft/s or greater when natural conditions (for example, weather patterns, water year) allow. The velocities must occur at multiple sites throughout, but not uniformly within, the Kootenai River designated critical habitat.

3. During the spawning season of May through June, water temperatures between 47.3 and 53.6° F (8.5 and 12° C), with no more than a 3.6° F (2.1° C) fluctuation in temperature within a 24-hour period, as measured at Bonners Ferry.

4. Submerged rocky substrates in approximately 5 continuous river miles to provide for natural free embryo redistribution behavior and downstream movement.

5. A flow regime that limits sediment deposition and maintains appropriate rocky substrate and inter-gravel spaces for sturgeon egg adhesion, incubation, escape cover, and free embryo development. Note: the flow regime described above under PCEs 1 and 2 should be sufficient to achieve these conditions.

Effects

There are no actions that occur in-water in designated sturgeon critical habitat or occupied sturgeon habitat. The only place that ITD roads are close to sturgeon habitat is where the bridge on U.S. 95 crosses the Kootenai River and the bridge is too large to be considered in the bridge-replacement part of this action. There are bridge repair actions which could occur but they would not likely adversely affect sturgeon or their critical habitat because of the effects minimization measures proposed. Any other actions proposed would occur on road segments that are greater than 400 yards from designated sturgeon critical habitat. These road segments, however, do cross tributaries to the Kootenai River. The effects which need to be considered are sediment and chemical contamination because these would be the most likely pathways for potential effects to sturgeon or sturgeon critical habitat.

There are sufficient erosion control measures proposed to minimize the risk of sediment delivery from any out-of-water activities. These include the use of coir logs and sediment fences. There are also sufficient effects minimization measures to protect against chemical contamination (spill plans, staging areas away from streams, etc.). The most likely avenue for adverse effects would be from in-water activities in the tributaries to the Kootenai River. The chemical contamination measures which include cleaning of all equipment before it enters the river would render the likelihood of chemical contamination discountable. The primary source for sediment delivery would be the re-suspension of sediments already in the river substrate. Sediment that is re-suspended from in-water work typically re-deposits within 300-400 yards of where the activity took place. Any additional sediment which might be delivered to the Kootenai River would be insignificant relative to the size of the river and its existing sediment load.

Determination of Effects on Kootenai River White Surgeon Designated Critical Habitat

The project types proposed under this PBA *may affect, but are not likely to adversely affect* critical habitat for the Kootenai River white sturgeon.

Rationale for Determination – There are no actions that occur in-water in designated sturgeon critical habitat or occupied sturgeon habitat. The only place that ITD roads are close to sturgeon habitat is where the bridge on U.S. 95 crosses the Kootenai River and the bridge is too large to be considered in the bridge-replacement part of this action. There are bridge repair actions which could occur but they would not likely adversely affect sturgeon or their critical habitat because of the effects-minimization measures proposed. Any other actions proposed would occur on road segments that are greater than 400 yards from designated sturgeon critical habitat. These road segments, however, do cross tributaries to the Kootenai River. The effects which need to be considered are sediment and chemical contamination because these would be the most likely pathways for potential effects to sturgeon or sturgeon critical habitat.

There are sufficient erosion control measures proposed to minimize the risk of sediment delivery from any out-of-water activities. These include the use of coir logs and sediment fences. There are also sufficient effects-minimization measures to protect against chemical contamination (e.g., spill plans, staging areas away from streams, etc.). The most likely avenue for adverse effects would be from in-water activities in the tributaries to the Kootenai River. The chemical contamination measures which include cleaning of all equipment before it enters the river would render the likelihood of chemical contamination discountable. The primary source for sediment delivery would be the re-suspension of sediments already in the river substrate. Sediment that is re-suspended from in-water work typically re-deposits within 300-400 yards of where the activity took place. Any additional sediment which might be delivered to the Kootenai River would be insignificant relative to the size of the river and its existing sediment load.

The primary factors limiting designated critical habitat for sturgeon are related to flow and actions contained within the PBA will not affect flow. Submerged rocky structures are also important aspects of sturgeon critical habitat. However, for the reasons referenced above for sediment delivery, it is not likely that the PBA will adversely affect this aspect of designated sturgeon critical habitat.

3.8 Utah valvata snail (Valvata utahensis)

Species Description and Life History

Utah valvata is a small freshwater gastropod having a turbanate shell with up to four whorls that typically reaches a maximum diameter of .24 to .28 inches. The snail is univoltine (one-year life cycle) with a reproductive period in the spring and/or fall (72 FR 31264). Emergence of new cohorts of the Utah valvata snails occurs throughout the year, depending on habitat [Frest and Johannes 1992, U.S. Bureau of Reclamation (USBR) 2002, USBR 2003, Lysne 2003], and is followed by rapid growth through the summer and fall. Over winter, snails become dormant (Cleland 1954, Lysne 2003, USBR 2003). Emergence of a new cohort follows approximately two weeks after oviposition (Cleland 1954, Heard 1963, Dillon 2000) and senescent snails (i.e., those approximately one year old) die shortly after reproduction (Cleland 1954, Lysne and Koetsier 2006).

Following the cessation of dormancy in spring, growth continues through summer until sexual maturity is reached at .16 to .20 inches in length (Hershey 1990, Lysne and Koetsier 2006). The Utah valvata is hermaphroditic (individuals have both male and female sex organs), but it is unknown whether it will self-fertilize. Utah valvata are between .10 to .14 inches in size during their first reproduction, and they deposit egg masses on hard surfaces that have 3 to 12 eggs per sac.

Range

The desert valvata is believed to have evolved in the Pleistocene Lake Idaho approximately 400,000 to 1.6 million years ago. Fossils of the species have been collected from California, Nevada, Utah, and Idaho, but current populations are only known from Idaho. In 1995, the U.S Fish and Wildlife Service described the distribution of the valvata as Snake River mile (RM) 579, just below the Thousand Springs Preserve, to Snake RM 714, just below American Falls Dam. Recent surveys indicate the species is now known to be more widespread than thought at the time of listing, and is tolerant of a variety of habitat conditions such as riverine habitats without spring influence, reservoirs, and springs.

Today, it is known to range in the Snake River from RM 582 to the confluence of the South Fork and Henry's Fork, Snake River RM 837. The species has a discontinuous distribution ranging from Hagerman [near RM 572] upstream to the lower Henry's Fork and the S.H. 33 bridge (RM 9.3, near the Snake RM 837.4). Below Milner Dam (RM 639.1), this species is present in the Box Canyon (RM 588.2) and Thousand Springs (RM 585) areas, Niagara Springs (RM 599), and Upper Salmon Falls Reservoir (RM 580). A colony also exists in the Big Wood River near Gooding, Idaho. Live specimens of the snail have been collected from the Big Wood River near Gooding, approximately 35 mi southwest of Timmerman Junction (Weigel 2003). Shells of the species have also been collected in Magic Reservoir, which is located on the Big Wood River south of U.S. 20 and 5 mi southwest of Timmerman Junction. No evidence of the snail has been documented in the Big Wood River north of Magic Reservoir.

At present, the most abundant colonies of Utah valvata snails known to exist in the Snake River Basin occur in river and reservoir habitats from Minidoka Dam (RM 675) upstream to the middle portion of American Falls Reservoir (approximately RM 725) (Hinson 2006). The recovery area for the desert valvata extends from Snake River mile 572 to 709 (USFWS 1995).

Habitat Requirements

The Utah valvata snail is a habitat generalist, occupying cold-water springs, spring creeks, the mainstem Snake River, and reservoirs in both fine sediments and more coarse substrates at a variety of water depths (Hinson 2006). The snail prefers small pebbles and gravels, cobbles embedded in silt, and submerged aquatic vegetation but is predominantly found in silt substrates. Populations of the species vary largely across its range. Utah valvata are usually found in lower velocity habitats of free-flowing river, spring habitat, or reservoirs (USFWS 1995, Weigel 2002, 2003). They are typically associated with fine sediments (<0.010 in. diameter) or gravels mixed with fines. The species is absent from boulder and bedrock substrates (Weigel 2003).

USFWS (2007) described that the species avoids areas with heavy currents or rapids and is absent from pure gravel-boulder bottoms. The snail prefers well-oxygenated areas of non-reducing calcareous mud or mud-sand substrate among beds of submergent aquatic vegetation (USFWS 1995). Cold, perennial flowing water with little to no fluctuation and good water quality are also important. Wiegel (2003) found reduced frequency of Utah valvata snail in plots located in higher velocity locations in the main stem of the Snake River. The Utah valvata snail was described as existing "at a few springs and mainstem Snake River sites in the Hagerman Valley and at a few sites below American Falls Dam downstream to Burley [Idaho]." Based on this analysis, Hinson (2006, pp. 3, 23-32) reported Utah valvata snails using a number of substrates (fines, cobbles, gravel), habitat types (river, springs, reservoirs), depths (from less than 1.6 ft) to greater than 32.8 ft, and water temperatures from 40.1° F to 66.6°F. The snails have also been found in areas of low and high concentrations of aquatic plants, and, in one case, were found in very fine, black, organically enriched sediments with dense submerged aquatic plant communities and attached filamentous (long thread-like) algae (Hinson 2006). Recent research has described the species life history and some ecological and physiological aspects of the species biology, but information about the snails' growth, survival and reproduction are not entirely known.

Threats

The USFWS listed the Utah valvata snail as endangered on December 14, 1992 (57 FR 59244). At that time, they determined that the Utah valvata snail was threatened by proposed hydroelectric development, the operation of existing hydropower dams, degraded water quality, water diversions, the introduced New Zealand mudsnail (*Potamopyrgus antipodarum*), and the lack of existing regulatory protections for spring habitats. However, Weigel (2003) found some evidence that reservoirs may be providing a seasonally stable environment, insulating snail populations from variations in food availability or harsh winter conditions.

The USFWS (2004a) describes how various factors have adversely affected the free flowing, cold-water environments where the listed Snake River snail species have existed for many years. They list the following human activities as adversely modifying habitat and contributing to deteriorated water quality:

- Hydroelectric development, operations, and maintenance.
- Water withdrawal and diversions.
- Point and non-point source water pollution.
- Inadequate regulatory mechanisms (which have failed to provide protection to habitats).
- Adverse effects associated with non-native species.

Water operations and storage associated with irrigation projects alter the natural flow regimes of the river. Some aspects of river impoundment appear to be favorable to Utah valvata snail (Weigel 2002, 2003).

A threats analysis provided by petitioners in 2007 stated that threats to Utah valvata snail habitat from water pollution were not as they were perceived when the species was listed in 1992 (Barker et al., in litt., 2006). The petitioners presented data on improvements to Snake River water quality and on changes in our understanding of Utah valvata snail's tolerance of nutrient-rich (e.g., nitrogen and phosphorus) water in the Snake River resulting from return flows from irrigated agriculture, runoff from feedlots and dairies, hatchery effluent, municipal sewage effluent, and other point and non-point discharges. The Utah valvata snail status report provided by the petitioners (Hinson 2006) noted that the U.S. Bureau of Reclamation (2003) conducted studies measuring the organic content in the sediment (ash- free dry weight) where Utah valvata snails are found in an attempt to create an index that relates snail densities with available forage. The highest Utah valvata snail densities sampled coincided with lower Lake Walcott reservoir habitat that had the greatest percentage of organic content in the sediments, suggesting that Utah valvata snails can reach their greatest densities in areas that are subject to high concentrations of nitrogen and phosphorus (Hinson 2006).

At the time of listing, the USFWS stated: "The quality of water in [snail] habitats has a direct effect on the species survival. The [Utah valvata snail] require[s] cold, well-oxygenated unpolluted water for survival. Any factor that leads to a deterioration in water quality would likely extirpate [the Utah valvata snail]" (USFWS 1992). Petitioners presented substantial information indicating that Utah valvata snails may be more tolerant of nutrient-rich waters than indicated by the best available information at the time of listing in 1992 (72 FR 31264).

Effects

Snails and their habitats are subject to the effects of road construction and maintenance. These activities could result in erosion and sediment delivery to the Snake River, its tributaries or adjacent cold-water springs complexes. These effects can degrade or inundate habitat used by snails during all life history phases, could reduce food abundance and could cause snail mortality. Although the proposed action could potentially affect snails during project implementation, it will not appreciably reduce the likelihood of both the survival and recovery of this species.

Determination for of Effect on Utah valvata snail

The project types proposed under this PBA are *likely to adversely* affect the Utah valvata snail.

Rationale for the Determination - Because the extent and amount of potential habitat for Utah valvata snail within Idaho is partially unknown and/or remains mostly unsurveyed, it is possible that road construction and maintenance could adversely affect the species. Effects of road building and maintenance will be minimized due to implementation of BMPs designed to avoid or minimize adverse effects to the species.

3.9 Bliss Rapids snail (Taylorconcha serpenticola)

Species Description and Life History

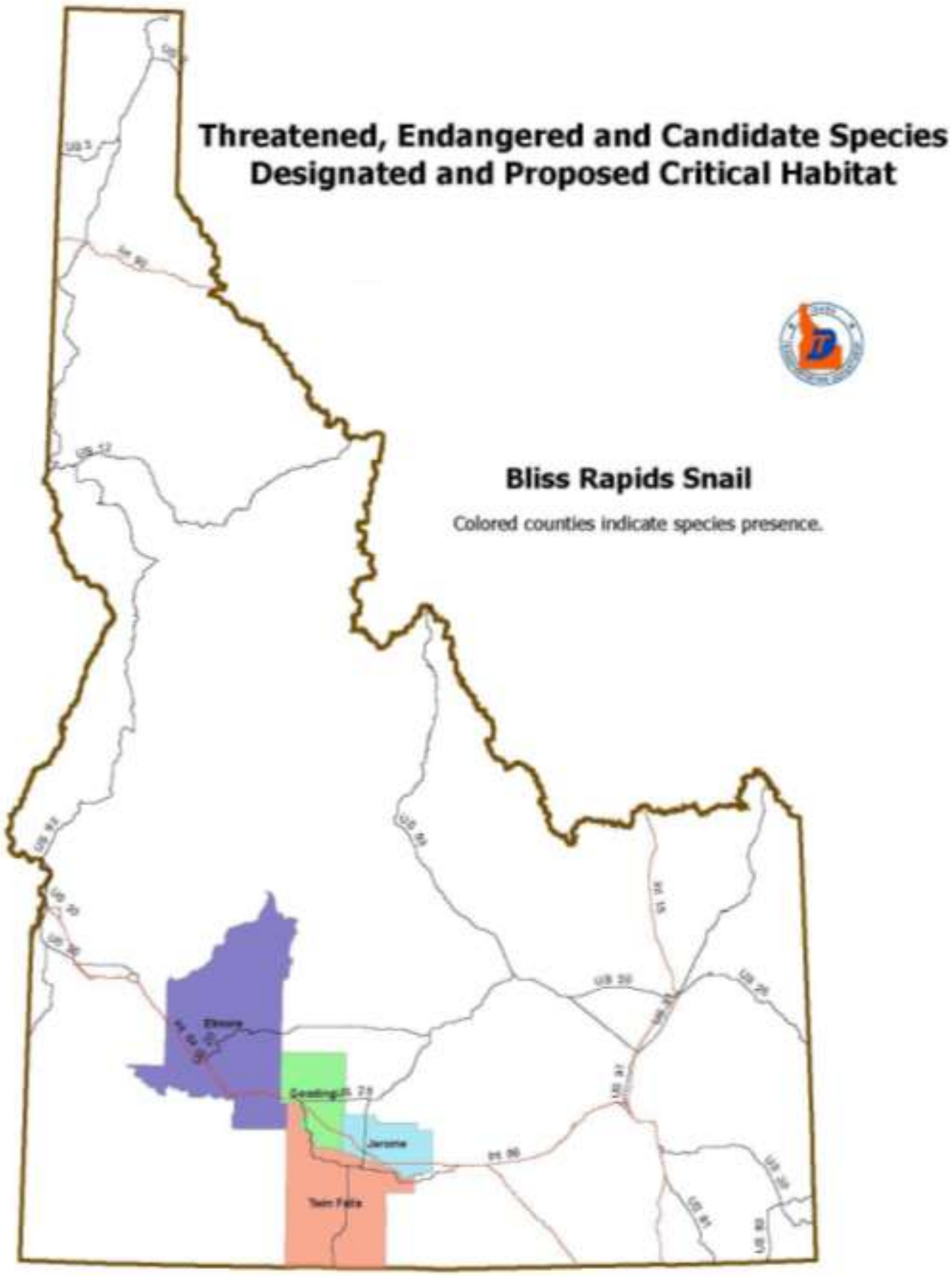
Adult Bliss Rapids snails measure from about approximately 0.008 to 0.098 inches in length, with three whorls, and are ovoid in shape. There are two color variants of the Bliss Rapids snail, the colorless or "pale" form and the orange-red or "orange" form. The pale form is slightly smaller with rounded whorls and more melanin pigment on the body (Hershler et al. 1994). The Bliss Rapids snail occurs in the Mid-Snake River and numerous cold-water tributaries along that river reach.

Habitat

The Bliss Rapids snail occurs on hard substrates in springs, creeks, and the Snake River within and adjacent to the Hagerman Valley (Hershler et al. 1994). The species does not burrow and avoids fine depositional sediment and surfaces with attached macrophytes (USFWS 1995a), but has been found in association with smaller, pebble- to gravel-sized substrates (Hershler et al. 1994, Stephenson and Myers 2003). While the Bliss Rapids snail has been documented on submerged, coarse woody debris in a small tributary of Box Canyon Spring (USFWS 2006b), this is apparently very atypical habitat (Hershler et al. 1994) and the species is normally restricted to rocky substrates. This species is considered negatively phototaxic and primarily resides on the lateral sides and undersides of rocks (Bowler 1990, Hershler et al. 1994).

The Bliss Rapids snail can be locally quite abundant, especially in large spring complexes and spring tributaries in the Hagerman Valley on irregular rock surfaces, commonly with encrusting red algae (USFWS 1995a). Data collected to date suggest that Bliss Rapids snails that reside in the Snake River are more frequently encountered and/or occur at higher densities in shallower habitats (≤3.3 ft in depth) (Richards et al., 2006). Reproduction appears to occur at different times of the year in different populations of snails. Those populations found in the main stem of the Snake River lay eggs from December to March, while those located in cold-water springs lay eggs from December to April; however, some reproduction may occur throughout the year. Eggs are laid individually on the sides and undersides of rocks and require about one month to hatch into fully developed juveniles. The Bliss Rapids snail has been found inhabiting waters ranging from approximately 46 ^{o}F to 68^{o} F. Bliss Rapids snails are periphyton grazers and are not found in association with substrates supporting a heavy macrophyte load. The Bliss Rapids snail is likely univoltine, having a one-year life cycle.

Changes in water temperature and dissolved oxygen have been noted as critical parameters for species typically associated with cold-water habitats such as the Bliss Rapids snail. This is likely an important factor controlling the distribution of the Bliss Rapids snail and may explain why this species reaches higher densities in spring habitats that tend to have significantly better water quality than the mainstem Snake River (Cazier 1997, 2001, both as revised 2003). It is not known how impaired water quality may affect the reproduction, survival, or other life history characteristics of this species, but published and unpublished field observations suggest that the Bliss Rapids snail is not tolerant of polluted or low-oxygen environments (Hershler et al. 1994, Bowler and Frest, unpub. Manscpt.). Since the Bliss Rapids snail requires free-flowing water and rocky substrates, siltation associated with erosion, reduced flow velocity, water impoundment, aquaculture facilities, and other water uses that reduce dissolved oxygen and add excessive nutrients or contaminants, may be particularly detrimental and the species is typically absent from such environments or, if present, only found at low densities (Hershler et al. 1994, Bowler and Frest, unpub. Manscpt.).



Historic and Current Distribution

The Bliss Rapids snail is discontinuously distributed in the mainstem Snake River and associated with spring tributaries between Clover Creek (RM 547) and Twin Falls (RM 610). Its range appears to be limited to habitats controlled or influenced by spring waters derived from the Snake River Plain Aquifer. Colonies are concentrated in the Hagerman reach in cold-water springs (e.g., Thousand Springs, Banbury Springs, Box Canyon Springs, Malad River, and Niagara Springs) and in lower densities within this mainstem Snake River reach (Hershler et al. 1994). Surveys for this snail in reservoirs have failed to locate it. The species has not been found outside of its documented historic range, although surveys conducted over the past 10 years have located the species at more locations within its known range. It is currently known from several large and multiple small springs and has been documented at low densities in about 19.8 miles of river habitat (Bean 2006).

Some researchers have noted the decline and disappearance of the Bliss Rapids snail from habitats where they were once common (Frest et al. 1991). The USFWS is currently conducting a status review of the species' distribution and abundance in response to a delisting petition and analyzing and aggregating available data.

Little is known about the population dynamics of the Bliss Rapids snail. This snail reaches its highest population densities in cold-water springs and tributaries of the Hagerman reach of the middle Snake River. Population densities of this snail are typically much lower in the main stem of the Snake River. For example, at the Sidewinder site in 2002, annual mean density was approximately 1.6 snails per ft^2. Densities tend to be greater in tributary springs; for example, at Thousand Springs Preserve, 2002 annual mean was 9.7 snails per ft^2 (Stephenson and Bean 2003). The differences between the frequency of colony presence and population densities in cold-water springs versus the Snake River are likely attributable to water quality, but may also be influenced by other undetermined factors. The only demographic studies conducted on the species to date are those by Richards et al. (2006) at Banbury Springs that show a slightly increasing trend in that isolated population.

Threats

See the general threats section above for threats information on applicable to the Bliss Rapids snail in the Jarbidge, Burley, and Shoshone field office areas. The New Zealand mudsnail is present at various densities within the Malad River drainage and likely has some effect on the resident Bliss Rapids snails there.

Effects

Snails and their habitats are subject to the effects of road construction and maintenance. These activities could result in erosion and sediment delivery to the Snake River, its tributaries or adjacent cold-water springs complexes. These effects can degrade or inundate habitat used by snails during all life history phases, could reduce food abundance and could cause snail mortality. Although the proposed action could potentially affect snails during project implementation, it will not appreciably reduce the likelihood of both the survival and recovery of this species.

Determination for of Effect on Bliss Rapids snail

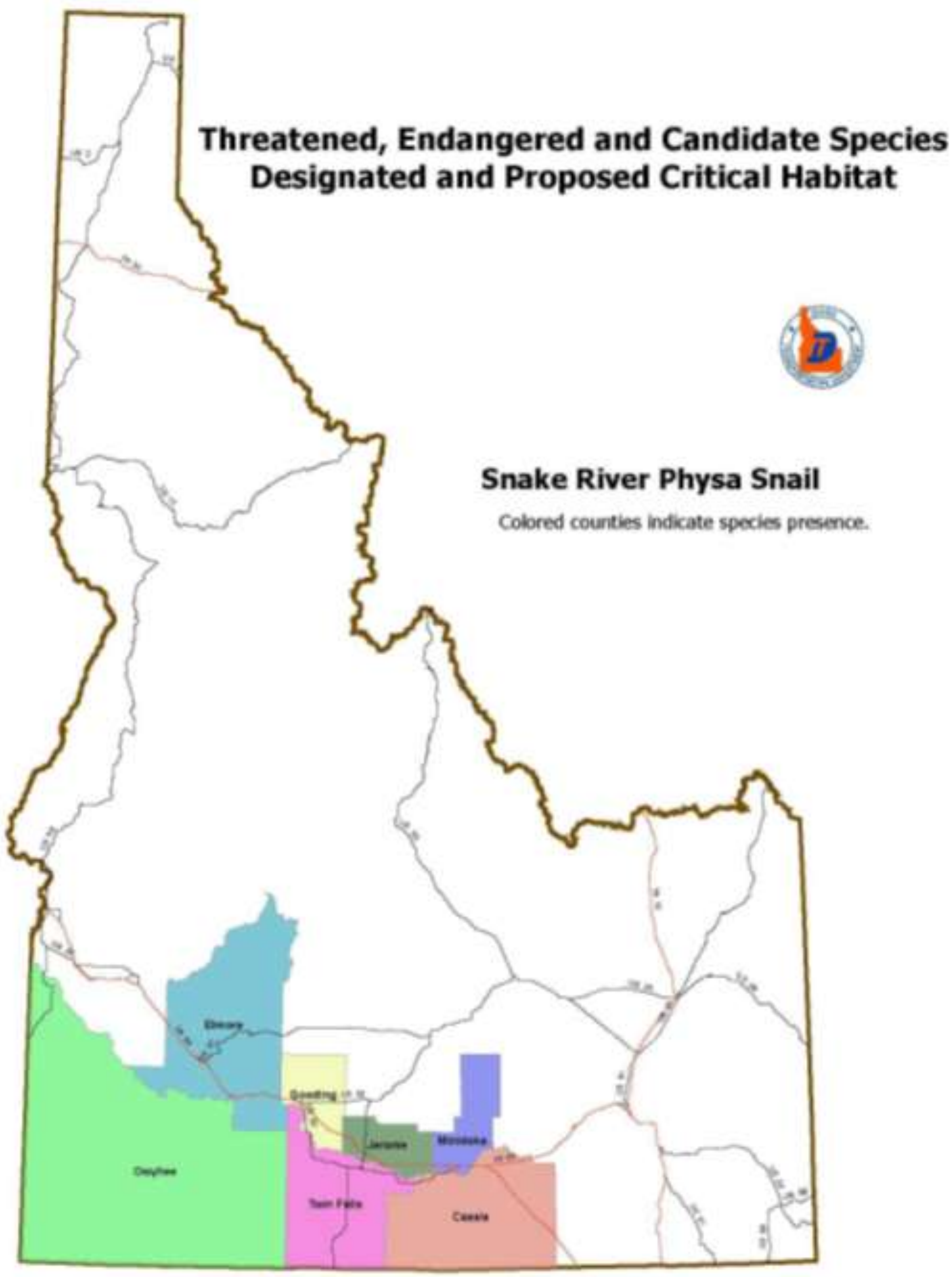
The project types proposed under this PBA are *likely to adversely* affect the Bliss Rapids snail.

Rationale for the Determination - Because the extent and amount of potential habitat for Bliss Rapids snail within Idaho is partially unknown and/or remains mostly unsurveyed, it is possible that road construction and maintenance could adversely affect the species. Effects of road building and maintenance will be minimized due to implementation of BMPs designed to avoid or minimize adverse effects to the species.

3.10 Snake River physa snail (Haitia [Physa] natricina)

Species Description and Life History

The Snake River physa snail is a small freshwater snail found only in the mainstem of the Snake River in Idaho. Adult Snake River physa snails are small, narrow and elongated, and approximately 0.2 to 0.3 in. long. Their shells are spiral and sinistral with 3 to 3.5 whorls, and amber to brown in color (57 FR 59244, Service 2002d).



Habitat

The Snake River physa snail requires cold, clean, well-oxygenated flowing water of low turbidity and is generally intolerant of pollution (USFWS 1995a). This species occurs on the undersides of gravel-to-boulder sized substrate in swift current in the mainstem middle Snake River (USFWS 2002d). Live snails have been found on boulders in the deepest accessible part of the river at the margins of rapids, but they are not known to tolerate whitewater areas with rapid flow (USFWS 2002d). The U.S. Bureau of Reclamation (1998) reported that Idaho Power Company collected live Snake River physa snails at two locations in the Snake River in 1996. Both collections occurred near turbulent deeper water on large cobble/boulder substrate. However, because of the difficulty in distinguishing this species from a more common species of *Physa*, these particular Idaho Power Company observations are unconfirmed (USFW 2004a). Taylor (1982) believed much of this species' habitat was in deep water beyond the range of routine sampling.

Little is known of this species' life history. Based on typical patterns for many cold-water snails in the Pacific Coast states, the Snake River physa snail probably breeds between February and May, and eggs are laid and hatch between March and July (USBR 1998). This species of mollusk is believed to be short-lived, generally completing its life cycle in two years or less (57 FR 59244).

Historic and Current Distribution

The Snake River physa snail is a "living fossil" that was named and described by D.W. Taylor in 1988 (55 FR 51931, 57 FR 59244). It is one of the few relict species that survived the ancient Pliocene Lake Idaho in southwestern Idaho about 3.5 million years ago (55 FR 51931, USFWS 2002d). The species subsequently existed in the Pleistocene-Holocene lakes and rivers of northern Utah and southeastern Idaho (USBR 1998).

USFWS reported that based on collections from 1956 through 1985, the Snake River physa snail's modern range was restricted to the Snake River from Grandview (RM 487) upstream through the Hagerman Reach to RM 573, and possibly upstream from Salmon Falls (57 FR 59244). This species also was recorded farther upstream below Minidoka Dam (RM 674) in 1987 (Pentec Environmental, Inc., 1991).

At present, there are two colonies of Snake River physa snail in the Hagerman and King Hill reaches of the Snake River (55 FR 51931). There is possibly a third disjunct colony immediately downstream of Minidoka Dam (USFWS 2002d). Data from the IDFG (2005) show this third colony occurs in the Snake River near Rupert.

The Idaho Transportation Department received an email from the USFWS on July 2, 2009, revising the information known about the extent of the range distribution for Snake River Physa. The range expansion of the listed snail is now considered present in the Snake River until it reaches the Oregon border. The species also occurs between Milner Pool and Lake Walcott in southcentral Idaho. From the information that was received,

> The historic range of the [Snake River Physa] was believed to include the Minidoka Reach, that reach being surveyed by the Bureau of Reclamation and where the species was recently rediscovered (2006-07) and areas downstream as far as Bancroft Springs (RM 553), near the town of King Hill. At that time, the species had not been recorded from the intervening river reach from Lower Salmon Falls Dam (RM 572) upstream and through Milner Pool (RM 663). The historic range of this species was as far downstream as the town of Grandview (RM 487). At the time of their listing, the species was not believed to occur downstream from King Hill based on the

> findings of biologists such as Taylor and Frest. As of 2008, Snake River physa were only known to occur in the Minidoka Reach of the Snake River, but the review of vouchered specimens found live-when-captured snails from as far downstream as Ontario, Oregon (RM 368), well downstream of its historic range, and as far upstream as the Bliss Reach (RM 559), just 1.5 mi downstream from Bliss Dam, within its historic and recent range.

The Snake River physa snail occurs in ITD's District 3 (Ada, Canyon, Payette, Elmore and Owyhee counties), Distrct 4 (Cassia, Elomore, Gooding, Jerome, Minidoka, Twin Falls counties), and Diestrict 5 (Cassia County).

The numbers of colonies and habitat conditions for Snake River physa snail continues to decline. This species has declined over all but a small fraction of its historical range and today exhibits a fragmented rather than continuous distribution as in the past (57 FR 59244). Live Snake River physa snails are always rare at collection sites, with fewer than 50 live specimens believed to have been collected in the Snake River (Frest et al. 1991). The two known colonies of Snake River physa snails in the Hagerman and King Hill reaches of the Snake River represent a species range reduction from approximately 49 river miles during the period 1956 through 1985, to 17 river miles at present (55 FR 51931). The third possible colony below Minidoka Dam is approximately more than 100 miles upriver and disjunct from the King Hill and Hagerman colonies. Taylor (USFWS 1995a) reported that the extirpation of the Grandview sub-population in the early 1980s was associated with the virtual elimination of the native bottom fauna in this reach of the Snake River.

Threats
See the general threats section for threats information on applicable to the Snake River physa snail.

Effects

Snails and their habitats are subject to the effects of road construction and maintenance. These activities could result in erosion and sediment delivery to the Snake River, its tributaries or adjacent cold-water springs complexes. These effects can degrade or inundate habitat used by snails during all life history phases, could reduce food abundance and could cause snail mortality. Although the proposed action could potentially affect snails during project implementation, it will not appreciably reduce the likelihood of both the survival and recovery of this species.

Determination for of Effect on Snake River physa snail

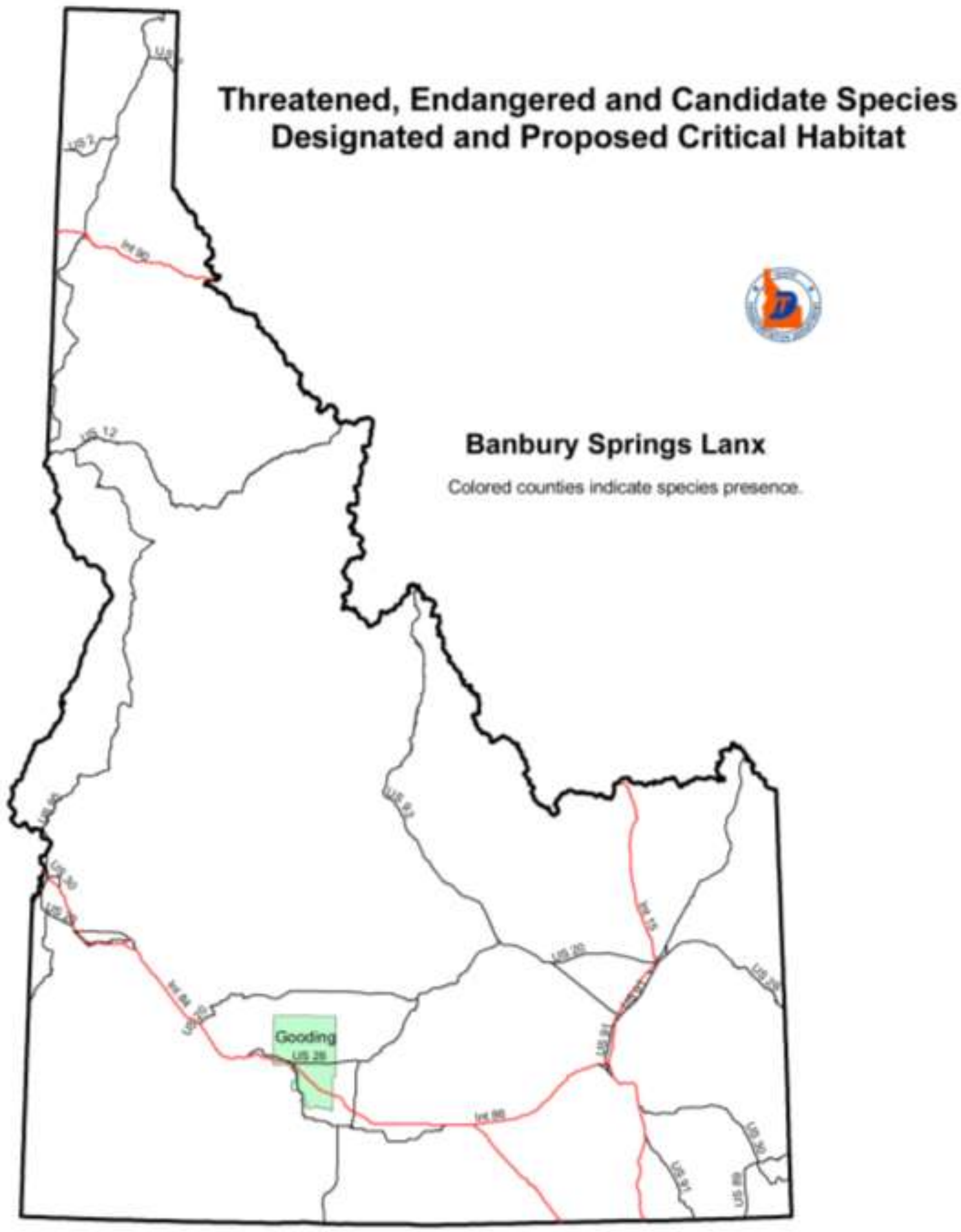
The project types proposed under this PBA are *likely to adversely affect* the Snake River physa snail.

Rationale for the Determination - Because the extent and amount of potential habitat for Snake River physa snail within Idaho is partially unknown and/or remains mostly unsurveyed, it is possible that road construction and maintenance could adversely affect the species. Effects of road building and maintenance will be minimized due to implementation of BMPs designed to avoid or minimize adverse effects to the species.

3.11 Banbury Springs Lanx *(Lanx sp.)*

Species Description and Life History

The Banbury Springs lanx or limpet is a small freshwater snail only found associated with a series of cold-water spring complexes adjacent to the Snake River in Idaho. The species is distinguished by a conical shaped shell of uniform red-cinnamon color with a subcentral apex or point (Frest and Johannes 1992). While not formally described, the species' status as distinct has been confirmed using molecular techniques (Clark 2007).



Life History and Habitat Requirements

The Banbury Springs lanx occurs on hard substrates in only four spring tributaries of the Snake River within and adjacent to the Hagerman Valley. Its general habitat appears to be similar to that of the Bliss Rapids snail which is a coinhabitant wherever the limpet occurs. However, the lanx appears to have additional and more restrictive habitat requirements given the small number of populations that exist and the small area occupied by each population. It is restricted to tributary stream habitats with low sediment and constant water flow in riffles, runs, glides and eddies. Water quality in habitats where the lanx occurs is regarded as being of good quality (e.g., water quality standards for cold-water biota) and having year-round temperatures which vary by only a few degrees, approximately 57 ^{o}F to 63^{o} F.

Historic and Current Distribution

The Banbury Springs lanx is only known from four isolated populations, all within six river miles of one another; Thousand Springs, Box Canyon Spring, Banbury Springs, and Briggs Spring. All of these springs are derived from the Snake River Plain Aquifer. The total area occupied by these colonies is small, and in most cases their densities are low, clumped, and/or unevenly distributed. The populations at Thousand and Banbury Springs appear to occupy areas of only a few tens of square meters, while those at Box Canyon and Briggs Springs appear to be patchily distributed over linear stream areas of a few hundred meters or less (USFWS. 2006a, 2006b).

The demographics of the Banbury Springs lanx are unknown. Idaho Power Company conducted periodic monitoring of the species at Banbury Springs from 1995 to 2001 and found average densities in that population to range from 5 to 7 snails per ft^2, ranging from zero to 22 snails per ft^2 in the summer months. Monitoring has not been conducted for the other three known populations and the full area of occupation and densities within those individual springs are still not fully known.

The Banbury Springs lanx is only found in ITD District Four in the Snake River. U.S. 30 in District Four is in the vicinity of the known habitat. Surveys at The Nature Conservancy's Thousand Springs Preserve following the discovery of the Banbury Springs lanx in 1991 showed 600 to 1,200 individuals in that colony. The colony was sporadically distributed within an area covering about 129 to 151 per ft^2. Population densities within that area ranged from 43 to 215 individuals per ft^2. These data and the previous discussion of this species' distribution indicate that population size and range of the Banbury Springs lanx are extremely limited. Habitat condition has generally been degraded over time because of numerous activities and is discussed in the Threats Analysis section.

The free-flowing, cold-water environments where the Banbury Springs lanx is known to occur have been negatively impacted by human developments. Prior development and water diversions may have impacted the species at all of its known population sites, but most of these occurred before the species was known to science. In the early 1900s, a majority of the springs comprising the Thousand Springs complex were diverted for hydropower generation, resulting in the destruction and/or degradation of appropriate habitat within that complex. Similarly, a majority of the spring flow at Box Canyon Spring was diverted for use across the Snake River in an aquaculture facility. It is unknown if this diversion destroyed habitat or killed individual lanx, but the species is found to be present a short distance downstream of the diversion pool. The Briggs Spring population may have similarly been affected by the construction of water conveyance channels for another aquaculture facility. Habitat destruction also occurred at Banbury Springs, where an impoundment may have destroyed habitat formerly occupied by, or available to, the species. The USFWS has not been informed of any plans to modify these study sites, and the Box Canyon site's designation as a state park will help ensure its long-term protection.

Effects

Snails and their habitats are subject to the effects of road construction and maintenance. These activities could result in erosion and sediment delivery to the Snake River, its tributaries or adjacent cold-water springs complexes. These effects can degrade or inundate habitat used by snails during all life history phases, could reduce food abundance and could cause snail mortality. Although the proposed action could potentially affect snails during project implementation, it will not appreciably reduce the likelihood of both the survival and recovery of this species.

Determination for of Effect on Banbury Springs lanx

The project types proposed under this PBA *may affect, but are not likely to adversely affect* the Banbury Springs lanx.

Rationale for the Determination - Because the extent and amount of potential habitat for Banbury Springs lanx snail within Idaho is partially unknown and/or remains mostly unsurveyed, it is possible that road construction and maintenance could adversely affect the species. Effects of road building and maintenance will be minimized due to implementation of BMPs designed to avoid or minimize adverse effects to the species.

3.12 Bruneau hot springsnail (Pyrgulopsis bruneauensis)

Species Description and Life History

The Bruneau hot springsnail has a small, globose to low-conic shell reaching a length of 0.22 in with 3.75 to 4.25 whorls. Fresh shells are thin, transparent, and white-clear, although appearing black due to pigmentation. In addition to its small size, less than 0.11 in. shell height, distinguishing features include a verge (penis) with a small lobe bearing a single distal glandular ridge and elongate, muscular filament.

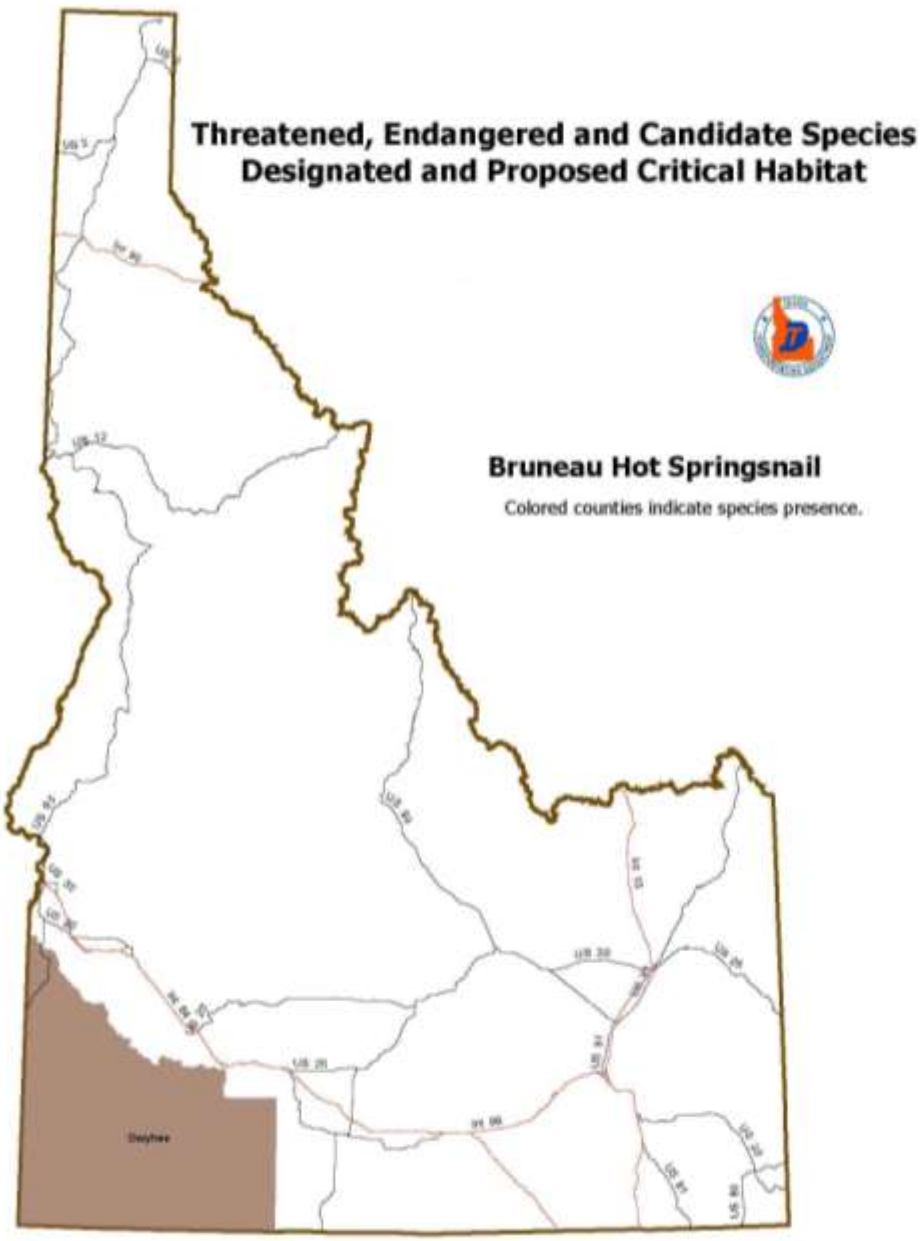
The Bruneau hot springsnail appears to be an opportunistic grazer that feeds upon algae and other periphyton in proportions similar to those found in its habitat. However, snail densities are lowest in areas of bright green algal mats and highest where periphyton communities are dominated by diatoms, which may provide a more nutritious food source than other food types, thus contributing to this greater density. It logically follows from this that Bruneau hot springsnail may make food selections based on nutritional richness rather than just choosing “preferred” individual food items. Fluctuations in Bruneau hot springsnail abundance correspond with changes in food quality based on chlorophyll content.

Sexual maturity can occur within two months, with a sex ratio approximating 1 to 1. Reproduction occurs at temperatures between 75.2 and 95°F; this occurs throughout the year except when inhibited by high or low temperatures. At sites affected by high ambient temperatures during summer and early fall months, recruitment corresponds with cooler periods. Sites with cooler ambient temperatures also exhibit recruitment during the summer months. Springs with cooler minimum temperatures most likely get warmer than 68°F (20°C) in the summer, providing the species opportunities for increased growth and reproduction. The Bruneau hot springsnail, whose individuals are dioecious, deposit its single round to oval eggs on hard surfaces such as rock substrates or other snail shells when suitable substrates are unavailable.

Biologists believe that some natural transfer of the Bruneau hot springsnail may occur among sites. The mechanisms for dispersal possibly include waterfowl passively carrying the Bruneau hot springsnail up or down the river corridor and spates, sudden overflows of water resulting from a downpour of rain or melting of snow, in the Bruneau River that would carry this taxon into other warm spring areas downstream. These mechanisms of dispersal would favor upstream to downstream genetic exchange.

Habitat

The hot spring and seep habitats of this snail are hydraulic outflows from the confined, regional geothermal aquifer that underlies Bruneau, Little, and Sugar valleys in north-central Owyhee County, an area of approximately 600 mi^2. This water flows through natural faults and fractures in the deep-lying volcanic and subsurface sedimentary rocks until it discharges at the surface through artesian vents, where the ground-level elevation is lower than the potentiometric or hydraulic head of the geothermal aquifer. The vast majority of the groundwater in this aquifer originates as natural recharge from precipitation in and around the Jarbidge and Owyhee mountains south of the Bruneau area. Groundwater flows northward from volcanic rocks to sedimentary rocks where it is discharged as either natural spring flow, well withdrawals, or leaves the area as underflow.



There also exists a shallow, unconfined cold-water aquifer within the upper layer of sedimentary rock. This second aquifer system is recharged from the infiltration of precipitation, stream flow, and applied irrigation water. Some scientists also believe that there may be recharge from upward-moving geothermal water into the cold-water aquifer. There also may be additional shallow-water aquifer recharge occurring through leaks in irrigation wells.

The Bruneau hot springsnail occurs in flowing thermal springs and seeps along an 5-mi reach of the Bruneau River in water temperatures ranging from 60.3°F to 98.4°F. This species has not been located outside the thermal plumes of hot springs entering the Bruneau River. The Indian Bathtub spring occurs at an elevation of 2,672 ft; the other thermal springs where this snail is found are at comparable elevations. The highest snail densities occur at temperatures ranging from 73°F to 98°F. Some of the Bruneau hot springsnail colonies are separated by distances of less than 3.3 ft.

The Bruneau hot springsnail occurs in these habitats on the exposed surfaces of rocks, gravel, sand, mud, algal film and the underside of the water surface; however, during the winter period of cold ambient temperatures and icing, snails are most often located on the undersides of outflow substrates that are least exposed to cold temperatures. In madicolous habitats, those with thin sheets of water flowing over rock faces, the species has been found in water less than 0.39 in deep. Current velocity is not considered a significant factor limiting the distribution of this snail, since they have been observed to inhabit nearly 100 percent of the available current regimes. In a September 1989 survey of 10 thermal springs in the vicinity of the Hot Creek-Bruneau River confluence, the total number of Bruneau hot springsnails per spring ranged from one to 17,319. The species abundance fluctuates seasonally but is generally stable under persistent spring flow conditions. Although on-site conditions are important, snail abundance is influenced primarily by temperature, spring discharge, and chlorophyll ratios.

Common aquatic community associates of the Bruneau hot springsnail include the mollusks *Physella gyrina*, *Fossaria exigua*, and *Gyraulus vermicularis*; the creeping water bug (*Ambrysus mormon minor*); and the skiff beetle (*Hydroscapha natans*). In addition, Hot Creek and several of the thermal springs along the Bruneau River support populations of *Poecilia reticulata* and *Tilapia* sp. These are exotic guppies that were apparently released into upper Hot Creek at the Indian Bathtub, from which they spread downstream and into nearby thermal springs and seeps along the Bruneau River.

Distribution

One habitat survey in 1996 found Bruneau hot springsnails in 116 of 204 flowing thermal springs and seeps in their 5-mi historical range along the Bruneau River. Eighty-six of these occupied springs are located upstream of the confluence of Hot Creek with the Bruneau River, 10 are at the confluence of Hot Creek, and 20 are downstream of the confluence of Hot Creek with the Bruneau River. Surveys conducted since 1991 indicate a moderate but significant decrease in suitable habitat and occupied pools. Since 1991, the total number of thermal springs in the Bruneau River has declined from 214 to 204, the number of springs occupied by Bruneau hot springsnails has declined from 130 to 116, and the population densities of occupied areas have declined from about 55 to 47 individuals per ft^2. Total site area, including all thermal springs and seeps whether occupied or unoccupied by Bruneau hot springsnails, increased by 4.3 percent from 1991 to 1996. Most of this increase was due to lower flows at one unoccupied spring site, resulting in more exposure of thermal outflow area below Buckaroo Dam, downstream of the majority of the occupied springs.

The Indian Bathtub area and most of the thermal springs along the Bruneau River upstream of Hot Creek are on lands administered by the Bureau of Land Management, while most Bruneau hot springsnail habitats downstream of the Indian Bathtub and Hot Creek confluence are on private land.

Threats

The primary threat to the Bruneau hot springsnail is a major reduction in its free-flowing thermal spring and seep habitats caused by agricultural-related groundwater withdrawal and pumping. This activity has depleted and continues to deplete the regional geothermal aquifer upon which snail habitat depends. Some scientists are convinced that leaks from uncased or poorly cased wells are also reducing water levels in the geothermal aquifer. The species and its habitat are also vulnerable to habitat modification from the sediments deposited by flash floods. In summary, the cumulative effects of water withdrawal continue to threaten the increasingly fragmented populations of the Bruneau hot springsnail and their thermal habitats.

Groundwater withdrawals from wells for domestic and agricultural purposes began in the area of the geothermal aquifer in the late 1890s. By the mid-1960s the decline in discharge from the Indian Bathtub spring became very noticeable, coinciding with the accelerated increase in groundwater withdrawal to provide irrigation for croplands newly put into production.

The two most apparent effects of pumping stress are declines in hydraulic head and declines in spring discharge. Changes in discharge from thermal springs correlate with changes in hydraulic head. These changes can fluctuate seasonally and are substantially less during late summer than in the spring.

Discharge fluctuations, which occur at most occupied springs, very frequently correspond with ground-water withdrawal rates; there are lower flows in the late spring to early fall when the need for pumping is greatest, and higher flows during late fall to spring when the need for pumping is lowest. Discharge from many of the thermal springs along Hot Creek and the Bruneau River has decreased or has been lost in the last 25 years, thus further restricting habitat for this taxon. The Hot Creek/Indian Bathtub spring site lost more than 90 percent of both its habitat and snail population during the period from 1954 to 1981. Rapidly dwindling spring flows were instrumental in this precipitous decline.

Spring discharge at the Indian Bathtub in 1964 was approximately 2,400 gal per minute; by 1978, it had dropped to between 130-162 gal per minute; and by the summer of 1990, discharge fell to zero through the early fall water withdrawal season. Visible spring discharge at the Indian Bathtub continues to be seasonal, intermittent most years, and quite low.

Snail population at the Indian Bathtub spring occurs on vertical rock faces protected from flash floods. In 1991, a flash flood sent huge amounts of sediment into the Hot Creek drainage, resulting in a 50 percent reduction in the size of the Indian Bathtub, a portion of which is now covered by approximately 10 ft of sediment. Rock face habitat in the immediate vicinity of Indian Bathtub was also severely reduced and covered with sediment during this and other recent flash floods.

Ongoing population monitoring studies indicate a lack of movement or recruitment of Bruneau hot springsnails back to the Hot Creek/Indian Bathtub sites. Several factors have been cited as contributing to this situation, including silty substrate that lacks available rock face surfaces for reproduction, weak migration abilities, fish predation, and a lack of an upstream colonization that may have prevented the Bruneau hot springsnail from returning to the upper Hot Creek and Indian Bathtub sites.

Groundwater withdrawals have generally declined over the past 15-20 years, primarily due to cropland retired from production through a crop land reclamation program. However, the volume of water pumped may increase significantly in the next few years as crop land will again be put into production. If present water management practices continue, if a substantial proportion of the crop-lands are returned to production, and if drier spring and summer climatic conditions return—

all of which affect pumping rates and duration—water levels in the aquifer will either continue to decline or will eventually stabilize at a lower level, resulting in the further loss of Bruneau hot springsnail habitat.

While huge spring flow declines have been documented at Indian Bathtub spring and several other springs, spring flow data has not been collected in all the remaining 116 springs containing Bruneau hot springsnails. Some scientists believe that prior to the recent decline in water levels in the aquifer and the consequent fragmentation of remaining populations all of the springs and seeps supporting snails were connected, which allowed the natural dispersal and transfer of individuals. Studies done in the early 1990s indicate a general decline in the total number of thermal springs along the Bruneau River, the number of springs occupied by Bruneau hot springsnails, and the densities per unit area of Bruneau hot springsnails in occupied pools. In 1993, dead Bruneau hot springsnails were found at one previously occupied spring site where flows had recently diminished and nine spring sites showed noticeable reductions in discharge. At this time there is no information available indicating how much lower water levels can continue to decline before all thermal springs along the Bruneau River are lost. As potentiometric surfaces in the geothermal aquifer continue to decline, additional spring discharges will be reduced or lost, resulting in the continued loss of Bruneau hot springsnail habitat.

Cattle grazing has damaged Bruneau hot springsnail habitats and directly eliminated snails, especially along Hot Creek. Cattle have destroyed and displaced snails through trampling in-stream substrates, and their browsing removes heat-moderating riparian vegetation, allowing water temperatures to climb to levels that first damage reproduction and then can kill Bruneau hot springsnails. Livestock grazing in the watershed adjacent to Hot Creek, combined with ongoing drought conditions, contributed to an increase in sedimentation of that creek which eliminated Bruneau hot springsnail seep and spring habitats for almost 500 ft in the Indian Bathtub/Hot Creek drainage. The Bureau of Land Management plans to control livestock grazing by installing fencing on the north end of Hot Creek drainage and the west side of the Bruneau River. The Bureau of Land Management also plans to install additional fencing along the east side of the Bruneau River. Both fencing projects, if properly maintained, will protect remaining snail habitat from the effects of livestock.

There are no current commercial uses for this species, although certain mollusk species have subsequently become vulnerable to illegal collection for scientific purposes after their rarity was widely publicized. Collection could now become a threat to this taxon because the distribution of the Bruneau hot springsnail is restricted and generally well-known.

There are no known diseases that affect Bruneau hot springsnails, but juvenile snails smaller are vulnerable to a variety of predators. Damselflies and dragonflies have been observed feeding upon Bruneau hot springsnails in the wild. The presence of wild guppy populations in Hot Creek and several of the other small thermal springs downstream along the west bank of the Bruneau River are a potential threat to this species, as they have been observed feeding upon these snails in the laboratory. In addition to guppies, a species of *Tilapia* has ascended into and reproduced in Hot Creek. The presence of this new potential exotic predator may constitute a threat to the Bruneau hot springsnail by restricting repopulation of the snail into Hot Creek and at other thermal spring sites that may be available to both species. The guppy and *Tilapia* are each capable of summer migration, when water temperatures are suitable, into the Bruneau River corridor, both upstream and downstream of Hot Creek. Movement of these exotic fish species into other thermal springs occupied by the Bruneau hot springsnail might affect their continued survival within individual spring sites. It should be noted that madicolous habitats support neither of these two exotic fishes or dragonflies, but do harbor numerous damselflies.

Sedimentation of Bruneau hot springsnail habitats is a significant threat to this species. Substantial sediments deposited by periodic flash floods cannot be flushed away by the remaining weak and declining spring flows. Measures which could protect Bruneau hot springsnail habitats in the Indian Bathtub and Hot Creek areas from the effects of flash flooding have not been implemented. These measures include the construction of small retention dams in the Hot Creek watershed to trap runoff sediment while maintaining thermal seep habitats. Flooding and sedimentation therefore continue to threaten Bruneau hot springsnail habitat.

Effects

Road construction, maintenance and operation could potentially affect habitat for the Bruneau hot springsnail, including springs, thermal springs and seeps. Effect to the species could occur during all life history phases, cause reduced food abundance and temporarily disturb or inundate springsnails.

Determination of Effect on Bruneau hot springsnail

The project types proposed under this PBA *may affect, but are not likely to adversely affect* the Bruneau hot springsnail.

Rationale for the Determination **-** Because the extent and amount of potential habitat for Bruneau hot springsnail within Idaho is partially unknown and/or remains mostly unsurveyed, it is possible that road construction and maintenance could affect the species. Effects of road building and maintenance will be minimized due to implementation of BMPs designed to avoid or minimize adverse effects to the species.

3.13 Snake River fall Chinook salmon *(Oncorhynchus tshawytscha)*

Species Description and Life History

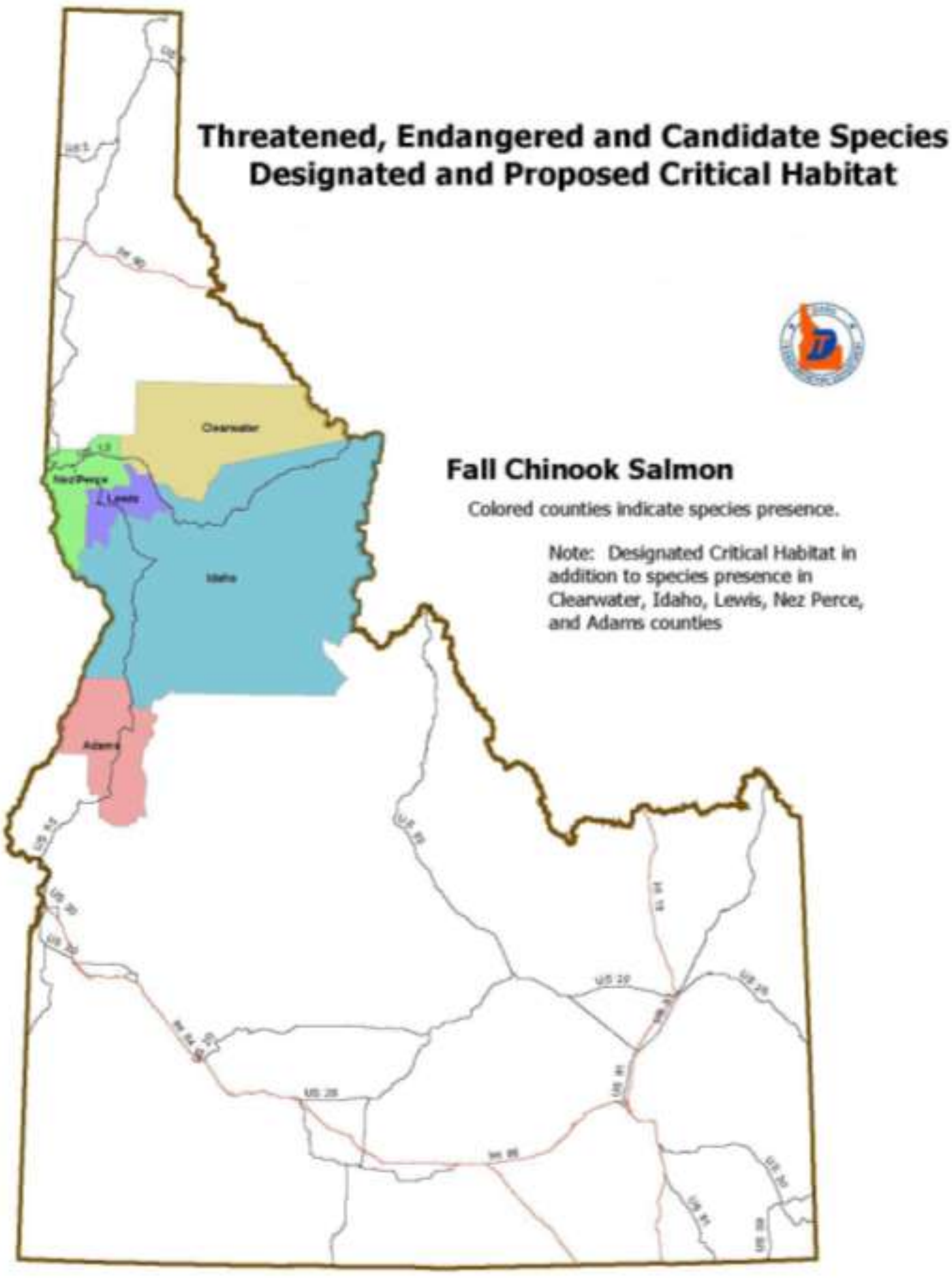
Prior to 1900, fall Chinook salmon were widely distributed in the Snake River and supported important commercial and tribal fisheries. In this century, construction of 12 dams on the mainstem Snake River has reduced spawning habitat to a fraction of its former extent. With completion of the Hells Canyon Dam and Lower Snake River dam complexes between 1958 and 1975, the most productive areas were inaccessible or inundated. Only about 103 miles of habitat remains in the main stem of the Snake River.

