

OFFICE OF SPECIES CONSERVATION

DIRK KEMPTHORNE
Governor

JAMES L. CASWELL
Administrator



P.O. Box 83720
Boise, Idaho 83720-0195

300 North Sixth Street
Boise, Idaho 83702

January 3, 2006

Bruce McConnell
Lemhi Soil and Water Conservation District
31 Highway 93 N., Suite D
Salmon, ID 83467

Dear Mr. McConnell:

The members of the Pacific Coast Salmon Recovery Fund (PCSRF) Board have made their decisions concerning the applications for Idaho's portion of Round 2 of the PCSRF FY 2005 appropriation. These decisions were not made in haste or arrived at easily. Our lengthy deliberations were a result of the both the volume and quality of projects submitted.

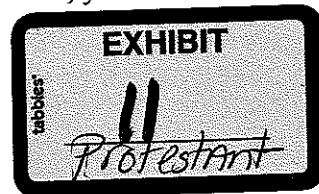
Our appreciation goes out to all project sponsors. This year's application process raised the bar for all applicants and all applicants are to be commended for the professional manner in which they responded. The funding decisions reflect our commitment to funding projects that can get on the ground quickly and provide the greatest immediate benefit to our anadromous fish populations.

Your project, Big Timber Creek 2 Diversion (Phase I Reconnect) assigned the number of 03605SA, will be funded at \$ 78,650.00. As one of the conditions for receiving your award, both parties must sign two copies of a formalized contract. Said contract has been included within this packet. In addition, please complete and sign both copies of Appendices B and C. We will return a signed original of the contract and appendices to you for your files. Because performance of this contract shall begin as of the date of this letter, said date shall be incorporated into the formal memorialized contract by reference (*See Heading 13, Term.*). Therefore, time for performance will begin on **3 January 2006**.

Attached is a copy of the updated Idaho Pacific Coastal Salmon Recovery Fund FY04-FY05 Grant Guidelines. These guidelines will take you step by step through the requirements for this grant.

You must be a registered vendor with the State of Idaho. If you are not currently listed as a vendor with the State of Idaho, have not done business with the State of Idaho in the last two years, or have had a recent change in your vendor status, please complete the enclosed Substitute W-9 and return it with your contract package. On the Substitute W-9 form, Part I (W-9 Tax Identification) is required. Parts II (Direct Deposit Authorization) and III (Remittance Advice on the Web) are optional.

If you are required to carry Workers' Compensation Insurance by the State of Idaho, you must submit a copy of your Workers' Compensation Insurance Binder to this office.

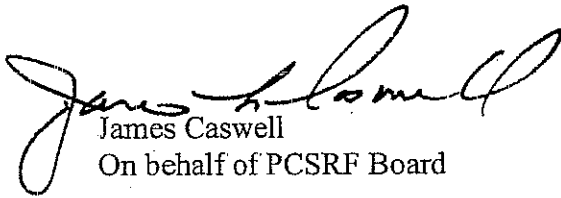


PSCRF Project # 03605SA
January 3, 2006
Page 2 of 2

Alison Squier, with Ziji Creative Resources, Inc., will contact you in two to three weeks. She will work with you on developing your Project Work Agreement, reporting requirements and related documentation.

Any questions can be referred to Jeff Allen at OSC at (208)-334-2189 x 11 or e-mail him at jallen@osc.idaho.gov. You have our thanks and congratulations.

Sincerely,



James Caswell
On behalf of PCSRF Board

c: Karl Dreher
Steve Huffaker
James Yost
Russell Knight

IDAHO PCSRF PROPOSAL APPLICATION FORM—FY2005

PROJECT NUMBER (will be assigned by OSC): 038055A

1. Contact Information

- 1.1. Applicant name (name of organization applying for grant): Idaho Fish and Game Department
- 1.2. Contact person (lead person to be contacted regarding project): Jeffrey Lutch
- 1.3. Address: 99 Highway 93 North, Salmon, ID 83467
- 1.4. Telephone: (208) 756-2271
- 1.5. Fax: (208) 756-6274
- 1.6. Email: jlutch@idfg.idaho.gov

2. Project Overview

- 2.1. Project title: Big Timber Creek Culvert Replacement (*Phase I Big Timber Creek Reconnect*)
- 2.2. Identify the 3rd field HUC(s) in which project will take place:
 - ☐ Clearwater
 - ☒ Salmon
 - ☐ Little Salmon
 - Other:
- 2.3. PCSRF objective (select one):
 - ☒ Salmon habitat protection and restoration
 - ☐ Watershed and subbasin planning and assessment
 - ☐ Salmon research, monitoring, and evaluation
 - ☐ Public outreach and education
 - ☐ Salmon enhancement (supplementation)
- 2.4. Project description (provide a summary of the project including a brief explanation of current conditions and reasons the project is needed):

Summary: The Big Timber Creek Culvert Replacement project is one of three proposals being submitted to the Pacific Coastal Salmon Recovery Fund for FY2005 as part of the large-scale Big Timber Creek reconnect plan in the Lemhi basin. The other projects, "L-63 Canal/Big Timber Siphon" and "Big Timber 2 Diversion Reconstruction", are being submitted by the Lemhi Soil and Water

Protestant

EXHIBIT

12

Conservation District (LSWCD). These projects are critical components for reconnecting Big Timber Creek with the Lemhi River so that Chinook salmon and Steelhead have unimpaired access to critical spawning and rearing habitats in these two watersheds.

The Idaho Fish and Game Department (IDFG) and the Upper Salmon Basin Watershed Project (USBWP) Technical Team worked collaboratively to develop an extensive reconnect plan that identifies fish migration barriers and prescribes strategies to remove or modify these barriers. Due to the complexity involved in meeting the goal of this reconnect, implementation of these strategies is proposed over the following project phases.

Phase 1: Structural Barrier Removal

- Reconstruct irrigation diversions as necessary,
- Reconstruct the L-63 / Big Timber Creek intercept,
- Modify/replace road culverts as necessary (State Highway 28, Lee Creek County road).

Phase 2: Flow Augmentation

- Complete a hydrology/geomorphology study to describe hydrologic processes in the Big Timber Creek and adjacent watersheds,
- Complete the Mike Basin model to describe location of water withdrawals and return flows (does water withdrawals from Big Timber Creek supplement Big Springs Creek),
- Transfer/consolidate points of diversions,
- Improve water conveyance through pipes and sprinklers,
- Determine and pursue options for purchasing/leasing water.

Phase 3: Flow Augmentation, habitat improvement, and water administration

- Investigate and pursue irrigation efficiencies on Little Timber Creek to supplement flows in lower Big Timber Creek,
- Rebuild and consolidate Carey Act Dam and Pipe diversions (BLM),
- Improving water conveyance through pipes,
- Determine options for purchasing water,
- Stock fence for grazing management on lower Timber Creek (below Hwy 28), Little Timber at the Timber Creek road crossing (BLM), and others as necessary
- Idaho Department of Water Resources water administration (headgates and measuring devices at points of diversions)

During Phase I, strategies (or tasks) will remove or improve structural barriers that currently block fish migration during any stream flow. The IDFG and LSWCD proposals being submitted to PCSRF will address three identified

barriers: 1) a road culvert at State Highway 28 that impairs fish passage, 2) the L63 canal that intercepts all flow from Big Timber Creek and 3) the Big Timber 2 Irrigation Diversion that blocks fish migration. These projects will be implemented simultaneously so that other projects may be developed to complete Phase 1 of the Big Timber Creek reconnect plan.

Planning and coordination with irrigators, state, federal, and tribal entities has already begun on subsequent phases for the reconnection of Big Timber Creek. Phase II will focus on augmenting stream flow in stream segments with inadequate water for fish passage. The IDFG and USBWP will work collaboratively with the Idaho Department of Water Resources to identify and implement strategies to improve flow (e.g. water transactions, diversion consolidation and conveyance improvements, and water administration).

Project Description. This proposal will improve one of several identified fish migration barriers that exist in the lower reaches of Big Timber Creek. The Big Timber Creek stream channel currently passes under Highway 28 before reaching the Lemhi River (Figure 1). Any flow available in this reach must pass through in a small culvert (approximately 42 inch squash pipe) that has been determined to be insufficient in accommodating high flows and fails to meet fish passage criteria for resident and anadromous salmonid species (Figures 2 and 3). This project will replace the existing culvert with a much larger pre-cast concrete open bottom box culvert (Appendix A). The new design will accommodate high flow events while maintaining a natural stream bottom. Project design and construction will be completed in cooperation with the Idaho Transportation Department (ITD).

Contributors. The IDFG will coordinate implementation of this project. The ITD will contribute 25% cost share towards this project in the form of engineering, design, and all phases of construction. Estimated costs for materials, engineering, design, and construction are provided in Appendix A.

Coordination. The IDFG will work collaboratively with the LSWCD and the USBWP to complete both Phase 1 projects. Funding to support federal/state compliance (e.g. cultural and natural resource compliance) for the Culvert Replacement and L63 Siphon projects is being submitted under this proposal.

Rationale. Of the 31 tributaries to the Lemhi River, all but two are functionally disconnected (i.e. fish are unable to migrate through certain tributary segments) from the mainstem river during part or all of the irrigation season (generally 1 April – 15 November). This usually occurs in the lower reaches of these tributaries, where stream segments are dewatered due to irrigation withdrawals and contain numerous structures that obstruct fish migration. Big Timber Creek is the largest of these disconnected tributaries, and arguably is one of the most important biologically because it would provide critical spawning and rearing habitat for ESA listed Chinook salmon and Steelhead. Currently, several structures impede fish migration into Big Timber Creek, regardless of the amount

of flow available. Addressing these structural impediments in Phase I is a critical first step for establishing a functional reconnection.

2.5. Identify the benefits that will be derived from this project (particularly, benefits to ESA listed steelhead or salmon): Replacing the road culvert at State Highway 28 will improve fish passage conditions for ESA listed juvenile and adult Chinook salmon and steelhead, and for ESA listed bull trout and other resident salmonid species that are migrating through the lower reaches of Big Timber Creek. This project supports the Big Timber Creek reconnect goal by providing unimpaired migration conditions for fish. Hence, access by fish to previously isolated spawning and rearing habitat is restored.

By providing conditions suitable for migration, Chinook salmon and steelhead populations will likely expand in range and numbers as adults and juveniles pioneer into good quality spawning and rearing habitat. The number of smolts that migrate to the ocean will increase as growth and survival conditions are improved in the Lemhi basin. Furthermore, the risk of losing anadromous fish to some catastrophic event is reduced as they expand into the Big Timber Creek watershed.

This project will also contribute to improving habitat in the Lemhi River. The Lemhi Agreement prescribes a conservation measure that provides high volume flows to be delivered through the upper river to improve spawning and rearing habitat for anadromous fish. Disconnected tributaries such as Big Timber Creek have not provided high spring flows that are necessary to maintain and improve the river channel. The existing culvert cannot accommodate high water events. By improving the culvert and developing agreements with irrigators not to divert water during certain times of the year, a spring "pulse" of water will be provided to the mainstem river. This will remove fine sediment, re-distribute consolidated gravel to improve spawning, and create undercut banks, pools, and side channels to improve juvenile rearing.

2.6. Summarize the monitoring and evaluation activities associated with this project (who, what, where, when and approximate costs): Monitoring and Evaluation activities will be supported by PCSRF Project # 01404SA, "Implementing Fish Conservation Measures in the Lemhi Basin". Staff will effectively monitor fish passage conditions after construction has been completed, which is expected in late summer 2006.

2.7. Length of stream (.01 miles) and/or number of acres to be monitored as part of project: Not more than 0.06 stream miles (300 ft) will be monitored to determine if the new culvert meets fish passage criteria.

- 2.8. Total PCSRF funds requested: Currently estimated at \$134,967.03. Budget details to be further developed during final project design.
- 2.9. Total non-federal match provided (cash and/or in-kind; note BPA funds are considered a non-federal match for the purposes of the PCSRF program—please see important attached cost share guidelines): Idaho Transportation Department will contribute \$33,780 (25% of contribution of requested PCSRF funds) in design, materials, and construction costs.
- 2.10. Anticipated project start date: It is anticipated that project will begin in summer 2006, although a specific date has not been determined.
- 2.11. Anticipated project end date (project must be completed within two years of PCSRF Board approval): It is anticipated that project will be completed by late summer 2006, although a specific date has not been determined.

3. Project Deliverables and Estimated Timeline

- 3.1. Please attach, or list below, major project deliverables along with the estimated timeline for completion of each deliverable. This project will provide the following deliverables: 1) final project design completed by February 2006, 2) necessary compliance documents completed by June 2006, 3) documentation of equipment and materials purchased by July 2006, 4) quarterly progress reports due 1 within one month of each quarter (April 2006, July 2006, October 2006, and January 2007), 5) a project completion report describing implementation (due 1 year following project completion), and 6) a section describing effectiveness monitoring to be included in the annual Lemhi Monitoring report.

4. Project Support and Relationship to Watershed/Subbasin Planning

- 4.1. Describe landowner support for the project: Project occurs within a State of Idaho right of way/road easement. Idaho Department of Transportation fully supports and will contribute significant resources towards this project.
- 4.2. Assess community support for the project: The community of landowners and irrigators in the Lemhi River watershed have demonstrated on-going support for conservation efforts and habitat improvements in the watershed.
- 4.3. Does the project address prioritized objectives and/or strategies identified in the relevant watershed and/or Northwest Power and Conservation Council approved subbasin plan(s)? If so, identify relevant plan(s): This project addresses prioritized objectives to functionally reconnect habitats and maintain metapopulations of fish, as defined in the Salmon River sub-basin Assessment.

4.4. Does the project address limiting factors identified in the relevant watershed and/or subbasin plan(s)? If so, identify relevant plan(s): This project addresses habitat fragmentation as limiting factors for fish, as defined in the Salmon River Sub-basin Assessment

4.5. Has this project been reviewed, and if applicable ranked against other potential PCSRF projects, by a local technical team, scientific advisory group, or the subbasin working group? Please attach group's findings: This project has been developed through the Upper Salmon Basin Watershed Project Technical Team.

5. Permits

5.1. List all government permits known to be needed to complete project: Idaho Department of Environmental Quality, Army Corps of Engineers 404 Stream channel modification permit.

5.2. Landowners granting access for project (please attach access agreements): Project occurs on State of Idaho highway right of way/easement.

6. Budget

6.1. Provide a summary of project costs including both PCSRF and non-Federal cash and/or in-kind match (attach additional budget detail if necessary):

<i>Category</i>	<i>PCSRF Funds</i>	<i>Cash Match*</i>	<i>In-Kind Match*</i>	<i>Total</i>
Salary				
Fringe				
Travel				
Supplies				
Communications/Utilities				
Training				
Lease/Rental				
Land Acquisition				
Capitalized Equipment	87,793			87,793
Design			13,380	13,380
Construction			20,400	20,400
Subcontracts	23,750			23,750
Other				
Indirect	23,424.03			23,424.03
TOTAL	134,967.03		33,780	168,747.03

* Total 25% non-Federal cash and/or in-kind match is required. BPA funds are considered non-Federal match for purposes of Idaho's PCSRF.

7. Project Worksite Information

Complete the following information for each on-the-ground worksite where project activities will take place (e.g., if culverts will be removed from two tributaries – complete all of the following project worksite information for each tributary). Some projects may have only one worksite, while others will have many. Complete and attach additional project worksite information pages as necessary.

7.1. Worksite number 1 of 1

7.2. Worksite name: Big Timber Creek Culvert Replacement

7.3. Briefly describe, in sequential order, the project activities that will take place at this worksite: The following activities will be required: 1) finalize design that includes hydrology and soil/substrate analysis, 2) material and supply purchasing, and 3) construction (installation, traffic control, etc.).

7.4. County where worksite is located: Lemhi

7.5. Land ownership at worksite (identify percentage):

Private:

State: 100%

Federal:

7.6. Worksite location:

Is GIS data available for the worksite (e.g., ARC GIS data files):

☒ Yes

☐ No

Provide one of the following:

Latitude:

Longitude:

- Or -

Streamname:

Begin Ft:

End Ft:

LLID:

- Or -

Township: 16N

Range: 26E

Section: 28

- Or -

3rd Field HUC:

4th Field HUC:

5th Field HUC:

Other location notes:

7.7. Anticipated work start date at this worksite: to be determined

7.8. Anticipated work end date at this worksite: to be determined

7.9. List salmonids historically present at this worksite: Chinook salmon, steelhead, rainbow/redband trout, bull trout, and westslope cutthroat trout.

7.10. ESUs targeted by actions to be completed at this worksite (select all that apply):

- ☒ Snake River Spring/Summer-run ESU Chinook Salmon
- ☐ Snake River Fall-run ESU Chinook Salmon
- ☒ Snake River Basin ESU Steelhead
- ☐ Snake River ESU Sockeye Salmon

7.11. Limiting factors addressed at this worksite through project actions (check all that apply):

- ☒ Biological processes
- ☒ Channel conditions
- ☐ Estuarine and near-shore habitat
- ☐ Exotic species
- ☐ Fire regime
- ☐ Floodplain conditions
- ☐ Irrigation diversions – screens
- ☐ Lake Habitat
- ☒ Loss of access to spawning and rearing habitat
- ☐ Predator/competitor interactions
- ☐ Riparian conditions
- ☐ Streambed sediment conditions
- ☐ Temperature
- ☐ Trophic interactions
- ☐ Water quality
- ☐ Water quality (toxics)
- ☐ Water quantity

Other:

7.12. Salmon habitat protection and restoration (complete this section only for habitat protection and restoration project worksites). Complete all of the following that apply to this project worksite:

Screening

- Number of screen(s) installed:
- Flow rate of water diverted (cfs):

- Quantity of water protected by screens (duty):

Instream Habitat

- Number of miles of streambank stabilization treatment (miles to .01 miles):
- Length of instream habitat treated, except for bank stabilization (miles to .01 miles): 0.011 miles

Instream Flow

- Amount of water returned to the stream (cfs):
- Start date of the return flow:
- End date of the return flow:
- # of water flow gauges installed:
- Volume of water leased or purchased (cfs):

Fish Passage Improvement

- Number of fish passage blockages removed or improved: 1
- Length of stream made accessible by the removal of barriers other than culverts (miles to .01 miles):
- Length of stream made accessible for passage of salmon species by the improvement or removal of culverts (miles to .01 miles): 62 stream miles (entire Big Timber Creek watershed)

Riparian Habitat

- Length of riparian stream bank treated (miles to .01 miles):
- Amount of riparian area treated except for invasive species treatment (acres):
- Amount of riparian area treated for invasive plant species (acres):

Upland Habitat

- Amount of upland area treated (acres):
- Length of road treated (miles to .01 miles):

Wetland

- Amount of wetland treated (acres):
- Amount of artificial wetland created (acres):
- Amount of wetland area of invasive species proposed for treatment and actually treated (acres):

Land acquisition/easements/leases

- Amount of land, wetland or estuarine area protected with acquisition/easement/lease (acres):
- Length of stream bank protected through land acquisition/easement/lease (miles to .01 miles):

7.13. Watershed and subbasin planning and assessment (complete this section only for watershed and subbasin planning and assessment project worksites)

- Does the project fund operation of watershed councils or provide technical assistance to watershed councils:
- Does the project provide staff support and/or infrastructure costs directly related to assessment or recovery planning:
- Does this project support development of a plan or assessment? If, so what is the name of the plan/assessment:
- Does the plan/assessment identify/prioritize specific factors limiting the production of populations and ESUs or conservation opportunities at the watershed scale:
- Does the plan/assessment incorporate biological goals consistent with State or Tribal conservation plans or Technical Recovery Team recommendations:
- Does the plan/assessment identify actions needed to meet goals:
- Has the plan/assessment been used by a local watershed group to guide restoration actions:
- Identify the number of stream miles surveyed for this plan/assessment that contain anadromous Pacific Salmon:
- Identify the number of stream miles surveyed for this plan/assessment that have riparian disturbance (e.g., landslide, road, parking lot, vegetation clearing):

7.14. Research, monitoring and evaluation (complete this section only for research, monitoring and evaluation project worksites)

- Is the project directly related to key salmon management questions regarding salmon recovery and/or sustainability of healthy salmon stocks:
- Number of organizations cooperating on the research, monitoring and evaluation project:
- Name of all cooperating organizations:
- Describe the research, monitoring and evaluation findings utilized in adaptive changes to salmon and watershed programs and policies:

- Stream length assessed/monitoring for habitat condition, water quality, salmonid abundance, and productivity in accordance with research, monitoring and evaluation or watershed monitoring strategy (01 miles):
- Identify the number and type of reports that will be prepared by the project on key management or restoration data, information, and needs (e.g., progress reports, monitoring reports or final reports associated with research):

7.15. Public outreach and education (complete this section only for public outreach and education project worksites)

- How many workshops and/or training events will be completed through this project:
- How many people will participate through the workshops and/or training events completed through this project:
- How many schools or other institutions will be reached by this project:
- How many documents will be produced by this project:
- Identify any other types of activities that will be accomplished through this project and how effectiveness of those activities will be measured:

Lower Big Timber Creek Project Area

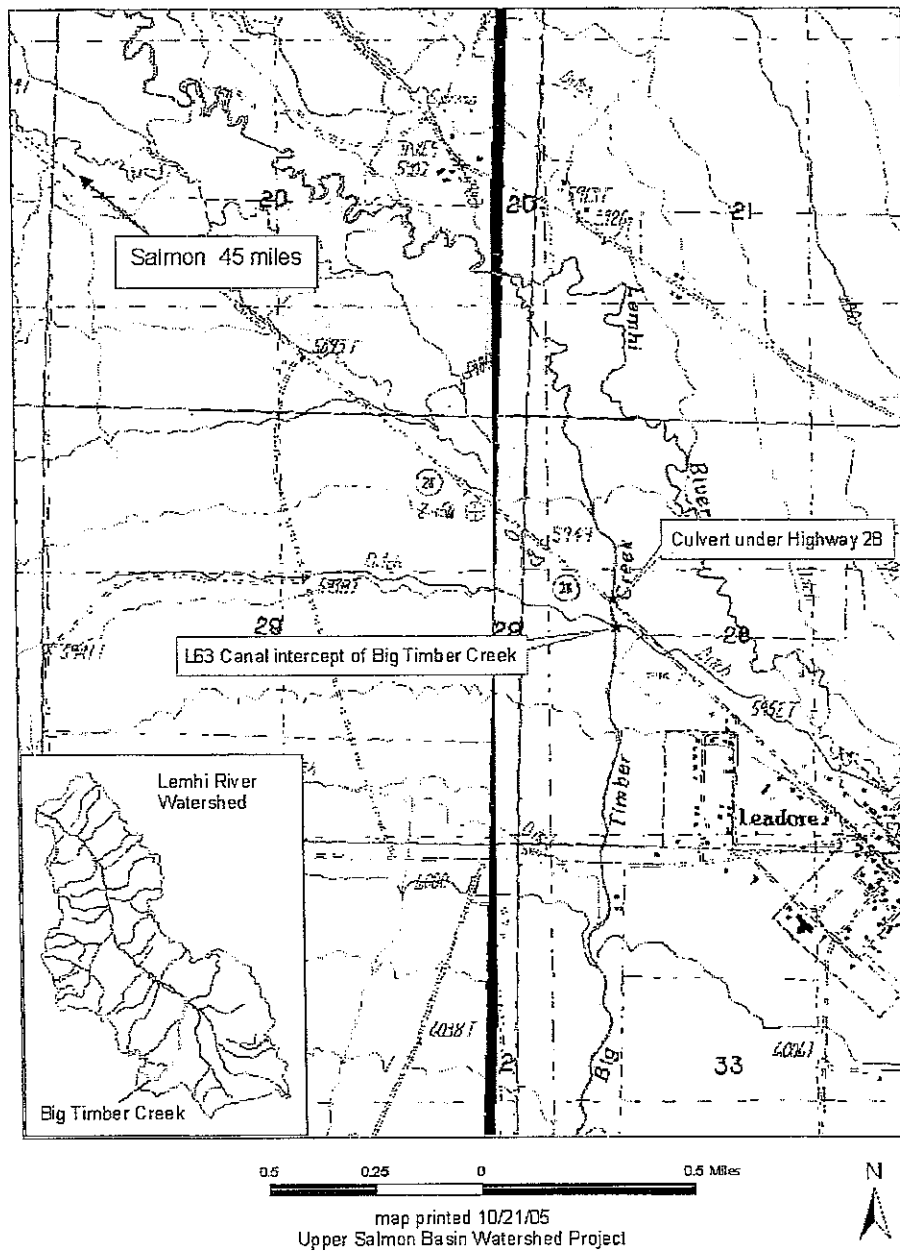


Figure 1. Location of culvert on Big Timber Creek.



Figure . The downstream end of the Highway 28 culvert, Big Timber Creek.



Figure 3. The upstream end of the Highway 28 culvert, Big Timber Creek.

Appendix A

Appendix A.1. Estimated costs for design.

PROJECT DESIGN COSTS

DESIGN

	PERSONS	RATE	HOURS	PRICE
CONCEPT	1	\$25.00	20	\$500.00
DESIGN	1	\$25.00	80	\$2,000.00
HYDRAULICS	1	\$25.00	20	\$500.00
CHECKING	1	\$30.00	20	\$600.00

EQUIPMENT

	EACH	RATE	HOURS	PRICE
COMPUTER	1	\$25.00	100	\$2,500.00
SUB-TOTAL				\$6,100.00

MATERIALS

	PERSONS	RATE	HOURS	PRICE
FIELD STUDY	2	\$25.00	20	\$1,000.00
OFFICE WORK	2	\$30.00	30	\$1,800.00

EQUIPMENT

	EACH	RATE	HOURS	PRICE
BACKHOE	1	\$45.00	12	\$540.00
COMPUTER	1	\$25.00	20	\$500.00
SUB-TOTAL				\$3,840.00

LOCATION

	PERSONS	RATE	HOURS	PRICE
FIELD WORK	2	\$25.00	30	\$1,500.00
OFFICE WORK	1	\$30.00	8	\$240.00

EQUIPMENT

	EACH	RATE	HOURS	PRICE
SURVEY EQUIPMENT	1	\$50.00	30	\$1,500.00
COMPUTER	1	\$25.00	8	\$200.00
SUB-TOTAL				\$3,440.00

TOTAL DESIGN COSTS

\$13,380.00

Appendix A.2. Estimated labor and equipment costs for construction.

CONSTRUCTION COSTS

LABOR

	PERSONS	RATE	HOURS	PRICE
5 PERSON CREW	5	\$25.00	80	\$10,000.00

EQUIPMENT

	EACH	RATE	HOURS	PRICE
TRACKHOE	1	\$100.00	50	\$5,000.00
DUMP TRUCK	2	\$40.00	20	\$1,600.00
CRANE	1	\$100.00	20	\$2,000.00
COMPACTOR	1	\$45.00	40	\$1,800.00
TOTAL CONST. COSTS				\$20,400.00

Appendix A.3. Cost estimates of the various culvert replacement options for Big Timber Creek.

Option 1 - Preferred

**COST ESTIMATE FOR PRECAST CONCRETE OPEN BOTTOM BOX
CULVERT
(12'span X 60'width X 8'rise)**

Pre-cast Box, Footings, and Wing-walls	\$62,418.00
Plant Mix Pavement including asphalt and additives	\$2,700.00
Base	\$1,780.00
Granular Borrow	\$2,136.00
Channel Rock	\$1,200.00
 Sub Total	 \$70,234.00
 Total (25% Contingencies)	 \$87,792.50

*See attached detailed estimate from AMCOR for cost breakdown of culvert.

Option 2

**COST ESTIMATE FOR PRECAST CONCRETE OPEN BOTTOM BOX
CULVERT
(12'span X 90'width X 8'rise)**

Pre-cast Box, Footings, and Wing-walls	\$86,224.00
Plant Mix Pavement including asphalt and additives	\$2,700.00
Base	\$1,780.00
Granular Borrow	\$3,204.00
Channel Rock	\$1,800.00
 Sub Total	 \$95,708.00
 Total (25% Contingencies)	 \$119,635.00

Option 3

**COST ESTIMATE FOR ALUMINUM OPEN BOTTOM BOX CULVERT
(12'span X 60'width X 8'rise)**

Pre-cast Box, Footings, and Wing-walls	\$57,095.00
Plant Mix Pavement including asphalt and additives	\$2,700.00
Base	\$1,780.00
Granular Borrow	\$2,136.00
Channel Rock	\$1,200.00
 Sub Total	 \$64,911.00
 Total (25% Contingencies)	 \$81,138.75

Option 4

**COST ESTIMATE FOR ALUMINUM OPEN BOTTOM BOX CULVERT
(12'span X 90'width X 8'rise)**

Pre-cast Box, Footings, and Wing-walls	\$80,897.00
Plant Mix Pavement including asphalt and additives	\$2,700.00
Base	\$1,780.00
Granular Borrow	\$3,204.00
Channel Rock	\$1,800.00
 Sub Total	 \$90,381.00
 Total (25% Contingencies)	 \$112,976.25

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P.O. Box 83720
Boise, Idaho 83720-0195

300 North Sixth Street
Boise, Idaho 83702

January 3, 2006

Bill Hutchinson
Idaho Fish and Game Department
600 S. Walnut
STATEHOUSE MAIL

Dear Mr. Hutchinson:

The members of the Pacific Coast Salmon Recovery Fund (PCSRF) Board have made their decisions concerning the applications for Idaho's portion of Round 2 of the PCSRF FY 2005 appropriation. These decisions were not made in haste or arrived at easily. Our lengthy deliberations were a result of the both the volume and quality of projects submitted.

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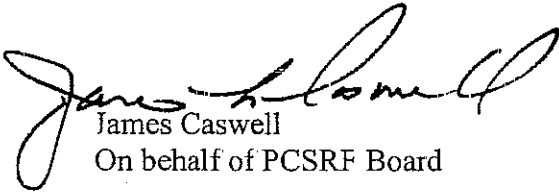


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January 3, 2006
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Any questions can be referred to Jeff Allen at OSC at (208)-334-2189 x 11 or e-mail him at jallen@osc.idaho.gov. You have our thanks and congratulations.

Sincerely,



James Caswell
On behalf of PCSRF Board

c: Karl Dreher
Steve Huffaker
James Yost
Jeffrey Lutch

Application Due December 15, 2006

Email application form and supporting documents or questions about the application process, to Jeff Allen, Office of Species Conservation, at: jallen@osc.idaho.gov

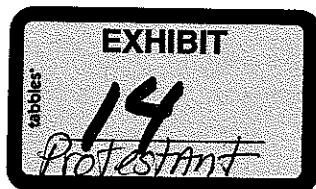
PROJECT NUMBER (will be assigned by OSC):

1. Contact Information

- 1.1. Applicant name (name of organization applying for grant): Lemhi Soil and Water Conservation District
- 1.2. Contact Person (lead person to be contacted regarding project): Elizabeth Olson
 - 1.2.1. Address: 945 Riverfront Drive, Suite D, Salmon, ID 83467
 - 1.2.2. Telephone: (208) 756-3211
 - 1.2.3. Fax: (208) 756-4705
 - 1.2.4. Email: lemhiscd@salmoninternet.com
- 1.3. Technical contact (person who will be project lead/implementer): Wendy Koons, PCSRF Project Planner
 - 1.3.1. Address: 995 Riverfront Drive, Suite B, Salmon, ID 83467
 - 1.3.2. Telephone: (208) 756-6322
 - 1.3.3. Fax: (208) 756-6376
 - 1.3.4. Email: wkoons@idahoag.us

2. Project Overview

- 2.1. Project title: Big Timber Reconnection and Upper Lemhi Flow Improvement
- 2.2. Identify the 3rd field Huc(s) in which project will take place:
 - ☐ Clearwater
 - ☒ Salmon
 - ☐ Little Salmon
 - Other:
- 2.3. PCSRF objective (only one objective per project may be selected):



- ☒ Salmon habitat protection and restoration
- ☐ Watershed and subbasin planning and assessment
- ☐ Salmon research, monitoring and evaluation
- ☐ Public outreach and education
- ☐ Salmon enhancement (supplementation)

- 2.4. Project abstract: (Summarize the project – Two to three paragraph limit): This project will significantly improve habitat conditions for Chinook salmon and steelhead in the upper Lemhi River (Figure 1). Two separate components of this project will be implemented for this purpose. First, Big Timber Creek will be reconnected with the Lemhi River by adding stream flow in a previously dewatered segment of lower Big Timber Creek. Second, an irrigation ditch will be eliminated at the headwaters of the Lemhi River to significantly improve stream flow in the upper river and to remove fish passage barriers that exist in Hawley Creek, Eighteenmile Creek, and Canyon Creek.

The objective of the Big Timber Creek Reconnect component is to provide 4.56 cfs flow in Big Timber Creek throughout the irrigation season (15 March to 15 November) for migrating Chinook salmon and steelhead so they may access high quality spawning and rearing habitat in this watershed. During the Lemhi irrigation season, Big Timber Creek is dewatered in most years in its lower reaches. Flow is available only in high water years during spring runoff, and typically lasts less than two weeks. This factor and the presence of structural barriers (currently being removed as part of Phase I Big Timber Creek Reconnect) prevents anadromous and stream resident/fluvial fish from migrating in and out of Big Timber Creek. This project will shepherd the most senior water rights in Big Timber Creek down the previously dewatered segment to the Lemhi River and then pump this water back to the original point of use.

The second component of the project will improve flow in the upper Lemhi River by eliminating an existing irrigation ditch and directing flow back to the river. This ditch, referred to as the "Whitefish Ditch," currently captures water originating from springs near the origin of the Lemhi River and also intercepts water from Eighteenmile Creek, Hawley Creek, and Canyon Creek before delivering water to the point of use. Stream flow ranging from 5-8 cfs will be directed back to the headwaters of the Lemhi River, thus improving spawning and rearing conditions for salmon and steelhead in the upper Lemhi basin. Fish barriers will also be removed by this component on those tributaries currently being intercepted, thereby improving access by fish to these tributaries.

- 2.5. Project additional details if needed. (Include a brief explanation of current conditions and the reasons the project is needed):

Big Timber Reconnect - The Big Timber Creek Reconnect component will utilize two senior water rights on Big Timber Creek (Lemhi Water District 74W) to

provide 4.56 cfs of water for fish in the previously dewatered segment. Currently, several water rights withdrawn from Big Timber Creek are used by Leadore Land Partners (LLP) for a combination of flood and sprinkler irrigation (Figure 2). Water rights #74-37 (3.36 cfs) and a portion of #74-40 (1.2 cfs) from Big Timber Creek, two of the earliest rights based on priority date, are used for this purpose and are always delivered to the irrigator (Source: Water Master Ditch Reports). The proposal will use water rights 74-37 and 74-40 to sprinkler irrigate 292 acres while maintaining a minimum flow in the Big Timber Creek channel. Water will be shepherded to the Lemhi River by first calling for these senior water rights at BT-2, spilling this amount of water to be put to beneficial use down the Timber Creek channel to the Lemhi River, then pumping the same amount of water from a second point of diversion (POD) on the Lemhi River to the point of use (Figure 3). The remaining water rights (74 – 39A and 74 – 15213) will continue to be diverted down BT-2 for flood irrigation and recharge purposes.

Seven activities have been identified in order to successfully meet the objectives of this project component. Each of these is described below, with associated cost share and contributors identified. A specific budget is described further in Table 1.

1) *Water Rights Transfers* – Several water rights and their points of use will be transferred through the Idaho Department of Water Resources (IDWR). The proposed new pivot (LLP 2) needs to be legally irrigable with #74-40. LLP is proposing an irrigation system reorganization. To successfully facilitate both this project and their proposed project, water rights from Big Timber and Little Timber Creeks will be transferred to make a single permissible Point of Use. IDWR facilitated development of this proposal to ensure that other water users would not be negatively affected. IDWR is also developing a conservation agreement with the landowner to ensure the 4.56 cfs of water is spilled for fish passage. No funds are being requested from PCSRF for this activity. LLP will pay the required transfer fee of \$ 1,010 to IDWR, which will be applied to the cost share required by PCSRF.

2) *Installing a New Sprinkler Pivot* - A new sprinkler pivot will be installed by LLP on acreage that is currently flood irrigated and uses a portion of these senior water rights. This pivot will be referred to as LLP 2, and will reside to the west of the existing pivot (LLP 1). Under this proposal, these two pivots will be served by the two senior water rights. As the landowner's fiscal responsibility, this new pivot will be considered as cost share required by Pacific Coastal Salmon Recovery Fund (PCSRF) and the Lemhi Soil and Water Conservation District (LSWCD). No funds are being requested from PCSRF for this component.

3) *New POD on the Lemhi River* – A new POD will be added on the Lemhi River in T16N R26E S20 NESE downstream of the confluence of Big Timber Creek for the two Big Timber water rights involved in this project. This is also being

coordinated through IDWR. The new POD will probably be named L-61B. No funds are being requested from PCSRF for this activity.

4) *Pump Station* - A pump station will be constructed at the new Lemhi POD to provide water from the Lemhi River to the point of use. Two irrigation pumps, variable frequency drive, sump, appropriate supporting structures, and fish screen complex to prevent fish entrainment into the pump station will be included. PCSRF funds are being requested for the pump house, move/demove, pumps, variable frequency drive, and sump. The IDFG Screen Program is coordinating design, engineering, construction, and maintenance of this component. These will be considered cost share for the PCSRF portion since the Screen Program is funded by the Bonneville Power Administration (BPA).

5) *Irrigation System* - An irrigation system of pipeline and supporting hardware will be installed on the participating landowner's property to deliver the water to the point of use. A total of 7,800 feet of pipeline will be constructed from the new Lemhi POD to the two sprinkler pivots (LLP 1 and LLP 2). Horizontal boring under highway 28 is required. The IDFG is securing the appropriate permits for this purpose. The IDFG Screen Program will purchase the irrigation pipe using BPA funds. They will also fund construction, including the horizontal pipeline crossing under Highway 28. These will be used as cost share requirements for the PCSRF portion of this budget.

6) *Power Supply* - An adequate commercial power source is required at the project site. Idaho Power Company has been contacted for installing the appropriate power lines and poles. Funding for this component is being requested from PCSRF. IDWR will offset pumping costs through their water transactions program.

7) *Water Administration* - Measuring devices will be installed on Big Timber Creek to ensure that adequate water is being delivered to the Lemhi River. Funds to support this component are being requested from PCSRF.

Upper Lemhi Flow Improvement - Activities necessary to remove the Whitefish ditch and improve flow in the upper Lemhi River are similar to the Big Timber Reconnect component. An existing pivot is currently served by water rights carried in the ditch (Figure 4). This proposal will close the current ditch, direct all flow to the headwaters of the Lemhi River, divert 3.5 cfs from the Lemhi River approximately 2 miles downstream at L-62, and pump this water out of L-62 from a station below the L-62 fish screen to the existing pivot and lines (Figure 5). The remaining flow will pass L-62 and remain in the Lemhi River.

Six activities are identified to complete the Whitefish Ditch project. These activities, responsible parties, budget requirements, and cost share are described below.

1) *Water Rights Transfers* – The Whitefish Ditch component includes three water rights; #74-1151, #74-1152 and #74-7039. These are the only water rights in the Whitefish Ditch and irrigate approximately 214 acres. The rights are for 7.54 cfs from the springs that are tributary to Eighteen-mile Creek. Approximately 3.5 cfs will be required to irrigate lands with the newly proposed project. IDWR will assist LLP in transferring acreage to make their current operation legal. Water from the springs will flow into the Lemhi River and then be diverted at the existing L-62 diversion. The only water rights in both L-63 and L-62 are owned by LLP. No funds are requested from PCSRF for this activity. A required transfer fee of \$530 will be paid by LLP, and will be applied toward the cost share required by the PCSRF.

2) *New POD on the Lemhi River (L-62)* – A new POD will be established on the Lemhi River. IDWR is coordinating administration needs. No PCSRF funds are requested for this activity.

3) *Pump Station* - A pump station will be constructed on the L-62 ditch just downstream from the existing fish screen complex. This is considered the most cost effective location because irrigation water is already screened and access to the site is established. An irrigation pump, variable frequency drive, sump, and appropriate supporting structures will be installed to pump the amount of water necessary to irrigate the acreage. PCSRF funds are being requested for these materials. The IDFG Screen Program is coordinating design, engineering, construction, and maintenance of this component. Funds for the pump screen are requested from PCSRF.

4) *Irrigation System* – Irrigation pipeline and supporting hardware will be installed on the participating landowner's property to deliver the water to the existing point of use. A total of 4,800 feet of pipeline is necessary to pump from L-62 to the pivot. The pipeline will cross the Old Lemhi Road. The IDFG is securing the appropriate permits from Lemhi County for this purpose. PCSRF funds are being requested for this activity.

5) *Power Supply* – Materials are required to provide commercial power for this component. PCSRF funds are being requested for this activity. IDWR will offset pumping costs through their water transactions program.

6) *Eliminate Ditch and Redirect Stream Flow* – Water collected in the Whitefish Ditch travels under State Highway 29, then travels away from the Lemhi River to the point of use. Modifications to the Whitefish ditch and historic channel are necessary to direct flow to the Lemhi River. Funding is requested from PCSRF for this activity.

- 2.6. Identify the benefits that will be derived from this project (particularly, benefits to ESA listed steelhead or salmon): The proposed project will provide a significant quantity of good quality spawning and rearing habitat that is currently

unavailable to ESA listed Chinook salmon, steelhead, fluvial bull trout, and other non-listed salmonids. It will also improve the existing habitat condition in the Lemhi River. Fifty-six stream miles in Big Timber Creek will be connected to the Lemhi River throughout the year. Additional flow will be provided in the upper Lemhi River where the majority of Chinook salmon spawn and rear. As a result, three viability criteria (abundance, distribution, and productivity) critical for fish to persist in the Lemhi sub-basin will be improved.

Of the 31 tributaries to the Lemhi River, all but two are functionally disconnected from the mainstem river during part or all of the irrigation season (generally 1 April – 15 November). Anadromous and stream resident/fluvial salmonids are unable to migrate through certain tributary segments, typically in the lower reaches of these tributaries, because of stream dewatering and/or numerous structures that obstruct fish migration. Big Timber Creek is the largest of these disconnected tributaries, and arguably is one of the most important biologically because it would provide critical spawning and rearing habitat for ESA listed Chinook salmon and Steelhead.

Mainstem flow in the Lemhi River is important for fish spawning and rearing. It has been suggested that increased flow results in improved survival of juvenile fish. The Whitefish Ditch component will likely contribute 5-8 cfs to the Lemhi River. The fish screen complex installed on the ditch near the location where it intercepts Canyon Creek has a capacity, at 80% screen immersion, of 7.4 cfs. In July of 2005, a total of 5.8 cfs was measured, indicating that significant flow is available throughout the summer. Furthermore, conveyance loss of water in this ditch has been reported. Thus, even more surface water may be available for the Lemhi River.

2.7. Summarize the monitoring and evaluation activities associated with this project (who, what, where, when and approximate costs):

This project will be included in the Upper Salmon Basin Watershed Program (USBWP) monitoring schedule after inspection by NRCS staff has certified that construction has met all standards and specifications as stipulated in the contract between the LSWCD and the landowner/irrigator. Monitoring points will be established prior to project construction and USBWP staff, on behalf of the LSWCD, will conduct photo-point and visual monitoring within one year of implementation to evaluate the effectiveness of the practice and verify that structures are functioning as intended. Additional photo-point and visual inspections will occur at 5-year intervals for the life of the landowner/irrigator contract with the LSWCD (i.e., a period of 15 years). Monitoring data is collected according to the USBWP monitoring plan and recorded and stored at the USBWP office in Salmon, ID. Costs for this monitoring are included in the USBWP operating budget. The LSWCD is not responsible for monitoring conducted by entities other than the USBWP or its representatives.

The IDFG will supervise additional monitoring and evaluation activities following a monitoring and adaptive management framework that is being described in the developing Lemhi Conservation Program. Pursuant to Section 6 of the ESA, compliance and effectiveness monitoring activities must be conducted and annual reports on those activities must be submitted to the Services (NMFS and USFWS) so that the Services can make the required findings on whether the activities implemented under the Section 6 Lemhi Conservation Plan meet ESA standards. Monitoring efforts conducted by the IDFG will be supervised by the Lemhi Conservation Program Coordinator (IDFG) currently supported by PCSRF contract # 011 05 SA. As part of this Phase II Big Timber Reconnect project, the IDFG is submitting an effectiveness monitoring proposal to acquire PCSRF funds for infrastructure and operating/personnel needs. Ongoing research projects in the Lemhi sub-basin, including the IDFG Idaho Supplementation Studies project and the IDFG Natural Production Monitoring and General Parr Monitoring studies (BPA funded) will costshare on effectiveness monitoring activities. Additional funding may also be provided for this purpose by Congress pursuant to the SRBA Settlement Agreement on the Nez Perce Tribal water right claims.

With respect to implementation monitoring, the IDFG will design an implementation compliance framework for use in collaboration with the USBWP, IDWR, the IDFG Screen Program, the National Resource Conservation Service, Idaho Power Company, the Idaho Transportation Department, landowners, and any other entity involved in project implementation. The IDFG will provide annual reports to the Services documenting implementation of project components and advising whether implementation is proceeding according to the expected timeline. The IDFG will design an effectiveness monitoring protocol, using a combination of existing monitoring activities and new research methods, to establish the extent to which these projects increase the quantity and improve the quality of existing habitat. The protocol will be used to determine the direct affect on Chinook salmon and steelhead by evaluating adult and juvenile distribution, abundance, and survival.

A Pilot Effectiveness Monitoring Study developed for the Lemhi Conservation Program will be useful in monitoring and evaluating the effectiveness of the proposed habitat actions. The study design was developed for the purpose of assessing changes in habitat condition as a result of habitat improvement projects, and developing relationships between habitat changes and fish response. Some response measures to changes in habitat that will be monitored for these projects include adequate passage flows, the amount of wetted area provided by the target flow, the response of the riparian community, and changes in stream temperature. Fish response will include expanded distribution of anadromous fish that pioneer into the newly reconnected habitats, improved survival, changes in size and age distribution of stream resident/fluvial trout, and changes in abundance.

Monitoring will begin in spring 2007 as components of the projects are implemented. A flow gage or some type of measuring device will be used to measure the water available for fish passage and measurements will be taken along stream transects to determine if fish passage criteria are met. Additional strategies to acquire more flow will be pursued as necessary based on an adaptive management program described in the draft Lemhi Conservation Plan. For fish response, a weir or some other fish counting structure will be installed in the lower reaches of Big Timber Creek to document changes in distribution of adult and juvenile anadromous and resident fish. Arrays designed to detect fish that are marked using Passive Integrated Transponder tags will be deployed on the stream bottom near the location of the weir to determine changes in distribution and rates of survival. Radio tagging and visual ground surveys will document movement and spawning by anadromous and fluvial salmonids.

2.8. Length of stream (.01 miles) and/or number of acres to be monitored as part of project: Big Timber = 56 miles; Upper Lemhi = 2 miles

2.9. Total PCSRF funds requested: \$246,675 (53.5% of total project cost)

2.10 Total non-federal match provided (cash and/or in-kind; note BPA funds are considered a non-federal match for the purposes of the PCSRF program – please see important attached cost share guidelines): \$214,740 (46.5% of total project cost)

2.11. Anticipated project start date (m/d/yy): January 1, 2007

2.12. Anticipated project end date (project must be completed within two years of PCSRF Board approval) (m/d/yy): December 31, 2008

3. Project Deliverables and Estimated Timeline

3.1. Please attach, or list below, major project deliverables along with the estimated timeline for completion of each deliverable.

Task/Milestone	Responsible Entity	Estimated Timeline for Completion
Project scoping and proposal development	USBWP and IDFG	December 2006
Site survey	NRCS and IDFG	March 2007
Engineering and design	NRCS and IDFG	May 2007
Develop conservation agreement with landowner	IDWR	May 2007
Landowner contract	LSWCD	May 2007
Joint 404/SAP permit application	Irrigator with USBWP assistance	May 2007
ESA consultation	IDFG	May 2007

Cultural resources compliance	USBWP	May 2007
NEPA compliance	USBWP	May 2007
Construction bids	LSWCD	May 2007
Construction and inspection oversight	LSWCD and IDFG	June 2007 – August 2008
Reporting – quarterly and final	USBWP	Quarterly
Annual Monitoring Report*	IDFG	Annually

* IDFG will summarize compliance and effectiveness monitoring activities annually into a report.

4. Project Support and Relationship to Watershed/Subbasin Planning

4.1. Describe landowner support for the project: The landowner/irrigator strongly supports this project. Some of the strategies used in this project were suggested by the landowner. Furthermore, the landowner/irrigator has supported and contributed to past conservation measures on their property, including those designed to remove barriers in Big Timber Creek as part of the Phase I reconnect plan. Other projects implemented on this property (e.g. Big Springs Creek Livestock exclusion fence, anadromous fish screens) demonstrate the landowner's commitment to improving fish habitat on private lands.

4.2. Assess community support for the project: The community of landowners and water users in the Lemhi River watershed have demonstrated on-going support for conservation efforts and habitat improvements in the watershed. This project has also been reviewed and approved by the LSWCD board of supervisors and the USBWP Advisory Committee. Both the board and the committee are comprised of community representatives and provide input to proposed projects. Finally, this project supports the tributary reconnect objectives of the Lemhi section 6 Agreement that will provide water users in the Lemhi basin incidental take coverage for ESA listed fish. The Lemhi Agreement is the product of a committee that includes Lemhi watershed landowners and water district 74.

4.3. Does the project address prioritized objectives and/or strategies identified in relevant watershed and/or Northwest Power and Conservation Council approved subbasin plan(s)? If so, identify relevant plan(s): This project addresses: 1) prioritized objectives to functionally reconnect habitats and maintain metapopulations of fish, as defined in the 2004 Salmon River Sub-basin Assessment; and 2) the recommendation to reconnect tributaries dewatered for irrigation for the Lemhi River, Hayden Creek to Leadore reach, as listed in the 2002 the USBWP Stream Habitat Inventory Report. This project satisfies two measures prescribed in the Lemhi Conservation Program to improve fish passage and the quality of stream habitat. These measures are: 1) reconnect 4 prioritized tributaries (includes Big Timber Creek) of the Lemhi River in the first five years

of the Section 6 Agreement under the ESA, and 2) improve mainstem flow in the upper Lemhi River.

- 4.4. Does the project address limiting factors identified in the relevant watershed and/or subbasin plan(s)? If so, identify plan(s) and the limiting factors within those plans: This project addresses habitat fragmentation as limiting factors for fish, as defined in the 2004 Salmon River Sub-basin Assessment and barrier free passage for adult and juvenile migration, as defined in the 1994 Model Watershed Plan.
- 4.5. Has the project been reviewed, and if applicable ranked against other potential PCSRF projects, by a local technical team, scientific advisory group, or the subbasin working group? Please attach group's findings: This project was reviewed by the USBWP Technical Team (Tech Team) on December 6, 2006, and ranked based on biological merit. The project scored extremely high for both habitat and passage considerations with regard to ESA-listed species (see attached ranking sheets for passage and habitat). More importantly, strategies designed to address habitat issues in Big Timber Creek, with the goal of functionally reconnecting this stream with the Lemhi River, were developed collaboratively. In 2005 the IDFG, working with the Tech Team, developed an extensive reconnect plan for Big Timber Creek that identifies fish migration barriers (e.g. diversion structures and dewatered stream reaches) and prescribes strategies to remove or modify these barriers. Three implementation phases were developed:

Phase 1: Structural Barrier Removal

- Reconstruct irrigation diversions as necessary
- Reconstruct the L-63 / Big Timber Creek intercept
- Modify/replace road culverts as necessary (State Highway 28, Lee Creek County road)

Phase 2: Flow Augmentation

- Develop tools (e.g. Mike Basin model) to describe hydrology/geomorphology in Big Timber Creek
- Maintain flow throughout the irrigation season in Big Timber Creek through:
1) transfer/consolidation of water rights, points of diversions, etc., and 2) improvements to water conveyance through pipes and sprinklers

Phase 3: Flow Augmentation, habitat improvement, and water administration

- Develop projects on Little Timber Creek to supplement flows in lower Big Timber Creek
- Rebuild and consolidate Carey Act Dam and Pipe diversions (BLM)
- Improving water conveyance through pipes

- Determine options for purchasing additional water
- Manage grazing to improve riparian and stream habitat conditions
- Administer water rights under state law (IDWR); install headgates and measuring devices as necessary

Objectives identified in Phase I of the reconnect plan are currently being met. In 2005 the IDFG and LSWCD secured funding from the PCSRF to modify three "key" fish barriers on Big Timber Creek. These barriers and the status of projects designed to improve them are: 1) L-63 Siphon (OSC # 035 05 SA) – construction is complete, 2) Highway 28 culvert replacement (OSC # 038 05 SA) – the contract for culvert construction has been awarded and implementation will be complete in the spring of 2007; and 3) Big Timber #2 Diversion Modification (OSC # 036 05 SA) – work continues on design, landowner agreements, operation and maintenance, etc., with implementation scheduled in summer 2007.

This proposal addresses key objectives in Phase II of the Big Timber Creek reconnect plan. Once Phases I and II are complete, adult and juvenile Chinook salmon, steelhead, and fluvial/resident trout can migrate in and out of Big Timber Creek without delay and access the high quality spawning and rearing habitat that is available throughout the Big Timber Creek watershed. Additional strategies will be developed in Phase II as necessary to augment the base flow established with this project, as part of an adaptive management program described in the draft Lemhi Conservation Plan. Phase III objectives will be pursued to improve the quality of the fish habitat.

5. Permits

- 5.1. List all government permits known to be needed to complete project: A US Army Corps of Engineers 404 permit and an IDWR stream alteration permit will be needed for implementation of this project.
- 5.2. Landowners granting access for project (please attach access agreements): Construction of all components for the Big Timber Reconnect and Upper Lemhi Flow Improvement Project will occur on the landowner/primary irrigator's property. An access route will be constructed to the project site through the landowner's property.

6. Budget

- 6.1. Provide a summary of project costs including both PCSRF and non-Federal cash and/or in-kind match (attach additional budget detail if necessary) in the table below: **SEE ATTACHED BUDGET DETAIL SHEET – TABLE 1, PAGE 26.**

6.2. The PCSRF Program does not allow for subcontracting with Federal agencies without a special exemption. These exemptions are issued sparingly and are discouraged. Do you plan on subcontracting with a federal agency?

☐ Yes If yes, with whom,
for what, and
how much?

☒ No

Category	PCSRF Funds	Cash Match*	In-kind Match*	Total
Salary			\$2,700	\$2,700
Fringe				
Travel				
Supplies				
Communications/Utilities				
Training				
Lease/Rental				
Land Acquisition				
Capitalized Equipment	\$224,250	\$210,500		\$434,750
Equipment O&M				
Subcontracts				
Other		\$1,540		\$1,540
Indirect	\$22,425			\$22,425
TOTAL	\$246,675	\$212,040	\$2,700	\$461,415

*Total 25% non-Federal cash and/or in-kind is required. BPA funds are considered non-Federal match for purposes of Idaho's PCSRF.

7. Project Worksite Information

Complete the following information for each on-the-ground worksite where project activities will take place (e.g., if culverts will be removed from two tributaries – complete all of the following project worksite information for each tributary). Some projects may have only one worksite, while other will have many. Complete and attach additional project worksite information pages as necessary.

7.1. Worksite number 1 of 2

7.2. Worksite name: **Big Timber Reconnect**

7.3. Briefly describe, in sequential order, the project activities that will take place at this worksite:

- Water rights transfer
- New pivot
- Establish new POD
- Construct pumping station

- Install new irrigation components
- Extend 3-phase power to run system

7.4. County where worksite is located: Lemhi

7.5. Landownership at worksite (identify percentage):

Private: 100%

State:

Federal:

7.6. Worksite location:

Is GIS data available for the worksite (e.g., ARC GIS data files):

☒ Yes

☐ No

Provide the following:

Latitude: 44°42'08.1"

Longitude: 113°22'46.6"

and

3rd Field HUC:

4th Field HUC: 1760204 – Lemhi Basin

5th Field HUC: 176020405 – Timber Creek

Other location notes:

7.7. Anticipated work start date at this worksite (m/d/yy): June 1, 2007

7.8. Anticipated work end date at this worksite (m/d/yy): December 31, 2008

7.9. List salmonids historically present at this worksite: Chinook salmon, steelhead/rainbow trout, bull trout, westslope cutthroat trout, red-band rainbow

7.10. ESUs targeted by actions to be completed at this worksite (select all that apply):

☒ Snake River Spring/Summer-run ESU Chinook Salmon

☐ Snake River Fall-run ESU Chinook Salmon

☒ Snake River Basin ESU Steelhead

☐ Snake River ESU Sockeye Salmon

7.11. Limiting factors addressed at this worksite through project actions (check all that apply):

☐ Biological processes

☒ Channel conditions

☐ Estuarine and near-shore habitat

- ☐ Exotic species
- ☐ Fire regime
- ☐ Floodplain conditions
- ☒ Irrigation diversions – screens
- ☐ Lake Habitat
- ☒ Loss of access to spawning and rearing habitat
- ☐ Predator/competitor interactions
- ☐ Riparian conditions
- ☐ Streambed sediment conditions
- ☐ Temperature
- ☐ Trophic interactions
- ☐ Water quality
- ☐ Water quality (toxins)
- ☒ Water quantity
- ☐ Other:

7.12. Salmon habitat protection and restoration (complete this section only for habitat protection and restoration project worksites. Complete all of the following that apply to this project worksite:

Screening

- Number of screen(s) installed: 1
- Flow rate of water diverted (cfs): 4.56 cfs
- Quantity of water protected by screens (duty): 4.56 cfs

Instream Habitat

- Number of miles of streambank stabilization treatment (miles to .01 miles): 0 miles
- Length of instream habitat treated, except for bank stabilization (miles to .01 miles): 0 miles

Instream Flow

- Amount of water returned to the stream (cfs): 4.56 cfs
- Start date for the return flow (m/d/yy): September 1, 2007
- End date of the return flow (m/d/yy): November 15, 2007 *flow will be maintained annually from March 15 – November 15 thereafter.
- # of water flow gauges installed: 1
- Volume of water leased or purchased (cfs): 0

Fish Passage Improvement

- Number of fish passage blockages removed or improved: 1
- Length of stream made accessible by the removal of barriers other than culverts (miles to .01 miles): .56 miles
- Length of stream made accessible for passage of salmon species by the improvement or removal of culverts (miles to .01 miles): 0 miles

Riparian Habitat

- Length of riparian stream bank treated (miles to .01 miles): 0 miles
- Amount of riparian area treated except for invasive species treatment (acres): 0 acres
- Amount of riparian area treated for invasive plant species (acres): 0 acres

Upland Habitat

- Amount of upland area treated (acres): 0 acres
- Length of road treated (miles to .01 miles): 0 miles

Wetland

- Amount of wetland treated (acres): 0 acres
- Amount of artificial wetland created (acres): 0 acres
- Amount of wetland area of invasive species proposed for treatment and actually treated (acres): 0 acres

Land acquisition/easement/leases

- Amount of land, wetland or estuarine area protected with acquisition/easement/lease (acres): 0 acres
- Length of stream bank protected through land acquisition/easement/lease (miles to .01 miles): 0 acres

7.1. Worksite number 2 of 2

7.2. Worksite name: **Upper Lemhi Flow Improvement/Whitefish Ditch**

7.3. Briefly describe, in sequential order, the project activities that will take place at this worksite:

- Water rights transfer
- Establish new POD
- Construct pumping station
- Install new irrigation components
- Extend 3-phase power to run system
- Eliminate ditch and redirect stream flow

7.4. County where worksite is located: Lemhi

7.5. Landownership at worksite (identify percentage):

Private: 100%

State:

Federal:

7.6. Worksite location:

Is GIS data available for the worksite (e.g., ARC GIS data files):

☒ Yes

☐ No

Provide the following:

Latitude: 44°42'6"

Longitude: 113°22'46"

and

3rd Field HUC:

4th Field HUC: 1760204 – Lemhi Basin

5th Field HUC: 176020404 – Eighteen-mile

Other location notes:

7.7. Anticipated work start date at this worksite (m/d/yy): June 1, 2007

7.8. Anticipated work end date at this worksite (m/d/yy): December 31, 2008

7.9. List salmonids historically present at this worksite: Chinook salmon, steelhead/rainbow trout, bull trout, westslope cutthroat trout, red-band rainbow

7.10. ESUs targeted by actions to be completed at this worksite (select all that apply):

☒ Snake River Spring/Summer-run ESU Chinook Salmon

☐ Snake River Fall-run ESU Chinook Salmon

☒ Snake River Basin ESU Steelhead

☐ Snake River ESU Sockeye Salmon

7.11. Limiting factors addressed at this worksite through project actions (check all that apply):

☐ Biological processes

☒ Channel conditions

☐ Estuarine and near-shore habitat

☐ Exotic species

☐ Fire regime

☐ Floodplain conditions

☒ Irrigation diversions – screens

☐ Lake Habitat

☒ Loss of access to spawning and rearing habitat

☐ Predator/competitor interactions

☐ Riparian conditions

☐ Streambed sediment conditions

☐ Temperature

☐ Trophic interactions

☐ Water quality

- ☐ Water quality (toxins)
- ☒ Water quantity
- ☐ Other:

7.12. Salmon habitat protection and restoration (complete this section only for habitat protection and restoration project worksites. Complete all of the following that apply to this project worksite:

Screening

- Number of screen(s) installed: 0
- Flow rate of water diverted (cfs): 3.5 cfs
- Quantity of water protected by screens (duty): 3.5 cfs

Instream Habitat

- Number of miles of streambank stabilization treatment (miles to .01 miles): 0 miles
- Length of instream habitat treated, except for bank stabilization (miles to .01 miles): 0 miles

Instream Flow

- Amount of water returned to the stream (cfs): 5-8 cfs
- Start date for the return flow (m/d/yy): September 1, 2007
- End date of the return flow (m/d/yy): November 15, 2007. * flow will be maintained annually from March 15 – November 15 thereafter.
- # of water flow gauges installed:
- Volume of water leased or purchased (cfs): 0

Fish Passage Improvement

- Number of fish passage blockages removed or improved: 2
- Length of stream made accessible by the removal of barriers other than culverts (miles to .01 miles): 78 miles of Eighteen-mile Creek and 22 miles of Canyon Creek when water is available
- Length of stream made accessible for passage of salmon species by the improvement or removal of culverts (miles to .01 miles): 0 miles

Riparian Habitat

- Length of riparian stream bank treated (miles to .01 miles): 0 miles
- Amount of riparian area treated except for invasive species treatment (acres): 0 acres
- Amount of riparian area treated for invasive plant species (acres): 0 acres

Upland Habitat

- Amount of upland area treated (acres): 0 acres
- Length of road treated (miles to .01 miles): 0 miles

Wetland

- Amount of wetland treated (acres): 0 acres
- Amount of artificial wetland created (acres): 0 acres
- Amount of wetland area of invasive species proposed for treatment and actually treated (acres): 0 acres

Land acquisition/easement/leases

- Amount of land, wetland or estuarine area protected with acquisition/easement/lease (acres): 0 acres
- Length of stream bank protected through land acquisition/easement/lease (miles to .01 miles): 0 acres

7.13. Watershed and subbasin planning and assessment (complete this section only for watershed and subbasin planning and assessment project worksites)

- Does the project fund operation of watershed councils or provide technical assistance to watershed councils:
- Does the project provide staff support and/or infrastructure costs directly related to assessment or recovery planning:
- Does the project support development of a plan or assessment: If so, what is the name of the plan/assessment:
- Does the plan/assessment identify/prioritize specific factors limiting the production of populations and ESUs or conservation opportunities at the watershed scale:
- Does the plan/assessment incorporate biological goals consistent with State or Tribal conservation plans or Technical Recover Team recommendations:
- Does the plan/assessment identify actions needed to meet goals:
- Has the plan/assessment been used by a local watershed group to guide restoration activities:
- Identify the number of stream miles surveyed for this plan/assessment that contain anadromous Pacific Salmon:
- Identify the number of stream miles surveyed for this plan/assessment that have riparian disturbance (e.g., landslide, road, parking lot, vegetation clearing):

7.14. Research, monitoring and evaluation (complete this section only for research, monitoring and evaluation project worksites)

- Is the project directly related to key salmon management questions regarding salmon recovery and/or sustainability of healthy salmon stocks:
- Number of organizations cooperating on the research, monitoring and evaluation project:
- Name of all cooperating organizations:
- Describe the research, monitoring and evaluation findings utilize in adaptive changes to salmon and watershed programs and policies:
- Stream length assessed/monitoring for habitat condition, water quality, salmonid abundance, and productivity in accordance with research, monitoring and evaluation or watershed monitoring strategy (.01 miles):
- Identify the number and type of reports that will be prepared by the project on key management or restoration data, information, and needs (e.g., progress reports, monitoring reports or final reports associated with research):

7.15. Public outreach and education (complete this section only for public outreach and education project worksites)

- How many workshops and/or training events will be completed through this project:
- How many people will participate through the workshops and/or training events completed through this project:
- How many schools or other institutions will be reached by this project:
- How many documents will be produced by this project:
- Identify any other types of activities that will be accomplished through this project and how effectiveness of activities will be measured:

Cost Share Guidelines

The non-Federal match, whether cash or in-kind, is expected to be paid out at the same general rate as the PCSRF share. Exceptions to this requirement are discouraged, but may in select circumstances be granted by OSC (pending approval from the NOAA Grant Officer), based on sufficient documentation demonstrating previously determined plans for, or later commitment of, cash or in-kind contributions.

In all cases, the subgrantee must meet their cost share commitment over the life of the award (two years or less). The same requirements that apply to the PCSRF award funds (e.g., adequacy of personnel records, inclusion of only allowable costs as defined in the applicable OMG circulars, and adequate documentation of costs), apply to the non-Federal match.

Non-Federal match used to meet Idaho's PCSRF requirements may not be included as contribution for any other federally assisted project or program.