The distribution of fall Chinook is more limited than that of the spring/summer Chinook ESU, and includes the lower reaches and tributaries of the Snake River, Clearwater River, Salmon River, Tucannon River, and Grande Ronde River (NMFS 1995). Fish from all of these rivers are found at one time or another in the lower Snake River. The upper reaches of the mainstem Snake River were the primary areas used by fall Chinook salmon, with only limited spawning activity reported downstream from river mile (RM) 273. Only limited spawning activity was reported downstream from RM 273, about 0.6 miles upstream of Oxbow Dam. Since then, irrigation and hydrosystem projects on the mainstem Snake River have blocked access to or inundated much of this habitat, causing the fish to seek out less preferable spawning grounds wherever they are available. Natural fall Chinook salmon spawning now occurs primarily in the Snake River below Hells Canyon Dam and the lower reaches of the Clearwater, Grand Ronde, Salmon, and Tucannon rivers.

Adult Snake River fall Chinook salmon enter the Columbia River in July and migrate into the Snake River from August through October. Fall Chinook salmon generally spawn from October through November, and fry emerge from March through April. Downstream migration generally begins within several weeks of emergence. Juveniles rear in backwaters and shallow water areas of major rivers and reservoirs through mid-summer before migrating to the ocean. Thus, they typically exhibit an ocean-type juvenile history. Once in the ocean, they spend one to four years (though usually three years) before beginning their spawning migration. Fall returns in the Snake River system are typically dominated by four-year-old fish. For detailed information on Snake River fall Chinook salmon, 56 FR 29542.

Some Snake River fall Chinook historically migrated over 939 miles from the ocean. Although the Snake River population is now restricted to habitat in the lower river, genes associated with the lengthier migration may still reside in the population. Because longer freshwater migrations in Chinook salmon tend to be associated with more extensive oceanic migrations (Healey 1983), maintaining populations occupying habitat that is well inland may be important in continuing diversity in the marine ecosystem as well.

Fall-run Chinook salmon returns to the Snake River generally declined through the first half of this century (Irving and Bjornn 1981). In spite of the declines, the Snake River Basin remained the largest single natural production area for fall-run Chinook salmon in the Columbia River drainage into the early 1960s (Fulton 1968). Spawning and rearing habitat for Snake River fall-run Chinook salmon was significantly reduced by the construction of a series of Snake River mainstem dams. Historically, the primary spawning fall-run Chinook salmon spawning areas were on the upper mainstem Snake River. Currently, natural spawning is limited to the area from the upper end of Lower Granite Reservoir to Hells Canyon Dam, the lower reaches of the Imnaha, Grande Ronde, Clearwater and Tucannon rivers, and small mainstem sections in the tail races of the Lower Snake hydroelectric dams.



Adult counts at Snake River dams are an index of the annual return of Snake River fall run Chinook salmon to spawning grounds. Lower Granite Dam is the uppermost of the mainstem Snake River dams that allow for passage of anadromous salmonids. Adult traps at Lower Granite Dam have allowed for sampling of the adult run as well as for removal of a portion of non-local hatchery fish passing above the dam. The dam count at Lower Granite covers a majority of fall-run Chinook salmon returning to the Snake River Basin. Since 1975, the estimated number of wild fall Chinook salmon passing Lower Granite Dam on the Snake River has been less than 1,000 per year, and in 1990 the estimate was less than 100. Counts from the dam between 1990 through 2003 ranged from as low as 572 to as many as 20,213 individuals. Counts for fall Chinook salmon were greatest in 2004. Fish counts for the year of 2004 amounted to 22,505 individuals passing Lower Granite Dam. Fish counts can be viewed at *www.fpc.org*.

Lyons Ferry Hatchery is on the mainstem Snake River below both Little Goose and Lower Monumental Dams. Although a fairly large proportion of adult returns from the Lyons Ferry Hatchery program do stray to Lower Granite Dam, a substantial proportion of the run returns directly to the facility. Lyons Ferry Hatchery was established as one of the hatchery programs under the Lower Snake Compensation Plan administered through the USFWS. Snake River fall-run Chinook salmon production is a major program for Lyons Ferry Hatchery, which is operated by the Washington Department of Fish and Wildlife and is along the Snake River mainstem between Little Goose Dam and Lower Monumental Dam. The department began developing a Snake River fall-run Chinook salmon broodstock in the early 1970s through a trapping program at Ice Harbor Dam and Lower Granite Dam. The Lyons Ferry facility became operational in the mid-1980s and took over incubation and rearing for the Snake River fall Chinook mitigation/compensation program.

For the Snake River fall Chinook salmon ESU as a whole, NMFS estimates that the median population growth rate (lambda) over the base period ranges from 0.94 to 0.86, decreasing as the effectiveness of hatchery fish spawning in the wild increases compared to that of fish of wild origin. NMFS has also estimated the risk of absolute extinction for then aggregate Snake River Chinook salmon population, using the same range of assumptions about the relative effectiveness of hatchery fish. At the low end, assuming that hatchery fish spawning in the wild have not reproduced (i.e. hatchery effectiveness), the risk of absolute extinction within 100 years is 0.40. At the high end, assuming that the hatchery fish spawning in the wild have been as productive as wild-origin fish (hatchery effectiveness = 100%), the risk of absolute extinction within 100 years is 1.00 (McClure et al. 2003).

Effects

Effects for Snake River fall Chinook salmon are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead – including the Snake River fall Chinook salmon – varies based on the project type. A complete determination is included in chapter 5.

3.14 Snake River fall Chinook salmon – Designated Critical Habitat

Critical habitat was designated for Snake River fall Chinook salmon on December 28, 1993, (58 FR 68543). The historic distribution of fall Chinook salmon in Idaho has occurred only in large mainstem rivers and tributaries to the Snake, Clearwater, and Salmon rivers. The current distribution of fall Chinook salmon is located along the mainstem Snake River immediately downstream from its confluence with Deep Creek, and the lower/middle main Salmon River (from the mouth upstream to approximately its confluence with French Creek), and the lower reaches of the Clearwater River.

Previous Chinook salmon status reviews (Waples et al. 1991, Myers et al. 1998) identified several concerns regarding Snake River fall Chinook salmon: steady and severe decline in abundance since the 1940s; loss of primary spawning and rearing areas upstream of the Hells Canyon Dam complex; increase in non-local hatchery contribution to adult escapement over Lower Granite Dam, and relatively high aggregate harvest impacts by ocean and in-river fisheries (NMFS 2006).

Snake River fall Chinook salmon, like many other species of Pacific salmon and steelhead, have experienced declines in abundance over the past several decades as a result of loss, damage or change to their natural environment. Water diversions for agriculture, flood control, domestic use, and hydropower have greatly altered or eliminated historically accessible habitat and degraded remaining habitat. Forestry, agriculture, mining, and urbanization have degraded, simplified, and fragmented habitat. Sedimentation from extensive and intensive land use activities (e.g., timber harvests, road building, livestock grazing, and urbanization) is recognized as a primary cause of habitat degradation throughout the range of Pacific salmon and steelhead. The destruction or modification of estuarine areas has resulted in the loss of important rearing and migration habitats (NMFS 2006a).

Dams and alterations in river flow and temperatures from various water uses in the upper Snake River and tributaries are the primary continuing threats to fall Chinook salmon range and habitat. The historic distribution of Snake River fall Chinook salmon extended from the mouth of the Snake River to a natural barrier at Shoshone Falls (RM 615). The construction of Swan Falls Dam in 1901 eliminated the upper 385 miles of the historic range of the species (Tiffin et al. 1999). With the construction of the Hells Canyon complex and the four lower Snake River dams from the late 1950s through mid-1970s, the spawning habitat for fall Chinook salmon in the mainstem Snake River was further reduced to its present state: approximately 100 miles of free flowing Snake River between Hells Canyon Dam and Lower Granite Reservoir. Added to the loss of more than 80 percent of the historic habitat in the Snake River are the heavily impacted migration conditions for the species caused by the lower four Columbia River dams. The eight dams/reservoirs the extant population must negotiate as both juveniles and adults cause compounded migration delays and mortality. The Dworshak Dam added effects on temperature and flows to the Clearwater River and to the Snake River habitats already affected by flow reductions and water temperature changes from management activities in the upper Snake River. Fall Chinook salmon now occupy mostly remnant areas with lower natural production potential than the habitats available in their former range (Connor et al. 2002, Dauble et al. 2003).

During all life stages Snake River fall Chinook salmon require cool water that is relatively free of contaminants. Water quality impairments in the designated critical habitat of this ESU include inputs from fertilizers, insecticides, fungicides, herbicides, surfactants, heavy metals, acids, petroleum products, animal and human sewage, dust suppressants (e.g., magnesium chloride), radionuclides, sediment in the form of turbidity, and other anthropogenic pollutants. Pollutants enter the surface waters and riverine sediments from the headwaters of the Snake, Salmon, and Clearwater rivers to the Columbia River estuary as contaminated stormwater runoff, aerial drift and deposition, and via point-source discharges. Some contaminants such as mercury and pentachlorophenol enter the aquatic food web after reaching water and may be concentrated or even biomagnified in the salmon tissue. This species also requires migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

Effects

Effects for Snake River fall Chinook salmon critical habitat are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead critical habitat – including critical habitat for the Snake River fall Chinook salmon – varies based on the project type. A complete determination is included in chapter 5.

3.15 Snake River Spring/Summer Chinook salmon *(Oncorhynchus tshawytscha)*

Species Description and Life History

Spring and summer Chinook salmon runs returning to the major tributaries of the Snake River were classified as an ESU by NMFS (Matthews and Waples 1991). This ESU includes production areas that are characterized by spring-timed returns, summer-timed returns, and combinations from the two adult timing patterns. Historically, the Salmon River system may have supported more than 40 percent of the total return of spring and summer Chinook to the Columbia system (e.g., Fulton 1968).

The Snake River spring/summer Chinook ESU includes current runs to the Tucannon River, the Grand Ronde River system, the Imnaha River and the Salmon River (Matthews and Waples 1991). Some or all of the fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha River, and Grande Ronde River hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries. The Salmon River system contains a range of habitats used by spring/summer Chinook. The South Fork and Middle Fork Salmon rivers currently support the bulk of natural production in the drainage. Two large tributaries entering above the confluence of the Middle Fork, the Lemhi and Pahsimeroi rivers both drain broad alluvial valleys and are believed to have supported substantial, relatively productive anadromous fish runs. Returns into the upper Salmon River tributaries have reestablished following the opening of passage around Sunbeam Dam on the mainstem Salmon River downstream of Stanley, Idaho. The dam was impassable to anadromous fish from 1910 until the 1930s.

Current runs returning to the Clearwater River drainages were specifically not included in the Snake River spring/summer Chinook ESU. Lewiston Dam in the lower mainstem of the Clearwater River was constructed in 1927 and functioned as an anadromous block until the early 1940s (Matthews and Waples 1991). Spring and summer Chinook runs into the Clearwater system were reintroduced via hatchery outplants beginning in the late 1940s. As a result, Matthews and Waples (1991) concluded that "...the massive outplantings of non-indigenous stocks presumably substantially altered, if not eliminated, the original gene pool."

The total annual production of Snake River spring and summer Chinook may have been in excess of 1.5 million adults returns per year (Matthews and Waples 1991). Returns to Snake River tributaries had dropped to roughly 100,000 adults per year by the late 1960s (Fulton 1968). Increasing hatchery production contributed to subsequent year's returns, masking a continued decline in natural production.

Aggregate returns of spring-run Chinook (as measured at Lower Granite Dam) showed a large increase over recent year abundances. The 1997-2001 geometric mean return of natural-origin Chinook exceeded 3,700. The increase was largely driven by the 2001 return which was estimated to have exceeded 17,000 naturally produced spring Chinook. However, a large proportion of the run in 2001 was estimated to be of hatchery origin (98.4 percent). The summer run over Lower Granite Dam has increased as well. The 1997-2001 geometric mean total return was slightly more than 6,000. The geometric mean return for the brood years for the recent returns (1987-96) was 3,076. Note: this does not address hatchery/wild breakdowns of the aggregate run.

Updated analyses of parr density survey results through 1999 by the Idaho Department of Fish and Game conclude that "generational parr density trends, which are analogous to spawner-to-spawner survivorship, indicate that Idaho spring-summer Chinook and steelhead with and without hatchery influence failed to meet replacement for most generations completed since 1985 (NMFS 2003). These data, however, do not reflect the influence of increased returns from 2001 through 2004.

Effects

Effects for Snake River spring/summer Chinook salmon are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead – including the Snake River spring/summer Chinook salmon – varies based on the project type. A complete determination is included in chapter 5.

3.16 Snake River Spring/Summer Chinook salmon--Designated Critical Habitat

Critical habitat was designated for Snake River spring/summer Chinook salmon on December 28, 1993 (58 FR 68543), and was revised on October 25, 1999 (64 FR 57399). Critical habitat is designated to include all river reaches presently or historically accessible to Snake River spring/summer Chinook salmon (except river reaches above impassable natural falls, and Dworshak and Hells Canyon dams) in various hydrologic units (e.g., Napias Creek). Critical habitat includes the stream bottom, the water, and the adjacent riparian zone, which is defined as the area within 300 ft of the line of high water of a stream channel or from the shoreline of a standing body of water.

Habitat impairment is common in the range of this ESU. Spawning and rearing habitats have been impaired by factors such as tilling, water withdrawals, timber harvest, grazing, mining, and alteration of floodplains and riparian vegetation. According to the ICBTRT, the Panther Creek population was extirpated because of legacy and modern mining-related pollutants creating a chemical barrier to fish passage. Mainstem Columbia and Snake river hydroelectric developments have altered flow regimes and estuarine habitat, and disrupted migration corridors.

During all freshwater life stages spring/summer Chinook salmon require cool water that is relatively free of contaminants. Water quality impairments in the designated critical habitat of this ESU include inputs from fertilizers, insecticides, fungicides, herbicides, surfactants, heavy metals, acids, petroleum products, animal and human sewage, dust suppressants (e.g., magnesium chloride), radionuclides, sediment in the form of turbidity, and other anthropogenic pollutants. Pollutants enter the surface waters and riverine sediments from the headwaters of the Snake, Salmon, and Clearwater River drainages as contaminated stormwater runoff, aerial drift and deposition, and via point source discharges. Some contaminants such as mercury and pentachlorophenol enter the aquatic food web after reaching water and may be concentrated or even biomagnified in salmon tissue. This species also requires rearing and migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

Effects

Effects for Snake River spring/summer Chinook salmon critical habitat are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

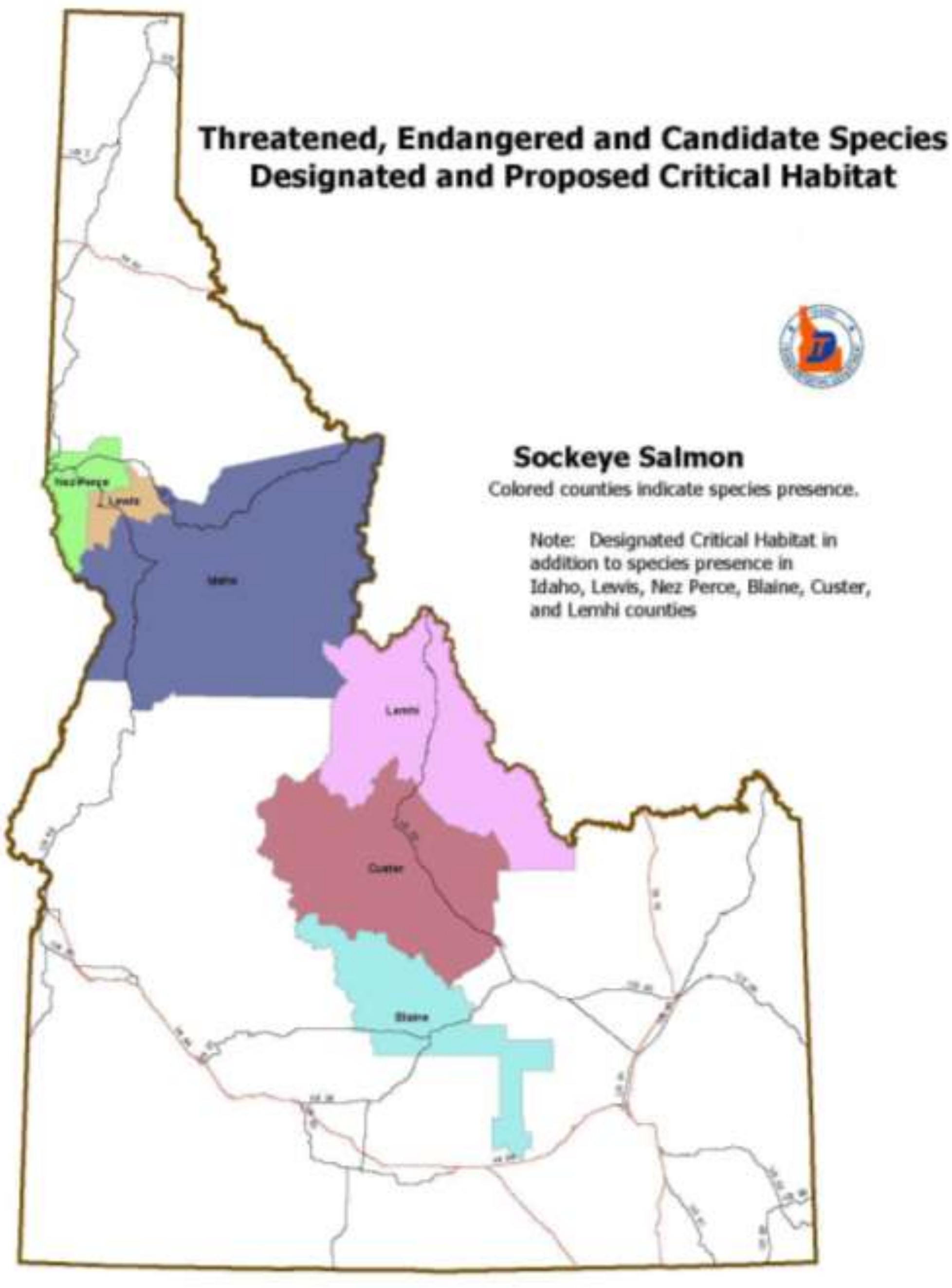
Determination of Effects

The determination of effects on salmon, trout and steelhead critical habitat – including critical habitat for the Snake River spring/summer Chinook salmon – varies based on the project type. A complete determination is included in chapter 5.

3.17 Snake River sockeye salmon *(Oncorhynchus nerka)*

Species Description and Life History

The Snake River sockeye salmon ESU includes populations of sockeye salmon from the Snake River Basin, Idaho (extant populations occur only in the Salmon River drainage). Under NMFS' interim policy on artificial propagation (58 FR 17573), the progeny of fish from a listed population that are propagated artificially are considered part of the listed species and are protected under the Endangered Species Act. Thus, although not specifically designated in the 1991 listing, Snake River sockeye salmon produced in the captive broodstock program are included in the listed ESU.



The first formal status review for salmon in the Pacific Northwest was conducted in response to a 1990 petition to list sockeye salmon from Redfish Lake in Idaho as an endangered species. The distinctiveness of this population became apparent early in the process: it spawns at a higher elevation 6,600 ft, and has a longer freshwater migration (932 miles) than any other sockeye salmon population in the world (Waples et al. 1991). A population of kokanee exists in Redfish Lake, and the relationship between the sockeye and kokanee was not well understood.

This issue was complicated by uncertainty regarding the effects of Sunbeam Dam, which stood for over two decades about 20 miles downstream of Redfish Lake. By all accounts, the dam was a serious impediment to anadromous fish, but documents differed as to whether it was an absolute barrier. Some argued that the original sockeye population in Redfish Lake was extirpated as a result of Sunbeam Dam, and that adult returns in recent decades were simply the result of sporadic seaward drift of kokanee (Chapman et al. 1990). According to this hypothesis, the original sockeye gene pool was extinct and the remaining kokanee population was not at risk because of its reasonably large size (5,000- 10,000 spawners per year). An alternative hypothesis held that the original sockeye salmon population managed to persist in spite of Sunbeam Dam, either by intermittent passage of adults or recolonization from holding areas downstream of the dam. The fact that the kokanee population spawns in the inlet stream (Fishhook Creek) in August and September, and all the recent observations of sockeye spawning have been on the lake shore in October and November, was cited as evidence that the sockeye and kokanee represent separate populations. According to this hypothesis, the sockeye population was critically endangered and perhaps on the brink of extinction.

At the time of the status review, the Biological Review Team unanimously agreed that there was not enough information to determine which of the above hypotheses were true (Waples et al. 1991). Although the kokanee population had been genetically characterized and determined to be quite distinctive compared to other sockeye salmon populations in the Pacific Northwest, no adult sockeye were available for sampling, so the review team could not evaluate whether the two forms shared a common gene pool. When pressed to make a decision regarding the ESU status of Redfish Lake sockeye salmon, the review team concluded that, because they could not determine with any certainty that the original sockeye gene pool was extinct, they should assume that it did persist and was separate from the kokanee gene pool. This conclusion was strongly influenced by consideration of the irreversible consequences of making an error in the other direction (i.e., if the species was not listed based on the assumption that kokanee and sockeye populations were a single gene pool and this later proved not to be the case, the species could easily go extinct before the error was detected).

Four adult sockeye returned to Redfish Lake in 1991; these were captured and taken into captivity to join several hundred smolts collected in spring 1991 as they outmigrated from Redfish Lake. The adults were spawned, and their progeny reared to adulthood along with the outmigrants as part of a captive broodstock program, whose major goal was to perpetuate the gene pool for a short period of time (one or two generations) to give managers a chance to identify and address the most pressing threats to the population. As a result of this program and related research, a great deal of new information has been gained about the biology of Redfish Lake sockeye salmon and limnology of the lakes in the Stanley Basin. Genetic data collected from the returning adults and the outmigrants showed that they were genetically similar but distinct from the Fishhook Creek kokanee. However, otolith microchemistry data (Rieman et al.1994) indicated that many of the outmigrants had a resident female parent. These results inspired a search of the lake for another population of resident fish that was genetically similar to the sockeye. The search led to the discovery of a relatively small number (perhaps a few hundred) kokanee-sized fish that spawn at approximately the same time and place as the sockeye. These fish, termed residual sockeye salmon, are considered to be part of the listed ESU. Given the status of the wild population under any criteria (16 wild and 264 hatchery produced adult sockeye returned to the Stanley basin between 1990 and 2000), NMFS considers the captive broodstock and its progeny essential for recovery.

Adult Snake River sockeye salmon enter the Columbia River in late spring and early summer and reach the spawning lakes in late summer and early fall. The entire mainstem Salmon River downstream from Alturas Lake Creek has been designated as critical habitat for sockeye salmon (50 CFR Part 226, December 28, 1993), but all spawning and rearing habitat is in the Upper Salmon subbasin.

Snake River sockeye salmon stocks in Pettit, Stanley, and Yellow Belly lakes were eliminated by a combination of fishery management practices designed to eliminate non-sport fishes, land use practices such as irrigation diversion, and migration blockage due to the Sunbeam Dam (Chapman et al 1990). Fishery management practices and the Sunbeam Dam are no longer adversely impacting Snake River sockeye salmon, however the species has been and continues to be adversely impacted by operation of the Federal Columbia River Power System (Chapman et al 1990), and by low flows that are exacerbated by operation of irrigation diversions (Chapman et al 1990).

Effects

Effects for Snake River sockeye salmon are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead – including Snake River sockeye salmon – varies based on the project type. A complete determination is included in chapter 5.

3.18 Snake River sockeye salmon – Designated Critical Habitat

Critical habitat was designated for Snake River sockeye salmon on December 28, 1993 (58 FR 68543). Critical habitat is designated to include all river reaches of the Columbia, Snake, and Salmon rivers. Critical habitat also includes Alturas Lake Creek, Valley Creek, Stanley Lake, Redfish Lake, Yellow Belly Lake, Petit Lake, Alturas Lake, and all inlet/outlet creeks to these lakes. Critical habitat for the endangered sockeye salmon includes the channel bottom, water column, and the adjacent riparian zone, which is defined as the area within 300 ft of the line of high water of a stream channel or from the shoreline of a standing body of water.

Habitat impairment is common in the range of this species. The migration corridor is impaired by factors such as tilling, water withdrawals, timber harvest, grazing, mining, and alteration of floodplains and riparian vegetation. Mainstem Columbia and Snake River hydroelectric developments have altered flow regimes, water temperature, and estuarine habitat, and disrupted migration corridors.

During all freshwater life stages, sockeye salmon require cool water that is free of contaminants. Water quality impairments in the designated critical habitat of the Snake River sockeye salmon include inputs from fertilizers, insecticides, fungicides, herbicides, surfactants, heavy metals, acids, petroleum products, animal and human sewage, dust suppressants (e.g., magnesium chloride), radionuclides, sediment in the form of turbidity, and other anthropogenic pollutants. Pollutants enter the surface waters and riverine sediments from the headwaters of the Salmon River to the Columbia River estuary as contaminated stormwater runoff, aerial drift and deposition, and via point source discharges. Some contaminants such as mercury and pentachlorophenol enter the aquatic food web after reaching water and may be concentrated or even biomagnified in the salmon tissue. Sockeye salmon require migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle. Snake River sockeye salmon are exposed to multiple contaminants during every life stage.

Effects

Effects for Snake River sockeye salmon critical habitat are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead critical habitat – including critical habitat for the Snake River sockeye salmon – varies based on the project type. A complete determination is included in chapter 5.

3.19 Snake River Basin steelhead *(Oncorhynchus mykiss)*

Species Description and Life History

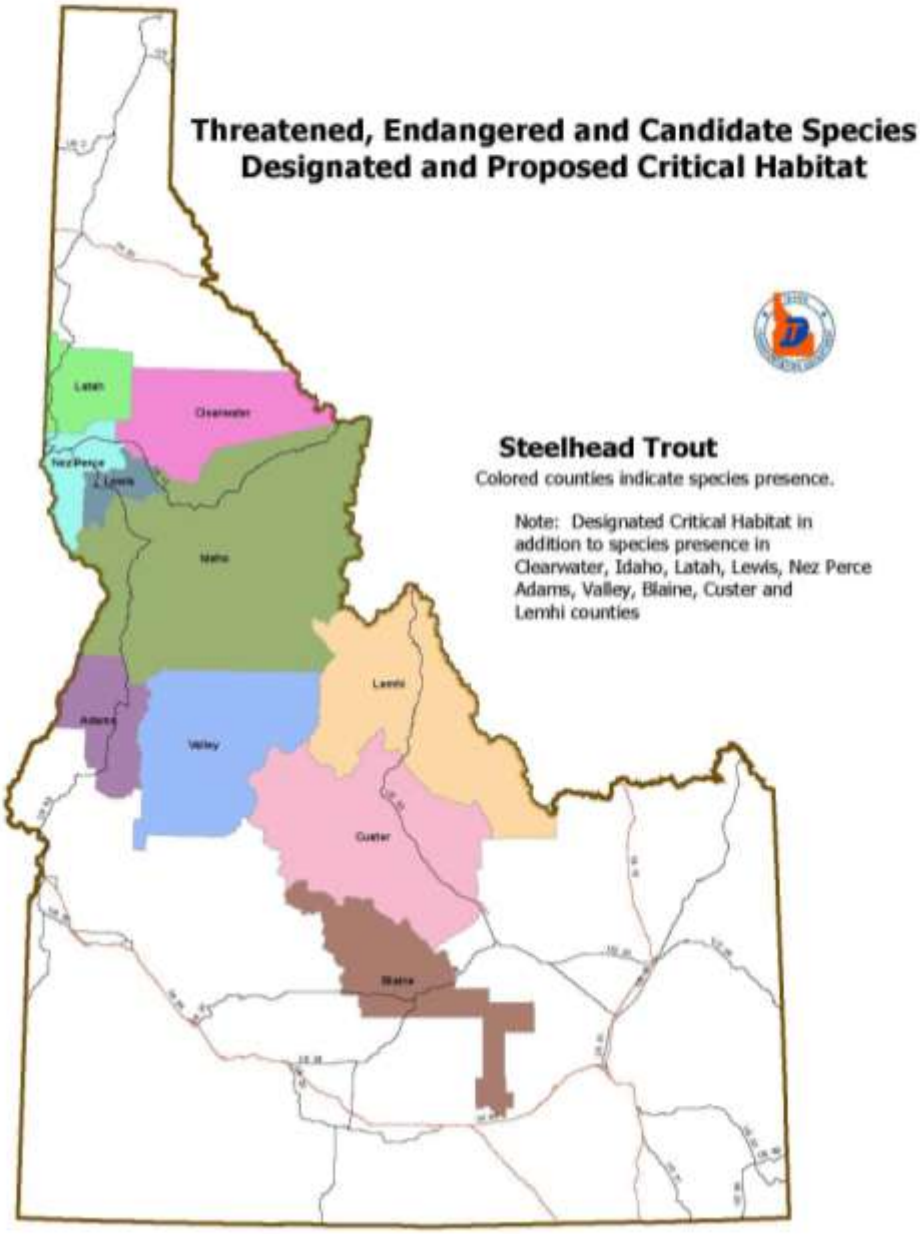
The Snake River historically supported more than 55 percent of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63 percent of the basin's natural production potential. The Snake River steelhead DPS is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (Good et al. 2005). Snake River steelhead migrate a substantial distance from the ocean (up to 940 miles) and use high-elevation tributaries (up to 6,562 ft above sea level) for spawning and juvenile rearing. Snake River steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead DPSs. Snake River Basin steelhead are generally classified as summer run, based on their adult run timing pattern. Summer steelhead enter the Columbia River from late June to October. After holding over the winter, summer steelhead spawn during the following spring (March to May). Managers classify up-river summer steelhead runs into two groups based primarily on ocean age and adult size upon return to the Columbia River. A-run steelhead are predominately age-1 ocean fish while B-run steelhead are larger, predominated by age-2 ocean fish.

With one exception (the Tucannon River production area), the tributary habitat used by Snake River steelhead DPS is above Lower Granite Dam. The ICBTRT (2003) identified six major population groups in the DPS:

- Grande Ronde River system
- Imnaha River drainage
- Clearwater River drainage
- Salmon River
- Hells Canyon
- Lower Snake

A-run populations are found in the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River's mainstem tributaries below Hells Canyon Dam. B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork Salmon); areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries. There are alternative escapement objectives of 10,000 (Columbia River Fisheries Management Plan) and 31,400 (Idaho) for B-run steelhead. B-run steelhead, therefore, represent at least a third and as much as three-fifths of the production capacity of the DPS.

With a few exceptions, recent annual estimates of steelhead returns to specific production areas within the Snake River are not available. Annual return estimates are limited to counts of the aggregate return over Lower Granite Dam. Returns to Lower Granite remained at relatively low levels through the 1990s. The 2001 run size at Lower Granite Dam was substantially higher relative to the 1990s. The 2002 through 2004 return years have declined annually but continue to remain higher than the 1990s return years.



Updated analyses of parr density survey results through 1999 by the IDFG conclude that "generational parr density trends, which are analogous to spawner to spawner survivorship, indicate that Idaho spring-summer Chinook and steelhead with and without hatchery influence failed to meet replacement for most generations completed since 1985 (IDFG 2002 as cited in NMFS 2003). These data, however, do not reflect the influence of increased returns from 2001 through 2004.

Effects

Effects for Snake River Basin steehead are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead– including the Snake River Basin steelhead – varies based on the project type. A complete determination is included in chapter 5.

3.20 Snake River Basin steelhead – Designated Critical Habitat

Critical habitat for Snake River Basin steelhead was designated on September 2, 2005, with an effective date of December 31, 2005 (70 FR 52630). Critical habitat in Idaho includes significant reaches in the Snake, Salmon, and Clearwater River basins; Table 21 in Federal Register details the streams within the Snake River Basin steelhead geographical range but excluded from critical habitat designation. Designated critical habitat for the Snake River Basin steelhead only includes the stream channel, with a lateral extent as defined by the ordinary high-water line.

The Snake River Basin Critical Habitat Analytical Review Team (CHART) concluded that all occupied areas contain spawning, rearing, or migration PCEs for this species. The CHART concluded that many of the watersheds within the Salmon and Clearwater River basins have high conservation values. The complex life cycle of steelhead gives rise to complex habitat needs, particularly during the freshwater phase (Spence et al. 1996). Spawning gravels must be of a certain size and free of sediment to allow successful incubation of the eggs. Eggs also require cool, clean, and well-oxygenated waters for proper development. Juvenile steelhead need abundant food sources, including insects, crustaceans, and other small fish. They need places to hide from predators (mostly birds and bigger fish), such as under logs, root wads and boulders in the stream, and beneath overhanging vegetation. They also need places to seek refuge from periodic high flows (side channels and off channel areas) and from warm summer water temperatures (cold-water springs, cool tributaries, and deep pools). Returning adults generally do not feed in fresh water but instead rely on limited energy stores to migrate, mature, and spawn. Like juvenile steelhead, the adults also require cool water and places to rest and hide from predators.

Like other salmonids, steelhead require cool water that is relatively free of contaminants during all life stages. Water quality impairments occur across the range of Snake River Basin steelhead. Steelhead require rearing and migration corridors with adequate passage conditions (water quality and quantity available at specific times) to allow access to the various habitats required to complete their life cycle.

Effects

Effects for Snake River Basin steelhead critical habitat are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead critical habitat – including critical habitat for the Snake River Basin steelhead – varies based on the project type. A complete determination is included in chapter 5.

3.21 Bull Trout (*Salvelinus confluentus*)

Species Description and Life History

Bull trout, a member of the Salmonidae family, is a char native to the Pacific Northwest and western Canada. Girard first described bull trout as *Salino spectabilis* in 1856 from a specimen collected on the lower Columbia River. Bull trout and Dolly Varden *(Sulvelinns malina)* were previously considered a single species (Cavender 1978, Bond 1992). Cavender (1978) presented morphometric (measurement), meristic (geometrical relation), ostcological (bone structure), and distributional evidence to document specific distinctions between bull trout and Dolly Varden. The American Fisheries Society formally recognized bull trout and Dolly Varden as separate species in 1980 (Robins et al. 1980).

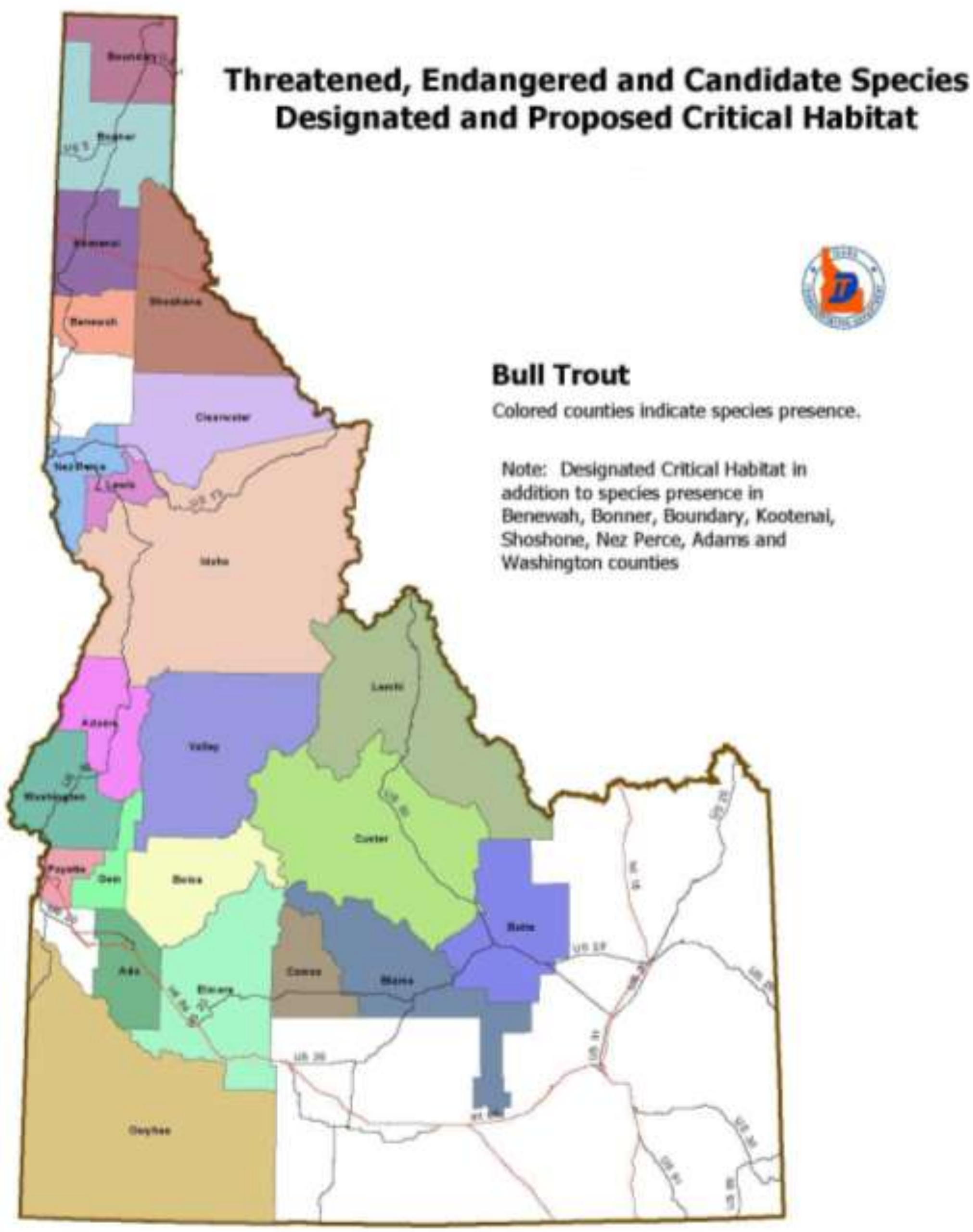
As noted above, in recognition of available scientific information relating to their uniqueness and significance, five segments of the coterminous United States population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units:

- Jarbidge River
- Klamath River
- Columbia River
- Coastal-Puget Sound
- St. Mary-Belly River

Each of these segments is necessary to maintain the bull trout's distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

Columbia River recovery unit currently contains about 90 core areas and 500 local populations. About 62 percent of these core areas and local populations occur in central Idaho and northwestern Montana. The condition of the bull trout within these core areas varies from poor to good but generally all have been subject to the combined effects of habitat degradation, fragmentation and alterations associated with one or more of the following activities:

- dewatering
- road construction and maintenance
- mining, and grazing
- blockage of migratory corridors by dams or other diversion structures
- poor water quality
- incidental angler harvest
- entrainment into diversion channels
- introduced non-native species



The draft bull trout recovery plan (USFWS 2002a) identifies the following conservation needs for this unit:

- maintain or expand the current distribution of the bull trout within core areas
- maintain stable or increasing trends in bull trout abundance
- maintain and restore suitable habitat conditions for all bull trout life history stages and strategies
- conserve genetic diversity and provide opportunities for genetic exchange

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in or near the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for one to four years before migrating downstream to either a lake or a reservoir (adfluvial), river (fluvial), or in certain coastal areas, to salt water (anadromous), where they reach maturity (Fraley and Shepard 1989, Goetz 1989). Resident and migratory strains often occur together, and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and Mclntyre 1993).

Bull trout have specific habitat requirements that distinguish them from other salmonids (Rieman and McIntyre 1993). Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989, Rieman and McIntyre 1993, Rieman and McIntyre 1995, Buchanan and Gregory 1997, Rieman et al. 1997). Dunhan et al. (2003) found that the probability of bull trout occurrences is low when mean daily temperatures exceed 57°F to 60°F; Selong *et a1*.(2001) reported that maximum growth of bull trout occurred at 55.8.°F. These temperature requirements may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre 1995).

Spawning areas are often associated with high elevation, cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, Rieman and McIntyre 1993, Rieman et al. 1997). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8° C and optimum water temperatures for egg incubation of 35°F to 39°F. In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 46°F to 48°F within a temperature gradient of 46°F to 59°F. Dunhan et al. (2003) found that maximum bull trout use during the summer (July 15 to September 30) occurred between 7 and 12° C.

All bull trout life history stages are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979, Fraley and Shepard 1989, Goetz 1989, Hoelscher and Bjornn 1989, Sedell and Everest 1991, Pratt 1992, Thomas 1992, Rich 1996, Sexauer and James 1997, Watson and Hillman 1997). In general, bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage in Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997).

Fraley and Shepard (1989) found that bull trout select spawning habitat in low gradient stream sections with gravel substrates; Goetz (1989) found preferred spawning water temperatures of 41°F to 48°F. They typically spawn from August to mid-October during periods of decreasing water temperatures. High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentage of fine sediments (Shepard et al. 1984). Pratt (1992) indicated that increases in fine sediments reduce egg survival and emergence.

Life history strategy influences bull trout size, with growth of resident fish generally slower than growth of migratory fish, and resident fish tending to be smaller at maturity and less fecund (Fraley and Shepard 1989, Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Repeat and alternate-year spawning has been reported, although repeat spawning frequency and post-spawning mortality are not well understood (Leathe and Graham 1982, Fraley and Shepard 1989, Pratt 1992). It is possible that four or more age-classes could comprise any spawning population, with each age-class including up to three migration strategies (Rieman and McIntyre 1993).

Migratory bull trout frequently begin upstream migrations as early as April and have been known to move as far as 155 mi to spawning grounds (Fraley and Shepard 1989). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to fry emergence may exceed 200 days. Fry normally emerge from early April through May, depending upon water temperatures and increasing stream flows (Pratt 1992, Ratliff and Howell 1992).

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, Goetz 1989, Donald and Alger 1992). Adult migratory bull trout are primarily piscivores (Fraley and Shepard 1989, Donald and Alger 1993).

Migratory corridors link seasonal habitats for all bull trout life history forms, and the ability to migrate is important to the persistence of local bull trout populations (Rieman and McIntyre 1993, Rieman et al. 1997). Pre- and post-spawning migrations facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to non-natal streams. Local populations extirpated by catastrophic events may also become re-established in this manner.

A metapopulation is an interacting network of local populations with varying sequences of migration and gene flow among them (Meffe and Carroll 1994). Metapopulation concepts of conservation biology theory are applicable to the distribution and characteristics of bull trout (Rieman and McIntyre 1993). Local populations may become extinct, but they may be reestablished by individuals from other nearby local populations. Metapopulations provide a mechanism for reducing the risk of local extinction because the simultaneous loss of all local populations is unlikely, and multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Rieman and McIntyre 1993).

The USFWS issued a final rule designating critical habitat for bull trout range wide on September 26, 2005. The designation includes 4,813 miles of stream or shoreline and 143,218 acres of lake or reservoir. The USFWS designated areas as critical habitat that:

- have documented bull trout occupancy within the last 20 years
- contain features essential to the conservation of the bull trout
- are in need of special management
- were not excluded under section 4(b)(2) of the Act

The final rule excluded from designation those federally managed areas covered under PACFISH, INFISH, the Interior Columbia Basin Ecosystem Management Project, and the Northwest Forest Plan Aquatic Conservation Strategy. The USFWS determined that these strategies provide a level of conservation and adequate protection and special management for the primary constituent elements of critical habitat at least comparable to that achieved by designating critical habitat. Areas managed under these strategies do not meet the statutory definition of critical habitat (i.e., areas requiring special management considerations) and were therefore excluded. The excluded areas include much of the proposed critical habitat in Idaho; the final rule only designates 294 miles of stream and shoreline and 50,627 acres of reservoirs or lakes.

Effects

Effects for bull trout are addressed in chapter 5 (Baseline Description of Action Area Watersheds).

Determination of Effects

The determination of effects on salmon, trout and steelhead– including bull trout – varies based on the project type. A complete determination is included in chapter 5.

3.22 Bull Trout – Designated Critical Habitat and Proposed Designated Critical Habitat

On September 26, 2005 the USFWS designated critical habitat (70 FR 56212) that encompasses all or parts of the following areas:

Clark Fork River Basin

- Lake Pend Oreille Subunit including: East River, Gold Creek, Granite Creek, Grouse Creek, Lightning Creek, Middle Fork East River, North Fork Grouse Creek, Pack River, Priest River, Tarlac Creek, Trestle Creek, Twin Creek, Uleda Creek

- Priest Lake and River Subunit including: Cedar Creek, Granite Creek, Hughes Fork, Indian Creek, Kalispell Creek, Lion Creek North Fork Indian Creek, Soldier Creek, South Fork Granite Creek, South Fork Indian Creek, South Fork Lion Creek, Trapper Creek, Two Mouth Creek, and Upper Priest River

- Coeur d'Alene Lake Basin including: Beaver Creek, Coeur d'Alene Lake and River, Eagle Creek, Fly Creek, North Fork Coeur d'Alene River, Prichard Creek, Ruby Creek, Saint Joe River, Steamboat Creek, and Timber Creek; and the Snake River sections between Farewell Bend State Park and Pine Creek.

This designation included 294 miles of streams and shoreline and 50,627 acres of lakes in Idaho as bull trout critical habitat.

On January 14, 2010, the USFWS proposed designated critical habitat (75 FR 2270) that encompasses all or parts of the following counties; Adams, Benewah, Blaine, Boise, Bonner, Boundary, Butte, Camas, Canyon, Clearwater, Custer, Elmore, Gem, Idaho, Kootenai, Lemhi, Lewis, Nez Perce, Owyhee, Shoshone, Valley and Washington. This includes 9,670.6 miles of stream shoreline distance and 197,914.7 acres of reservoir and lake area.

The following bull trout PCEs have been identified as contributing to designate and proposed critical habitat conditions:

- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.

- Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
- An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.
- Water temperatures ranging from 36°F to 59 °F, with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.
- Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12 percent) of fine substrate less than 0.03 inches in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.
- A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.
- Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
- Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.

Effects

Effects for Bull trout designated critical habitat and proposed designated critical habitat are addressed in chapter 5 (Baseline Description of the Action Area Watersheds).

Determination of Effects

The determination of effects on Bull trout designated critical habitat and proposed designated critical habitat varies based on the project type. A complete determination is included in Chapter 5.

3.23 Spalding's catchfly *(Silene spaldingii)*

Species Description and Life History

Spalding's catchfly is a member of the pink or carnation family, the Caryophyllaceae. It was first collected by Henry Spalding around 1846 near the Clearwater River in Idaho and later described by Sereno Watson in 1875, based on the Spalding material. The species has no other scientific synonyms nor has its taxonomy been questioned. Common names include Spalding's catchfly, Spalding's silene, and Spalding's campion. Spalding's catchfly overlaps in range and is somewhat similar in appearance with several other species in the genus: *S. scouleri* (Scouler's catchfly), *S. douglasii* (Douglas's catchfly) *S. csereii* (Balkan catchfly), *S. csereii* (Oregon catchfly).

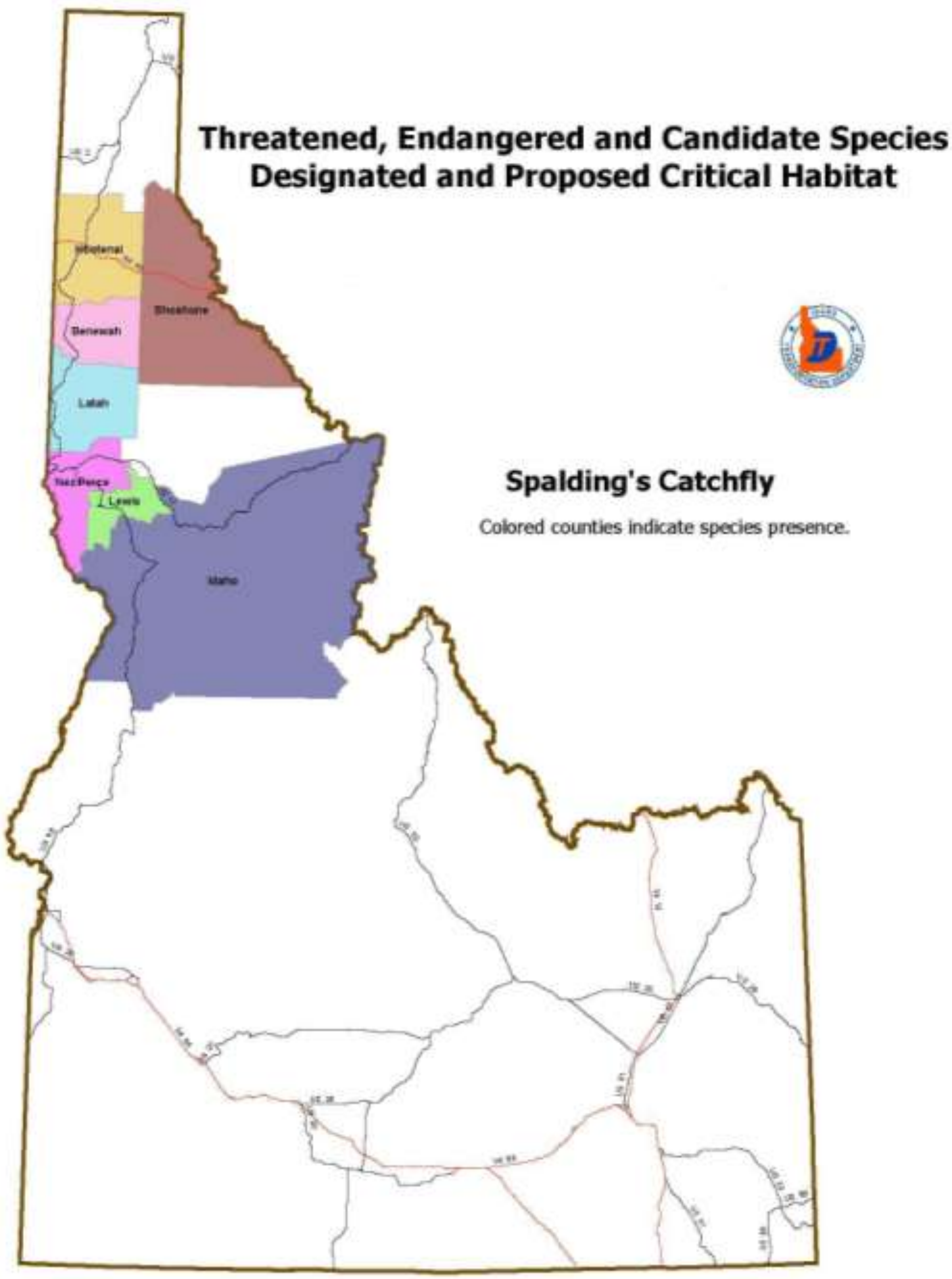
Spalding's catchfly is an herbaceous perennial, emerging in spring and dying back to below ground level in the fall. Plants range from 8 to 24 inches in height, occasionally up to 30 in. There is generally one distinctively yellow-green stem per plant, but sometimes there may be multiple stems. Each stem bears 4 to 7 pairs of leaves that are 2 to 3 inches in length, and has swollen nodes where the leaves are attached to the stem. All green portions of the plant (leaves, stems and calyx) are covered in dense sticky hairs that frequently trap dust and insects, hence the common name "catchfly." The plant has a persistent caudex (underground stem tissue) atop a long taproot (3 ft or longer in length). The long taproot makes transplanting the species difficult at best, and perhaps impossible. Typically Spalding's catchfly blooms from mid-July through August, but it can bloom into September.

Three to 20, and sometimes over 100, flowers are horizontally positioned near the top of the plant in a branched arrangement (inflorescence). Flowers are approximately 0.6 in. long; however, the majority of the flower petal is enclosed within a leaf-like tube, the calyx, which resembles green material elsewhere on the plant and has 10 veins running from the flower mouth to the base of the flower. The visible portion of the five flower petals is small (0.08 in.), cream-colored, and extends only slightly beyond the calyx. Attached to the visible flower petals (blades) are four to six very small (0.02 in.) appendages, the same color as the blades. The flowers are perfect (have both male and female parts). Each fertilized flower matures vertically and becomes a cup-like fruit capsule with up to 150 seeds. Fruits mature from August until September and one stem may have both flowers and mature fruit capsules at the same time. Seeds are small (0.08 in.), wrinkled, flattened, winged, and light brown when mature. (USFWS 2007)

Habitat

Spalding's catchfly occurs at elevations between 1,200 to 5,300 ft. In general, summers are hot and dry, while winters are cool to cold and moist across the range of Spalding's catchfly; anywhere from 45 to 65 percent of the precipitation occurs during the winter months. A drought period occurs in mid and late summer when precipitation is minimal and temperatures are high. Consequently, most of the vegetation does not grow in summer, but can remain active during the winter months when moisture is more readily available. The majority of growth occurs in spring. Spalding's catchfly is different; it grows during the summer drought when the majority of the surrounding vegetation is dormant.

Average temperatures can vary significantly from winter to summer and from day to night. These are general climatic parameters; variations across the range of Spalding's catchfly can be dramatic and are heavily influenced by elevation, geography, and topography. Spalding's catchfly is generally found in deep loamy soils (fertile soils composed of organic material, clay, sand, and silt) and in more mesic, moist sites such as northern slopes, swales, or other small landscape features. These mesic sites are highly productive, with total plant cover and forage dry weight sometimes three times greater than drier, more shallow-soiled bluebunch wheatgrass (*Pseudoroegneria spicata*) communities. Soils in the tri-state (Idaho, Oregon, and Washington) area are loess (wind-dispersed) and ash (from volcanic eruptions). Spalding's catchfly is found on a wide range of slopes, from flat areas to slopes as great as 70 percent. Most occurrences are found on grades ranging from 20 to 40 percent slope, although this may be an artifact of where intact habitat has not been converted to other uses.



Spalding's catchfly is found primarily within the more mesic grasslands of the Pacific Northwest Bunchgrass association/type, extending from Washington and Oregon into parts of Montana and into adjacent British Columbia, and Alberta, Canada. Pacific Northwest bunchgrasses where Spalding's catchfly is found are characterized by either *Festuca idahoensis* (Idaho fescue) or by both *F. idahoensis* and *Pseudoroegneria spicata* (bluebunch wheatgrass) and *Festuca idahoensis* in Idaho, Oregon, and Washington. The summer drought across Spalding catchfly's range prevents tree species from establishing in most Spalding's catchfly habitats and results in a climax grassland community.

Primary grassland habitat types within the Pacific Northwest bunchgrass grasslands include:

- *Festuca idahoensis – Symphoricarpos albus* (snowberry)
- *Festuca idahoensis – Rosa* spp. (rose)
- *Festuca idahoensis – Koeleria cristata* (prairie junegrass)
- *Pseudoroegneria spicata – Festuca idahoensis* or *Festuca idahoensis Pseudoroegneria spicata*
- *Festuca scabrella*

Primary shrub habitats include:

- *Festuca idahoensis*
- *Artemisia tripartite* (three-tip sagebrush)

Primary forest habitat types include:

- *Pinus ponderosa* (ponderosa pine) – *Festuca idahoensis*
- *Pinus ponderosa – Symphoricarpos albus*

In 2004, 73 percent of known Spalding's catchfly occurrences are within grassland habitat types, 20 percent within shrub steppe habitat types, and 7 percent within forest habitat types. Although the recent discovery of several new sites in the shrub-steppe of the Canyon Grasslands significantly increases the number of plants and sites in this habitat type.

In Idaho, Spalding's catchfly are known to occur in two physiographic regions that are characterized by distinctive physical features. These regions are distinctive from one another in climate, plant composition, historical fire frequencies, and soil characteristics. These differences are significant in that they may translate into differences in life histories, habitat trends, consequences of fire suppression, and types of weed control as they apply to conservation of Spalding's catchfly. The physiographic regions are the Canyon Grasslands along the Snake, Salmon, Clearwater, Grande Ronde, and Imnaha rivers in Idaho, Oregon, and Washington; and the Palouse Grasslands in southeastern Washington and adjacent west-central Idaho.

Of the physiographic regions where Spalding's catchfly is found in Idaho, the habitat of the Canyon Grasslands is the most intact, largely because the canyon walls are steep and do not lend themselves to agricultural or urban developments. The Canyon Grasslands range widely in elevation, as evidenced by the presence of Hells Canyon, the deepest canyon in the United States at a depth of 7,900 ft. The dramatic range in elevation within the Canyon Grasslands results in marked variations in the climate and vegetation. Soils within the Canyon Grasslands range from solid bedrock cliffs to deep loess and ash deposits. Within the Canyon Grasslands, Spalding's catchfly is found at the lowest and highest elevations rangewide from 1,200 to 5,300 ft, generally on northerly slopes that support more mesic *Festuca idahoensis* communities. At higher elevations (over approximately 5,000 ft) in the Canyon Grasslands the northern slopes are inhabited by tree species and Spalding's catchfly is found on southern slopes where bunchgrass communities reside. Because of their steep topography, the Canyon Grasslands are the most under-surveyed area for Spalding's catchfly, and also represent the area where large populations of Spalding's catchfly may be most easily conserved because they are more removed from human influence.

The Palouse Grasslands are extremely fertile and may comprise the world's best wheat land. An underlying basalt layer is covered with deep deposits of loess and ash, forming long undulating dune-like plains of rich soils. These soil deposits can reach depths of 350 to 450 ft, although generally less, and have high moisture-holding capacity and water infiltration rates. Occasionally tall granitic hills ("steptoes") protrude above the undulating dunes. Beginning in 1880, the Palouse Grasslands have undergone a dramatic conversion to farm lands; it is estimated that today only 0.1 percent of the grasslands remain in a natural state. The remains of the Palouse Grasslands include small remnants in rocky areas or at field corners. The Camas Prairie in Idaho between the Clearwater and Salmon rivers is included with the Palouse Grasslands here because soil properties and land conversions are similar; however, the Camas Prairie is generally higher in elevation and cooler and moister than other portions of the Palouse Grasslands. Spalding's catchfly within the Palouse Grasslands is restricted to small fragmented populations ("eyebrows," field corners, cemeteries, rocky areas, and steptoes) on private lands, and in larger remnant habitats such as research lands owned by Washington State University. Elevations occupied by Spalding's catchfly within the Palouse Grasslands range from 2,300 to 4,400 ft. Of all the places where Spalding's catchfly resides, those in the Palouse Grasslands are the most threatened.

Rangewide suitable habitat for Spalding's catchfly would include all flat, east-facing, north-facing, and even south-facing (at higher elevations) slopes between 1,200 to 5,300 ft in elevation within *Festuca idahoensis* and *Festuca scabrella* communities that are associated with Pacific Northwest bunchgrasses, sagebrush-steppe, and open pine forests. Even within what is presently understood to be suitable habitat, Spalding's catchfly is quite infrequent. At present it appears that there are tracts of suitable habitat for Spalding's catchfly on private and public lands within the Canyon Grasslands. There is little remaining habitat within the Palouse Grasslands. (USFWS 2007).

Effects

In Idaho, Spalding's catchfly is strongly associated with prairie grasslands and remnants as described above. There is potential for direct and indirect effects from transportation, including accidental destruction of individuals or disturbance of occupied or potential habitat. Direct impacts to known populations or suitable habitats from road construction are avoidable because species surveys can be performed. In addition, roads have the potential to spread non-native plant species. Management actions to prevent and control invasive and noxious weeds using integrated weed management techniques, including the use of herbicides, could reduce the area and severity of damage to bluebunch wheatgrass and Idaho fescue communities by reducing the quantity of invasive species. This could decrease the competition within habitats suitable for Spalding's catchfly. Given that ITD cannot predict exact locations of future projects, ITD cannot discount the potential for adverse effects to undiscovered populations or potential habitat for Spalding's catchfly.

Determination of Effects on Spalding's catchfly

The project types proposed under this PBA *may affect, but are not likely to adversely affect* Spalding's catchfly.

Rationale for the Determination - All activities documented under this PBA will be subject to evaluation by the USFWS. Spalding's catchfly may exist on or adjacent to highway rights of way and unknown individuals or populations could be at risk to road construction and maintenance. Noxious weeds and other invasive plants have encroached on populations of Spalding's catchfly. Indirect effects from highway uses may cause weed encroachment into occupied habitats. Weed management along highway rights of way is employed, and adaptive management practices are available if new populations are identified. When activities take place within suitable habitat, species surveys will be conducted. Adverse effects to Spalding's catchfly from highway construction or maintenance activities shall be avoided.