**Big Timber Reconnect & Upper Lemhi Flow Improvement Project Location
(Lemhi River Watershed 5th Field HUCs Impacted by Project)**

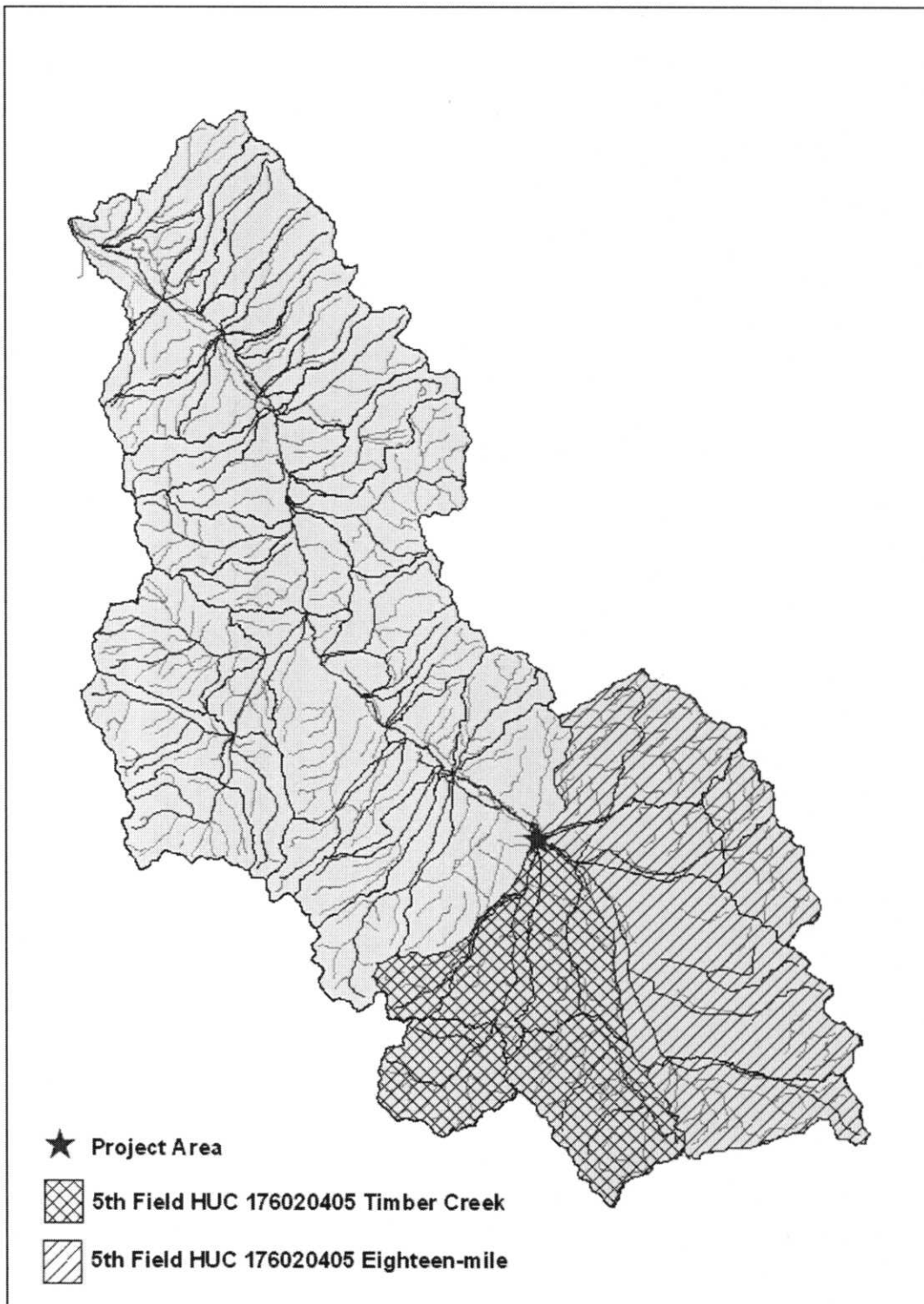


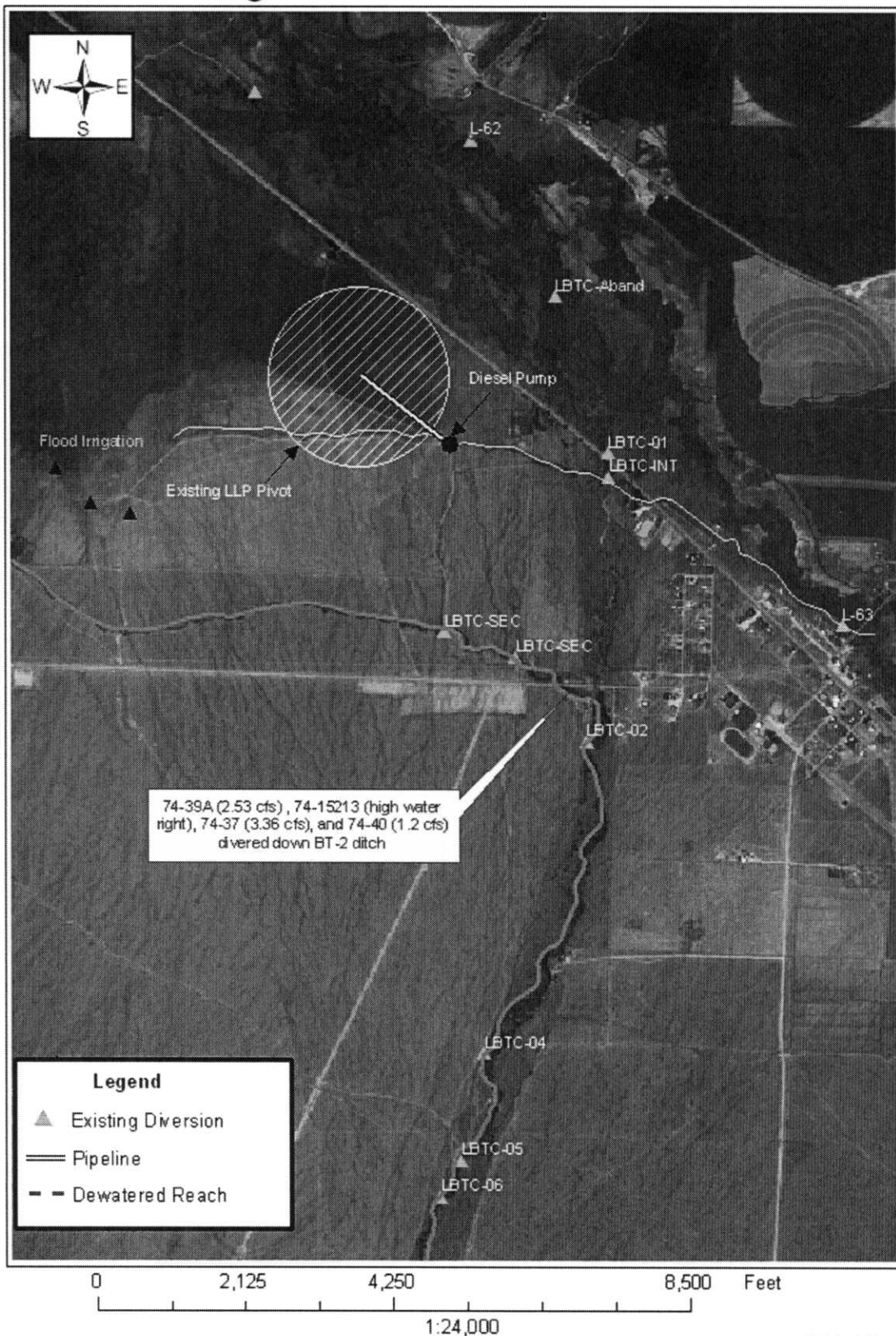
FIGURE 1

Printed: December 4, 2006



FIGURE 2
Big Timber Current Conditions

Leadore Quadrangle
T15N, R26E, Section 5
T16N, R26E, Sections 20,
21, 28, 29, 32, & 33

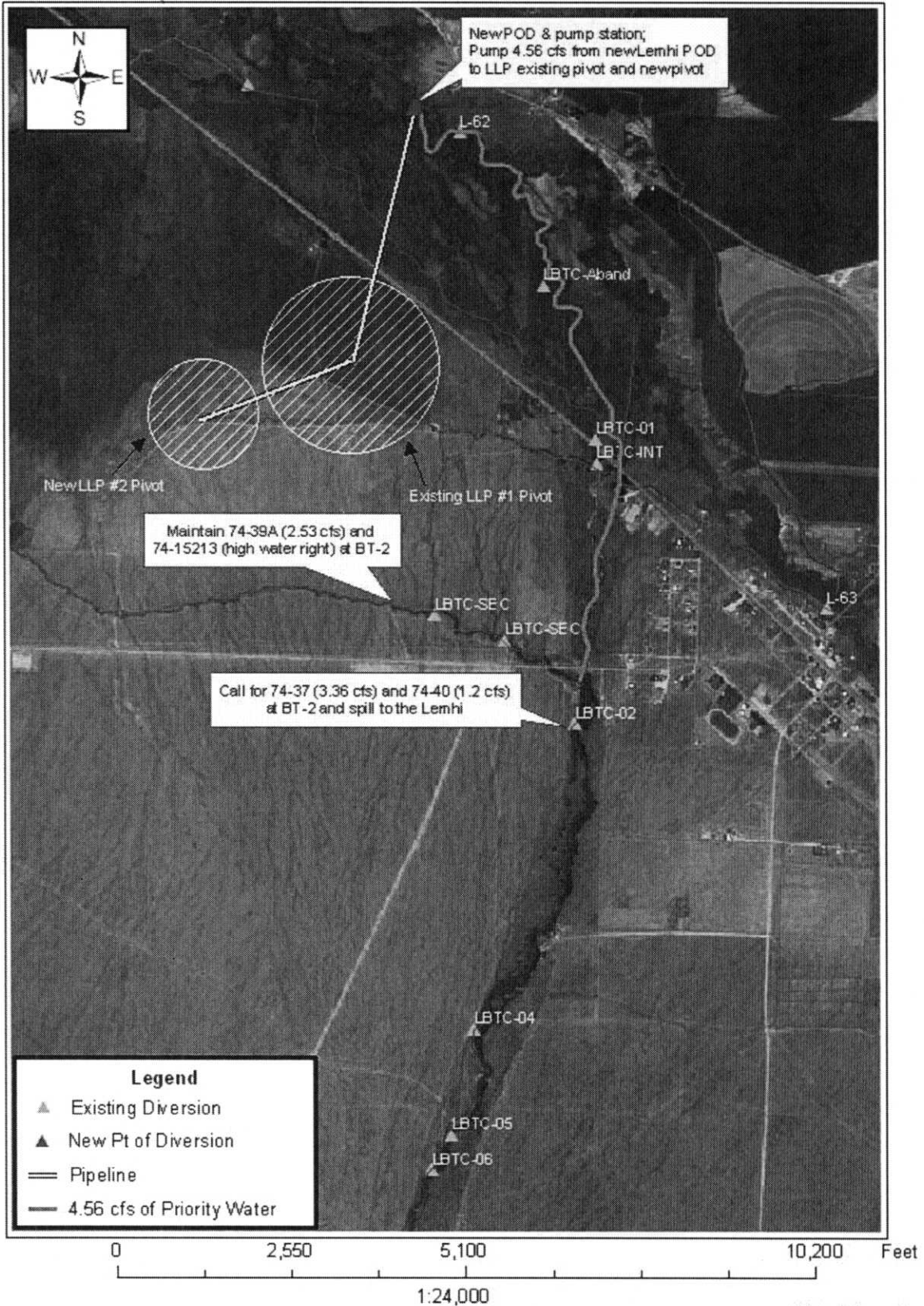


Printed: December 5, 2006



FIGURE 3 Big Timber Reconnect

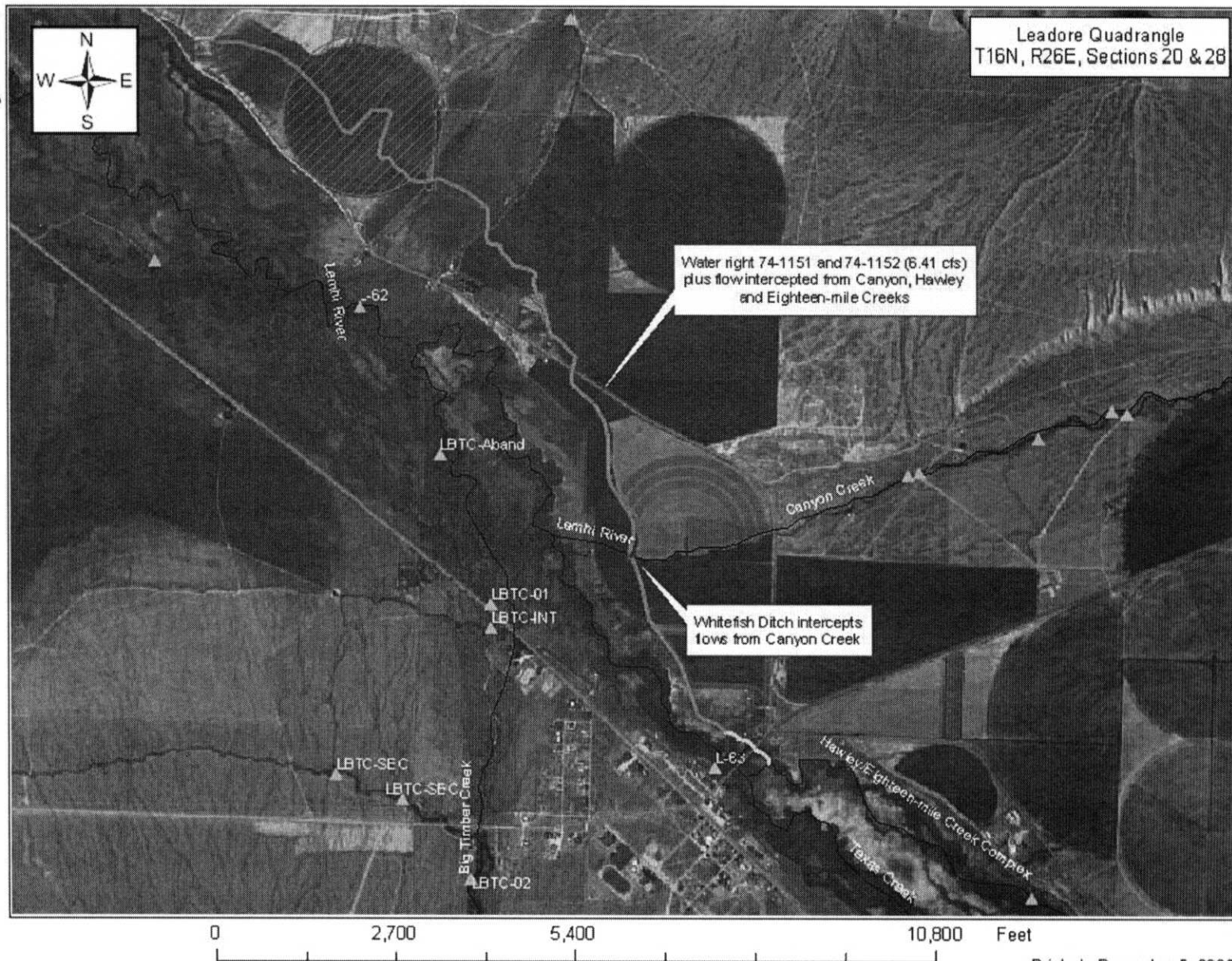
Leadore Quadrangle
T15N, R26E, Section 5
T16N, R26E, Sections 20,
21, 28, 29, 32, & 33



Printed: December 5, 2006



Whitefish Ditch Current Conditions



Printed: December 5, 2006

FIGURE 4



Proposed Upper Lemhi Flow Improvements via Whitefish Ditch Modifications

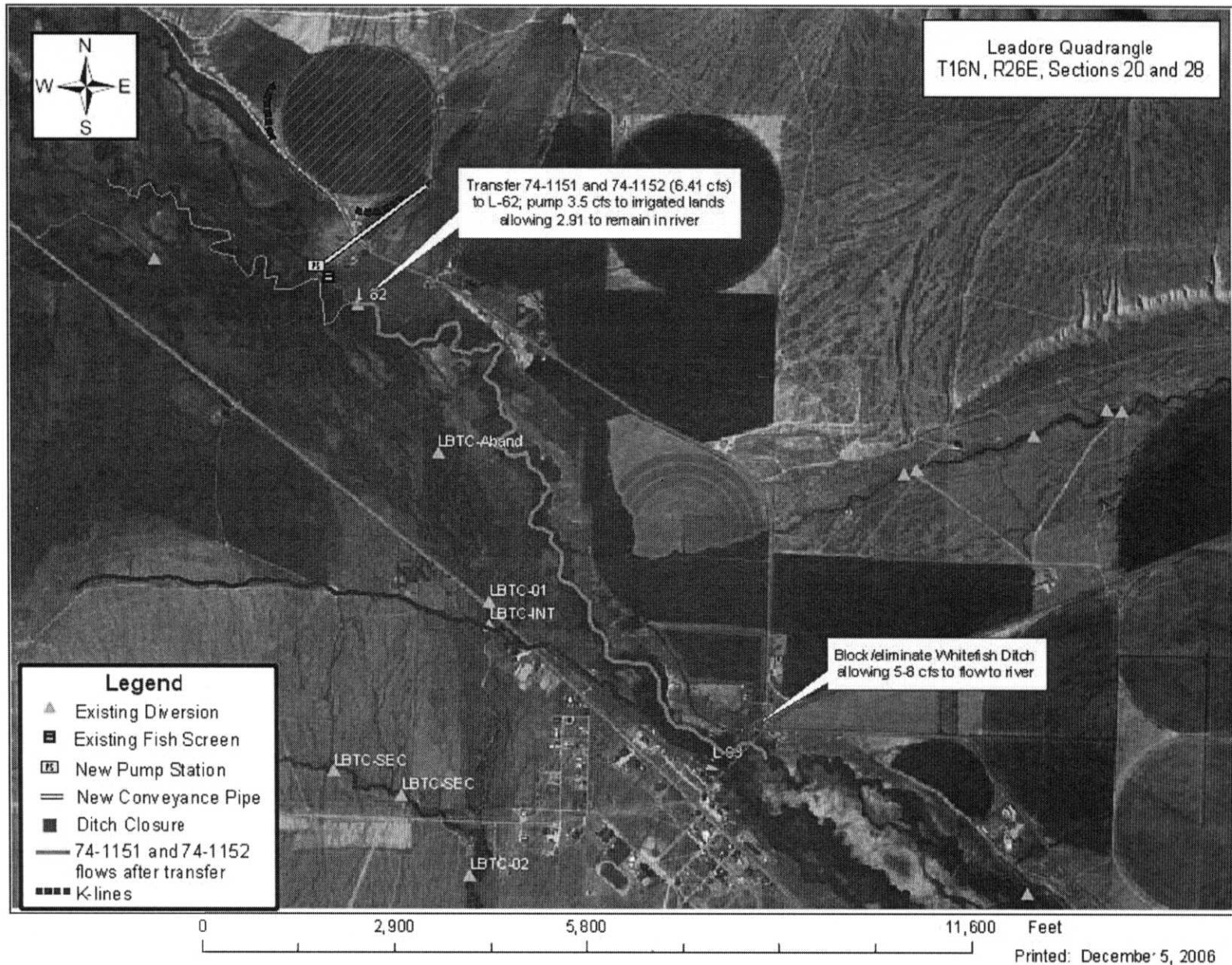


FIGURE 5

TABLE 1: BIG TIMBER RECONNECT AND UPPER LEMHI FLOW IMPROVEMENT PROPOSED BUDGET

COMPONENT	ACTIVITY	ITEM	PCSRF	COST SHARE - CASH			COST SHARE - IN KIND		
				SP (BPA)	IDWR	LANDOWNER	SP (BPA)	LANDOWNER	IDWR
Big Timber Reconnect	1) Install LLP 2 Pivot	Pivot				\$50,000			
	2) H2O Rights Transfer	IDWR Operating							\$1,500
		Water Transfer Fee				\$1,010			
	3) New POD	IDWR Operating							
	4) Pump Station	Mobe/Demobe	\$2,500						
		Turbine Pump 100hp	\$34,500						
		Turbine Pump 50hp	\$17,250						
		VFD	\$18,750						
		Sump	\$4,000						
		Pump House	\$2,000						
		Fish Screen							
		Point of Diversion							
		Access Road							
	5) Pipeline	15" Pipeline (4800')		\$72,000					
		10" Pipeline (3000')		\$22,500					
		Miscellaneous		\$6,000					
		Highway Boring		\$50,000					
	6) Power	3-Phase Power	\$20,000						
		Annual Cost Estimate							
	7) Water Administration	Gage/Headgate	\$5,000						
Upper Lemhi Flow Improvement - Whitefish Ditch	1) Redirect Ditch Flow	Channel Modification	\$2,500						
	2) H2O Rights Transfer	IDWR Operating							
		Water Transfer Fee				\$530		Included in \$530 transfer fee above	\$1,200
	3) New POD	Water Transfer Fee							
	4) Pump Station	Turbine Pump 100hp	\$34,500						
		VFD 100hp	\$12,500						
		Sump	\$3,000						
		Pump House	\$2,000						
		Fish Screen	\$17,500						
	5) Pipeline	12" Pipeline (2300')	\$23,000						
		4" Pipeline (2500')	\$6,250						
		5 10-pod K-lines	\$11,000						
		Miscellaneous App.	\$1,500						
		Misc Irrigation Equipment				\$10,000			
	6) Power	Power Pole	\$6,500						
	Sub-totals		\$224,250	\$150,500		\$61,540			\$2,700
	10% LSWCD Indirect		\$22,425						
	Totals		\$246,675	\$150,500		\$61,540			\$2,700
TOTAL PCSRF REQUEST =			\$246,675	TOTAL NON-FEDERAL COST SHARE =			\$214,740		
TOTAL ESTIMATED PROJECT COST =			\$461,415	(PCSRF = 53.5%; NON-FEDERAL = 46.5%)					



UPPER SALMON BASIN WATERSHED PROJECT TECH TEAM RANKING

*** (NOT INTENDED FOR DISTRIBUTION OUTSIDE OF THE USBWP TECH TEAM) ***

PASSAGE PROJECT (project name) **BIG TIMBER RECONNECT AND UPPER LEMHI FLOW IMPROVEMENT**

Passage projects include: reconnects, diversion structure modifications, culvert modifications culvert replacement augmented flows, etc

1. Limiting Factors

1.A REACH (Maximum point value 30): Identify the **Existing Limiting Factors** for the **REACH** as indicated in the Habitat Goals and Priorities table. This table can be accessed on the USBWP Tech Team website at www.watershedproject.org. Refer to "Goals" 1 and 2 for the specific **REACH**. Using professional judgement, determine values for how the project **Addresses Limiting Factors** within the **REACH**. Multiply the **Existing Limiting Factor** value by the **Addresses Limiting Factor** value, then add these scores to obtain the **Reach Subtotal**

REACH (as defined in the Habitat Goals and Priorities table)					
	Existing Limiting Factors High=5 Medium=3 Low=1	x	Addresses Limiting Factors High/Significantly Improves=3 Medium/Enhances=2 Low/Conserves=1 Does Not Address=0	=	Score
Flow	5	x	3	=	15
Physical Barriers	5	x	3	=	15
Reach Subtotal					30

1.B IMPACT AREA (Maximum point value 30): Using professional judgement, determine values for **Existing Limiting Factors** within the **IMPACT AREA** of the project. Determine values for how the project **Addresses Limiting Factors** within the **IMPACT AREA**. Multiply the **Existing Limiting Factor** value by the **Addresses Limiting Factor** value, then add these scores for the **Impact Area Subtotal**

IMPACT AREA (immediate area affected by project)					
	Existing Limiting Factors High=5 Medium=3 Low=1	x	Addresses Limiting Factors High/Significantly Improves=3 Medium/Enhances=2 Low/Conserves=1 Does Not Address=0	=	Score
Flow	5	x	3	=	15
Physical Barriers	5	x	3	=	15
Impact Area Subtotal					30

2. **BENEFITS TO SPECIES AND LIFE STAGES** (Maximum point value 50): Determine values based on professional judgement and/or coordination with regional fisheries biologists. Add all of the values for the subtotal. (Values: New=5; Significantly Improved=3; Moderately Improved=2; Slightly Improved =1 No change=0)

Species \ Life Stage	Provides Access to Spawning/ Incubation Habitat	Provides Access to Rearing Habitat
Chinook Salmon	5	5
Steelhead Trout	5	5
Bull Trout	5	5
Westslope Cutthroat Trout	5	5
Red-band Trout	5	5
Species and Life Stages Subtotal =		50

3. **SHIPUSS PRIORITY FOR BIOLOGICAL FACTORS:** Refer to Table 2 in the SHIPUSS document and enter the appropriate score based on the *Adjusted Percent Total* (APT) for stream or reach. Priority 1 (APT of 70% or greater) = 20, Priority 2 (APT of 50%-69%) = 10, and Priority 3 (APT of less than 50%) = 0

20

4. **TOTAL PROJECT SCORE** (Add the subtotals from 1A, 1B, 2 and 3):

130

OVERALL PROJECT RANKING: Using this criteria, a score of 0 to 20 is a **low** ranking; 21 to 60 is a **medium** ranking; and 61 or greater is a **high** ranking

The OVERALL PROJECT RANKING for this project is (check one): ☐ LOW ☐ MEDIUM ☒ HIGH

Additional comments relevant to the biological merit of this project should be included on the reverse side of this form.

Version 5/8/2006

Comments relevant to the biological merit of this project: _____

- Regarding bull trout, cutthroat and rainbow – opening habitat to fluvial component. Magnitude of habitat newly opened is huge. Big Timber, Upper Lemhi, Canyon, 18-mile, Hawley. Diversity and spatial distribution significantly expanded



UPPER SALMON BASIN WATERSHED PROJECT TECH TEAM RANKING

*** (NOT INTENDED FOR DISTRIBUTION OUTSIDE OF THE USBWP TECH TEAM) ***

HABITAT PROJECT (project name) BIG TIMBER RECONNECT AND UPPER LEMHI FLOW IMPROVEMENT

Habitat projects include: riparian protection (grazing management), riparian enhancement, bank stabilization, instream habitat enhancement (pool habitat enhancement cover, resting areas, off-channel habitat substrate enhancement) and flows (pulse habitat forming, minimum target flow)

4. Limiting Factors

1.A REACH (Maximum point value 27): Identify the **Existing Limiting Factors** for the **REACH** as indicated in the Habitat Goals and Priorities table. This table can be accessed on the USBWP Tech Team website at www.watershedproject.org. Refer to "Goals" 3, 4 and 5 for the specific **REACH**. Using professional judgement, determine values for how the project **Addresses Limiting Factors** within the **REACH**. Multiply the **Existing Limiting Factor** value by the **Addresses Limiting Factor** value, then add these scores to obtain the **Reach Subtotal**.

REACH (as defined in the Habitat Goals and Priorities table)					
	Existing Limiting Factors High=3 Medium=2 Low=1	x	Addresses Limiting Factors High/Significantly Improves=3 Medium/Enhances=2 Low/Conserves=1 Does Not Address=0	=	Score
Instream Structures/Pools	2	x	3	=	6
Temperature/Riparian	2	x	3	=	6
Sediment	2	x	3	=	6
Reach Subtotal					18

1.B IMPACT AREA (Maximum point value 45): Using professional judgement, determine values for **Existing Limiting Factors** within the **IMPACT AREA** of the project. Determine values for how the project **Addresses Limiting Factors** within the **IMPACT AREA**. Multiply the **Existing Limiting Factor** value by the **Addresses Limiting Factor** value, then add these scores for the **Impact Area Subtotal**.

IMPACT AREA (immediate area affected by project)					
	Existing Limiting Factors High=5 Medium=3 Low=1	x	Addresses Limiting Factors High/Significantly Improves=3 Medium/Enhances=2 Low/Conserves=1 Does Not Address=0	=	Score
Instream Structures/Pools	3	x	2	=	6
Temperature/Riparian	3	x	3	=	9
Sediment	3	x	2	=	6
Impact Area Subtotal					21

5. **BENEFITS TO SPECIES AND LIFE STAGES*** (Maximum point value 45): Determine values based on professional judgement and/or coordination with regional fisheries biologists. Add all of the values for the subtotal. (Values: High/Significantly Improves=3; Medium/Enhances=2; Low/Conserves=1; Does Not Support=0)

Species \ Life Stage	Spawning/ Incubation	Rearing	Over- wintering
Chinook Salmon	3	3	2
Steelhead Trout	1	1	1
Bull Trout	1	1	1
Westslope Cutthroat Trout	1	2	1
Red-band Trout	2	2	1
Species and Life Stages Subtotal =			23

*Reference Table for Benefits to

Life Stage	Needs	Potential Projects/Fixes
Spawning/Incubation	Suitable gravel	Riparian, pulse flow, pools, side channel
	Structure complexity	Riparian, pulse flow, pools, structures
Over-Wintering	Pools/complexity	Pools
	Flow	Quantity
Rearing	Temperature	Riparian, pulse flow, pools, quantity
	Flow	Quantity
	Temperature	Riparian, pulse flow
	Food	Riparian, pulse flow

Species and life Stages

Habitat Project Ranking Criteria continued on reverse side of this form:

4. TOTAL PROJECT SCORE (Add the subtotals from 1A, 1B, 2 and 3):

OVERALL PROJECT RANKING: Using this criteria, a score of 0 to 20 is a **low** ranking; 21 to 60 is a **medium** ranking; and 61 or greater is a **high** ranking.

The OVERALL PROJECT RANKING for this project is (check one): ☐ LOW ☐ MEDIUM ☒ HIGH

Comments relevant to the biological merit of this project:

- Decisions confined to immediate impact area only and not new habitats opened by project implementation
- Reference passage ranking criteria for benefits of habitat expansion.

LEMHI RIVER MONITORING PLAN

2003 Annual Progress Report

By

**Tim Resseguie
Fishery Biologist
Lemhi River Monitoring Plan**

**Idaho Department of Fish and Game
Salmon Region Office
99 Highway 93 North
P.O. Box 1336
Salmon, Idaho 83467**

To

Lemhi River Basin Conservation Agreement Cooperators:

**Idaho Office of Species Conservation
Idaho Department of Water Resources
Lemhi Irrigation District
NOAA Fisheries
National Oceanic and Atmospheric Administration
Upper Salmon Basin Watershed Project
U.S. Fish and Wildlife Service
Water District 74**

April 2004



temperature (9.0 C) for 145 days (97 % of recording time) and maximum critical temperature (13 C) for 129 days (86% of recording time) during the recording period between May 14th and October 10th, 2003 (Table 3).

Big Springs Creek

The highest instantaneous water temperatures recorded at any site in the Lemhi River monitoring area occurred at the mouth of Big Springs Creek (26.7° C on both July 20th and 21st, 2003; Table 2). The mean daily average temperature (13.1°C) recorded at this site is similar to the mean daily average recorded (13.0°C) at the McFarland Campground site on the upper Lemhi River. Although the daily average temperature never exceeded the cold-water biota threshold temperature of 19° C, the water temperature did exceed the criteria for daily maximum (22.0° C) for 48 days between the dates of June 5th and August 20th, 2003. Upstream of the mouth, water temperatures remained cooler and displayed less diel variability. At the LBSC-03 diversion site, the mean daily water temperature was only 1.2°C cooler than at the mouth, however, water temperature exceeded 22.0°C on only eight days during the summer months. Further upstream, near one the largest spring sources of Big Springs Creek (HWY 28 culvert), the water temperature remained more stable, with a mean daily average of 11.5° C and an instantaneous maximum of 16.5° C. Water temperature at this site never exceeded the coldwater biota threshold temperatures. However, average daily temperatures were higher than the spawning critical temperature of 9.0° C for 100% of the days recorded between May 30th and October 15th, 2003. The daily maximum critical spawning temperature was exceeded on 71% of days during the recording period.

Tributaries

Water temperatures in the tributaries above the diversions that typically dewater the stream were generally cooler than the Lemhi River. Maximum daily temperatures never exceeded the threshold temperature of 22.0°C and daily average temperatures never exceeded the critical temperature of 19.0°C. At the Kenney Creek location, the mean daily average water temperature was 9.9°C and the instantaneous maximum temperature was 19.2°C. Temperatures met spawning criteria for 69 days (45 % of the days during the recording period) but exceeded criteria between June 10th and September 12th, 2003.

Temperatures at Big Timber Creek were slightly warmer (mean daily average = 11.4° C; instantaneous maximum = 20.8° C). At the Big Timber location, temperatures met spawning criteria for 49 days (32% of the days recorded). Exceedences occurred between May 14th and September 12th 2003. The thermograph deployed near Lee Creek Road on Big Eightmile Creek malfunctioned and did not record temperatures properly, so these data could not be analyzed. Graphs of daily average and maximum water temperature at all monitoring locations are in Appendix D.

Fish Passage

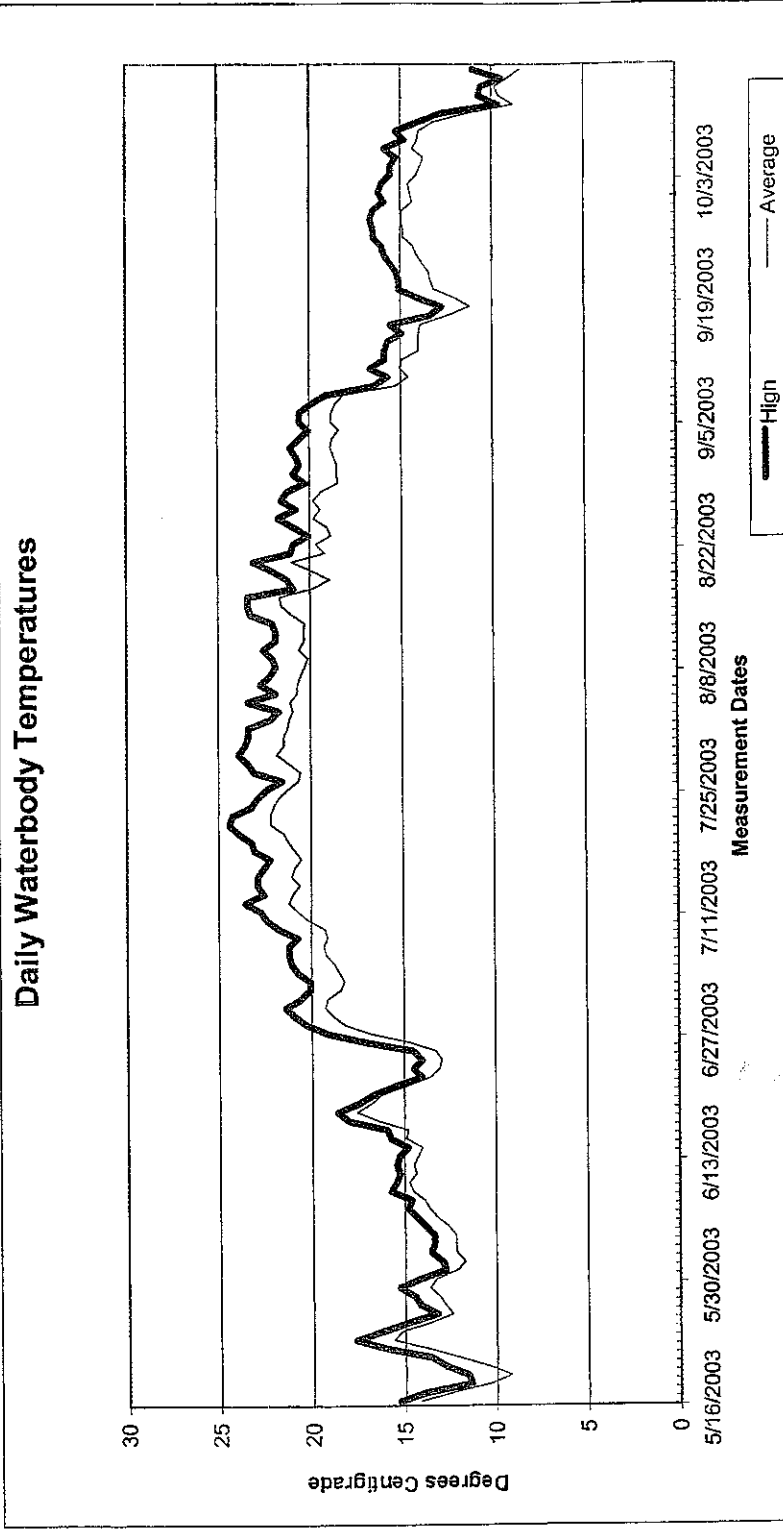
Lower Lemhi River

The lower Lemhi River between the L-06 diversion dam and the confluence was monitored several times during the peak of the 2003 irrigation season to inspect "critical reaches" identified in 2002, to assess fish passage at these locations, and to determine if

APPENDIX D

Thermographs of daily average and maximum water temperatures at temperature monitoring locations.

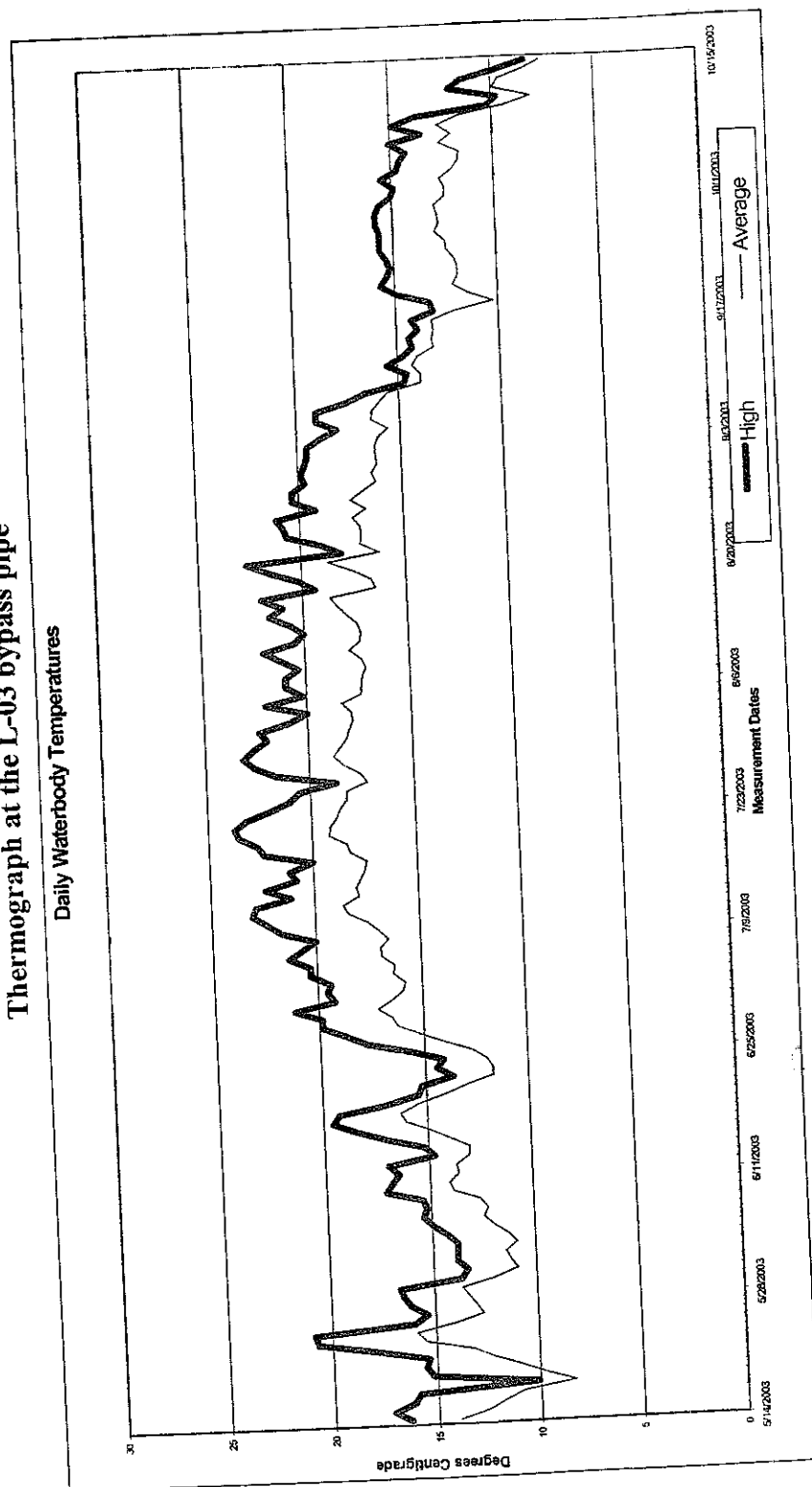
Thermograph at Salmon River near Lemhi River Confluence



Appendix D-1. Average and maximum daily water temperatures at the Salmon River near the confluence with the Lemhi

Thermograph at the L-03 bypass pipe

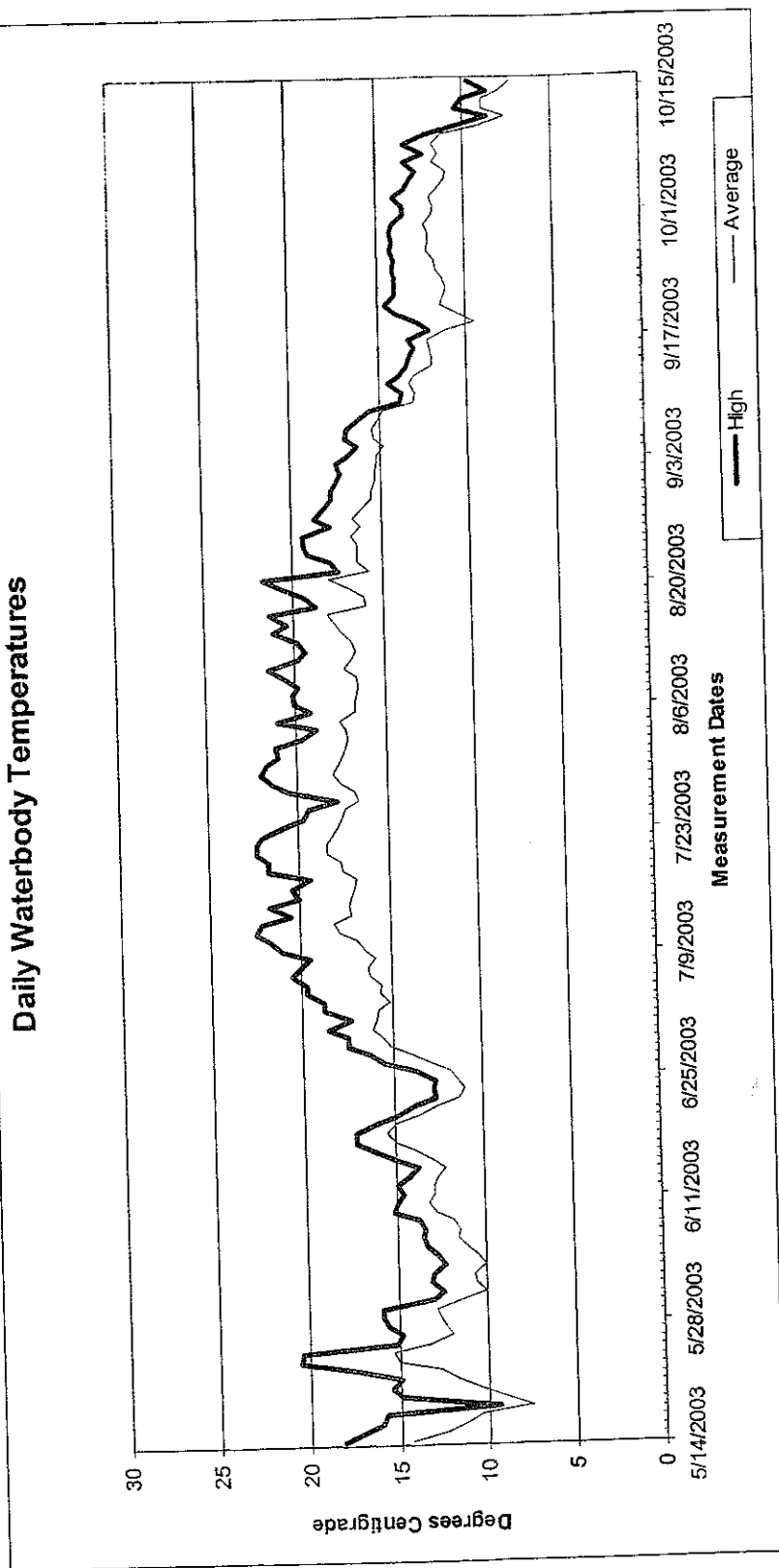
Daily Waterbody Temperatures



Appendix D-2. Average and maximum daily water temperatures at the L-03 bypass pipe from May 14th through October 15th 2003.

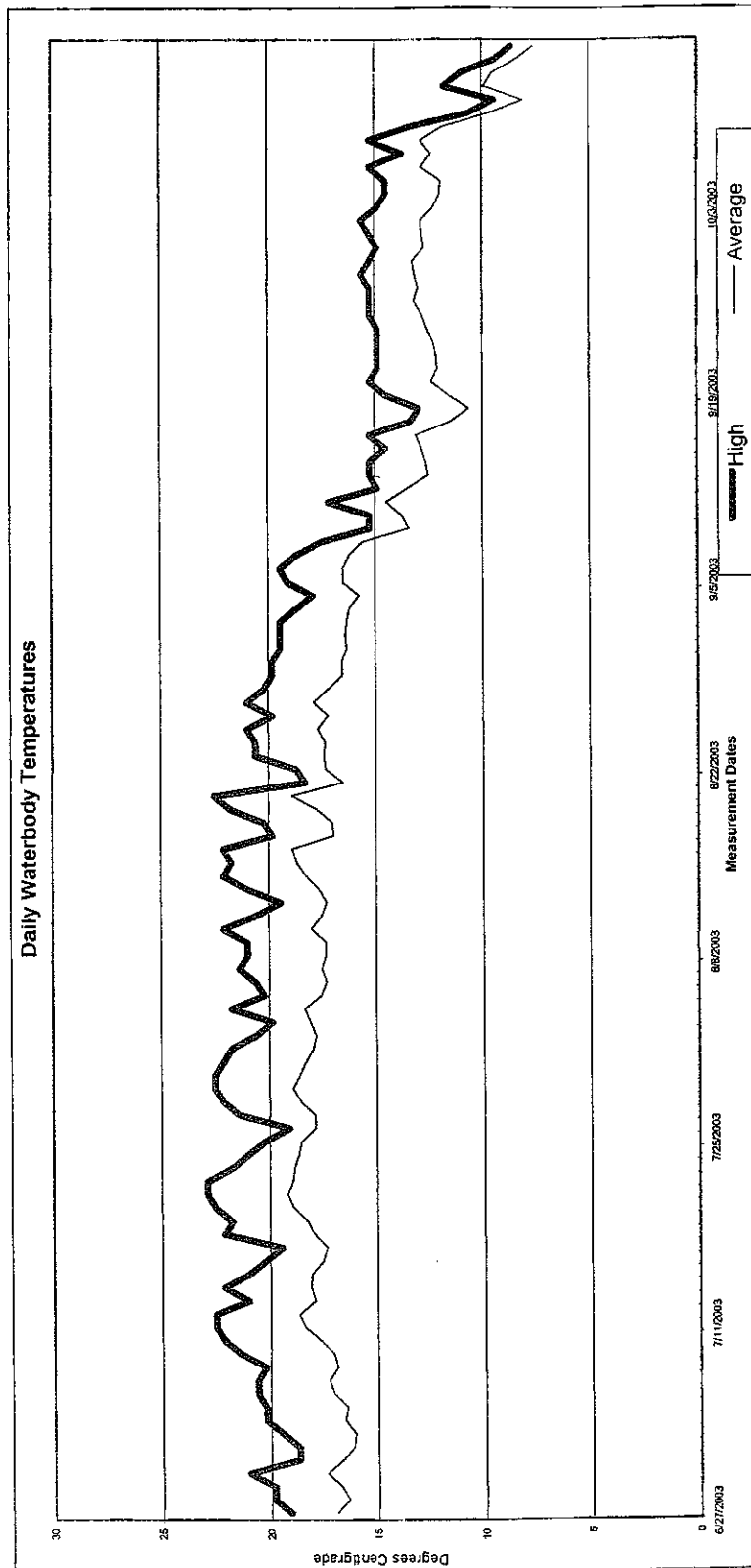
Thermograph at the L-03 Diversion

Daily Waterbody Temperatures



Appendix D-3. Average and maximum daily water temperature at the L-03 diversion from May 14th through October 15th 2003.

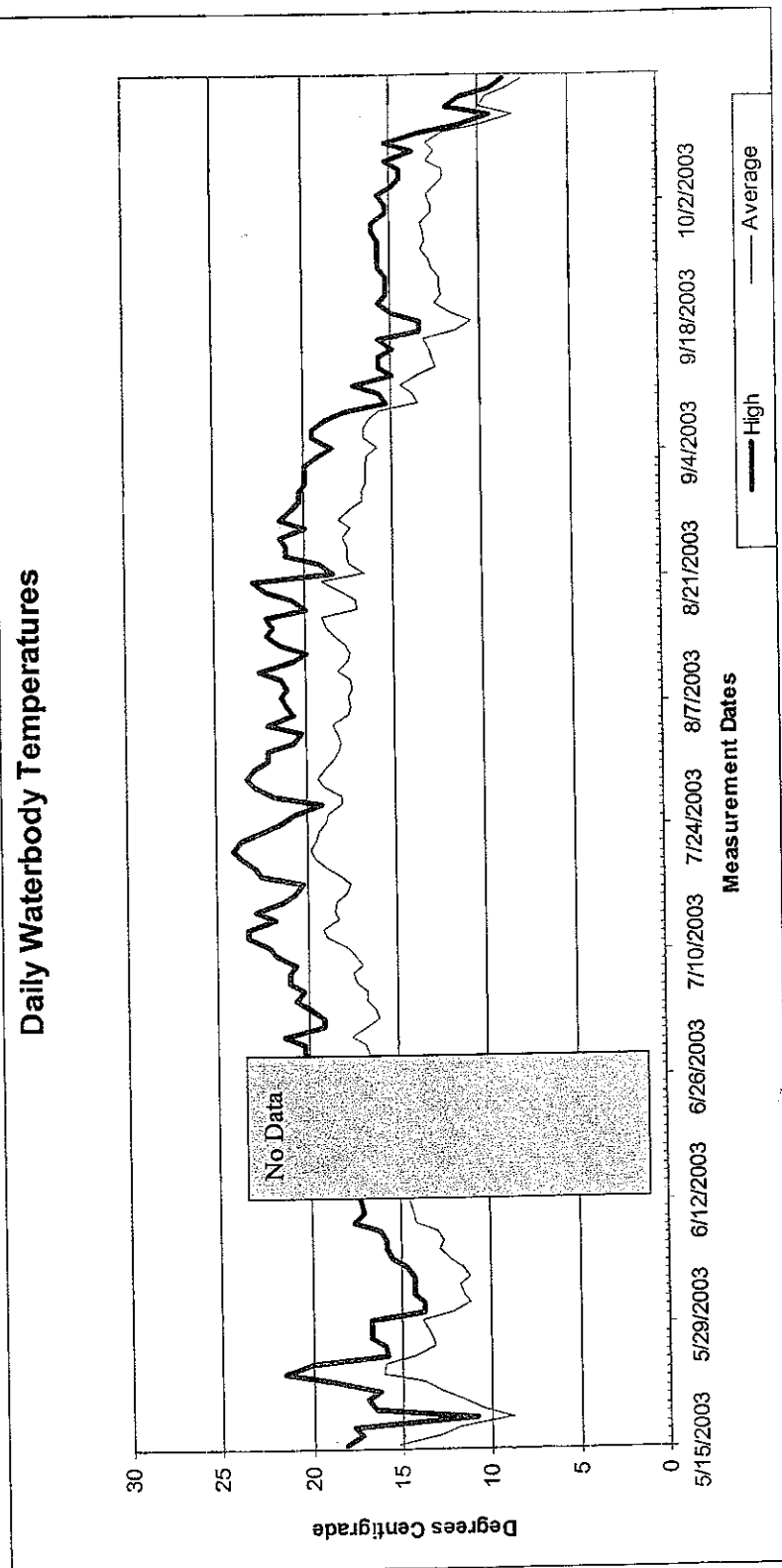
Thermograph at the L-03A bypass pipe



Appendix D-4. Average and maximum daily water temperatures at the L-03A bypass pipe from June 27th through October 15th, 2003.

Thermograph at L-03A diversion

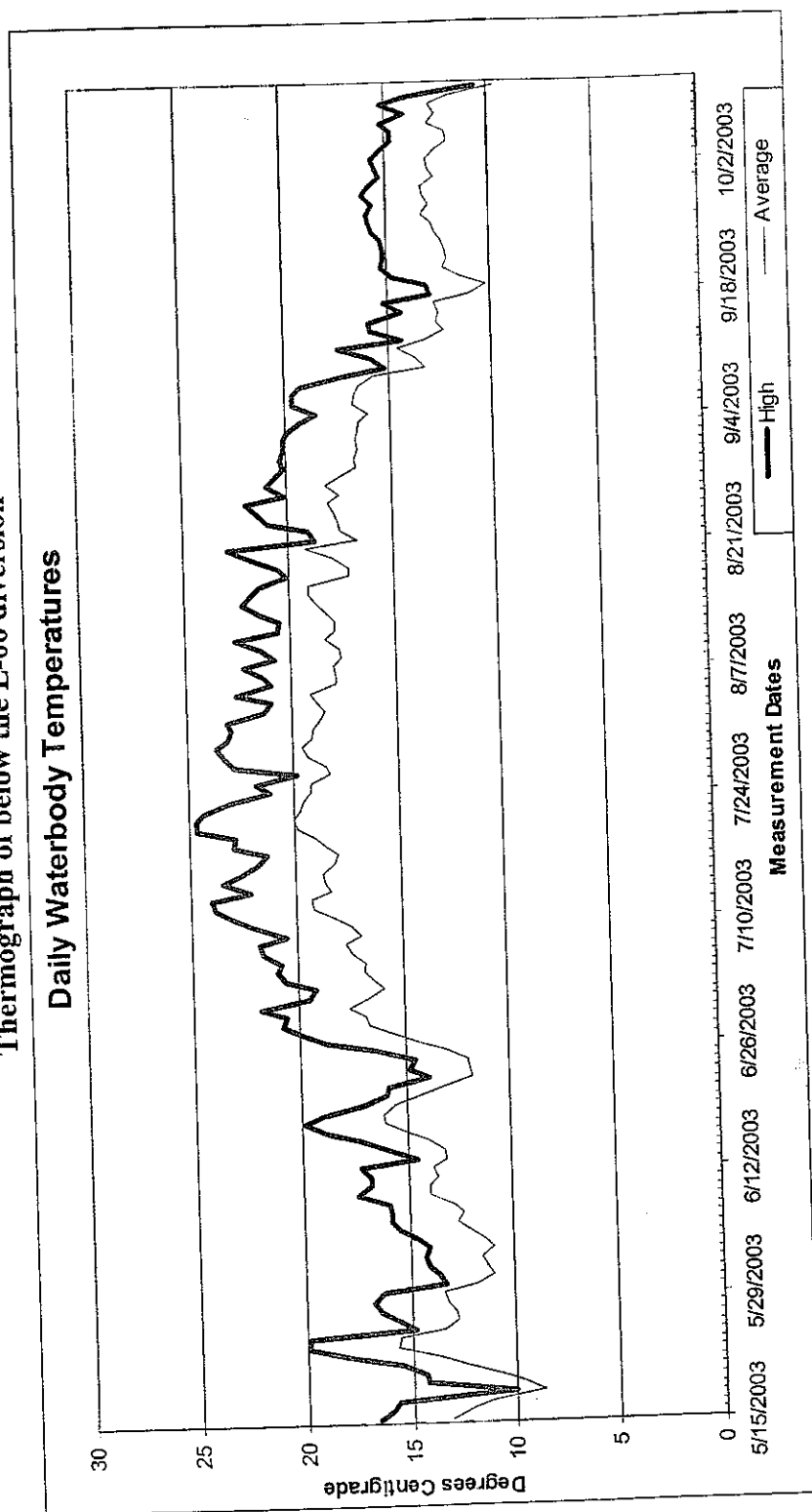
Daily Waterbody Temperatures



Appendix D-5. Average and maximum daily water temperatures recorded at the L-03A diversion from May 15th through October 15th, 2003. (Temperatures from June 10th through June 26th are excluded because thermograph was lost and unaccounted for during that time).

Thermograph of below the L-06 diversion

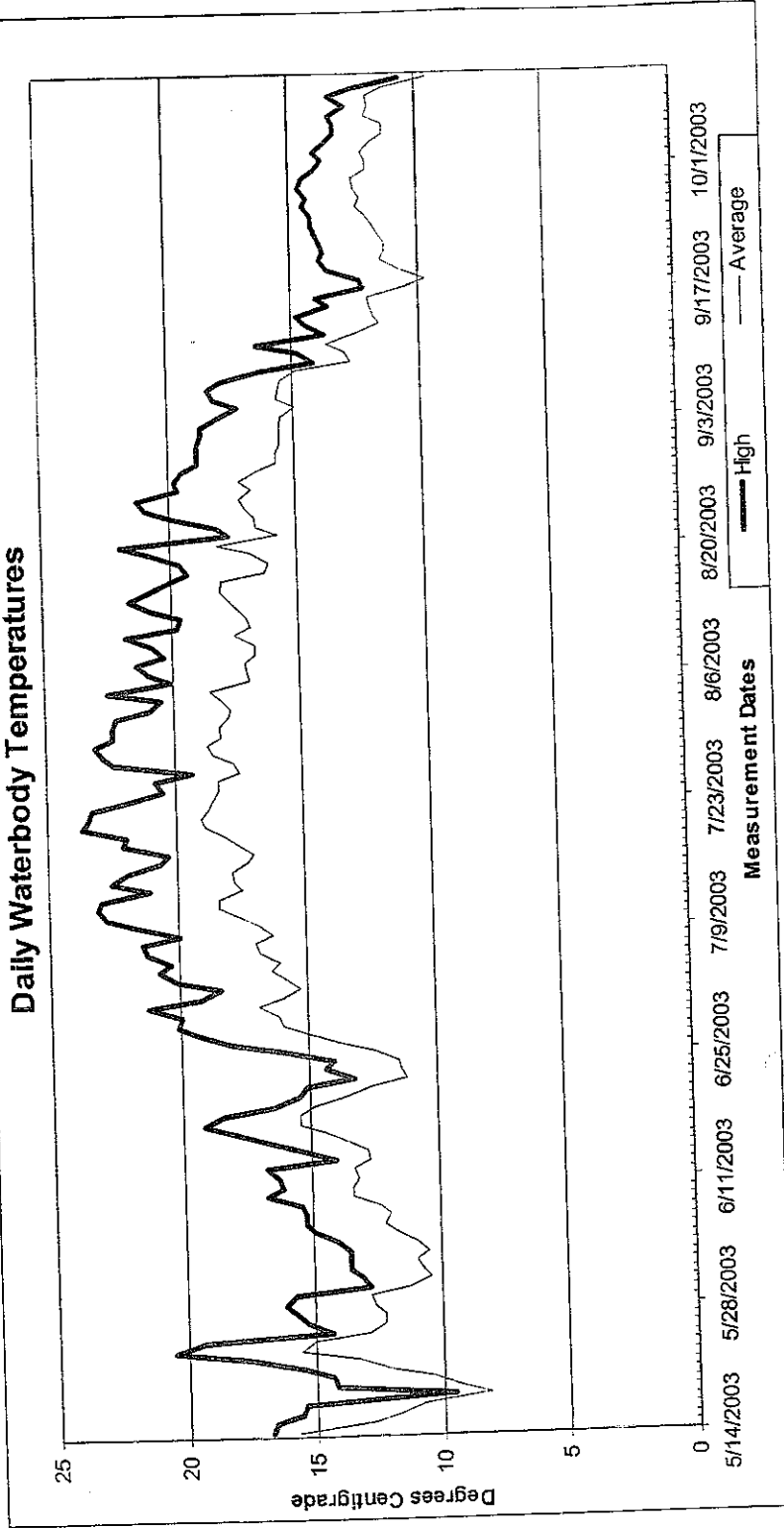
Daily Waterbody Temperatures



Appendix D-6. Average and maximum daily water temperatures recorded at the L-06 diversion from May 15th through October 15th, 2003.

Thermograph at L-07 diversion

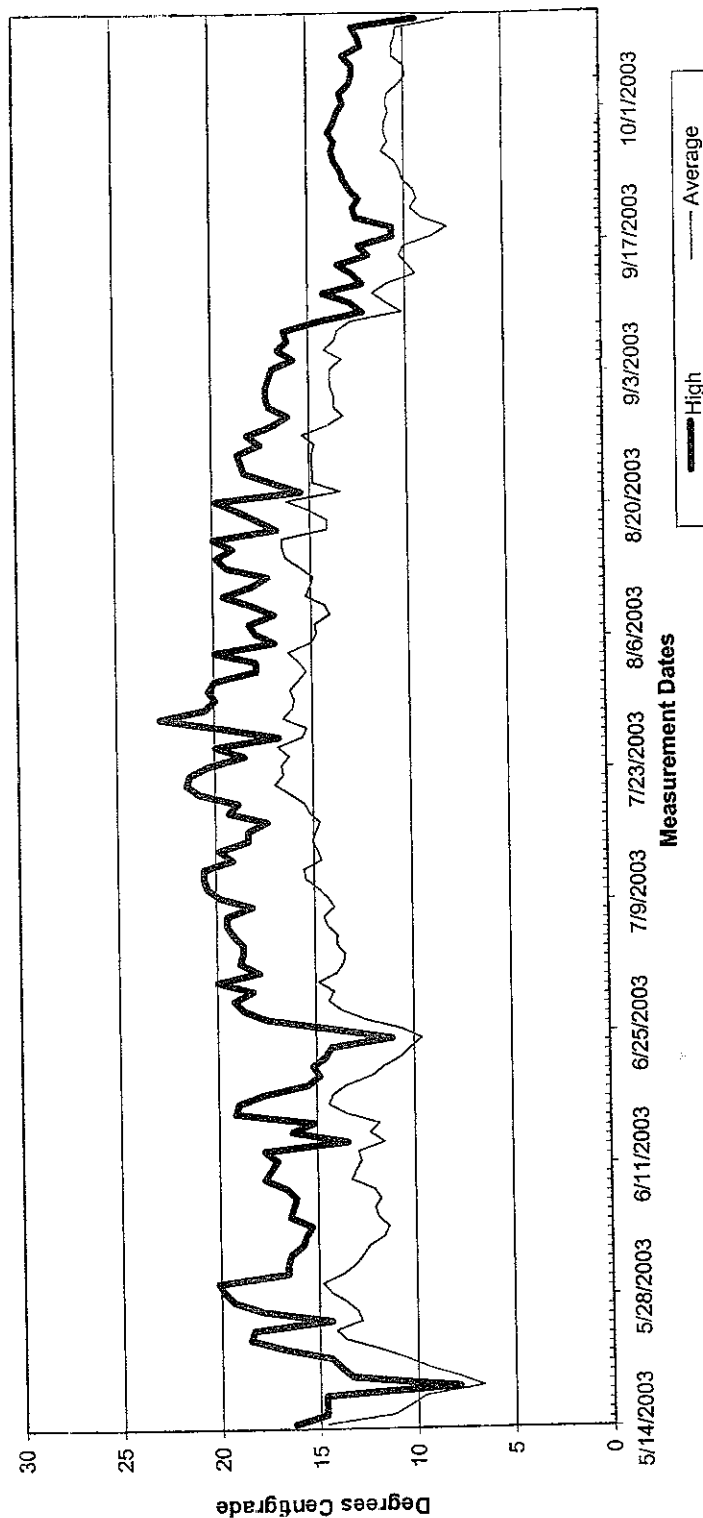
Daily Waterbody Temperatures



Appendix D-7. Average and maximum daily water temperatures recorded at the L-07 diversion from May 14th to October 15th, 2003.

Thermograph at the McFarland Campground

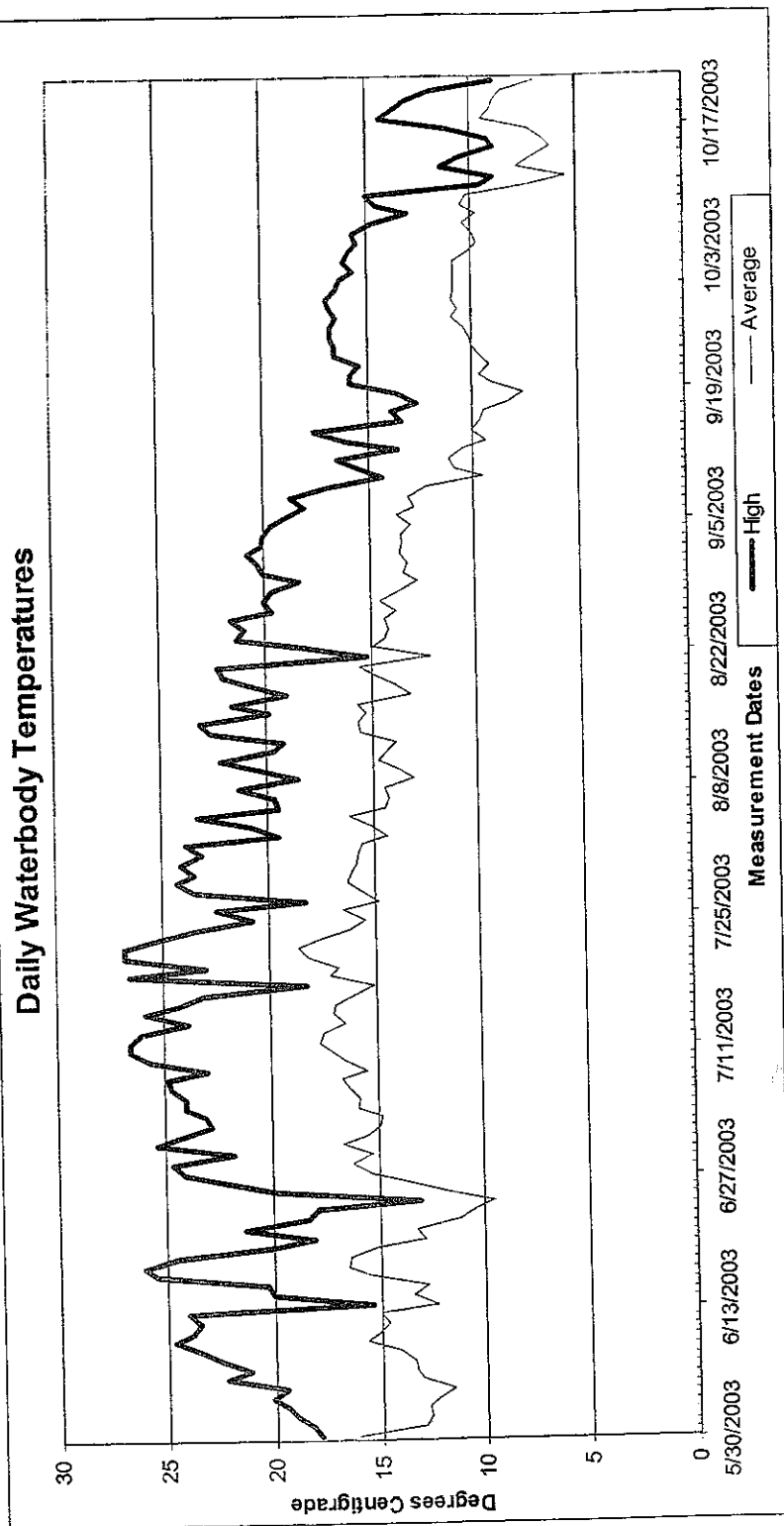
Daily Waterbody Temperatures



Appendix D-8. Average and maximum daily water temperatures recorded at the McFarland Campground on the upper Lemhi River from between May 14th and October 10th, 2003.