3.24 Water howellia (*Howellia aquatilis*)

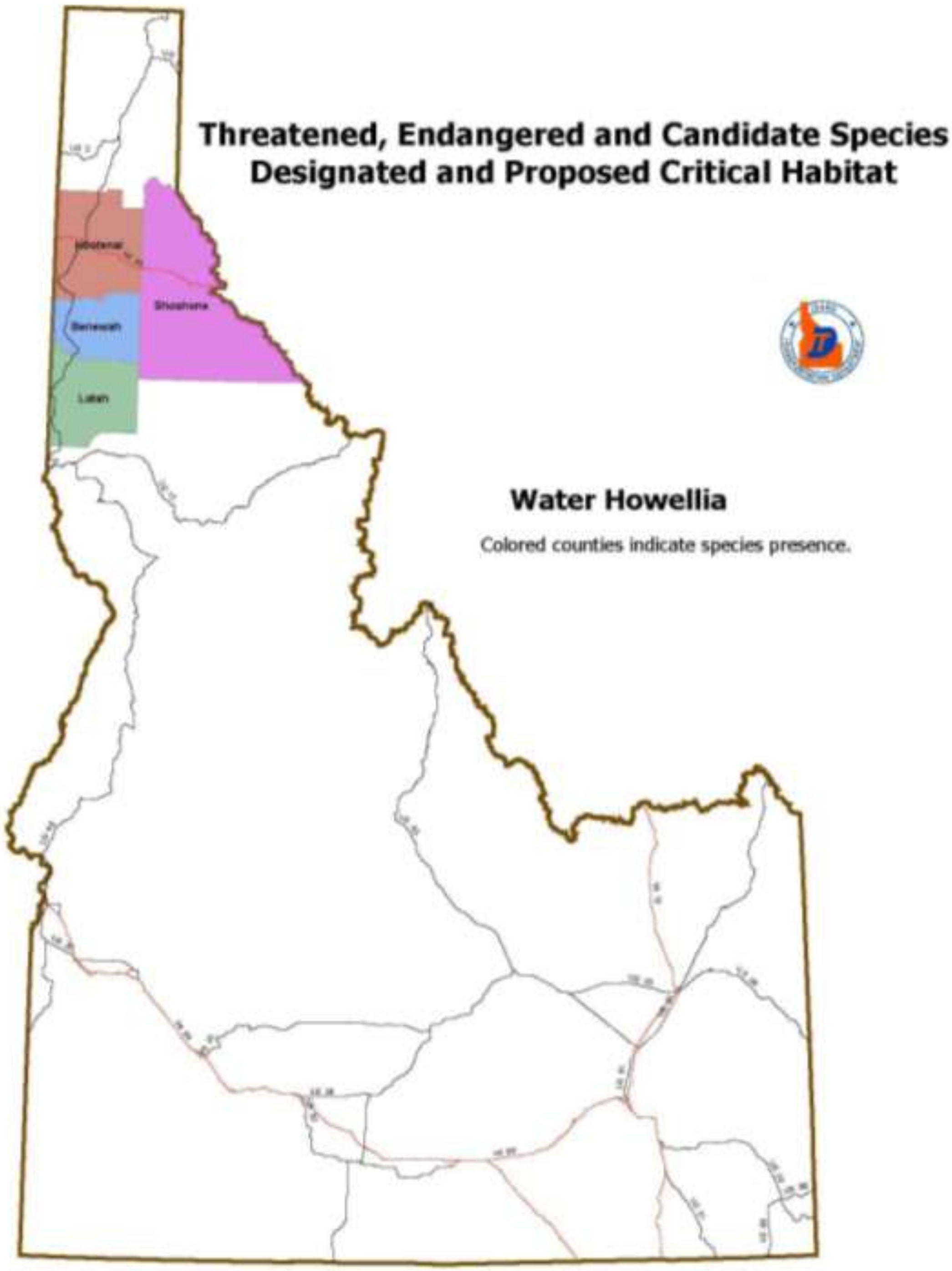
Species Description and Life History

Water howellia is an annual aquatic species in the Campanulaceae (bellflower) family. Individuals are mostly submerged and rooted in the bottom sediments of the vernal freshwater wetlands to which the species is adapted. Individual plants sometimes persist in the outer edges of these wetlands, but generally they disappear as the habitat dries at the end of the summer. The stems branch several inches from the base and each branch then extends to the surface of the water. The numerous leaves are an inch or two long and very narrow. *Howellia aquatilis* produces both cleistogamous and chasmogamous flowers. The small, cleistogamous flowers, which lack a conspicuous corolla (floral tube), develop along the stem beneath the water surface. As the growing branches reach the surface, more conspicuous chasmogamous flowers develop above the water. These emergent flowers are white, have five lobes on one side of the corolla, and are about 114 in. across. Both cleistogamous and chasmogamous flowers give rise to thin-walled fruits that are ultimately an inch or more long, and which contain one to five large, shiny brown seeds that are about 114 in. long.

Described in technical terms, water howellia is a flaccid, annual, aquatic herb, mostly submergent, often with shortly emergent branches. Plants are naked below, branched above; the entire plant is glabrous, green, and about 4-24 in. tall, occasionally taller. Leaves are numerous, alternate, or some of them subopposite or whorled in threes, linear or linear-filiform, entire or nearly so, 0.4-2 in. long, and up to 0.06 in. wide. Flowers are white, mostly 3-10 in number, axillary, often scattered, pedicellate or subsessile, both petaliferous (when emergent) or much reduced and inconspicuous (when submerged). The fully developed, emergent corollas are about 0.08-0.1 in. long, irregular, with the tubes deeply cleft dorsally, and five-lobed. Filaments and anthers are connate; two of the anthers are shorter than the others. Calyx lobes are 0.06-0.28 in. long; pedicels are stout, 0.04-0.16 in. long, merging gradually with the base of the capsule. Ovary is unilocular, with parietal placentation; stigma is two-lobed; fruit is 0.2-0.5 in. long, 0.04-0.08 in. thick, irregularly dehiscent by the rupture of the very thin lateral walls. Seeds are large, 0.08-0.16 in. long, five or fewer in number, and shiny brown (adapted from Hitchcock et al. 1959, Dorn 1984).

Although other members of the Campanulaceae can occur in similar habitats (e.g. *Downingia* spp.), none are likely to be confused with the monotypic H. *aquatilis.* In California, *Legenere limosa* (Campanulaceae) occurs in wet areas and vernal pools within the same geographic region from which H. *aquatilis* was historically collected. However, the pattern of branching of L. *linzosa* is different from that of *H. aquatilis* and its leaves are not as long, nor as linear, as those of *H. aquatilis.*

An unrelated species that is vegetatively similar to H. *aquatilis,* and that is frequently found growing with it, is *Callitriche heterophylla* (Callitrichaceae). However, the submergent linear leaves of the latter species are most often opposite (only rarely whorled), and the floating leaves are broadly obovate. In addition, the flowers of *C. heterophylla* are axillary, very inconspicuous, and do not have a corolla.



Effects

In Idaho, habitat occupied by water howellia is only known to occur in Latah County, on the Palouse Prairie. The primary effects to water howellia come from changes in land use and from natural disturbance. Human-caused disturbance to water howellia or its habitat have been caused by timber harvest and conversion of native habitats to agricultural land. The primary source of natural disturbance is the introduction or invasion of occupied sites by non-native species, such as Reed Canary grass.

Because water howellia habit is coincident with wetlands and/or waters of the United States, road construction and maintenance would not be considered a primary threat to the species. Occurrence of the species and previously undiscovered locations would occur during species or habitat survey and/or wetland delineations.

Determination of Effects on Water Howellia

The project types proposed under this PBA *may affect, but are not likely to adversely affect* water howellia.

Rationale for the Determination - All activities documented under this PBA will be subject to evaluation by the USFWS. Discovery of and potential effects to water howellia would likely occur during wetland and/or waters of the U.S. investigation. Water howellia is only known to occur in few locations in Latah County. Known occurrences are on private land and adequately buffered from adjacent state highway routes. Weed management along highway rights of way is employed and adaptive management practices are available if new populations are identified. When activities take place within suitable habitat, species surveys will be conducted. Adverse effects to water howellia from highway construction or maintenance activities shall be avoided.

3.25 MacFarlane's four-o'clock *(Mirabilis macfarlanei)*

Species Description and Life History

MacFarlane's four-o'clock (*Mirabilis macfarlanei*) is a long-lived perennial plant with conspicuous magenta flowers. It belongs to the four-o'clock family (Nyctaginaceae). Several stems arise from a stout, deep-growing taproot. Leaves are opposite, somewhat succulent, shiny green on the upper surface with a whitish or bluish luster on the lower surface, and nearly sessile. Leaves are round (orbicular to broadly lanceolate) becoming progressively smaller toward the top of the stem. Each inflorescence consists of four to seven funnel-shaped flowers (perianths) subtended by a purple-tinged involucre (whorl of bracts). Flowers are large, approximately 1 in. long and 1 in. wide, and grow in the leaf axil. Each flower has five stamens, which are usually exerted. Flowering occurs from early May to early June. Fruits are nutlet-like with ten ribs.

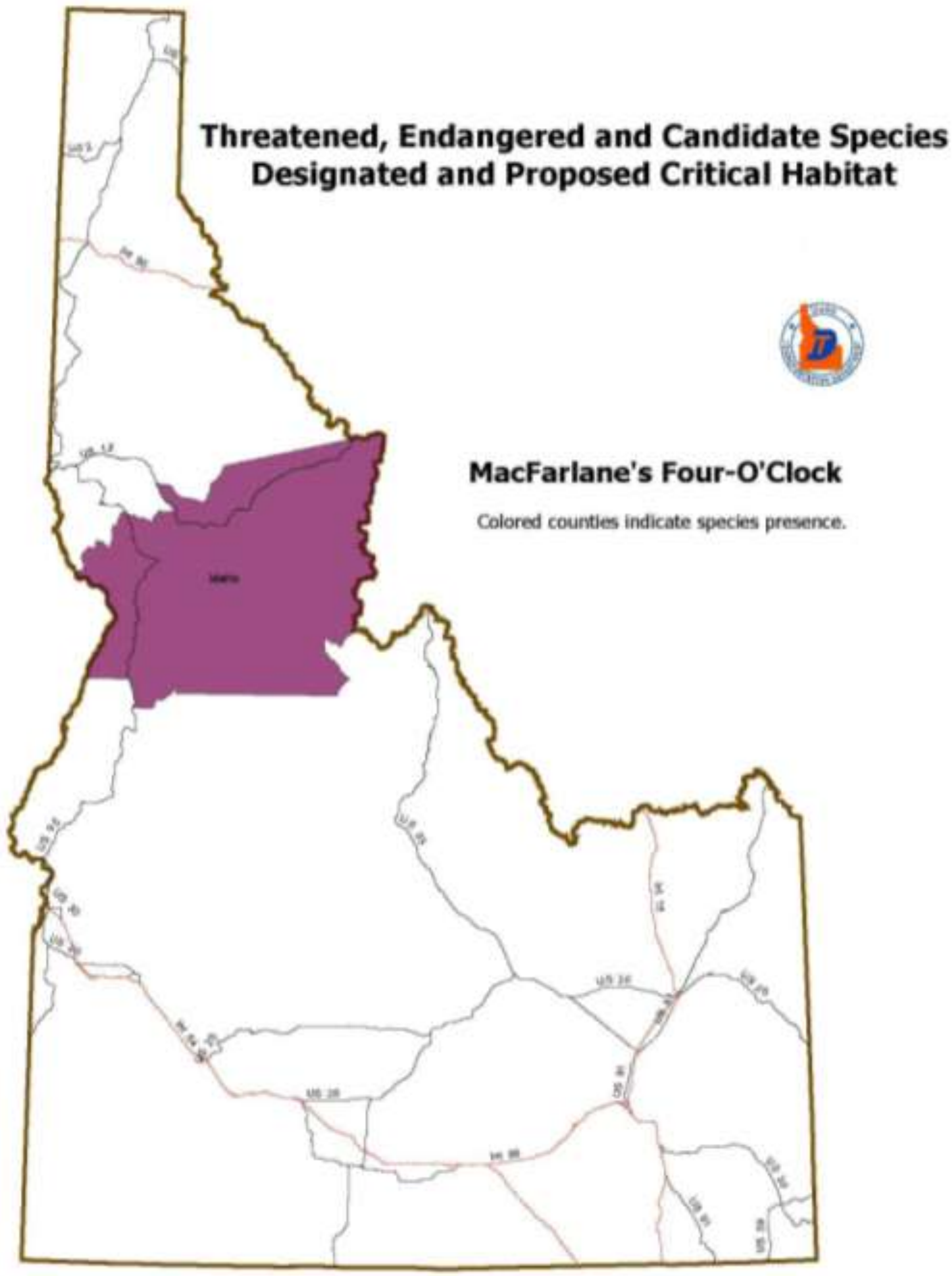
Although MacFarlane's four-o'clock is a tap-rooted perennial that reproduces by seed, it is also able to colonize adjacent areas by means of thick spreading rhizomes. These rhizomes produce daughter plants or clones. Some populations of MacFarlane's four-o'clock are composed of several clones, but small populations may be composed entirely of a single clone (USFWS 2000g).

The BLM has conducted long-term monitoring of MacFarlane's four-o'clock and detectable expansion of MacFarlane's four-o'clock into unoccupied adjacent suitable habitat from seeds does not appear prevalent.

Habitat

According to the USFWS (2000g), MacFarlane's four-o'clock is found in river canyon grassland habitats. These sites are dry and generally open with scattered shrubs. Plants can be found on all aspects, but plants often occur on southeast to western aspects. Slopes may be steep or nearly flat. Populations are found at elevations from 1,000 to 3,500 ft on soils with a sand component and often with talus, gravel or cobbles present as well. Talus rock underlies the soil on several sites making them relatively unstable and prone to erosion (USFWS 2000g).

MacFarlane's four-o'clock usually occurs in bunchgrass communities dominated by bluebunch wheatgrass and Sandberg's bluegrass (*Poa secunda*) (USFWS 2000g). Vegetation on these sites is typically in fair to good ecological condition. Associated vegetation includes a wide variety of other species, such as sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida longiseta),* pale alyssum (*Alyssum alyssoides*), varileaf phacelia (*Phacelia heterophylla),* common yarrow (*Achillea millefolium*), rubber rabbitbrush (*Chrysothamnus nauseosus*), smooth sumac (*Rhus glabra*), plains prickly pear (*Opuntia polycantha*), evening primrose (*Oenothera cespitosa),* bent milkvetch (*Astragalus inflexus),* and hackberry (*Celtis reticulata*). Other commonly associated exotic species (including noxious and other weeds) include cheatgrass (*Bromus tectorum*), soft brome *(Bromus mollis)*, St. Johnswort *(Hypericum perforatum), yellow starthistle (Centaurea solstitialis)*, and dalmation toadflax *(Linneria genistifolia)* (USFWS 2000g).



Historic and Current Distribution

The history and current distribution of MacFarlane's four-o'clock was described by USFWS in the reclassification of the species from endangered to threatened status (61 FR 1093).

> *Mirabilis macfarlanei* was named for Ed MacFarlane, a boatman on the Snake River, who pointed out the plant to Rollins and Constance in 1936 along the Oregon side of the Snake River. These botanists described the species later that year (Constance and Rollins 1936). Records indicate MacFarlane's four-o'clock was collected along the Snake River (Hells Canyon area) in 1939. In 1947, a second population was discovered near the confluence of Skookumchuck Creek and the Salmon River in Idaho by R.J. Davis. The Salmon River plants are geographically isolated from

> the Snake River plants. Futile searches for *M. macfarlanei* from 1947 to the mid-1970s led botanists to consider that the species was possibly extinct. In May 1977, two plants were found within the Snake River unit along the Snake River near Cottonwood Landing on the Oregon side of the river. Within the Salmon River drainage, 25 plants were rediscovered in 1979 on 10 acres of Bureau of Land Management land (Heidel 1979) at Skookumchuck and 700 plants were discovered in 1980 on 45 acres of Bureau of Land Management land in the Long Gulch area above the Salmon River, Idaho County, Idaho.
>
> Since 1983, 6,485 additional plants have been located on approximately 108 acres, bringing the total number to 7,212 plants inhabiting approximately 163 acres in three disjunct areas. The Snake River unit has about 4,752 plants occupying about 25 acres of habitat that occurs along six miles of Hells Canyon on the banks and canyonland slopes above the Snake River, Idaho County, Idaho, and Wallowa County, Oregon. Known localities within the Snake River unit include Cottonwood Landing, Island Gulch, Kurry Creek, Kurry Creek-West Creek divide, Mine Gulch, Tyron Bar, and West Creek. The Salmon River unit has about 1,660 plants occupying approximately 68 acres along 18 miles of banks and canyonland slopes above the Salmon River, Idaho County, Idaho. Known localities within the Salmon River unit include Cody Draw, Henry's Gulch, John Day Creek, Long Gulch, Lucas Draw, Lucile Caves, Skookumchuck Creek, McKinzie Creek, Box Canyon, Rhett Creek, and Slicker Bar. The third unit, the Imnaha, was discovered in 1983 and has approximately 800 plants on 70 acres of habitat along three miles of canyonland slopes above the Imnaha River, Wallowa County, Oregon. Within the Imnaha unit, only two localities, Fence Creek and Buck Creek, have been documented. The plants generally occur on talus slopes within canyonland corridors above the three rivers.
>
> Within the Snake River unit, all of the plants occur on Nez Perce and Wallowa/Whitman National Forests lands. A majority of the plants along the Snake River are within the Hells Canyon National Recreation Area. Within the Salmon River unit, 935 plants (56 percent) inhabit 13 acres of private lands with the remaining plants and 55 acres of habitat managed by the Bureau of Land Management. Within the Imnaha unit, approximately 300 plants (37 percent) are located on ten acres of private lands. The remaining 500 plants occur on 60 acres of Wallowa/Whitman National Forest lands above Fence Creek, Wallowa County, Oregon (61 FR 10693).

Ten populations of MacFarlane's four-o'clock are known to occur on federal lands. Two populations are found in the Snake River canyon area (Idaho County, Idaho, and Wallowa County, Oregon), five in the Salmon River area (Idaho County, Idaho), and two in the Imnaha River area (Wallowa County, Oregon). A few small populations and portions of one large population occur on privately owned lands within the Cottonwood PA and have no status under the Endangered Species Act (BLM 2004b).

Five populations of MacFarlane's four-o'clock occur on BLM lands within the Cottonwood PA. One of the populations is a result of transplant efforts of the BLM at the Lucile Caves Research Natural Area. Within the Cottonwood PA, livestock grazing occurs on allotments that provide potential habitat for MacFarlane's four-o'clock, including two of the populations on BLM land and a third population is partially grazed and partially fenced to exclude livestock. Two populations on BLM lands are totally protected from grazing (BLM 2004a).

Threats

The recovery plan for MacFarlane's four-o'clock lists several current and potential threats to the species (USFWS 2000g), including herbicide and pesticide use.

> Spraying vegetation in areas where *M. macfarlanei* occurs could potentially have an adverse effect on this species if weed control activities are not carefully implemented and monitored. One population is directly adjacent to a major highway along the Salmon River in Idaho, where

> roadside vegetation spraying is routinely conducted. It is also possible that insect control activities (i.e., pesticide spraying) may adversely affect pollinators of MacFarlane's four-o'clock such as bumblebees *(Bombus* spp.).

Insect damage and disease, as well as invasion by weeds, are also threats to MacFarlane's four-o'clock (USFWS 2000g).

> Some *M. macfarlanei* plants are damaged by insects, such as lepidopterans and spittle bugs (Baker 1983, Baker 1985, Kaye et al. 1990). A type of fungal disease has also been noted on some plants (USFWS 1985). Because of connections between ramets, diseases may spread rapidly through clonal plant populations (Hartnett and Bazzaz 1985). Although damage from insects and disease do not currently appear to be significant in four-o'clock populations, these threats should be monitored.
>
> Exotic (non-native) plant species pose a serious threat to *M. macfarlanei* and other native plants since they compete with native species for space, light, water, and nutrients. Two of the most serious exotic species are *Bromus tectorum* (cheatgrass) and *Centaurea solstitialis* (yellow starthistle). *Centaurea solstitialis* infestations have increased significantly in the Snake River Canyon in the past decade (Johnson 1995). Efforts to control *Centaurea solstitialis* have been initiated at a sites containing *M.* macfarlanei. In grasslands that have been invaded by cheatgrass, seedling establishment of native perennial species may be limited by cheatgrass competition for moisture (Young 1994).
>
> Other weeds of concern on the Cottonwood PA are dalmation toadflax and rush skeletonwood. Grazing by livestock threatens this four-o'clock species (USFWS 2000g).

Although it is uncertain whether most or all populations of this four-o'clock have been grazed by domestic livestock in the past, livestock grazing still occurs at some sites. Livestock impact this species directly by trampling or consuming plants (Kaye 1995), and can result in reduced reproduction (seed set) by plants.

Because *M. macfarlanei* occurs in grassland habitats favored for livestock use, some degree of soil erosion and soil compaction is likely to occur, especially under heavy grazing or during wet periods. Grazing by domestic livestock can change the community composition of grassland habitats by decreasing the frequency of native species, allowing the invasion and proliferation of undesirable and unpalatable exotic species (Franklin and Dyrness 1988). In addition, livestock grazing can adversely affect soil cryptogams (non-vascular plants that form a crust on the soil surface) in arid and semiarid rangelands (Bethlenfalvay and Dakessian 1984), and may impact native pollinators, particularly ground- nesting bees (Sugden 1985).

Grazing impacts would be similar for wildlife species, including Rocky Mountain bighorn sheep *(Ovis canadensis)*, Rocky Mountain elk *(Cervus elaphus),* mule deer (*Odocoileus hemionus*) and mountain goats *(Oreamnos americanus).* All are found in and near four-o'clock habitat in Hells Canyon National Recreation Area and the Salmon River on a seasonal basis. On BLM lands in Idaho, three of the populations occur in areas that are leased for livestock grazing. One of these populations that is leased for livestock grazing has the majority of the plants protected (exclosure fence) from grazing, while a small portion (i.e., colony) is not fenced off from livestock.

According to the USFWS (2000g), specific effects of historic and current fire regimes on MacFarlane's four-o'clock are unknown. Fire suppression activities and rehabilitation efforts, including seeding with non-native species, are a potential threat to this species, as described by the USFWS (2000g):

> It is possible that *M. macfarlanei* habitat has burned less frequently in the past 100 years due to fire suppression. Sites where fire has been excluded are vulnerable to accelerated succession, e.g., the invasion of shrubs or trees into grassland or meadow communities. However, the invasion of cheatgrass alters natural community dynamics by producing greater fire fuel levels, which may result in frequent, large-scale range fires. In areas where cheatgrass has invaded sagebrush-grass communities, altered fire dynamics have converted formerly productive, perennial communities into annual-dominated communities with increased fire management problems (Tausch et al. 1995).
>
> Wildfires that occur during summer and fall months when *M. macfarlanei* plants are dormant may have minimal direct effects on this species since the underground rhizomes will be largely insulated from fire. However, fires may result in adverse changes in the ecological condition of sites and lead to the subsequent invasion by exotic species. Burning may also result in concentrations of ungulates grazing within the burned areas, which might cause increased consumption and trampling of *M. macfarlanei* plants. The primary concern from wildfires appears to be during the active growing period (typically April through June) when the aboveground plants would be susceptible to fire kill or injury.

Recreational access to MacFarlane's four-o'clock sites could cause impacts. "Some populations of four-o'clock are located near hiking or recreational trails, so that trampling by humans is a threat to this species. Repeat monitoring of *M. macfarlanei* sites on steep slopes can also result in localized trampling impacts," according to the USFWS (2000g). In addition, uncontrolled OHV use is a potential threat to this species on both public and private lands where the terrain is not as steep. Road and trail construction and maintenance could also negatively impact this species (USFWS 2000g). Another threat resulting from recreational access is the potential for collection by amateur or professional botanists for scientific or horticultural purposes. According to the USFWS (2000g), some colonies of this attractive plant are readily accessible, making plant collection a potential threat to MacFarlane's four-o'clock populations.

Mining and the road construction often associated with mining activity may pose a threat as well (USFWS 2000g).

Competition for pollinators and inbreeding depression are also threats to this species (USFWS 2000g):

> Preliminary observations have shown that successful pollination of MacFarlane's four-o'clock flowers may be hindered by competition from adjacent plant species. No data currently exist on the natural history (e.g., biotic and abiotic requirements) of the primary pollinators of *M. macfarlanei*. It is unknown whether pollinator populations are adequate for the successful reproduction of *M. macfarlanei* at all sites, although one study (Barnes 1996) found that seed set in *M. macfarlanei* does not appear to be pollen-limited.
>
> Some observers have noted that seedling recruitment is apparently rare in populations of *M. macfarlanei* (Barnes et al. 1994). This could be influenced by extrinsic factors such as competition, inadequate pollination, nutrient levels, or annual precipitation. Inbreeding depression could result in poor seed viability, reduced germination success, or poor seedling survivorship. If new individuals are not successfully added to the population, the population viability of *M. macfarlanei* may decrease over time.

Barnes (1996) believed that gene flow (i.e., by pollen or seed dispersal) among *M. macfarlanei* populations is limited, based on the high degree of population differentiation. In populations that lose genets with time, dominance by one or a few clones is likely unless new genets are recruited into the population (Hartnett and Bazzaz 1985). Although the effects of inbreeding depression have not been specified for *M. macfarlanei*, inbreeding depression is a potential threat to this species. Genetic variability is important in influencing a plant species' response to stochastic (random naturally occurring) events, herbivory, and adverse environmental conditions (Huenneke 1991).

Slope failures or risk for slope failures have been documented as a risk to *M. macfarlanei*. A lower slope failure and landslide that blocked U.S. 95 occurred in 1996 and 1997, and it impacted plants in the John Day population. Slope instability has been documented immediately upslope from the Skookumchuck population and the Blackhawk Bar Colony.

Effects

Because MacFarlane's four-o'clock is associated with open, steep canyon grasslands, direct impacts to the known MacFarlane's four-o'clock sites and its habitat are highly unlikely to occur from road construction. Management actions to prevent and control invasive and noxious weeds using integrated weed management techniques, including the use of herbicides, could reduce the area and severity of damage to bluebunch wheatgrass and Idaho fescue communities by reducing the quantity of invasive species. This could decrease the competition, allowing native and MacFarlane's four-o'clock to increase in number.

There is potential for direct and indirect effects from transportation, including accidental destruction of individuals or disturbance of occupied or potential habitat. Roads have the potential to spread non-native plant species. Weed control adjacent to and within listed plan populations can reduce adverse effects from non-native species competition. Given that ITD cannot predict exact locations of future projects, ITD cannot discount the potential for adverse effects to undiscovered populations or potential habitat for the Macfarlane's four-o'clock.

Determination of Effects on Macfarlane's four-o'clock

The project types proposed under this PBA *may affect, but are not likely to adversely affect* MacFarlane's four-o'clock.

Rationale for the Determination - All activities documented under this PBA will be subject to evaluation by the USFWS. MacFarlane's four-o'clock exist on or adjacent to highway rights of way and unknown individuals or populations could be at risk to road construction and maintenance. Noxious weeds and other invasive plants have encroached on populations of MacFarlane's four-o'clock. Indirect effects from highway uses may cause weed encroachment into occupied habitats. Weed management along highway rights of way is employed and adaptive management practices are available if new populations are identified. When activities take place within suitable habitat, species surveys will be conducted. Adverse effects to Macfarlane's four-o clock from highway construction or maintenance activities shall be avoided.

3.26 Ute ladies'-tresses (Spiranthes diluvialis)

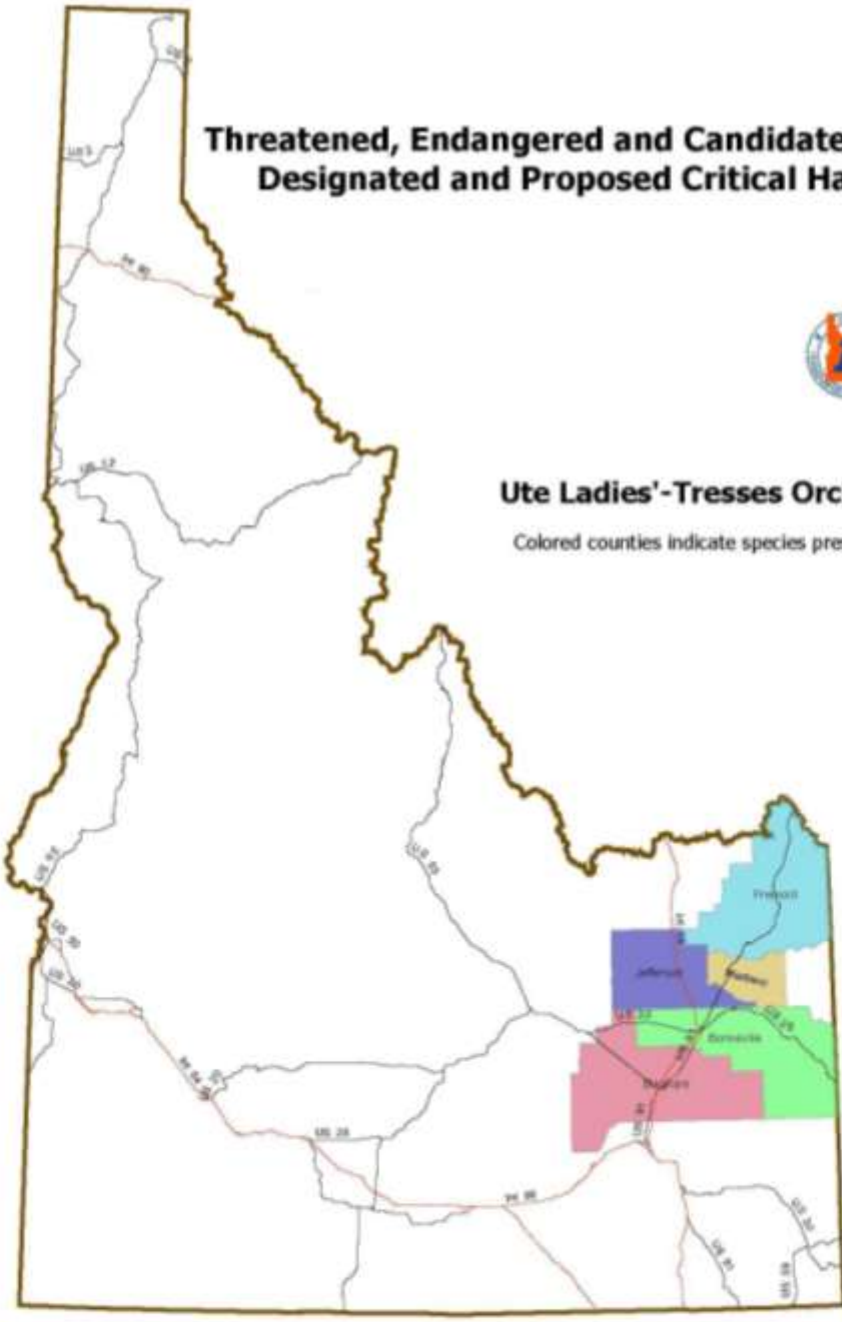
Species Description and Life History

Ute-ladies'-tresses (*Spiranthes diluvialis*) is a perennial, terrestrial orchid with 7 to 32-in. stems arising from tuberously thickened roots. Its narrow leaves are about 11 in. long at the base and become reduced in size toward the apex (Jordan 1999). The flowering stalk consists of few to many small white or ivory flowers clustered into a spiraling spike arrangement at the top of the stem. The species is characterized by whitish, stout flowers. The orchid usually flowers from the end of July until early September. Reproductively mature plants do not flower every year. Reproduction appears to be strictly sexual, with bumblebees as the primary pollinators. Each fruit contains thousands of very small seeds. Seeds disseminate primarily through water transport. After seeds reach suitable habitat, they must come in contact with the suitable species of mycorrhizal endophyte. This fungus provides the developing plant with the nutrients necessary for further growth (USFWS 1995b, Jordan 1999). The orchid seedlings may remain underground, dependent on mycorrhizal fungi, for up to eight years (Fertig 2000).

Species Range

Ute ladies'-tresses was historically found in riparian areas in Colorado, Utah, and Nevada (57 FR 2048). In 1981, live plants belonging to the genus *Spiranthes* were collected in Colorado by W.G. Gambill and W.F. Jennings and sent to C.J. Sheviak for examination. The following year, additional specimens were collected in meadows along Clear Creek in Colorado, and from similar habitat in Utah (57 FR 2048). After examining these and other specimens from Colorado, Utah, and Nevada (some of which were assigned in the past to other *Spiranthes* species), Sheviak described a new species, *Spianthes diluvialis* (Sheviak 1984). The type locality is along Clear Creek in Golden, Colorado. The Ute ladies'-tresses are known to occur in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming (57 FR 2048, Jordan 1999). Although the orchid has a large geographic range, most occurrences contain fewer than 100 individuals. In 2004, a petition to delist this orchid was published in the Federal Register (69 FR 60605), based on additional information acquired and provided to the USFWS. New occurrences have been documented in Nebraska, Wyoming, Washington, Idaho, Utah, and Colorado, substantially increasing the known range and estimated population size (69 FR 60605).

In Idaho, the orchid is found along the Snake River, including populations along the South Fork and the North Fork (Henry's Fork) of the Snake River. Populations in Idaho have shown population fluctuations, while new species occurrences have also been found expanding the species range in Idaho from when it was first listed in 1992. Examples of population fluctuations are shown in one population where the 2001 count of 4,133 individuals represented a significant expansion at one location on the Snake River below Palisades Dam (Murphy 2001). The 2002 survey showed a significant decrease in counted individual plants, down 2,380 to 1,753 individuals. New populations were discovered in 2002 at the Idaho Department of Fish and Game (IDFG) Chester Wetlands Wildlife Management Area on the Henry's Fork below the Cross Cut Diversion Dam above St. Anthony, Idaho and in 2003 on private land near Texas Slough between the Snake River below Palisades Dam and Henry's Fork (Murphy 2003, 2004b). The new population at Chester Wetlands WMA was the first documented occurrence outside the Snake River corridor below Palisades Dam (Murphy 2003).



The BLM, the USFS, and the IDFG Conservation Data Center surveyed numerous sites on BLM lands on the Snake River from the Henry's Fork confluence to American Falls Reservoir. They found no Ute ladies'-tresses (Moseley 1998; Murphy 2004a).

Habitat

Ute ladies-tresses is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams (57 FR 2048). The species occurs primarily in areas where the vegetation is relatively open and not overly dense, overgrown, or overgrazed (Coyner 1989, 1990; Jennings 1989, 1990). The orchid occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seepy areas associated with old landscape features within historical floodplains of major rivers, as well as in wetlands and seeps near freshwater lakes or springs. In some localities in the eastern Great Basin, Ute ladies'-tresses are found near freshwater lakes or springs (57 FR 2048). The plant seems to require permanent sub-irrigation (Coyner 1989), indicating a close affinity with floodplain areas where the water table is near the surface throughout the growing season. It grows primarily in areas where the vegetation is relatively open and not overly dense or overgrown (Coyner 1989, Coyner 1990, Jennings 1989, Jennings 1990), although a few populations in eastern Utah and Colorado are found in riparian woodlands. Plants usually occur in small scattered groups and occupy relatively small areas within the riparian system (Stone 1993). These preferred habitat features seem to imply that the plant is most likely to occur in riparian habitats created and maintained by stream activity within their floodplains (USFWS 1995b). The Ute ladies'-tresses is a floodplain species that is suspected to require mid-seral riparian habitats created by streams and rivers with actively changing channels (USFWS 1995b). The orchid appears to be well adapted to, and perhaps dependent on, regular disturbances from water moving through floodplains. Natural fluvial processes create new habitat. Flooding also maintains the existing habitat by reducing tree and shrub colonization of gravel bars. Nearly all occupied sites have a high water table (usually within 5 to 18 in.) of the surface augmented by seasonal flooding, snowmelt, runoff and irrigation. Ute ladies'-tresses ranges in elevation from 720 to 1,830 ft in Washington to 7,000 ft in northern Utah.

This orchid is tolerant of a mix of herbaceous wetland, forb, and grass species but does not compete well with emergent or aggressive species that form dense monocultures, such as Russian olive (*Elaeagnus angustifolia*), reed canary grass (*Phalaris arundinacea*), and other similar non-native invasives (USFWS 1995b). Maturing riparian communities with an overstory of trees or shrubs do not provide suitable habitat conditions (USFWS 1995b, Moseley 1998). The plants thrive in full sun or partial shade; Moseley (1998) notes that the species is often associated with cottonwood galleries. The plants are not tolerant of long-term standing water throughout the growing season.

In research within the floodplain of Idaho's Snake River, Moseley (2000) identified the five distinct cover types the Ute ladies'-tresses occupies:

- wandering spike-rush (*Eleocharis rostellata*)
- silverberry/redtop (*Elaeagnus commutate*)
- wooly sedge (*Carex lanuginose*)
- sandbar willow/mesic graminoid (*Salix exigua/mesic graminoid*)
- varied scouring rush (*Equisetum variegatum*)

The wandering spike-rush and silverberry/redtop tend to occur as larger-scale patches on the Snake River, while the sandbar willow/mesic graminoid and varied scouring rush are rarer and occur as small-scale patches within the cottonwood forests. The Ute ladies'-tresses occurs in connection with the wandering spike-rush and wooly sedge communities only on Kellys Island (Moseley 2000). The Bureau of Reclamation has funded two efforts to determine river operation schemes that mimic more natural streamflows to support the IDFG cutthroat trout management program. In 2000, the Bureau of Reclamation initiated a project to analyze operations from an ecological perspective. The Ecologically Based System Management project identified annual and interannual operations to support long-term ecological functions in the Snake River below Palisades Dam (Hauer et al. 2004). Burnett and Van Kirk (2004) provided a statistical analysis of a long-term regulated hydrograph and a long-term unregulated hydrograph for the Snake River below Palisades Dam as they related to the ratio between high and low flows and the effects of the alteration ratio on cutthroat trout. These studies looked at post-dam operations that influenced the physical and biological character of the river and suggested that species that evolved under flow conditions in high-energy Rocky Mountain streams benefit from regulated flow regimes that mimic naturally occurring hydrographs. Flows great enough to cause sediment mobilization that scour rainbow trout redds and give Yellowstone cutthroat trout a competitive edge also provide the mechanism for channel erosion and avulsion processes that benefit Ute ladies'-tresses (Burnett and Van Kirk 2004, Hauer et al. 2004).

Hauer et al. (2004) and Merigliano (1995) report that in order to maintain the existing habitat mosaic, including cottonwood and Ute ladies'-tresses' habitats on the Snake River below Palisades Dam, flows in excess of 30,000 cfs are needed to cause erosion and avulsion of the floodplain (orthofluvial flows). Hauer et al. (2004) determined that a flow of 17,000 to 19,000 cfs is the average threshold flow needed to begin mobilizing sediment within the active river channel (parafluvial flow). The erosion and avulsion process that creates or destroys habitat begins at this flow. Hauer et al. (2004) also noted that the ramp-down rate from these higher flows is important to this process, with a 5 percent ramp-down likely most effective. Hauer et al. (2004) suggest a minimum of around 28,000 cfs in wet years to initiate orthofluvial flow with sustained flows of 30,000 cfs for as long as possible, with flows over 25,000 cfs for 12 to 15 days in the very wettest of years (4 years out of 45). Merigliano (1995) suggests that flows of 38,000 cfs are necessary every 10 to 15 years for the establishment of new cottonwood stands. Murphy (2004a) and Moller and Van Kirk (2004) identify that past project operations below Palisades Dam on the Snake River, as measured at the Snake River near Irwin and Heise gages, have decreased winter flows during the storage season, reduced June peak flows, and increased summer flows during the irrigation season. Project operations have significantly reduced the high, annual scouring flows associated with uncontrolled spring runoff. Over the last 87 years, the average unregulated (theoretical operation without the project) peak flow for the Snake River at Heise gage would have been 32,081 cfs as opposed to actual average regulated peak flow of 21,000 cfs since Palisades Dam was completed in 1956. This reduction in peak flows reduces the mobilization of sediment, which in turn may alter seral development of some plant communities and reduce the amount or development of new mid-seral riparian habitat. Murphy (2004a) notes that over time, the affected mid-seral communities could become drier and allow progressive encroachment of shrub and woody vegetation.

Most of the known populations of Ute ladies'-tresses are inundated for a period of time ranging from several days to several weeks under flow conditions that range from 18,000 cfs to 20,000 cfs (Moseley 1998). Spring inundation is considered a normal occurrence within the habitat of this orchid and is likely necessary for the continued existence of the plant (Moseley 1998) and its habitat. Once the higher flows associated with spring runoff recede, the orchids again become exposed and can begin the normal growth cycle. Actual average daily flows in June at the Snake River near Heise gage exceeded 18,000 cfs for at least one day in 27 years since 1956 (57 percent). The actual monthly average flow during June has exceeded 18,000 cfs in 12 of those years (25.5 percent). Low summer flows that occur due to extreme drought can cause moisture stress at some orchid sites during July and August, which Murphy (2004a) reports as the prime growing period. Murphy (2004a) reports that inadequate soil moisture is not likely a limiting factor at any site when flows are higher than 6,900 cfs. In 2001, August streamflow on the Snake River dropped to 6,879 cfs and was sufficiently low enough to cause moisture stress (Murphy 2003). Murphy (2003) goes on to report that flows of 8,400 cfs maintain adequate soil moisture at all but one occurrence, and flows of 7,300 cfs or higher are high enough to maintain soil moisture "at most occurrences." Winter flows are not reported as causing adverse growth conditions, most likely because the plants are dormant.

In 2004, the USFWS published a 90-day finding on a petition to delist the Ute ladies'-tresses orchid and initiation of a five-year review (USFWS 2004). Research after the 1992 listing, including monitoring of species numbers, certain demographic parameters, and habitat characteristics, has improved understanding of population fluctuations, habitat preferences, and threats to habitat conditions. Research has continued on pollination biology, genetics, and root-associated fungi. Research and monitoring have been conducted on the relationship of stream flows, groundwater levels, and stream channel form to surfaces on which the orchid occurs.

Threats

The USFWS listed the orchid in 1992 based on the best scientific and commercial information available at the time. As stated and documented in the final listing rule, this action was taken, in part, because of (1) the threats of habitat loss and modification and (2) the orchid's small population and low reproductive rate, which make it vulnerable to other threats. The petition filed to delist the orchid in 2004 states that there is substantial new information indicating that the population size and distribution are much larger than known at the time of listing; there is more information on life history and habitat needs, allowing better management; and threats are not as great in magnitude or imminence as understood at the time of listing (USFWS 2004).

Several long-term threats may affect the species and its habitat, including urban development; stream channelization; stream alterations that reduce the natural dynamics of stream systems; increased demands for agricultural, municipal, and industrial water; recreation; and invasion by non-native plant species (USFWS 1995b). These threats are expected to intensify as the population of western states grows. Murphy (2000, 2001, 2003, 2004a) and Moseley (2000) describe short-term effects from a variety of adverse human actions, including hydrologic and floodplain alterations, livestock grazing/trespass grazing, off-highway vehicle use, recreation, and non-native weed invasions. The Ute ladies'-tresses is distributed primarily on federal land (only four of the 22 known orchid sites below Palisades Dam are on private land or non-federal land; two of these are partially on federal land), but private and state activities and management programs may affect Ute ladies'-tresses and its habitat. Future activities that are reasonably certain to occur in the action area are livestock grazing and increased residential development. Livestock grazing in the area has been an ongoing activity for many years, and future practices may not differ significantly from past practices. Residential development will also continue in and near the Snake River; future development will likely further alter the floodplain dynamics.

Agricultural development has several components that could continue to threaten the species as a whole. Water diversion, channelization, groundwater withdrawal, and increased sedimentation from upland land-clearing and development activities have likely affected some populations. Alteration in hydrology of natural stream and river systems has been reported as both beneficial and detrimental to the orchid, depending on the availability of water throughout the growing season (Jordan 1999). Heavy livestock grazing is believed to be detrimental to the species. Mild to moderate grazing and mowing early in the growing season may promote flowering by opening the canopy of competing vegetation, permitting the orchid to grow in full sun. However, grazing and mowing later in the growing season may impede fruit set by removing flowering stalks and enhancing harvest of the fruits by small mammals. Livestock trampling may also be detrimental. Many orchid populations occur on public rangelands where domestic livestock and grasshoppers are commonly viewed as competitors for forage. Insecticides registered for control of grasshoppers on rangelands include acephate, carbaryl, Dimilin, and Malathion (USEPA 1985). These pesticides also affect bumblebees, which are the preferred pollinators of the Ute ladies'-tresses (Fertig 2000).

Cattle grazing poses a short-term impact to the species from the loss of flowering plants and a long-term threat from the loss of production (Murphy 2004a). Impacts from recreation activities, such as camping, boating, and fishing, continue to increase in this reach of the Snake River. Murphy (2004a) reports that effects to 11 occurrences are associated with recreation. Off-highway vehicle use causes a minor threat. Non-native weeds may be responsible for nearly extirpating the orchid from two sites and are in competition with the orchid at nearly all sites (Murphy 2004a). Grazing and recreational use appear to be the most likely activities affecting the plant along the Snake River below Palisades Dam. Recent surveys along the Snake River below Palisades Dam reflect this. It is generally believed that any activity that degrades floodplain riparian or wetland habitats also affects Ute ladies'-tresses (USFWS 1995b).

Several recent Idaho surveys illustrate fluctuations in species population (Moseley 1998, 2000; Murphy 2000, 2001, 2003, 2004a). Poor understanding of the species and poor survey timing may explain some population variations. The number of plants observed in any specific population may also vary considerably from year to year and may lead to false estimates of the population size and vigor. Apparent fluctuations in populations are the result of dormancy periods likely brought on by variation in environmental conditions. During dormancy periods, there may either be no above-ground growth or limited above-ground growth with no floral development. Specific trend data has not been developed for the Idaho occurrences of this species. The species is often difficult to observe for a variety of reasons, including the plant's small size among its grassy habitats, the natural variability in year-to-year flowering plants, alternations in phenology due to annual climate fluctuations, and mistimed surveys that miss peak flowering (Murphy 2004a). Additionally, counting flowering plants may not determine the long-term health of the population because it does not take into account the general condition of the habitat.

The threat from alteration of the flow regime is the result of reduced peak flows that may reduce the ability of the river to maintain existing orchid habitat and create new orchid habitat through erosion and avulsion. The hydrologic alteration of the Snake River below Palisades Dam presents the greatest threat to the long-term viability of the Ute ladies'-tresses on the South Fork of the Snake River (Murphy 2004a); this alteration is most evident in the suppression of the ecological processes inherent in fluvial systems. Several sources have indicated that reduction in peak flows have reduced geomorphologic processes downstream from Palisades Dam (Merigliano 1995, Moseley 1998, Hauer et al. 2004, Murphy 2004a). In general, floodplains are modified by erosional deposition and channel avulsion, which lead to destruction and development of habitats, both temporally and spatially; this is described as a "shifting habitat mosaic" within the floodplain (Hauer et al. 2004). The constant creation and destruction of habitats is the basis for the biological diversity within riparian habitats. The BLM contributed funding for a study by Merigliano (1995) to investigate the effects of natural and managed river flows on maintenance of cottonwood stands below Palisades Dam. This study analyzed pre-dam river flows to identify flows to maintain the cottonwood forest on the South Fork. The study also presents information showing that post-dam flow regulation has reduced large flood flows, sediment transport, and channel migration, causing a reduction in the amount of suitable areas for cottonwood establishment and long-term survival of the existing cottonwood forest and in turn the riparian habitat of the river.

Effects

Virtually all known occurrences within the State of Idaho are or at one time were associated with the Snake floodplain in early to mid-seral riparian habitats.

However, because of the cryptic nature (up to 10-year dormancy) of this species' life history and the relatively broad characterization of potential habitat throughout its large range, it is impossible to rule out the possibility that new populations may be found in areas within or adjacent to highway rights of way.

Determination of Effects on Ute ladies'-tresses

The project types proposed under this PBA *may affect, but are not likely to adversely affect* Ute ladies'-tresses.

Rationale for the Determination - Because the extent and amount of potential habitat for Ute ladies'-tresses within Idaho is partially unknown and/or remains mostly unsurveyed, it is possible that road construction and maintenance could affect Ute ladies'-tresses

The project types proposed under this PBA have a low likelihood of impacting Ute ladies'-tresses orchid. Because potential habitat for *Spiranthes diluvialis* in Idaho is still relatively broadly characterized, road construction and maintenance activities could effects undiscovered Ute ladies'-tresses orchid populations in unsurveyed habitat. Weed management along highway rights of way is employed and adaptive management practices are available if new populations are identified. When activities take place within suitable habitat, species surveys will be conducted. Adverse effects to Ute ladies'-tresses from highway construction or maintenance activities shall be avoided.

3.27 Slickspot peppergrass (Lepidium papilliferum)

Species Description and Life History

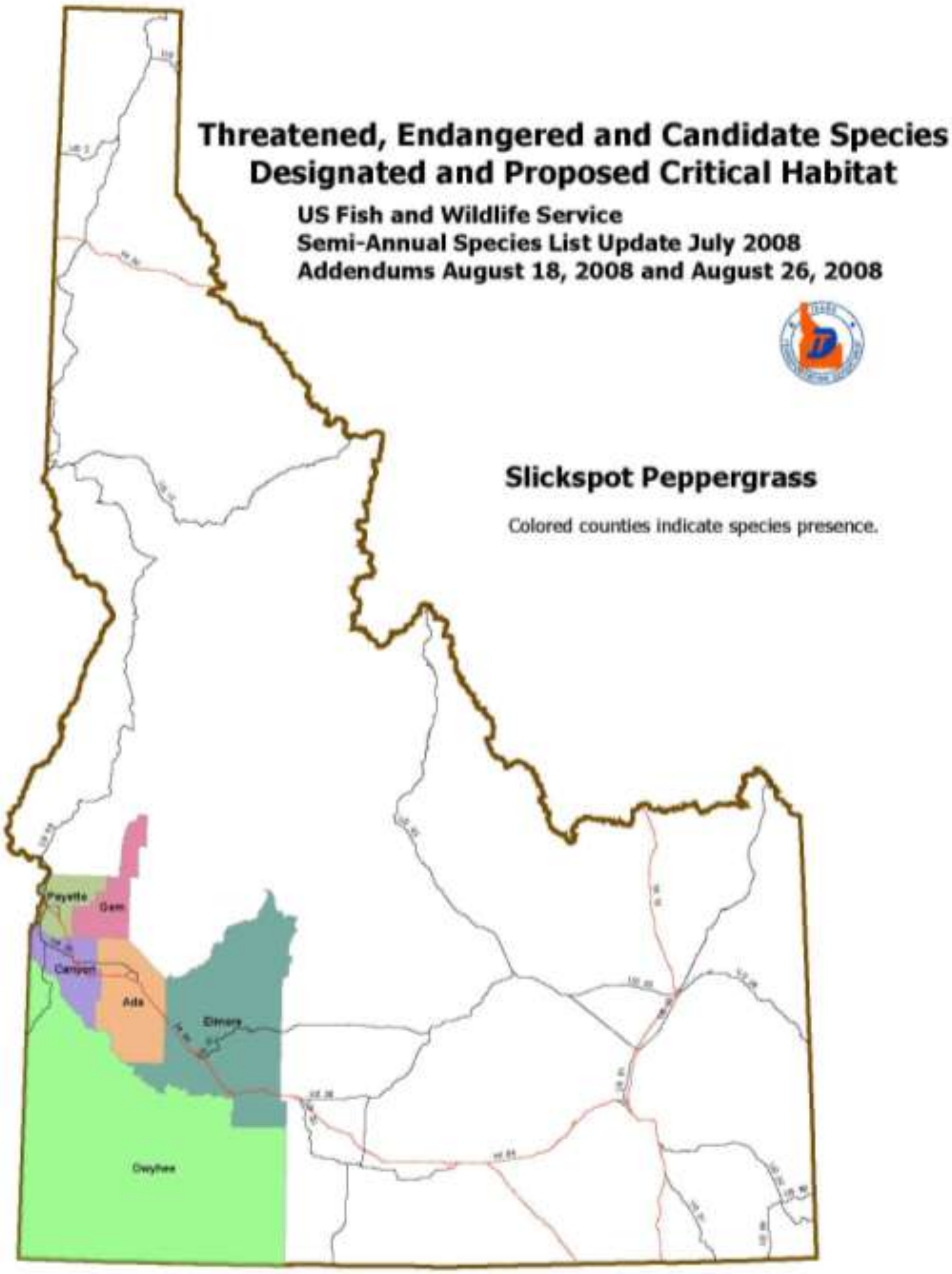
Slickspot peppergrass is an annual or biennial plant in the mustard family (Brassicaceae) that reaches 4 to 12 inches in height. Leaves and stems are pubescent (covered with fine, soft hairs), and the divided leaves have linear segments (Moseley 1994). Numerous small, white 4-petalled flowers terminate the branches. This species produces small, orbicular (spherical), flattened fruits (siliques) that are approximately 0.1 inches long. The fertilization mechanism of these hits is mainly insect pollination by bees (Apidae, Colletidae, and Alictidae families), flies (Syrphidae family), and some beetle species (Dermestidae and Cerambycidae families (Robertson 2002). The primary seed dispersal mechanism is probably gravity, although wind and water may have a minor role (Moseley 1994). Slickspot peppergrass seeds may be viable in the soil for up to 12 years (Dana Quinney, in litt., 2002).

Population Size and Location

Of 88 known occurrences supporting slickspot peppergrass, 70 are currently extant (existing), 13 are considered extirpated (extinct), and five are historic (i.e., plants have not been relocated; location information is based on collections made between 1911 and 1974) (Moseley 1994, Mancuso 2000, ICDC 2002).

Occurrences of slickspot peppergrass can include one to several occupied slickspots within an area determined to be suitable habitat. The total amount of habitat containing interspersed slickspots that have extant occurrences of slickspot peppergrass is about 12,356 acres. Only six of the 70 extant occurrences are considered to be high-quality habitat and contain large numbers of the plants (ICDC 2002). The number of slickspot peppergrass individuals at each extant occurrence ranges from 1 to 3,000 (Mancuso 2000, ICDC 2002).

Like many short-lived plants growing in arid environments, the above-ground number of slickspot peppergrass individuals at any one site can fluctuate widely from one year to the next depending on seasonal precipitation patterns (Mancuso and Moseley 1998, Mancuso 2001). Flowering individuals represent only a portion of the population and occupied habitat, with the seed bank contributing the remainder, and apparently the majority, in many years (Mancuso and Moseley 1998). For annual plants, maintaining a seed bank (a reserve of dormant seeds, generally found in the soil) is important for year-to-year and long-term survival (Baskin and Baskin 1978). A seed bank includes all of the seeds in a population and generally covers a larger area than the extent of observable plants seen in a given year (Given 1994). The number and location of standing plants (the observable plants) in a population varies annually due to a number of factors, including the amount and timing of rainfall, temperature, soil conditions, and the extent and nature of the seed bank. The extent of seed bank reserves is variable from population to population, and large fluctuations in the number of standing plants at a given site may occur from one year to the next. Depending on the vigor of the individual plant and the effectiveness of pollination, dozens, if not hundreds of seeds could be produced.



Habitat

Slickspot peppergrass occurs in semi-arid sagebrush-steppe habitats on the Snake River Plain, Owyhee Plateau, and adjacent foothills in southern Idaho. Associated native species include Wyoming big sagebrush, basin big sagebrush, bluebunch wheatgrass, Thurber's needlegrass, Sandberg's bluegrass, and bottlebrush squirreltail. Non-native species frequently associated with slickspot peppergrass include cheatgrass, tumble mustard, bur buttercup, clasping peppered, and crested wheatgrass (Moseley 1994, Mancuso and Moseley 1998).

Slickspot peppergrass is restricted to small depositional microsites similar to vernal pools (generally known as slickspots, mini-playas, or natric sites) that range from less than 10 ft^2 to about 110 ft^2 in diameter within communities dominated by other plants (Mancuso et al. 1998). Slickspot microsites are widespread, but slickspot peppergrass is limited to one or more series of slickspots covering a relatively small area. These sparsely vegetated microsites are very distinct from the surrounding shrubland vegetation, and are characterized by relatively high concentrations of clay and salt (Fisher et al. 1996). The microsites also have reduced levels of organic matter and nutrients due to the lower biomass production compared to surrounding habitat areas. The restricted distribution of slickspot peppergrass is likely a product of the scarcity of these extremely localized, specific soil conditions, and the loss and degradation of these habitat areas throughout southwestern Idaho.

Threats

Most sagebrush-steppe habitat that has not been converted to cropland in southwestern Idaho has been degraded by wildfire, livestock grazing and trampling, the invasion of non-native plant species, and off-road vehicle use; these factors continue to threaten all remaining habitat for slickspot peppergrass (Moseley 1994, Mancuso and Moseley 1998, ICDC 1999, Mancuso 2000). The conversion of the original sagebrush-steppe to annual grasslands and non-native perennial grasslands has reduced suitable remaining habitat, and destroyed some individuals, and fragmented or isolated extant occurrences (Moseley 1994). Subsequent increased frequency of fire, and the associated invasion of weedy annual plants, are serious range-wide threats to the long-term integrity of slickspot peppergrass habitat and population viability (Mancuso and Moseley 1998).

The displacement of native plants by non-native species is a major problem in sagebrush-steppe habitats of the Intermountain region (Rosentreter 1994). Widespread grazing by livestock in the late 1800s and early 1900s severely degraded sagebrush-steppe habitat, enabling introduced annual species (especially cheatgrass) to become dominant over large portions of the Snake River Plain (Yensen, D. 1980a, Moseley 1994). The invasion of cheatgrass has shortened the fire frequency of the sagebrush-steppe from between 60 to 110 years, to less than five years as it provides a continuous, highly flammable he1 through which a fire can easily spread (Whisenant 1990, Moseley 1994, Mancuso and Moseley 1998). The result has been the permanent conversion of vast areas of the former sagebrush-steppe ecosystem into non-native annual grasslands. An estimated 5 to 6 million acres of sagebrush-steppe in the western Snake River Basin has been converted to nonnative annual vegetation dominated by cheatgrass and medusahead (Noss et al. 1995), primarily due to continued overgrazing and fire. The continued cumulative effects of overgrazing and fire suppression permit the invasion of non-native plant species into slickspot habitats (Rosentreter 1994). Slickspot peppergrass populations typically decline or are extirpated following the replacement of sagebrush-steppe habitat by non-native annuals.

Another problem has been the use of nonnative perennial species, such as crested wheatgrass and intermediate wheatgrass, to restore or rehabilitate shrub-steppe habitat after a fire event. Although some slickspot peppergrass may temporarily persist in spite of these restoration seedings, most occurrences support small numbers of plants (fewer than five per slickspot) and long-term persistence data are unavailable (Mancuso and Moseley 1998). Habitat degradation, fragmentation, and loss of sagebrush-steppe vegetation have occurred throughout the range of slickspot peppergrass. Popovich (2001) found in his surveys for slickspot peppergrass in the

Inside Desert area on BLM land in 2000 that, generally, slickspots dominated by non-native vegetation had fewer slickspot peppergrass plants than slickspot sites with greater native vegetation retention.

Livestock trampling of slickspots is one of the main disturbances to slickspot microsites (Mancuso 2001), especially in the spring (approximately April through June) when the soils are moist. Trampling by livestock can physically damage the vegetation that exists there and compact the soil, which greatly accelerates desertification processes through increased soil loss and water runoff (Moseley 1994, Popovich 2001). This can also lead to the loss of slickspot integrity, particularly from winter through spring when standing water remains for a longer period of time after a rainfall (Belnap et al. 1999, Air Force 2000). Livestock effects on unique habitats such as slickspots are magnified in areas where non-native plant invasions and altered fire regimes occur.

Livestock trampling of slickspots can also lead to the invasion or increase of non-native annual species such as cheatgrass, tumble mustard, bur buttercup, and clasping pepperweed into shrub-steppe habitats through transport of the seeds of these species by animals in their feces or hides (Ellison 1960, Pyke 1999). In addition, the presence of livestock in an area with slickspots generally results in increases in organic debris, such as livestock feces, especially when the slickspots contain standing water. As organic debris is increased, the incidence of non-native species invasion also increases, leading to the loss of suitable habitat for slickspot peppergrass.

Wildfire is a threat to all known slickspot peppergrass occurrences throughout its range. As described above, the invasion of cheatgrass has shortened the fire frequency of sagebrush-steppe habitat from between 60 to 110 years, to less than five years. Frequent fires are likely to degrade remaining slickspot peppergrass habitat in the future. For example, 29 of the 40 monitored (73 percent) slickspot peppergrass occurrences have been completely burned, have a mosaic burn pattern, or have distinct burned and unburned segments (Mancuso 2000). Fire may also indirectly impact slickspot peppergrass by increasing erosion, resulting in deposit of sediment on slickspots, and subsequently covering plants. Increased sedimentation after a fire may also allow weedy species to invade slickspots (DeBolt 1999 cited in Air Force 2000).

Fire rehabilitation is needed to reduce the invasion of non-native vegetation to burned areas; however, post-fire range restoration efforts also threaten slickspot peppergrass. Some occupied slickspots have been lost following drill-seedings, but it is often not clear whether fire, seeding, or the combination of the two disturbances caused the disappearance of the species or the slickspot. Slickspots may reform over time after being drilled (Moseley 1994, Noe 1999 cited in Air Force 2000), but it is not known if slickspot peppergrass populations will remain viable for as long as the slickspot takes to reform (Air Force 2000). In their study examining the effects of drill-seeding on slickspot peppergrass, Scholten and Bunting (2001) found that the density of slickspot peppergrass individuals was lower on drilled slickspots than on non-drilled sites.

Drill-seeding may have less severe impacts on slickspot habitat than disking the soil, but the success of fire rehabilitation efforts at maintaining slickspots and slickspot peppergrass varies considerably. Drill-seeding tends to break the linkages between slickspots and can result in slickspots shrinking in size, particularly those that are relatively small. Seeding methods that cause minimal soil disturbance (e.g., “no-till” drills) are available, but have not been regularly used in southwestern Idaho to date. In some cases, not seeding burned areas can result in the loss of slickspot peppergrass occurrences due to non-native weed invasion. In 2001, the BLM modified its rangeland drills used in fire rehabilitation to reduce the seeding depths so the drills would be less damaging to slickspot peppergrass habitat. Seeding burned areas with crested wheatgrass, a non-native forage species, or other non-native perennial grasses, has resulted in the destruction of at least one slickspot peppergrass site (Moseley 1994).

Crested wheatgrass is a strong competitor and its seedlings are better than native species at acquiring moisture at low temperatures (Lesica and DeLuca 1998). For example, on the Juniper Butte ETR, approximately 80 percent or 9,163 acres of this area is dominated by non-native perennial plant communities as a result of fire rehabilitation efforts (Air Force 1998).

Also, the practice of "green-stripping" or converting native habitat to non-native plant species that are not considered to be very flammable has occurred (Moseley 1994). Since wildfire prevention and control is a high priority for the BLM and other agencies in southwestern Idaho, potential threats to slickspot peppergrass habitat associated with these activities are expected to continue.

Herbicides and pesticides may negatively impact this species, either directly or indirectly (i.e., via drift). While herbicides may kill individual slickspot peppergrass plants, pesticide spraying can negatively affect pollinators of slickspot peppergrass, impacting seed production. Herbicides and pesticides may be used by federal agency staff and other parties in areas such as agricultural areas and roadsides. Slickspot peppergrass could be present in or adjacent to such areas.

The long-term viability of slickspot peppergrass occurrences on private land is questionable due to the continuing expansion of residential developments in and around Boise (Moseley 1994). Twenty-eight of the 88 known slickspot peppergrass occurrences (32 percent) occur either wholly or partially on private lands. Of these, 13 occurrences (46 percent) are known to have been extirpated within the past 50 years (Moseley 1994; ICDC 2002). Urbanization, agricultural conversion, and associated factors (e.g., increased risk of damage or extirpation from fire, trampling, and off-road vehicle use) threaten all existing slickspot peppergrass occurrences on private land.

Effects

Because Slickspot peppergrass is associated with the sagebrush-steppe in southwestern Idaho, impacts to Slickspot peppergrass and its habitat are possible to occur from road construction. Management actions to prevent and control invasive and noxious weeds using integrated weed management techniques, including the use of herbicides, could reduce the area and severity of damage to bluebunch wheatgrass and Idaho fescue communities by reducing the quantity of invasive species. This could decrease the competition, allowing other native species and Slickspot peppergrass to increase in number.

There is potential for direct and indirect effects from transportation, including accidental destruction of individuals or disturbance of occupied or potential habitat. Roads have the potential to spread non-native plant species. Weed control adjacent to and within listed plan populations can reduce adverse effects from non-native species competition. Given that ITD cannot predict exact locations of future projects, ITD cannot discount the potential for adverse effects to undiscovered populations or potential habitat for the Slickspot peppergrass.

Determination of Effects on slickspot peppergrass

The project types proposed under this PBA *may affect but are not likely to adversely affect* Slickspot peppergrass.

Rationale for the Determination - All activities documented under this PBA will be subject to evaluation by the USFWS. Slickspot peppergrass exists on or adjacent to highway rights of way and unknown individuals or populations could be at risk to road construction and maintenance. Noxious weeds and other invasive plants have encroached on populations of Slickspot peppergrass. Indirect effects from highway uses may cause weed encroachment into occupied habitats. Weed management along highway rights of way is employed, and adaptive management practices are available if new populations are identified. When activities take place within suitable habitat, species surveys will be conducted. Adverse effects to Slickspot peppergrass from highway construction or maintenance activities shall be avoided.

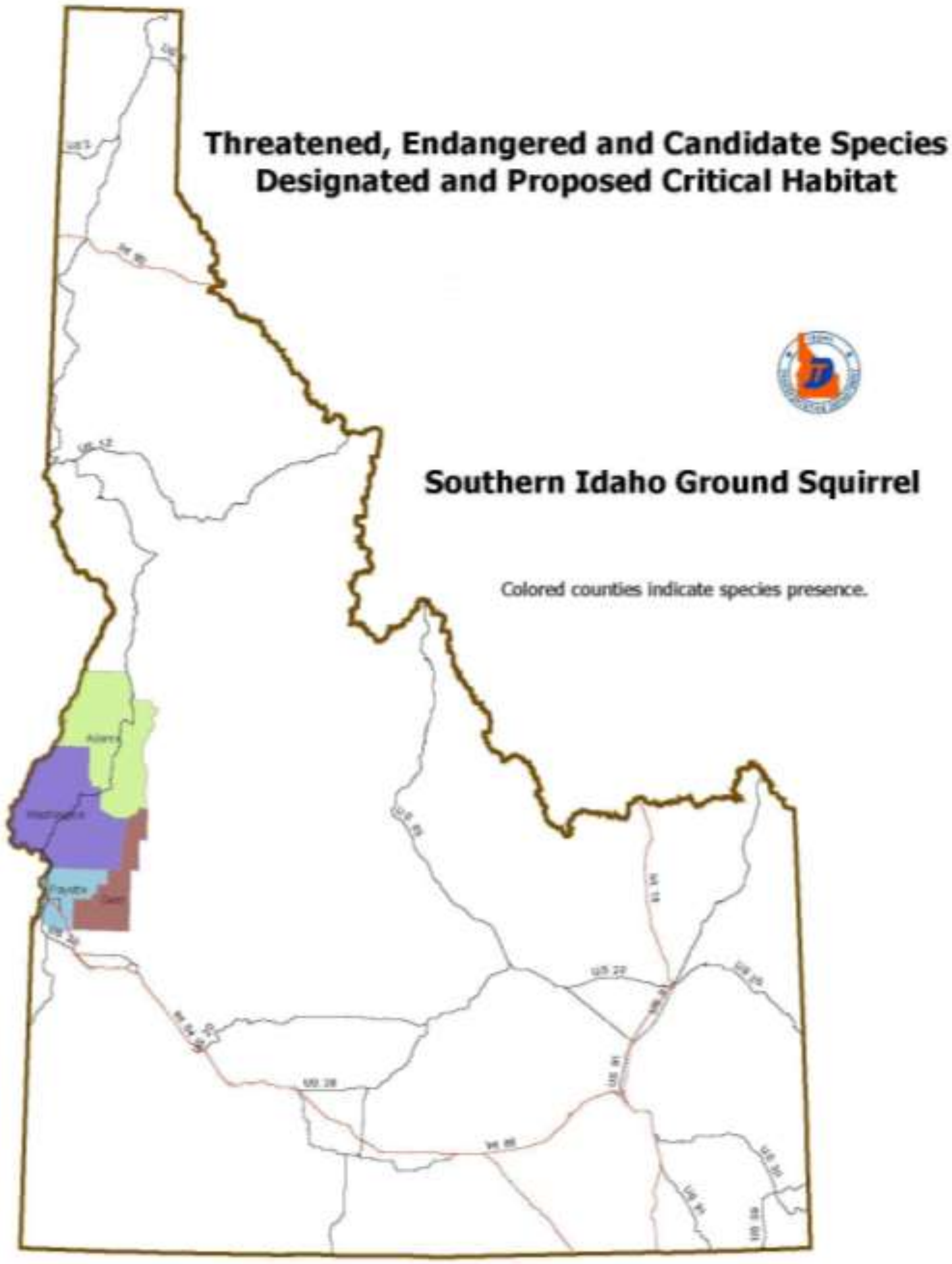
Candidate Species

3.28 Southern Idaho ground squirrel (Spermophilus brunneus endemicus)

The southern Idaho ground squirrel is about 8 to 9 in. long, with a short narrow tail, tan feet and ears, and a grey-brown throat. Research suggests that this ground squirrel prefers native cover such as big sagebrush, bitterbrush and a variety of native forbs and grasses; however, some nonnative features may enhance their survival such as alfalfa fields, haystacks and fence lines. Adult ground squirrels emerge from seasonal hibernation in late January or early February (depending on elevation and habitat conditions), and remain above ground for about four to five months. During this time, they feed on grass seed, stems and green leafy vegetation that are required for fat storage to survive the long months of hibernation. When ground squirrels emerge from their burrows in the spring, they begin breeding and young are born about 3 weeks later. In about 50 days, the juveniles leave nest burrows. Above-ground activity ceases by late June or early July when the ground squirrels return to their burrows for hibernation. Recent surveys indicate that the southern Idaho ground squirrel occurs in about 38 square miles in Idaho: extending from Emmett northwest to Weiser and the surrounding area of Squaw Butte, Midvale Hill, and over to the Henley Basin in Gem, Payette, and Washington counties. Its range is bounded on the south by the Payette River, on the west by the Snake River and on the northeast by lava flows with little soil. Currently, the distribution of the species is patchy, with areas of localized abundance and large areas of apparently suitable habitat that are unoccupied or sparsely occupied. The areas of localized abundance are typically concentrated around human-altered landscapes such as golf courses and row crop or farmed fields (particularly alfalfa and clover). Threats to the southern Idaho ground squirrel include exotic grasses and weeds, habitat fragmentation, direct killing from shooting, trapping or poisoning, predation, competition with Columbian ground squirrels, and inadequacy of regulatory mechanisms to protect the species or its habitat.

The southern Idaho ground squirrel spends much of its time underground. Adults emerge from seasonal torpor in late January or early February, depending on elevation and microhabitat conditions (Yensen and Sherman 1997). As with other small-eared ground squirrels in the northwest, the adults have a short active season above ground of four to five months, which are spent reproducing and foraging before the long seasonal torpor begins (Moroz et al. 1995, Yensen and Sherman 1997). Females are bred within the first few days of emerging from torpor. Young are born about three weeks later and emerge from the nest burrow in about 50 days. All age groups of the southern Idaho ground squirrel cease above ground activity by late June or early July to begin torpor.

Southern Idaho ground squirrels are found in the lower elevation shrubshteppe habitat of the Weiser River Basin. Their habitat is typified by rolling hills, basins and flats composed of lacustrine and fluvial sediments between 2,200- and 3,200-ft elevations. They inhabit an area once dominated by big sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*), and a variety of native forbs and bunchgrasses (Yensen 1991). Prescott and Yensen (1999) suggested that these ground squirrels prefer areas with a high percentage of native cover types, especially areas with big sage; however, some non-native features may enhance their survival as well, specifically alfalfa fields, haystacks or fence lines. The predominant vegetation in these areas was formerly big sagebrush-bunchgrass-forb association, with bitterbrush found in the sandier locations (Yensen 2000). The big sagebrush-bunchgrass-forb complex has dramatically changed so that exotic annuals and other non-native species have replaced much of the former vegetative composition.



A high-quality diet of green vegetation and seeds is required to store enough fat to survive long months of torpor. Though dietary requirements of the southern Idaho ground squirrel have not been studied extensively (Yensen and Sherman 1997), they are likely to be similar to those of other ground squirrels in Idaho (Dyni and Yensen 1996). Southern Idaho ground squirrels are thought to prefer native species of perennial grasses and forbs that provide a reliable source of nutritious forage (Yensen 1999, Prescott and Yensen 1999, Yensen et al. 1992). However, currently the site known to contain the largest population of southern Idaho ground squirrels is the Rolling Hills Golf Course in Weiser where they apparently do well on irrigated lawn grasses.

Prescott and Yensen (1999) found that occupied southern Idaho ground squirrel sites commonly were associated with human-created habitat features. It appears as though ground squirrels can successfully inhabit non-native habitats if nutrition and other requirements can be met.

Range

As of 2001, the known range of the southern Idaho ground squirrel occurs within an approximately 518,000-acre area extending from Emmett, Idaho, northwest to Weiser, Idaho and the surrounding area of Squaw Butte, Midvale Hill and Henley Basin in Gem, Payette and Washington counties (Yensen 1991*).* Its range is bounded on the south by the Payette River, on the west by the Snake River and on the northeast by lava flows with little soil development (Yensen 1991).

The historical range of southern Idaho ground squirrels is estimated to have formerly extended farther north as far as Goodrich, Idaho in Adams County (Yensen 1980, Yensen 1991); however, recent studies have shown a severe decline in the number of population sites in the northern part of their range. For example, the only known historical site in Adams County was not occupied in 1999 (Yensen 1999, Yensen 2000), and southern Idaho ground squirrels may currently be extinct in Adams County (Yensen 2001).

The population of southern Idaho ground squirrels was estimated at around 40,000 in 1985 (Yensen 1999). Surveys strongly suggest a precipitous decline in squirrel populations since the mid-1980s. A 1999 survey of 145 of the 180 known historical population sites indicated that only 53 sites (37 percent) were still occupied (Yensen 1999). Furthermore, 52 of the 53 occupied sites had what Yensen (1999) characterized as “remarkably low levels of activity.” The percentage of active sites for southern Idaho ground squirrels decreases from south to north; 58 percent of the sites in Gem County still had squirrels (Yensen 1999). The percentage dropped to 46 percent in Payette County and decreased to 27 percent of the sites in Washington County. Ground squirrels were seen at only 19 of the occupied sites despite 28 person-days of careful surveys of 145 sites. Furthermore, at 18 of the occupied sites only a single individual was seen, fecal pellets were found at 13 sites and vocalizations were heard at only one site. The only population site in the study with a high level of squirrel activity was at the golf course in Weiser (Yensen 1999).

In the spring of 2000, Yensen (2000) surveyed the remaining 35 historical sites that had not been surveyed in 1999. From March to June 2000, the IDFG surveyed 93 exchange parcels of Bureau of Land Management (BLM) lands and about 30 mi^2 of contiguous rangeland for southern Idaho ground squirrels (Yensen and Haak 2000). As a result of surveys conducted in 1999 and 2000, a total of 219 sites (occupied and unoccupied) were identified (Yensen 2000). Of the 219 sites, 98 (44 *5* percent*)* were active sites in the year 2000. Activity was not confirmed or remained undetermined at the other 121 (56 percent*)* sites. Ground squirrel activity was low at all the sites surveyed. For comparison, in the early 1980s, several thousand individuals would likely have been observed during a survey throughout the range of the southern Idaho ground squirrel (Yensen 2000). Of the 219 sites, 85 percent (186) were located on private lands, mostly ranches and farms, 12 percent (26) were under federal management by the BLM, and 3 percent (7) were on lands managed by the Idaho Department of Lands. These data do not represent a census of southern Idaho ground squirrels because they include only a small portion of the species' range.

A total of 76 new southern Idaho ground squirrel sites were identified during surveys in 2001 (Yensen 2001), and another 7 sites were identified during surveys in 2003 (Yensen 2003). The total number of known sites for the species range-wide is currently 302. However, consistent with results from surveys in recent years, the number of individual ground squirrels at each newly identified site is very low. A number of additional sites were identified in 2003 that may support southern Idaho ground squirrels (sign was found but individuals were not detected); presence-absence surveys will be conducted at these sites during likely periods of peak ground squirrel activity in 2004 (Yensen 2003). Yensen (2001) estimated the current range-wide population of southern Idaho ground squirrels to be from 2,000-4,500 individuals.

In May 2003, IDFG personnel surveyed the Rolling Hills Golf Course and Weiser Cemetery in Weiser for southern Idaho ground squirrels (IDFG 2003). Up to 26 individuals were observed in seven locations in the Rolling Hills Golf Course, and up to 38 individuals were observed in seven locations in the Weiser Cemetery. It is suspected that both locations support higher numbers of ground squirrels than were observed during the May surveys. Burrows were not enumerated at either location; however, 40 burrows were counted in a 200-meter section along Indian Head Road, which runs between the golf course and the cemetery. One ground squirrel was observed crossing Indian Head Road from the golf course to the cemetery. Ground squirrels were also observed moving between the cemetery grounds and adjacent fields to the west and south.

Biologists conducted southern Idaho ground squirrel surveys on BLM land north of Emmett during May and June 2003 (IDFG 2003). A combination of hiking and motorcycles was used to conduct the surveys; a total of 133 ground squirrels were observed at 23 locations. Surveys conducted during June 2003, on land near Sweet detected 45 individuals (IDFG 2003).

Habitat on this parcel is a mixture of irrigated and mowed grass, landscaping, and unmowed areas. Ground squirrels may also occur on adjacent properties near Sweet; IDFG and USFWS will attempt to survey these areas in 2005.

Demography and Dispersal Investigations

Researchers from Boise State University and the College of Idaho began a study of the status and potential regulating factors of the southern Idaho ground squirrel population in 2002

(Barrett et al. 2003). Seven sub-populations located in Gem, Payette, and Washington counties were chosen to serve as study sites. The number of ground squirrels captured at each study site varied from 17 to 121 individuals in 2002 and from 72 to 154 in 2003. Trapping began earlier in 2003 than it did in 2002. The estimated population sizes of breeding individuals ranged from 16 to 74 in 2002 and from 23 to 56 in 2003. The estimated juvenile population ranged from 45 to 186 in 2002 and from 93 to 199 in 2003. Average productivity in 2002 was estimated at 6.7 juveniles per female and at 5.8 juveniles per female in 2003.

Researchers from Boise State University and Albertson College of Idaho began a study of the dispersal of yearling and juvenile southern Idaho ground squirrels, as well as factors that maximize success in translocating ground squirrels in 2003 (Panek and Munger 2003). In the first year of tracking ground squirrel movements, the average yearling movements were approximately 197 ft for males and 240 ft for females. None of the yearlings dispersed from the study population. Out of 34 juvenile ground squirrels that were radio-collared, six (14 percent) dispersed from the study area. Gender was evenly split among the dispersers: three males and three females. All juveniles dispersed into areas currently occupied by ground squirrels. In addition, 11 of the collared squirrels dispersed within the popu1ation;'distances ranged from 302 to 958 ft.

Researchers also investigated translocation of southern Idaho ground squirrels in 2003 (Panek and Munger 2003). Two groups of squirrels were translocated: one group was taken from the Van Deussen Ranch and transferred to property owned by Soulen Livestock Company, and the second group was taken from Zoo Boise and transferred to BLM land. Most of the ground squirrels that were transferred to the Soulen Livestock land moved approximately 300 m away from the release site and many did not survive until the end of the 2003 active season. Results of this portion of the experiment indicate that additional factors not considered during the 2003 field season are influencing the success of ground squirrel translocation efforts. Many of the juveniles that were transferred from Zoo Boise remained in the area in which they were released.

Threats

Habitat deterioration is a threat to the species, and appears to be a leading cause of the apparent population decline of southern Idaho ground squirrels (Yensen 1999). In recent decades, invasion of exotic annuals has changed the species composition of vegetation and has altered the fire regime in a perpetuating cycle throughout much of the range of these squirrels (Whisenant 1990).

Cheat grass (*Bromus tectorum*) and medusahead rye (*Taeniatherium aspemm*) are of limited forage value to the ground squirrels, have highly variable annual productivity, and now dominate much of the squirrels' range (Yensen 1999, Yensen et al. 1992). Diversity of native forbs and grasses decreases where these exotics take over, limiting the dietary diversity available to ground squirrels (Yensen 1999). Without the reliable and nutritious diet provided by native grasses and forbs, these ground squirrels must rely on the highly variable productivity and nutritional value of exotic annuals. In years of low rainfall, low productivity of these exotics could prevent squirrels from storing enough fat to overwinter. Yensen et al. (1992) showed that populations of Pauite ground squirrels (Spermophilus mollis) were highly unstable and prone to extinction in areas invaded by exotic annuals.

Although deterioration of native shrub-steppe habitat and invasion of exotic annual grasses has likely had a negative effect on southern Idaho ground squirrels, the species does use non-native vegetation and alternate habitats successfully. Many ground squirrel populations occur where human-related land use impacts are greatest, for example, around ranch corrals, fence lines, and equipment storage areas. Currently the largest population of southern Idaho ground squirrels is located on and adjacent to the Rolling Hills Golf Course and the Weiser Cemetery, which are generally dominated by irrigated lawn grasses. In the spring of 2003, a population of southern Idaho ground squirrels was also documented at the public golf course in Payette, Idaho. Prescott and Yensen (1999) found that sites occupied by southern Idaho ground squirrels had significantly more big sagebrush (*Artemisia tridentata*) than unoccupied sites. Prescott and Yensen (1999) also observed all occupied southern Idaho ground squirrels sites had at least one of the following: fences, haystacks, sagebrush, or nearby houses, and concluded that ground squirrels have a better chance of survival when one or more of these characteristics is present at the site. Ground squirrels may have used areas with sagebrush because cover of perennial vegetation is likely greater in these areas, or sagebrush cover may provide more hiding cover from predators (Prescott and Yensen 1999). Ground squirrels may successfully use the human-related habitat features discussed above, such as fence lines and alfalfa fields, due to the cover these areas provide to avoid predators and high quality forage created by hayfields and the availability of nutritious early successional plant species growing at disturbed sites.

Recreational shooting and other direct killing of southern Idaho ground squirrels is common and is a notable mortality factor of southern Idaho ground squirrels, although no studies have been conducted to determine the specific effects on ground squirrel populations. Evidence of recreational shooting was found at a southern Idaho ground squirrel population site where squirrel activity recently ceased (Yensen 1999). The IDFG recognizes the southern Idaho ground squirrel as a species of special concern. Species of special concern are protected, by state law, from "taking" (shooting, trapping, poisoning) or possession. In its 2002-2003 upland game regulations pamphlet (IDFG 2002a), the IDFG notified the public that northern and southern Idaho ground squirrels were protected from shooting. Yensen (1998) suggested that the impact of recreational shooting on populations of southern Idaho ground squirrels should be evaluated throughout its range.

Ground squirrels are sometimes considered pests by farmers and ranchers (Prescott and Yensen 1999). When available, alfalfa crops are one of the preferred food sources for southern Idaho ground squirrels, resulting in localized crop losses during years of high squirrel populations (Prescott and Yensen 1999). Badgers are often attracted to population sites of ground squirrels, where they dig large holes in the ground that can be dangerous to livestock (Prescott and Yensen 1999). Efforts to control ground squirrel populations are frequently undertaken regardless of species and most often include shooting or poisoning. Control efforts can adversely affect population sites of southern Idaho ground squirrels (Yensen 1998, Prescott and Yensen 1999, Yensen 2000). In fact, the population site known to contain the greatest number of southern Idaho ground squirrels is located at the Rolling Hills Golf Course, and has been subjected to control efforts in an attempt to exterminate the squirrels, although no control efforts have been conducted the past several years. Yensen (1998) suggested that use of pesticides associated with crop production and insect infestation may also play a role in the decline of this species.

Because the number of southern Idaho ground squirrels at occupied sites is generally small, a disease outbreak could have a severe effect (Moroz et al. 1995). Disease has been suggested as potentially contributing to the decline of southern Idaho ground squirrels (Prescott and Yensen 1999, Yensen 1999), though no epizootic infestation has been noticed in either subspecies of Idaho ground squirrel (Yensen et al. 1996, Yensen and Sherman 1997). Blood analyses to determine whether pandemic diseases are present have not been done. Plague, a contagious bacterial disease found in rodents, has not been identified in southern Idaho ground squirrels (Yensen et al. 1996). The disease is of particular concern, since once established, it could decimate the remaining small numbers of squirrels at occupied sites.

Predation has not been suggested as one of the causes of the southern Idaho ground squirrels' decline; however, predators can have a severe impact on prey populations that occur at critically low numbers. For example, badgers have been known to extirpate entire colonies of Washington ground squirrels (*Spermophilus washingtoni*) (Betts 1999). As with northern Idaho ground squirrels, one can assume that southern Idaho ground squirrels are preyed upon by many species including red-tailed hawks (*Buteo jamaicensis*), prairie falcons (*Falco mexicanus*), northern harriers (*Circus cyaneus*), badgers (*Taxidea taxus*), long-tailed weasels (*Mustela frenata*), and gopher snakes (*Pituophis melanoleucus*) (Yensen and Sherman 1997).

Competition with Columbian ground squirrels (*Spermophilus columbianus*) may constitute a threat to southern Idaho ground squirrels. The restricted range of Idaho ground squirrels occurs within the much wider range of the Columbian ground squirrel, and they occur sympatrically in some localities (Dyni and Yensen 1996). Southern Idaho ground squirrels are known to be limited by interspecific competition with Columbian ground squirrels (Moroz et al. 1995, Yensen and Sherman 1997, Haak 2000), including competition for burrow sites (Haak 2000) and food resources (Dyni and Yensen 1996). Where the two species occur sympatrically, Columbian ground squirrels occupy the more productive, mesic habitat with deeper soils (Yensen 1980, Dyni and Yensen 1996, Haak 2000).

Habitat destruction and fragmentation appears to have resulted in a distribution of relatively isolated population sites of southern Idaho ground squirrels. Isolation of these small populations may play a role in the decline of this species. For example, genetic evidence indicates that different populations of the northern subspecies are isolated enough to be genetically distinct from one another (Gavin et al. 1999, Yensen and Sherman 1997); this is likely to be the case for the southern subspecies as well. Small, isolated populations are more susceptible to natural disasters, catastrophic invasions of predators, parasites, or diseases, and suffer from loss of viability associated with genetic drift and inbreeding (Moroz et al. 1995, Gavin et al. 1999).

Effects

Construction, maintenance, and use of roads have the potential to impact southern Idaho ground squirrel through a number of mechanisms. Habitat can become inaccessible to individuals where roads function as a barrier to movement. Avoidance behavior can result in substantial amounts of suitable habitat being unavailable to these species. Further, such habitat loss can fragment populations into smaller subpopulations through loss of connectivity between populations, which can lead to demography fluctuations, inbreeding, loss of genetic variability, and local population extinctions (USFS 2000).

Where roads function as barriers to movement, travel, and dispersal, they can significantly alter population demographics and genetics of a species. Rico et al. (2007) found that whereas individual voles and mice were observed crossing narrow highways, wide highways served as complete barrier to movement, effectively separating populations on either side of the highway demographically. Increased habitat fragmentation between colonies could impact dispersal between these populations, which could lead to demographic consequences should such separation be maintained.

Roads facilitate human activities that could contribute to direct and indirect mortality. Given the isolated nature of existing southern Idaho ground squirrel colonies and the relatively low population numbers, loss of just a few individuals, particularly adult breeding females, may have demographic consequences (Sherman and Runge 2002).

Determination of Effects on Southern Idaho Ground Squirrel

The project types proposed under this PBA are *likely to adversely affect* the southern Idaho ground squirrel.

Rationale for Determination - Road construction and maintenance have the potential to adversely affect the southern Idaho ground squirrel. Adverse effects might occur due to short-term habitat degradation or increased chance for mortality where roads are constructed. At the project level, all activities that include excavation or disturbance outside of the roadway prism and within occupied habitat or potentially suitable habits will be subject to the following BMPs, which are designed to avoid or minimize adverse effects to the species.

- Determine if a project is within or near known occupied southern Idaho ground squirrel sites or suitable habitat. Southern Idaho ground squirrel occurrence is dynamic across the landscape, and this distribution likely will change over time.
- As of 2001, the known range of the southern Idaho ground squirrel occurs within an approximately 518,000-acre area extending from Emmett, Idaho northwest to Weiser, Idaho and the surrounding area of Squaw Butte, Midvale Hill and Henley Basin in Gem, Payette and Washington counties (Yensen 1991).
- Its range boundary on the south is the Payette River. It is bounded on the west by the Snake River and on the northeast by lava flows with little soil development (Yensen 1991)
- Conduct project-specific presence/absence surveys for southern Idaho ground squirrel within occupied sites or suitable habitat prior to any ground-disturbing activities. Surveys should follow the protocol established by the U.S. Fish and Wildlife Service and Idaho Department of Fish and Game, which specifies qualified individuals, timing, number of visits, weather considerations, etc. The prime survey periods are (1) shortly after adult/yearling emergence in spring when squirrels are breeding and not obscured by growing vegetation (beginning late January and early February at lower elevations and adjusted accordingly by elevation and snow pack), and (2) after pup emergence in summer (beginning mid to late April at lowest elevations). Coordination with the Idaho Department of Fish and Game is helpful prior to conducting surveys.
- At locations determined to be occupied (from project-specific surveys), schedule construction activities to reduce conflicts. Projects that involve excavation (e.g., working beyond the existing roadway, replacing culvers, widening, etc.) at or near occupied sites should be scheduled after pups have emerged and before adults retreat below ground to hibernate. This window occurs early June through first week of July at lower elevations and is adjusted accordingly for higher elevations.
- At locations determined to be occupied, monitor squirrel behavior during construction using a qualified individual. On-site monitoring during construction allows for adaptive modifications.
- At locations determined to be occupied, restrict indiscriminate parking of vehicles and heavy machinery to existing disturbed areas. Conduct clearance surveys to designate parking and staging areas. Vegetated road edges should be avoided.
- Conduct presence/absence surveys at material source sites and waste sites associated with projects if these locations occur in modeled habitat.

3.29 Yellow-billed cuckoo (Coccyzus americanus)

Species Description and Life History

The cuckoo is a medium-sized bird of about 12 inches in length, and weighing about 2 oz. The species has a slender, long-tailed profile, with a fairly stout and slightly down-curved bill, which is blue-black with yellow on the basal half of the lower mandible. Plumage is grayish-brown above and white below, with rufous primary flight feathers. The tail feathers are boldly patterned with black and white below. The legs are short and bluish-gray, and adults have a narrow, yellow eye ring. Juveniles resemble adults, except the tail patterning is less distinct, and the lower bill may have little or no yellow.

Males and females differ slightly. Males tend to have a slightly larger bill, and the white in the tail tends to form oval spots, whereas in females the white spots tend to be connected and less distinct (Hughes 1999). Mated males have a distinctive “kowlp” call, which is a loud, nonmusical series of notes about 2–3 seconds long which slows down and slurs toward the end. Unmated males use a separate call, which is an indeterminate series of soft notes ‘‘coocoo- coo-coo.’’ Both members of a pair may give the ‘‘knocker’’ call, which is a harsh, rattled, series of notes (Hughes 1999). Clutch size is usually two or three eggs, and development of the young are very rapid, with a breeding cycle of 17 days from egg-laying to fledging of young. Although cuckoos usually raise their own young, they are facultative brood parasites, occasionally laying eggs in the nests of other cuckoos or other bird species (Hughes 1999).

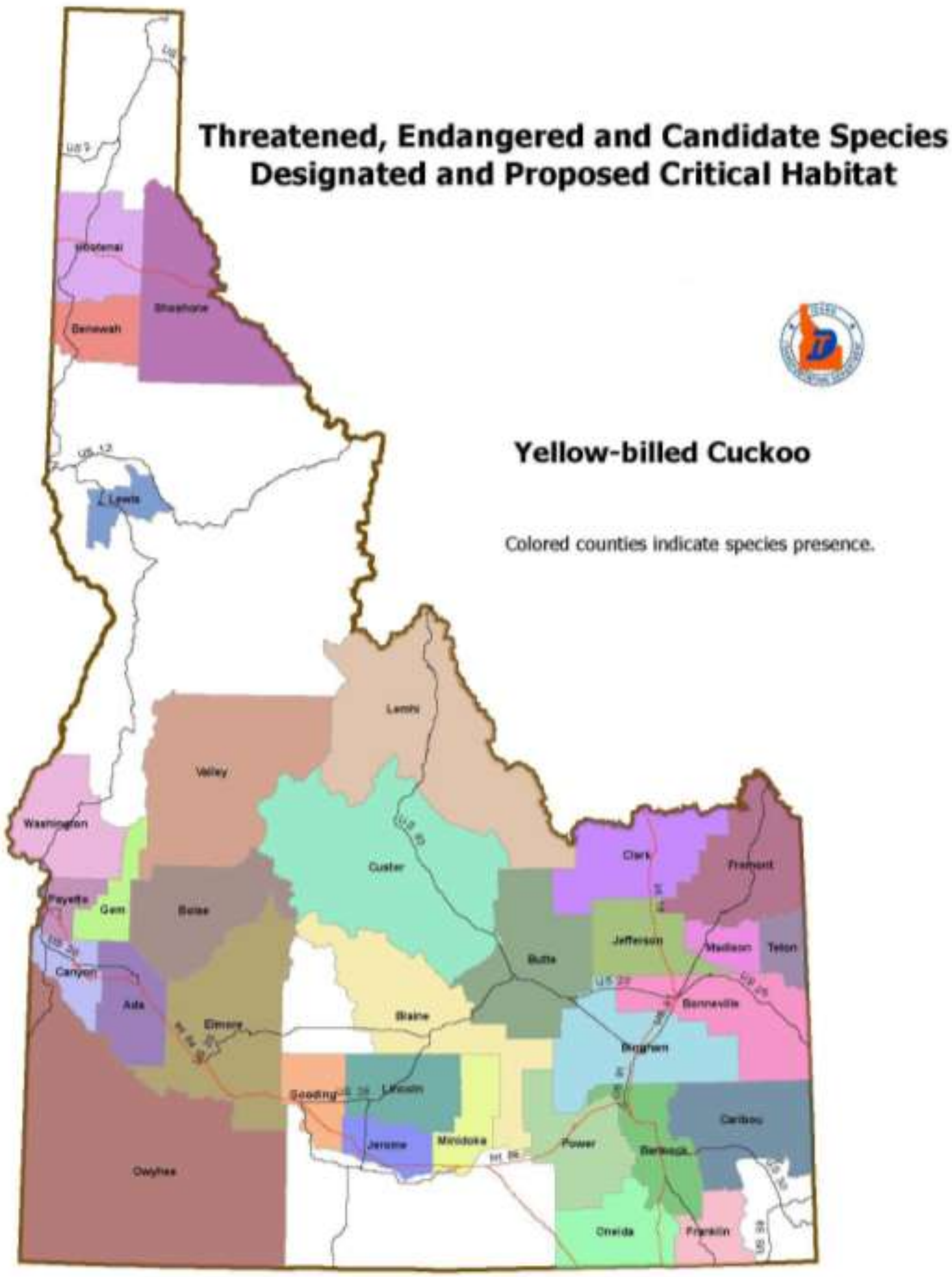
The cuckoo winters in South America (DeSchauensee 1970) and typically arrives on its western U.S. breeding ground in late June or early July (Phillips et al. 1964, Ryser 1985). The cuckoo (Coccyzus americanus) is a member of the avian family Cuculidae and order Cuculiformes. The approximate 128 members of Cuculidae share the common feature of a zygodactyl foot, in which two toes point forwards and two toes point backwards. Six species of Cuculidae breed in the U.S.; two of these species breed west of the Continental Divide – the yellow-billed cuckoo and the greater roadrunner.

Range

The western distinct population segment (DPS) is described as the area west of the crest of the Rocky Mountains (66 FR 38611). For the northern tier of Rocky Mountain states (Montana, Wyoming, and northern and central Colorado), the crest coincides with the Continental Divide. In the southern Colorado and New Mexico, the crest coincides with the eastern boundary of the upper Rio Grande drainage, including the Sangre de Cristo Mountains and excluding the drainage of the Pecos River. In west Texas the DPS boundary is the line of mountain ranges that form a southeastern extension of the Rocky Mountains to the Big Bend area of west Texas, and which form the western boundary of the Pecos River drainage. The DPS for the yellow-billed cuckoo is based primarily on the first of the two conditions cited above; the population segment is markedly separated from other populations. In addition, the northern and southern boundaries of the proposed DPS are the international boundaries with Canada and with Mexico since the DPS policy allows the USFWS to delimit the boundaries of a DPS along international boundaries.

The cuckoo was once common in riparian habitat throughout the western U.S. The original breeding range extended from interior California (formerly north to western Washington and southwestern British Columbia), southern Idaho, Wyoming and south through California (AOU 1998). Most records of nesting yellow-billed cuckoos are from the southwestern states of

California, Arizona, and Colorado (Roberson 1980). The yellow-billed cuckoo was formerly a very rare summer visitor in western Washington, especially in the Puget Sound area (Roberson 1980). In recent years, the range of the yellow-billed cuckoo has contracted in the western U.S. (AOU 1998). Most current records of nesting yellow-billed cuckoos are from the southeastern states of California, Arizona, and Colorado (Roberson 1980). The cuckoo over-winters from northern South America to northern Argentina.



In Idaho, the species was considered a rare and local summer resident (Burleigh 1972), with only three records for the state over the previous 100 years. In northern and central Idaho, there have only been four records of yellow-billed cuckoo over the last century (Taylor 2000). The most recent record for this area comes from the South Fork of the Snake River in 1992 (Stephens and Sturts 1997). In southwestern Idaho, the yellow-billed cuckoo has been considered a rare, sometimes erratic, visitor and breeder in the Snake River valley. Numerous sightings have been recorded in the southwestern part of the state during the past 25 years. The yellow-billed cuckoo appears to have a precarious existence in Idaho and could easily become extirpated from the state in the near future. Available information is inadequate to judge population or distributional trends. The breeding population in Idaho is likely limited to a few breeding pairs at most. A recent survey of yellow-billed cuckoo continues to show the majority of sightings are in the Snake River corridor in southeast Idaho with few or no sightings in other areas where the cuckoo has been historically observed (Reynolds 2004).

Habitat

Western cuckoos breed in large blocks of riparian habitats (particularly woodlands with cottonwoods and willows), while eastern cuckoos breed in a wider range of habitats, including deciduous woodlands and parks (Ehrlich et al. 1988). Dense understory foliage appears to be an important factor in nest site selection, while cottonwood trees are an important foraging habitat in areas where the species has been studied in California (Laymon et al. 1993).

Cuckoos nest in deciduous woodlands associated with wetlands or streams. The cuckoo is dependent on the combination of a dense willow understory for nesting, a cottonwood overstory for foraging, and large patches of habitat ranging from 10 acres (Gaines and Laymon 1984) to in excess of 20 acres (Laymon et al. 1989). Nest sites are constructed in branches about 4 to 15 ft above the ground in shrubs or and other vegetation (Dillinger 1989).

Western cuckoos appear to require large blocks of riparian habitat for nesting. Along the Sacramento River in California, nesting cuckoos occupied home ranges that included 25 acres or more of riparian habitat (Gaines 1974, Laymon et al. 1993). Another study on the same river found riparian patches where cuckoo pairs averaged 99 acres (Halterman 1991). Home ranges in the South Fork of the Kern River in California averaged about 42 acres (Laymon et al. 1993). Nesting densities ranging from 1 to 15 pairs per 99 acres were estimated in a New Mexico study (Howe 1986), and three plots in Arizona had densities ranging between 8.2, 19.8, and 26.5 pairs per 99 acre (Hughes 1999). Nesting west of the Continental Divide occurs almost exclusively close to water, and biologists have hypothesized that the species may be restricted to nesting in moist river bottoms in the west because of humidity requirements for successful hatching and rearing of young (Hamilton and Hamilton 1965, Rosenberg et al. 1991). Nesting peaks later (mid-June through August) than in most co-occurring bird species, and may be triggered by an abundance of the cicadas, katydids, caterpillars, or other large prey which form the bulk of the species' diet (Hamilton and Hamilton 1965, Rosenberg et al. 1991). The species is inconspicuous on its breeding range, except when calling to attract or to contact mates.

Western cuckoos have historically occurred and/or still occur in several distinct ecoregions including the Great Basin, Sonoran and Mohave deserts, northern Pacific Rainforest, northern Rockies, southern Rockies/Colorado Plateau, coastal California, and Sierra Madre Occidental ecoregions (Graham 1992, U.S.NABCI 2000, Pashley et al. 2000). While these western ecoregions differ in many respects, they are joined by common factors, which also distinguish them from most eastern ecoregions within which cuckoos occur. Foremost among these is the fact that western cuckoo populations, and the vast majority of cuckoos, occur along narrow and patchy riparian corridors that provide relatively suitable moist deciduous woodlands within arid landscapes otherwise dominated by vegetation types unable to support cuckoos. By contrast, east of the Rocky Mountains, the cuckoo occurs in extensive bottomland forests in the Mississippi River and other drainages, as well in deciduous woodlands in non-riparian situations, including deciduous forests such as oak hickory forests, parks, and some suburban areas (Wilson 1999, Amundson et al. 2000).

Threats

The U.S. Fish and Wildlife Service (66 FR 38611) describes declines in western cuckoo populations being attributed to loss of willow and cottonwood forests in which the cuckoo nest. Grazing, dams, flood control, and urban and agricultural development have had an impact on the cuckoo's primary habitat, riparian forests. The current distribution of the western cuckoo is comprised of isolated population groups that would be susceptible to extirpation.

While the cuckoo is still relatively common east of the crest of the Rocky Mountains, biologists estimate that more than 90 percent of the bird's riparian (streamside) habitat in the West has been lost or degraded. These modifications, and the resulting decline in the distribution and abundance of cuckoos throughout the western states, is believed to be due to conversion to agriculture; grazing; competition from non-native plants, such as tamarisk; river management, including altered flow and sediment regime; and flood control practices, such as channelization and bank protection. Based on non-imminent threats of a high magnitude, the USFWS assigned a listing priority number of 6 to this DPS of cuckoo (66 FR 38611).

Principal causes of riparian habitat losses are conversion to agricultural and other uses, dams and river flow management, stream channelization and stabilization, and livestock grazing. Available breeding habitats for cuckoos have also been substantially reduced in area and quality by groundwater pumping and the replacement of native riparian habitats by invasive non-native plants, particularly tamarisk (Groschupf 1987, Rosenberg et al. 1991). Estimates of riparian habitat losses include 90-95 percent for Arizona, 90 percent for New Mexico, 90-99 percent for California, and more than 70 percent nationwide (Ohmart 1994). Much of the remaining habitat is in poor condition and heavily affected by human use (Almand and Krohn 1978). Fragmentation effects include the loss of patches large enough to sustain local populations, leading to local extinctions, and the potential loss of migratory corridors, affecting the ability to recolonize habitat patches (Hunter 1996).

Another likely factor in the loss and modification of the cuckoo is the invasion by the exotic tamarisk (Tamarisk sp.). Tamarisk was introduced into western North America from the Middle East in the late 1800s as an ornamental windbreak and for erosion control. It has spread rapidly along southwestern watercourses, typically at the expense of native riparian vegetation, especially cottonwood/willow communities. Although tamarisk is present in nearly every southwestern riparian community, its dominance varies. It has replaced some communities entirely, but occurs at a low frequency in others. The spread and persistence of tamarisk has resulted in significant changes in riparian plant communities. In monotypic tamarisk stands, the most striking change is the loss of community structure. The multi-layered community of herbaceous understory, small shrubs, middle-layer willows, and overstory deciduous trees is often replaced by one monotonous layer. Plant species diversity has declined in many areas and relative species abundance has shifted in others. Other effects include changes in percent cover, total biomass, fire cycles, thermal regimes, and perhaps insect fauna (Kerpez and Smith 1987, Carothers and Brown 1991, Rosenberg et al. 1991, Busch and Smith 1993). The yellow-billed cuckoo is considered very vulnerable to tropical deforestation on its wintering grounds (Morton 1992), and while losses of neotropical forests and woodlands have been substantial and ongoing, particularly in Central America and northern South America (Hartshorn 1992, Brown and Lomolino 1998), the relationship between over-wintering habitat and yellow-billed cuckoo populations has not been studied.

Predation is also a potential threat to the cuckoo. Adults have been preyed upon by falcons (Hector 1985), and nestlings have been taken by hawks, jays, grackles (Quiscalus quiscala) (Nolan and Thompson 1975, Launer et al. 1990) and by various snake and mammal species (Nolan 1963). In eastern Mexico, adults are frequently attacked by raptors during migration (Wilson 1999). From a study done by Wilson on 252 nests of yellow-billed cuckoos in Arkansas, predation accounted for 91 percent of all nest failures, with small mammals, birds, and reptiles depredating the greatest proportion (Wilson 1999).

In addition to destruction and degradation of riparian habitats, pesticides may affect cuckoo populations (Groschupf 1987, Hughes 1999), although the evidence is too limited to evaluate this effect. It warrants further study. In areas where riparian habitat borders agricultural lands, e.g., in California's central valley, pesticide use may indirectly affect cuckoos by reducing prey numbers, or by poisoning nestlings if sprayed directly in areas where the birds are nesting (Laymon and Halterman 1987a). Accumulation of chlorinated hydrocarbon pesticides, particularly dichlorodiphenyltrichloroethylane (DDT), has affected other bird species, particularly top predators (Robinson and Bolen 1989). Pesticides may affect behavior (e.g., loss of balance) or cause death by direct contact. Laymon (1980) reported sublethal poisoning of young caused by spraying active nests in walnut orchards. Pesticide use may also contaminate preferred prey items, particularly lepidopteran larva, other invertebrates and food sources next to areas adjoining agricultural land (Laymon and Halterman 1987a).

Although DDT use has been banned in the United States since 1972, cuckoos may be exposed to DDT on wintering grounds where DDT use has not been banned. Analysis of two eggs collected in California in 1979 showed very low levels of dichlorodiphenyldichloroethylene (DDE), a stable metabolite of DDT, but eggshell fragments collected in 1985 from three nests along the South Fork of the Kern River in California averaged 19 percent thinner than pre-DDT era eggshells (Laymon and Halterman 1987b). DDT has caused eggshell thinning in other bird species, but its role in the Kern River observations is unknown.

Effects

The primary threat to the western yellow-billed cuckoo is the alteration of riparian ecosystems due to grazing, the spread of exotics (e.g., tamarisk), and dams and levees. Road construction and maintenance is not considered a primary threat to the species.

Road construction and maintenance do have the potential to impact individuals depending on their nature, timing, and location. For example, construction and maintenance of roads can facilitate increased human disturbance into wildlife habitat, including the riparian corridors inhabited by cuckoos. Possible adverse effects to yellow-billed cuckoo could occur from activities such as vegetation treatments, and noxious and invasive weed infestations. Surface disturbing activities that could result in soil compaction and loss of vegetative cover, and therefore reduced infiltration and increased runoff and sedimentation of surface waters, could affect yellow-billed cuckoo. Invasion of non-native species into cuckoo habitat can be a risk factor to the species if it occurs at a large scale. Herbicide treatments could affect the cuckoo's that occur on public lands. Dermal contact with foliage sprayed by pesticides could also affect the cuckoo.

Determination of Effects on the Yellow-Billed Cuckoo

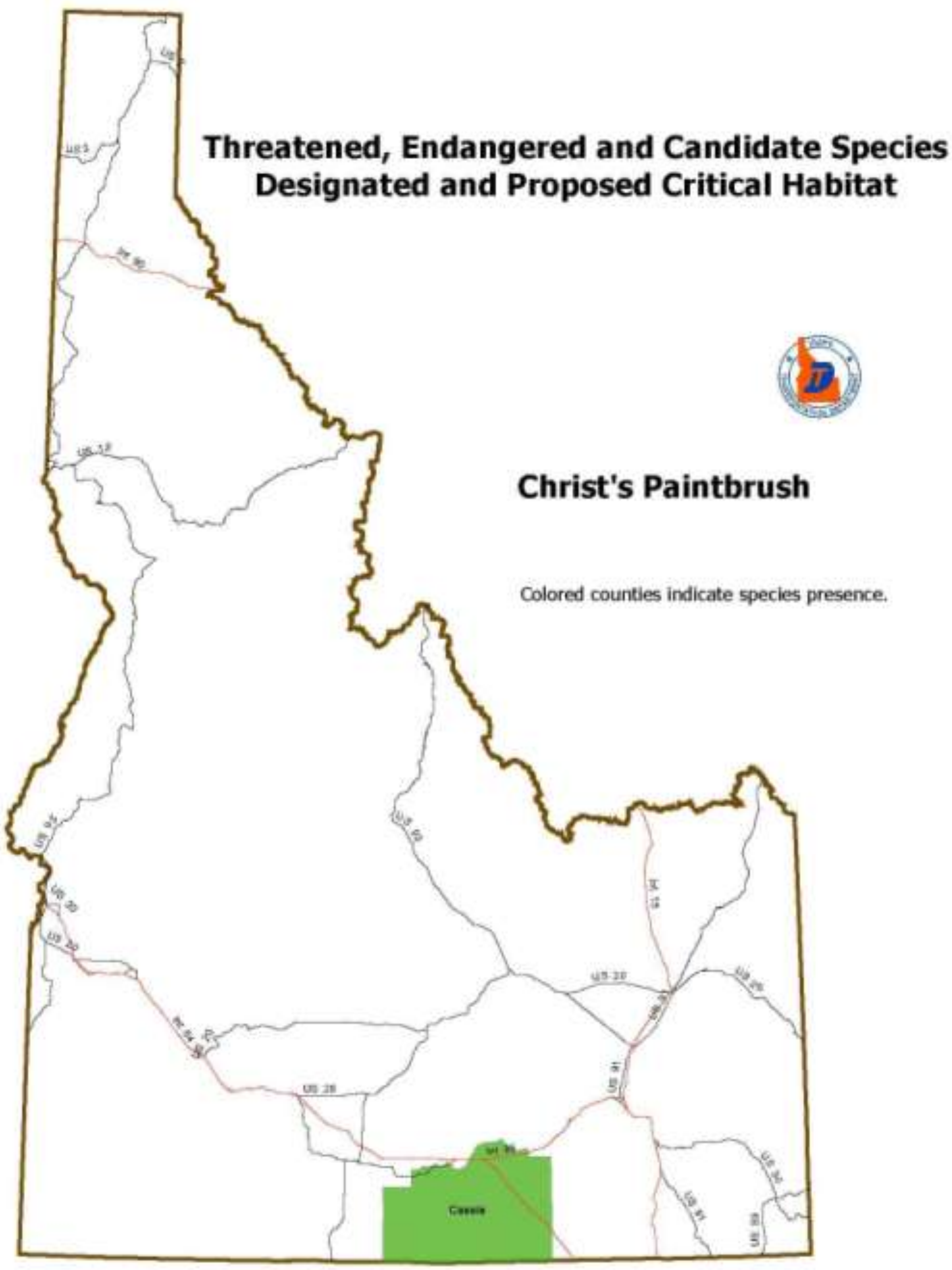
The project types proposed under this PBA *may affect, but are not likely to adversely affect* the yellow-billed cuckoo.

Rationale for Determination – The activities discussed in this PBA would not substantially reduce the availability of nesting, perching, or foraging habitat for the cuckoo. Because the majority of the state is not within the species range distribution and it is uncertain whether the cuckoo is a regular breeding resident in the state of Idaho, the proposed project types would not likely have a long-term adverse impact on this federal candidate species as long as the BMPs are incorporated into the project as stated in this programmatic PBA.

3.30 Christ's Indian paintbrush *(Castilleja christii)*

Species Description and Life History

Christ's Indian paintbrush is currently a candidate for listing under the Endangered Species Act and is on the USFWS Notice of Review List. *Castilleja christii* is a sensitive plant species on the Regional Forester's Sensitive Plant List for the Intermountain Region. The U.S. Fish and Wildlife Service and USDA Forest Service signed a Candidate Conservation Agreement for Castilleja christii in 2005, outlining 10 years of conservation actions for this rare species.



Christ's Indian paintbrush is a perennial forb 6 to 20 in. tall, and is a striking yellow-to-yellow-orange color. The plant grows best in moist, subalpine meadows. It reproduces by seed, and plant growth begins around snowmelt, leading to peak flowering from July to mid-September. Only one population of this plant is known to exist in the world. This single population occurs on Mount Harrison, a gently sloping mountaintop at the north end of the Albion Mountains in south central Idaho (managed by the Sawtooth National Forest). The species is currently threatened primarily by smooth brome (Bromus inermis), an invasive grass species that is found within the population. The Forest Service and the U. S. Fish and Wildlife Service entered into a 10-year agreement in 2005 to work together on the conservation of this species.

Effects

Christ's Indian paintbrush is one of Idaho's rarest plants. It is found in a single population at Mount Harrison in the Sawtooth National Forest in the Albion Mountains of Cassia County, Idaho. This location is several miles away from any roads administered by the Idaho Transportation Department. Road construction and maintenance is not considered a primary threat to the species.

Determination of Effects on Christ's paintbrush

The proposed actions by ITD will have *no effect* on this isolated population of Christ's Indian paintbrush due to its distance from ITD administered roads.

Rationale for Determination –ITD's roads are at a lower elevation than the habitat for Christ's Indian paintbrush. There are no ITD-administered roads within any habitat or potential habitat for Christ's Indian paintbrush.

3.31 Columbia spotted frog *(Rana luteiventris)*

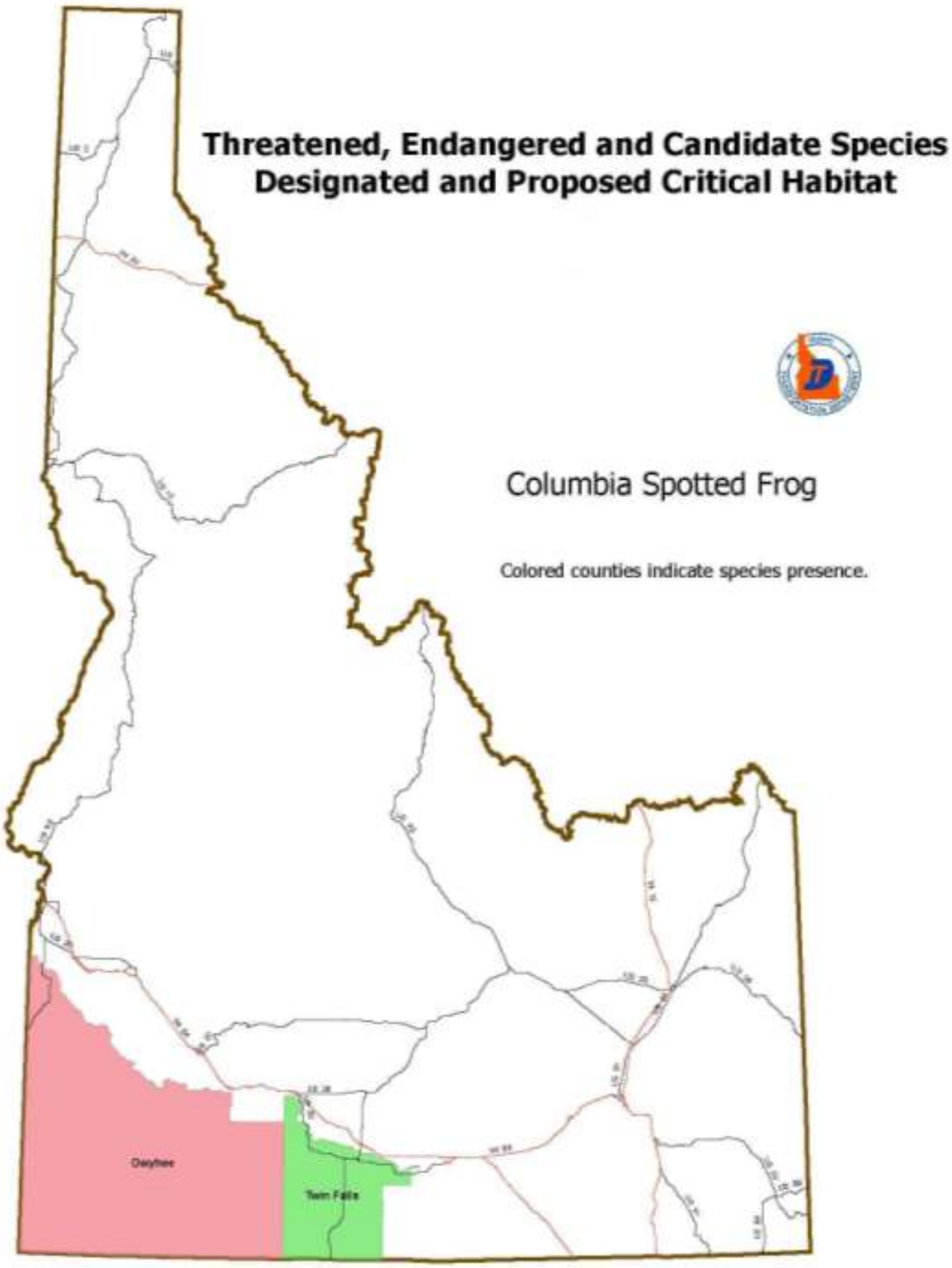
Species Description and Life History

Populations of the Columbia spotted frog (*Rana luteiventris*) are found from Alaska and British Columbia to Washington east of the Cascades; eastern Oregon, Idaho, the Bighorn Mountains of Wyoming, the Mary's, Reese, and Owyhee river systems of Nevada; the Wasatch Mountains, and the western desert of Utah (Green et al.1997). Genetic evidence (Green et al.1997) indicates that Columbia spotted frogs may be a single species with three subspecies, or may be several weakly differentiated species. The USFWS currently recognizes four populations based on disjunct distribution: Northern, Great Basin, Wasatch, and West Desert. Columbia spotted frogs are believed to be abundant within the northern population of the species' range from Alaska to Wyoming (Gomez 1994). The other three disjunct populations (Great Basin, Wasatch, and West Desert) received candidate status in 1993 based on the loss of subpopulations in a number of areas in Nevada. The Great Basin population is distributed in isolated patches from eastern Oregon, through southwest Idaho, and into Nevada. At that time, the Great Basin population was given an Endangered Species Act listing priority of nine; in 2001 the priority was raised to 3 (the highest listing rank possible for a subspecies), based upon the discovery of *Chytridiomycosis* in the Owyhee subpopulation, declining numbers, and the imminence of threats. The Columbia spotted frog is known to occur in Owyhee and Twin Falls counties, Idaho. The USFWS, in its 1993 Federal Register notice which presented a "warranted but precluded" finding on whether to list spotted frogs under the ESA, suggested that spotted frog populations south of the Snake River plain should be managed in a way similar to other disjunct populations that are in decline. As of 2001, the Idaho Conservation Data Center had recorded 51 element occurrences for Great Basin population of Columbia spotted frogs: one was extirpated, presence was not verified at five, and 20 had five or fewer frogs observed at the most recent survey (ICDC 2000).

The largest known threat to spotted frogs is habitat alteration and loss, specifically loss of wetlands used for feeding, breeding, hibernating, and migrating. Reduction or loss of habitat can be attributed at least in part to recent drought conditions, spring developments, livestock impacts on wetlands, water diversions, road construction, dam construction, fire, and loss of native beavers. Other threats include predation by nonnative species and diseases. These threats, most of which are anthropogenic in nature, are likely playing a role in the decline of spotted frogs (Munger 2003).

Range

Today, Columbia spotted frogs of the Great Basin Population occur at remnant, isolated, higher elevation sites in Nevada, southwestern Idaho, and eastern Oregon. Historically, the range of the Great Basin Population included the Raft River and Goose Creek drainages, the lower portions of which occur in Cassia County and the Owyhee Mountains in Owyhee County in southern Idaho. Recent surveys conducted in the Raft River and Goose Creek drainages in Idaho failed to locate spotted frogs (Reaser 1997). In 1994 and 1995 the Bureau of Land Management (BLM) conducted surveys in the Jarbidge and Snake River Resource Areas in Twin Falls County, Idaho. These efforts were also unsuccessful in locating spotted frogs (McDonald 1996). Frogs were found in Bear Creek and Shack Creek in 1997 and 2001.



Prior to 1993, spotted frog occurrence in the Owyhee Mountain range of southwestern Idaho was only recorded for six historical sites (Munger et al.1996). However, extensive BLM-funded surveys since 1993 have led to a substantial increase in the number of sites in southwest Idaho known to be occupied by spotted frogs. Although these surveys increased the available information regarding known species locations, most of these sites support small numbers of frogs. Of the approximately 52 known element occurrences in 2005, fewer than 10 frogs were observed at 37 sites at last observation. Monitoring at 10 of the 52 occupied sites since 1997 indicates a general decline in the number of adult spotted frogs encountered (Engle and Munger 2000, Munger and Lingo 2003). All known local populations in Owyhee County appear to be functionally isolated (Munger and Lingo 2003).

Habitat

Spotted frogs live in spring seeps, meadows, marshes, ponds and streams, usually where there is abundant vegetation. They often migrate along riparian corridors between habitats used for spring breeding, summer foraging, and winter hibernation. Springs, cutbanks, and willow roots provide quality habitat for hibernacula that are well-oxygenated and stable in temperature. U.S. 93 in southern Twin Falls County does not have any of this type of habitat within the Idaho Transportation Department right-of-way.

Past studies have shown that frogs require habitat components serving four major life-history needs: hibernating, breeding, foraging, and migrating (IDFG et al.1995, Munger 2003, Munger and Lingo 2003).

First, hibernacula with oxygenated water and sufficient interstitial spaces for frogs to seek protection are required for successful overwintering. Munger (2003) observed that five types of hibernacula may be used by Columbia spotted frogs: undercut banks, spring openings, the interior of beaver dams, water-flooded burrows associated with Geyer's willow, and the bottoms of ponds (See also IDFG et al.1995). Bull and Hayes (2000) found that overwintering patterns were linked to local environmental variations and observed overwintering at aquatic sites.