Thermograph at Big Springs Creek Mouth

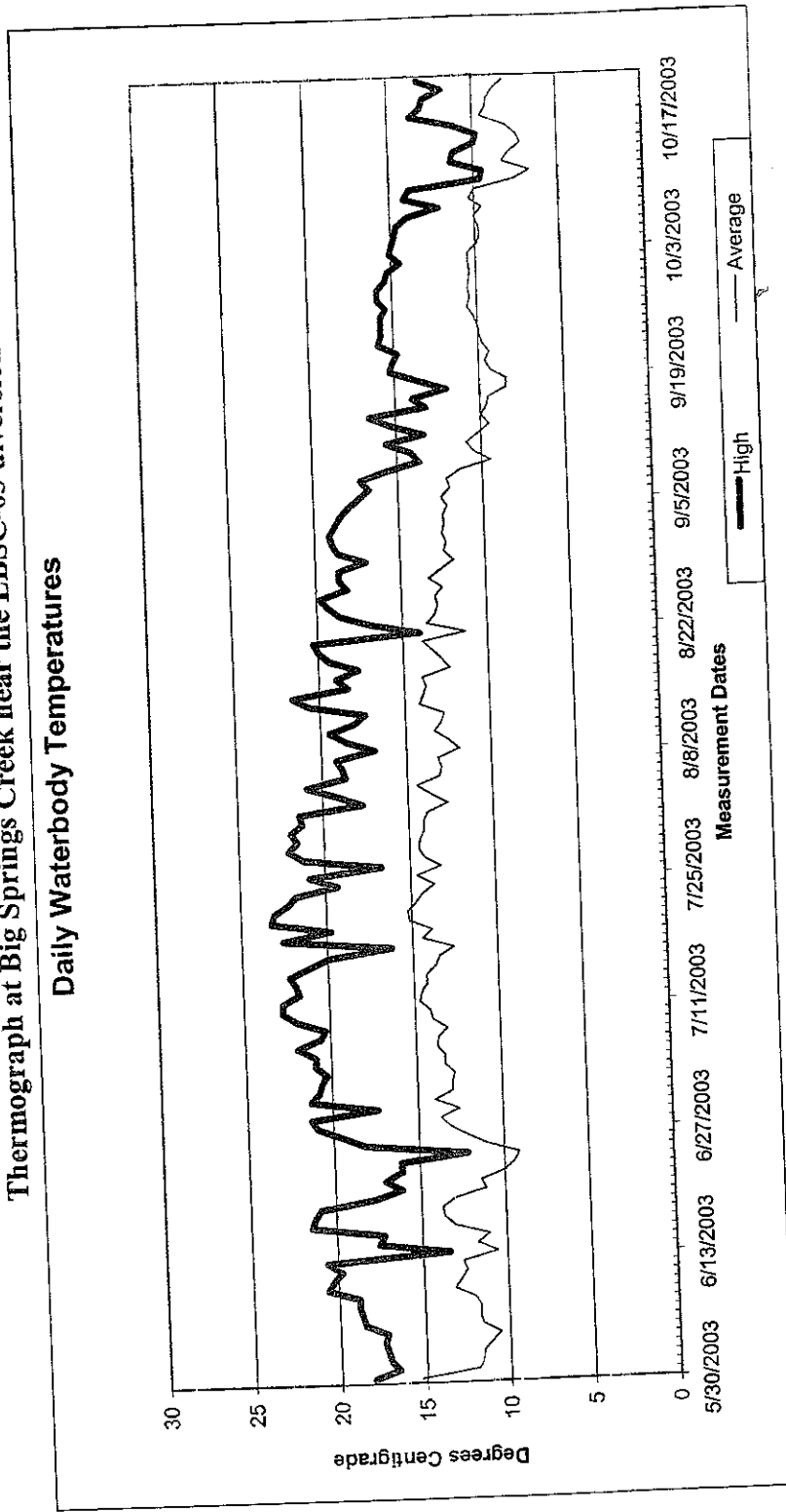
Daily Waterbody Temperatures



Appendix D-9. Average and maximum daily water temperatures recorded at the Big Springs Creek mouth (downstream) site between May 30th and October 22nd, 2003.

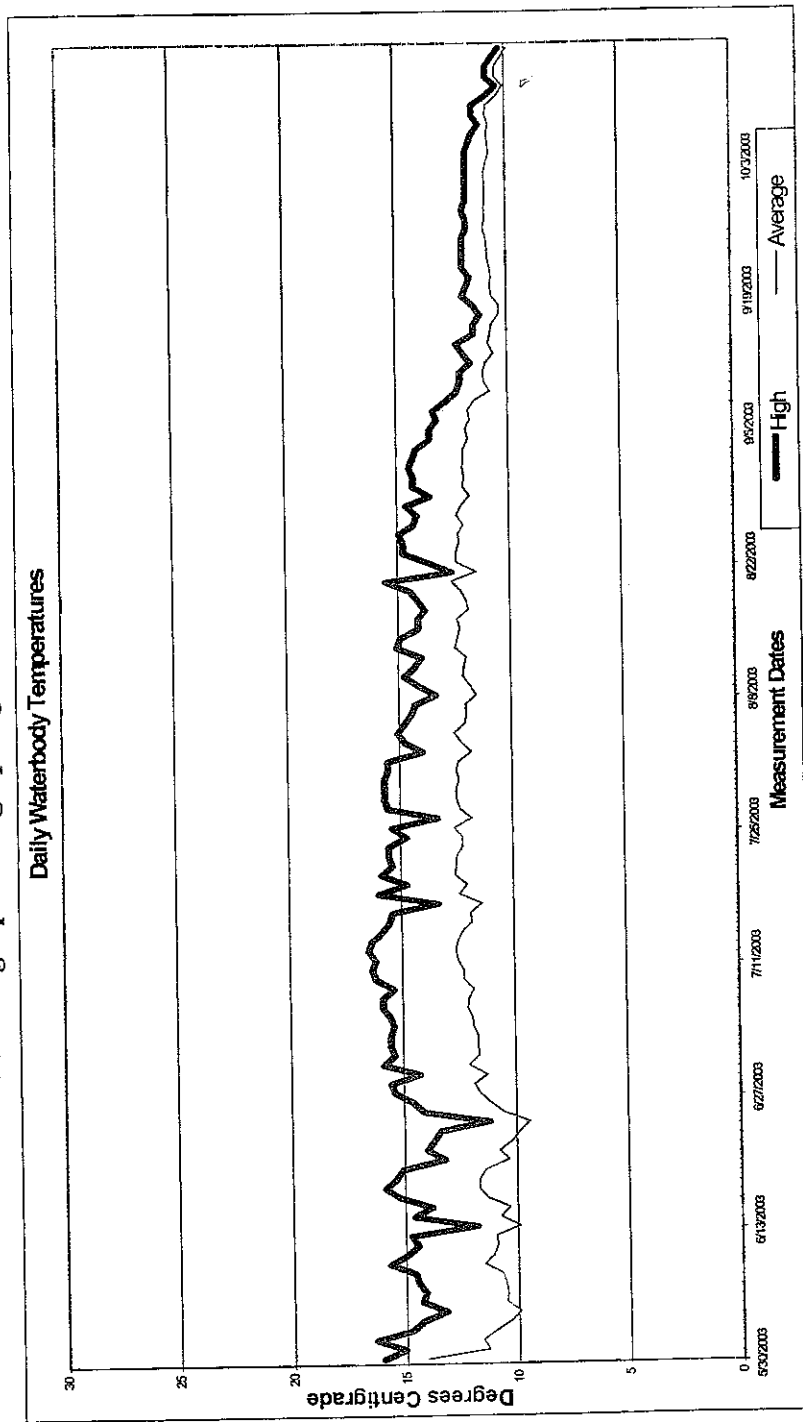
Thermograph at Big Springs Creek near the LBSC-03 diversion

Daily Waterbody Temperatures



Appendix D-10. Average and maximum daily water temperature at Big Springs Creek LBSC-03 (mid stream) between May 30th and October 22, 2003.

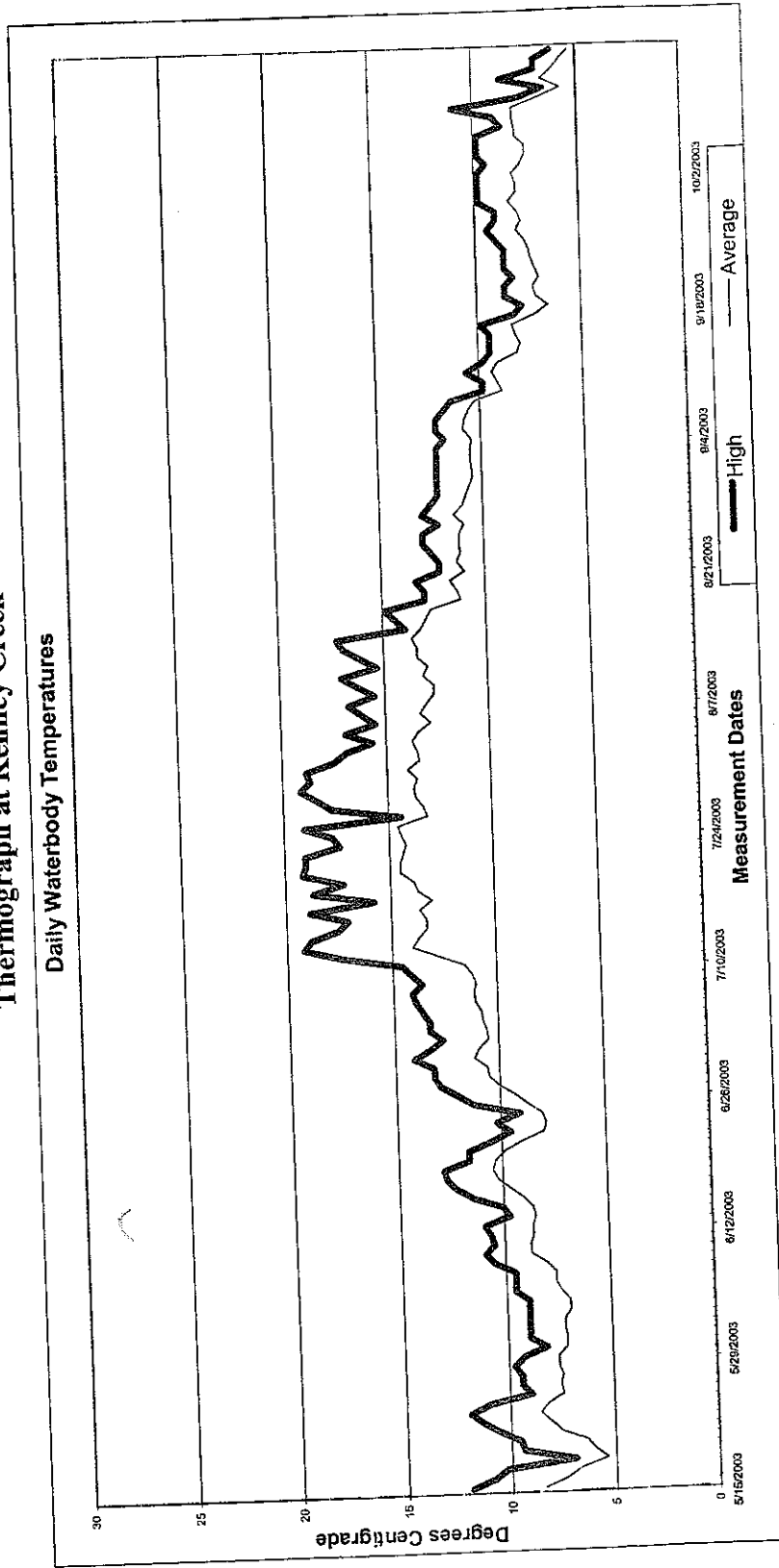
Thermograph at Big Springs Creek near the HWY 28 culvert



Appendix D-11. Average and maximum daily water temperature at the Big Springs Creek HWY 28 culvert (upstream) site for May 30th through October 15th, 2003.

Thermograph at Kenney Creek

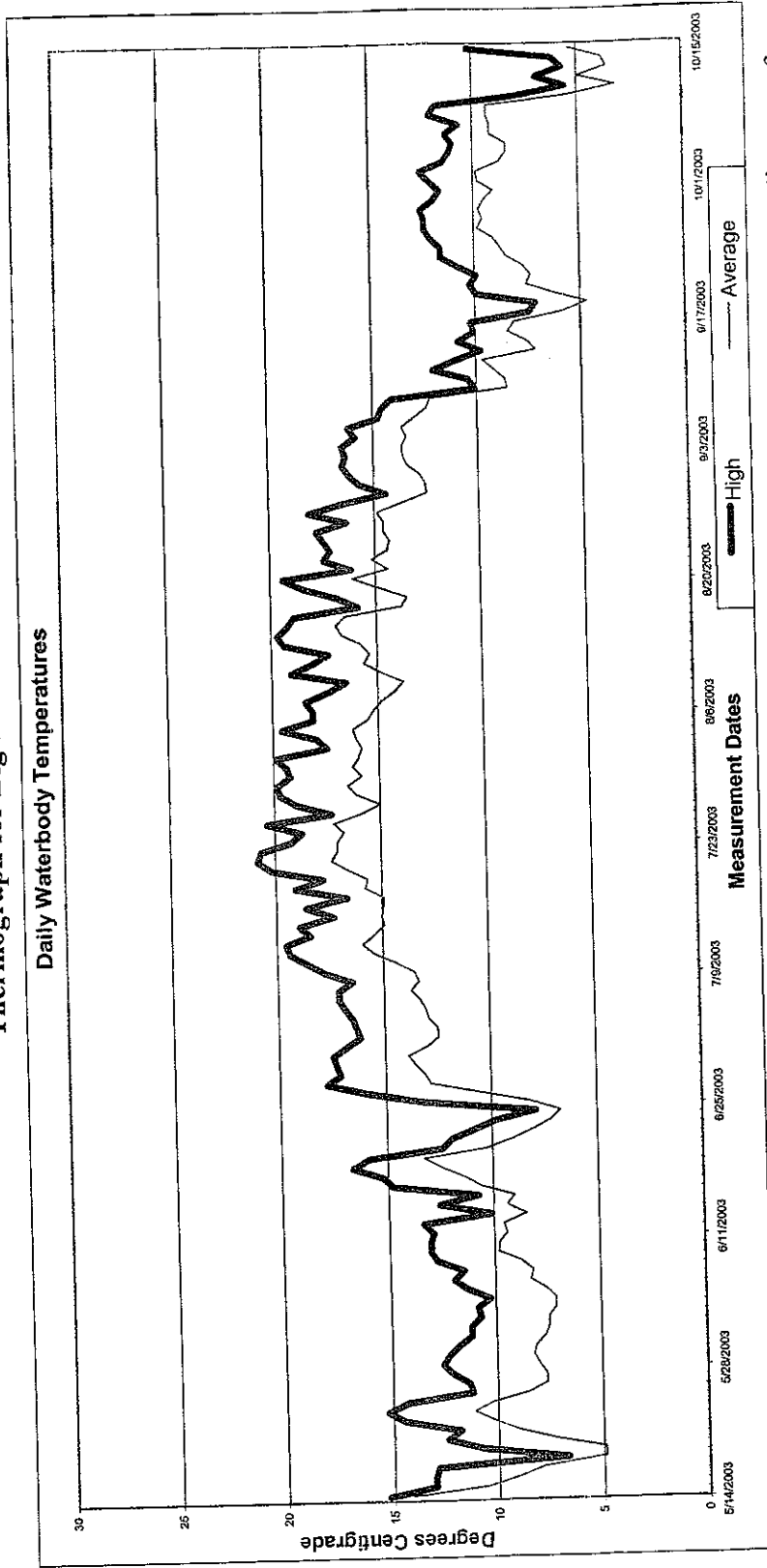
Daily Waterbody Temperatures



Appendix D-12. Average and maximum daily temperatures at Kenney Creek upstream from the 2nd diversion (moved to 3rd diversion after stream was dewatered on August 17th) from May 15th through October 10th, 2003.

Thermograph for Big Timber Creek

Daily Waterbody Temperatures



Appendix D-13. Average and maximum daily water temperatures at Big Timber Creek above the lowest diversion for May 14th through October 15th, 2003.

IDFG SALMON

20

RECLAMATION

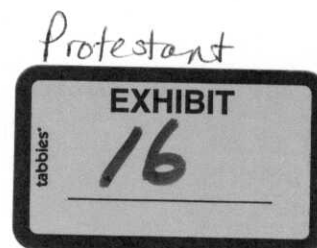
Managing Water in the West

Flow Characterization Study

Instream Flow Assessment Big Timber Creek, Idaho



U.S. Department of the Interior
Bureau of Reclamation
Technical Service Center
Denver, Colorado



June 2004

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Prepared for:

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SUMMARY

The Bureau of Reclamation conducted flow characterization and habitat studies on Big Timber Creek, located in the Lemhi River sub-basin in Idaho, to identify stream flow needs to support relevant life history stages of summer steelhead (*Oncorhynchus mykiss*), spring chinook salmon (*O. tshawytscha*), and bull trout (*Salvelinus confluentus*). The study area encompassed the mainstem Big Timber Creek from its confluence with the Lemhi River upstream to Basin Creek. Seven study sites were selected to represent mesohabitat types within each stream reach distinguished by unique hydrology, channel morphology, slope, or land use characteristics. Big Timber flows were measured at one study site located upstream from major diversions using a stage recorder during the 2003 irrigation season. Unimpaired flows ranged from 16 cfs in late September to 295 cfs on May 31. Reclamation characterized flow needs for various life stages of the selected species in Big Timber Creek using the Physical Habitat Simulation (PHABSIM) model at each study site. Attempts to conduct field surveys at low, medium, and high flows at most sites were confounded by diversions downstream from the unimpaired site. In most cases, only medium and low flows were measured. However, these conditions typically occur during the summer irrigation season with the diversions. Habitat modeling results reflected differences in stream channel hydraulics among study sites. Cross-sectional profile and wetted area comparisons of study sites showed a narrower, more confined stream channel and less wetted surface area per any given flow in lower reaches of Big Timber Creek than upstream reaches. Thus, less flow was needed for suitable fish habitat in the lower reaches than the upper reaches given present stream channel morphology. For example, at the most downstream study site, flow required for adult salmonid passage was 13 cfs. This compared with the most upstream site where passage flow was 17 cfs. Study results can be used to determine a target flow or flows to improve passage, spawning, and rearing conditions for salmon, steelhead, and bull trout.

Flow levels are affected by weather, snowpack, rainfall, and water withdrawal. Diverted water can reduce water quality. Shallower, slower water tends to warm faster than deeper, faster water. Warmer water holds less dissolved oxygen than cooler water. The combination of warm water with less dissolved oxygen, especially water temperatures above 20°C (68°F) and dissolved oxygen below 5 milligrams per liter, can stress salmonids (Bjornn and Reiser 1991). The temperature at which 50% mortalities (LC-50) occur in juvenile Chinook salmon is 25°C (77°F), when acclimated to 15°C (59°F) (Armour 1991). The upper lethal limit is 24°C (75°F) for steelhead (Bell 1991). In general, problem eutrophication is a partial result of irrigation return flow (non-point source) and possibly cattle feedlots (point source). However, agricultural runoff presents a low level of potential impact to water quality.

Water withdrawals have degraded the aquatic resources in the Lemhi River sub-basin by reducing flow in the river channels. Water use for irrigation is heavy, with water appropriations exceeding natural flows at times, most notably in the summer. Water appropriation varies by season, with less proportion of consumptive use in winter and most in summer. Artificially low streamflow limits the movement of fish, reduces the amount of physical habitat available for fish to live in, and reduces quality of habitat.

3.6 Summary

Based on this analysis, the primary limiting factors for fisheries in Big Timber Creek appear to be summer temperature and flow. Self-sustaining fish populations exist for the species of interest with no reported fish die-offs, and there is an available water supply throughout the year upstream from the major diversions. However, warm summer water temperatures are affected partly by water withdrawals, which also affect stream flows. Although high summer water temperature may limit the fisheries in late July and early August, fish populations continue to exist within available physical habitat throughout the year.

4.0 METHODS

The approach for characterizing flow needs in Big Timber Creek involved planning and execution of a Physical Habitat Simulation (PHABSIM) study in the stream segments identified above. The Technical Service Center (TSC) of Reclamation in Denver, Colorado was responsible for (1) collecting and compiling existing hydrology and biological data for salmon, steelhead, and bull trout using these streams; (2) conducting the study; and (3) providing Reclamation's Snake River Area Office in Boise, Idaho with a final report and associated data. These tasks are briefly outlined below.

4.1 Microhabitat Analysis

PHABSIM predicts changes in the relationships between in-stream flows and fish habitat for individual species and life stages and is best used for decision-making when alternative discharges are being evaluated (Bovee et al. 1998). It is useful for comparing the relative effects of various in-stream flow release schedules. Stream flow and habitat

data are used in a group of models called PHABSIM. Hydraulic models are used to calculate water surface elevations and depths and to simulate velocities for specific flows. Depth, velocity, substrate material, and cover data are used to determine available habitat. The model outputs proportions of suitable and unsuitable reaches of the stream and shows how often a specified quantity of suitable habitat is available. This methodology is scientifically tested and is generally an accepted technique for determining flows needed for fish. The habitat requirements of a number of species are not known; therefore, application can be limited unless emphasis is placed on developing habitat suitability criteria (HSC) for species of interest. The output of the model must be measured against biological knowledge.

Studies utilizing PHABSIM require extensive data collection and analyses. The steps in a PHABSIM study are briefly outlined below.

4.1.1 Mesohabitat Classification and Inventory

Specific procedures at each study site included:

- Locate study segments for study site selection.
- Map habitat features for stream segment. Habitat mapping, or mesohabitat typing, started at the upper segment boundary and proceeded downstream. The "cumulative-lengths approach" described by Bovee (1997) was used for habitat mapping. Habitat types were defined based on the purpose of hydraulic modeling to capture hydraulic changes (e.g., backwater and slopes).
- Thus, Reclamation used the following mesohabitat classification scheme:
 - low gradient riffles (slope),
 - moderate gradient riffles (slope),
 - high gradient riffles (slope),
 - runs (slope), and
 - pools (backwater).

Linear distance of each major habitat type was recorded and the total of each habitat type and total length mapped were recorded at the end of each segment. The mapped data were used to determine percentages of each habitat type.

- Study sites were selected based on habitat mapping.

4.1.2 Collection of hydraulic data

PHABSIM requires hydraulic and habitat suitability data to determine the instream flow requirements for the species and/or life history stage of interest. Several hydraulic sub-models can be used with PHABSIM including STGQ, WSP, and MANSQ. Field data collection was designed to accommodate any of these models. PHABSIM data

collection included several steps: study segment location, habitat mapping, transect (cross section) placement and data collection.

- Transects were placed in all habitat types that represented over 5 percent of the total available habitat. Transects were placed in homogeneous habitat types with the number of transects dependent upon the physical and hydraulic features of each habitat type. The number of transects necessary to capture the depth, velocity, cover and substrate distribution and variability is in large part a function of the specific river being worked on, the mesohabitat type being sampled, and the HSCs
- Additional non-habitat simulation transects were placed at hydraulic controls (HC) by professional judgment to aid in hydraulic calibrations. The shallowest path across riffles or shallow runs within the study site was used to address passage issues for juvenile and adult salmonids.
- At each set of transects in each habitat type the following data were collected: establishment of horizontal reference points, distance between transects, field notes referencing general habitat and stream conditions in the transect areas, and reference photos of habitat and of each transect within each habitat type.

Field data were collected according to Bovee (1997) using standard surveying equipment above the water surface and using depth measured from a wading rod for wet areas. Reclamation personnel coordinated field survey procedures with the USGS flow study conducted in the upper Salmon River for quality control. We attempted to conduct the surveys at low medium, and high discharges. Vertical elevations were established throughout each habitat type by using differential leveling with a total station instrument (Bovee 1997). A benchmark was established (with rebar) and assigned the arbitrary elevation of 100.00 feet. All differential leveling was referenced to this benchmark. Water surface elevations (WSL) were measured to the nearest 0.01 ft near the water's edge along each transect at all discharges. Channel cross sections were measured (vertical and horizontal) to the nearest 0.1 ft between headpins at each transect during low discharge. Discharge measurements at each transect were taken at the three discharges.

4.1.3 Depth, Velocity, Substrate, and Cover

Depths, mean velocities, substrates, and cover were measured at various points along each transect. Stationing across transects was oriented with 0.0 on the left bank looking upstream for modeling purposes. Depths were measured using a top setting wading rod. Streambed elevations and water depths were measured to the nearest 0.1 ft. Mean column water was measured to the nearest 0.1 ft/sec using a Marsh McBirney Flo-Mate 2000 velocity meter attached to the wading rod. Substrate and cover for PHABSIM were visually assessed using a system developed by EA Engineering (1991b) (Table 6). A temporary staff gage was installed at each site so that fluctuations in WSL could be monitored during data collection.

Table 6. Big Timber Creek instream substrate and cover coding system.¹

Code	SUBSTRATE	diameter (in)	diameter (mm)
1	Detritus	organic matter	
2	Silt	<0.0024	0-0.062
3	Sand	0.0024 - 0.125	0.062-3.2
4	Small Gravel	0.125 - 1.0	3.2-25
5	Coarse Gravel	1-3	25-76
6	Cobble	3-10	76-256
7	Boulder	>10	>256
8	Bedrock		
9	Aquatic Veg		
	COVER		
1	Woody debris		
2	Undercut	undercut bank	
3	Cobble/Boulder	(>3")	
4	Aquatic vegetation		
5	Large gravel	(2-3")	
6	Canopy	canopy or overhead structure	
7	Emergent vegetation		
8	No cover		

¹ Source: EA Engineering (1991b)

Velocity calibration sets were collected at three different time periods between June and September, 2003 in an attempt to cover a range of flows.

Additional transect-specific data (i.e., flow and water surface elevations) were also collected during each of the velocity surveys at each site. These stage-discharge measurements provided the data necessary for model calibration and extended the range for hydraulic simulations. The applicability of the range of flows simulated to actual flows in the stream is dependent on the flows measured.

4.1.4 Habitat Suitability Criteria (HSC)

Species HSCs are required for PHABSIM analysis. Habitat suitability criteria, or curves, are interpreted using a suitability index (SI) on a scale of 0 to 1, with 0 being unsuitable and 1 being most utilized or preferred. Habitat suitability criteria that accurately reflect the habitat requirements of the species of interest are essential to developing meaningful and defensible instream flow recommendations. The recommended approach is to develop site specific criteria for each species and life stage of interest. An alternative involves using existing curves and literature to develop suitability criteria for the species of interest. No site-specific HSCs are available in the Lemhi River sub-basin and time and budgetary constraints precluded developing HSCs specific to Big Timber Creek. While such information may become available in the future through a separate study, the TSC worked with other interested parties and agencies in the interim to evaluate existing criteria curves appropriate for the Lemhi River sub-basin and decided to use HSCs that were developed for the upper Salmon River and Clearwater Basins by EA Engineering (1991b) for the Bureau of Indian

Affairs, and which represented the general habitat requirements of each particular fish species and lifestage for the Lemhi River sub-basin streams.

4.1.5 Hydraulic Model Selection and Calibration

Reclamation used the USGS Windows version of PHABSIM (USGS 2001) and coordinated hydraulic modeling procedures with the USGS flow study conducted in the upper Salmon River for quality control. PHABSIM has several submodels available for hydraulic simulations. These include STGQ, WSP, and MANSQ (USGS 2001), with STGQ being the most rigorous in terms of data requirements. Each hydraulic model requires multiple flow measurements to extend the predictive range. Depending on model performance, the predictive range may be restrictive, or wide ranging (i.e., 0.1 to 10 times the measured discharges) (USGS 2001). Since water is diverted between April 1 and September 30 of each year for irrigation, the range of flows for the hydraulic simulations covered flows that typically occur during these months.

Field sampling was designed to collect data in formats suitable for application in any of the hydraulic models identified above. The following approach was used:

- Enter field data into appropriate format for water surface simulations
- Calibrate STGQ, MANSQ, or WSP (depending on site specific conditions) to measured WSL
- Document calibration procedure
- Simulate a range of flows to predict water surface elevations
- Simulate depths and velocities for range of flows that occur during the irrigation season
- Evaluate simulation range based on velocity adjustment factors (VAF's) and other calibration sub-models
- Document acceptable range of simulations
- Conduct velocity simulation production run for applicable range of flows that may occur during the irrigation season.

4.1.6 Habitat Modeling

Table 7 shows various life stages and variables used to describe microhabitat.

Table 7. Life stages for species of interest and microhabitat variables used to describe habitat.

Life Stage	Depth	Velocity	Substrate	Cover
Adult passage	X			
Adult holding	X	X	X	
Adult spawning	X	X	X	
Juvenile rearing	X	X	X	X

Since velocity HSCs for juvenile and adult bull trout were developed for nose velocities at 0.2 feet off the stream bottom (EA Engineering 1991b), the nose velocity option in the habitat model was used for these life stages of bull trout.

The following example describes how habitat weighting factors (WF) were determined. Study Site 3 had five cross sections: one deep run, three shallow runs, and one moderate gradient riffle. Within this site, based on the habitat mapping percentages (Appendix B), the three shallow runs represented 340 ft (34%), the moderate gradient riffle 540 ft (54%), and the deep run represented 120 ft (12%) of a 1,000 ft idealized reach. The shallow run distance of 340 ft was divided equally by three (113', 113', 114') to represent the three shallow runs at Study Site 3. Both the deep run and moderate gradient riffle distances remained the same. Weighting factors of 0.00-1.0 were calculated for each cross section to accurately represent the entire stream reach (Table 8).

Table 8. Example of setting cross section weighting factors for habitat modeling.

Cross section	Habitat type	Distance from previous cross section (ft)	Weighting factor
1	Riffle	0	1.0
2	Shallow run	540	1.0
3	Shallow run	114	1.0
4	Shallow run	113	0.48
5	Deep run	233	0.0
Total		1,000	

An assigned WF of 1.0 moved upstream, and an assigned WF of 0.0 moved downstream, or backwards from the cross section. Weighting factors greater than 0.0 up to 1.0 moved the habitat upstream in proportion to the value assigned. For instance, the X-sec 1 WF of 1.0 applied continually upstream to X-sec 2, the entire 540 ft. The same applied to X-sec 2 and 3. The final cross section was handled differently. Essentially, it was combined into one unit, and assigned two WFs to complete the study site. The distances of X-sec 4 and 5 were combined (113+120) for a total distance of 233 ft. The formula below was used for attaining a WF:

$$233(x) = 113$$

$$X = 113/233 = 0.48$$

where X represented the unknown WF, 233 ft was the combined distance (X-sec 4 & 5), and 113 ft was the distance of X-sec 4.

The WF of 0.48 applied the habitat weighting 48% upstream to represent the final run. A weighting factor of 0.0 applied the habitat weighting of the remaining area, or 52% downstream from cross section 5. Figure 7 illustrates this procedure.