Second, successful frog breeding requires sites that have sufficient water to allow young to complete the larval phase. After emergence, adults move to breeding areas in the enrolled land area, and beyond. Breeding usually occurs in pooled water (*e.g.*, oxbows, lakes, stock ponds, beaver-created ponds, springs, seeps in wet meadows, and stream-side channels) with floating vegetation and some emergent vegetation (IDFG et al.1995, Reaser 1997).

Successful egg production and the viability and metamorphosis of spotted frogs are susceptible to habitat variables such as water temperature, water depth, pH, desiccation, overhanging vegetation, and the presence/absence of nonnative fishes and bullfrogs. Nonnative species are not known to be a threat at Sam Noble Springs (Munger et al.1996). Breeding and egg deposition may take place as early as late March and tadpoles 15 hatch through May. Columbia spotted frogs may transform from tadpoles to frogs from June through the end of the summer season (Engle 2001). Following breeding, frogs may remain at the same site or move to other feeding areas. Frogs require shallow pond margins and moist areas with vegetative cover for feeding habitat. Frogs forage in the wet meadow and along the margins of the ponds (Engle 2001).

Frogs need movement corridors containing water and vegetatative cover for safe travel among required habitat components. Breeding areas may be located hundreds of meters away from overwintering sites, thus the ability to move between breeding and hibernation sites is critical. The wet meadows and associated watercourses serve as dispersal corridors and are important for short-distance seasonal migrations on the enrolled lands (Engle 2001).

Determination of Effects on Columbia spotted frog

The proposed actions by ITD will have *no effect* on the Columbia spotted frog.

Rationale for Determination – The Great basin population of the Columbia Spotted Frog is found at higher elevation locations in ITD Districts 3 and 4. The Great Basin population is found in eastern Oregon, southwestern Idaho, and Nevada. In Idaho, it occurs in the mid-elevations of the Owyhee uplands and in southern Twin Falls County. While the slower flowing portions of the Snake River and some of the springs in the vicinity of highways administered by the Idaho Transportation Department (the project area) may be functionally suitable as habitat, their proximity (40 miles to the north in Twin Falls County) to known populations of spotted frogs, along with the ITD highways settings in low elevations on the Snake River Plain rather than at mid elevations in the Owyhee uplands, renders the species likely absent from the area in districts 3 and 4.

The locations of known Columbia Spotted Frog – Great Basin populations are several miles away from any roads administered by the Idaho Transportation Department. The proposed actions by ITD would have *no effect* on the isolated populations due to the distance from the ITD administered roads. ITD’s roads are at a lower elevation than the habitat for Columbia Spotted Frog – Great Basin population. There are no ITD administered roads within any habitat for Columbia Spotted Frog – Great Basin population.

3.32 Goose Creek Milkvetch (*Astragalus anserinus*)

Species Description and Life History

The Goose Creek milkvetch is a low-growing matted perennial forb with grey hairy leaves, pink-purple flowers, and brownish-red curved seed pods. This species is distinguished from other similar milkvetch species by its smaller flowers and leaflets along with its color and the shape of the seed pods. Little scientific research has been conducted on this milkvetch but it is know that the species normally flowers from late May to early June and it is understood to be insect-pollinated. The longevity of this species is not well known and recent research from burned habitat in Nevada and Utah indicate large fluctuations in the number of individuals in a population between years with a doubling or halving of individuals in successive years (74 FR 46521). The wide fluctuations in numbers suggests the species is either short-lived or plants may remain dormant during some growing seasons.

Range

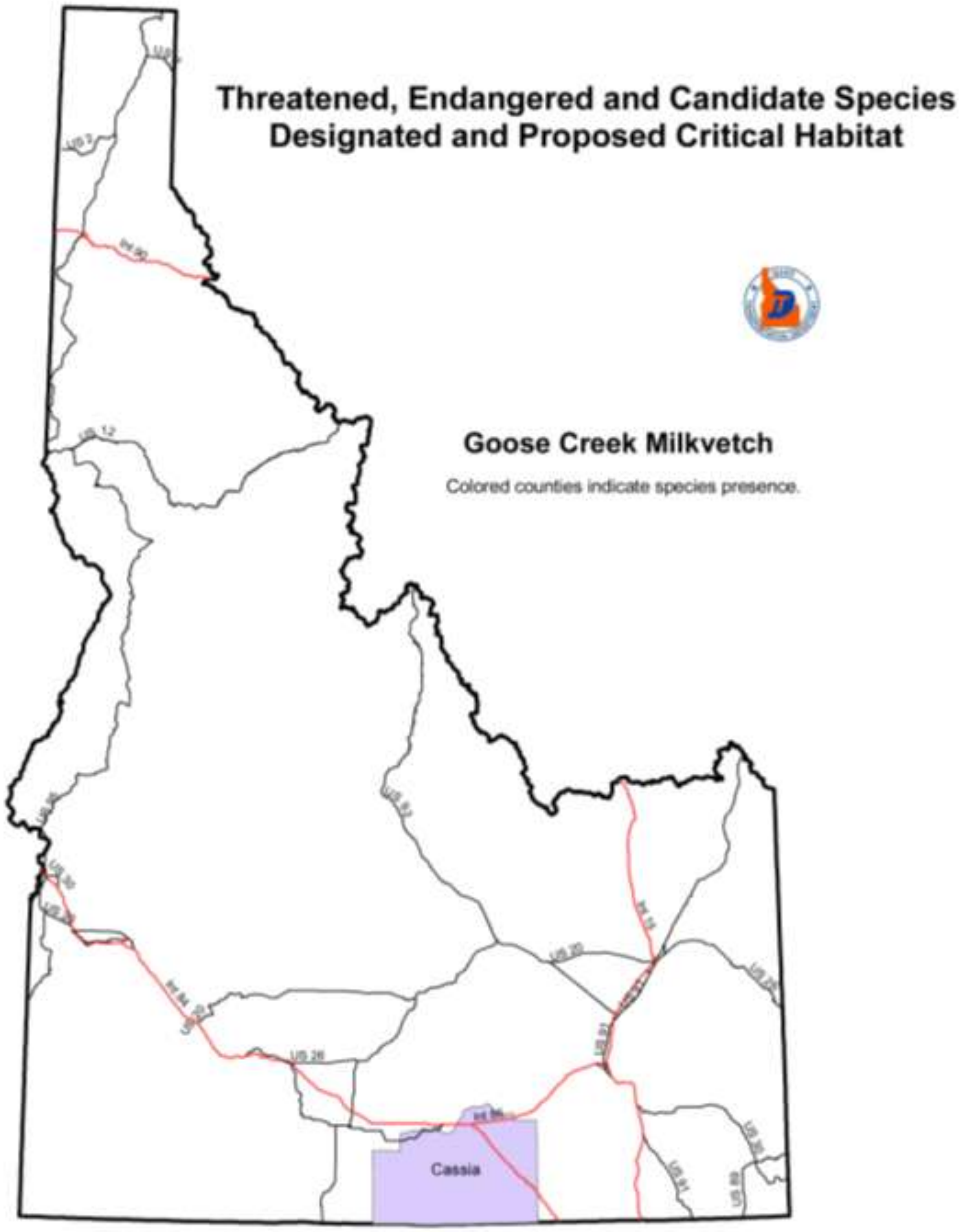
This plant is endemic to the Goose Creek drainage in Idaho (Cassia County), Nevada (Elko County), and Utah (Box Elder County). In Idaho, this plant is found in a ten square mile area of southern Cassia County. The Goose Creek milkvetch was first collected in Box Elder County, Utah in 1982. This species is currently known from occurrences in Idaho (5), Nevada (10), and Utah (4).

Habitat

The majority of sites where this species is found occur on federal lands managed by the BLM. The Goose Creek milkvetch is found in sparsely vegetated areas in sagebrush and juniper habitats. The plant is not normally found on north-facing slopes. Associated plant species where this plant has been found includes Wyoming big sagebrush, Utah juniper, green or yellow rabbitbrush, Sandberg's bluegrass and needle and thread grass. The species is known from soils containing volcanic ash and particulates found along Goose Creek near the Idaho, Utah, and Nevada border (74 FR 46521). The Goose Creek milkvetch regularly grows on slopes but has been found on flat sites with soil texture ranging from silty to sandy and gravelly. This plant has also been found growing on abandoned anthills. This milkvetch has been observed at elevations between 4,900 and 5,885 ft. Habitat of this plant varies from stable areas with minimal erosion to washes and steep slopes with heavy erosion.

Threats

The major threats to Goose Creek milkvetch include future habitat degradation and modifications to sagebrush-steppe habitat due to an altered wildfire regime; diminished recruitment capacity due to the 2007 wildfire that eliminated 53 percent of the individuals and burned 25 percent of occupied habitat; loss of additional individuals and diminished recruitment from future wildfires; and the effects from habitat competition from both seeded and unseeded non-native plant species. Other threats that may threaten this plant to a lesser degree include livestock use, recreation, mining, development, and inadequacy of regulatory mechanisms (74 FR 46521).



Effects

The primary threat to the Goose Creek milkvetch is habitat degradation to sagebrush-steppe habitat on federal lands, primarily BLM lands, from changed wildfire regime. Road and fire line construction and maintenance can destroy habitat and kill or injure individuals. Road construction and maintenance do have the potential to impact individuals depending on their nature, timing, and location. For example, construction and maintenance of roads can facilitate increase human disturbance into sagebrush-steppe habitat. Surface disturbing activities that could result in soil compaction and loss of vegetative cover and therefore reduced infiltration and increased runoff and sedimentation of surface waters could affect Goose Creek milkvetch.

The Goose Creek drainage in Idaho, Nevada, and Utah is found in a sparely populated area and the effects of development are relatively minor. This species occurs in an area that has few human-inhabited areas (fewer than 10) and few buildings. Documented effects of roads on small sections of the elemental occurrences have taken place, and construction of new roads and fire lines associated with the 2007 wildfire impacted some sites in Utah. Most of the land adjacent to Goose Creek is under private ownership and is under livestock pasture. Development pressures in this remote area have been few (74 FR 46521). There are no significant continuing effects to this species from existing roads or development and future development risks are low at this time.

Determination of Effects on Goose Creek milkvetch

The project types proposed under this PBA will have *no effect* on this species or its habitat.

Rationale for Determination – Goose Creek Reservoir is South of Oakley, Idaho and the only State Highway in the area is S.H. 27, which ends at Oakley. A gravel road running south towards Nevada and Utah runs along Goose Creek. Goose Creek milkvetch habitat does not occur along any state highways administered by ITD.

3.33 Bald and Golden Eagle Protection Act

The bald eagle is no longer listed under the Endangered Species Act and has recently been removed from the USFWS list. Bald eagles are still protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. At the time they were de-listed, the U.S. Fish and Wildlife Service provided National Bald Eagle Management Guidelines. The intent of the guidelines is to provide guidance on permitted activities and recommended timing of activities to ensure the continued viability of habitat for bald eagles.

The recommendations provided by the U.S. Fish and Wildlife Service in the National Bald Eagle Management Guidelines will be followed to help minimize impacts to bald eagles by avoiding disturbance, which is prohibited by the Bald and Golden Eagle Protection Act. During the breeding season, bald eagles are sensitive to a variety of human activities, but individual eagles react differently to human activities. The guidelines provide recommendations for avoiding disturbance by:

- Applying distance buffers
- Applying landscape buffers
- Avoiding some activities during the breeding season

ITD will make all attempts to follow distance and landscape buffers and avoidance of activities during the breeding season. ITD will follow the guidelines and provide a 660-ft buffer between maintenance activities and occupied nest sites during the breeding season. If ITD cannot provide a 660 ft buffer and believes that special circumstances apply that increase or diminish the likelihood of bald eagle disturbance, or if ITD cannot adhere to the guidelines, ITD will contact the USFWS in an effort to arrive at a reasonable solution.

Chapter 4: Baseline Descriptions

4.1 Baseline Description of the Action Area Watersheds for ESA-listed Aquatic Species

The "environmental baseline" includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). For projects that are ongoing actions, the effects of future actions over which the federal agency has discretionary involvement or control will be analyzed as "effects of the action."

The environmental baseline can be described in terms of the biological requirements for habitat features and processes necessary to support life stages of the ESA-listed species within the action area. When the environmental baseline departs from those biological requirements, the adverse effects of a proposed action on the ESA-listed species or its habitat are more likely to jeopardize the ESA-listed species or result in destruction or adverse modification of a critical habitat (NMFS 1999).

Biological requirements of salmon, steelhead, and bull trout

The biological requirements of salmon, steelhead and bull trout in the action area vary depending on the life history stage and natural range of variation present within that system. Generally, during spawning migrations, adult salmon require clean water with cool temperatures and access to thermal refugia, dissolved oxygen near 100 percent saturation, low turbidity, adequate flows and depths to allow passage over barriers to reach spawning sites, and sufficient holding and resting sites. Anadromous fish select spawning areas are based on species-specific requirements of flow, water quality, substrate size, and groundwater upwelling. Embryo survival and fry emergence depend on substrate conditions (e.g., gravel size, porosity, permeability, and oxygen concentrations), substrate stability during high flows, and, for most species, water temperatures of 55.4°F or less. Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting. Migration of juveniles to rearing areas—whether the ocean, lakes, or other stream reaches—requires access to these habitats. Physical, chemical, and thermal conditions may all impede movements of adult or juvenile fish.

Each ESA-listed fish species considered resides in or migrates through the action area. Thus, for this action area, the biological requirements for salmon, steelhead and bull trout are the habitat characteristics that would support successful spawning, rearing, and migration of the ESA-listed species considered in this document, and the Primary Constituent Elements for freshwater spawning sites, rearing sites and freshwater migration corridors associated with those species.

Effects of land management and development

In general, the environment for ESA-listed species in the referenced basins has been dramatically affected by the development and operation of the Federal Columbia River Power System. Storage dams have eliminated mainstem spawning and rearing habitat, and have altered the natural flow regime of the Snake and Columbia rivers, decreasing spring and summer flows, increasing fall and winter flow, and altering natural thermal patterns. The Federal Columbia River Power System kills (approximately 46 percent) or injures a portion of the smolts passing through the system (NMFS 2004a). Slowed water velocity and increased temperatures in reservoirs delays smolt migration timing and increases predation in the migratory corridor (NMFS 2004, Independent Scientific Group 1996, National Research Council 1996). Formerly complex mainstem habitats have been reduced to predominantly single channels, with reduced floodplains and off-channel habitats eliminated or disconnected from the main channel (Sedell and Froggatt 2000, Independent Science Group 2000, Coutant 1999). The amount of large woody debris in these rivers has declined, reducing habitat complexity and altering the rivers' food webs (Maser and Sedell 1994).

Other anthropogenic activities that have degraded aquatic habitats or affected native fish populations in the Snake River Basin include stream channelization, elimination of wetlands, construction of flood-control dams and levees, construction of roads (many with impassable culverts), timber harvest, splash dams, mining, water withdrawals, unscreened water diversions, agriculture, livestock grazing, urbanization, outdoor recreation, fire exclusion/suppression, artificial fish propagation, fish harvest, and introduction of non-native species (Henjum et al. 1994, Rhodes et al. 1994, National Research Council 1996, Spence et al. 1996, Lee et al. 1997, NMFS 2004). In many watersheds, land management and development activities have:

- reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands
- elevated fine sediment yields, degrading spawning and rearing habitat
- reduced large woody material that traps sediment, stabilizes stream banks, and helps form pools
- reduced vegetative canopy that minimizes solar heating of streams;
- caused streams to become straighter, wider, and shallower, thereby reducing rearing habitat and increasing water temperature fluctuations
- altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior
- altered floodplain function, water tables and base flows (Henjum et al. 1994, McIntosh et al. 1994, Rhodes et al. 1994, Wissmar et al. 1994, National Research Council 1996, Spence et al. 1996, and Lee et al. 1997).

Basins in action area

The action area covers 71 subbasins (fourth-level HUCs), encompassing all areas potentially affected directly or indirectly by this programmatic consultation. Because of the potential for downstream effects and cumulative effects within watersheds, the action area encompasses entire subbasins where listed species and designated critical habitat occur.

A general review of the environmental baseline has been divided up into six basins:

- Kootenai River Basin
- Pend Oreille River Basin
- Coeur d' Alene River Basin
- Clearwater River Basin

- Salmon River Basin
- Snake River Basin

4.11 Kootenai River Basin

Over two-thirds of the Kootenai River drainage lies within the province of British Columbia, Canada. The Kootenai River is the second largest tributary to the Columbia River and has an average annual flow of 14,150 ft^3/s, as measured near the Montana/Idaho border (USGS 1999). The total drainage area of the Kootenai River within the recovery unit boundaries in the United States is about 14,000 mi^2, about 80 percent of which is in Montana and 20 percent is in Idaho.

The Kootenai River Basin remains sparsely populated. Fewer than 100,000 people live within the drainage upstream of Kootenay Lake. About 90 percent of the Kootenai watershed is coniferous forest. A small amount is agricultural land, used mainly for pasture and forage production (Marotz et al. 1988). The forest products industry is the dominant industrial activity in the Kootenai River Basin. About 80 percent of the commercial timberland in the Kootenai River drainage within the United States is owned and managed by the federal government (Kootenai and Idaho Panhandle national forests).

The river originates in Kootenay National Park (near Banff, British Columbia) and enters Lake Koocanusa 42 mi north of the Montana border at an elevation of about 2,310 ft mean sea level. Libby Dam, which created Lake Koocanusa in 1972, is located 17 mi upstream of Libby, Montana (MBTSG 1996). Downstream of the dam, the river turns northwest and crosses the Montana/Idaho border near Troy, Montana, at the lowest elevation point in Montana (1,820 ft mean sea level). The river continues northwest across the Idaho panhandle and leaves the United States, reentering British Columbia just upstream of Kootenay Lake, at an elevation of 1,750 ft mean sea level.

The lower Kootenai River can be divided into two subreaches with different characteristics (Panhandle Bull Trout Technical Advisory Team 1998a). The underlying bedrock of the Kootenai River drainage downstream of Libby Dam consists primarily of belt series rock. Intrusions of igneous rock are scattered throughout the area, which has been highly influenced by glacial activity from both continental ice masses. The Kootenai River is free-flowing from Libby Dam over Kootenai Falls and about 80 mi to Bonners Ferry, Idaho. It is mostly constricted in a single channel located in a narrow canyon. This portion of the river has a substrate of gravel to large rubble, with some deep pools and bedrock shelves.

Downstream of the canyon, the character of the river changes dramatically. Immediately upstream of Bonners Ferry, there is a braided depositional zone extending nearly 6 mi (PBTTAT 1998a). The lower 47 mi of the Kootenai River within the United States meanders through the fertile Kootenai River bottomlands from Bonners Ferry to the international border. The water level is influenced by the elevation of Kootenay Lake in British Columbia, resulting in a relatively flat, slow-moving river with holes up to 100 ft deep. Because the floodplain is aggressively diked to protect agricultural lands, the natural pattern and flow regime of the valley bottom streams have been impacted. Many of the tributary streams that enter the Idaho section of the Kootenai River flow from hanging valleys over bedrock controls, with steep sections and impassable barriers. River substrate is primarily sand, silt, and clay. The river continues in this fashion for another 31.05 mi in British Columbia, to its confluence with the southern arm of Kootenay Lake.

Bull trout are one of six native salmonid species distributed throughout the Kootenai River drainage. Other native salmonids include westslope cutthroat trout; redband trout, of which there are two strains (Gerrards, which grow very large and are piscivorous, and residents, which are small and inhabit headwater streams); pygmy whitefish; and mountain whitefish (see the appendix for a complete list of fish species found in the recovery unit). Kokanee are also native to Kootenay Lake, and they spawned historically in some tributaries in Idaho, and perhaps Montana. The native salmonids share these waters with the Kootenai River population of white sturgeon, which was listed as endangered in 1994 under the Endangered Species Act.

It is not known whether Kootenai Falls was historically an upstream migration barrier to bull trout prior to the construction of Libby Dam. Speculation was that high spring flows may have allowed seasonal fish passage. Local bull trout populations in the Kootenai River downstream of Kootenai Falls were believed to include migratory adfluvial fish from Kootenay Lake in British Columbia, as well as fluvial Kootenai River fish that may have moved freely throughout the drainage. Recent evidence, collected by radio telemetry studies, indicates that bull trout can and do surmount the falls. This ability suggests that local populations of bull trout downstream of Libby Dam should all be considered one interconnected unit, and the USFWS has treated this area as one core area in this recovery plan. Resident bull trout may have been present historically in some drainages, and resident bull trout now occur in Libby Creek and possibly other sites.

4.12 Pend Oreille River Basin

The Clark Fork River originates at the confluence of Silver Bow and Warm Springs creeks in the Deer Lodge Valley of Montana and flows primarily in a northwesterly direction for about 350 river miles to its terminus at Lake Pend Oreille, Idaho. The Clark Fork River is Montana's largest river in terms of stream discharge, with an average annual stream flow of 22,230 $ft^{2/}s$ near Cabinet Gorge Dam near Clark Fork, Idaho, a few kilometers upstream of the mouth at Lake Pend Oreille. The total drainage area upstream of that point is 22,073 mi^2. Downstream of Lake Pend Oreille, the river is renamed the Pend Oreille River. The Pend Oreille River flows across the northeast corner of Washington for about 125 mi before joining with the Columbia River in southern British Columbia.

Lake Pend Oreille is the largest and deepest natural lake in Idaho (PBTTAT 1998b). It covered about 83,200 acres under natural conditions, and it now (post-impoundment by Albeni Falls Dam) has a surface area of about 94,720 acres (PBTTAT 1998b). The lake has more than 175 mi of shoreline, with mean and maximum depths of 538 ft and 1,152 ft, respectively. Nearly all of the waters currently accessible to bull trout from Lake Pend Oreille lie within the State of Idaho, including 9 mi of the Clark Fork River upstream to Cabinet Gorge Dam (PBTTAT 1998b).

About 95 percent of Lake Pend Oreille's volume is in the large, southernmost basin, a glacially influenced portion of the Purcell Trench (PBTTAT 1998b). Average hydraulic residence time in the southern basin is estimated to exceed 10 years (PBTTAT 1998b). The main body of Lake Pend Oreille never freezes.

Lake Pend Oreille is an oligotrophic (nutrient-poor) lake. Woods (1991) compared recent water quality data to historical data and reported that the pelagic (open-water) zone of Lake Pend

Oreille showed no major temporal changes in nutrient concentrations, chlorophyll concentrations, or Secchi disc water transparency depths since the early 1950s (PBTTAT 1998b). Nutrient concentrations in shoreline areas and in the northern basin of the lake are considerably higher because of urbanization and suspended sediments in Clark Fork River inflow.

Cabinet Gorge Dam, constructed in 1952, partially regulates flows in the Clark Fork River. The Settlement Agreement with the Federal Energy Regulatory Commission for licensing Cabinet Gorge Dam provides for a minimum flow of 5,000 $ft^{3/}s$. River flows are augmented by groundwater inflow, which contributes at least an additional 800 $ft^{3/}s$, below the dam (PBTTAT 1998b). Cabinet Gorge Dam is operated as a peaking facility. During low flow periods, daily releases typically vary from 5,000 $ft^{3/}s$ to about 20,000 $ft^{3/}s$ or more. This range may vary depending on availability of water and demand for electricity.

The Clark Fork River watershed upstream of Lake Pend Oreille includes most of western Montana and covers some 22,905 mi^2 (PBTTAT 1998b). Average annual river flow is approximately 22,230 $ft^{3/}s$. The river contributes approximately 92 percent of the annual inflow to the lake (PBTTAT 1998b) and most of the suspended sediment load.

The U.S. Army Corps of Engineers operates Albeni Falls Dam on the Pend Oreille River; the dam is located in Idaho near the Washington border. The Clark Fork River is renamed the Pend Oreille River as it exits the lake. This dam, also constructed in 1952, impounds 28 mi of the Pend Oreille River and regulates the lake's elevation between 2,051 ft mean sea level in winter and 2,062.5 ft mean sea level in summer.

The lower Priest River originates at the outlet of Priest Lake. The lower Priest River flows a distance of 45 river miles to its confluence with the Pend Oreille River at the City of Priest River. Major tributaries include the Upper West Branch and Lower West Branch Priest rivers and the East River.

Bull trout have been documented in the East River system and the lower Priest River downstream of Priest Lake. Based on the sizes of fish observed, speculations have been made that the bull trout in the East River are probably migrants from Lake Pend Oreille. East River bull trout may represent a rather unique population, whose adults migrate downstream from the main body of the lake into the Pend Oreille River arm, then up the Priest River system. Until genetic or radiotelemetry studies can confirm this, the lower Priest River fish will be treated as a local population of the Lake Pend Oreille core area. Tributaries to the lower Priest River were probably important historically for foraging and thermal refuge by adult and subadult bull trout.

Land ownership in the basins that are direct tributaries to Lake Pend Oreille is typically 75 to 98 percent U.S. Forest Service, with most of the remaining land in private ownership (PBTTAT 1998b). The exception is the Pack River drainage, which is 55 percent U.S. Forest Service land, 36 percent private land, 7 percent State of Idaho land, and 2 percent Bureau of Land Management land.

The Trestle Creek watershed enters Lake Pend Oreille from the Cabinet Mountains at the northern end of the lake. Trestle Creek is a 14,713-acre, third-order watershed that includes several smaller tributaries. Trestle Creek contains some of the highest-quality bull trout habitat remaining in the Lake Pend Oreille/lower Clark Fork River tributary system.

Lightning Creek is approximately 22 mi long and drains into the Clark Fork River 2.5 mi upstream of Lake Pend Oreille (PBTTAT 1998b). The Lightning Creek channel is unstable, and aerial photos from the 1930s suggest that lower Lightning Creek has shifted from a primarily single-channel stream to a highly braided stream with an increased width-to-depth ratio. A barrier falls is present on Lightning Creek near Quartz Creek. Bull trout spawn in the upper main stem of Lightning Creek below Quartz Creek, as well as in most major tributaries.

Pack River comprises the second largest watershed draining into Lake Pend Oreille. The Pack River Basin has more glacial fluvial deposits than any other basin in the watershed, and the underlying geology is largely granitic in origin. As a result, sand-sized sediment is the primary material that is eroded and transported in streams of this basin. The Pack River Basin supports diverse land uses and contains lands under private, state, and federal ownership. These uses, coupled with the Sundance fire in 1967, have negatively influenced habitat conditions for bull trout in Pack River (PBTTAT 1998b). Loss of riparian vegetation and associated root masses due to fire, salvage, timber harvesting, livestock grazing, or clearing reduces bank stability and results in delivery of fine sediment to the stream channel.

Grouse Creek is a fourth-order watershed with a drainage area comprising 31,352 acres. It is an important tributary to the Pack River watershed for bull trout. Grouse Creek flows from the western side of the Cabinet Mountains and drains west by southwest into the Pack River. A large portion of the Grouse Creek watershed lies within the “transient snow zone,” identified as lands within an elevation range that exhibits frequent rain-on-snow events, resulting in flooding. The transient snow zone in northern Idaho is estimated at 2,500 to 4,500 ft in elevation (PBTTAT 1998b).

Gold and North Gold creeks are adjacent drainages entering the southeast end of Lake Pend Oreille in close proximity to each other. Gold Creek is currently the second most important bull trout spawning stream in the watershed (after Trestle Creek), with an average of about 102 redds per year from 1983 to 1998 (LPOWAG 1999). Excess bedload (largely a result of the mining legacy), sediment, and a lack of large woody debris are considered to be the greatest limiting factors for bull trout habitat in the watershed. North Gold Creek has supported an average of about 30 redds per year and has been impacted by development of a homestead, which is now being reclaimed under U.S. Forest Service ownership. The creek has also been negatively impacted by past timber harvest activities.

Granite Creek is a large 16,712-acre watershed on the east side of Lake Pend Oreille. Bull trout habitat is patchy and has been affected by urban development in the floodplain, roads, and timber harvest. Sullivan Springs is a spring-fed tributary that enters Granite Creek about 0.6 mi upstream of the lake, and it is an important spawning stream for bull trout and kokanee salmon. Bull trout spawning activity in the drainage has been erratic, varying from no redds in 1992 to as many as 132 redds in 1997 (LPOWAG 1999).

Bull trout in the interconnected Lake Pend Oreille watershed appear to be entirely adfluvial (PBTTAT 1998b). Some fish make extensive spawning migrations into the larger tributaries beginning in March and April (PBTTAT 1998b). A fall migration also occurs (August and September) into the Clark Fork River (Pratt and Huston 1993) and other Lake Pend Oreille tributaries.

The entire Priest River Basin is 979 mi^2 in size (PBTTAT 1998c). The basin is primarily within the northwest corner of the Idaho Panhandle, within Bonner and Boundary counties. Approximately 24 mi^2 of the basin are in British Columbia, where the headwaters of the Upper Priest River originate in the Nelson Mountain Range. Headwaters of major tributaries on the western side of the basin are located in northeast Washington. The basin is flanked on the east and west sides by the Selkirk Mountain Range. Elevation within the basin ranges from 2,051 ft at low winter pool of Lake Pend Oreille (reservoir) behind Albeni Falls Dam to more than 7,000 ft within the Selkirk Mountains.

The lake complex is made up of Upper Priest Lake, a 2.7-mi connecting channel called the Priest River Thoroughfare, and Priest Lake. Priest Lake is the third largest natural lake that is entirely within Idaho and second largest in terms of volume. Water levels in the lakes and Priest River Thoroughfare are partially controlled by an outlet dam and structure at the southwest corner of the lower lake.

The climate in the Priest River watershed is transitional between a northern Pacific coastal type and a continental type (PBTTAT 1998c). July and August are the only distinct summer months, and temperatures are relatively mild because of the Pacific maritime influence (average daily summer maximums are around 28° C (82° F). Winter temperatures are also relatively mild compared with areas east of the Rocky Mountains. Annual precipitation (rain and melted snow) averages 32 in. at lake surface equivalent elevation. Average precipitation within the peaks of the Selkirk Mountains can reach 60 in. At elevations above 4,800 ft, snowfall accounts for more than 50 percent of total precipitation (PBTTAT 1998c). The wettest months are normally November, December, and January.

Upper Priest Lake has a surface area of 1,338 acres, a mean depth of 60 ft, and a volume of 80,000 acre-feet (PBTTAT 1998c). The lake has a short hydraulic residence time, about 3 months on average, and is heavily influenced by the major tributary, Upper Priest River. Lake level is controlled by the outlet dam on Priest Lake since the upper lake, connecting channel, and lower lake are all at the same elevation at summer pool. The main, or lower, Priest Lake has a surface area of 23,300 acres, a mean depth of 128 ft, and a volume of 3,000,000 acre-feet. Average hydraulic residence time is about three years. The Priest River Thoroughfare contributes about 40 percent of the annual inflow to Priest Lake.

The Priest River Basin has numerous tributaries. The Upper Priest River portion of the watershed complex drains into the upper lake and into the Thoroughfare. The total drainage area is 204 mi^2. Two large tributaries to the lake, Upper Priest River and Hughes Fork, join before entering the northwest corner of the lake. From the Canadian border, Upper Priest River flows through a steep side canyon at a moderate gradient (around 100 ft/mi), and then flattens into a fairly large floodplain for the last 2 mi. A waterfall about 0.6 mi south of the border is the limit of upstream fish migration. Hughes Fork has a moderate gradient and includes a large wetland area, Hughes Meadows. Trapper Creek, which drains the northeast corner of the upper lake watershed, and Caribou Creek, which drains to the Thoroughfare from the east about 1 mi upstream of its mouth, are the other major watersheds in the Upper Priest Lake drainage. These tributaries originate in the Selkirk Mountains and have typically high gradients.

The main Priest Lake portion of the drainage begins near the mouth of the Priest River Thoroughfare and extends to the southern end of the lake near the town of Coolin. The thoroughfare, draining the upper lake, is by far the highest flow volume tributary to the lower lake. Major streams draining the Selkirk Range on the east side of the lake are Lion Creek, Two Mouth Creek, Indian Creek, Hunt Creek, and Soldier Creek. All these streams, except Soldier Creek, are relatively confined and of high gradient above the reaches that are near the mouths. The lower end of Soldier Creek has a flat gradient and a large associated wetland. Seven minor flow streams are interspersed between the major east-side tributaries. From Squaw Creek south to Fenton Creek, headwaters are at lower elevations, about halfway up the Selkirk Range. Chase Creek is outflow from Chase Lake. While Chase Creek is a moderately sized subwatershed, Chase Creek flow volume into Priest Lake is low. This watershed is flat, with primarily groundwater resources, which do appear to be hydraulically linked to the lake (PBTTAT 1998c).

The west side of the Priest Lake subbasin extends from Beaver Creek, discharging just south of the Thoroughfare, to the southern end of the lake (PBTTAT 1998c). The subbasin has one major stream, Granite Creek, and one moderate-size stream, Kalispell Creek. The remaining tributaries are of low volume. The Granite Creek subwatershed is the single largest in the basin. Headwaters of the south and north forks of Granite Creek are at lower elevations than east-side streams, mostly between 4,000 to 5,000 ft. Overall, the average gradient of Granite Creek is low, and many flat sections have associated wetlands. The subwatersheds of Reeder Creek, Kalispell Creek, Reynolds Creek, and Lamb Creek have large areas of flat gradient in the middle and lower elevations. The groundwater systems are extensive in these watersheds, and many branch streams go subterranean prior to discharging into the primary tributary channels.

Around the 72 miles of Priest Lake shoreline, approximately 26 percent of the property is privately owned (PBTTAT 1998c), and the most concentrated residential and business development has occurred on this property. Within the federal- and state-owned lands, considerable waterfront development has occurred through lease lot programs.

Information on bull trout distribution in the Priest River Basin in pre-development times (pre-1880s) is scarce and is presented mostly in oral histories of long-time residents (PBTTAT 1998c). Few manmade barriers to fish movement existed in the 1800s, so migratory stocks in the Priest Lake Basin could access and potentially exchange genetic material with other stocks residing in the Priest River, Pend Oreille River, and Lake Pend Oreille (Gilbert and Evermann 1895, PBTTAT 1998c).

Bull trout have been reported in most of the large accessible tributaries to Upper Priest Lake and Priest Lake (PBTTAT 1998c). The extent and type of bull trout utilization is partially documented.

4.13 Coeur d’Alene River Basin

The Coeur d’Alene Recovery Unit is located in four northern Idaho counties: Shoshone, Kootenai, Benewah, and Latah. Coeur d’Alene Lake is the principal water body in the basin and serves as the base elevation for the principle streams and rivers in the area. The lake is the second largest in Idaho. The cities of Coeur d’Alene (Kootenai County) and St. Maries (Benewah County) are the most populated areas in the Coeur d’Alene Recovery Unit. Coeur d’Alene is located on the northernmost shoreline of Coeur d’Alene Lake, and St. Maries lies about 19 kilometers (12 miles) upstream of Coeur d’Alene Lake on the St. Joe River. The basin is approximately 3,840 mi^2 and extends from Coeur d’Alene Lake upstream to the Bitterroot Divide on the border of Idaho and Montana. Range in elevation is 2,120 ft to more than 7,000 ft along the divide (NPPC 2001a).

The Spokane River, the only surface outlet of Coeur d'Alene Lake, flows westerly from the northern end of the lake to its confluence with the Columbia River, 100 miles to the southwest (NPPC 2001). A series of falls on the upper Spokane River formed barriers to the post-glacial dispersal of fishes, such as the Pacific salmon and steelhead, from the lower Columbia River to the Coeur d'Alene Lake Basin (Simpson and Wallace 1982).

The origins of Coeur d'Alene Lake are related to continental glaciation, and the lake provides the base elevation for the St. Joe River and Coeur d'Alene River subbasins. The lake was formed when a flooded river valley was impounded by deposits from the glacial Lake Missoula floods.

The lake lies in a naturally dammed river valley, and its outflow is currently controlled by Post Falls Dam. For part of the year, Post Falls Dam holds the lake level at higher elevations than would occur under natural conditions and creates a backwater effect in the lower Coeur d'Alene, St. Joe, and St. Maries rivers. At full pool (lake elevation 2128 ft) the lake covers 31,876 acres, and at minimum pool level (lake elevation 2120 ft) the lake covers 30,146 acres. The lake is 26 mi long and anywhere from 1.0 to 6.0 mi wide. The mean depth of the lake is 72 ft, with a maximum depth of 209 ft (NPPC 2001a).

Instream flows in the basin are typically low during late summer and early fall and high in the spring and early summer. Runoff and peak discharge from Coeur d'Alene Lake generally occur from April to June, but the highest peak flows recorded are from mid-winter rain-on-snow events. Peak flows from the St. Joe and Coeur d'Alene rivers have exceeded 50,000 ft$^{2/}$s and 70,000 ft$^{2/}$s, respectively. Mean monthly discharges from both the St. Joe and Coeur d'Alene rivers range from September lows of 400 to 500 ft$^{2/}$s to April and May highs of 7,000 to 8,000 ft$^{2/}$s.

Many tributaries feed Coeur d'Alene Lake. The two principal tributaries are the Coeur d'Alene and St. Joe rivers that drain the Coeur d'Alene and St. Joe mountains, respectively. The St. Joe River Basin drains an area of approximately 1,726 mi^2 and contains more than 739 mi of streams with over 78 principal tributaries. The Coeur d'Alene River Basin drains an area of approximately 1,489 mi^2 and contains an estimated 654 mi of stream with over 78 tributaries. In addition, over 27 tributaries encompassing over 200 miles of streams feed directly into Coeur d'Alene Lake (NPPC 2001a).

Major land managers within the basin include the U.S. Forest Service, Bureau of Land Management, State of Idaho, Coeur d'Alene Tribe, Louisiana Pacific Company, Crown Pacific International Corporation, and Potlatch Corporation. A portion of the basin lies within the boundaries of the Coeur d'Alene Indian Reservation. The U.S. Forest Service manages most of the land within the basin. The Idaho Department of Fish and Game and the Coeur d'Alene Tribe are managers of fish populations within the basin.

Water quality conditions vary widely in the Coeur d'Alene Lake Basin. Water quality problems include high levels of heavy metals (lead, cadmium, and zinc) in the South Fork Coeur d'Alene River and many of its tributaries, high nutrient loading in portions of the lower St. Joe and St. Maries rivers, and high sediment loads and temperatures in a number of streams throughout the basin (PBTTAT 1998d). In total, over 85 water bodies that include streams, stream segments, rivers, and lakes within the Coeur d'Alene Recovery Unit are currently listed on the State of

Idaho’s 303(d) list of water quality impaired waters because of being water quality limited and not supporting their beneficial uses. However, many areas within the basin maintain good water quality conditions that fully support beneficial uses during the entire year or for major portions of the year. These areas include water bodies in the upper portions of the St. Joe and North Fork Coeur d’Alene rivers, portions of the mainstem corridors in the St. Joe and North Fork Coeur d’Alene rivers, and portions of Coeur d’Alene Lake.

Bull trout are currently found primarily in the upper portions of the St. Joe River subbasin (PBTTAT 1998d, USFWS 1998), which contains spawning and rearing habitats. Migratory bull trout also use the St. Joe River and Coeur d’Alene Lake for foraging, migrating, and overwintering habitat. The current distribution is substantially less than the historical distribution. For example, Fields (1935) and Maclay (1940) documented bull trout in over 30 streams and river reaches throughout the basin over 60 years ago. Bull trout have not been observed in many of these streams in recent years, and spawning and rearing appear to be concentrated in relatively few tributaries of the St. Joe River subbasin (USFWS 1998).

The North Fork Coeur d’Alene River and its tributaries encompass a relatively large portion of the Coeur d’Alene Recovery Unit. Within the North Fork Coeur d’Alene drainage, Maclay (1940) observed bull trout in eight creeks (Grizzly, Brown, Beaver, Lost, Big, Downey, Yellow Dog, and West Fork Eagle Creeks), in addition to the North Fork Coeur d’Alene River. Bull trout were observed in Brown and Graham creeks by Idaho Department of Fish and Game researchers from 1984 to 1987 (Apperson et al. 1988). However, neither additional surveys in these two streams (PBTTAT 1998d), nor surveys of 73 other streams in the North Fork Coeur d’Alene River drainage from 1994 to 1995 (Dunnigan and Bennett 1997) confirmed the presence of bull trout. The origin of the bull trout observed in Prichard Creek may have been fish stocking in Revett Lake in the early 1990s; those fish may have moved downstream (PBTTAT 1998d). In the 1970s, Laumeyer (1976) did not observe bull trout at 21 sites sampled within the North Fork Coeur d’Alene River drainage.

In the St. Joe River subbasin, the highest densities of bull trout are primarily found upstream of Heller Creek. In 1992, surveys led by biologists from the Idaho Department of Fish and Game and the U.S. Forest Service in up to 29 locations resulted in observations of redds in more than 20 stream and river reaches. Overall, more than 70 percent of the bull trout redds were located upstream of Heller Creek, with over 50 percent occurring in an approximately 2-mi reach of Medicine Creek (PBTTAT 1998d). The Idaho Department of Fish and Game currently conducts annual bull trout surveys in three index streams within the St. Joe River subbasin (Medicine and Wisdom Creeks and the upper St. Joe River between Heller Creek and St. Joe Lake).

Maclay (1940) documented bull trout in Sisters, Bluff, Boulder (a tributary of Marble Creek), Bruin, Quartz, and Mica Creeks. Recent surveys determined that spawning and rearing are unlikely in Bruin and Quartz creeks, and failed to document bull trout in Mica Creek during 1993 to 1994 (PBTTAT 1998d). Two bull trout were observed during snorkel surveys conducted in summer 1974 in Mica Creek (Thurow and Bjornn 1978).

Although bull trout were not observed in Indian Creek by Maclay (1940) or during recent surveys, habitat conditions appear conducive to bull trout, and the creek’s proximity to other spawning streams may encourage colonization (PBTTAT 1998d). In 1997, two bull trout of about

5.5 inches in length were sampled in Eagle Creek (St. Joe River subbasin), suggesting occasional use or recruitment within the stream.

In the St. Maries River drainage, Fields (1935) and Maclay (1940) observed bull trout in Santa Creek. Recent surveys did not collect bull trout in any tributaries in the drainage (PBTTAT 1998d). However, anecdotal reports from anglers indicate that bull trout may be present in the St. Maries River.

In 1996, the U.S. Forest Service completed aquatic habitat surveys in the federally managed portions of the North Fork St. Joe River drainage, and the Idaho Department of Environmental Quality and U.S. Forest Service conducted electrofishing surveys in selected areas (PBTTAT 1998d). The U.S. Forest Service has also conducted infrequent bull trout surveys in the drainage since 1992. Given survey results, it is unlikely that the North Fork St. Joe River drainage presently supports bull trout. However, considering the relatively large size of the drainage (72,160 acres) and its proximity to other spawning areas, bull trout may occasionally use the drainage.

While sampling error is likely during counts, Dunham et al. (2001) found that estimated adult escapement and counts were strongly correlated. Studies have shown that the number of bull trout varies in different systems. Dunham et al. (2001) found a mean number of 2.8 adults per redd in Trestle Creek, Idaho, while Fraley et al. (1981) found an average of 3.9 adults in the Flathead River Basin, Montana. Using the results of these studies, with an average of 2.8 to 3.9 adult spawners per redd, along with data from counts conducted by the U.S. Forest Service and Idaho Department of Fish and Game from 1992 to 2001, the Coeur d'Alene Recovery Unit Team estimated the number of annual adult bull trout spawners in the St. Joe River and its tributaries at between 190 and 264. However, because annual comprehensive bull trout surveys are not being conducted in all tributary or river reaches where spawning has been previously documented and because some bull trout may exhibit alternate year spawning behavior (Shepard et al. 1984; Hvenegaard and Thera 2001), these population estimates may be low. Nonetheless, using the best available information to establish these estimates, using conclusions from theoretical models used by Rieman and Allendorf (2001) for maintaining genetic variability, and considering the risks related to stochastic and deterministic processes, the recovery unit team considers the population of bull trout within the Coeur d'Alene Recovery Unit to be seriously imperiled.

The Coeur d'Alene Recovery Unit Team maintains that occasional surveys do not demonstrate absence of bull trout in tributary streams. In most cases, such surveys are not rigorous and do not offer the best chances of observing low densities of bull trout. Therefore, even where occasional surveys have failed to document the presence of bull trout, if habitat parameters suitable for bull trout occupation are present, these areas may be considered candidates for restoration and at this time are considered essential for the recovery of bull trout within the Coeur d'Alene Recovery Unit. For these reasons, some streams may be added to or excluded from the list of priority streams when new information becomes available.

4.14 Clearwater River Basin

The Clearwater River Basin is located in north-central Idaho between the 46th and 47th latitudes in the northwestern portion of the continental United States. It is a region of mountains, plateaus, and deep canyons within the Northern Rocky Mountain geographic province. The basin is bracketed by the Salmon River Basin to the south and St. Joe River subbasin to the north.

The Clearwater River drains approximately a 9,645-mi^2 area. The basin extends approximately 100 mi north to south and 120 mi east to west (Maughan 1972). There are four major tributaries that drain into the main stem of the Clearwater River: the Lochsa, Selway, South Fork Clearwater and North Fork Clearwater rivers. The Idaho–Montana border follows the upper watershed boundaries of the Lochsa and Selway rivers, and the eastern portion of the North Fork Clearwater River in the Bitterroot Mountains. The North Fork Clearwater River then drains the Clearwater Mountains to the north, while the South Fork Clearwater River drains the divide along the Selway and Salmon rivers. Dworshak Dam, located two miles above the mouth of the North Fork Clearwater River, is the only major water regulating facility in the basin. Dworshak Dam was constructed in 1972 and eliminated access to one of the most productive systems for anadromous fish in the basin. The mouth of the Clearwater is located on the Washington–Idaho border at the town of Lewiston, Idaho where it enters the Snake River 139 river miles upstream of the Columbia River (NPPC 2001b).

More than two-thirds of the total acreage of the Clearwater Basin is evergreen forests (over 4 million acres), largely in the mountainous eastern portion of the basin. The western third of the basin is part of the Columbia plateau and is composed almost entirely of crop and pastureland. Most of the forested land within the Clearwater Basin is owned by the federal government and managed by the USFS (over 3.5 million acres), but the state of Idaho and Potlatch Corporation also own extensive forested tracts. The western half of the basin is primarily in the private ownership of small forest landowners and timber companies, as well as farming and ranching families and companies. There are some small private in-holdings within the boundaries of USFS lands in the eastern portion of the basin. Nez Perce Tribe lands are located primarily within or adjacent to Lewis, Nez Perce, and Idaho counties within the current boundaries of the Nez Perce Indian Reservation. These properties consist of both Fee lands owned and managed by the Nez Perce Tribe, and properties placed in trust status with the Bureau of Indian Affairs. Other agencies managing relatively small land areas in the Clearwater basin include the National Park Service, BLM, ITD, and IDFG (NPPC 2001b).

Water quality limited segments are streams or lakes which are listed under Section 303(d) of the Clean Water Act for either failing to meet their designated beneficial uses, or for exceeding state water quality criteria. The current list of 303(d) listed segments was compiled by the Idaho Department of Environmental Quality in 1998, and includes 135 defined stream reaches within the Clearwater Basin. Individual stream reaches are often listed for multiple (up to 11) parameters, making tabular summary difficult.

Small-scale irrigation, primarily using removable in-stream pumps, is relatively common for hay and pasture lands scattered throughout the lower elevation portions of the subbasin, but the amounts withdrawn have not been quantified. The only large-scale irrigation/diversion system within the Clearwater subbasin is operated by the Lewiston Orchards Irrigation District within the Lower Clearwater.

Seventy dams currently exist within the boundaries of the Clearwater Basin. The vast majority of existing dams exist within the Lower Clearwater (56), although dams also currently exist in the Lower North Fork (3), Lolo/Middle Fork (5), and South Fork (6) watersheds (NPPC 2001b).

The seven largest reservoirs in the basin provide recreational and other beneficial uses. Dworshak, Reservoir A, Soldiers Meadows, Winchester, Spring Valley, Elk River, and Moose

Creek reservoirs all provide recreational fishing opportunities. Reservoir A and Soldiers Meadows Reservoir are also part of the Lewiston Orchards Irrigation District irrigation system. Capacity of other reservoirs within the Clearwater Basin is limited to 65 acre-feet or less, and in most cases is less than 15 acre-feet, limiting their recreational capacity (NPPC 2001b).

Agriculture primarily affects the western third of the basin on lands below 2,500 ft elevation, primarily on the Camas Prairie both south and north of the mainstem Clearwater and the Palouse. Additional agriculture is found on benches along the main Clearwater and its lower tributaries such as Lapwai, Potlatch, and Big Canyon creeks. Hay production in the meadow areas of the Red River and Big Elk Creek in the American River watershed accounts for most of the agriculture in the South Fork Clearwater (Clearwater Basin Bull Trout Technical Advisory Team 1998). Total cropland and pasture in the subbasin exceeds 760,000 acres. Agriculture is a particularly large part of the economy in Nez Perce, Latah, Lewis, and Idaho Counties, which all have large areas of gentle terrain west of the Clearwater Mountains. Small grains are the major crop, primarily wheat and barley. Landscape dynamics, hydrology, and erosion in these areas are primarily determined by agricultural practices (NPPC 2001b).

Subwatersheds with the highest proportion of grazeable area (less than 50 percent) within the Clearwater Basin are typically associated with USFS grazing allotments in lower-elevation portions of their ownership areas. However, the majority of lands managed by the USFS within the Clearwater subbasin are not subjected to grazing by cattle or sheep, including all or nearly all of the Upper Selway, Lochsa, and Upper and Lower North Fork watersheds. Subwatersheds outside of the USFS boundaries typically have less than 25 percent of the land area defined as grazeable, although this is as much as 75 percent for some. Privately owned property within the subbasin typically contains a high percentage of agricultural use, with grazeable lands found only in uncultivated areas. In contrast, grazing allotments on USFS lands are typically large, often encompassing multiple HUCs, resulting in higher proportions of grazeable area than those contained in primarily privately owned lands (NPPC 2001).

Mines are distributed throughout all eight watersheds in the Clearwater subbasin, with the lowest number of occurrences in the Upper and Lower Selway. Ecological hazard ratings for mines (delineated by ICBEMP) indicate that the vast majority of mines throughout the subbasin pose a low relative degree of environmental risk. However, clusters of mines with relatively high ecological hazard ratings are located in the South Fork Clearwater River and in the Orofino Creek drainage (Lolo/Middle Fork) (NPPC 2001b).

Within the mainstem portion of the Clearwater River, the most substantial production of spring Chinook salmon probably occurred in the Lolo and Potlatch Creek drainages (Clearwater National Forest 1997, Clearwater Basin Bull Trout Technical Advisory Team 1998). Currently hatchery spring Chinook are released for harvest mitigation and to supplement natural production (Nez Perce Tribe and IDFG 1990, IDFG 2001b). Re-introduction of spring Chinook salmon following removal of the Lewiston Dam has resulted in naturally reproducing runs in Lolo Creek, and mainstems and tributaries of the Lochsa, Selway, and South Fork Clearwater rivers (Larson and Mobrand 1992). Founding hatchery stocks used for spring Chinook salmon were primarily obtained from the Rapid River Hatchery (Kiefer et al. 1992, Nez Perce Tribe and IDFG 1990). Initially however, spring Chinook stocks imported for restoration came from Carson, Big White, Little White or other spring Chinook captured at Bonneville dam (Nez Perce Tribe and IDFG 1990). Genetic analyses confirm that existing natural spring Chinook salmon in the Clearwater

River Basin are derived from reintroduced Snake River stocks (Matthews and Waples 1991). Spring Chinook salmon are classified as "present – depressed" in all areas of the Clearwater Basin where status information is available (NPPC 2001b).

Fall Chinook salmon within the Clearwater Basin represent an important metapopulation within the Snake River ESU. Maintenance and function of fall Chinook salmon metapopulation dynamics within the Clearwater Basin itself will play an important role in recovery of the Snake River ESU. Fall Chinook salmon reintroduction efforts in the Clearwater Basin began in 1960 (NPPC 2001b). A total of 6,733,000 fall Chinook were reintroduced by the IDFG into the upper Clearwater Basin from 1960-1967, mainly through eyed-egg plants in artificial spawning channels along the Selway River near the Fenn Ranger Station (Richards 1968). Counts of fall Chinook at the Lewiston Dam increased from three in 1962 to a high of 122 in 1966, and back down to 90 in 1969. Due to insignificant returns of fall Chinook, the original re-introduction program was terminated in 1968 (Hoss 1970). Mallett (1974) estimated that 55 percent of all Columbia River steelhead historically originated from within the Snake River Basin, of which the Clearwater Basin made up a substantial component.

Over 43,000 steelhead were counted at Lewiston Dam near the mouth of the Clearwater River during the 1962-63 run year (Miller 1987) and historic runs may have ranged as high as 40,000 – 60,000 steelhead annually (NPPC 2001b). Wild steelhead historically occupied all major drainages and a majority of the tributaries within the Clearwater Basin. The upper half of the South Fork Clearwater watershed maintained a historically strong population of steelhead (Nez Perce National Forest 1998).

The only remaining steelhead runs in the Clearwater Basin with limited or no hatchery influence occur in the Lochsa and Selway river systems (B-run) and lower Clearwater River tributaries (A-run) (IDFG 2001b). Steelhead in other portions of the basin have been heavily influenced by hatchery stocking, with the majority originating from Dworshak National Fish Hatchery (Nez Perce Tribe and IDFG 1990). Steelhead production at Dworshak National Fish Hatchery is made up entirely of B-run steelhead (NPPC 2001b).

Wild A-run steelhead within the Clearwater Basin occurs only in the lower mainstem tributaries (Rich et al. 1992), South Fork Clearwater tributaries up to Butcher Creek, and Maggie Creek in the Middle Fork Clearwater (Nez Perce Tribe and IDFG 1990). The Potlatch River and East Fork Potlatch River are considered important streams for production of wild A-run steelhead because of their accessibility in relation to the mainstem Clearwater (NPPC 2001). Wild A-run steelhead also occur in Big Canyon, Cottonwood, Lapwai, Mission, Bedrock, and Jacks creeks (Clearwater National Forest 1997, USFWS and Nez Perce Tribe 1995, Kucera and Johnson 1986), with Big Canyon and Cottonwood creeks as the primary aggregates based on available habitat and observed juvenile densities (USFWS and Nez Perce Tribe 1997). No hatchery outplanting of A-run steelhead has occurred within the Clearwater Basin, and interbreeding of A-run and hatchery-produced B-run steelhead is thought to be minimal due to differences in spawn timing (USFWS and Nez Perce Tribe 1997). Habitat problems in A-run streams include high soil erosion rates, high bedload movement rates, altered channel morphology and riparian areas, variable streamflows with severely limited late summer flows, and high summer temperatures in lower tributary reaches (Kucera and Johnson 1986, Nez Perce Tribe and IDFG 1990).

Steelhead status is present–depressed throughout the majority of their range in the Clearwater Basin. Designations of present–strong for steelhead are only noted in Fish and Hungery creeks (Lochsa watershed), the lower portions of Meadow Creek (Lower Selway watershed), and portions of Moose and Bear creeks (Upper Selway watershed). The Lochsa and Selway river systems have been identified as refugia areas for steelhead (Thompson 1999) based on location, accessibility, habitat quality, and number of roadless tributaries (NPPC 2001b).

4.15 Salmon River Basin

The Salmon River flows 410 miles north and west through central Idaho to join the Snake River. The Salmon River is the largest subbasin in the Columbia River drainage, excluding the Snake River, and has the most stream miles of habitat available to anadromous fish. The total subbasinis approximately 14,000 square miles. Major tributaries include the Little Salmon River, South Fork Salmon River, Middle Fork Salmon River, Panther Creek, Lemhi River, Pahsimeroi River, and East Fork Salmon River (IDFG 1990).

Public lands account for approximately 91 percent of the Salmon River Basin, with most of this being in federal ownership and managed by seven national forests or the Bureau of Land Management (BLM). Public lands within the basin are managed to produce wood products, domestic livestock forage, and mineral commodities; and to provide recreation, wilderness, and terrestrial and aquatic habitats. Approximately 9 percent of the basin land area is privately owned. Private lands are primarily in agricultural cultivation, and are concentrated in valley bottom areas within the upper and lower portions of the basin.

Land management practices within the basin vary among landowners. The greatest proportion of National Forest lands are federally designated wilderness area or areas with low resource commodity suitability. One-third of the National Forest lands in the basin are managed intensively for forest, mineral, or range resource commodity production. The BLM lands in the basin are managed to provide domestic livestock rangeland and habitats for native species. State of Idaho endowment lands within the basin are managed for forest, mineral, or range resource commodity production. Near-stream or in-channel activities of relevance to fish and wildlife conservation include efforts by landowners, private or otherwise, to modify stream channels in order to protect property. Examination of the geographic distribution of permitted channel alterations during the past 30 years suggests that the long-term frequency of these activities was relatively consistent across much of the Salmon River basin, but less common in the Upper Middle Fork Salmon, Lower Middle Fork Salmon, Middle Salmon-Chamberlain, and Pahsimeroi watersheds. It is unclear to what degree channel-modifying activities completed without permits may have had on the observed pattern. Stream channels in the basin are also altered, albeit on a smaller scale, by recreational dredging activities (NPPC 2001b).

Water quality in many areas of the basin is affected to varying degrees by land uses that include livestock grazing, road construction, logging and mining (NPPC 2001b). Eighty-nine water bodies in the Salmon River Basin are classified as impaired under the guidelines of Section 303(d) of the Clean Water Act. The primary parameters of concern are sediments (88 cases), nutrients (17 cases), flow alteration, irregular temperatures, and habitat alteration. Ten to 25 percent of the waters within the South Fork Salmon and the Lower Salmon River watersheds are listed as impaired by the USEPA. Five to 10 percent of the waters in the Little Salmon, Pahsimeroi, Middle Salmon-Panther, Lemhi, and Middle Salmon-Chamberlain watersheds are impaired. In the Upper Salmon, Upper Middle Fork Salmon, and the Lower Middle Fork Salmon, less than 5 percent are listed as impaired (NPPC 2001b).

In the Lemhi, Upper Salmon, Pahsimeroi, and Middle Salmon-Panther watersheds, less than 20 percent of the larger streams meet all designated uses (i.e., specific uses identified for each water body through state and tribal cooperation, such as support of salmonid fishes, drinking water supplies, maintenance of aquatic life, consumption of fish, recreational contact with water, and agriculture) (NPPC 2001b).

Partial and seasonal barriers have been created on a few of these streams. Partial to complete barriers to anadromous fish exist on Panther Creek in the form of acid mine drainage, and on the Lemhi, Pahsimeroi and upper Salmon rivers at water diversions for irrigation. Twenty minor tributaries contain dams that are used for numerous purposes such as irrigation, recreation and fish propagation (IDFG 1990).

The diversion of water, primarily for agricultural use within the Salmon River Basin, has a major impact on developed areas – particularly the Lemhi, Pahsimeroi, the main stem, and several tributaries of the Salmon River. Although many diversions are screened, several need repair and upgrading. A major problem is localized stream dewatering. In addition to water diversions, numerous small pumping operations for private use occur throughout the subbasin. Impacts of water withdrawal on fish production are greatest during the summer month when streamflows are critically low (IDFG 1990).

The Salmon River Basin encompasses portions of five U.S. Department of Agriculture, Forest Service wilderness areas. The Frank Church River of No Return Wilderness area, one of the five within the subbasin, is the largest wilderness area in the contiguous United States. Specific management guidelines for wilderness areas generally prohibit motorized activities and allow natural processes to function in an undisturbed manner.

Mining, though no longer a major land use as it was historically, it is still very prevalent in parts of the Salmon River Basin. Impacts from mining include severe stream alterations in substrate composition, channel displacement, bank and riparian destruction, and loss of in-stream cover and pool-forming structures. All of these impacts are typical of large-scale dredging and occur with other types of mining. Natural stream channels within the Yankee Fork, East Fork of the South Fork, and Bear Valley Creek have all had documented spawning and rearing habitat destroyed by dredge mining. Furthermore, heavy metal pollution from mine wastes and drainage can eliminate all aquatic life and block access to valuable habitat as seen in Panther Creek (IDFG 1990).

The Salmon River Basin historically produced an estimated 38 percent of the spring and 45 percent of the summer Chinook salmon that entered the Columbia River (IDFG 1990). Spring Chinook salmon of the upper Salmon River migrate farther inland than any other runs of Chinook in the lower 48 states, traveling more than 900 miles to spawn and rear at over 6,000 ft above sea level (Hassemer 1998). Summer Chinook in the Upper Salmon are classified as wild. Chinook returning to the East Fork Salmon River downstream from Herd Creek are considered summer Chinook.

Summer Chinook salmon are native to the Pahsimeroi drainage, but information describing the original stock is limited (Keifer et. al., 1992). A weir and adult trap were constructed on the river in 1969 to intercept summer Chinook salmon and steelhead. Hatchery production began when wild summer Chinook broodstock were collected at the weir. Natural production of summer Chinook has been maintained by releasing fish above the weir or by fish escaping upriver prior to weir installation.

The spring Chinook population in the Lemhi drainage has been maintained primarily by natural production, spawning mostly upstream from Hayden Creek. Hatchery augmentation from Hayden Creek ended in 1982. Summer Chinook, thought to be present historically, have become extinct.

Historically, the Middle Fork Salmon River is reported to have supported 27 percent of Idaho's Chinook harvest (Mallet 1974). This estimate was made at a time when the runs had already been substantially depressed by fisheries outside the Salmon River Basin as well as a variety of disturbances within other areas. The Middle Fork Salmon River spring Chinook is a purely wild run with a strong age 5 component. Summer Chinook currently constitute a minor component of the runs in this watershed (Thurow 2000).

Chinook are indigenous to some of the larger tributaries in the middle main Salmon River, such as Bargamin and Chamberlain creeks. Chinook spawning was also documented historically in Horse Creek. It has not been confirmed whether the Chinook in this portion of the subbasin are a spring or summer run. For management purposes they are classified and managed as wild spring run. Hatchery Chinook have not been outplanted anywhere within the Middle Salmon-Chamberlain watershed (Kiefer et al 1992).

Naturally producing populations of these spring Chinook in the Lower Salmon River exist in Slate and Whitebird creeks, and occasionally juveniles are found in other tributaries. No stream-type Chinook of hatchery origin have been stocked anywhere within the Lower Salmon watershed. The Chinook runs in the area have been maintained by natural spawning of native fish. Rapid River has a remnant wild run of summer Chinook. The most consistent sport and tribal fisheries in the past two decades have occurred on the fully hatchery-produced spring Chinook run in the Little Salmon River (Hassemer 1991, Janssen 1992, 1993, Janssen and Kiefer 1998, Jansen and Kiefer 1999).

Prior to construction of the Hells Canyon complex of dams and the lower four Snake River dams, the Snake River Basin was one of the most important producers of fall Chinook salmon in the Clearwater River Basin (Fulton 1968). Before 1958, most fall Chinook salmon spawned in the mainstem Snake River in Idaho between Marsing and Swan Falls (Haas 1965).

Although there is no historical record of large-scale spawning by fall Chinook in the Salmon River, it is logical to assume that some spawning occurred when adult escapement was high and environmental conditions favorable. The opportunity for successful production of subyearling smolts in the Salmon River was probably limited, however, due to cold winter water temperatures that would delay egg incubation and warm summer water temperatures that would impair smoltification and survival (IDFG 2001).

Historically, Snake River sockeye salmon were found in headwater lakes along tributaries of the Snake River, including five lakes in the upper Salmon River drainage, Payette Lake on the North Fork Payette River, and Wallowa Lake on the Grand Ronde River. Sockeye salmon may have used Warm Lake, a tributary lake of the South Fork Salmon River. Within the upper Salmon subbasin, sockeye salmon were found in Redfish, Alturas, Pettit, Stanley, and possibly Yellowbelly lakes.

Snake River sockeye salmon have declined dramatically in recent years. Currently, only Redfish Lake supports a remnant anadromous run and these fish are found seasonally along the migratory corridor between the lake and the mouth of the Salmon River.

The Middle Fork Salmon and South Fork Salmon River are managed by the IDFG as sanctuaries for wild B-run steelhead. Hatchery production of both A and B-run steelhead occurs outside the subbasin at Hagerman National Fish Hatchery (2.4 million smolt capacity, A run) operated by the USFWS under Lower Snake River Compensation Plan (LSRCP) and Magic Valley Fish Hatchery, a LSRCP facility (2 million smolt capacity, A run) operated by IDFG. Niagara Springs Fish Hatchery (1.6 million smolt capacity) was built as Idaho Power Company mitigation for the Hells Canyon Dam complex and is operated by the IDFG. Releases of smolts occur at the in-subbasin hatcheries, satellite facilities and nearby developed areas for sport harvest. Over one million eyed eggs have been placed in streamside incubators for volitional releases of fry to unoccupied tributary streams. Broodstock is collected at in-subbasin traps (NPPC 2001b).

Areas of the basin upstream of the Middle Fork Salmon River have been stocked with hatchery steelhead, and the IDFG has classified these runs of steelhead as natural. The majority of these steelhead are progeny of introduced hatchery stocks from the Snake River. With the construction of Hells Canyon Dam in the 1960s, the USFWS, the ITD, USFS, Bonneville Power Administration, Bureau of Reclamation, and IDFG attempted to mitigate the effects of the dam by establishing a hatchery-managed, sport fishery in the upper Salmon River. Naturally produced steelhead upstream of the Middle Fork are classified as A- run, based upon characteristics of size, ocean age, and timing. Out-of-subbasin Snake River A-run steelhead have been released extensively in this area, and it is unlikely any native wild populations still exist (NPPC 2001b).

Both recent and historical data on the spawning populations of steelhead in specific streams within the Salmon River Basin are very limited. Mallet (1974) estimated that historically 55 percent of all Columbia River steelhead originated from the Snake River Basin, which includes the Salmon River Basin. Though not quantified, a large proportion of these fish were likely produced in the Salmon River Basin (NPPC 2001b).

4.16 Snake River Basin

The Snake River originates at 9,500 ft, along the continental divide in the Wyoming portion of Yellowstone National Park. The Snake River flows 1,038 miles — westward toward the Idaho-Oregon border, northwest to its confluence with Henry’s Fork near Rexburg and then to Pasco, Washington, where it flows into the Columbia River. The Snake River is a large river that is one of the most important water resources in the State of Idaho. The Boise, Payette, and Weiser rivers in Idaho and the Owyhee, Malheur, Burnt, and Powder rivers in Oregon join the Snake River in this Idaho-Oregon border reach. The Snake River passes through Hells Canyon and Idaho Power Company’s Hells Canyon Complex. Brownlee Dam, near River Mile (RM) 285, is the uppermost facility, with Oxbow and Hells Canyon dams downstream. The basin includes agriculture, and private and federal irrigation.

The Snake River Basin upstream from Brownlee Dam drains about 72,590 m^2. This area includes 31 dams and reservoirs with at least 20,000 acre-feet of storage each. The Bureau of Reclamation, Idaho Power Company, and a host of other organizations own and operate various facilities. These facilities have substantial influence on water resources, supplies, and the movement of surface and groundwater through the region. The total storage capacity of these reservoirs is more than 9.7 million acre-feet. In addition, there are numerous smaller state, local, and privately owned and operated dams and reservoirs throughout the upper Snake River Basin.

The Bonneville Power Administration administers dams and power plants on the Snake River and the Columbia River. They report the annual flow of the Snake River averages about 14 million acre-feet per year into Brownlee Reservoir and about 37 million acre-feet below Lower Granite Dam, downstream from Lewiston. This compares to annual average flows of 135 million acre-feet for the Columbia River at The Dalles, Oregon, and 198 million acre-feet at the mouth of the Columbia River. As of 2002, about 3.3 million acres were being irrigated in the State of Idaho. This includes some acreage outside the Snake River Basin but does not include about 170,000 acres of land in the Snake River Basin in eastern Oregon currently irrigated as part of Bureau of Reclamation projects. Although irrigated acreage served by federal projects has changed little since 1959, total irrigation in Idaho has increased by more than 25 percent (USBR 1998). Much of the new, private irrigation during this period uses groundwater.

The area includes rugged mountains, semi-arid desert, fertile agricultural land (primarily irrigated), and barren outcrops of lava flows. Rangeland, lava flows, and timber are the dominant land covers in the basin. Pine and spruce forests inhabit the higher elevations. Most of the land in the basin is owned by the federal government (U.S. Forest Service, U.S. Bureau of Land Management, and U.S. Department of Energy).

One of the most prominent physiographic features of the basin is the Snake River Plain. This curved topographic feature extends across southern Idaho into eastern Oregon. The Snake River Plain is approximately 350 miles long and varies in width from 30 to 75 miles. The Snake River is the dominant hydrologic feature of the basin and is the only river discharging from the area. The Snake River extends from its source in Jackson Lake, Wyoming, to its confluence with the Columbia River in Washington.

The Snake River has many tributary streams that are important components of the river system. The tributaries provide a means of collecting the precipitation that accumulates in the mountains surrounding the Snake River Plain. Water collected in the tributaries, enters the Snake River directly as surface flows, evaporates, or infiltrates into the subsurface where it later enters the river as spring flows. Fifteen of the nation's 65 class one springs (greater than 100 $ft^{2/}s$ discharge) are in the Snake River Basin. These springs support fish hatcheries that produce the majority of the Nation's commercial trout and produce juvenile fish for planting in lakes and streams.

The amount of natural flow in most of the streams varies throughout the year due to the annual cycle of precipitation. Water accumulates during the winter snowfalls and is released by spring melting of the snow pack. The normally hot, dry periods of late summer and early fall are additional factors driving the cyclic nature of flow volumes. In many locations the annual variation in streamflow volume is altered depending on the operational needs of the many reservoirs that have been constructed within the system.

The Snake River and its tributaries, including the aquifers that make up the groundwater system, provide water for many uses including agricultural use, municipalities, industrial and domestic use, recreation, Native American cultural needs, and habitat for fish and wildlife. The U.S.

Bureau of Reclamation, along with other state and federal agencies and private groups, are attempting to manage the water resources of the basin for the many, sometimes competing, uses.

The middle Snake River is a managed water system where normal flow regimes are no longer present. Development of the middle and upper Snake River for irrigation, and later for hydroelectricity, severely impedes historic and contemporary aquatic conditions. Development for irrigation began in the late 1860s when the first major irrigation diversion was built. The first hydroelectric dam (Swan Falls) was built in 1901; Milner in 1905; Minidoka in 1906. Today, there are conservatively 44 hydroelectric projects and countless diversions in the subbasin that have greatly affected the hydrology of the Snake River and its tributaries and the aquatic species present. The downstream projects act as barriers to fish migration and have eliminated anadromous fish, not only impacting the fisheries populations, but also resulting in a significant decrease in biomass input to the terrestrial ecosystems and influencing wildlife population potentials. Upstream projects (e.g., Milner and American Falls dams) greatly changed the hydrograph. The hydrology of all of the major tributaries in this subbasin is severely modified; some reaches are seasonally dewatered because of irrigation diversion, and many tributaries are impacted by irrigation return flows. Stream habitat degradation occurs because of these hydrologic modifications. Water withdrawals and returns, coupled with a loss of riparian vegetation stabilizing stream banks, results in channel down-cutting and widening, which can be a major source of habitat degradation and sedimentation (e.g., Rock Creek).

Thirty-one water bodies/stream segments in the Upper Snake Rock subbasin were listed on Department of Environmental Quality's 1996 §303(d) list, including 10 segments of the middle Snake River. Pollutants of concern include sediment, nutrients (phosphorus and nitrogen), pathogens (fecal coliform bacteria), ammonia, pesticides, oil and grease (IDEQ 1999).

Hydroelectric development throughout the Middle Snake River, as well as hydrologic modification in the Upper Snake Rock, have impacted snail species through inundation of lotic habitats, isolating segmented populations, and reducing suitable shallow water shoreline. Declines in snail populations have been attributed in part to water quality degradation due to tributary and agricultural return flows laden with sediment; nutrients; runoff from dairies and feedlots; effluent from aquaculture, industrial and municipal facilities; and stormwater runoff (IDEQ 1999).

Bull trout are listed as a threatened species in Blaine, Camas, and Elmore counties, but they do not occur within the Camas Creek or Little Wood River drainages, in the Big Wood River subbasin, or upstream of the C.J. Strike Reservoir. The threatened and endangered species that have linkage to water quality are several mollusk species (e.g., Utah valvata snail and Banbury Springs lanx that rely on water quality).

A sample of several significant Snake River subbasins follows.

Big Wood River subbasin

The Big Wood River subbasin has many manmade reservoirs that are a part of the more complex network of natural and manmade water bodies of the Big Wood River system. The Magic Reservoir is the largest and more famous of all the reservoirs. It fulfills its purpose in providing irrigation and power generation. Approximately 60 percent of the storage in Magic Reservoir is used within the Middle Little Wood River area, with the remainder being used on cropland in the

Big Wood River subbasin. The Big Wood River Company (Shoshone, Idaho) operates the manmade canal system of the Big Wood River subbasin. It is a single management unit that has storage space in American Falls Reservoir and behind Magic Dam, as well as natural flow rights on the Wood River system.

The Wood River system includes the Big Wood River and the Little Wood River and irrigates approximately 98,000 acres. Other management units that service the subbasin are the North Side Canal Company (160,000 acres) and Milner-Gooding Canal (62,400 acres) as well as a number of smaller canal companies that are privately owned and are operated above the Magic Reservoir.

Camas Creek Subbasin

This subbasin runs from the headwaters of Camas Creek (west of Packer Butte in the Camas Prairie of Elmore County) to its mouth, where the creek empties into Magic Reservoir. The subbasin lies along the western border of the Upper Snake River Basin in Idaho, with the Big Wood River and Upper Snake-Rock subbasins surrounding it. The southern border of the Camas subbasin runs from the mouth of Camas Creek, in a southwest direction along the southern edge of Macon Flat, then west within the Camas Prairie along the northern edge of the Mount Bennett Hills to the headwaters. From here, the Camas Creek subbasin begins to run in a northeast direction, moving gradually into the Sawtooth National Forest. The northern border runs above Smoky Dome and Cannonball Mountain and then further north along Willow Creek to the Camas County line. From here, the eastern border runs in a southeast direction along the county line, then just south of the Kelly Mountains, continuing southeast to the mouth of Camas Creek. A number of streams are dry throughout the summer and into the spring months in the lower prairie reaches of the water body, and a few water bodies have small segments that are perennial due to groundwater influences (water tables and beaver dams) despite the remainder of the water body being dry.

Snake River subbasin

This area includes a total of 348,000 acres. Bureau of Land Management (BLM) lands within the subbasin total 3,912 acres (1 percent). Forest Service (USFS) lands comprise the majority of the subbasin, followed by private, and Idaho Department of Lands (IDL). The Snake River subbasin includes the drainage area from the confluence of the Salmon River (river mile 188.2) upriver to Hells Canyon Dam (river mile 247.0). The general analysis area includes 58.8 miles of the mainstem Snake River, tributaries, and face drainages.

Basalt rocks are the dominant surface rocks that overlay metamorphic rocks found in the bottom of the river canyon. The Columbia River basalt group is the most extensive rock type in this area. The Snake River canyon is very rugged with steep slopes and rock outcrops are common. Uplands may include steep and rugged mountains or plateaus with rolling to moderate slopes. Lower elevation areas are dominated with grassland habitats, while breaklands may have patterned grassland and timbered sites. The moderately sloped plateau areas may be forested with interspersed forest lands and pasture lands. Higher elevation areas are forested. Canyon grasslands are primarily a broad extension of the Pacific bunchgrass formation. The dominant habitat types are bluebunch wheatgrass and Idaho fescue (*Festuca idahoensis*). Sand dropseed and red three-awn (*Aristida longiseta*) have become disclimax species on some river benches, bars, and toeslope areas. Annual grasses (i.e., cheatgrass (*Bromus tectorum*)) and weeds are common invaders of poor- and fair-condition canyon grasslands within the subbasin. Shrubland communities dominated by common snowberry and hackberry occur on moderate to steep toeslopes where favorable moisture regimes permit shrub growth in the bunchgrass zones.

The subbasin provides habitat for the listed fall Chinook salmon, spring/summer Chinook salmon, steelhead, and bull trout. BLM sensitive species occurring in the subbasin include westslope cutthroat trout, redband/rainbow trout, Pacific lamprey, and white sturgeon. The mainstem Snake River is used as an upstream and downstream passage corridor by fall Chinook salmon, spring/summer Chinook salmon, steelhead, bull trout, and westslope cutthroat trout. Fall Chinook salmon will use the mainstem Snake River for spawning and rearing. Spring/summer Chinook salmon and steelhead will use the mainstem river to a limited extent for rearing. Steelhead will use accessible tributaries for spawning and rearing. Spring/summer Chinook salmon will use Granite Creek and Sheep Creek for spawning and rearing. Spring/summer Chinook salmon will also use the mouth area or lower reaches of accessible tributaries for juvenile rearing. Bull trout will use the mainstem Snake River for subadult/adult rearing and winter habitat. Bull trout spawning and early rearing are documented as occurring in Granite Creek and Sheep Creek. Westslope cutthroat trout are currently found in Granite Creek and Sheep Creek. Pacific lamprey use the Snake River for migration and probably use the larger tributary streams for spawning and rearing. White sturgeon use the Snake River for spawning and rearing.

Weiser River Watershed

The Weiser River Watershed encompasses a large area in southwestern Idaho. The headwaters for the Weiser River originate in the southern end of the Seven Devil Mountain Range and the west-central mountains of Idaho. A majority of the population in the watershed is associated with small homesteads. The municipalities of Weiser, Midvale, Cambridge, and Council are the only recognized urban areas in the watershed.

Fishery data are available for many water bodies in the Weiser River Watershed. The Idaho Department of Fish and Game (IDFG) completed extensive fish surveys on many segments of the river itself. IDFG and United States Forest Service completed numerous studies in smaller watersheds to address bull trout issues. Much of the lower elevation portion of the Weiser River Watershed is dominated by warm water, non-game species, while more cold-water species dominate the fisheries higher in the watershed (Cambridge and upstream).

The portion of the Weiser River Watershed upstream from the confluence of the Little Weiser River has been identified as a key watershed for bull trout (*Salvelinus confluentus*). The bull trout has been listed as a threatened species under the Endangered Species Act (USFWS 2002a). Local populations of bull trout have been found in the upper Little Weiser River, East Fork Weiser River, and upper Hornet Creek.

North Fork Payette River Watershed

The North Fork Payette River Watershed lies entirely in southwestern Idaho and comprises about 3,240 square miles. The drainage originates in the Sawtooth and Salmon River mountains and flows southwesterly until it empties into the Snake River near Payette, Idaho. This area has listed tributaries to the North Fork Payette River above Payette Lake and to Payette Lake itself; the North Fork Payette River and tributaries from Cascade Dam to the confluence with the South Fork Payette River; and, finally, the Main Payette River up to and including Black Canyon Reservoir.

Due to the wide range in elevation, this section of the Payette River has a variety of fish and fish habitats. Some of the native fish such as Kokanee Salmon, are now stocked in lakes and rivers. The construction of Black Canyon Dam eliminated salmon and steelhead in the drainage by creating a fish barrier. Black Canyon Reservoir is considered a transition zone from a warm water type fishery to a cold-water type fishery and provides only marginal fish habitat. Sand from upstream land disturbances has covered most habitats. Game species present in the reservoir include largemouth bass, smallmouth bass, black crappie, bluegill, channel catfish, and bullhead. All of these are non-native species that are warm-water tolerant and more water-pollution tolerant than cold-water species.

Upstream from Black Canyon Dam, the gradient of the river increases and cold-water species increase in abundance. The North Fork of the Payette River in the high gradient Payette River canyon has been severely altered by railroad and highway construction, providing only a marginal fishery for salmonids. However, in unaltered sections such as the Cabarton reach, the North Fork is productive for salmonids, particularly redband trout. Alpine lakes within the Payette River drainage are stocked with rainbow trout, cutthroat trout, rainbow-cutthroat hybrids, golden trout and arctic grayling.

Bull trout are present in isolated areas in the watershed. Columbia River Basin bull trout (*Salvelinus confluentus*) were listed as threatened in 1998 (64 FR 111). Bull trout require stable stream channels, complex and diverse cover, clean spawning gravel, unblocked migration routes, and cold water (<64° F). Bull trout are fall spawners. Bull trout habitat has been threatened by land use practices that result in degraded habitat due to loss of riparian cover, decreased water quality, and increased sedimentation. In addition, land management practices that result in barriers to migration (e.g., dams or impassable culverts) have also threatened populations. Finally, other non-native species, such as brook trout, that are competitive to bull trout also pose a substantial threat.

Three bull trout population watersheds are within the Squaw Creek watershed: Squaw Creek, Third Fork Squaw Creek and Second Fork Squaw Creek. Existing populations occur in Third Fork, Second Fork and Main Squaw Creek in the upper reaches. Historically, bull trout were found in the lower reaches of Squaw Creek, suggesting that Squaw Creek is also a migratory corridor. Spawning habitat is lacking large woody debris, which may account for the lack of large pools. The Third Fork Squaw Creek is at risk for excess fine sediment, which could also account for the lack of large pools. The Second Fork Squaw Creek has migration barriers as well as excess fine sediment, which hinder the development of the bull trout community. Gold Fork drainage is also a key bull trout watershed.

Bull trout are also found elsewhere in the watershed but populations are patchy in nature. In September 2004, the U.S. Fish and Wildlife Service designated areas of critical bull trout habitat. Neither the Squaw Creek nor Gold Fork watersheds received critical designation.

South Fork Payette River Subbasin

The South Fork Payette River subbasin is located primarily in Boise County with the upper half of the Deadwood River Watershed in Valley County. Based on Idaho Department of Water Resources spatial data, the subbasin contains approximately 813 square miles. The South Fork Payette River subbasin is designated as U.S. Geological Survey cataloging unit (fourth field) 17050120. The subbasin contains the entire South Fork Payette River from its headwaters in the

Sawtooth Mountains to its confluence with the Middle Fork Payette River near Garden Valley, Idaho. The South Fork Payette River subbasin is bounded on the north by the Salmon River Mountains, on the east by the Sawtooth Mountains and on the south by the Boise Mountains. Elevations of the South Fork Payette River range from approximately 8,920 ft at the headwaters to 3,000 ft at the confluence with the Middle Fork Payette River (IDEQ 2005).

The Black Canyon Dam, built on the Payette River in 1924, blocked the migration of fish that had an anadromous life history in the subbasin. These fish include Chinook salmon, steelhead, and Pacific lamprey, which are now extirpated from the subbasin. The Idaho Department of Fish and Game has stocked rainbow trout, Atlantic salmon, Chinook salmon, Arctic grayling (*Thymallus arcticus*), bull trout, coho salmon (*Oncorhynchus kisutch*), kokanee, westslope cutthroat trout, Bear Lake cutthroat trout, fine spotted cutthroat trout, Henrys Lake cutthroat trout, and steelhead in the subbasin since 1967. Since 2001, stocking has been limited to rainbow trout, steelhead, and kokanee. Fishery management in the South Fork Payette River subbasin is currently focused on natural production of wild trout (IDFG 2001, IDEQ 2005).

The South Fork Payette River subbasin contains two key watersheds for bull trout (Batt 1996). The Deadwood River key watershed contains the Deadwood River and tributaries above Deadwood Reservoir. The South Fork Payette River key watershed contains the South Fork Payette River and tributaries above the mouth of the Deadwood River, including the Deadwood River and tributaries below Deadwood Reservoir. All life history forms of bull trout are known to occur in both key watersheds (Jimenez and Zaroban 1998, IDEQ 2005).

Two dams, Grimes Pass dam and the Deadwood Dam, have been constructed in the South Fork Payette River subbasin. The Grimes Pass dam was first constructed in 1904 and was washed out in 1943. The Grimes Pass Dam was never rebuilt. The Deadwood Dam was completed in 1931. The Deadwood Dam impounds 3,055 acres of Deadwood Reservoir, which extends 3.5 mi upstream (Smith 1983) (IDEQ 2005).

Boise-Mores Creek Subbasin

The Boise-Mores Creek subbasin contains the upper mainstem Boise River, Arrowrock Reservoir, Lucky Peak Reservoir, Mores Creek, and their tributaries. Elevations range from 2,840 ft at the base of Lucky Peak Reservoir to 9,070 ft at the upper boundary of the Sheep Creek drainage. The Boise-Mores Creek subbasin covers 620.5 mi^2 in Boise, Ada, and Elmore counties. The southwestern corner of the basin is in Ada County, and the southeastern section of the basin lies in Elmore County. Highway 21 parallels Mores Creek for most of its length. Forest Service Road 268 parallels the Boise River along Lucky Peak and Arrowrock reservoirs and the mainstem Boise River throughout the segment included in this HUC (TMDL 2009).

The streamflow regimes in the watershed have been dramatically altered from historical conditions. Two dams (Lucky Peak Reservoir Dam and Arrowrock Reservoir Dam) were built that isolate migrant fish populations in the subbasin. In addition, downstream dams on the Snake and Columbia River systems have blocked anadromous fish. Remaining migrant fish species have adapted from a fluvial existence to a fluvial/adfluvial lifestyle, generally wintering in reservoirs (TMDL 2009).

In the Boise-Mores Creek subbasin, headwater drainages are generally populated by fish communities of low richness (i.e., few species). Headwater fish communities generally consist of bull trout (*Salvelinus confluentus*) or rainbow/redband trout (*Onchorynchus mykiss* spp.), or both, in addition to sculpin (*Cottus* spp.). Downstream fish communities (found in mainstem migration corridors or reservoir wintering areas) are more diverse and include native species such as mountain whitefish (*Prosopium williamsoni*), northern pike minnow (*Ptychocheilus oregonensis*), redside shiner (*Richardsonius balteatus*), several sucker species (*Catostomus* spp.), and dace (*Rhinichthys* spp.) (TMDL 2009).

Important bull trout spawning and rearing streams include Sheep Creek, the Boise River, and Arrowrock Reservoir. Fluvial and adfluvial bull trout migrate out of the Upper Boise River tributaries and into the mainstem Boise River and Arrowrock Reservoir. Some fish are entrained from Arrowrock Reservoir into Lucky Peak Reservoir, especially during times of high reservoir discharge. There is no upstream fish passage from Lucky Peak Reservoir back to Arrowrock Reservoir. Entrained bull trout are restricted to Mores Creek as potential spawning and rearing habitat. In 2000-2001, U.S. Forest Service fisheries survey crews observed several juvenile bull trout in Upper Mores Creek. In addition, adfluvial bull trout were tracked out of Lucky Peak migrating upstream to above Idaho City in Mores Creek by U.S. Bureau of Reclamation and Forest Service personnel. These fish returned to Lucky Peak during mid-summer, long before spawning season in September and October (TMDL 2009).

While bull trout are thought to be particularly sensitive to environmental change, their dispersal capabilities afford them the opportunity to potentially re-colonize these disturbed streams once conditions become suitable. However, stable bull trout populations require high quality habitat. Large rivers or lakes supporting migratory populations have the highest potential for supporting large, flourishing populations (Rieman and McIntyre 1993) (TMDL 2009).

Specific to the Boise River Basin, bull trout have been reported throughout the Upper Boise subbasin and have also been found in several areas of the Boise-Mores Creek subbasin. Bull trout found in both subbasins exhibit both the migratory and resident life history forms. For more detailed life history studies on bull trout in the Boise River Basin (Monnot et al, 2008, Salow 2001, Flatter 2000, TMDL 2009).

Bull trout have the capability to colonize all tributaries of the subbasin that do not contain impassable barriers. In almost all situations, bull trout were sympatric (coexisted) with anadromous fish species and were the predominant species group. In the absence of anadromous fish, bull trout have adapted to a fluvial/adfluvial existence. Findings of federal and state biologists indicate that most local populations of bull trout are strongly influenced by the resident form, though the migratory form is important. Migratory forms have been documented in Boise River Basin complexes. The first complex consists of Arrowrock Reservoir and the North Fork Boise River, Middle Fork Boise River, and lower South Fork Boise River. The second complex consists of Anderson Ranch Reservoir and the upper South Fork Boise River. It is notable that migratory forms were historically fluvial in nature but apparently have adapted to an adfluvial lifestyle following construction of both Arrowrock (1915) and Anderson Ranch (1950) dams. As previously mentioned, bull trout entrained into Lucky Peak Reservoir are using this reservoir habitat similarly. Adult bull trout captured in the early spring in Arrowrock and Lucky Peak Reservoirs have attained 28 inches in length (Flatter 2000, Salow 2001, TMDL 2009).

Based on the Idaho Fish and Game and U.S. Bureau of Reclamation research, upstream migration by adult bull trout out of Arrowrock Reservoir begins in early April through early July. These fish enter spawning streams in the middle and north forks of the Boise River in late July or August. Spawning commences in September and October when water temperatures decrease below 10° C. Following spawning, adults reenter the main stems and migrate downstream to winter in Arrowrock Reservoir. Bull trout have patchy distribution within the watersheds of the Boise River Basin. While bull trout distributions are probably influenced by habitat loss, dams, diversions, and exotic species, juvenile bull trout also appear to be naturally restricted to cold stream temperature conditions (Rieman and McIntyre 1993, TMDL 2009).

Lower Boise River Watershed

The Lower Boise River watershed drains 1290 mi^2 of rangeland, forests, agricultural lands and urban areas. The lower Boise River is a 64-mi stretch that flows through Ada County, Canyon County, and the city of Boise, Idaho. The watershed also drains portions of Elmore, Gem, Payette, and Boise counties. The river flows in a northwesterly direction from its origin at Lucky Peak Dam to its confluence with the Snake River near Parma, Idaho. Major tributaries include (but are not limited to) Fifteenmile Creek, Mill Slough, Mason Creek, Indian Creek, Conway Gulch, and Dixie Drain (TMDL 1999).

The lower Boise River is home to numerous species of wildlife. The canopy along the river reach near Barber Dam provides winter roosts for bald eagles. Downstream, Eagle Island hosts a great blue heron rookery (Resource Systems, Inc., 1983). Other birds and mammals living in the lower Boise River corridor include but, are not limited to egrets, ducks, geese, deer, beaver, and muskrat. The river corridor supports two heron rookeries, in the Wood Duck Island subdivision and near the Monroc facility in Eagle. The lower Boise River supports a natural and stocked fishery. Two reaches, Lucky Peak to Star and Star to the mouth, support distinctly different fish. The river above Star is a cold-water fishery composed primarily of the salmonids mountain whitefish, rainbow trout, and brown trout. Above Star the river is regularly stocked with rainbow trout by the Idaho Department of Fish and Game. Cool- and warm-water species dominate the river below Star with suckers, dace, carp, and large and small mouth bass being most abundant. The river below Star supports few if any trout species; however, mountain whitefish are seasonally abundant, especially in the fall-winter period (TMDL 1999).

The lower Boise River from Lucky Peak Dam to the confluence with the Snake River is designated for cold-water biota. In addition, the part of the river that extends from the Diversion Dam to Caldwell is designated for salmonid spawning. Recent data indicate that salmonid spawning is likely an existing use in the river from Caldwell to the mouth. The condition of fish and benthic macroinvertebrates in the Boise River indicate that cold-water biota and salmonid spawning uses are impaired in all segments of the river. Temperature and sediment are the pollutants causing impairment of aquatic life. In addition, flow alteration and habitat conditions impair aquatic life uses in the Boise River (TMDL 1999).

Aquatic insects and worms, as a group called benthic macroinvertebrates, are useful indicators of habitat and water quality conditions. Benthic macroinvertebrates are important consumers of algae and detritus in streams, and are a food source for many species of fish. In the Boise River, benthic macroinvertebrate data are available from the U.S. Geological Survey for five sites sampled in October of 1995 and 1996. The sites include Eckert Road, Glenwood Bridge, Middleton, Caldwell, and Fort Boise (near the mouth of the river). Habitat and water quality conditions can be inferred from the numbers and types of pollution-tolerant and pollution-intolerant organisms present at a site. Benthic macroinvertebrate data indicate that the Boise

River has degraded habitat from Eckert Road to its mouth, with habitat conditions for benthic organisms generally declining to a low point near Middleton and Caldwell (TMDL 1999).

Fish populations in the Boise River include rainbow trout, brown trout, mountain whitefish, sculpin, redside shiner, sucker, and chub. The fish are not evenly distributed throughout the river and some species are more successful in sustaining their populations than others. The Boise River experiences intense angling pressure. Currently, natural reproduction of both wild and hatchery trout stocks are insufficient to sustain populations. As a result, the IDFG must stock between 50 and 60 thousand hatchery, catchable-sized rainbow trout and thousands of brown trout fingerlings annually (TMDL 1999).

Brown and rainbow trout generally are limited to the portion of the river upstream of Star Diversion. Trout populations are sustained by stocking programs and limited natural reproduction. Rainbow trout observed at Middleton may be incidental or may be from Indian Creek, which had a significant natural trout population prior to a major fish kill in 1986.

Mountain whitefish, a cold-water salmonid species, have been found in all reaches of the river from Lucky Peak Dam to its mouth at all sampling dates (TMDL 1999). Cold-water biota use the Boise River as habitat from Lucky Peak Dam to the confluence with the Snake River. Fish sampling shows that mountain whitefish, a cold-water species, are present along the length of the river, during both the summer (1997) and winter (1996). Past studies by IDFG confirm the presence of cold-water species from Lucky Peak Dam to the Snake River.

Salmonid spawning is also an existing use in all reaches of the river from Diversion Dam to the mouth. Trout and mountain whitefish are known to spawn to a limited extent in the river between Diversion Dam and Star. Trout are absent downstream of Star and salmonid spawning is limited to mountain whitefish. Multiple age classes of mountain whitefish, including young of year fish were found downstream of Star, demonstrating that spawning is likely occurring (TMDL 1999).

4.2 Environmental Baseline for Listed Snake River Snails

This section describes the current status and associated environmental baseline condition of each listed mollusk considered in this PBA. The environmental baseline is defined as the current habitat condition for the species.

4.21 Action Area for listed mollusks

The action areas include lands within the Idaho Transportation Department (ITD) right-of-way in districts 3-6 near the Snake River. Each district contains a mixture of Bureau of Land Management, Forest Service, state and privately owned lands in Bannock, Bingham, Blaine, Bonneville, Camas, Cassia, Elmore, Fremont, Gooding, Jefferson, Jerome, Lincoln, Madison, Minidoka, Owyhee, Power, and Twin Falls counties, Idaho.

Snake River Physa Snail

- District 3 (Elmore and Owyhee Counties)
- District 4 (Cassia, Elmore, Gooding, Jerome, Minidoka, Twin Falls counties)
- District 5 (Cassia County)

Bliss Rapids Snail

- District 3 (Elmore County)
- District 4 (Elmore, Gooding, Jerome, Twin Falls counties)

Utah Valvata Snail

- District 4 (Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, Twin Falls counties)
- District 5 (Bannock, Bingham, Cassia and Power counties)
- District 6 (Bingham, Blaine, Bonneville, Fremont, Jefferson and Madison counties)

Banbury Springs Lanx

- District 4 (Gooding County)

4.22 Recovery Plan Conservation Actions

The Snake River Aquatic Species Recovery Plan lists a series of actions, each with specific implementation tasks that are needed to initiate recovery of the remaining four listed Snake River snail species. Many of these actions and tasks are the same for all four listed species of mollusks and are described in detail in the Recovery Plan (USFWS 1995a). The snail species that would benefit from the following initial recovery actions from the Recovery Plan are indicated in parentheses after each bullet:

- Ensure state water quality standards for cold-water biota and habitat conditions so that viable, self-reproducing snail colonies are established in free-flowing mainstem and cold-water spring habitats within specified geographic ranges, or recovery areas, for each of the four listed species. Snails detected at the sites selected for monitoring will be surveyed on an annual basis to determine population stability and persistence, and verify presence of all life history stages for a minimum of five years. (Snake River physa snail, Utah valvata snail, Bliss Rapids snail, and Banbury Springs lanx)

- Develop and implement habitat management plans that include conservation measures to protect cold-water spring habitats occupied by Banbury Springs lanx, Bliss Rapids snail, and Utah valvata snail from further habitat degradation (i.e., diversions, pollution, or development).

- Stabilize the Snake River Plain Aquifer to protect discharge at levels necessary to conserve occupied cold-water spring habitats. (Banbury Springs lanx, Bliss Rapids snail, and Utah valvata snail)
- Evaluate the effects of nonnative flora and fauna on listed species in the Snake River from C.J. Strike Dam to American Falls Dam (Snake River physa snail, Utah valvata snail, Bliss Rapids snail, and Banbury Springs lanx).

4.23 Listed Snake River Snail Threats and Information Applicable to the ITD Districts Three, Four, Five and Six.

The Snake River Aquatic Species Recovery Plan discussion of reasons for decline is presented here in its entirety and notes whether threats generally apply to all or only some of the listed Snake River mollusk species.

The free-flowing, cold-water environments required by the listed Snake River species have been affected by, and are vulnerable to, continued adverse habitat modification and deteriorating water quality from one or more of the following:

- hydroelectric development
- load-following (the practice of artificially raising and lowering river levels to meet short-term electrical needs by local run-of-the-river hydroelectric projects)
- effects of hydroelectric project operations
- water withdrawal and diversions
- water pollution
- inadequate regulatory mechanisms (which have failed to provide protection to the habitat used by the listed species)
- possible adverse affects of exotic species

Seven proposed hydroelectric projects, including two high-dam facilities, potentially threaten remaining free-flowing river reaches between the C.J. Strike and American Falls dams. Dam construction adversely affects aquatic species through direct habitat modification and the ability of the Snake River to assimilate point and nonpoint source pollution. Further hydroelectric development along the Snake River would inundate existing snail habitats through impoundment; reduce critical shallow shoreline habitats in tail water areas due to water fluctuations; elevate water temperatures; reduce dissolved oxygen levels in impounded reaches; and further fragment remaining mainstem populations or colonies of the listed snails.

Load-following also threatens native aquatic species habitat. Load-following is a frequent and sporadic practice that results in dewatering aquatic habitats in shallow shoreline areas. With the exception of the Banbury Springs lanx and possibly the Snake River physa snail, these daily water fluctuations prevent federally listed species and species of concern from occupying the most favorable habitats. The quality of water in these habitats has a direct effect on the survival of native aquatic species. Water temperature, velocity, dissolved oxygen concentrations and substrate type are all critical components of water quality that affect the survival of the five listed aquatic snails. These species require cold, clean, well-oxygenated, and rapidly flowing waters. They are intolerant of pollution and factors that cause oxygen depletion, siltation, or warming of their environment.

Recovery of the listed species will require restoration of their habitat, and will entail restoration of the water quality of the middle Snake River to a level that supports and maintains a diverse and sustainable aquatic ecosystem. In particular, reduction of nutrient and sediment loading to the river and restoration of riverine conditions are needed to recover the listed species.

Any factor that leads to deterioration in water quality would likely extirpate these taxa. For example, the Banbury Springs lanx lacks lungs or gills and respires through unusually heavy, vascularized mantles. This species cannot withstand even temporary episodes of poor water quality conditions. Because of stringent oxygen requirements, any factor that reduces dissolved oxygen concentrations for even a few days would very likely prove fatal to most or all of the listed snails.

Factors that further degrade water quality include reduction in flow rate, warming as a result of impoundment, and increases in the concentration of nutrients, sediment, and other pollutants reaching the river. The Snake River is affected by runoff from feedlots and dairies, hatchery and municipal sewage effluent, and other point and nonpoint discharges. During the irrigation season, 13 perennial streams and more than 50 agricultural surface drains contribute irrigation tail waters to the Snake River (IDHW 1991). In addition, commercial, state, and federal fish culture facilities discharge wastewater into the Snake River and its tributaries. These factors, coupled with periodic, drought-induced low flows, have contributed to reduced dissolved oxygen levels and increased plant growth and a general decline of cold-water free-flowing river species of the Snake River.

Water quality in the alcove springs and tributary spring streams in the Hagerman Valley area have also been affected, though not as severely as the mainstem Snake River. The Hagerman area receives massive cold-water recharge from the Snake River Plain aquifer. However, several of these springs and spring tributaries have been diverted for hatchery use, which reduces or eliminates clean water recharge and contributes flows enriched with nutrients to the Snake River. At The Nature Conservancy’s Preserve near Hagerman, colonies of Utah valvata and Bliss Rapids snails have recently declined or been eliminated at several sites. This decline is due to decreases in water quality primarily from agriculture and aquaculture wastewater originating outside of and flowing into the preserve (Frest and Johannes 1992).

Another threat to the listed species is the presence of the New Zealand mudsnail (*Potamopyrgus antipodarum*) in the middle Snake River. The widely distributed and adaptable mudsnail is experiencing explosive growth in the Snake River and shows a wide range of tolerance for water fluctuations, velocity, temperature and turbidity. The species seems to prefer warmer polluted waters over pristine cold spring environments. Based on recent surveys, the mudsnail is not abundant in habitats preferred by Banbury Springs lanx, Bliss Rapids snail, or the Utah valvata snail. However, the species does compete directly for habitats of the Snake River physa snail in the mainstem Snake River.

Sediment delivery associated with several Bureau-permitted activities can potentially pose site-specific water quality and habitat threats to listed Snake River snails. Sediment delivery to the

Snake River or resulting springs may result from soil disturbance and erosion associated with Bureau-permitted activities, and from the loss of protective groundcover because of wildfires or non-native plant invasion followed by erosion. Off-highway vehicle recreation in upland areas with erosive soils, such as in the Jarbidge Field Office area, may also contribute to sediment delivery into listed Snake River snail habitat. Sediment delivery to the Snake River or springs may result if unrestricted livestock grazing occurs along the river banks and if livestock facilities, such as watering troughs, are inappropriately located in the bottom of gullies with highly erosive soils. Sediment delivery to the Snake River also can occur as a result of off-highway vehicle activities or mining, with potential effects most severe in areas near the river and tributaries with unstable and highly erosive soils. In addition, because the Utah valvata snail and the Bliss Rapids snail occur in shallow as well as deep water, these species and their habitats are subject to trampling, and possible mortality (take), by watering livestock or recreational activities such as swimming, wading, or watercraft launching.

4.24 Factors Affecting the Species

The free-flowing, cold-water environments where the listed Snake River snails evolved have been negatively impacted by anthropogenic activities throughout their range. Development of water impoundments and hydroelectric dams has changed the fundamental character of the Snake River. This has resulted in fragmentation of previously continuous river habitat, affected fluvial and energy flow dynamics (Osmundson et al. 2002), and contributed to the degradation of water quality. In addition to the loss of habitat and isolation effects posed by dams and hydropower operations, specifically load following, are documented to have negative impacts to aquatic species occupying habitats downstream of such facilities (Fisher and LaVoy 1972, Gislason 1980, Morgan et al. 1991, Christman et al. 1996). This is especially important for shallow-dwelling species like the Bliss Rapids snail. Data from recent studies has shown that similar operations on the middle Snake River can be expected to negatively impact Bliss Rapids snails through desiccation and exposure to extremes in air temperature (Richards, D. and Arrington 2007, Richards, R. and B. Kerans in litt. 2007), but studies are ongoing and these impacts have not yet been fully quantified.

Multiple studies have linked high nutrient loads (especially nitrates and other nitrogen compounds) in the aquifer to various agricultural practices (USEPA 2002, Neely 2005). While some agricultural practices have remained relatively constant (e.g., irrigated crop lands), others have increased significantly (e.g., cattle and dairy production). It has yet to be determined how such increases may impact the Snake River Plain Aquifer, nonpoint sources of pollutants into the Snake River, or the listed snails reliant on these spring or river habitats. Water quality issues are the greatest concern for the continued existence of these snail species.

Degraded water quality in some alcove and tributary springs and streams has also adversely affected snails (Frest and Johannes 1992). Despite the often high-nutrient content of spring discharges, free-flowing, cold-water spring tributaries are recognized as the most important habitats for the listed Snake River snails, including the Bliss Rapids snail. Numerous cold-water springs in the Hagerman Reach and throughout the middle Snake River have been diverted for aquaculture, power generation (e.g., Thousand Springs), and agricultural uses — which have resulted in degraded water quality in some springs. In addition, infrequent and unpredictable contaminant spills represent a potential threat to listed Snake River snails.

Changes in the use of stored water in the Snake River Basin for agriculture or other uses also impact listed Snake River snails and their habitats. For example, federal and private water projects withhold, store, and release water to coincide with irrigation needs. This timing is substantially different than flows occurring under a natural hydrograph to which the species is adapted. The majority of water storage in the basin has recently reverted to agricultural use and this is reflected in the withholding of river flows below Milner Dam. The combination of withholding of river flows together with input of agricultural returns below Milner Dam is a primary source of water quality degradation, and likely a limiting factor in the distribution of the Bliss Rapids snail in this river reach (USEPA 2002). River populations of the Bliss Rapids snail only become more numerous downstream of the Thousand Springs Complex and Malad River, where relatively cleaner spring contributions constitute a significant portion of the river volume.

In its altered state, the middle Snake River provides suitable habitat for numerous alien species, and these species have the potential to impact listed Snake River snails. Most notable of these is the New Zealand mudsnail (*Potamopyrgus antipodarum*), which is now present, if not abundant, throughout a large portion of the middle Snake River inhabited by listed Snake River snails. The New Zealand mudsnail appears to flourish in watercourses with relatively low DO and with substrates of mud or silt. It has also been recorded to reach high densities within some of the cold-water spring complexes of the middle Snake River, in habitats commonly occupied by Bliss Rapids snail (e.g., in excess of 495,000 per m^2 at Banbury Springs) (Richards et al. 2001). Dr. D. Gustafson of Montana State University (in Richards 2001) documented declines of native snails in the presence of a growing mudsnail population, and others have observed New Zealand mudsnails densely packed on rock surfaces formally occupied by the Bliss Rapids snail (Frest et al. 1991, Bowler et al. 1993). Study of the competitive interactions of the mudsnail with native North American aquatic species is ongoing; these non-native snails have been shown to spread and reproduce rapidly, and greatly deplete the standing crop of aquatic algae and periphyton (Cada 2001, Hall 2001, Hall et al. 2003). The physiologic plasticity of the New Zealand mudsnail allows it to thrive in eutrophic reservoir habitats, as well as some cold-water tributaries. It is likely that the anthropogenic alterations of the middle Snake River – including the presence of dams and hydroelectric operations – and reduced water quality are partially responsible for this invading snail's success (Bowler et al. 1993).

Physical and ecological barriers (e.g., reservoirs) in the range of listed Snake River snails may preclude or limit genetic exchange between small, isolated populations. This results in reduced genetic variation, which is documented to have negative impacts on their reproductive output and overall vigor (Shaffer 1981, Dudash and Fenster 2000). At least one study has documented delayed maturation and reduced fecundity in small isolated colonies of aquatic snails (Puurtinen et al. 2004).

Spring outflows from the Snake River Plain Aquifer have been declining over the past 50 years. Prior data indicate that spring out-flow had actually increased since the turn of the 20th century when past flood irrigation methods may have helped charge the aquifer (Kjelstrom 1992). Water conservation measures implemented over the past 30 years, along with increased groundwater pumping may account for the more recent declines. Groundwater pumping is currently a contentious issue in the area and will remain a serious threat to listed Snake River snails as water demand for municipal or agricultural use increases and/or under conditions of prolonged drought.

Chapter 5: Effects Analysis for ESA-listed Fish Species

The effects analysis presented in this PBA is organized into two sections; one for "not likely to adversely affect" actions, and the other for "likely to adversely affect" actions. Table 4, below, labels the proposed actions and their associated effect determinations. Table 5 and Table 7 in the following text detail the rationales for "not likely to adversely affect" determinations and "likely to adversely affect" determinations.

Table 4. Project effect determinations for all species

Not Likely to Adversely Affect Projects	Likely to Adversely Affect Projects
Seal Coats, Tack Coat, Prime Coat	2-Lane Bridge Construction – (Over Water)
Plant Mix Overlay	Bank Stabilization (Riprap) – Stream Channel
CRABS (Cement Recycled Asphalt Base Stailization)	Bank Stabilization (Gabion Basket) – Stream Channel
CIR (Cold In-Place Recycle)	Culvert Installation – Perennial Stream
Bridge Deck Hydro-Demolition	
Silica Fume and Latex Modified Concrete Overly	Culvert Maintenance – Perennial Stream
High Molecular Weight Methacrylate Seal (HMWM)	Culvert Extension – Perennial Stream
Concrete Waterproof Systems (Membrane Type A,B,C and D)	Geotechnical Drilling
Bridge Deck Epoxy Seal	Small Structure Repair
2-Lane Bridge Construction (Upland)	All LAA projects assume in-water work and issuance COE, IDWR and IDEQ permits.
Excavation and Embankment for Roadway Construction (Earthwork)	
Rock Scaling	
Passing Lanes, Turnbays and Slow Moving Vehicle Turnouts (Wide Shoulder Notch)	
Pavement Widening (Sliver Shoulder Notch)	
Bank Stabilization (Riprap) – Upland	
Bank Stabilization (Gabion Basket) – Upland	
Mechanically Stabilized Earth Embankment (MSE Wall)	
Ditch Cleaning	
Culvert Installation – Seasonal	
Culvert Extension – Seasonal Stream	
Culvert Maintenance – Seasonal Stream	
Guardrail Installation	
Striping (methl methacrylate or paint)	

5.1 Effects analysis for "Not Likely to Adversely Affect" actions

The following table provides a checklist for documenting environmental baseline and effects of actions on relevant indicators for the action area. It applies to actions with a "Not Likely to Adversely Affect" determination.

Table 5. Environmental baseline and matrix effects on bull trout, salmon and steelhead (NLAA projects)

Pathways	Environmental Baseline			Effects of the Actions		
Indicators	Properly Functioning	At Risk	Unacceptable Risk	Restore	Maintain	Degrade
Watershed Conditions						
Watershed Road Density	n/a	n/a	n/a	n/a	n/a	n/a
Streamside Road Density	n/a	n/a	n/a	n/a	n/a	n/a
Landslide Prone Road Density	n/a	n/a	n/a	n/a	n/a	n/a
Riparian Vegetation Condition	…	X	…	…	X	…
Peak/Base Flow	n/a	n/a	n/a	n/a	n/a	n/a
Water Yield (ECA)	n/a	n/a	n/a	n/a	n/a	n/a
Sediment Yield	…	X	…	…	X	…
Channel Condition & Dynamics						
Width/Depth Ratio	…	X	…	…	X	…
Streambank Stability	…	X	…	…	X	…
Floodplain Connectivity	n/a	n/a	n/a	n/a	n/a	n/a
Water Quality						
Temp – Snake River Basin Steelhead and Chinook	…	X	X	…	X	…
Temp – Bull Trout	…	X	X	…	X	…
Suspended Sediment	…	X	…	…	X	…
Chemical Contamination/Nutrients	X	X	…	…	X	…
Habitat Access						
Physical Barriers	n/a	n/a	n/a	n/a	n/a	n/a
Habitat Elements						
Cobble Embeddedness	…	X	…	…	X	…
Percent Surface Fines	…	X	…	…	X	…
Percent Fines by Depth	…	X	…	…	X	…
Large Woody Debris	…	X	…	…	X	…
Pool Frequency	…	X	…	…	X	…
Pool Quality	…	X	…	…	X	…
Off-Channel Habitat	…	X	…	…	X	…
Habitat Refugia	n/a	n/a	n/a	n/a	n/a	n/a

Note: Indicators of properly functioning, at risk, and not properly functioning habitat condition.

For the purposes of this checklist, "restore" means to change the function of an indicator for the better, or that the rate of restoration rate is increased.

For the purposes of this checklist, "maintain" means that the function of an indicator will not be degraded and that the natural rate of restoration for this indicator will not be retarded.

For the purposes of this checklist, "degrade" means to change the function of an indicator for the worse, or that the natural rate of restoration for this indicator is retarded. In some cases, a low environmental baseline indicator maybe further worsened, and this should be noted.

All indicators identified as n/a are not addressed further in this document.

5.11 Watershed Conditions

Riparian Vegetation Condition

Environmental Baseline: At Risk. Riparian vegetation provides high bank stability. Federal ownership within the action area provides for protection of existing riparian areas. Non-federal ownership habitats are at risk from anthropogenic activities such as livestock grazing, mining, timber harvest, development, and road-building.

Effect of Actions: Maintain. Stream bank disturbance will be kept to insignificant levels. Not Likely to Adversely Affect projects (listed in Table 4) will have little or no ground disturbance in riparian areas; therefore, matrix parameters for riparian vegetation condition will be maintained. Any riparian vegetation that is disturbed will be re-seeded or re-planted with appropriate species. Any disturbance will be insignificant at the stream reach scale.

Sediment Yield

Environmental Baseline: At Risk. Environmental baseline for sediment yield varies widely throughout the project area.

Effects of Actions: Maintain. Effects of the action will be to maintain sediment yield within the referenced basins because there will be little or no ground disturbance. Construction activities will have negligible potential to adversely affect streambank stability or sediment yield due to the stringent erosion control measures and monitoring which will be implemented. Project effects will be short-term in duration and scale; therefore, matrix parameters for sediment yield will be maintained.

5.12 Channel Conditions and Dynamics

Width/Depth Ratio

Environmental Baseline: At Risk. Environmental baseline for width/depth ratios vary widely through the project area. Some river segments have been encroached on by highway construction and development (see Sediment Yield).

Effect of Actions: Maintain. Width/depth ratios could be affected by large sediment inputs and/or streambank disturbance. Not Likely to Adversely Affect projects (listed in Table 4) will have little or no ground disturbance in riparian areas and will not adversely affect sediment yield or streambank stability; therefore, matrix parameters for width/depth ratios will be maintained (see Sediment Yield above).

Streambank Stability

Environmental Baseline: At Risk. River banks are generally considered stable when large substrate such as cobble, boulders and rip-rap is present. Unstable riverbanks are most often localized along small river segments or locations where human activities have created disturbance.

Effect of Actions: Maintain. The action will maintain riverbank stability. The proposed “not likely to adversely affect” projects will not cause disturbance to streambanks below ordinary high-water mark and will therefore not affect stability at this most important level. In some cases, small amounts of streambank above the ordinary high-water mark could be disturbed. Because of the small scale of these actions and because disturbed areas will be re-seeded or re-planted, streambank stability will not be significantly affected. Therefore, matrix parameters for streambank stability will be maintained.

5.13 Water Quality

Temperature - Spawning

Environmental Baseline: Unacceptable Risk. 303d list indicates large numbers of streams/rivers (and their tributaries) that have water quality issues.

Effect of Actions: Maintain. Stream temperatures are influenced by riparian vegetation and tributary inflow. There are no components in the proposed action which could affect tributary inflow. Any riparian vegetation that is disturbed will be reseeded or replanted. Riparian vegetation will be affected on a very small scale. Therefore, matrix parameters for temperature will be maintained.

Temperature - Rearing/Migration

Environmental Baseline: Unacceptable Risk. See Temperature - Spawning

Effect of Actions: Maintain. See Temperature - Spawning

Suspended Sediment

Environmental Baseline: At Risk. See Sediment Yield

Effect of Actions: Maintain. See Sediment Yield

Chemical Contamination

Environmental Baseline: Properly Functioning. Environmental baseline condition for chemical contamination has a high (good) condition. Few chemical contamination problems have been identified within the state.

Effect of Actions: Maintain. Effects of the action will maintain the high condition rating within the state. Chemical contamination is not likely to occur due to the strict preventative measures proposed for project implementation; therefore, matrix parameters for chemical contamination will be maintained.

5.14 Habitat Elements

Cobble Embeddedness

Environmental Baseline: At Risk. See Sediment Yield.

Effect of Actions: Maintain. See Sediment Yield.

Percent Surface Fines

Environmental Baseline: At Risk. See Sediment Yield.

Effect of Actions: Maintain. See Sediment Yield.

Percent Fines By Depth

Environmental Baseline: At Risk. See Sediment Yield.

Effect of Actions: Maintain. See Sediment Yield.

Large Woody Debris

Environmental Baseline: At Risk. Environmental baseline for large woody debris varies widely throughout the project area.

Effect of Actions: Maintain. Effects of the action will be to maintain large woody debris within the referenced basins because there will be little or no ground or vegetation disturbance, or in-water work. This will protect both the sources of potential large woody debris and the existing amounts of large woody debris. Therefore, matrix parameters for large woody debris will be maintained.

Pool Frequency

Environmental Baseline: At Risk. Conditions vary widely throughout the state. Conditions contributing to Pool Frequency, such as streambank stability, sediment yield and large woody debris will not be adversely affected; therefore, matrix parameters for pool frequency will be maintained.

Effect of Actions: Maintain. Pool frequency is typically a function of large woody debris (which serves to help form pools) and sediment processes (an excess of sediment can fill pools). Because sediment yield and large woody debris will not be adversely affected by the "not likely to adversely affect" actions, pool frequency will not likely be adversely affected.

Pool Quality

Environmental Baseline: At Risk. See Pool Frequency.

Effect of Actions: Maintain. See Pool Frequency.

Off-Channel Habitat

Environmental Baseline: At Risk. Off-channel habitat is present but use may be limited in some reaches. Land uses such as highway building, railroad, and private development have infringed upon or cut-off floodplains, backwater areas, and side channel areas.

Effect of Actions: Maintain. Effect of the action will be to maintain existing off-channel habitats; therefore, matrix parameters for off-channel habitat will be maintained.

5.15 Take

Harassment

Environmental Baseline: At Risk. Spring/summer Chinook salmon, fall Chinook salmon, Snake River Basin steelhead, and bull trout. Throughout the project area, seasonal fishing from shore, wading, and from boats (float and power boats) has the potential to harass steelhead, fall Chinook salmon and bull trout. Steelhead, fall Chinook salmon and bull trout are staging, overwintering, or migrating during this period. Boat use has the highest potential to disturb or harass fish, particularly power boats. Any of these species may be caught while anglers are fishing for other species. It is common for these species to be caught and released. Incidental catching of bull trout does occur, but is not common.

Sockeye salmon and spring/summer Chinook salmon migrate through a river segment more quickly than fish utilizing the area for spawning, rearing, or overwintering/staging. Adult and smolt migrations are taking place during the spring periods (April to July). Spring/summer Chinook salmon adults and smolts are susceptible to being caught or harassed during spring migration periods. Sockeye salmon move quickly during migration periods, and migrating fish numbers are very low. Summer recreational fishing may occasionally result in a listed fish being caught. Snake River Basin Steelhead smolts are commonly caught. All caught listed species must be released unharmed. In-stream use associated with wading or swimming may harass fish, but to a lesser extent because it is confined to a very localized and small segment within a watershed.

Effect of Actions: Maintain. None of the actions listed above involve in-stream activities which could harass ESA-listed fish species. Potential effects of activities taking place on shore would only cause insignificant effects; therefore, matrix parameters for Harassment will be maintained.

Redd Disturbance

Environmental Baseline: At Risk. Condition varies widely across the state.

Effect of Actions: Maintain. Redds could be disturbed through physical damage (crushed) or sediment delivery. Effects of the action will be to maintain baseline conditions for spawning and incubation because there is no in-stream work. Therefore, matrix parameters for redd disturbance will be maintained (see Take/Harassment and Sediment Yield).

5.16 Primary Constituent Elements (PCEs)

ESA analysis of effect on designated critical habitat focuses on effects to Primary Constituent Elements (PCEs). The PCEs for salmon and steelhead are described below. Types of sites and essential physical and biological features designated as PCEs for salmon and steelhead, and the species life stage each PCE supports**.**

All potential effects to PCEs for salmon and steelhead from "not likely to adversely affect" actions are described above in the matrix analysis.

Table 6. Primary Constituent Elements for salmon and steelhead

Site	Essential Physical and Biological Features	ESA-listed Species Life Stage
Snake River Steelhead		
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity & floodplain connectivity to form and maintain physical habitat conditions	Juvenile growth and mobility
	Water quality and forage	Juvenile development
	Natural cover	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover	Juvenile and adult mobility and survival
Snake River Spring/summer Chinook Salmon; fall Chinook		
Spawning & Juvenile Rearing	Spawning gravel, water quality and quantity, cover/shelter, food, riparian vegetation, and space	Juvenile and adult.
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, safe passage	Juvenile and adult.
Snake River Sockeye Salmon		
Spawning & Juvenile Rearing	Spawning gravel, water quality and quantity, water temperature, food, riparian vegetation, and access	Juvenile and adult.
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, safe passage	Juvenile and adult.

Note: Additional PCEs pertaining to estuarine, near shore, and offshore marine areas have also been described for Snake River steelhead. These PCEs will not be affected by the proposed action and have therefore not been described in this PBA.

Forage includes aquatic invertebrate and fish species that support growth and maturation.

Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Food applies to juvenile migration only.

5.17 Bull Trout Subpopulation Characteristics and Habitat Integration

Environmental Baseline: At Risk. Referenced basins have a moderate condition for subpopulation size, growth and survival, life history diversity and isolation, persistence and genetic integrity, and habitat conditions. Many reaches are used by fluvial bull trout for migration, overwintering, and adult rearing. Population data is lacking in many drainages. Many of the subbasins within the action area provide sub-optimal adult and subadult rearing temperatures due to elevated summer water temperatures.

Effect of Actions: Maintain. Effects of the action will maintain existing conditions for bull trout subpopulation characteristics and habitat integration. Project will have negligible potential to adversely impact habitats. The Idaho Department of Fish and Game is responsible for consultation and establishing fishing seasons for Idaho. The Primary Constituent Elements (PCEs) for bull trout will not be adversely modified by implementation of any project actions. The PCEs that will not be adversely altered by this action include the following:

- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporehic flows) to contribute to water quality and quantity and provide thermal refugia.
- Migratory habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
- An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
- Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes with features such as large wood, side channels, pools, undercut banks and substrates, to provide a variety of depths, gradients, velocities, and structure.
- Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shade, such as that provided by riparian habitat; and local groundwater influence.
- Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount (e.g., less than 12 percent) of fine substrate less than 0.85 mm (0.03 in.) in diameter and minimal embeddedness of these fines in larger substrates are characteristic of these conditions.
- A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, they minimize departures from a natural hydrograph.
- Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
- Few or no nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass; inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.

The NLAA actions described in Table 4 will not adversely affect bull trout PCEs for the following reasons:

- The conservation measures proposed include numerous measures to prevent chemical contamination. These include having staging, fueling, and storage areas adequately buffered from aquatic areas and not allowing uncured concrete to come into contact with water.