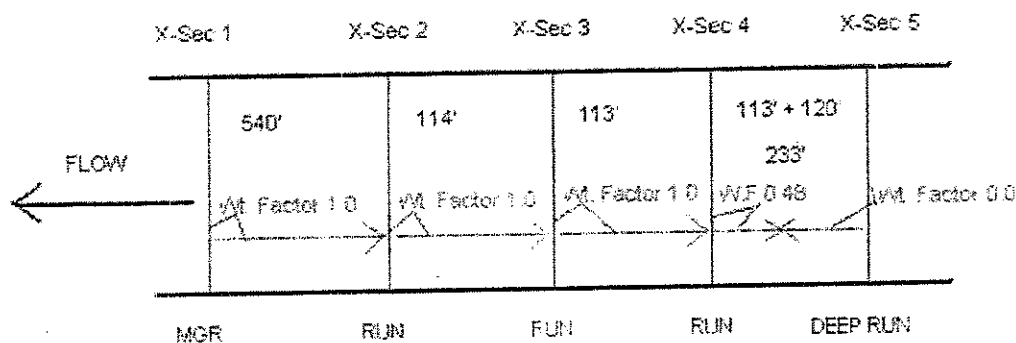


Figure 7. Example of weighting factor assignments at a PHABSIM study site.

If there was a hydraulic control (HC) cross section anywhere in the site it would not affect the habitat weighting. As for the distances (from previous cross section), the cross section immediately upstream from the HC would have a distance of '0 ft'; canceling out the HC in the model. For example, the distances and WF for the cross sections at Study Site 1 are listed in Table 9.

Table 9. Example of setting cross section weighting factors for habitat modeling with hydraulic controls.

Cross section	Habitat type	Distance from previous cross section (ft)	Weighting factor (WF)
1	Run	0	1.0
2	Hydraulic Control (HC)	55	1.0
3	Pool	0	1.0
4	Pool	170	1.0
5	HC	170	1.0
6	Pool	0	1.0
7	Riffle	170	0.87
8	Run	435	0.0
Total		1,000	

Weighted usable area (WUA) within each representative stream reach was calculated for each discharge of interest for each species. Weighted usable area is an index of habitat availability or quantity for the selected species/life stage at each simulated flow. The WUA for each species was computed by multiplying the depth, velocity, substrate, and cover HSC values for a life stage at predicted hydraulic conditions, and cell surface area in the HABTAE submodel of PHABSIM. The output from the HABTAE simulation was habitat area, expressed as WUA (ft²/1,000 ft of stream). Weighted Usable Area was predicted for a range of discharges at the six study sites. For presentation purposes, WUAs were normalized as a percentage of maximum habitat. It

should be noted that there is a level of uncertainty associated with the WUAs. Sources of uncertainty include errors in HSCs, hydraulic simulations, or selection of options to simulate microhabitat (e.g., geometric versus multiplicative means). Recognition that there is uncertainty in these sources is important in the interpretation and use of PHABSIM model results (Bovee et al. 1998).

Habitat for juveniles of each species was modeled separately using substrate and cover because of the known association of this life stage with cover. Since all substrates and cover were considered most suitable (SI=1.0) for juveniles, habitat modeled for substrate included the discrete cover component because cells containing cover were already accounted for by the continuous substrate variable.

4.2 Passage

Suggested passage criteria for adult Chinook salmon, steelhead trout, and bull trout follow guidelines adopted by Oregon Department of Fish and Wildlife and taken from Thompson (1972) and Scott et al. (1981) (Table 10). To determine the recommended flow for passage, shallow bars most critical to passage of adult fish were located, and a linear transect was measured which followed the shallowest course from bank to bank. For each transect, a flow was computed for conditions which met the minimum depth criteria in Table 10 where at least 25% of the total transect width and a continuous portion equaling at least 10% of its total width, equal to or greater than the minimum depth, was maintained (Thompson 1972). Both width criteria must be met to insure passage.

Table 10. Suggested Big Timber River salmonid passage criteria (Thompson 1972; Scott et al. 1981).

Species	Minimum Depth (ft)	Maximum Water Velocity (ft/sec)
Steelhead Trout	0.6	8.0
Chinook Salmon	0.8	8.0
Bull Trout	0.4	4.0

4.3 Flow Recommendations using PHABSIM

The NOAA Fisheries draft protocol estimates idealized annual flow schedules for Pacific and interior northwest streams (Arthaud et al. 2002). The protocol identifies objectives for deriving minimum flow conditions necessary to protect sensitive salmonid life stages that can be quantified using PHABSIM methodologies. Results from this study can be used to help determine target flow objectives to improve passage, spawning, and rearing conditions for salmon, steelhead, and bull trout. Table 11 provides suggested critical life stage assignments for each month in the Lemhi River Drainage which could be used to determine target flows from the PHABSIM analysis.

Table 11. Suggested critical life-stage assignments for applying flow recommendations in the Lemhi River Drainage.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Steelhead	J	J	A	P/S	S	S	J	J	J	J	J	J
Chinook salmon	J	J	J	J	A	A	P/S	P/S	S	S	J	J
Bull trout	J	J	A	A	A	A	A	A	P/S	S	J	J

J=juvenile; A=adult; S=spawning; P=passage

5.0 RESULTS AND DISCUSSION

Measured discharges and dates of field surveys are summarized in Table 12. Attempts to measure low, medium, and high flows at most sites were confounded by diversions downstream from Study Site 7. In most cases, only medium and low flows were measured. However, these conditions typically occur during the summer irrigation season with diversions. At Study Site 1, only low flow from groundwater seepage was present each time it was visited during the summer. Reclamation was able to measure one additional higher flow in late March, 2004 to improve model calibration and habitat simulations.

Written descriptions and photos of each selected study site are provided in Appendix A. Habitat mapping proportions are presented in Appendix B. Cross sectional profiles and measured WSLs are illustrated in Appendix C. Hydraulic model calibration results are summarized in Appendix D. Habitat suitability criteria (HSCs) are presented in Appendix E.

Complete habitat modeling output results (i.e., WUA vs discharge) are summarized in Appendix F for each stream reach. Graphical representations of final normalized WUA versus discharge relationships are presented in Figures 8 to 28 for each site. Juvenile habitat using the cover component independent of substrate did not model well because of the binary HSC criteria (i.e., present (SI=1.0) or absent (SI=0.0)). If a method could be developed to provide some quality ranking of cover types, the modeling could be improved. Separate cover habitat modeling results are included in Appendix F tables for juveniles. Appendix G contains site-specific IFG4 files for input into the PHABSIM program.

Passage flow results for contiguous widths at depths greater than the passage criteria (Table 10) are illustrated in Figures 29-35.

Summary results, including flows required for optimal WUAs and to flows needed to meet the 0.6 feet deep passage criteria are presented in Tables 13 to 19. Summary results reflected differences in stream channel hydraulics among study sites.

Table 12. Discharges measured from highest to lowest at Big Timber Creek study sites during field surveys in 2003.

Stream Site	Discharge (cfs)	Survey Dates
Study Site 1	2.0	June 24
	1.2	July 15
	1.3	September 18
	6.5	March 31, 2004
Study Site 2	8.2	September 18
	6.0	June 29
	4.9	July 17
Study Site 3	15.8	June 25
	8.9	September 18
	8.0	July 15
Study Site 4	11.0	June 29
	9.0	September 17
	8.0	July 17
Study Site 5	28.0	June 28
	25.0	July 16
	15.0	September 17
Study Site 6	29.0	July 16
	16.0	June 27
	13.0	September 16
Study Site 7 (Reference)	47.0 (gage)	June 26
	27.0 (gage)	July 17
	17.0 (gage)	September 15

Examination of cross-sectional profiles of study site transects (Appendix C) showed a narrower stream channel in the lower reaches (e.g., Study Site 1) of Big Timber Creek than the upstream reaches (e.g., Study Site 7). At any given flow, more wetted area occurred at Study Site 7 than Study Site 1. For example, at 10 cfs, 13,106 ft² of wetted area per 1,000 ft of stream occurred at Study Site 1. This compared with 21,993 ft² of wetted area per 1,000 ft of stream at Study Site 7 (Appendix F). Thus, with a smaller channel, less flow was needed to optimize habitat in the lower reaches than the upper reaches (Tables 13 to 19). For example, at Study Site 1, 5 cfs provided optimal habitat for juvenile bull trout, 9 cfs for adult bull trout, 10 cfs for spawning, and 13 cfs was required for passage of adults. These flows were less than Study Site 7 where 20 cfs provided optimal habitat for adult and juvenile bull trout, 60 cfs for spawning, and 17 cfs was required for passage.

Weighted Usable Area (WUA) estimates from a previous unpublished study conducted by EA Engineering on Big Timber Creek (Dudley Reiser, personal communication, July 21, 2003) were compared to our results at Study Site 7 (Appendix F). The objective of the EA Engineering study was to determine flows for fish recovery based on undisturbed stream segments and unimpaired flows for the Bureau of Indian Affairs adjudication process. This differed from our study objectives to determine target flows to improve passage, spawning, and rearing conditions for salmon, steelhead, and bull

trout in stream segments impacted by irrigation diversions. Thus, the value of this comparison was a relative check on our ability to replicate the habitat modeling results from a previous study and was only appropriate at Study Site 7 because this was the only stream segment located upstream from the major diversions where the stream channel hydraulics were similar between studies. Appendix F includes graphical comparisons of the habitat modeling results between this study and the less intensive EA Engineering study in the vicinity of Study Site 7. Although study results show similarities for the spawning life stage, reasons for differences between WUA estimates for other life stages are unknown since the EA Engineering study was never published. The results of this study are not easily transferrable to other drainages unless hydrology, hydraulics, and limiting factors (e.g., temperature, passage) are similar among streams.

6.1 Guidelines for Using Study Results

The results presented in this report summarize the hydrology, habitat, and temperature characteristics of Big Timber Creek during summer, 2003. PHABSIM analysis of the data collected and compiled for this study resulted in a series of graphs that illustrate relations between a dimensionless value called weighted usable area (WUA) and discharge (Figures 8-28). The highest point on each curve represents the discharge at which habitat is optimized for adult, spawning, or juvenile life stages for the fish species analyzed in this study (salmon, steelhead, and bull trout). These optimized values, summarized in Tables 13-19, rarely coincide among life stages for any one species. Furthermore, adult, spawning, and juvenile life stages for salmon, steelhead, and bull trout occur at different times of the year (Table 11). These results imply that the optimum amount of water needed for adult, spawning, and juvenile life stages is not constant, but varies during the year. It is suggested to consider these implications during development of flow targets. Also, WUAs do not address water availability in any way and even the unregulated flow may commonly exceed or be less than the discharge at which the maximum WUA is available. The amount of WUA available, in terms of lost or gained, can be determined by comparing to a reference or unregulated streamflow condition. Typically, the maximum, percentiles, or inflections are chosen from these curves at the level of protection desired or at points above which greater amounts of flow only provide minor gains in usable habitat. In streams with more than one species of interest, the results should be reviewed to insure the recommended flows are beneficial to all species and harmful to none.

The mechanisms by which the various components are integrated and the relative importance they are assigned within the water management decision process is a matter of professional judgment and beyond the scope of this study. However, it would seem reasonable that providing connectivity to the Lemhi River by providing enough water for adult fish passage would be foremost in management priorities. Water depths are an additional consideration for the adult life stage (Figures 29-35). Choice of target flows should not be reduced below the optimum flow to the point that stream depth is reduced below the level needed for fish passage (Tables 13-19), depending on available water supply.

Discharge estimates providing optimal WUA for juvenile salmonid lifestages are usually less than summer base flows, suggesting a disconnect between the models used and actual juvenile salmonid needs. Reasons for this may include: inability to accurately measure and/or quantify habitat parameters such as, flow velocity, cover, and substrate, at a scale that is meaningful for small fishes; inability to accurately quantify side channels, bank indentations, riparian wetlands, or other lateral habitats that are important for rearing juvenile salmonids; and inability to adequately incorporate temperature, or other water quality parameters, into the model. Thus, until juvenile habitat modeling can be improved, the existing juvenile WUA results should be used with caution in developing flow recommendations.

The selection of a target flow should be based on a hierarchical system of highest priority life stage and species present for the month or period of concern, using the assumption that the priority life stage and species would require higher streamflows than other life stages and species. Table 11 provides some general guidelines. For small tributary streams of the Lemhi River sub-basin, suggested priority life stage ranking would be (from high to low): passage > spawning > adult > juvenile. Once the priority life stage and species are ranked, then each study site should be examined to determine streamflow and passage conditions for the time period of concern.

Once an adequate number of sites have been characterized using PHABSIM, it may be feasible to develop habitat-discharge relations for streams with similar basin characteristics within specific geographic locations. This could possibly provide a regional planning tool that could eliminate intensive site-specific studies.

The natural hydrograph also needs to be considered when developing flow targets. In drought years, summer flows that provide maximum possible habitat may not be attainable because of the hydrologic limits on the stream. Also, PHABSIM does not estimate flow or habitat needs of downstream migrants or spring runoff conditions necessary for maintenance of channel morphology or riparian zone functions. Arthaud and others (2002) have shown that downstream migrant survival can significantly increase with discharge. Thus, high spring flows that mimic the natural hydrograph should be a consideration in managing streamflows outside PHABSIM analysis.

Finally, it should be noted that PHABSIM was designed as a tool to provide science-based linkage between biology and river hydraulics with results to be used in negotiations or mediated settlements (Arthaud et al. 2002).

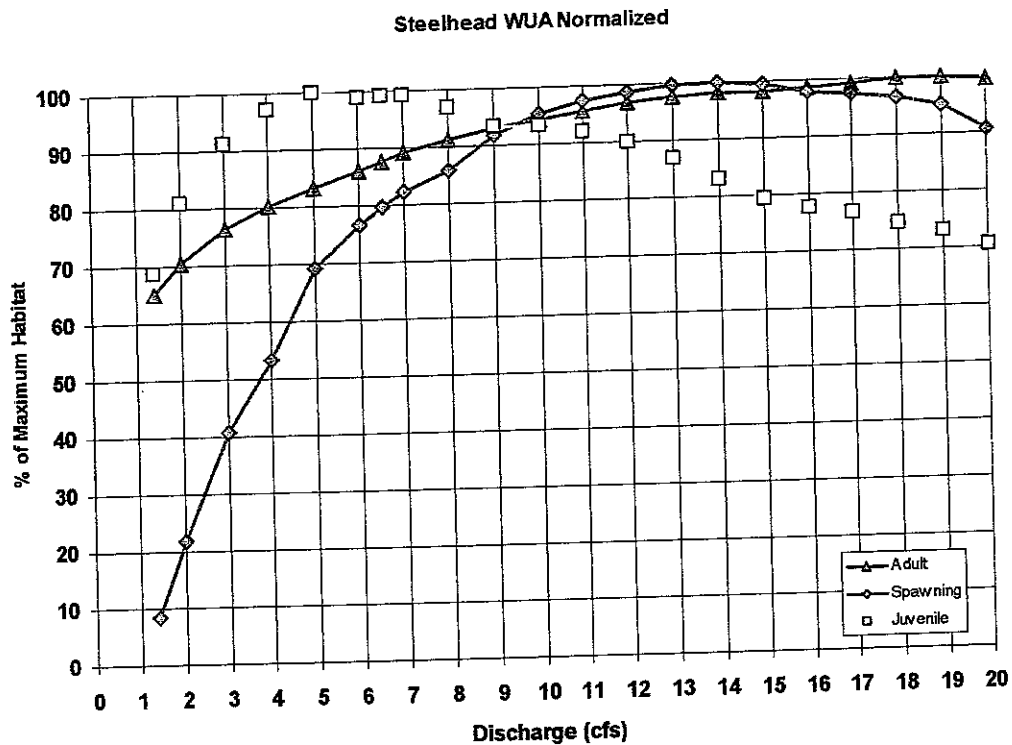


Figure 8. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Study Site 1.

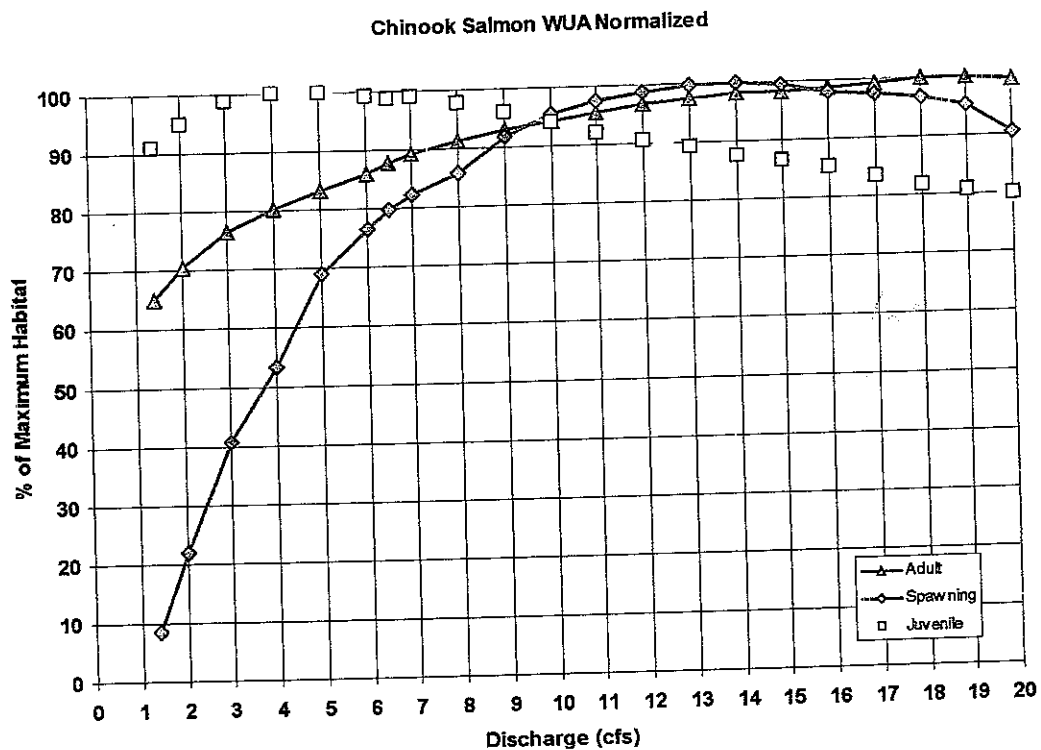


Figure 9. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Study Site 1.

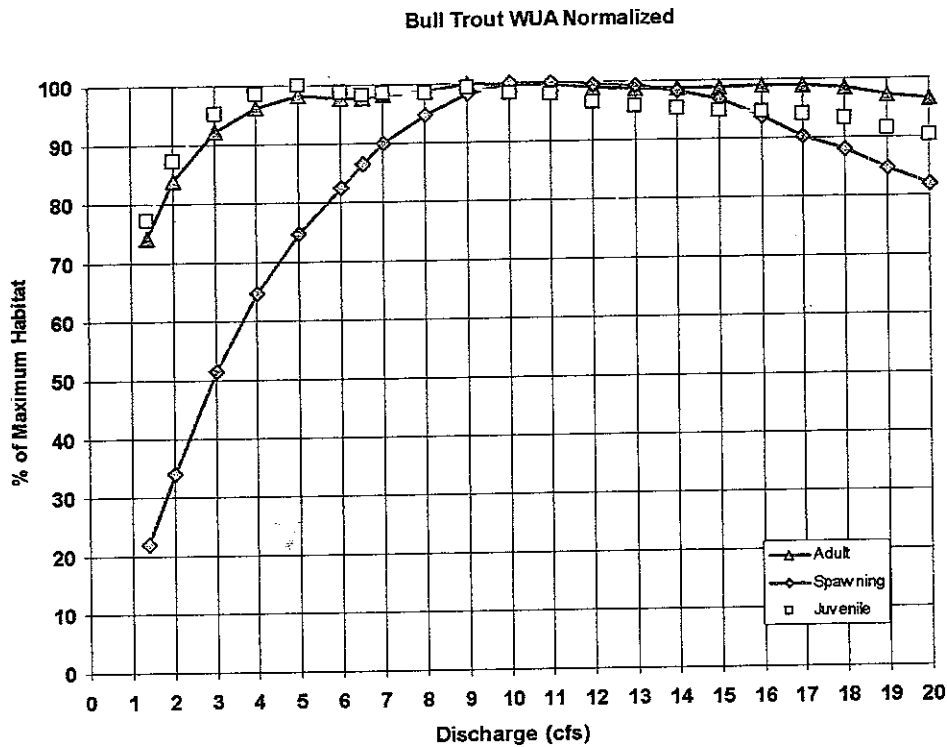


Figure 10. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Study Site 1.

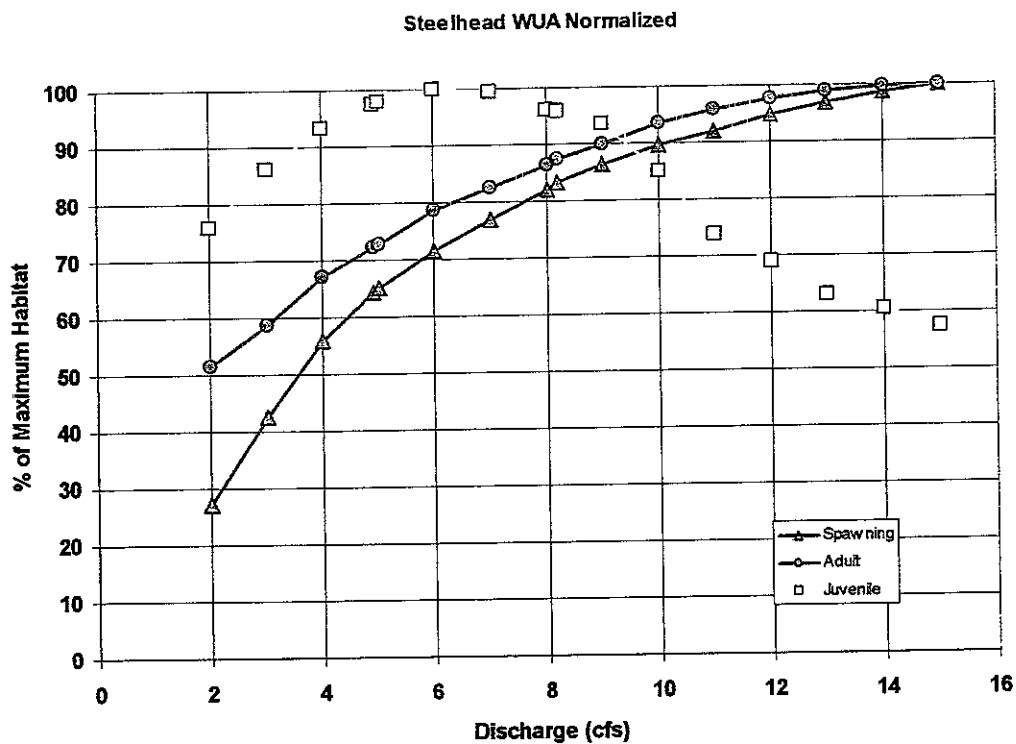


Figure 11. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Study Site 2.

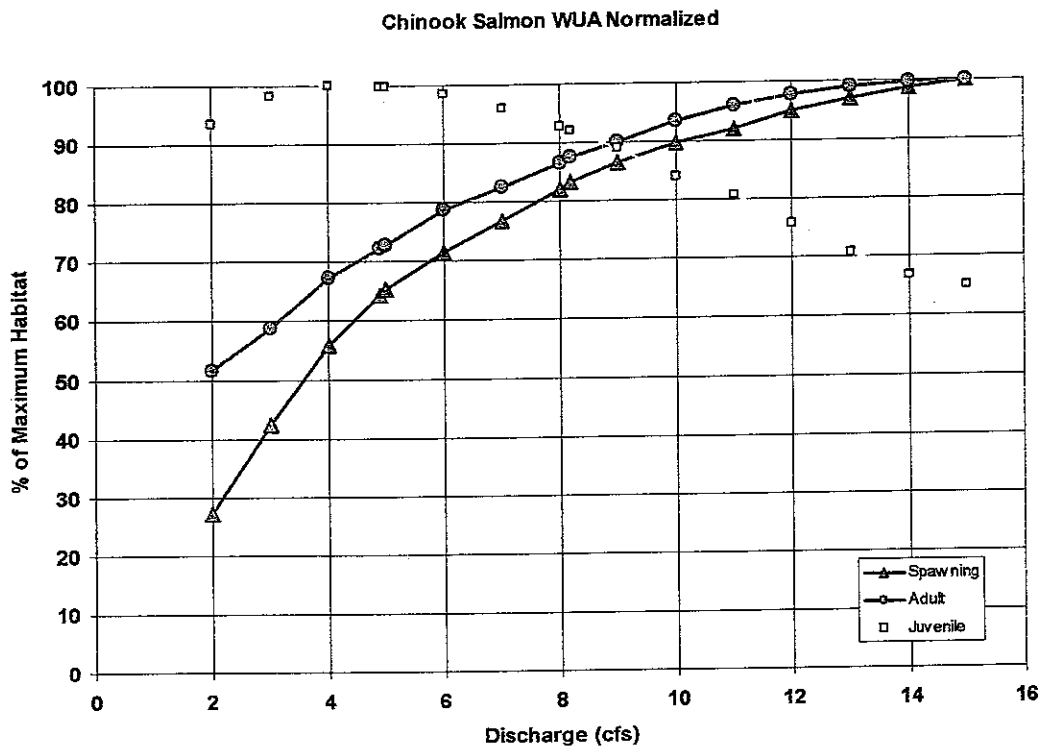


Figure 12. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Study Site 2.

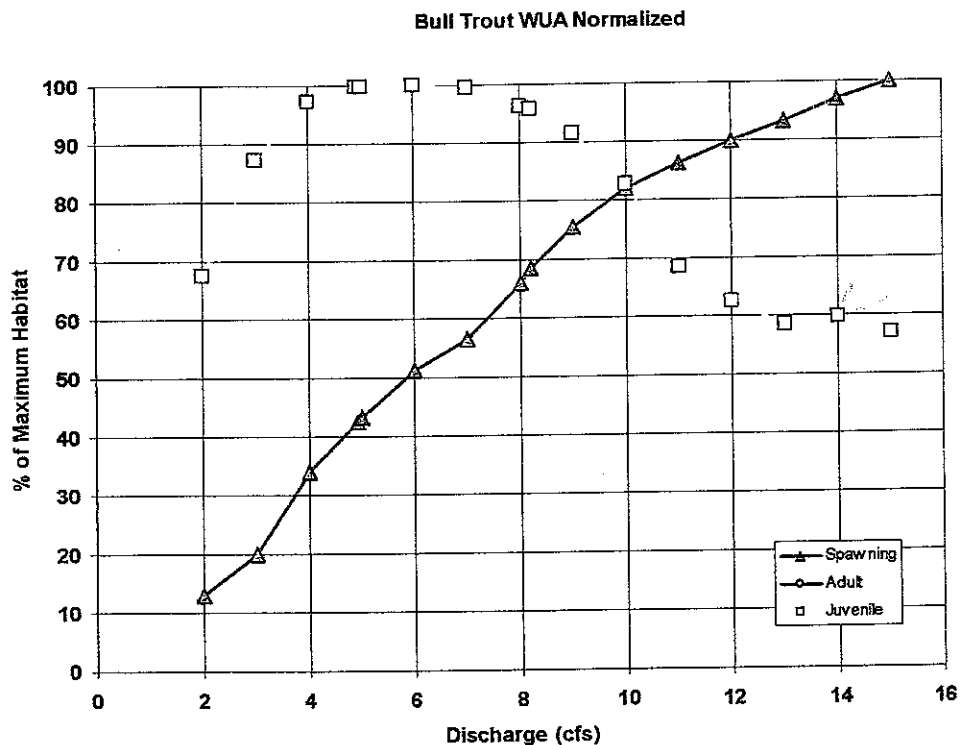


Figure 13. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Study Site 2 (adults same as juveniles).

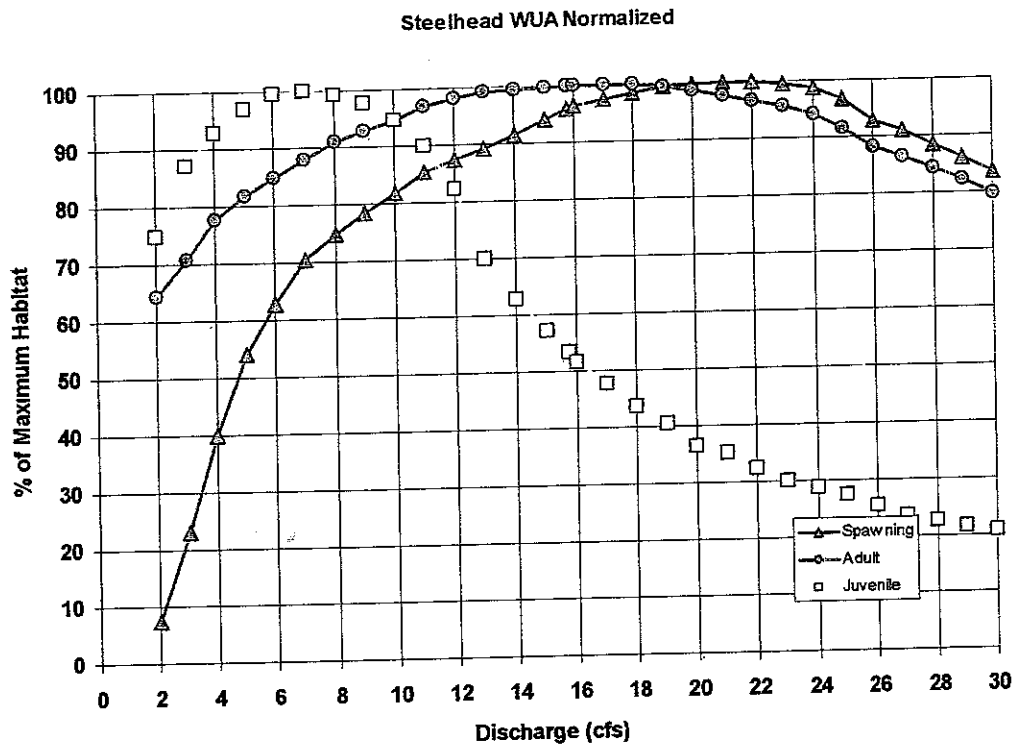


Figure 14. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Study Site 3.

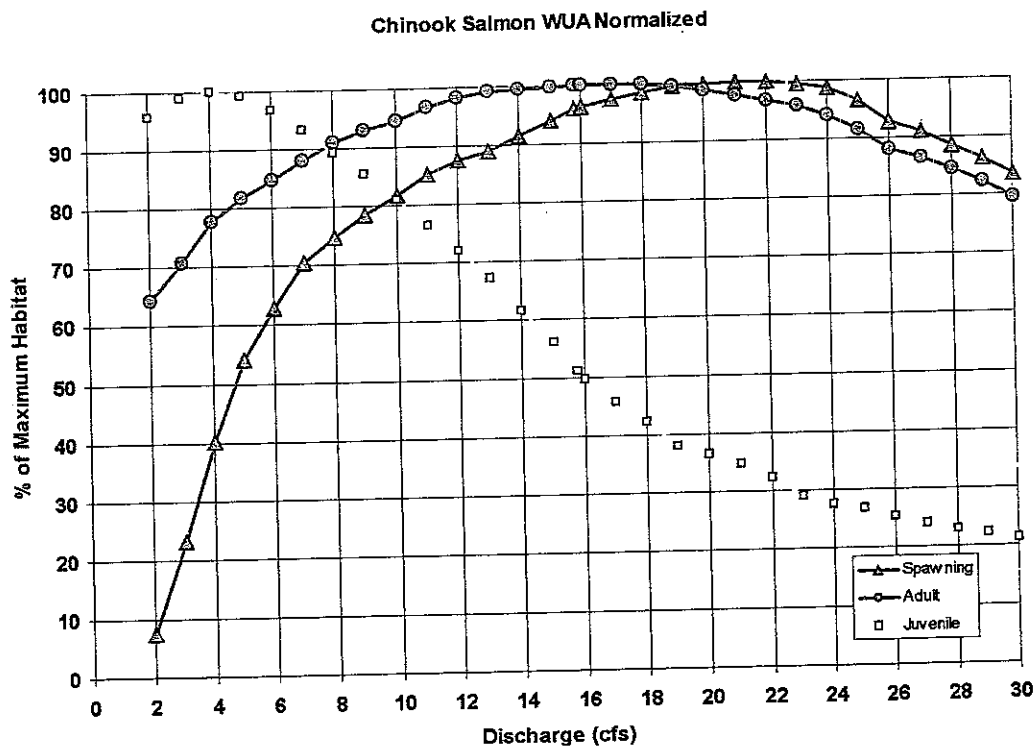


Figure 15. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Study Site 3.