- Water temperatures are primarily affected by stream shade and flow. Stream shade is typically a function of riparian vegetation condition and there will be minimal effects to riparian vegetation with the proposed action. There are also no actions proposed that would affect stream flows. For these reasons, the proposed action would not likely affect water temperature.
- Complex stream channels would not likely be adversely affected by these actions because there would be not channel-altering work conducted.
- Substrate composition could only be affected by the introduction of large amounts of fine sediment and, for the reasons referenced above, this will not likely occur under these actions.
- There are no actions which will alter stream hydrographs.
- There are no actions which will affect sub-surface water sources.
- There are no actions that will alter migratory corridors.
- Bull trout food bases could only be altered through mechanisms of chemical contamination, sediment delivery, or alteration of riparian vegetation. Chemical contamination could potentially kill prey species but, for the reasons referenced above, this will not likely occur. Sediment delivery could potentially cover prey habitat or suffocate prey species but, for the reasons referenced above, this will not likely occur. A reduction in riparian vegetation could potentially reduce the food supply of prey species but, for the reasons above, riparian vegetation will not likely be adversely affected.
- The proposed action will not introduce predatory, interbreeding, or competitive nonnative species.

5.18 Interrelated and Interdependent Effects (NLAA)

The project is not interrelated or interdependent with any other known ITD, BLM, IDFG or FS actions planned within the project areas.

5.19 Cumulative Effects (NLAA)

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). Cumulative effects that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

Between 2000 and 2007, the population of Idaho increased 15.9 percent (http://quickfacts.census.gov/qfd/states/16000.html) Thus, it is assumed that future private and state actions will continue within the action area, increasing as population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, or residential development is also likely to grow. The effects of new development caused by that demand are likely to reduce the conservation value of the habitat within the watershed. The documented subbasins have a moderate to high risk for combined effects of activities occurring on private and state lands. A large variety of actions within the analysis area may affect listed species and habitat. The primary potential for adverse effects are associated with increased development, residences, roads, highways, timber harvest, livestock grazing, and recreation use. Recreational use is increasing annually in the referenced subbasins.

The effects of the action, when considered cumulatively with effects of reasonably certain future state and private actions are not likely to adversely affect the conservation value of the affected critical habitat.

5.110 Determination of Effect (NLAA)

It has been determined that implementation of actions identified as NLAA in Table 4 "*may affect but are not likely to adversely affect*" Snake River fall Chinook salmon, spring/summer Chinook salmon, Snake River Basin steelhead, Snake River sockeye salmon, bull trout, Kootenai River white sturgeon, Banbury Spring snail, Bruneau hot springsnail, Selkirk Mountain woodland caribou, grizzly bear, gray wolf, Northern Idaho ground squirrel, Canada lynx, MacFarlane's four-o'clock, water howellia, Ute ladies'-tresses, Spalding's catchfly, slickspot peppergrass, Christ's paintbrush, Columbia spotted frog, southern Idaho ground squirrel and yellow-billed cuckoo, or designated critical habitat for these species.

The rationale for this determination is based on the following:

Aquatics

- The action will not degrade the condition of any matrix indicators.
- All appropriate construction BMPs, including monitoring and adaptive management practices, will be employed to minimize effects to riparian vegetation condition, sediment yield, width/depth ratios, streambank stability, temperature (spawning), temperature (rearing/migration), suspended sediment, chemical contamination, cobble embeddedness, percent surface fines, percent fines by depth, large woody debris, pool frequency, pool quality, off channel habitat, harassment and redd disturbance within the referenced river basins.

Terrestrials

- There will be no take of any listed species.
- Projects do not occur within any designated critical habitats.
- Projects are not anticipated to alter or impact habitat for prey species.
- Appropriate work windows will be established with Idaho Department of Fish and Game and adhered to.
- Adequate displacement habitat exists near project areas.

Essential Fish Habitat (Chinook and Coho salmon)

The proposed actions listed as NLAA in Table 4 will not adversely affect essential fish habitat for the reasons described above in the matrix analysis.

5.2 Effects analysis for "Likely to Adversely Affect" actions

The following table provides a checklist for documenting environmental baseline and effects of actions on relevant indicators for the action area. It applies to actions with a "Likely to Adversely Affect" determination.

Table 7. Environmental baseline and matrix effects on bull trout, salmon and steelhead (LAA projects)

Pathways	Environmental Baseline			Effects of the Actions		
Indicators	Properly Functioning	At Risk	Unacceptable Risk	Restore	Maintain	Degrade
Watershed Conditions:						
Watershed Road Density	n/a	n/a	n/a	n/a	n/a	n/a
Streamside Road Density	n/a	n/a	n/a	n/a	n/a	n/a
Landslide Prone Road Density	n/a	n/a	n/a	n/a	n/a	n/a
Riparian Vegetation Condition	…	X	…	…	X	…
Peak/Base Flow	n/a	n/a	n/a	n/a	n/a	n/a
Water Yield (ECA)	n/a	n/a	n/a	n/a	n/a	n/a
Sediment Yield	…	X	…	…	…	X
Channel Condition & Dynamics:						
Width/Depth Ratio	…	X	…	…	…	X
Streambank Stability	…	X	…	…	…	X
Floodplain Connectivity	n/a	n/a	n/a	n/a	n/a	n/a
Water Quality:						
Temp – Snake River Basin Steelhead and Chinook	…	…	X	…	X	…
Temp – Bull Trout	…	…	X	…	X	…
Suspended Sediment	…	X	…	…	…	X
Chemical Contamination/Nutrients	X	…	…	…	X	…
Habitat Access:						
Physical Barriers	n/a	n/a	n/a	n/a	n/a	n/a
Habitat Elements:						
Cobble Embeddedness	…	X	…	…	…	X
Percent Surface Fines	…	X	…	…	…	X
Percent Fines by Depth	X	…	…	…	…	X
Large Woody Debris	…	X	…	…	X	…
Pool Frequency	…	X	…	…	…	X
Pool Quality	…	X	…	…	…	X
Off-Channel Habitat	n/a	n/a	n/a	n/a	n/a	n/a
Habitat Refugia	n/a	n/a	n/a	n/a	n/a	n/a

Note: Indicators of properly functioning, at risk, and not properly functioning habitat condition.

For the purposes of this checklist, "restore" means to change the function of an indicator for the better, or that the rate of restoration rate is increased.

For the purposes of this checklist, "maintain" means that the function of an indicator will not be degraded and that the natural rate of restoration for this indicator will not be retarded.

For the purposes of this checklist, "degrade" means to change the function of an indicator for the worse, or that the natural rate of restoration for this indicator is retarded. In some cases, a low environmental baseline indicator maybe further worsened, and this should be noted.

All indicators identified as n/a are not address further in this document.

5.21 Watershed Conditions

Riparian Vegetation Condition

Environmental Baseline: At Risk. Riparian vegetation provides high bank stability. Federal ownership within the action area provides for protection of existing riparian areas. Non-federal ownership habitats are at risk from anthropogenic activities such as livestock grazing, mining, timber harvest and road building.

Relevant Project Types: Two-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair

Effect of Actions: All of the relevant project types have the capacity to adversely affect riparian vegetation condition through both temporary and permanent ground disturbing activities. The proposed action for the two-lane bridge replacement is the only action that has specific measures to replace disturbed vegetation. Bank stabilization actions typically involve the covering of some riparian vegetation for the length of the project, as do culvert installation and extension actions. Culvert maintenance actions might have a small adverse impact on riparian vegetation but this will only be short-term in nature.

Although these actions might have an adverse impact on riparian vegetation, these impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Sediment Yield

Environmental Baseline: At Risk. Environmental baseline for sediment yield varies widely throughout the project area.

Relevant Project Types: 2-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair , Geotechnical Drilling

Effects of Actions: All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-shore ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will likely also be relatively small. Idaho state water quality standards will be met during project implementation.

The proposed actions would result in temporary elevated turbidity. Bash et al. (2001) identified timing, duration, intensity, and frequency of sediment exposure as the most critical aspects of a sediment effects analysis. Depending on the level of exposure, suspended sediment can cause lethal, sublethal, and behavioral effects in juvenile and adult salmonids (Newcombe and Jensen 1996). For salmonids, elevated suspended sediment (i.e., turbidity) has been linked to a number of behavioral and physiological responses (i.e., gill flaring, coughing, avoidance, and increase in blood sugar levels) which indicate some level of stress (Bisson and Bilby 1982, Sigler et al. 1984, Berg and Northcote 1985, Servizi and Martens 1992). Most of these studies observed chronic turbidity levels rather than the brief spikes likely under the proposed action. Although turbidity may cause stress, Gregory and Northcote (1993) have shown that moderate levels of turbidity (35 to 150 nephelometric turbidity units) accelerate foraging rates among juvenile Chinook salmon, likely because of reduced vulnerability to predators (camouflaging effect).

Expected turbidity levels are within the levels at which Gregory and Northcote (1993) observed increased foraging by juvenile Chinook salmon. Although there are studies indicating the expected turbidity levels could cause gill abrasion and/or increased coughing, those studies only observed long-term exposures to elevated turbidity. Under the proposed action, turbidity increases would last only short periods of time before returning to background levels and are relatively consistent with the natural environmental pulses. Therefore, the turbidity increases are likely to cause only very minor behavioral effects, such as temporary avoidance of the action area (Lloyd et al. 1987). Some fish are likely to remain in the affected area due to the small and temporary increase in turbidity (Bisson and Bilby 1982). Fish that remain in the action area are likely to capitalize on increased foraging opportunities (Quigley 2003, Gregory and Northcote 1993).

Therefore, minor turbidity levels from the proposed action are likely to cause short-term avoidance responses and potentially, corresponding short-term increases in foraging rates. Although these actions might have an adverse impact on sediment yield, these impacts are typically small relative to the project’s action area and even smaller when considered in a watershed context.

5.22 Channel Conditions and Dynamics

Width/Depth Ratio

Environmental Baseline: At Risk. Environmental baseline for width/depth ratios vary widely through the project area. Some river segments have been encroached on by road construction and development.

Relevant Project Types: 2-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair

Effects of Actions: Width/depth ratios could be adversely affected by activities that produced sediment and consequently resulted in a decrease in pool depths. All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-shore ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Idaho state water quality standards will be met during project implementation.

Although these actions may have an adverse impact on sediment yield, these impacts are typically small relative to the project’s action area and even smaller when considered in a watershed context. As the effects on sediment yield are small, the effects on width/depth ratios would likewise be small.

Streambank Stability

Environmental Baseline: At Risk. Riverbanks are often considered stable when large substrate such as cobble, boulders, and rip-rap is present. Unstable riverbanks are most often localized along small river segments or locations where human activities have created disturbance.

Relevant Project Types: Two-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair

Effect of Actions: Streambanks could be temporarily destabilized by activities conducted during the two-lane bridge replacement, culvert installation, culvert extension and culvert maintenance activities. However, the areas disturbed by these activities would be very small and the disturbance is not likely to last longer than one year.

Streambank stability could be negatively affected by any bank stabilization type of action. Many areas that will receive rip-rap are areas that have already had armoring treatments. The net change in streambank disturbance in these areas will be minimal. The immediate area of the project would be negatively affected because of the rigidity of the structures — a rigidity that is not typically found in most stream types. This rigidity often reduces the biological availability of the streambank habitat by simplifying habitat features. Energy from streamflow is transferred downstream after streambanks are hardened; this often leads to destabilized streambanks. The proposed action includes measures to increase habitat availability such as the development of an irregular toe and bank line and the use of large, irregular rocks to create interstitial spaces and small alcoves. These measures will also create roughness which will reduce the velocity of the streamflow being directed downstream; this will therefore reduce the potential for downstream streambank destabilization.

5.23 Water Quality

Temperature - Spawning

Environmental Baseline: Unacceptable Risk. 303d list indicates large numbers of streams/rivers (and their tributaries) that have water quality issues.

Relevant Project Types: Two-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair

Effect of Actions: The only project components which could potentially affect stream temperatures are those that reduce stream shade by removing riparian vegetation. All of the relevant project types have the capacity to adversely affect riparian vegetation condition through both temporary and permanent ground disturbing activities. The proposed action for the two-lane bridge replacement is the only action that has specific measures to replace disturbed vegetation. Bank stabilization actions typically involve the covering of some riparian vegetation for the length of the project, as do culvert installation and extension actions. Culvert maintenance actions might have a small adverse impact on riparian vegetation, but this will only be short-term in nature.

Although these actions may have an adverse impact on riparian vegetation, the impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Temperature - Rearing/Migration

Environmental Baseline: Unacceptable Risk.

Relevant Project Types: Two-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair

Effect of Actions: The only project components which could potentially affect stream temperatures are those that reduce stream shade by removing riparian vegetation. All of the relevant project types have the capacity to adversely affect riparian vegetation condition through both temporary and permanent ground disturbing activities. The proposed action for the two-lane bridge replacement is the only action that has specific measures to replace disturbed vegetation. Bank stabilization actions typically involve the covering of some riparian vegetation for the length of the project, as do culvert installation and extension actions. Culvert maintenance actions might have a small adverse impact on riparian vegetation, but this will only be short-term in nature.

Although these actions may have an adverse impact on riparian vegetation, these impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Suspended Sediment

Environmental Baseline: At Risk. 303d list indicates large numbers of streams/rivers (and their tributaries) that have water quality issues.

Relevant Project Types: Two-lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair, Geotechnical Drilling

Effects of Actions: All of the relevant project types have the capacity to adversely affect sediment yield and all will have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-shore ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will be relatively small. Idaho state water quality standards will be met during project implementation. (See Sediment Yield)

Although these actions may have an adverse impact on sediment yield, these impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Chemical Contamination

Environmental Baseline: Properly Functioning. Environmental baseline condition for chemical contamination has a high (good) condition. Few chemical contamination problems have been identified within the state.

Relevant Project Types: Two-lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair

Effects of Actions: As all of the relevant project types use heavy machinery, all have the potential to contribute chemical contamination to streams in the project action area. However, the proposed actions contain numerous effects-minimization measures that help reduce this risk. These include the implementation of spill prevention plans; placing fueling, staging, and storage areas away from aquatic areas; and ensuring that all machinery being used does not have damaged hoses, fitting, lines, or tanks. These effects minimization measures reduce the risk of chemical contamination to discountable levels.

5.24 Habitat Elements

Cobble Embeddedness

Environmental Baseline: At Risk. See Sediment Yield.

Relevant Project Types: Two-lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair, Geotechnical Drilling

Effects of Actions: Cobble embeddedness is primarily affected by changes in streamflow or sediment delivery. There are no proposed actions that will affect streamflows, which means that the key factor which could affect embeddedness is sediment yield. All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-stream ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will be relatively small. Idaho state water quality standards will be met during project implementation. (See Sediment Yield.)

Although these actions may have an adverse impact on sediment yield, these impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Percent Surface Fines

Environmental Baseline: At Risk. See Sediment Yield

Relevant Project Types: Two-lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair, Geotechnical Drilling

Effects of Actions: Percent surface fines is primarily affected by changes in streamflow or sediment delivery. There are no proposed actions that will affect streamflows, which means that the key factor which could affect surface fines is sediment yield. All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-stream ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will be relatively small. Idaho state water quality standards will be met during project implementation.

Although these actions may have an adverse impact on sediment yield, these impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Percent Fines By Depth

Environmental Baseline: At Risk. See Sediment Yield.

Relevant Project Types: Two-Lane Bridge Replacement, Bank Stabilization (Riprap), Bank Stabilization (Gabion), Culvert Installation – Perennial Stream, Culvert Extension – Perennial Stream, Culvert Maintenance – Perennial Stream, Small Structure Repair, Geotechnical Drilling

Effects of Actions: Percent fines by depth is primarily affected by changes in streamflow or sediment delivery. There are no proposed actions that will affect streamflows, which means that the key factor which could affect the percentage of fines by depth is sediment yield. All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-stream ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will be relatively small. Idaho state water quality standards will be met during project implementation. (See Sediment Yield.)

Although these actions might have an adverse impact on sediment yield, these impacts are typically small relative to the project's action area and even smaller when considered in a watershed context.

Pool Frequency

Environmental Baseline: At Risk. Conditions vary widely throughout the State.

Effect of Actions: Pool Frequency is most likely affected by excessive sediment yield or reductions in the large woody debris that helps form pools in small to medium size streams.

All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-stream ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will likely also be relatively small. Idaho state water quality standards will be met during project implementation.

Most of the streams which ITD roads border are larger streams in which pool formation is not driven by large woody debris processes. Also, there are not large areas where riparian vegetation will be affected, further minimizing the risk of affecting pool formation from a lack of large woody debris.

Pool Quality

Environmental Baseline: At Risk. See Pool Frequency.

Effect of Actions: Pool Quality is most commonly affected by excessive sediment yield or reductions in the large woody debris that helps form pools in small to medium streams.

All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-stream ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will likely also be relatively small. Idaho state water quality standards will be met during project implementation.

Most of the streams bordered by ITD roads are larger streams in which pool formation is not driven by large woody debris processes. Also, there are not large areas where riparian vegetation will be affected, further minimizing the risk of affecting pool formation from a lack of large woody debris.

5.25 Take

Harassment

Environmental Baseline: At Risk. Spring/Summer Chinook salmon, fall Chinook Salmon, Snake River Basin Steelhead, Sockeye salmon and Bull trout. Throughout the project area, seasonal fishing from shore, wading, and boats (float and power boats) has the potential to harass steelhead, fall Chinook salmon and bull trout. Steelhead, fall Chinook salmon and bull trout are staging, overwintering, or migrating during this period. Boat use has the highest potential to disturb or harass fish, particularly power boats. Any of these species may be caught while anglers are fishing for other species. It is common for these species to be caught and released. Incidental catching of bull trout does occur, but is not common.

Sockeye salmon and spring/summer Chinook salmon migrate through a river segment more quickly than fish utilizing the area for spawning, rearing, or overwintering/staging. Adult and smolt migrations are taking place during the spring periods (April to July). Spring/summer Chinook salmon adults and smolts are susceptible to being caught or harassed during spring migration periods. Sockeye salmon move quickly during migration periods, and migrating fish numbers are very low. Summer recreational fishing may on occasion result in a listed fish being caught. Snake River Basin Steelhead smolts are commonly caught. All caught listed species must be released unharmed. In stream use associated with wading or swimming may harass fish, but to a lesser extent because it is confined to a very localized and small segment of a large river.

Effect of Actions: All of the proposed actions that are likely to adversely affect listed species involve in-stream work. Instream work will only occur with coordination with IDFG personnel and will only occur during approved in-stream work windows. These inwater works windows are typically mid-summer when bull trout are often in headwater reaches of streams; these stream reaches do not often coincide with the highways considered in this consultation. Anandromous species may be present during work windows but are often only present as juveniles. Although project activities might harass juvenile anadromous fish, they can easily leave the affected areas and flee to suitable habitat nearby. As noted above in sediment yield, excessive sediment in the river may cause fish to avoid the project area. These effects are expected to be short in duration and small in scale. Pile driving may occur during construction of two-lane bridge projects or retaining walls. Pile driving creates sound effects which adversely affect fish. All pile-driving work will take place in dewatered work areas. As such, pile-driving sound effects will be non-lethal and limited to harassment of listed species.

Redd Disturbance

Environmental Baseline: At Risk. Condition varies widely across the state.

Effect of Actions: All of the proposed actions that are likely to adversely affect listed species involve in-stream work. Instream work will only occur with coordination with IDFG personnel and will only occur during approved in-stream work windows. Because of this adherence to in-stream work window – a time when redds are not typically present in the stream – the redds of listed species will not likely be adversely affected.

ESA analysis of effect on designated critical habitat focuses on effects to Primary Constituent Elements (PCEs). The PCEs for salmon and steelhead are described below. Types of sites and essential physical and biological features designated as PCEs for salmon and steelhead, and the species life stage each PCE supports**.**

All potential effects to PCEs for salmon and steelhead from "likely to adversely affect" actions (Table 4) are described above in the matrix analysis.

Table 8. Effects to Primary Constituent Elements for salmon and steelhead

Site	Essential Physical and Biological Features	ESA-listed Species Life Stage
Snake River Steelhead		
Freshwater spawning	Water quality, water quantity, and substrate	Spawning, incubation, and larval development
Freshwater rearing	Water quantity & floodplain connectivity to form and maintain physical habitat conditions	Juvenile growth and mobility
	Water quality and forage	Juvenile development
	Natural cover	Juvenile mobility and survival
Freshwater migration	Free of artificial obstructions, water quality and quantity, and natural cover	Juvenile and adult mobility and survival
Snake River Spring/Summer Chinook Salmon; Fall Chinook		
Spawning & juvenile rearing	Spawning gravel, water quality and quantity, cover/shelter, food, riparian vegetation, and space	Juvenile and adult
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, safe passage	Juvenile and adult
Snake River Sockeye Salmon		
Spawning & juvenile rearing	Spawning gravel, water quality and quantity, water temperature, food, riparian vegetation, and access	Juvenile and adult
Migration	Substrate, water quality and quantity, water temperature, water velocity, cover/shelter, food, riparian vegetation, space, safe passage	Juvenile and adult

Note: Additional PCEs pertaining to estuarine, near shore, and offshore marine areas have also been described for Snake River steelhead. These PCEs will not be affected by the proposed action and have therefore not been described in this PBA.

Forage includes aquatic invertebrate and fish species that support growth and maturation.

Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

Food applies to juvenile migration only.

5.26 Bull Trout Subpopulation Characteristics and Habitat Integration

Environmental Baseline: At Risk. Referenced basins have a moderate condition for subpopulation size, growth and survival, life history diversity and isolation, persistence and genetic integrity, and habitat conditions. Many reaches are used by fluvial bull trout for migration, overwintering, and adult rearing. Population data is lacking in many drainages. Many of the subbasins within the action area provide suboptimal adult and subadult rearing temperatures due to elevated summer water temperatures.

Effect of Actions: Degrade. Effect to the action will potentially degrade existing conditions for bull trout subpopulation characteristics and habitat integration. Projects may potentially adversely impact bull trout habitat. Effects are anticipated to be small in scale and short in duration.

The Primary Constituent Elements (PCEs) for bull trout will likely be adversely affected by implementation of the “likely to adversely affect” actions detailed above in table 8. Below is an analysis of potential effects on bull trout PCEs.

- Permanent water having low levels of contaminants
- Water temperatures ranging from 2 to 15° C
- Complex stream channels with features such as woody debris, side channels, pools, etc.
- Substrate of sufficient amount, size, and composition
- Natural hydrograph, including peak, high, low, and base flows within historic ranges
- Springs, seeps, groundwater sources, and subsurface water connectivity
- Migratory corridors with minimal physical, biological, or chemical barriers
- Abundant food base

The conservation measures proposed include numerous measures to prevent chemical contamination. These include having staging, fueling, and storage areas adequately buffered from aquatic areas and not allowing uncured concrete to come into contact with water. For these reason, chemical contamination to bull trout critical habitat will not likely occur.

Water temperatures are primarily affected by stream shade and flow. Stream shade is typically a function of riparian vegetation condition and some of the actions may cause small adverse effects to riparian vegetation. These effects would be small and of short duration. There are also no actions proposed that would affect stream flows. For these reasons, the proposed action would only have small, short-term adverse effects on water temperature.

Complex stream channels would not likely be adversely affected by these actions because there would be not channel-altering work conducted.

Substrate composition could only be affected by the introduction of fine sediment. All of the relevant project types have the capacity to adversely affect sediment yield and all have preventative measures in place to minimize sediment yield effects. The measures proposed are primarily directed at minimizing sediment delivery from on-stream ground disturbance. However, as all of these actions have the potential for in-stream work, there will be sediment produced through the disturbance of the stream substrate. Because there is a limited amount of in-stream work, the amount of sediment produced will likely also be relatively small. Idaho state water quality standards will be met during project implementation.

The proposed actions would result in temporary elevated turbidity. Although these actions might have an adverse impact on sediment yield, these impacts are typically small relative to the project’s action area and even smaller when considered in a watershed context.

There are no actions which would alter stream hydrographs. There are no actions which will affect sub-surface water sources. There are no actions that will alter migratory corridors.

Bull trout food bases could only be altered through mechanisms of chemical contamination, sediment delivery, or alteration of riparian vegetation. Chemical contamination could potentially kill prey species but, for the reasons referenced above, this will not likely occur. As referenced above, sediment delivery and riparian vegetation could be adversely affected by the proposed action. Any such effects will be small and short-term. Therefore, any adverse effects to bull trout food bases will be small and of short duration.

The proposed action will not introduce predatory, interbreeding, or competitive non-native species.

5.27 Interrelated and Interdependent Effects (LAA)

The project is not interrelated or interdependent with any other known actions.

5.28 Cumulative Effects (LAA)

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR 402.02). Cumulative effects that reduce the ability of a listed species to

meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

Between 2000 and 2007, the population of Idaho increased 15.9 percent (http://quickfacts.census.gov/qfd/states/16000.html) Thus, FHWA and COE assume that future private and state actions will continue within the action area, increasing as population density rises. As the human population in the action area continues to grow, demand for agricultural, commercial, or residential development is also likely to grow. The effects of new development caused by that demand are likely to reduce the conservation value of the habitat within the watershed. However, within the action area, FHWA and the COE are not aware of any future private or state activities.

5.29 Determination of Effect (LAA)

It has been determined that implementation of actions identified as LAA in Table 4, are *likely to adversely affect* Snake River fall Chinook salmon, spring/summer Chinook salmon, Snake River Basin steelhead, Snake River sockeye salmon, bull trout, Utah valvata snail, Snake River physa snail, Bliss Rapids snail or designated critical habitat for these species. The rationale for this determination is based on the following:

- The action will, to small extent, degrade the condition of matrix indicators.
- All appropriate construction BMPs, including monitoring and adaptive management practices will be employed to minimize effects to Riparian Vegetation Condition, Sediment Yield, Width/Depth Ratios, Streambank Stability, Temperature-Spawning, Temperature-Rearing/Migration, Suspended Sediment, Chemical Contamination, Cobble Embeddedness, Percent Surface Fines, Percent Fines by Depth, Large Woody Debris, Pool Frequency, Pool Quality, Off Channel Habitat, Harassment and Redd Disturbance within the referenced river basins.

Likely to Adversely Affect Essential Fish Habitat (Chinook and coho salmon)

As noted above, a certain subset of the proposed actions will likely adversely affect listed species or their designated critical habitat. These actions will also have an adverse effect on essential fish habitat. As noted above in the matrix analysis, the actions will have short term and localized adverse effects on essential fish habitat.

Literature Cited

Adams, A.W. 1963. The lynx explosion. North Dakota Outdoors 26:20-24. 61pp.

Agee, J.K. 1999. Disturbance ecology of North American boreal forests and associated northern mixed/subalpine forests. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station. 62pp.

Air Force. 1998. Enhanced training in Idaho, Final Environmental Impact Statement. Volume 1, January 1998. 132pp.

Air Force. 2000. Final Juniper Butte Range Integrated Natural Resource Management Plan. Mountain Home Air Force Base, Idaho. 131pp.

Almand, J.D., and W.B. Krohn. 1978. The position of the Bureau of Land Management on the protection and management of riparian ecosystems. Pages 359-361 in Strategies for protection and management of floodplain wetlands and other riparian ecosystems: proceedings of the symposium (R.R. Johnson and J.F. McCormick, technical coordinators). USDA Forest Service Gen. Tech. Report WO-12, Washington, DC.

American Ornithologists Union (AOU). 1998. Checklist of North American birds. 7th ed. American Ornithologists' Union, Washington, DC. 142pp.

Amundson, R. G. et al. 2000. Letter to Wayne S. White, U.S. Fish and Wildlife Service, Sacramento, California, regarding comments on status of yellow-billed cuckoo in western Colorado. April 14, 2000. 144pp.

Anderson, E.M., and M.J. Lavallo. 2003. Bobcat and lynx. Pages 758-786 in G.A. Feldhamer, B.C. Thompson, and J.A. Chapman (Eds.). Wild mammals of North America: Biology, management, and conservation (2nd Edition). The Johns Hopkins University Press, Baltimore.

Apperson, K., and P. Anders. 1991. Kootenai River white sturgeon investigations and experimental culture. U.S. Department of Energy, Bonneville Power Administration. Annual Progress Report, Contract # DE-A179-88BP93497. Portland, Oregon. 73pp.

Apperson, K.A., M. Mahan, W.D. Horton, and C.M. Falter. 1988. North Idaho streams fishery research. Study completion report, Project F-73-R-10. Idaho Department of Fish and Game. 164pp.

Apps, C.D. 1999. Space-use, diet, demographics, and topographic associations of lynx in the southern Canadian Rocky Mountains. Pages 351-372 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Apps, C. D., and B.N. McLellan, 2006. Factors influencing the dispersion and fragmentation of endangered mountain caribou populations. Biol. Conserv. 130:84–97.

Apps, C.D., A. Dibb, and A.J. Fontana. 1999. Lynx Ecology in the Southern Canadian Rocky Mountains: preliminary results and conservation implications. In biology and management of species and habitats at risk. Conference Proceedings, British Columbia Ministry of Environment, Lands and Parks, Victoria.

Aubry, K.B., G.M. Koehler, J.R. Squires. 1999. Ecology of Canada lynx in southern boreal forests. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Aubry, K.B., G.M. Koehler, J.R. Squires. 2000. Ecology of Canada lynx in southern boreal forests. Pages 373-369 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Baker, C. 1983. Report on field studies relative to the insects associated with Mirabilis macfarlanei during bloom periods with emphasis on pollination. Department of Biology, Boise State University. 120pp.

Baker, C. 1985. Insects associated with Mirabilis macfarlanei (Nyctaginaceae) with emphasis on the life cycle of Lithariepteryx n. sp. (Lepidoptera: Heliodinae). Abstract. Proceedings of the Washington State Entomological Society 47:756.

Barker Rosholt & Simpson LLP, in litt. 2006. Memorandum from Barker Rosholt & Simpson LLP addressing perceived threats to Utah valvata from 1996 -2006. Attachment to February 27, 2006 letter from James Caswell, Idaho Office of Species Conservation to Jeff Foss, Snake River Fish and Wildlife Office. 79pp.

Barnes J.L. 1996. Reproductive ecology, population genetics, and clonal distribution of the narrow endemic: *Mirabilis macfarlanei* (Nyctaginaceae). Master's Thesis, Utah State University, Logan. 121pp.

Barnes, J.L., P.G. Wolf, and V.J. Tepedino, 1994. Genetic Diversity and Gene Flow: Implications of the Rare Plant, Mirabilis macfarlanei (Nyctaginaceae). Logan, UT: Unpublished report for the Department of Biology, Utah State University. 121pp.

Barrett, J.S., J.C. Munger, and E. Yensen. 2003. Effects of an altered landscape on the demography of the southern Idaho ground squirrel (*Spermophilus brunneus endemicus*). Annual Report submitted to U.S. Bureau of Land Management, Boise Idaho. BLM Challenge Cost Share Task # DAF020015. 136pp.

Bash, J., C. Cerman, and S. Bolton. 2001. Effects of Turbidity and Suspended Solids on Salmonids. Center for Streamside Studies, University of Washington. 74pp.

Baskin, J.M., and C.C. Baskin. 1978. The seed bank in a population of an endemic plant species and its ecological significance. Biol. Conserv. 14:125-1 30. 129pp.

Batt, P. E. 1996. Governor Philip E. Batt's State of Idaho bull trout conservation plan. Office of the Governor. Boise, Idaho. 116 pp.

Bean, B. 2006. Spatial distribution of the threatened Bliss Rapids snails downstream from Bliss and Lower Salmon Dams: season two summary. Appendix 6. Idaho Power Company 2006 Section 10 Report. May 2007. 81pp.

Belnap, J., J. Williams, and J. Kaltenecker. 1999. Structure and function of biological soil crusts. Pages 1 61 – 178 in: Pacific Northwest Forest and Rangeland Soil Organisms Symposium, Pacific Northwest Research Station, General Tech. Rep. PNW-GTR 42.

Berg, L., and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of. Fisheries and Aquatic Science 42:1410-1417.

Bergerud, A.T., H.E. Butler, and D.R. Miller. 1984. Antipredator tactics of calving caribou: dispersion in mountains. Can. J. Zool. 65:1566-1575.

Bethlenfalvay, G. J., and S. Dakessian. 1984. Grazing effects on mycorrhizal colonization and floristic composition of the vegetation on a semiarid range in Northern Nevada. Journal of Range Management 37:312–316.

Betts, B.J. 1999. Current status of Washington ground squirrels in Oregon and Washington. Northwest Naturalist 80:35-38.

Bisson, P.A., and R.E. Bilby. 1982. Avoidance of suspended sediment by juvenile coho salmon. North American Journal Fisheries Management 4:371-374.

Bittner, S.L., and O.J. Rongstad. 1982. Snowshoe hare and allies. in J.A. Chapman and G.A. Feldhamer (eds.). Wild mammals of North America biology, management and economics. Johns Hopkins University Press, Baltimore, MD.

Boag, T.D. 1987. Food habits of bull char, *Salvelinus confluentus*, and rainbow trout, *Salmon gairdneri*, coexisting in a foothills stream in northern Alberta. Canadian Field-Naturalist 101:56-62.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and effects of human activity on the species. In Howell, P.J. and D.V. Buchanan eds. Proceedings of the Gearhart Mountain bull trout workshop; August 1992, Gearhart Mountain, OR. Corvallis, Or: Oregon Chapter of the American Fisheries Society: 1-4.

Bonneau, J.L., and D.L. Scarnecchia. 1996. Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. Transactions of the American Fisheries Society 125:628-630.

Bowler, P.A. 1990. The Rapid Spread of the Freshwater Hydrobiid Snail *Potamopyrgus antipodarum* (Gray) in the Middle Snake River, Southern Idaho. Proceedings of the Desert Fisheries Council 21:173-182.

Bowler, P.A., C.M. Watson, J.R. Yearsley, and P.A. Cirone. 1993. Assessment of Ecosystem Quality and It's Impacts on Resource Allocation in the Upper Snake River Basin. Proceedings of the Desert Fishes Council 24: 42-51.

Bowler, P.A., and T.J. Frest. Unpublished manuscript A. Water quality tolerances of freshwater mollusks in the Middle Snake River Sub-basin, southern Idaho.

Brainerd, S.M. 1985. Reproductive ecology of bobcats and lynx in western Montana. MS. Thesis, University of Montana, Missoula.

Brand, C.J., and L.B. Keith. 1979. Lynx demography during a snowshoe hare decline in Alberta. J. Wildl. Manage. 43:827-849.

Brand, C.J., L.B. Keith, and C.A. Fischer. 1976. Lynx responses to changing snowshoe hare densities in central Alberta. J. Wildl. Manage. 40:416-428.

Brown, J.H., and M.V. Lomolino. 1998. Biogeography, second edition. Sinauer Associates, Sunderland, MA. Pages 558-562.

Brusven M.A. and C. MacPhee. 1976. The effect of river fluctuations resulting from hydropeaking on selected aquatic invertebrates and fish. OWRT Technical Completion Report. Project No. A-035-IDA. University of Idaho, Moscow.

Buchanan, D.V., and S.V. Gregory. 1997. Development of water temperature standards to protect and restore habitat for bull trout and other cold water species in Oregon. Proceedings of the Friends of the Bull Trout Conference. Calgary, Alberta.

Bull, E.L., and M.P. Hayes. 2000. Livestock effects on reproduction of the Columbia spotted frog. J. Range Management. 53(3):291-294.

Bureau of Land Management (BLM). 2004a. Geographic Information System. Unpublished Data. BLM, Cottonwood Field Office, Cottonwood, ID.

Bureau of Land Management (BLM). 2004b. Cottonwood Field Office Fire Management Plan. NW-ID-2004-012. August 2004. BLM, Cottonwood Field Office, Cottonwood, ID.

Burleigh, T. 1972. Birds of Idaho. Caxton Printers. Caldwell, Idaho. in Austin, M.L. 2001. Comments: “Western Yellow-billed Cuckoo”. Idaho Watersheds Project. February 2001.

Burnett, B., and R. Van Kirk. 2004. “Quantitative Methodology for Assessing Hydrologic Alteration at the Watershed Scale.” Department of Mathematics, Idaho State University, Pocatello, Idaho.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, I.V. Lagomarsino. 1996. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. U.S. Dept. of Commerce, NOAA Tech. Memo., NMFS-NWF SC-27. 261pp.

Busch, D.E., and S.D. Smith. 1993. Effects of fire on water salinity relations of riparian woody taxa. Oecologia 94a:186-194.

Buskirk, S.W., L.F. Ruggiero, K.B. Aubry, D.E. Pearson, J.R. Squires, and K.S. McKelvey. 1999. Comparative ecology of lynx in North America. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Buskirk, S.W., L.F. Ruggiero, C.J. Krebs. 2000a. Habitat fragmentation and interspecific competition: implications for lynx conservation. Pages 83-100 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado

Buskirk, S.W., L.F. Ruggiero, K.B. Aubry, D.E. Pearson, J.R. Squires, K.S. McKelvey. 2000b. Comparative ecology of lynx in North America. Pages 397-417 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Cada, C. 2001. Effects of New Zealand mudsnails on native invertebrates in Darlington Ditch, Montana. Minutes of the First Annual Conference on New Zealand Mudsnails in the Western USA, July 9-10, 2001. Bozeman, Montana.

Carothers, S.W., and B.T. Brown. 1991. The Colorado River through Grand Canyon: natural history and human change. University of Arizona Press. Tucson, AZ. 235pp.

Cavender, T.M. 1978. Taxonomy and distribution of bull trout, Salvelinus confluentus (Suckley), from the American Fisheries Northwest. California Fish and Game 64:139-174.

Cazier, L.D. 1997 as revised 2003. Middle Snake River aquatic macroinvertebrate and ESA snail survey. Idaho Power Co., Boise, Idaho. G. Finni Supplemental Analysis, October 2003.
Chapman, D.J. and B.E. Julius. 2005. The use of preventative projects as compensatory restoration. Journal of Coastal Research 40:120-131.

Cazier, L.D. 2001, as revised 2003. Middle Snake River aquatic macroinvertebrate and ESA snail survey (for 1997). Section 10 Permit Rpt. Idaho Power Co. March 2001. G. Finni Supplemental Analysis, October 2003.

Chapman, D.J. and B.E. Julius. 2005. "The Use of Preventative Projects as Compensatory Restoration." *Journal of Coastal Research* SI(40):120-131.

Chapman, D. W., W. S. Platts, D. Park, and M. Hill. 1990. Status of Snake River sockeye salmon. Final report. Pacific Northwest Utilities Conference Committee, Portland, OR. 90pp.

Christensen, A.G., and M.J. Madel. 1982. Cumulative effects analysis process, grizzly bear habitat component mapping. Kootenai National Forest.

Christman, S.P., E.L. Mihalcik, and F.G. Thompson. 1996. Tulotoma magnifica (Conrad, 1834) (Gastropoda: Viviparidae) status and biology in the Coosa River, Alabama. Malacological Review 29:17-63.

Clark, S.A. 2007. The taxonomic status of the Banbury Springs lanx (Gastopoda: Lymnaeidae), an endangered freshwater snail from the Snake River, Idaho, United States. Report submitted to the U.S. Fish & Wildlife Service, Boise, Idaho. 7pp.

Clark, T.W., and M.R. Stromberg. 1987. Mammals in Wyoming. University of Kansas Museum of Natural History.

Cleland, D.M. 1954. A study of the habits of *Valvata piscinalis* (Müller) and the structure and function of the alimentary canal and reproductive system. Proceedings of the Malacological Society of London 30:167-203.

Clearwater Basin Bull Trout Technical Advisory Team. 1998. Lower Clearwater River Bull Trout Problem Assessment. Prepared for the state of Idaho.

Clearwater National Forest. 1997. Clearwater Subbasin Ecosystem Analysis at the Watershed Scale. Orofino, ID.

Connor, W. P., H. L. Burge, R. Waitt, and T. C. Bjornn. 2002. Juvenile Life History of Wild Fall Chinook Salmon in the Snake and Clearwater Rivers. North American Journal of Fisheries Management 22:703–712.

Constance, L., and R. Rollins. 1936. New or otherwise noteworthy northwestern plant-II: two new species from the Grand Canyon of the Snake River. Proceedings of the Biological Society of Washington 49:147-150.

Coutant, C.C. 1999. Perspectives on temperature in the Pacific Northwest's fresh waters. Oak Ridge National Laboratory, Report ORNL/TM-1999/44, Oak Ridge, Tennessee.

Coyner, J. 1989. Status check on reported historic populations of *Spiranthes diluvialis*. Memorandum U.S. Fish and Wildiife Service. Salt Lake City, Utah. 9pp.

Coyner, J. 1990. Report for population study *Spiranthes diluvialis*. Unpublished report. Bureau of Land Management and Red Butte Gardens, University of Utah. Salt Lake City. 29pp.

Dauble, D.D., Hanrahan, T.P., Geist, D.R., and Parsley, M.J. 2003. Impacts of the Columbia River hydroelectric system on mainstem habitats of fall chinook salmon. N. Am. J. Fish. Manag. 23:641–659.

DeSchauensee, R.M. 1970. A Guide to the Birds of South America, Livingston Publishing Co.
Dillinger, Bill. 1989. Last stand of the cuckoo. Outdoor California, March-April.

Dillinger, B. 1989. Last stand of the cuckoo. Outdoor California, March-April.

Dillon, R.T. Jr. 2000. The Ecology of Freshwater Molluscs. Cambridge University Press, Cambridge, UK.

Donald, D.B., and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology. 71:238-247.

Dorn, R.D. 1984. Vascular plants of Montana. Mountain West Publishing, Cheyenne, Wyoming. 276pp.

Dudash, M.R., and C.B. Fenster. 2000. Inbreeding and outbreeding depression in fragmentedpopulations. Pages 35-53 In Young A.G., G.M. Clarke, (eds.). Genetics, demography, andviability of fragmented populations. Cambridge University Press, Cambridge, United Kingdom.

Dunham, J., B. Rieman, and K. Davis. 2001. Source and magnitude of sampling error in redd counts for bull trout Salvelinus confluetus. North American Journal of Fisheries Management 21(2):343-352.

Dunham, J.B., B.E. Rieman, and G.L. Chandler, 2003. Influences of temperature and environmental variables on the distribution of bull trout at the southern margin of its range. N. Am. J. Fish. Manag. 23: 894–904.

Dunnigan, J.L., and D.H. Bennett. 1997. The spatial distribution of westslope cutthroat in the Coeur d'Alene River System, Idaho. Thesis. Department of Fish and Wildlife Resources, University of Idaho, Moscow.

Dyer, S.J., J.P. O'Neill, S.M. Wasel, and S. Boutin. 2002. Quantifying barrier effects of roads and seismic lines on movements of female woodland caribou in northeastern Alberta. Can. J. Zool. 80:839–845.

Dyni, E., and E. Yensen. 1996. Dietary similarity in sympatric Idaho and Columbian ground squirrels (Spermophilus brunneus and Spermophilus *columbianus*). Northwest Science 70(2):99-108.

Ehrlich, P.R., D.S. Dobkin, and D. Wheye. 1988. The birders handbook: a field guide to the natural history of North American birds. Simon and Schuster, New York, NY.

Ellison, L. 1960. Influence of grazing on plant succession of rangelands. The Botanical Review. Vol. 26(1):1-78.

Engle, J.C. 2000. Columbia spotted frog Great Basin population (Owyhee Mountains subpopulation) long-term monitoring plan, Owyhee County, Idaho. Prepared for U.S. Fish and Wildlife Service, Boise Field Office, Boise, Idaho. 33pp.

Engle, J.C. 2001. Population Biology and Natural History of Columbia spotted frogs (*Rana luteiventris*) in the Owyhee Uplands of Southwest Idaho: Implications for Monitoring and Management. M.S. Thesis, Boise State University, Boise, Idaho. 66pp.

Engle, J.C., and J.C. Munger. 2000. Population fragmentation of spotted frogs in the Owyhee Mountains. Final Report to the Bureau of Land Management, Boise State University, Boise, Idaho. 15pp.

Evans, H.F. 1960. A preliminary investigation of caribou in the northwestern United States. M.S. Thesis, Montana State Univ., Missoula. 145pp.

Fashingbauer, B.A. 1965. The woodland caribou in Minnesota. Pages 133-166. In J.B. Moyle ed. Big Game in Minnesota. Tech. Bull. No. 9 Division of Game and Fish. Minneapolis.

Fertig, W. 2000. Status Review of the Ute Ladies Tresses (*Spiranthes diluvialis*) in Wyoming. Wyoming Natural Diversity Database, Laramie, Wyoming.

Fields 1935. The St. Joe: five year fish and game report. U.S. Forest Service, St. Joe National Forest, St. Maries, Idaho.

Fisher, S.G., and A. LaVoy. 1972. Differences in littoral fauna due to fluctuating water levels below a hydroelectric dam. J. Fish. Res. Board Can. 29:1472-1476.

Fisher, H., L. Eslick, and M. Seyfried. 1996. Edaphic factors that characterize the distribution of Lepidium vapilliferum. Technical Bulletin No. 96-6, Idaho Bureau of Land Management, Boise, Idaho. 22pp.

Flatter, B. 2000. Life history and population status of migratory bull trout in Arrowrock Reservoir, Idaho. Master's Thesis. Boise State University, Boise, Idaho.

Flinn, P. 1956. Caribou of Idaho. Unplubl. Rpt. Idaho Dept. of Fish and Game, Boise. 79pp.

Fraley, J. J., and B. B. Shepard. 1989. Life History, Ecology, and Population Status of Migratory Bull Trout (Salvelinus confluentus) in the Flathead Lake River System, Montana. Northwest Science 63(4);133-143.

Fraley, J., D. Read and P. Graham. 1981. Flathead River fishery study 1981. Montana Department of Fish, Wildlife, and Parks, Helena. In: K.L. Pratt. 1985. Pend Oreiile trout and char life history study. Idaho Department of Fish and Game, Boise.

Franklin, J.F., and C.T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Oregon State University press, Corvallis, Oregon. 452pp.

Frest, T. J., P. A. Bowler, and R. Hershler. 1991. The Ecology, Distribution, and Status of Relict Lake Idaho Molluscs and other Endemics in the Middle Snake River. Draft Manuscript.

Frest, T.J., and E.J. Johannes. 1992. Distribution and ecology of the endemic and relict mollusk fauna of Idaho TNC's Thousand Springs Preserve. Final report prepared for The Nature Conservancy of Idaho, Sun Valley, ID. March 3, 1992. 139pp.

Fulton, L. A. 1968. Spawning areas and abundance of chinook salmon, *Oncorhynchus tshawytscha*, in the Columbia River Basin--Past and present. U.S. Fish. Wildl. Serv. Spec. Sci. Rep.--Fish. 571, 26pp.

Gaines, D. 1974. Review of the status of the yellow-billed cuckoo in California: Sacramento Valley populations. Condor 76:204-209.

Gaines, D., and S.A. Laymon. 1984. Decline, status and preservation of the yellow-billed cuckoo in California. Western Birds 15:49-80.

Gavin, T.A., P.W. Sherman, and E. Yensen. 1998. Translocation and inventory of northern Idaho ground squirrels (*Spermophilus brunneus brunneus*) in 1998. Cornell University, Ithaca, New York, and Albertson College, Caldwell, Idaho. 11pp.

Gavin, T.A., P.W. Sherman, E. Yensen, and B. May. 1999. Population genetic structure of the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). Journal of Mammalogy 80:156-168.

Gilbert, C.H., and B.W. Evermann. 1895. A report upon investigations in the Columbia River basin with descriptions of four new species of fish. In: McDonald. Bulletin of the U.S. Fish Commission. Volume XIV. Washington, DC.

Gill, A.E., and E.Yensen. 1992. Biochemical differentiation in the Idaho ground squirrel, *Spermophilus brunneus* (Rodentia: Sciuridae). Great Basin Naturalist 52(2):155-159.

Gislason, J.C. 1980. Effect of flow fluctuations due to hydro electric peaking on benthic insects and periphyton of the Skagit River, Washington. Doctoral dissertation, University of Washington, Seattle.

Given, D.R. 1994. Principles and practice of plant conservation. Timber Press, Portland, Oregon. Pages 66-67.

Goetz, F. 1989. Biology of the bull trout, Salvelinus confluentus, a literature review. Eugene, OR U.S. Department of Agriculture, Forest Service, Willamette National Forest. 53pp.

Gomez, D. 1994. Conservation assessment for the Spotted Frog (*Rana pretiosa*) in the Intermountain Region. USDA Forest Service Intermountain Region. 30pp.

Good, T.P., R.S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-66, 598pp.

Graham, G.L. 1992. Texas wildlife viewing guide. Falcon Press Publishing. Helena, MT. 160pp.

Gregory, R.S., and T.S. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50:223-240.

Green, D.M., H. Kaiser., T.F. Sharbel, J. Kearsley, and K.R. McAllister. 1997. Cryptic species of spotted frogs, *Rana pretiosa* complex, in western North America. Copeia 1997:1-8.

Groschupf, K. 1987. Status of the yellow-billed cuckoo (Coccyzus americanus occidentalis) in Arizona and west Texas. Report prepared for the U.S. Fish and Wildlife Service, under contract no. 20181-86-00731. 34pp.

Gunderson, H.L. 1978. A mid-continent irruption of Canada lynx, 1962-1963. Prairie Naturalist 10:71-80.

Haak, B. 2000. Northern Idaho ground squirrel population monitoring and habitat mitigation, 2000 annual report. RA No. 99-A-17-0044. Idaho Department of Fish and Game, Nampa, Idaho. 12pp.

Haas, J.B. 1965. Fishery Problems Associated with Brownlee, Oxbow, and Hells Canyon Dams on the Middle Snake River. Fish Commission of Oregon, Investigation Report 4, Portland, Oregon.

Hall, R.O. 2001. Estimating New Zealand mudsnail impact based on consumption rates of algae in 2 rivers in Yellowstone National Park. Montana. Minutes of the First Annual Conference on New Zealand Mudsnails in the Western USA. Bozeman, Montana.

Hall, R.O., J.L. Tank, and M.F. Dybdahl. 2003. Exotic snails dominate nitrogen and carbon cycling in a highly productive stream. Frontiers in Ecology and the Environment 1:407-411.

Halterman, M.D. 1991. Distribution and habitat use of the yellow-billed cuckoo (Coccyzus americanus occidentalis) on the Sacramento River, California, 1987-90. M.S. Thesis, California State University, Chico, CA. 49pp.

Hamilton, W.J. III, and M.E. Hamilton. 1965. Breeding characteristics of yellow-billed cuckoos in Arizona. Proc. California Academy of Sciences, 4th Series, 32:405-432.

Hanson, D.L., T.G. Cochnauer, J.D. DeVore, et al. 1992. White sturgeon management framework plan. Pacific States Marine Fisheries Commission. Portland, Oregon.

Harger, E.M. 1965. The status of the Canada lynx in Michigan. Jack-pine Warbler 43:150-153.
Hartnett D.C., and F.A. Bazzaz 1985 The integration of neighborhood effects by clonal genets in *Solidago canadensis*. Journal of Ecology 73: 415-427

Hartshorn, G.S. 1992. Forest loss and future options in Central America. Pages 13-19 in J.M. Hagan, III and D.W. Johnston, eds. Ecology and conservation of neotropical migrant landbirds. Smithsonian Institution Press, Washington, DC. 19pp.

Hash, H. 1990. Montana lynx population status and considerations. Unpubl. Rpt. Montana Department of Fish, Wildlife, and Parks, Helena.

Hassemer, P. 1991. Little Salmon River spring chinook *Oncorhynchus tshawytscha* sport harvest, 1986-1990. Idaho Department of Fish and Game and Idaho Power Company, Boise.

Hassemer, P. 1998. Upper Salmon River spring chinook salmon in Idaho. In: U.S. Fish and Wildlife Service. 1998. Proceedings of the Lower Snake River Compensation Plan Status Review Symposium. Compiled by USFWS-LSRCP. Boise, Idaho.

Hatler, D.F. 1988. A lynx management strategy for British Columbia. Prep. for BC Ministry of Environment, Victoria.

Hauer, F.R., M.S. Lorang, D. Whited, and P. Matson. 2004. Ecologically Based Systems Management: the Snake River - Palisades Dam to Henrys Fork. Final report for the Bureau of Reclamation, Boise, Idaho. Flathead Lake Biological Station, Division of Biological Sciences, University of Montana, Poloson, Montana.

Healey, M.C. 1983. Coastwide distribution and ocean migration patterns of stream- and ocean-type chinook Salmon, Oncorhynchus tshawytscha. Canadian Field-Naturalist 97:427-433.

Heard, W.H. 1963. Reproductive features of Valvata. Nautilus 77:64-68.

Hector, D.P. 1985. The diet of the aplomado falcon in eastern Mexico. Condor 87:336-342. in Hughes, J.M. 1999. Yellow-billed cuckoo (Coccyzus americanus) in The birds of North America, No. 418 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 28pp.

Heidel, B. 1979. Endangered and threatened plants in the Northern Idaho BLM Distric. 100pp.

Henjum, M.G., J.R. Karr, D.L. Bottom, D.A. Perry, J.C. Bednarz, S.G. Wright, S.A. Beckwitt, and E. Beckwitt. 1994. Interim Protection for Late-successional Forests, Fisheries and Watersheds. National Forests East of the Cascade Crest, Oregon and Washington. A Report to the United States Congress and the President. The Wildlife Society, Bethesda, MD.

Hershey, A.E. 1990. Snail populations in arctic lakes: competition mediated by predation? Oecologia 82:26-32.

Hershler, R., T.J. Frest, E.J. Johannes, P.A. Bowler, and F.G. Thompson. 1994. Two New Genera of Hydrobiid Snails (Prosobranchia: Rissooidea) from the Northwestern United States. The Veliger 37(3): 221-243.

Hinson, D.R. 2006. Evaluation of Utah valvata (*Valvata utahensis*) status in the Snake River Basin, Idaho. Final Report prepared by Steward and Associates (Snohomish, WA) for Barker Rosholt & Simpson LLP (Boise, ID). February 23, 2006. 47pp. + appendix.

Hitchcock, C.L., A. Cronquist, M. Ownbey, and J.W. Thompson. 1959. Vascular plants of the Pacific Northwest. Univ. of Washington Press, Seattle, WA. 510pp.

Hodges, K.E. 1999a. The ecology of snowshoe hares in northern boreal forests. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Hodges, K.E. 1999b. Ecology of snowshoe hares in southern boreal and montane forests. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Hodges, K.E. 2000. Ecology of snowshoe hares in southern boreal and montane forests. Pages 163-206 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Hoelscher, B., and T.C. Bjornn. 1989. Habitat, densities, and potential production of trout and char in Pend Oreille Lake tributaries. Job Compl. Rep., Proj. F-71-R-10, Subproj. III, Job 8. Boise, ID: Idaho Dept. Fish and Game. 60pp.

Hoss, S.A. 1970. Reintroductions of salmon and steelhead into portions of the Clearwater River drainage. Annual project closing Report July 1, 1968 to June 30, 1969. Columbia River Fishery Development Program. Project No. 161.22A. Contract No. 14-17-0001-1860. Idaho Department of Fish and Game, Boise, Idaho. 10pp.

Hovey, F.W., and B.N. McLellan. 1996. Estimating population growth of grizzly bears from the Flathead River drainage using computer simulations of reproduction and survival rates. Can. J. Zool. 74:1409-1416.

Howe, W.H. 1986. Status of the yellow-billed cuckoo (*Coccyzus americanus*) in New Mexico. Final Report, Contract No. 516.6-75-09, New Mexico Dept. of Game and Fish. Santa Fe, NM. 16 pp + appendices.

Huenneke, L.F. 1991. Ecological implications of genetic variation in plant populations. In: Falk, D. A.; Holsinger, K. E., eds. Genetic and Conservation of Rare Plants. New York: Oxford University Press. 283pp.

Hughes, J.M. 1999. Yellow-billed cuckoo (*Coccyzus americanus*) in The Birds of North America, No. 418 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 28pp.

Hunter, M.L., Jr. 1996. Fundamentals of Conservation Biology. Blackwell Science, Inc., Cambridge, MA.

Hvenegaard, P.J., and T.M. Thera. 2001. Monitoring the bull trout (*Savelinus confluentus*) spawning run in Lynx Creek—a tributary to the Kakwa River, West Central Alberta. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Idaho Conservation Data Center (ICDC). 1999. Element occurrence records for *Lepidium papilliferum*. Idaho Department of Fish and Game, Conservation Data Center.

Idaho Conservation Data Center (ICDC). 2000. Spotted frog database. Idaho Department of Fish and Game, Boise, Idaho.

Idaho Conservation Data Center (ICDC). 2002. Element occurrence records for *Lepidium papilliferum*. Idaho Department of Fish and Game, Conservation Data Center.

Idaho Department of Environmental Quality (IDEQ). 1999. Upper Snake Rock Watershed Management Plan. Dr. Balthasar Buhidar and The Water Quality Protection Staff of the Idaho Division of Environmental Quality, Twin Falls Regional Office, and The Middle Snake River Technical Advisory Committee, DEQ, Twin Falls Regional Office, December 20, 1999.

Idaho Department of Environmental Quality (IDEQ). 2005. Subbasin Assessment of the South Fork Payette River July 2005 Prepared by: Department of Environmental Quality Boise Regional Office Principle Author:Craig Shepard
http://www.deq.idaho.gov/water/data_reports/surface_water/
tmdls/payette_river_sf/payette_river_sf_pref.pdf

Idaho Department of Fish and Game (IDFG). 1990. A Vision for the Future. Idaho Department of Fish and Game Policy Plan 1990-2005. Boise, Idaho. 33pp.

Idaho Department of Fish and Game (IDFG). 2001a. IDFG Fisheries Management Plan 2001-2006. Idaho Department of Fish and Game, Boise, Idaho.

Idaho Department of Fish and Game (IDFG). 2001b. Fisheries management plan 2001-2006. Bureau of Fisheries. Boise, Idaho. 312 p.

Idaho Department of Fish and Game (IDFG). 2002. Upland Game Season and Rules-Regulations 2002-2003. Boise Idaho. 32pp.

Idaho Department of Fish and Game (IDFG). 2003. Spring 2003 Southern Idaho Ground Squirrel Investigation Report. Prepared by Kevin Warner. IDFG, Nampa, Idaho. 5pp.+ appendices.

Idaho Department of Fish and Game (IDFG). 2005. Idaho Comprehensive Wildlife Conservation Strategy. Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise, ID.

Idaho Department of Fish and Game (IDFG), Idaho Department of Parks and Recreation (IDPR), Bureau of Land Management (BLM), Regions 1 and 4 of the U.S. Forest Service (USFS), and U.S. Fish and Wildlife Service (USFWS). 1995. Draft Habitat Conservation Assessment and Conservation Strategy; Spotted Frog (*Rana pretiosa*). Idaho State Conservation Effort.

Idaho Department of Health and Welfare (IDHW). 1991. Problem Assessment for the Middle Snake River, from Shoshone Falls to Lower Salmon Falls. Division of Environmental Quality. 25pp.

Independent Science Group. 2000. Return to the River: Restoration of Salmonid Fishes in the Columbia River Ecosystem. Council document 2000-12. For the Northwest Power Planning Council, Portland, Oregon. http://www.nwcouncil.org/library/return/2000-12.htm

Independent Scientific Group. 1996. Return to the river: restoration of an alternative conceptual foundation and synthesis of science underlying the Fish and Wildlife Program of the Northwest Power Planning Council. Portland, Oregon: Northwest Power Planning Council, 444pp.

Interagency Conservation Strategy Team (ICST). 2003. Final conservation strategy for the grizzly bear in the Yellowstone Ecosystem. March 2003. http://www.fs.fed.us/r1/wildlife/igbc/ConservationStrategy/final_cs.pdf.

Interior Columbia Basin Technical Recovery Team (ICBTRT). 2003. Independent Populations of Chinook, Steelhead, and Sockeye for Listed Evolutionarily Significant Units Within the Interior Columbia River Domain. Working draft of the OCBTRT dated July 2003.

Irving, J.S., and T.C. Bjornn. 1981. Status of Snake River fall chinook salmon in relation to the Endangered Species Act. Prepared for the U.S. Fish and Wildlife Service, Portland, Oregon.

Jakober, M.J. 1995. Autumn and winter movements and habitat use of resident bull trout and westslope cutthroat trout in Montana. Master's Thesis. Montana State University, Bozeman.

Janssen, P. 1992. Little Salmon River spring chinook *Oncorhynchus tshawytscha* sport harvest report, 1992. Idaho Department of Fish and Game, Boise.

Janssen, P. 1993. Little Salmon River spring chinook *Oncorhynchus tshawytscha* sport harvest report, 1993. Idaho Department of Fish and Game, Boise.

Janssen, P., and S.W. Kiefer. 1998. Little Salmon River, Idaho spring chinook salmon *Oncorhynchus tshawytscha* 1998 sport harvest report. Idaho Department of Fish and Game, Boise.

Janssen, P., and S.W. Kiefer. 1999. Little Salmon River, Idaho spring chinook salmon *Oncorhynchus tshawytscha* 1999 sport harvest report. Idaho Department of Fish and Game, Boise.

Jennings, W.F. 1989. Final Report. Species Studied: *Eustoma grandiflorum, Spiranthes diluvialis, Malaxis brachypoda, Hypoxis hirsuta, Physaria bellii, Aletes humilis*. Unpublished Report prepared for the Nature Conservancy under the Colorado Natural History Small Grants Program. The Nature Conservancy, Boulder, Colorado. 48pp.