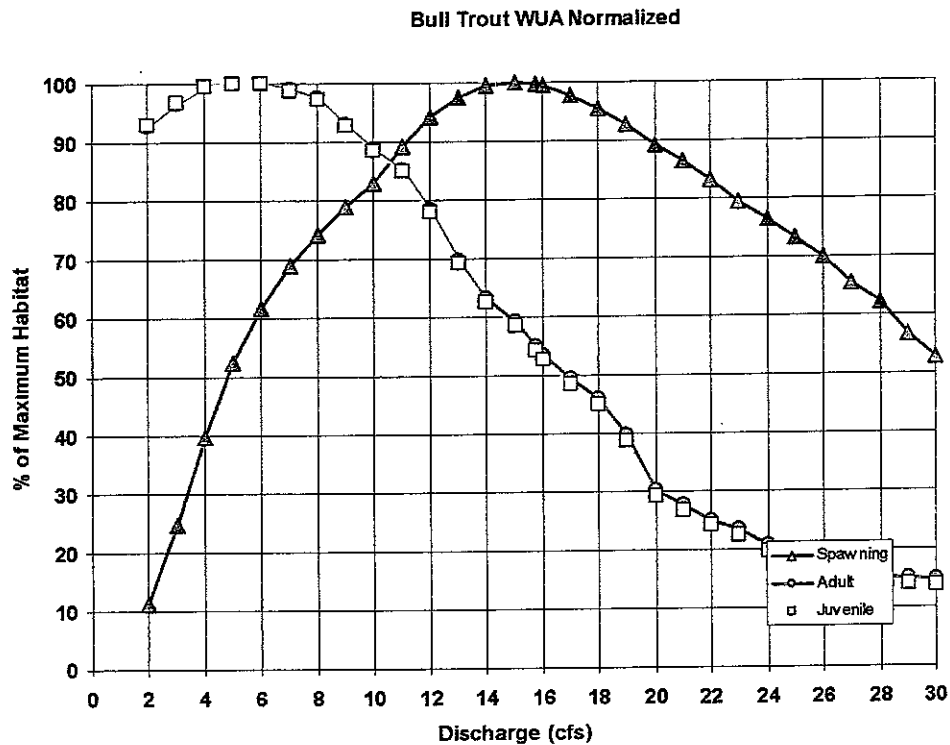


Figure 16. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Study Site 3.

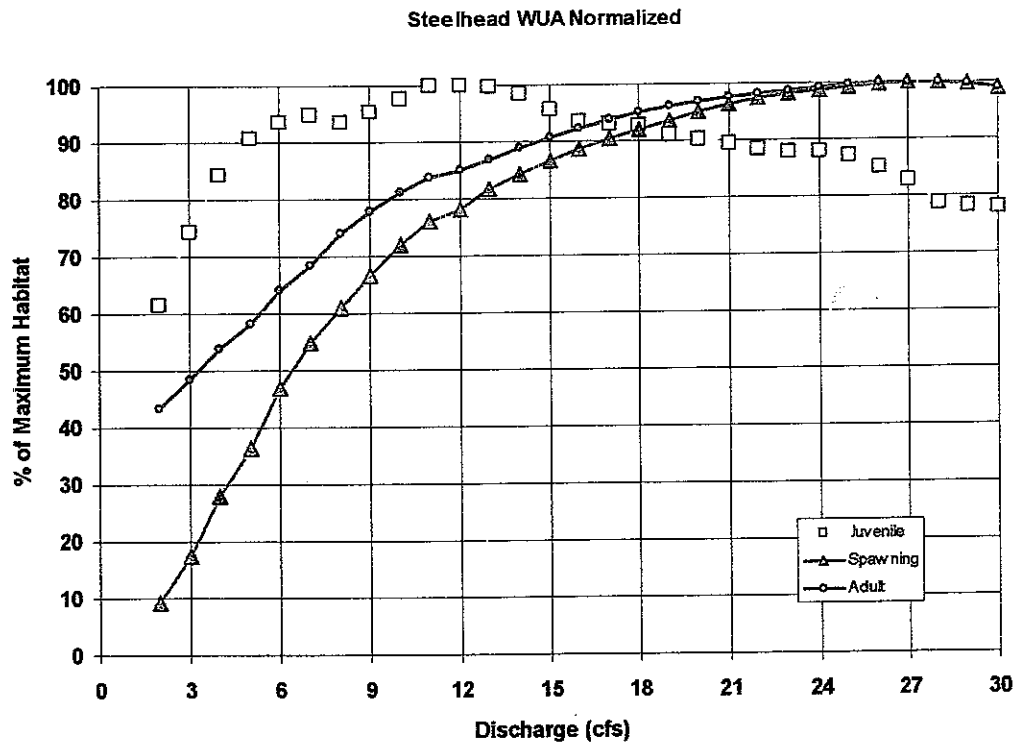


Figure 17. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Study Site 4.

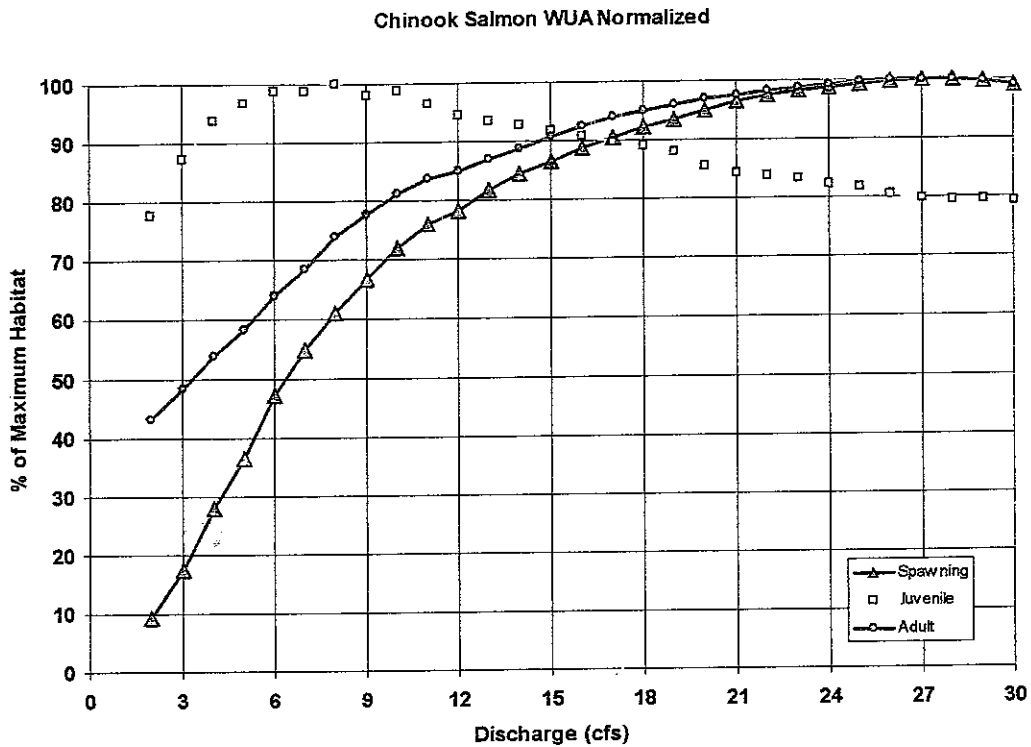


Figure 18. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Study Site 4.

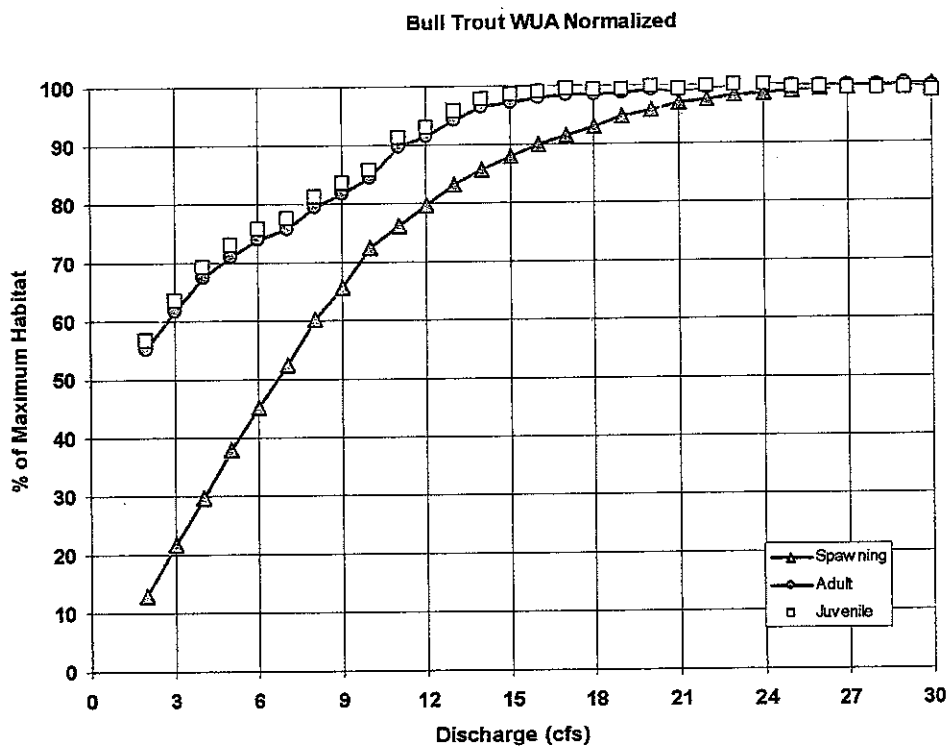


Figure 19. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Study Site 4.

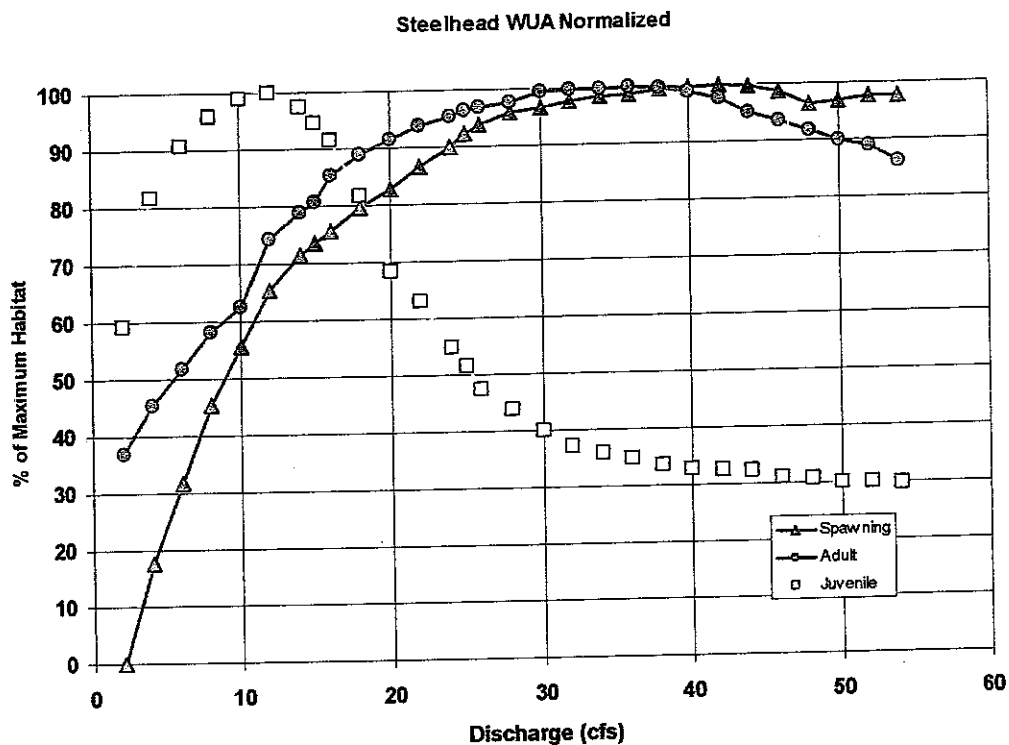


Figure 20. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Study Site 5.

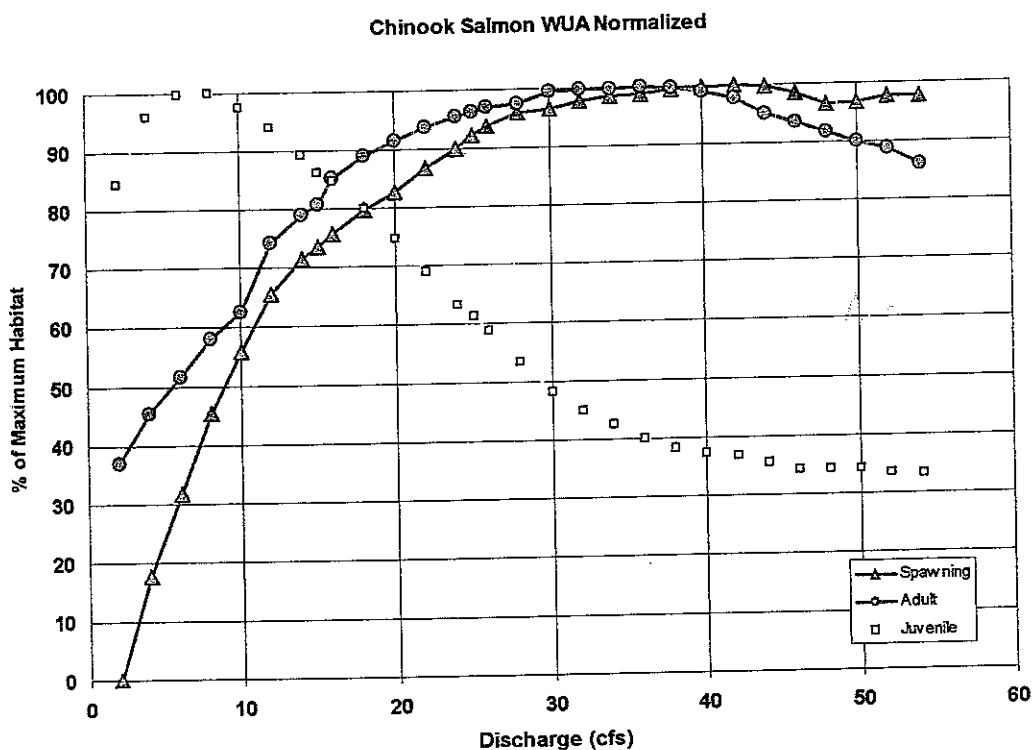


Figure 21. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Study Site 5.

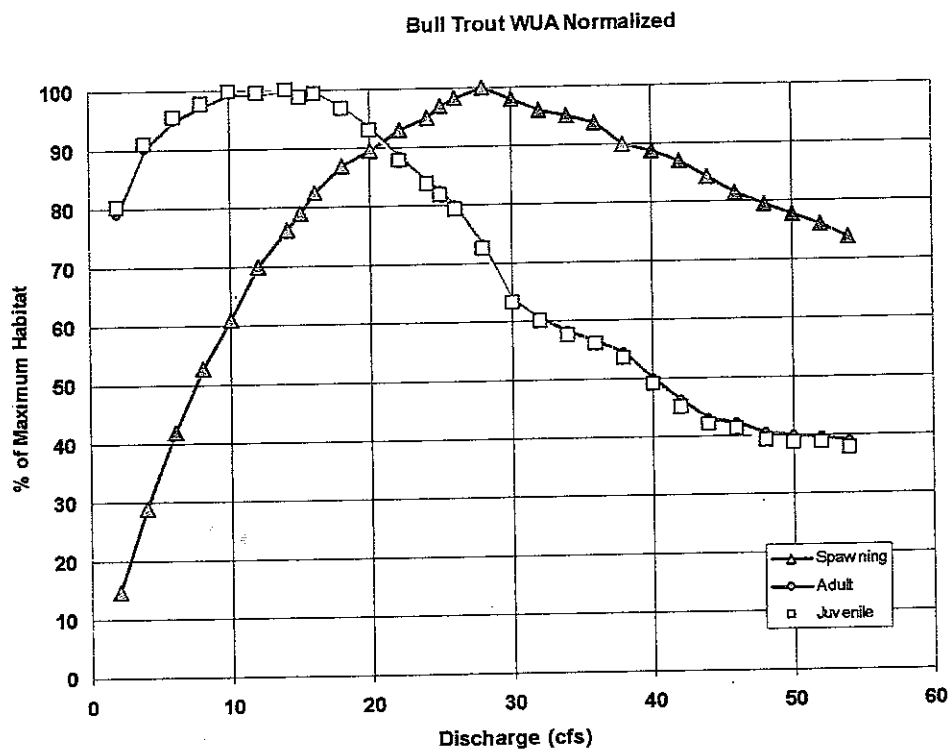


Figure 22. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Study Site 5.

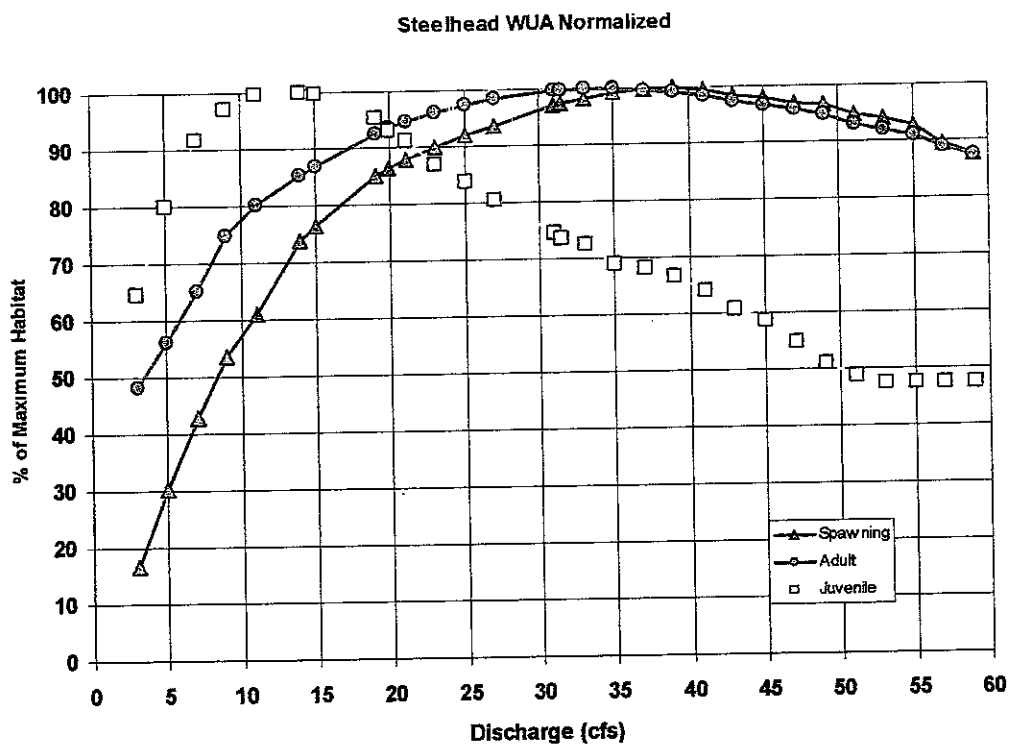


Figure 23. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Study Site 6.

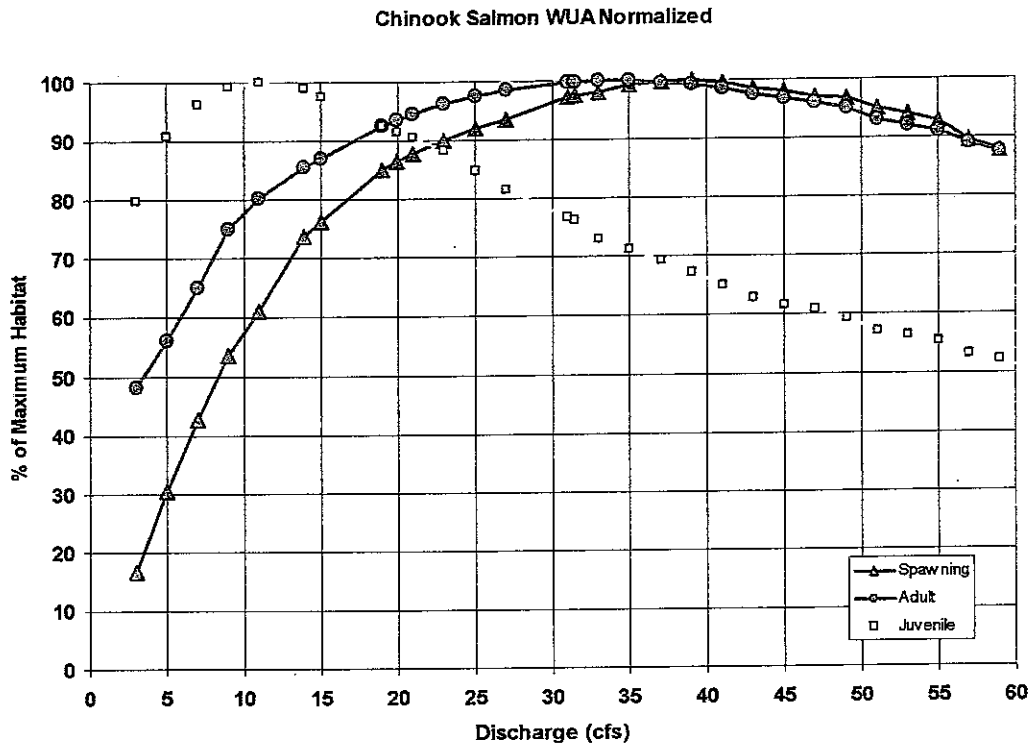


Figure 24. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Study Site 6.

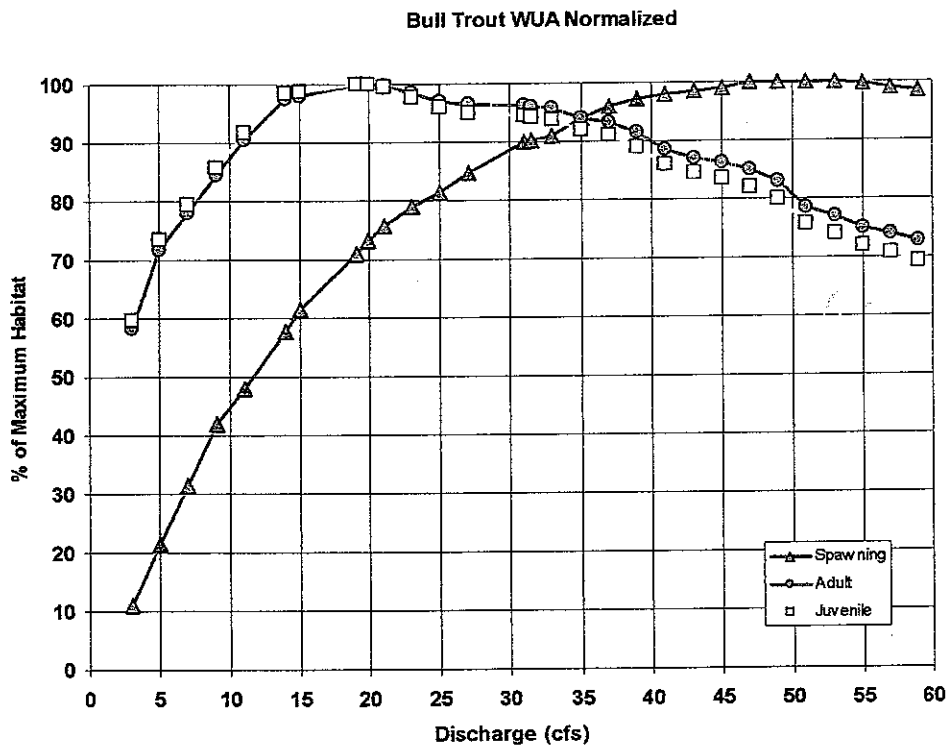


Figure 25. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Study Site 6.

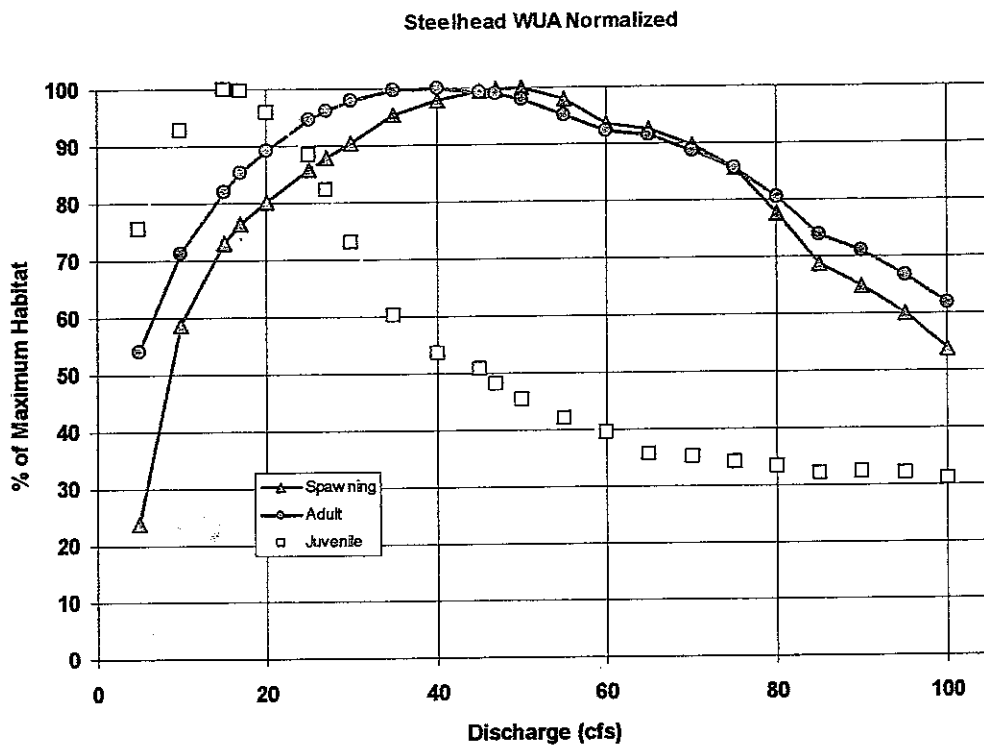


Figure 26. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for steelhead in Big Timber Creek, Reference Site.

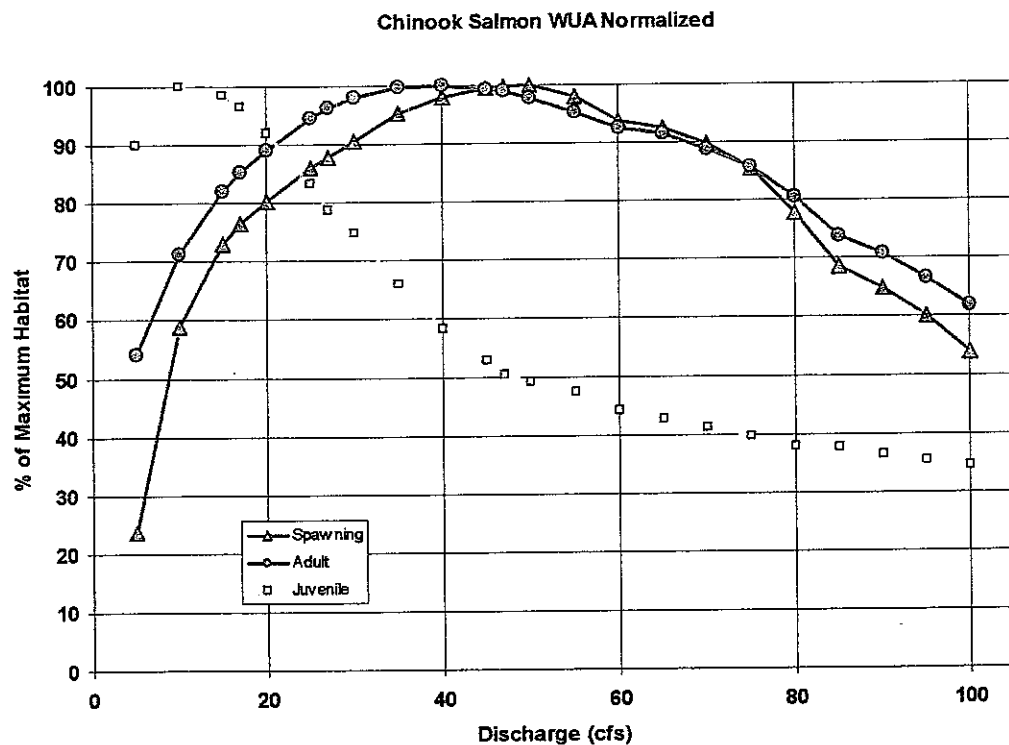


Figure 27. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for Chinook salmon in Big Timber Creek, Reference Site.

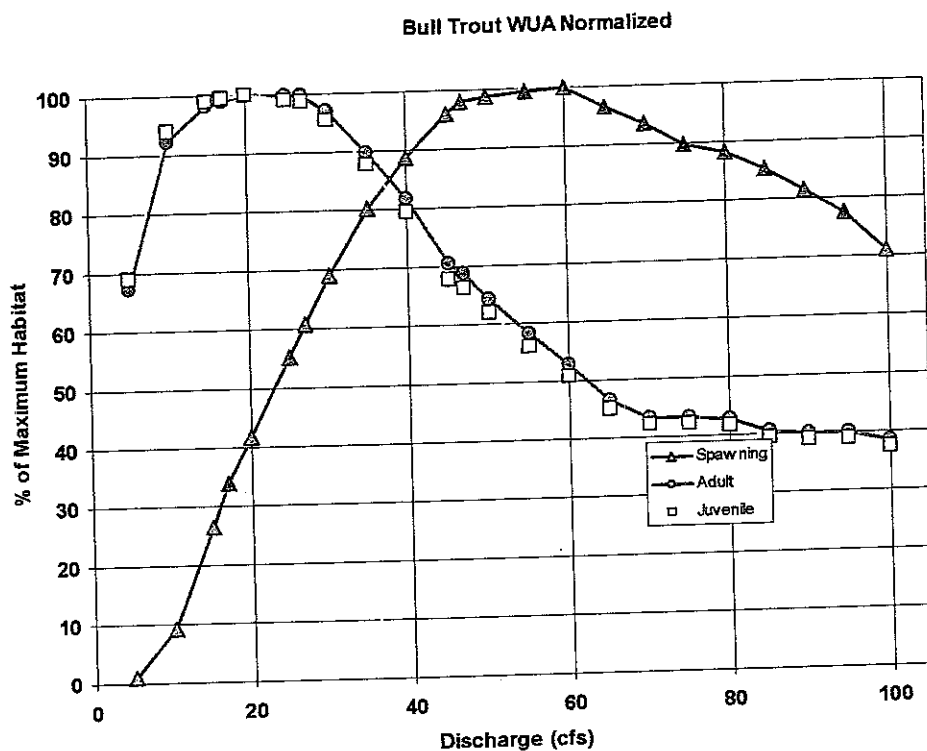


Figure 28. Normalized (% of maximum habitat) weighted usable area (WUA) versus discharge relationships for bull trout in Big Timber Creek, Reference Site

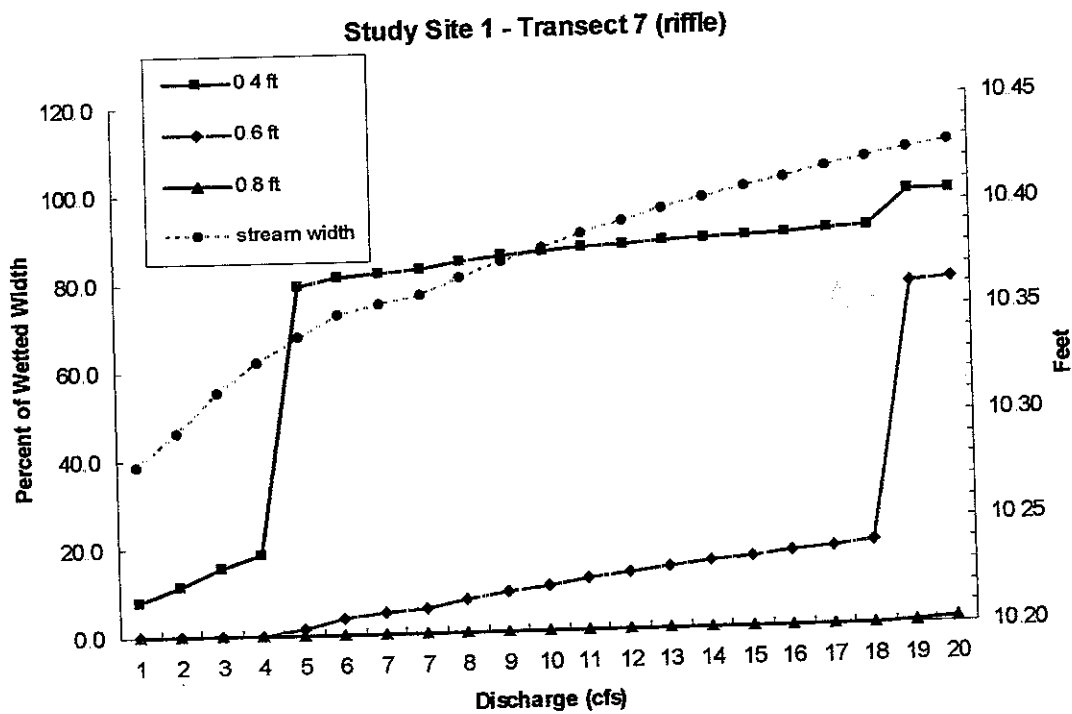


Figure 29. Contiguous widths at depths greater than passage criteria at a riffle transect (56 feet longitudinal distance) on Big Timber Creek, Study Site 1.