Jennings, W.F. 1990. Final Report. Species Studied: *Spiranthes diluvialis, Sisyrinchium pallidum*. Unpublished Report Prepared for the Nature Conservancy under the Colorado Natural History Small Grants Program. The Nature Conservancy, Boulder, Colorado. 22pp.

Jimenez, J. M., and D.W. Zaroban. 1999. Deadwood and Payette Rivers key watersheds bull trout problem assessment. Southwest basin native fish technical group. Boise Regional Office, Idaho Division of Environmental Quality, Boise, Idaho. 63pp.

Johnson, C.A., 1995. MacFarlane's Four-o'clock (*Mirabilis macfarlanei*). Draft memo to the file, dated September 11, Cottonwood, ID.

Joly, K., C. Nellemann, and I. Vistnes. 2006. A reevaluation of caribou distribution near an oilfield road on Alaska' s North Slope. Wildlife Society Bulletin 34:866–869.

Jordan, L.A. 1999. Utes Ladies'-tresses Orchid Biology/Ecology Summary. Recovery Team, U.S. Fish and Wildlife Service.

Kasworm, W.F. 2001. Preliminary grizzly bear population trend estimates in the Cabinet-Yaak Recovery Zone, 1983-2000. Internal memo, U.S. Fish and Wildlife Service, Libby, Montana.

Kasworm, W.F. 2002. Population demographics and status for the CYE in relation to the grizzly bear recovery plan (USFWS 1993). Internal memo, U.S. Fish and Wildlife Service, Libbly, Montana.

Kasworm, W.F., H. Carriles, and T.G. Radandt. 2000. Cabinet-Yaak grizzly bear recovery area 1999 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 48pp.

Kasworm, W.F., H. Carriles, and T.G. Radandt. 2002. Cabinet-Yaak grizzly bear recovery area 2001 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 48pp.

Kasworm, W.F., H. Carriles, and T.G. Radandt. 2004. Cabinet-Yaak grizzly bear recovery area 2003 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 62pp.

Kaye, T.N., W. Messinger, and S. Massey. 1990. Population Monitoring Plan, Habitat Analysis, and Breeding System of Mirabilis macfarlanei. Report submitted to the Wallowa-Whitman National Forest and United States Departement of Agriculture. 22pp.

Kaye, T.N. 1995. Evaluation of Population Monitoring for *Mirabilis macfarlanei*, 1990-1995. Report submitted to the Wallowa-Whitman national Forest and Oregon Department of agriculture. 11pp.

Kerpez, T.A., and N.S. Smith. 1987. Saltcedar control for wildlife habitat improvement in the southwestern United States. USDI Fish and Wildlife Service, Resource Publication 169, Washington D.C. 17pp.

Kiefer, S., M. Rowe, and K. Hatch. 1992. Stock Summary Reports for Columbia River Anadromous Salmonids Volume V: Idaho Final Draft for The Coordinated Information System. Idaho Department of Fish and Game.

Kjelstrom, L.C. 1992. Assessment of spring discharge to the Snake River, Milner Dam to King Hill, Idaho. U.S. Geological Survey Water Fact Sheet, Open-File Report 92-147.

Kjelstrom, L.C., 1992, Streamflow gains and losses in the Snake River and ground-water budgets for the Snake River plain, Idaho and eastern Oregon: U.S. Geological Survey Open-File Report 90-172, 71pp.

Koehler, G.M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north-central Washington. Can. J. Zool. 68:845-851.

Koehler, G.M., and K.B. Aubry. 1994. Lynx. Pages 74-98 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski (eds.). The scientific basis for conserving forest carnivores: American Marten, Fisher, Lynx, and Wolverine in the western United States.

Koehler, G.M., and J.D. Brittell. 1990. Managing spruce-fir habitat for lynx and snowshoe hares. J. Forestry 88:10-14.

Kroger, R. L. 1973. Biological effects of fluctuating water level in the Snake River, Grand Teton National Park. Wyoming. Am. Mid. Nat. 89: 478 481.

Kucera, P.A., and Johnson, D.B. 1986. A Biological and Physical Inventory of the Streams Within the Nez Perce Reservation: Juvenile Steelhead Survey and Factors That Affect Abundance in Selected Streams in the Lower Clearwater subbasin, Idaho. Lapwai, ID: Nez Perce Tribe, Fisheries Resource Management.

Lake Pend Oreille Watershed Advisory Group (LPOWAG). 1999. Lake Pend Oreille bull trout conservation plan. Prepared for State of Idaho, Boise. Resource Planning Unlimited.

Laumeyer, P.H. 1976. Fishes of the Coeur d'Alene River system. Thesis presented at Eastern Washington State College, Cheney.

Larson, R.E., and L. Mobrand. 1992. Nez Perce Tribal Hatchery Master Plan and Appendices. Nez Perce Tribe; Mobrand Biometrics; Bonneville Power Administration, Division of Fish and Wildlife.

Laymon, S.A. 1980. Feeding and nesting behavior of the yellow-billed cuckoo in the Sacramento Valley. Wildlife Management Branch Administration Rep. 80-2, California Department of Fish and Game, Sacramento.

Laymon, S.A., and M.D. Halterman. 1987a. Can the western subspecies of the yellow-billed cuckoo be saved from extinction? Western Birds 18:19-25.

Laymon, S.A., and M.D. Halterman. 1987b. Distribution and status of the yellow-billed cuckoo in California. Final report to the California Department of Fish and Game, Contract #C-1845. Sacramento, CA. 35pp.

Laymon, S.A., M.D. Halterman, and T. Gallion. 1989. Nesting ecology of the yellow-billed cuckoo on the Kern River: 1989 Nature Conservancy and California Department of Fish and Game Non-Game Wildlife Investigations, Endangered Species Section, Sacramento, CA.

Laymon, S.A., P.L. Williams, and M.D. Halterman. 1993. Breeding status of the yellow-billed cuckoo in the South Fork Kern River Valley, Kern County, California: summer 1992. Unpublished report prepared for U.S.D.A. Forest Service, Sequoia National Forest, CA. 36pp. + figures.

Launer, A.E., D.D. Murphy, S.A. Laymon, and M.D. Halterman. 1990. 1990 Distribution and habitat requirements of the yellow-billed cuckoo in California. Center for Conservation Biology Stanford University. Stanford, CA. 26pp.

Leathe, S. A., and P.J. Graham. 1982. Flathead Lake fish food habits study - Final report. Montana Department of Fish, Wildlife and Parks. Kalispell, Montana, 137pp.

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, and J.E. Williams. 1997. Broadscale Assessment of Aquatic Species and Habitats. Volume III, Chapter 4. U.S. For. Serv., Gen. Tech. Rep. PNW-GTR-405. Portland, Oregon.

Lesica, P., and T.H. Deluca. 1998. Long-term harmful effects of crested wheatgrass on Great Plains grassland ecosystems. Journal of Soil and Water Conservation, 51(5):408-409.

Lloyd, D.S., J.P. Koenings, and J.D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries Management 7:18–33.

Lysne, S.J. 2003. The life history and ecology of two endangered Snake River gastropods: Utah valvata (*Valvata utahensis*: Call) and Idaho springsnail (*Pygulopsis idahoensis*: Pilsbry). Master's Thesis, Boise State University. July 2003. 103pp.

Lysne, S.J., and P. Koetsier. 2006. The life history of the Utah (desert) valvata, *Valvata utahensis*, in the Snake River, Idaho. Journal of Freshwater Ecology 21:285-291.

Mace, R. D., J.S. Waller, T.L. Manley, L.J. Lyon, and H. Zuuring. 1996. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. Journal of Applied Ecology 33:1395–1404. CrossRef, CSA

Mace, R.D., and J.S. Waller. 1997. Final report: grizzly bear ecology in the Swan Mountains Montana. Montana Department of Fish, Wildlife and Parks, Helena, Montana, USA.

Mace, R.D., and J.S. Waller. 1998. Demography and population trend of grizzly bears in the Swan Mountains, Montana. Conservation Biology. 12:1005-1016.

Maclay, D.J. 1940. Tentative management plan—Coeur d'Alene National Forest. U.S. Forest Service, Coeur d'Alene, Idaho.

McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behavior, habitat use and demography. J. Appl. Ecol. 25:451-460.

Mallett, J. 1974. Inventory of salmon and steelhead resources, habitat use and demands. Federal Aid in Fish Restoration, Job Performance Report: Project F-58-R-1. Idaho Department of Fish and Game, Bosie, Idaho.

Mancuso, M. 2000. Monitoring habitat integrity for *Lepidium papilliferum* (slickspot peppergrass): 1999 results. Idaho Department of Fish and Game, Conservation Data Center, Boise, Idaho. 16pp. + appendices.

Mancuso, M. 2001. Monitoring habitat integrity for *Lepidium papilliferum* (slickspot peppergrass) 2000 results. Report prepared for State of Idaho, Military Division. Task Order No. 001 -FY-00. 22pp. + appendices.

Mancuso, M., and R.K. Moseley. 1998. An ecological integrity index to assess and monitor *Lepidium pauilliferum* (slickspot peppergrass) habitat in southwestern Idaho. Idaho Department of Fish and Game, Conservation Data Center, Boise, Idaho. 15pp. + appendices.

Mancuso, M., C. Murphy, and R.K. Moseley. 1998. Assessing and monitoring habitat integrity for *Leuidium papilliferum* (slickspot peppergrass) in the sagebrush-steppe of southwestern Idaho. Idaho Department of Fish and Game, Conservation Data Center.

Manley, T.L. 1986. Woodland caribou status review. Job Final. Rpt. Statewide Endangered Species. Proj. No. SE-1-13. Montana Dept. Fish and Wildl., Parks, Helena. 84pp.

Marotz, B.L., B. Hansen, and S. Tralles. 1988. Instream flows needed for successful migration, spawning and rearing of rainbow and westslope cutthroat trout in selected tributaries of the Kootenai River. Montana Department of Fish, Wildlife and Parks. Prepared for Bonneville Power Administration. Project Number 85-6.

Maser, C., and J.R. Sedell. 1994. From the Forest to the Sea: The Ecology of Wood in Streams, Rivers, Estuaries, and Oceans. St. Lucie Press, Delray Beach, Florida.

Matthews, G.M., and R.S. Waples. 1991. Status review for Snake River spring and summer shinook salmon. U.S. Department of Commerce, NOAA Technical Memorandum NMFS F/NWC-200, Seattle, WA., 75pp.

Mattson, D.J., R.R. Knight, and B.M. Blanchard. 1986. The effects of developments and primary roads on grizzly bear habitat use in Yellowstone National Park, Wyoming. International Conference on Bear Research and Management, 7:259-273.

Maughan, O.E. 1972. Distribution and Geographic Variations of Sculpin in the Clearwater River Basin. Washington State University, Pullman. Ph.D. thesis. 213pp.

McClure, M.M., Holmes, E.E., Sanderson, B.L., and Jordan, C.E. 2003. A large-scale, multi-species assessment: anadromous salmonids in the Columbia River basin. Ecol. Appl. 13:964–989.

McCord, C.M., and J.E. Cardoza. 1982. Bobcat and lynx. In J.A. Chapman and G.A. Feldhamer (eds.). Wild mammals of North America biology, management and economics. Johns Hopkins University Press, Baltimore, MD.

McCullough, M. 1990. An evaluation of the Maine caribou reintroduction project, 1986 to 1989. Unpubl. Rpt. Maine Caribou Proj., Univ. of Maine, Orono. 54pp.

McCullough, M. 1991. Final Report—Maine caribou project 1986-1990. Maine Dept. Inl. Fish and Wildl., Bangor.

Mc Donald, M. 1996. Amphibian Inventory of the Jarbridge and Snake River Resource Areas. Idaho Bureau of Land Management Tech. Bull. No. 96-13. 23pp.

McIntosh, B.A., J.R. Sedell, J.E. Smith, R.C. Wissmar, S.E. Clarke, G.H. Reeves, and L.A. Brown. 1994. Management History of Eastside Ecosystems: Changes in Fish Habitat Over 50 Years, 1935 to 1992. USDA Forest Service, Pacific Northwest Research Station, General Technical Report PNW-GTR-321. February. http://www.fs.fed.us/pnw/publications/gtr321/

McKelvey, K.S., S.W. Buskirk, C.J. Krebs. 1999a. Theoretical insights into the population viability of lynx. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

McKelvey, K.S., K.B. Aubry, Y.K. Ortega. 1999b. History and distribution of lynx in the contiguous United States. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

McKelvey, K.S., K.B. Aubry, and Y.K. Ortega. 2000. History and distribution of lynx in the contiguous United States. Pages 207-264 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

McLellan, B.N., and D.M. Shackleton. 1988. Grizzly bears and resource-extraction industries: effects of roads on behavior, habitat use and demography. J. Appl. Ecol. 25:451-460.

Mech, L.D. 1973. Canadian lynx invasion of Minnesota. Biol. Conserv. 5:151-152.

Mech, L.D. 1977. Record movement of a canadian lynx. J. Mammal. 58:676-677.

Mech, L.D. 1980. Age, sex, reproduction, and spatial organization of lynxes colonizing northeastern Minnesota. J. Mammal. 61:261-267.

Mech, L.D., M.E. Nelson, and H. Drabik. 1982. Reoccurence of caribou in Minnesota. Am. Midl. Nat. 108(1):206-208.

Meffe, G.K., and C.R. Carroll. 1994. Principles of conservation biology. Sinauer Associates, Inc. Sunderland, Massachusetts. 673pp.

Merigliano, M. 1995. Ecology and Management of the South Fork River Cottonwood Forest. Final Draft Report. School of Forestry, University of Montana.

Miller, W.H. 1987. A Review of Dworshak National Fish Hatchery Record. U.S. Fish and Wildlife Service Dworshak Fisheries Assistance Office. Ahsahka, Idaho.

Moller, S., and R. Van Kirk. 2004. Hydrologic Alteration and its Effect on Trout Recruitment in the South Fork Snake River Project. Completion report for the Idaho Department of Fish and Game. Departments of Biological Sciences and Mathematics, Idaho State University, Pocatello, Idaho.

Monnot, L., J.B. Dunham, T. Hoem, and P. Koetsier. 2008. Influences of body size and environmental factors on autumn downstream migration of bull trout in the Boise River, Idaho. North American Journal of Fisheries Management. 28:231-240.

Montana Bull Trout Scientific Group (MBTSG). 1996. Middle Kootenai River drainage bull trout status report. Prepared for the Montana Bull Trout Restoration Team. Montana Department of Fish, Wildlife and Parks, Helena.

Moroz, P., S. Jeffries, F. Gordon, A. Hansen, W. Owen, J. Rohlman, C. Lunte, R. Howard, C. Harris, and L. Lewis. 1995. Idaho ground squirrel, *Spermophilus brunneus brunneus*, habitat conservation assessment, conservation strategy. Idaho Interagency Conservation/Prelisting Effort. Idaho Department of Fish and Game, Boise, Idaho. 18pp.

Morgan, R.P. II, Jacobsen, R.E., Weisberg, S.B., McDowell, L.A., and Wilson H.T. 1991. “Effects of flow alteration on benthic macroinvertebrate communities below the Brighton Hydroelectric Dam”, Journal of Freshwater Ecology, 6(4), 419-429.

Morton, E.S. 1992. What do we know about the future of migrant landbirds? Pages 579-589 in J.M. Hagan, III and D.W. Johnston, editors. Ecology and conservation of neotropical migrant landbirds. Smithsonian Institution Press, Washington, DC.

Moseley, R.K. 1994. Report on the conservation status of *Lepidium papilliferum*. Idaho Department of Fish and Game, conservation Data Center, Boise, Idaho. 35pp. + appendices.

Moseley, R.K. 1998. Ute Ladies’-tresses (*Spiranthes diluvialis*) in Idaho: 1997 Status Report. Conservation Data Center, Idaho Fish and Game Department, Boise, Idaho.

Moseley, R.K. 2000. Ute Ladies’-tresses (*Spiranthes diluvialis*) in Idaho: 1999 Status Report. Natural Resource Policy Bureau, Idaho Department of Fish and Game, Boise, Idaho.

Mowat, G., K.G. Poole, M. O'Donoghue. 1999. Ecology of lynx in northern Canada and Alaska. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Mowat, G., K.G. Poole, M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Pages 265-306 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Munger, J.C. 2003. Critical habitat elements for Columbia spotted frogs in the Owyhee Mountains. Report on a challenge cost share agreement between Boise State University and the Bureau of Land Management. Boise, Idaho. January 10, 2003. 15pp.

Munger, J.C., and H.A. Lingo. 2003. Reintroduction of beaver to aid restoration of the spotted frog population in Stoneman Creek. Report on the FY2001 and FY2002 research funded by a challenge cost share agreement between Boise State University and the Bureau of Land Management. Boise, Idaho. February 10, 2003. 7pp.

Munger, J. C., M. Gerber, M. Carrol, K. Madrid and C. Peterson. 1996. Satus and Habitat Associations of the Spotted Frog (*Rana pretiosa*) in Southwest Idaho. Technical Bulletin No. 96-1. U. S. Department of Interior, Bureau of Land Management. 11pp. + maps, tables, and appendices.

Murphy, C. 2000. Ute Ladies’-tresses (*Spiranthes diluvialis*) in Idaho: 2000 Status Report. Natural Resource Policy Bureau, Idaho Department of Fish and Game, Boise, Idaho.

Murphy, C. 2001. Ute Ladies’-tresses (*Spiranthes diluvialis*) in Idaho: 2001 Status Report. Natural Resource Policy Bureau, Idaho Department of Fish and Game, Boise, Idaho.

Murphy, C. 2003. Ute ladies'-tresses (*Spiranthes diluvialis*) in Idaho: 2002 Status Report. Natural Resource Policy Bureau, Idaho Department of Fish and Game, Boise, Idaho.

Murphy, C. 2004a. Monitoring Ute Ladies'-tresses (*Spiranthes diluvialis*) on the South Fork Snake River, Idaho: Conservation Status and Third Year Results of Habitat Monitoring. Idaho Conservation Data Center, Idaho Department of Fish and Game, Boise, Idaho.

Murphy, C. 2004b. Memo to Those concerned with Ute Ladies'-tresses *(Spiranthes diluvialis)*. From Chris Murphy, Botanist, Idaho Conservation Data Center. Re: Monitoring Ute Ladies'-tresses *(Spiranthes diluvialis)* in Idaho

Myers, J.M., R.G. Kope, G.J. Bryant, et al. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA.

National Marine Fisheries Service (NMFS). 1995. Endangered Species Act Section 7 consultation Biological Opinion-Reinitiation of consultation on 1994 -1998 operation of the federal Columbia River power system and juvenile transportation program in 1995 and future years. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Seattle, Washington.

National Marine Fisheries Service (NMFS). 1999. The Habitat Approach. Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Anadromous Salmonids. Northwest Region, Habitat Conservation and Protected Resources Divisions, Portland, Oregon (August 26, 1999).
http://www.nwr.noaa.gov/1habcon/habweb/habguide/habitatapproach_081999.pdf

National Marine Fisheries Service (NMFS). 2003. Programmatic biological opinion and Magnuson-Stevens Fishery Conservation and Management Act essential fish habitat consultation for the Bonneville Power Administration habitat improvement program (HIP) in the Columbia River basin. August 1, 2003. National Marine Fisheries Service, Seattle, WA.

National Marine Fisheries Service (NMFS). 2004. Consultation on Remand for Operation of the Columbia River Power System and 19 Bureau of Reclamation Projects in the Columbia Basin (Revised and reissued pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon)). Northwest Region. Seattle WA, 98115.
http://seahorse.nmfs.noaa.gov/pls/pctspub/sxn7.pcts_upload.summary_list_biop?p_id=14756

National Marine Fisheries Service (NMFS). 2006. Draft Snake River salmon and steelhead Recovery plan. NMFS, Boise, ID.

National Research Council. 1996. Upstream Salmon and Society in the Pacific Northwest. National Academy Press, Washington, D.C.

Nellis, C.H., S.P. Wetmore, L.B. Keith. 1972. Lynx-prey interactions in central Alberta. J. Wildl. Manage. 36:320-329.

Newcombe, C.P., and J.O. Jensen. 1996. Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. North American Journal of Fisheries Management 16, No. 4.

Nez Perce National Forest. 1998. South Fork Clearwater River Landscape Assessment Vol. I: Narrative.

Nez Perce Tribe and Idaho Department of Fish and Game. 1990. Clearwater River Subbasin Salmon and Steelhead Production Plan. Funded by the Northwest Power Planning Council; Columbia Basin Fish and Wildlife Authority.

Nolan, V. Jr. 1963. Reproductive success of birds in a deciduous scrub habitat. Ecology 44:305-313. in Hughes, J.M. 1999. Yellow-billed cuckoo (*Coccyzus americanus*). in The birds of North America, No. 418 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. 28pp.

Nolan, V. Jr., and C.F. Thompson. 1975. The occurrence and significance of anomalous reproductive activities in two North American non-parasitic cuckoos *Coccyzus* spp. Ibis 117:496-503.

Northwest Power Planning Council (NPPC). 2001a. Coeur d'Alene subbasin summary. Prepared by The Coeur d'Alene Tribe and other contributors for the Northwest Power Planning Council.

Northwest Power Planning Council. (NPPC). 2001b. Technical Guide for Subbasin Planners. Council document 2001-20.

Noss, R.F., E.T. LaRoe III, and J.M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. U.S. Department of the Interior, National Biological Service, Washington, D.C. 47pp.

O'Donoghue, M., S. Boutin, C.J. Krebs, and E.J. Hofer. 1997. Numerical responses of coyotes and lynx to the snowshoe hare cycle. Oikos 80:150-162.

O'Donoghue, M., S. Boutin, C.J. Krebs, D.L. Murray, and E.J. Hofer. 1998a. Behavioural responses of coyotes and lynx to the snowshoe hare cycle. Oikos 82:169-183.

O'Donoghue, M., S. Boutin, C.J. Krebs, G. Zuleta, D.L. Murray, and E.J. Hofer. 1998b. Functional responses of coyotes and lynx to the snowshoe hare cycle. Ecology 79:1193-1208.

Ohmart, R.D. 1994. The effects of human-induced changes on the avifauna of western riparian habitats. Studies in Avian Biology 15:273-285.

Oliver, G. 1979. A final report on the present fisheries of the Wigwam River with an emphasis on the migratory life history and spawning behavior of Dolly Varden Charr *Salvelinus malma* (Walbaum). Fisheries investigations in tributaries of the Canadian portion of Libby Reservoir. Victoria, BC: British Columbia Fish and Wildlife Branch. 27pp.

Osmundson, D.B., R. J. Ryel, V.L. Lamarra, and J. Pitlick. 2002. Flow-sediment-biota relations: Implications for river regulation effects on native fish abundance. Ecological Applications 12:1719-1739.
Panek, K.C., and J.C. Munger. 2003. Southern Idaho ground squirrels; dispersal and translocation, 2003 field season. Annual report submitted to the U.S. Fish and Wildlife Service. Biology department, Boise State University, Idaho. 6pp.

Panhandle Bull Trout Technical Advisory Team (PBTTAT). 1998a. Kootenai River Basin bull trout problem assessment. Prepared for the State of Idaho. Boise, Idaho.

Panhandle Bull Trout Technical Advisory Team (PBTTAT). 1998b. Lake Pend Oreille key watershed bull trout problem assessment. Prepared for the State of Idaho, Boise.

Panhandle Bull Trout Technical Advisory Team (PBTTAT). 1998c. Priest River Basin bull trout problem assessment. Prepared for the State of Idaho, Boise.

Panhandle Bull Trout Technical Advisory Team (PBTTAT). 1998d. Coeur d'Alene Lake Basin bull trout problem assessment. Draft. Prepared for the State of Idaho. December 1998.

Parker, G.R., J.W. Maxwell, L.D. Morton, and G.E.J. Smith. 1983. The ecology of the lynx (*Lynx canadensis*) on Cape Breton Island. Can. J. Zool. 61:770-786.

Pashley, D.N., C.J. Beardmore, J.A. Fitzgerald, R.P. Ford, W.C. Hunter, M.S. Morrison, and K.V. Rosenberg. 2000. Partners in Flight - Conservation of the birds of the United States. The Plains, VA. 92pp.

Pentec Environmental, Inc. 1991. Critical review of the U.S. Fish and Wildlife Service proposal to list five molluscs in the Snake River, Idaho, as endangered species. Final Report prepared for Bart M. O'Keefe. C.H. 20pp.

Phillips, A.R., J. Marshall, and G. Monson. 1964. The birds of Arizona. Univ. of Arizona Press, Tucson, AZ.

Poole, K.G. 1994. Characteristics of an unharvested lynx population during a snowshoe hare decline. J. Wildl. Manage. 58:608-618.

Poole, K.G. 1997. Dispersal patterns of lynx in the Northwest Territories. J. Wildl. Manage. 61:497-505.

Popovich, S. 2001. Survey for slickspot peppergrass in the Inside Desert, BLM-Jarbidge Resource Area, Idaho. Report prepared for the Bureau of Land Management. Order Number DAA10109. 22 pp. + appendices.

Pratt, K. L. 1992. A review of bull trout life history. Pages 5–9 in P. J. Howell and D. V. Buchanan, editors. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River. Draft. Prepared for Avista Corporation, Spokane, Washington.

Prescott, D.J., and E. Yensen. 1999. Habitat variable correlated with presence of southern Idaho ground squirrels *Spermophilus brunneus endemicus*. 19pp.

Puurtinen, M., K.E. Knott, S. Suonpää, T. van Ooik, and V. Kaitala. 2004. Genetic variability and drift load in populations of aquatic snails. Evolution 58(4):749-756.

Pyke, D.A. 1999. Invasive exotic plants in sagebrush ecosystems of the Intermountain West. Pages 576-577, Proceedings: Sagebrush steppe ecosystems symposium. P.G. Entwistle, A.M. Debolt, J.H. Kaltenecker, and K. Steenhof, complilers, Bureau of Land Management Publication No. BLMIIDIPT-001001+1150, Boise, Idaho.

Quinn, N.W.S., and G. Parker. 1987. Lynx. in M. Novak, J.A. Barber, M.E. Obbard, B. Malloch (eds.). Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources.

Quinney, D. 2000. Military training in Orchard Training Area *Lepidium papilliferum*, and its habitat. Idaho Army National Guard Technical Report 04. 8pp + appendices.

Quigley, J.T. 2003. Experimental field manipulations of stream temperatures and suspended sediment concentrations: behavioral and physiological effects to juvenile Chinook salmon. Master's Thesis. Simon Fraser University, Burnaby, British Columbia, Canada.

Ratliff, D.E., and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 In: P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearharg Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.

Reaser, J.K. 1997. Amphibian declines: conservation science and adaptive management. Ph.D. Thesis, Stanford University, Stanford, California.

Resource Systems, Inc. 1983. Boise River and fish habitat study.

Reynolds, T.D. 2004. 2003 Summary Report, A survey for yellow-billed cuckoo in recorded historic and other likely locations in Idaho.

Rhodes, J.J., D.A. McCullough, and F.A. Espinosa, Jr. 1994. A Coarse Screening Process for Potential Application in ESA Consultations. Columbia River Intertribal Fish Commission. Prepared under NMFS/BIA Inter-Agency Agreement 40ABNF3. December.

Rich, C.F., Jr. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M.S. Thesis, Montana State University, Bozeman, Montana.

Rich, B.A., R.J. Scully, and C.E. Petrosky. 1992. Idaho Habitat/Natural Production Monitoring. Part I. General Monitoring Subproject, Annual Report 1990. Portland: Idaho Department of Fish and Game. Prepared for Bonneville Power Administration.

Richards, D.C., 2001. Competion between the threatened Bliss Rapids Snail, *Taylorconcha serpenticola* (Hershler et al.) and the invasive aquatic snail, *Potamopyrgus antipodarum* (Gray). Montana State University, Ph.D. thesis. Bozeman, Montana.

Richards, D.C., Cazier, L. D., and G. T. Lester. 2001. Spatial distribution of three snail species, including the invader *Potamopyrgus antipodarum* in a freshwater spring. Western North American Naturalist. 6(13): 375-380.

Richards, D.C., Falter C.M., and Steinhorst, K. 2006. Status review of the Bliss Rapids Snail, *Taylorconcha serpenticola* in the Mid-Snake River, Idaho. Unpublished report prepared for Idaho Power Company, Boise, Idaho. June 2006. 170pp.

Richards, D.C. and T. Arrington. 2007. Estimating median time to extinction for spring and river *Taylorconcha serpenticola* populations. Draft Report to Idaho Power Company and Fish & Wildlife Service. Dated 16 May 2007. 9 pages.

Richards, M. 1968. Appraisal of project results for salmon and steelhead reintroductions and introductions into the Clearwater River drainage, Idaho. Annual project closing report July 1, 1966 to June 30, 1967. Columbia River Fishery Development Program. Project N. 161. 1B-IDA. Contract No. 14-17-0001-1419. Idaho Department of Fish and Game, Idaho. 9pp.

Richards, RD.RC. and Kerans B.L. 2007. Effects of rapid river-stage fluctuations on the survivorship of *Taylorconcha serpenticola* (Hershler et al.), the Threatened Bliss Rapids snail. 9pp.

Rico, A., P. Kindlmann, and F. Sedlacek. 2007. Road crossing in bank voles and yellow-necked mice. Acta Theriologica 52:85–94.

Rieman, B.E., and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21:756-764.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. Gen. Tech. Rep. INT-302. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Boise, ID. 38pp.

Rieman, B.E., and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124:285-296.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River Basins. North American Journal of Fisheries Management 17:1111-1125.

Rieman, B. E., D. L. Myers, and R. L. Nielsen. 1994. Use of otolith microchemistry to discriminate *Oncorhynchus nerka* of resident and anadromous origin. Can. J. Fish. Aquat. Sci. 51:68-77.

Roberson, D. 1980. Rare birds of the west coast of North America. Woodcock Publications.

Robertson, I. 2001. Insect-mediated pollination of slickspot peppergrass, *Lepidium papilliferum*: implications for population viability. Final report to Bureau of Land Management, Task Order No. DAFO 100 10. 16pp.

Robins, R.C., R.M. Bailey, C.E. Bond, J.R. Brooker, E.A. Lachner, et al. 1980. A List of Common and Scientific Names of Fishes from the United States and Canada, Fourth Edition. American Fisheries Society Special Publication, no. 12. American Fisheries Society. Bethesda, Maryland, USA. 174pp.

Robinson, W.T., and E.G. Bolen. 1989. Wildlife Ecology and Management. MacMillian Pub. Corp., N.Y., N.Y. 574pp.

Rominger, E.M. Unpubl. Rpt. Early-Winter Habitat. U.S. Fish and Wildlife Service, Boise, Idaho. 20pp.

Rosenberg, K.V., R.D. Ohmart, W.C. Hunter, and B.W. Anderson. 1991. Birds of the lower Colorado River Valley. University of Arizona, Tucson, AZ.

Rosentreter, R. 1994. Displacement of rare plants by exotic grasses. Pages 170-174, Proceedings - ecology and management of annual rangelands, S.B. Monsen and S.G. Kitchen, compilers, General Technical Report INT-GTR-3 13, USDA Forest Service, Intermountain Research Station, Ogden, Utah.

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G., Patton, T. Rinaldi, J. Trick, A. Vendehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2000. Lynx conservation assessment and strategy. USFS, USFWS, BLM, and U.S. National Park Service. Publication R1-00-53. USFS, Missoula, Montana. 142pp. Online version available at: <http://www.fs.fed.us/rl/planning/lynx/lynx.html>.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, J.R. Squires. 1999. The scientific basis for lynx conservation: qualified insights. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Rust, H.J. 1946. Mammals of northern Idaho. J. Mammal. 27:308-327.

Ryser, Jr., F.A. 1985. Birds of the Great Basin. University of Nevada Press, Reno.

Saunders, J.K. 1963. Food habits of the lynx in Newfoundland. J. Wildl. Manage. 27:384-390.

Salow, T.D. 2001. Population structure and movement patterns of adfluvial bull trout (*Salvelinus confluentus*) in the North Fork Boise River basin, Idaho. Master's Thesis. Boise State University, Boise, Idaho.

Scholten, M., and S. Bunting. 2001. Long-term effects of selected rehabilitation practices on *Lepidium papilliferum* (slickspot peppergrass). University of Idaho. Report to the Bureau of Land Management. 11pp.

Schwartz, M.K., L.S. Mills, K.S. McKelvey, L.F. Ruggiero, and F.W. Allendorf. 2002. DNA reveals high dispersal synchronizing the population dynamics of Canada lynx. Nature 415:520-522.

Scott, M.D. 1985. The woodland caribou. Audubon Wildl. Rpt 1985. 14pp.

Scott, M.D., and G. Servheen. 1985. Caribou Ecology. Job Comp. Rpt., Proj. No. W-160-R-11. Idaho Dept. of Fish and Game, Boise, Idaho. 136pp.

Sedell, J.R., and F.H. Everest. 1991. Historic changes in pool habitat for Columbia River Basin salmon under study for TES listing. Draft U.S. Department of Agriculture Report, Pacific Northwest Research Station, Corvallis, Oregon.

Sedell, J.R., Froggatt, J.L. 2000. Importance of Streamside Forests to Large Rivers: The Isolation of the Willamette River, Oregon, U.S.A., from its Floodplain by Snagging and Streamside Forest Removal. Verhandlung Internationale Vereinigung Limnologie Vol. 22, No. 3, p 1828-1834, December, 1984. 2 Fig, 1 Tab, 19 Ref. NSF grant DEB-8112455.

Selong, J.H., T.E. McMahon, A.V. Zale, and F.T. Barrows. 2001. Effect of temperature on growth and survival of bull trout, with application for an improved method for determining thermal tolerance for fishes. Transactions of theAmerican Fisheries Society 130:1026-1037.

Servheen, C., J.S. Waller and P. Sandstrom. 2001. Identification and management of linkage zones for grizzly bears between the large blocks of public land in the northern Rocky Mountains. Unpublished report. USFWS, Missoula, Montana.

Servheen, G., and J. Lyon. 1989. Habitat use by woodland caribou in the Selkirk Mountains. J. Wildl. Manage. 53:230-237.

Servizi, J.A., and D.W. Martens. 1992. Sublethal responses of coho salmon (*Oncorhynchus kisutch*) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49:1389-1395.

Sexauer, H. M., and P.W. James. 1997. A comparison of the microhabitat use by juvenile bull trout in four streams located in the eastern Cascades, Washington. Pages 361–370 in W. C. Mackay, M. K. Brewin, and M. Monita, editors. Trout Unlimited Canada, Bull Trout Task Force, Calgary, Alberta.

Shaffer, M.L. 1981. Minimum population sizes for species conservation. BioScience, 31(2): 131-134.

Shepard, B.B., K.L. Pratt, and P.J. Graham. 1984. Life histories of westslope cutthroat and bull trout in the upper Flathead River basin, Montana.

Sherman P.W., and M.C. Runge. 2002. Demography of a population collapse: The Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). Ecology 83:2816-2831.

Sherman, P., and E. Yensen. 1994. Behavior and ecology of Idaho ground squirrel. Annual report detailing results of the 1993 field season. Cornell University, Ithaca, New York. 12pp.

Sheviak, C.J. 1984. *Spiranthes diluvialis* (Orchidaceae), a new species from the western United States. Brittonia 36(1):8-14.

Sigler, J., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelhead and coho salmon. Transactions of the American Fisheries Society 113:142-150.

Simpson, J.C., and R.L. Wallace. 1982. Fishes of Idaho. Department of Biological Sciences, University of Idaho, Moscow.

Simpson, K., G.P. Woods, and K.B. Hebet. 1985. Movements and habitats of caribou in the Columbia Mountains of B.C., B.C. Fish and Wildl. Branch Rep.., Nelson. 34pp.

Slough, B.G., and G. Mowat. 1996. Population dynamics of lynx in a refuge and interactions between harvested and unharvested populations. J. Wildl. Manage. 60:946-961.

Smith, E. M. 1983. History of the Boise National Forest 1905-1976. Idaho State Historical Society. Boise, Idaho. 166pp.

Spence, B.C., G.A. Lomnicky, R.M. Hughes, and R.P. Novitzki. 1996. An ecosystem approach to salmonid conservation. TR-4501-96-6057. ManTech Environmental Research Services Corp., Corvallis, Oregon. (December 1996). http://www.nwr.noaa.gov/1habcon/habweb/habguide/ManTech/front.htm

Squires, J.R., and T. Laurion. 1999. Lynx home range and movements in Montana and Wyoming: preliminary results. In Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al., tech. eds. The scientific basis for lynx conservation in the contiguous United States. Gen. Tech. Rpt. RMRS-GTR-30. Ogden, UT: U.S. Dept. Agriculture, Forest Service, Rocky Mountain Research Station.

Squires, J.R., and T. Laurion. 2000. Lynx home range and movements in Montana and Wyoming: preliminary results. Pages 337-349 in Ruggiero, L.F., K.B Aubry, S.W. Buskirk, et al. Ecology and conservation of lynx in the contiguous United States. University Press of Colorado, Boulder, Colorado.

Stephens D. A., and S.H. Sturts. 1997. Idaho bird distribution. Idaho Museum of Natural History, Pocatello and Idaho Department of Fish and Game. Boise, ID.

Stephenson, M.A., and B.M. Bean. 2003. Snake River aquatic macroinvertebrate and ESA snail surveys. Section 10 Permit Rpt. Idaho Power Co. May 2003.

Stephenson, M. A., and R. Myers. 2003. Response to FERC Additional Informational Request 9: Listed Snails—Cove Creek. Idaho Power, Boise, ID. 25pp.

Stevenson, S.K., and D.F. Hatler. 1985. Woodland caribou and their habitat in southern British Columbia. Vol. 1. Infor. Serv. Branch, B.C. Min. of For., Victoria. 355pp.

Stone, R.D. 1993. Final Report for the 1992 Challenge Cost Share Project, Uinta and Wasatch-Cache National Forest, Target Species: Ute Ladies'-tresses Orchid (*Spiranthes diluvialis* Sheviak). Utah Natural Heritage Program, Salt Lake City, Utah.

Sugden, E. 1985. Pollinators of *Astragalus monoensis* barneby (Fabaceae)—new host records—potential impact of sheep grazing. Gt. Basin Nat. 45:299–312.

Tausch, R. J., J. C. Chambers, R. R. Blank, and R. S. Nowak. 1995. Differential establishment of perennial grass and cheatgrass following fire on an ungrazed sagebrush-juniper site. Pages 252 257 in B. A. Roundy, E. D. McArthur, J. S. Haley, and D. K. Mann, compilers, Proceedings: wildland shrub and arid land restoration symposium. USDA Forest Service General Technical Report INT-GTR-313.

Taylor, D.M. 2000. Status of yellow-billed cuckoo in Idaho. Western Birds. Volume 31. No. 4:252-253.

Taylor, D.W. 1982. Status Report on Snake River *Physa* snail. U.S. Fish and Wildlife Service, Portland, OR. 8pp.

Thiel, R.P. 1987. The status of Canada lynx in Wisconsin, 1865-1980. Wisconsin Academy Sciences, Arts and Letters 75:90-96.

Thomas, G. 1992. Status of bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.

Thompson, K.L. 1999. Biological Assessment: Lower Selway *4th Code HUC*. Fish, Wildlife and Plants. Nez Perce National Forest, Moose Creek Ranger District.

Thurow, R.F., 2000, Dynamics of Chinook salmon populations within Idaho's Frank Church Wilderness−implications for persistence in McCool, S.F., and others, comps., v. 3—Wilderness as a place for scientific inquiry: Proceedings of the wilderness science in a time of change conference, Missoula, Montana, May 23-27, 1999, U.S. Forest Service RMRS-P-15-VOL-3:143-151.

Thurow, R.F., and T.C. Bjornn. 1978. Response of cutthroat trout populations to cessation of fishing in St. Joe River tributaries. Final Report F-60-R Bulletin No. 25. College of Foeresty, Wildlife, and Range Sciences, University of Idaho, Moscow.

Tiffin, K. F., D.W. Rondorf, W.P. Connor, H.L. Burge. 1999. Post-release attributes and survival of hatchery and natural fall Chinook salmon in the Snake River. Annual Report 1998. Prepared for Bonneville Power Administration, Portland, OR.

Total Maximum Daily Load (TMDL). 1999. Lower Boise River TMDL, Subbasin Assessment, Total Maximum Daily Loads, December 18, 1998 Revised: September 29, 1999 Prepared by: Department of Environmental Quality Boise Regional Office

Total Maximum Daily Load (TMDL). 2009. Boise-Mores Creek Subbasin Assessment and TMDL June 2009 Prepared by: Department of Environmental Quality Boise Regional Office Principle Author: Lauri Monnot

Truksa, A., and E. Yensen. 1990. Photographic evidence of vegetation changes in Adams County, Idaho. Journal of the Idaho Academy of Science 26:18-40.

Tumlison, R. 1987. *Felis lynx*. Mammalian Species 269:1-8.

U.S. Bureau of Reclamation (USBR). 1998. Biological Assessment—Bureau of Reclamation Operations and Maintenance in the Snake River Basin above Lower Granite Dam. U. S. Bureau of Reclamation, Northwest Region, Boise, Idaho.

U.S. Bureau of Reclamation (USBR). 2002. Research, monitoring, and surveys for snails protected under the Endangered Species Act in the upper Snake River, Idaho. Annual Report submitted to the U.S. Fish and Wildlife Service, Snake River Basin Office, Boise ID. April 2002. 23pp. + appendices.

U.S. Bureau of Reclamation (USBR). 2003. Monitoring and distribution surveys for Utah valvata snails protected under the Endangered Species Act in the upper Snake River, Idaho. Annual Report submitted to the U.S. Fish and Wildlife Service, Snake River Basin Office, Boise, ID. April 2003. 28pp.

U.S. Department of Interior. 1994. The impact of Federal programs on wetlands, Vol. II, a report to Congress by the Secretary of the Interior, Washington, DC, March 1994. Pages 1,5,13-18,213-225.

U.S. Environmental Protection Agency (USEPA). 1985. "Diflubezuron (Dimilin) Chemical Fact Sheet 9/85." Washington, D.C.

U.S. Fish and Wildlife Service (USFWS). 1985. Recovery plan for the Macfarlane's Four-o'clock, *Mirabilis macfarlanei*. U.S. Fish and Wildlife Service, Portland, OR. 47pp.

U.S. Fish and Wildlife Service (USFWS). 1993. Grizzly Bear Recovery Plan. U.S. Dep. Inter., U.S. Fish and Wildlife Service, Missoula, Mont. 181pp.

U.S. Fish and Wildlife Service (USFWS). 1995a. Snake River Aquatic Species Recovery Plan. Snake River Basin Office, Ecological Services, Boise, Idaho. 92pp.

U.S. Fish and Wildlife Service (USFWS). 1995b. Ute ladies'-tresses (Spiranthes diluvialis) recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. 46pp.

U.S. Fish and Wildlife Service (USFWS). 1998. Klamath River and Columbia River bull trout population segments: status summary. Prepared by the U.S. Fish and Wildlife Service's bull trout listing team.

U.S. Fish and Wildlife Service (USFWS). 2000a. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Contiguous U.S. Distinct Population Segment of the Canada Lynx and Related Rule; Final Rule. FR 65:16051-16086

U.S. Fish and Wildlife Service (USFWS). 2000b. Draft conservation strategy for the grizzly bear in the Yellowstone area. U.S. Fish and Wildlife Service, Missoula, Montana, USA.

U.S. Fish and Wildlife Service (USFWS). 2000c. Summary of public comments on the draft conservation strategy for the grizzly bear in the Yellowstone area. U.S. Fish and Wildlife Service, Missoula, Montana, USA.

U.S. Fish and Wildlife Service (USFWS). 2000d. Final environmental impact statement on grizzly bear recovery in the Bitterroot Ecosystem. Missoula, MT

U.S. Fish and Wildlife Service (USFWS). 2000e. Lolo Pass redevelopment project and U.S. Highway 12 improvements - Biological Opinion (File # 104.0700/1-4-00-F-735/HUC # 17060303). Snake River Basin Office, Boise, Idaho. 42pp.

U.S. Fish and Wildlife Service (USFWS). 2000f. Safe harbor agreement with Bob and Peggy Mack for the northern Idaho ground squirrel. Snake River Basin Office, Boise, Idaho. 19pp. November 4, 2009

U.S. Fish and Wildlife Service (USFWS). 2000g. Revised recovery plan for MacFarlane's Four-o'clock (*Mirabilis macfarlanei*). U.S. Fish and Wildlife Service, Portland, OR. 46pp.

U.S. Fish and Wildlife Service (USFWS) 2001a. Endangered and Threatened Wildlife and Plants; 12-Month Finding for a Petition To List the Yellow-billed Cuckoo (*Coccyzus americanus*) in the Western Continental United States. FR66:38611-38626.

U.S. Fish and Wildlife Service (USFWS). 2001b. Amended biological opinion for the continued implementation of the Idaho Panhandle National Forests Land and Resource Management Plan; USFWS Reference: 1-9-00-F-1 (105.0000). Upper Columbia Fish and Wildlife Office, Spokane, Washington. 81pp.

U.S. Fish and Wildlife Service (USFWS). 2001c. Biological opinion for the effects to the threatened bull trout (*Salvelinus confluentus*), the threatened grizzly bear (*Ursus arctos horribilis*), the threatened Canada lynx (*Lynx canadensis*), and the endangered gray wolf (*Canis lupus*) from the reconstruction of US Highway 93 from Evaro to Polson, in Missoula and Lake Counties, Montana (Project F 5-1(9)6). Helena Field Office, Helena, Montana. 87pp.

U.S. Fish and Wildlife Service (USFWS). 2002a. Draft Recovery Plan for the Klamath River and Columbia River Distinct Population Segments of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

U.S. Fish and Wildlife Service (USFWS). 2002b. Endangered and Threatened Wildlife and Plants; Listing the Plant *Lepidium papilliferum* (slickspot peppergrass) as Endangered; Proposed Rule and Notice of Public Hearing. FR 67:46441-46450.

U.S. Fish and Wildlife Service (USFWS). 2002c. Biological opinion on the proposed Canyon Junction to Tower Junction road improvement for Yellowstone National Park and its effects on the grizzly bear (*Ursus arctos horribilis*) and gray wolf (*Canis lupus*). Cheyenne Field Office, Cheyenne, Wyoming. 25pp.

U.S. Fish and Wildlife Service (USFWS). 2002d. Section 7 Guidelines—Snake River Basin Office—Snake River Mollusks: Idaho springsnail (*Pyrgulopsis idahoensis*), Utah valvata snail (*Valvata utahensis*), Snake River physa snail (*Physa natricina*), Bliss Rapids snail (*Taylorconcha serpenticola*), and Banbury Springs lanx (*Lanx* spp.). U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service (USFWS). 2002e. Threatened, Endangered, Proposed and Candidate Species: biological Information and Guidance. U.S. Fish and Wildlife Service, Snake River Basin Office, Dept. of Interior. August 2002. Boise, Idaho.

U.S. Fish and Wildlife Service (USFWS). 2003a. Recovery Plan for the Northern Idaho Ground Squirrel *(Spermophilus brunneus brunneus)*. Portland, Oregon. 68pp.

U.S. Fish and Wildlife Service (USFWS). 2004. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to Delist the Ute Ladies'-Tresses Orchid and Initiation of a 5-Year Review. FR 69:60605-60607.

U.S. Fish and Wildlife Service (USFWS). 2004a. Biological Opinion for the Federal Energy Regulatory Commission Proposed Relicensing of Five Hydroelectric Facilities on the Middle Snake River, Idaho: Shoshone Falls (FERC No. 2778), Upper Salmon Falls (FERC 2777), Lower Salmon Falls (FERC 2061), Bliss (FERC 1975), and C.J. Strike (FERC 2055), and their impacts on Five Mollusc Species and Bald Eagles. U.S. Fish and Wildlife Service, Snake River Basin Office, Department of Interior. May 2004. Boise, Idaho.

U.S. Fish and Wildlife Service (USFWS). 2006a. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx. FR 71:66007-66061.

U.S. Fish and Wildlife Service (USFWS). 2006b. Fish and Wildlife Service Field Notes on Box Canyon and Banbury Springs, Gooding County, Idaho. 11 January 2006.

U.S. Fish and Wildlife Service (USFWS). 2006c. Fish and Wildlife Service Field Notes on Briggs Springs and Thousand Springs, Gooding County, Idaho. 22 January 2006.

U.S. Fish and Wildlife Service (USFWS). 2007a. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition To Remove the Utah (Desert) Valvata Snail (*Valvata utahensis*) from the List of Endangered and Threatened Wildlife. FR 72:31264-31268.

U.S. Fish and Wildlife Service (USFWS). 2007b. Recovery Plan for *Silene spaldingii* (Spalding's Catchfly). U.S. Fish and Wildlife Service, Portland, Oregon. Xiii 187pp.

U.S. Fish and Wildlife Service (USFWS). 2008a. Endangered and Threatened Wildlife and Plants; Revised Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx (*Lynx canadensis*); Proposed Rule. FR 73:10859-10896.

U.S. Fish and Wildlife Service (USFWS). 2008b. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to Change the Listing Status of the Canada Lynx. FR 73: 76990-76994.

U.S. Fish and Wildlife Service (USFWS). 2009. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx; Final Rule. FR 74:8616-8702.

U.S. Fish and Wildlife Service (USFWS) and Nez Perce Tribe. 1995. Interactions of Hatchery and Wild Steelhead in the Clearwater River of Idaho. Ahsahka, ID.

U.S. Fish and Wildlife Service (USFWS) and Nez Perce Tribe. 1997. Interactions of Hatchery and Wild Steelhead in the Clearwater River of Idaho. Ahsahka and Lapwai, ID.

U.S. Forest Service (USFS). 2000. Habitat restoration plan (2001-2006) for the northern Idaho ground squirrel (*Spermophilus brunneus brunneus*). USDA, Payette National Forest, McCall, Idaho. 25pp.

U. S. Geological Survey (USGS). 1982. Deadwood River Idaho 1:100,000-scale metric topographic map. Denver, Colorado.

U.S. Geological Survey (USGS). 1999. Water resources data, Montana, water year 1998. Water Data Report MT-98-1. USGS, Helena, Montana.

U.S. North American Bird Conservation Initiative (U.S.NABCI). 2000. U.S. Fish and Wildlife Service, Arlington, VA.

Wakkinen, W.L., and W.F. Kasworm. 1997. Grizzly bear and road density relationships in the Selkirk and Cabinet-Yaak recovery zones. U.S. Fish and Wildlife Service, Missoula, Montana.

Waples, R.S., O.W. Johnson, and R.P. Jones. 1991. Status Review for Snake River Sockeye Salmon. U.S. Department of Commerce, National Marine Fisheries Service, Northwest Fisheries Science Center, NOAA Technical Memorandum NMFS-F/NWC-195. http://www.nwfsc.noaa.gov/publications/techmemos/tm195/tm195.htm

Ward, R.M.P., and C.J. Krebs. 1985. Behavioral responses of lynx to declining snowshoe hare abundance. Can. J. Zool. 63:2817-2824.

Washington Department of Wildlife. 1993. Status of the North American lynx (Lynx canadensis) in Washington. Unpubl. rpt. Washington Department of Wildlife, Olympia.

Watson, G., and T.W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: and investigation at hierarchical scales. North American Journal of Fisheries Management 17:237-252.

Weaver, J.L., and G. Amato. 1999. Lynx surveys in the Cascade Range Washington and Oregon. Unpubl. rpt. Wildlife Conservation Society, Bronx, New York.

Weigel, D.E. 2002. Monitoring and Distribution Surveys for Utah Valvata Snails Protected under the Endangered Species Act in the Upper Snake River, Idaho. Annual Report. Prepared by the U. S. Bureau of Reclamation, Boise, Idaho. Submitted to the U.S. Fish and Wildlife Service, Boise, Idaho.

Weigel, D.E. 2003. Monitoring and Distribution Surveys for Utah Valvata Snails Protected under the Endangered Species Act in the Upper Snake River, Idaho. Annual Report. Prepared by the Bureau of Reclamation, Boise, Idaho. Submitted to the U.S. Fish and Wildlife Service, Boise, Idaho.

Weir, J.N., S.P. Mahoney, B. Mclaren, and S.H. Ferguson. 2007. Effects of mine development on woodland caribou *Rangifer tarandus* distribution. Wildl. Biol. 13:66-74

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake River Plain: ecological and management implications. In**:** Proceedings: Symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management, E.D. McArthur, E.M.

Wilson, J.K. 1999. Breeding biology of the yellow-billed cuckoo relative to timber harvest in a bottomland hardwood forest. PhD Thesis, University of Georgia. 107pp.

Wissmar, R.C., J.E. Smith, B.A. McIntosh, H.W. Li, G.H. Reeves, and J.R. Sedell. 1994. Ecological Health of River Basins in Forested Regions of Eastern Washington and Oregon. Gen. Tech. Rep. PNW-GTR-326. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. Portland, OR. 65pp.

Yensen, D.L. 1980. A grazing history of southwestern Idaho with emphasis on the Birds of Prey Study Area. Bureau of Land Management, Boise District. Pages 40,41,43,65.

Yensen, E. 1980. Population status of the Idaho ground squirrel. A publication of the Center for Research, Grants, and Contracts. Boise State University, Idaho. 9pp.

Yensen, E. 1991. Taxonomy and distribution of the Idaho ground squirrel, *Spermophilus brunneus.* Journal of Mammalogy 72:583-600.

Yensen, E. 1998. Known localities of *Spermophilus endemicus.* A report for U. S. Fish and Wildlife Service, Snake River Basin Office, Boise, Idaho. 7pp.

Yensen, E. 1999. Population survey of the southern Idaho ground squirrel, *Spermophilus brunneus endemicus. A* report for U. S. Fish and Wildlife Service, Snake River Basin Office, Boise, Idaho. 16pp.

Yensen, E. 2000. Additional surveys for southern Idaho ground squirrels, *Spermophilus brunneus endemicus.* A report for U. S. Fish and Wildlife Service, Snake River Basin Office, Boise, Idaho. 9pp.

Yensen, E. 2001. Population estimate for the southern Idaho ground squirrel *(Spermophilus bmnneus endemicus). A* report for the U.S. Fish and Wildlife Service, Snake River Basin Ofice, Boise, Idaho. 20pp.

Yensen, E. 2003. Survey for southern Idaho ground squirrels on Soulen Livestock Company lands. A report for the US. Fish and Wildlife Service, Snake River Basin Office, Boise, Idaho. 18pp.

Yensen, E., and B. Haak. 2000. Population survey of the southern Idaho ground squirrel. BLM Challenge Cost Share Project; Agreement No. 203. Department of Interior, Bureau of Land Management, Boise, Idaho. 16pp.

Yensen, E., C. R. Baird, and P. Sherman. 1996. Larger ectoparasites of the Idaho ground squirrel, *Spermophilus brunneus*. Great Basin Naturalist 56:237-246.

Yensen, E., D.L. Quinney, K. Johnson, K. Timmerman, and K. Steenhof. 1992. Fire, vegetation changes, and population fluctuations of Townsend's ground squirrels. American Midland Naturalist 128:299-312.

Yensen, E., M.P. Luscher, and S. Boyden. 1991. Structure of burrows used by the Idaho ground squirrel, *Spermophilus brunneus.* Northwest Science 65(3):93-100.

Yensen, E., and P. Sherman. 1997. Mammalian species: the Idaho ground squirrel, *Spermophilus brunneus.* Journal of the American Society of Marnmalogists. 560:1-5.

Yensen, E., and P. Sherman. 2003. Ground-dwelling squirrels of the Pacific Northwest. Illustrations by W.P. Hooper. U.S. Fish and Wildlife Service and U.S. Bureau of Land Management, Boise, Idaho. 28pp.

Young, J.A. 1994. History and use of semiarid plant communities changes in vegetation. In: Monsen, S. B.; Kitchen, S. G., compilers. Proceedings-ecology and management of annual rangelands; 1992 May 18-21; Boise, ID. Gen. Tech. Rep. INT-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 5-8.

Form # 0289

ITD 0289 (Rev. 04-10)
itd.idaho.gov

Programmatic Biological Assessment
Project Pre-notification
Idaho Transportation Department

Key Number	Project Number	Project Name

District	Decimal Degrees Latitude	Longitude	Construction Timeframe	Water Body Name	4th Code HUC Number

ITD Project Manager Name	Completed By	Date

Project Categories (check all that apply)

Seal Coat, Tack Coat and Prime Coat	☐	Passing Lanes, Turnbays, Slow Moving Vehicle Turnouts	☐
Plant Mix Overlay	☐	Pavement Widening (Sliver Shoulder Notch)	☐
Cement Recycled Asphalt Base Stabilization (CRABS)	☐	Bank Stabilization (Rip-rap)	☐
Cold In-Place Recycle (CIR)	☐	Bank Stabilization (Gabion Basket)	☐
Bridge Deck Hydro-Demolition	☐	Mechanically Stabilized Earth Embankment (MSE Wall)	☐
Silica Fume and Latex Modified Concrete Overlay	☐	Ditch Cleaning	☐
High Molecular Weight Methacrylate Seal (HMWM)	☐	Small Structure Repair	☐
Concrete Waterproofing Systems (Membrane Type A, B, C and D)	☐	Culvert Installation (New Culverts and Replace Existing Culverts)	☐
Bridge Deck Epoxy Ship Seal	☐	Culvert Extension	☐
Two-lane Bridge Construction	☐	Culvert Maintenance	☐
Excavation and Embankment for Roadway Construction (Earthwork)	☐	Guardrail Installation	☐
		Striping (methyl methacrylate or paint)	☐
Rock Scaling	☐	Geotechnical Drilling	☐

Project Description (Start and End Date, Work Windows, Dewatering, etc.)

List Project Specific BMPs

ESA Listed Species Potentially Affected

ESA Listed Species With Possibility of Take

	Yes	No
Does the project have a federal nexus?	☐	☐
ESA listed plant survey required? (attach documentation)	☐	☐
ESA listed snail survey required? (attach documentation)	☐	☐
Culvert Projects: Is providing fish passage necessary?	☐	☐

	Yes	No
Electro-Shocking Proposed?	☐	☐
If Yes, will fish be handled?	☐	☐
If Yes, will fish be killed?	☐	☐
If No, will fish be harmed or harassed?	☐	☐
Is NTU monitoring proposed? (Extent of Take monitoring)	☐	☐

Signature of DE, ADE, DMTCE, or RE	Date

Page 1 of 3

Programmatic Biological Assessment
Project Pre-notification

Project Images - Click in a square to insert a project image; insert only one project image in each square. If necessary, resize picture to no more than 2.5" x 2.5".

Programmatic Biological Assessment
Project Pre-notification

Insert a copy of the project area map in the box; resize map as needed.

Distribute Within 45 Days To: NMFS FWS FHWA COE ITD HQ Environmental Section Manager

Page 3 of 3

Form # 0290

ITD 0290 (Rev. 04-10)
itd.idaho.gov

Programmatic Biological Assessment
Construction Monitoring
Idaho Transportation Department

Key Number	Project Number	Project Name		
District	Decimal Degrees Latitude Longitude	Construction Timeframe	Water Body Name	4th Code HUC Number
Completed By			Date	

Project Categories (check all that apply)

Seal Coat, Tack Coat and Prime Coat	☐	Passing Lanes, Turnbays, Slow Moving Vehicle Turnouts	☐
Plant Mix Overlay	☐	Pavement Widening (Sliver Shoulder Notch)	☐
Cement Recycled Asphalt Base Stabilization (CRABS)	☐	Bank Stabilization (Rip-rap)	☐
Cold In-Place Recycle (CIR)	☐	Bank Stabilization (Gabion Basket)	☐
Bridge Deck Hydro-Demolition	☐	Mechanically Stabilized Earth Embankment (MSE Wall)	☐
Silica Fume and Latex Modified Concrete Overlay	☐	Ditch Cleaning	☐
High Molecular Weight Methacrylate Seal (HMWM)	☐	Small Structure Repair	☐
Concrete Waterproofing Systems (Membrane Type A, B, C and D)	☐	Culvert Installation (New Culverts and Replace Existing Culverts)	☐
Bridge Deck Epoxy Ship Seal	☐	Culvert Extension	☐
Two-lane Bridge Construction	☐	Culvert Maintenance	☐
Excavation and Embankment for Roadway Construction (Earthwork)	☐	Guardrail Installation	☐
Rock Scaling	☐	Striping (methyl methacrylate or paint)	☐
		Geotechnical Drilling	☐

	Yes	No
BMPs are constructed and monitored	☐	☐
Storm Water Pollution Prevention Plan (SWPPP) is prepared	☐	☐
Erosion and sediment control plan is prepared	☐	☐
Chemical contamination measures are in place	☐	☐
Were fish taken during project construction?	☐	☐
Were fish killed during project construction?	☐	☐

Number of Fish Handled During Project Construction
Species of Fish
Length of Stream Channel Hardened (if applicable)

NTU Monitoring

Date								
Reading								

NTU Monitoring Comments

Comments Regarding Species Documentation or Project Implementation

Signature of DE, ADE, DMTCE, or RE	Date

Page 1 of 2

Programmatic Biological Assessment
Construction Monitoring

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