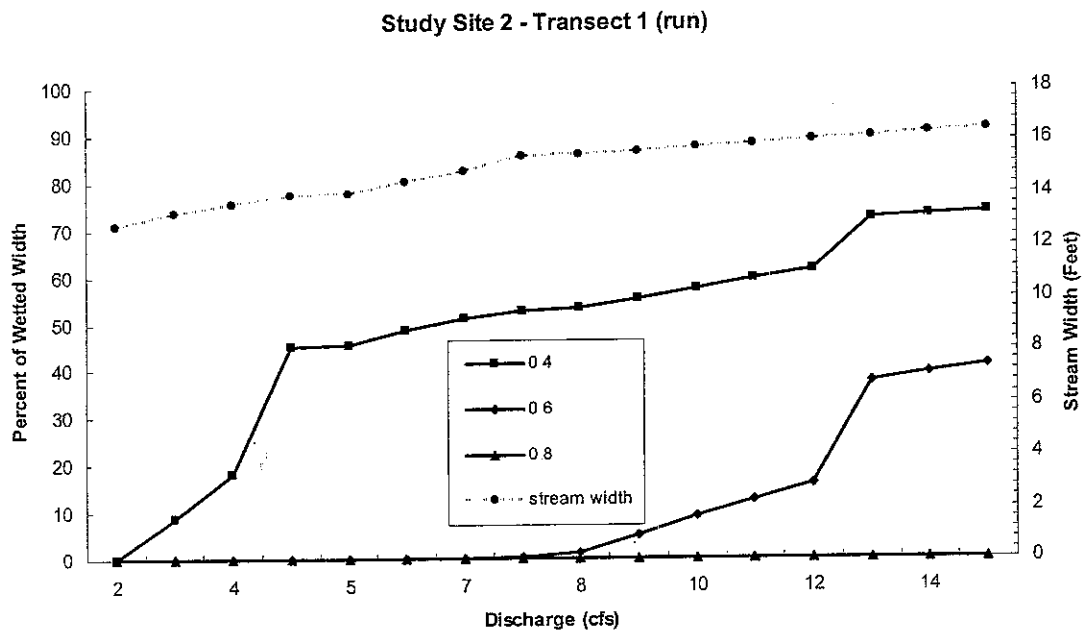


Figure 30. Contiguous widths at depths greater than passage criteria at a run transect (17 feet longitudinal distance) on Big Timber Creek, Study Site 2.

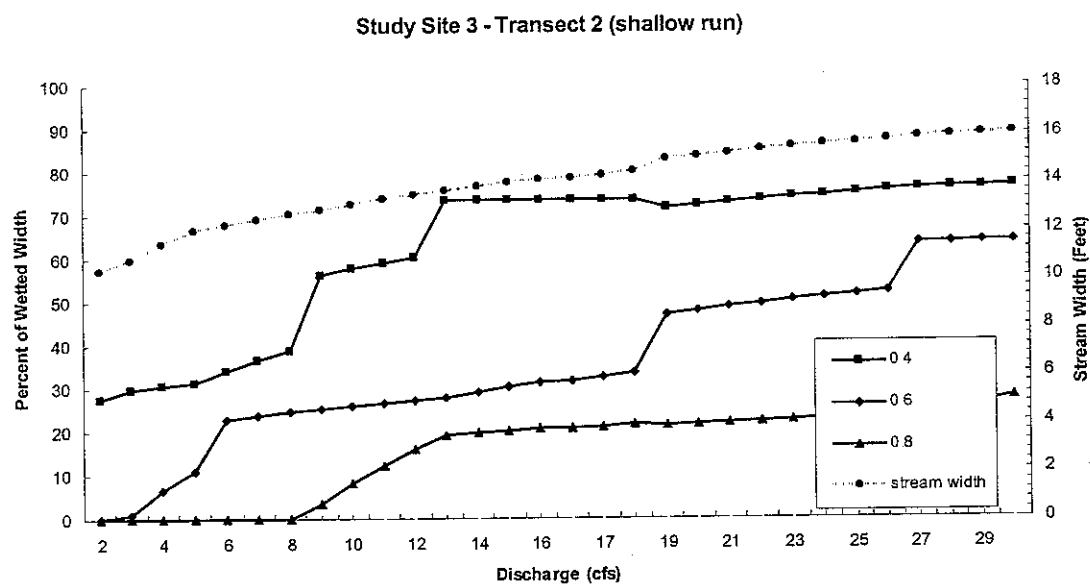


Figure 31. Contiguous widths at depths greater than passage criteria at a run transect (75 feet longitudinal distance) on Big Timber Creek, Study Site 3

Study Site 4 - Transect 1

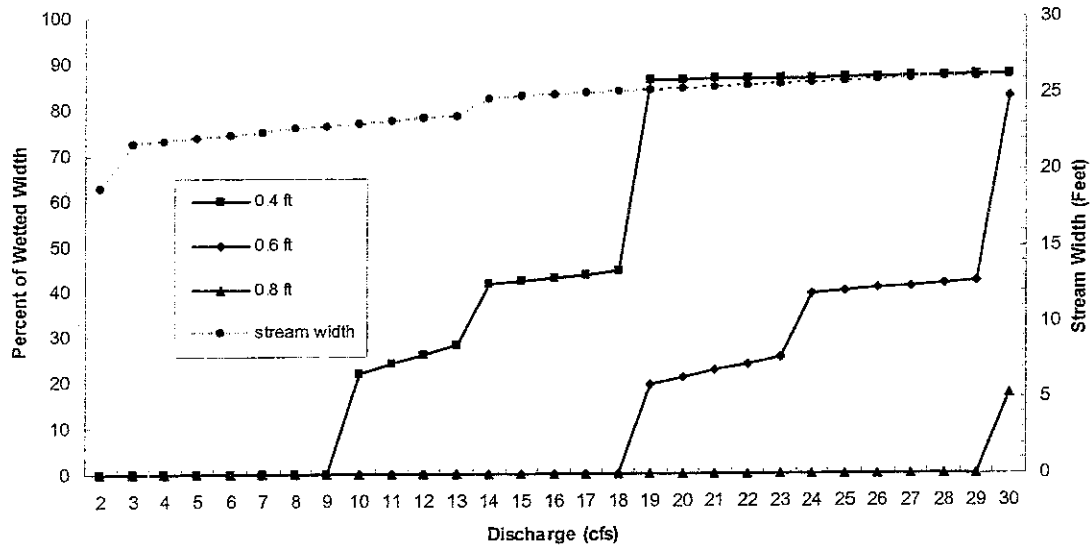


Figure 32. Contiguous widths at depths greater than passage criteria at a riffle transect (17 feet longitudinal distance) on Big Timber Creek, Study Site 4.

Study Site 5 - Transect 5 (riffle)

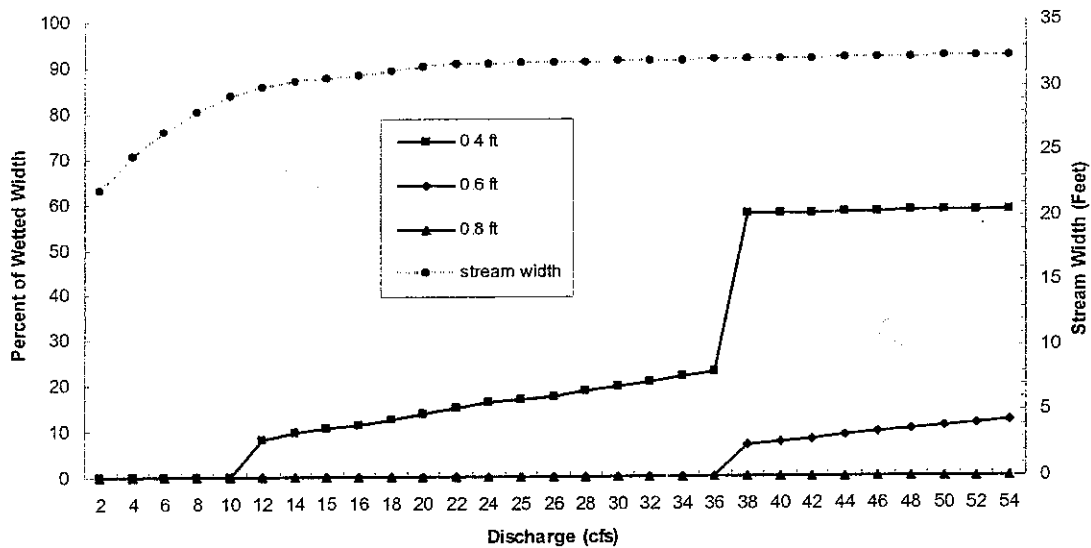


Figure 33. Contiguous widths at depths greater than passage criteria at a riffle transect (30 feet longitudinal distance) on Big Timber Creek, Study Site 5.

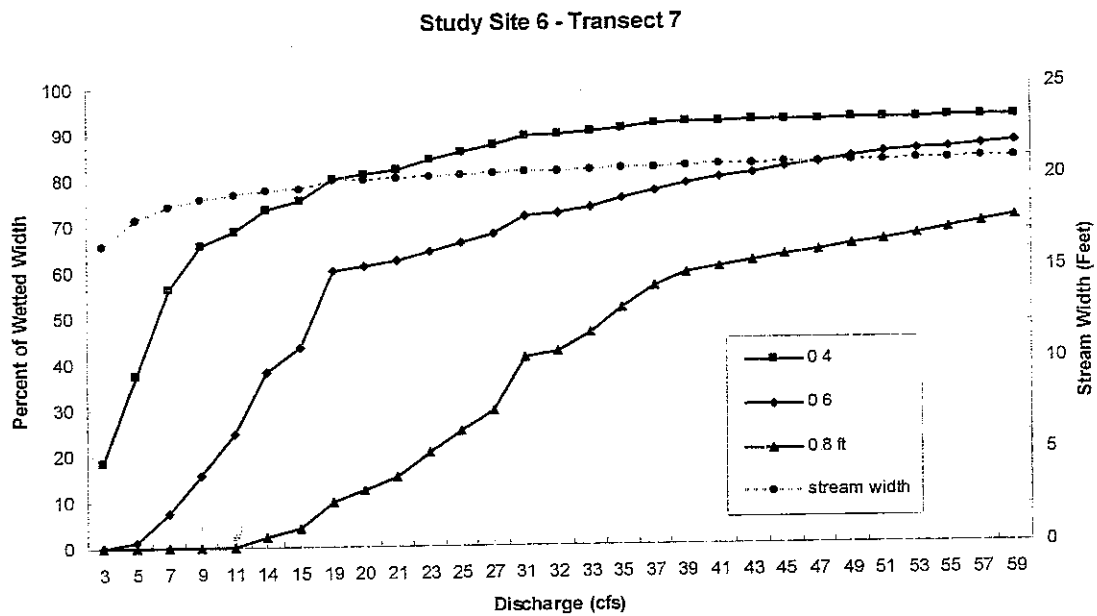


Figure 34. Contiguous widths at depths greater than passage criteria at a shallow run transect (23 feet longitudinal distance) on Big Timber Creek, Study Site 6.

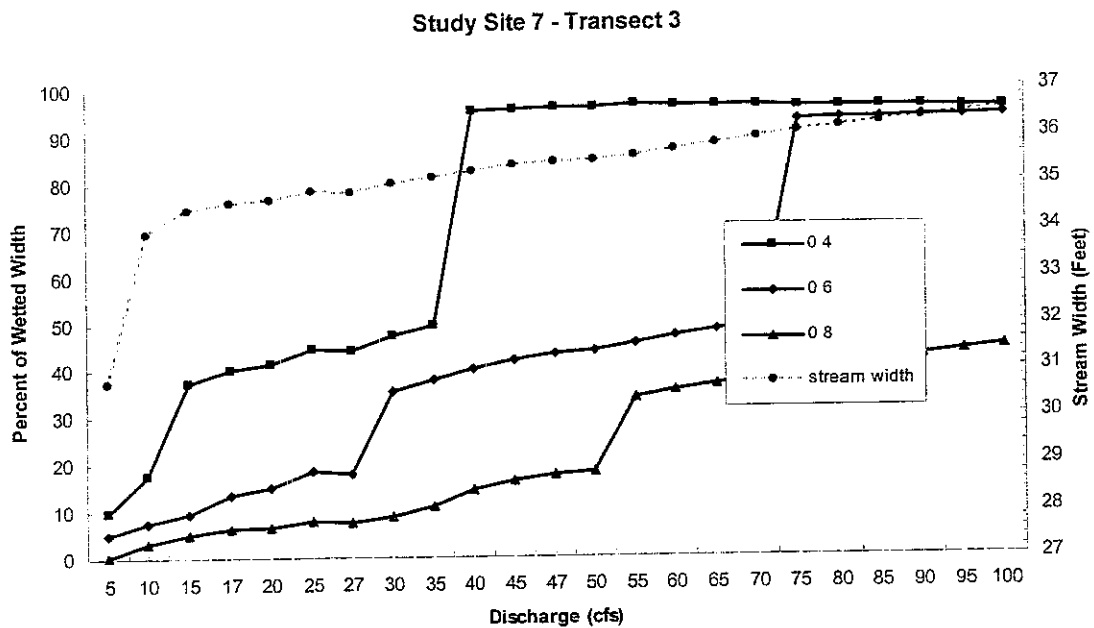


Figure 35. Contiguous widths at depths greater than passage criteria at a riffle transect (22 feet longitudinal distance) on Big Timber Creek, Study Site 7.

Table 13. Habitat modeling summary at Study Site 1 on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	14	14	10	NA ²	NA
Adult	18	18	9	13	10
Juvenile	5	4	5	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

Table 14. Habitat modeling summary at Study Site 2 on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	>15	>15	>15	NA ²	NA
Adult	>15	>15	6	13	11
Juvenile	6	4	6	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

Table 15. Habitat modeling summary at Study Site 3 on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	21	21	15	NA ²	NA
Adult	16	16	6	9	5
Juvenile	7	4	6	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

Table 16. Habitat modeling summary at Study Site 4 on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	28	28	29	NA ²	NA
Adult	27	27	24	19	19
Juvenile	11	8	23	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

Table 17. Habitat modeling summary at Study Site 5 on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	42	42	28	NA ²	NA
Adult	36	36	14	>54	48
Juvenile	12	8	14	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

Table 18. Habitat modeling summary at Study Site 6 on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	39	39	49	NA ²	NA
Adult	35	35	20	11	9
Juvenile	14	11	19	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

Table 19. Habitat modeling summary at Study Site 7 (Reference Site) on Big Timber Creek.

Life Stage	Discharge (cfs) required for optimum weighted usable area (WUA)			Discharge (cfs) required for adult salmonid passage using 0.6 foot depth criterion ¹	
	Steelhead	Chinook salmon	Bull trout	>25% of total channel width	>10% of contiguous channel width
Spawning	50	50	60	NA ²	NA
Adult	40	40	20	15	17
Juvenile	15	10	20	NA	NA

¹ Passage criteria taken from Thompson (1972) and Scott et al. (1981); both width criteria must be met to insure passage.

² NA – Not applicable

6.0 ACKNOWLEDGEMENTS

We thank the numerous representatives from various organizations who contributed to the success of this project. Al Simpson of Reclamation and Greg Lowell of IDFG provided valuable assistance in obtaining landowner permission on private land. Joe Spinazola of Reclamation contributed to the planning and funding of the study. Jim Henriksen of USGS provided quality control of the PHABSIM modeling. Terry Maret, John Hortness, Joseph Bunt, and Alvin Sablan assisted with obtaining valuable hydrology data. Patrick Murphy of IDFG provided recently collected fishery data for Big Timber Creek. Dudley Reiser of R2 Resource Consultants provided useful information on previous PHABSIM work completed for BIA. Representatives on the Interagency Technical Workgroup organized by Reclamation also provided guidance, including Cynthia Robertson (IDFG), Jim Morrow and Donald Anderson (NOAA Fisheries), Jana Brimmer (FWS), and Jude Trapani (BLM).

7.0 REFERENCES

- Armour, C.L. 1991. Guidance for evaluating and recommending temperature regimes to protect fish. U.S. Fish and Wildlife Service Biological Report 90(22). 13 pp.
- Arthaud, D., K. Kratz, K. Vandemoer, and M. Grady. 2002. NMFS-NWR protocol for estimating tributary streamflow to protect salmon listed under the Endangered Species Act. National Marine Fisheries Service Habitat Conservation Division-NWR. Draft. 24 pp. (November 26, 2002).
- Bell, M.C. 1991. Fisheries handbook of engineering requirements and biological criteria. Fish Passage Development and Evaluation Program, U.S. Army Corps of Engineers, North Pacific Division, Portland, Oregon.
- Bjornn, T.C. and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 in W.R. Meehan (ed.), Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society Special Publication 19, Bethesda, Maryland.
- Bovee, K.D. 1997. Data collection procedures for the Physical Habitat Simulation System. U.S. Geological Survey, Biological Resources Division. Fort Collins, CO. 141 pp.
- Bovee, K.D., B.L. Lamb, J.M. Bartholow, C.D. Stalnaker, J. Taylor, and J. Henriksen. 1998. Stream habitat analysis using the instream flow incremental methodology. U.S. Geological Survey, Biological Resources Division. Information and Technical Report USGS/BRD-1998-0004. 131 pp.
- Bugert, R., P. LaRiviere, D. Marbach, S. Martin, L. Ross, and D. Geist. 1990. Lower Snake River compensation plan salmon hatchery evaluation program. 1989

Annual Report to U.S. Fish and Wildlife Service (Cooperative Agreement 14-16-0001-89525)

- Cannamela, D.A. 1992. Potential impacts of releases of hatchery steelhead trout "smolts" on wild and natural juvenile Chinook and sockeye salmon. Idaho Department of Fish and Game, White Paper, Boise.
- EA Engineering Science and Technology. 1991a. Fish species periodicity within the Clearwater and Salmon River Basins, Idaho, Idaho instream flow studies: Redmond, Washington, Prepared for Bureau of Indian Affairs, Portland, Oregon. Variousy paginated
- EA Engineering, Science, and Technology. 1991b. Review, evaluation, and selection of final habitat suitability curves: Idaho instream flow project. Prepared for Bureau of Indian Affairs, Portland, Oregon. Draft.
- Goetz, F. 1989. Biology of the bull trout *Salvelinus confluentus*: a literature review U.S. Department of Agriculture, Forest Service, Willamette National Forest, Eugene, Oregon.
- Hortness, J.E. and C. Berenbrock. 2001. Estimating monthly and annual streamflow statistics at ungaged sites in Idaho. USGS Water Resources Investigations Report 01-4093. 15 pp.
- Idaho Administrative Code. <http://www2.state.id.us/adm/adminrules/rules/idapa58/58index.htm>.
- Idaho Department of Environmental Quality (IDEQ). 1999. Lemhi River watershed TMDL. June.
- Murphy, P and M. Horsmon. 2004. Big Timber Creek Fisheries Report. Draft. Idaho Department of Fish and Game Anadromous Screen Program. Bonneville Power Administration Fish Screen Improvement Project #1994-015-00 74 pp.
- Nickelson, T.E., J.W. Nicholas, A.M. McGie, R.B. Lindsay, D.L. Bottom, R.J. Kaiser, and S.E. Jacobs. 1992. Status of anadromous salmonids in Oregon coastal basins. Oregon Department of Fish and Wildlife, Research and Development Section, Corvallis, and Ocean Salmon Management, Newport, Oregon.
- NMFS (NOAA Fisheries). 2002. Maintenance of Essential Fish Habitat While Proposing to Withdraw and Review Critical Habitat Designations for 19 ESU's of Pacific salmon and steelhead. NOAA Fisheries. Washington, D.C. (March 11, 2002).
- Northwest Power Planning Council (NPPC). 2001. Draft Salmon Subbasin Summary. November 30.

- Scott, M., Contreras, G., Forsgren, H., Reynoldson, K., and McDevitt, G.,
1981, Anadromous fish instream flow needs and conflicts within the
Sawtooth National Recreation Area: U.S. Forest Service, 46 p.
- Simpson, J. C. and R. L. Wallace. 1982. Fishes of Idaho. The University Press of
Idaho. Moscow, ID
- Thompson, K. E. 1972. Determining stream flows for fish life. Proceedings of the
instream flow requirements workshop, Pacific Northwest River Basins
Commission, Portland, Oregon. Pp. 31-50
- U.S. Geological Survey (USGS). 2001. PHABSIM for Windows User's Manual and
Exercises. Midcontinent Ecological Science Center. Open file report 01-340.

LEMHI RIVER SUB-BASIN ASSESSMENT

An Assessment of Resource Conditions and Issues within the
Watersheds of the Lemhi River Valley.

Prepared for
Principal Working Group
Lemhi County Riparian Conservation Agreement

Draft Document for Watershed Advisory Group Review

February, 1998



BIG TIMBER CREEK WATERSHED

WATERSHED DESCRIPTION

General

The Big Timber Creek watershed, located approximately 50 miles southeast of Salmon, enters the Lemhi River near the town of Leadore. The watershed encompasses 55,275 acres of combined private, State and federally managed lands. The lower portions of Big Timber Creek are mostly on private property stretching east toward Leadore. There are a few isolated pieces of BLM adjacent to this lower section of stream that are part of the Timber Creek and Leadore Hill allotments.

The landscape has a few rolling hills that attract the viewers eye. These are deposits of glacial moraine that are covered by sagebrush/grass communities. Large areas of irrigated land occupy the lower portions of the watershed. Slopes in the lower portion of the watershed are less than 5% for the most part. West of Big Timber Creek, a knoblike ridge with 20% slopes isolates the stream from the main road that bisects the area lengthwise. The topography is fairly gentle, when compared to most other watersheds within the EMA, since only 10% of area exceeds 40% slope. Elevation varies from 6,000 feet in the flats near Leadore, to 10,000 feet, at the hydrologic divide which forms the western boundary. Aspect is generally easterly to northeasterly.

Acreage and stream ownership distribution is shown in Table 5.

	Total	BLM	USFS	State	Private
Watershed Acres	55,275	3,959	43,162	63	8,090
Mainstem Stream Miles	19.1	3.0	12.5	0.0	3.6
Watershed Stream Miles	62.5	5.6	47.0	0.0	9.9
Percent Watershed Acres	100%	7.2%	78.1%	0.1%	14.6%
Percent Watershed Stream Miles	100%	8.7%	75.4%	0.0%	15.9%

Climate

Precipitation varies with elevation and aspect. The lower elevation, flat areas and gentle slopes near Leadore tend to receive 8 to 11 inches of precipitation, while the steeper and wettest sites receive up to 23 inches annually, mostly in the form of snow. Climatic records from the Leadore area, show the following:

average annual temperature: 36 degrees F
 maximum temperature: 99 degrees F
 minimum temperature: -38 degrees F

average annual precipitation: 7.47 inches
 maximum annual precipitation: 10.7 inches
 minimum annual precipitation: 6.2 inches

Water Body Description

Big Timber Creek has a mainstem base flow of approximately 45 cfs before diversions begin to affect water quantity. Near the town of Leadore, the base flow is down to around 5 cfs before the final diversions remove the remainder of the water. The mean annual flow is 38.6 cfs. The North Fork Little Timber has a mean annual flow of 10.5 cfs and the Middle Fork is 7.5 cfs. Stream gradient is generally slight, ranging from 1 to 4% across most of the B channel. Higher up in the watershed, however, stream gradient exceeds 4% for 39% of the stream length, in the A channel. Both forks of Little Timber are much higher gradient systems. Big Timber has several important tributaries, including Little Timber, Trail, Cabin, Squirrel, Rocky and Basin Creeks. There are also many smaller tributaries and springs within the watershed.

There are numerous unscreened diversions and one large diversion dam on Big Timber Creek, which have been in place and used since the late 1800's. During the irrigation season, Big Timber Creek is dewatered by the time it reaches the Lee Creek Road, about one mile west of Leadore. The single largest diversion occurs at the Carey Act dam, which is located just below where Big Timber Creek leaves the canyon and enters the flats. There are three other diversions on BLM lands along Big Timber Creek and one diversion on Little Big Timber.

There are 34 water rights claims on Big Timber Creek, totalling 102.54 cfs for the period March 15 to November 15, and an additional claim for 2.1 cfs for the period April 1 to November 1. There are also 13 water rights claims on Little Timber Creek totalling 50.5 cfs for the period March 15 to November 15.

Soils

Soil information is presented below, broken out by parent material (i.e. sedimentary, volcanic, granitic), landtype, and landform.

Granite

Landtype Association 30G - Cryic Uplands (G109as-1, 109bs-1)

Landform - This association contains the broad, gently-sloping ridgetops and mountain slopes which occur at high elevations (above 7,600 feet) in the granitics. The dominant slope-forming process has been the action of freezing and thawing. Slope gradients generally range from 15 to 50 percent. These lands do not show evidence of glaciation, however, the influence of glacial climates has been a very important element in their formation.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures range from sandy loam to sand. Coarse fragments are mainly gravels that occur in moderate amounts generally more than 35 percent. These soils usually have a low water-holding capacity because of the soils coarse textures.

The inherent erosion hazard of these soils is low to high (depending on slope), the debris slide hazard is low, the surface creep hazard is low to moderate, the slump hazard is very low and the revegetation potential is fair on the cool-moist aspects to poor on the hot-dry aspects.

The major soils are Typic Cryochrepts and Typic Cryoboralfs. Families are sandy-skeletal, mixed and loamy-skeletal, mixed.

Landtype Association 50G - Glacial Troughlands (G111a, 111a-R, 111b, 111bs-1)

Landform - This association includes the U-shaped valleys that have been carved and shaped in granitic bedrock by moving valley glaciers. They are generally in elevation above 7,600 feet. These valleys have steep concave sideslopes and gently-sloping, wide valley bottoms. These lands occur adjacent to and below high peaks, rocky ridges and cirque basins. Moraines occur within the valleys and on lower sideslopes of these glaciated lands.

Soils - The soils developed on these lands are mostly shallow (less than 20 inches) on the sideslopes with some moderately deep (20-40 inches) soils in the valley bottoms. Soil textures range from loamy sand to sandy loam. Coarse fragments are mainly gravels and cobbles that occur in moderate amounts, generally greater than 35 percent. These soils usually have a low water-holding capacity due to the soil coarse textures.

The inherent erosion hazard of these soils is moderate to very high, the debris slide hazard is moderate to high, the surface creep hazard is moderate to high, the slump hazard is low, and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the dry-hot aspects.

The major soils are Mollic Cryoborolls, Dystric Cryochrepts and Typic Cryochrepts. Families are sandy-skeletal, mixed, and loamy-skeletal, mixed. Because of these hazards and the high amounts of water handled by these lands, soil-disturbing activities (especially on the sideslopes) could lead to significant erosion and sedimentation.

Quartzite

Landtype Associations 20Q - Mountain Slope Lands (Q120's, 130, 133, 140)

Landform - This association is comprised of the moderately-steep mountain slopes which have been formed primarily by stream-cutting action in the quartzite bedrock. Slopes may be smooth with gradients generally range between 40 to 65 percent. Valleys are V-shaped and ridges are fairly sharp and may be dissected by many small V-shaped drainages. These lands are usually found at elevations above 5,500 feet.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures range from loam to sandy loam. Coarse fragments are mainly angular cobble and gravel that occur in high amounts, generally greater than 35 percent.

The inherent erosion hazard of these soils is low to moderate, the debris slide hazard is very low to moderate, the surface creep hazard is very low to moderate, the slump hazard is low, and the revegetation potential is fair to good on the cool aspects, but fair to poor on the warm to hot aspects.

The major soils are Typic Cryoborolls, Argic Lithic Cryoborolls, Argic Pachic Cryoborolls, Typic Cryorthents, Typic Cryochrepts, Mollic Cryoborolls, Argic Cryaquolls and Cumulic Cryaquolls. Families are loamy-skeletal, mixed; sandy-skeletal, mixed; loamy-skeletal, mixed, nonacid; sandy, mixed, shallow; clay-skeletal, mixed; sandy, mixed; fine-loamy, mixed; coarse-loamy, mixed and fine-silty, mixed.

Landtype Association 30Q - Cryic Uplands (Q109's)

Landform - This association contains the broad, gently-sloping ridgetops and mountain slopes which occur at high elevations (above 6,000 feet usually) in the quartzites. The dominant slope-forming process has been the action of freezing and thawing. Slope gradients generally range from 15 to 50 percent. These lands do not show evidence of glaciation, however, the influence of glacial climates has been a very important element in their formation.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures range from sandy loam to loam. Coarse fragments are mainly cobbles, gravels, and stones that occur in high amounts, generally more than 35 percent.

The inherent erosion hazard of these soils is low to moderate, the debris slide hazard is very low to low, the surface creep hazard is very low to low, the slump hazard is very low, and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the south aspects.

The major soils are Typic Cryorthents, Typic Cryochrepts, Typic Cryoborolls, and Argic Cryoborolls. Minor soils are Typic Cryoborolls, Glossic Cryoborolls, Mollic Cryoborolls, Cryic Paleborolls, Dystric Cryochrepts, Argic Cryaquolls and Cumulic Cryaquolls. Families are sandy-skeletal, mixed; loamy-skeletal, mixed; fine-silty, mixed; loamy-skeletal, mixed, nonacid; fine-loamy, mixed; coarse-loamy, mixed; clayey-skeletal, montmorillonitic and fine, montmorillonitic. Wet areas generally contain Argic Cryaquolls.

Landtype Association 50Q - Glacial Troughlands (Q111a, 111b, 111c)

Landform - This association includes the U-shaped valleys that have been carved and shaped in quartzite bedrock by moving valley glaciers. They are generally in elevations above 6,800 feet. These valleys have steep concave sideslopes and gently sloping, wide valley bottoms. These lands occur adjacent to and below high peaks, rocky ridges and cirque basins. Major mountain in this landtype association in the Lemhi Mountain Range is Junction Peak, at 10,608 feet. Glacial moraines occur within the valleys and on lower sideslopes of these glaciated lands.

Soils - The soils developed on these lands are mostly shallow (less than 20 inches) on the sideslopes with some moderately deep (20-40 inches) to deep (greater than 40 inches) soils in the valley bottoms. Soil textures range from loam to sandy loam. Coarse fragments are mainly gravels and cobbles that occur in moderate to high amounts generally more than 35 percent.

The inherent erosion hazard of these soils is low to moderate, the debris slide hazard is moderate to high, the surface creep hazard is low to moderate, the slump hazard is low, and the revegetation potential fair to good on the cool-moist aspects and fair to poor on the south aspects.

The major soils are Typic Cryoborolls, Pachic Cryoborolls, Argic Cryaquolls, and Cumulic Cryaquolls. Families are loamy-skeletal, mixed and fine-silty, mixed.

Because of these hazards and the high amounts of water handled by these lands, soil-disturbing activities (especially on the sideslopes) could lead to significant erosion and sedimentation.

Landtype Association 60Q - Strongly Glaciated Lands (Q110, 111d, 113)

Landform - This association is comprised of the high-elevation lands which have been strongly modified by alpine glaciation. Cirques, cirque basins, headwalls, high peaks, and ridges adjacent to the cirques have been carved by glaciers and dominate the landscape. Elevations are above 6,800 feet. Bedrock is quartzite and sideslopes are often in excess of 60 percent. The cirque basins have gentler slopes. Talus and rock outcrop are common in these lands.

In this landtype association in the Lemhi Mountain Range are the following lakes and mountain peaks: North Fork Little Timber Creek Lakes, Middle Fork Little Timber Creek Lakes, Gunsight Peak at 10,835 feet, Rocky Peak at 10,551 feet and Yellow Peak at 10,968 feet.

Soils - The soils developed on these lands are mostly shallow (less than 20 inches) on the sideslopes with moderately deep (20-40 inches) to deep (greater than 40 inches) soils in the cirque basins. Soil textures range from loam to sandy loam. Coarse fragments include gravels, cobbles and stones that occur in high amounts, greater than 35 percent.

The inherent erosion hazard of these soils is moderate to high, the debris slide hazard is low to moderate, the surface creep hazard is low to moderate, the slump hazard is very low, and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the south aspects.

The major soils are Lithic Cryorthents, and Typic Cryochrepts. Minor soils of Dystric Cryochrepts, Argic Cryaquolls and Cumulic Cryaquolls. Families are loamy-skeletal mixed; fine-silty, mixed and sandy-skeletal mixed. Dystric Cryochrepts are found at high elevations with high rainfall and the Argic Cryaquolls and Cumulic Cryaquolls are found in the wet meadow areas.

Because of the short growing seasons and relatively poor soil development, the effects of soil disturbance are generally longer-lived here than in other types of land.

Volcanic

Landtype Association 20V - Mountain Slopelands (V120, 125, 130, 133)

Landform - This association is comprised of the moderately-steep mountain slopes which have been formed primarily by stream-cutting action in the volcanic bedrock. Slopes may be smooth or may be dissected by many V-shaped drainages and with gradients generally ranging between 40 to 65 percent. Valleys are V-shaped and ridges are fairly sharp. These lands are usually found at elevations between 5,600 and 8,600 feet.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures range from sandy loam and silt loams in the rhyolites to clay loams in the basalts. Coarse fragments are mainly gravel and cobble that occur in moderate amounts, generally greater than 35 percent.

The inherent erosion hazard of these soils is moderate to high, the debris slide hazard is low to moderate, the surface creep hazard is low to moderate, the slump hazard is moderate to high, and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the south aspects.

The major soils are Typic Cryoborolls, Argic Cryoborolls, Pachic Cryoborolls, Lithic Cryoborolls, Argic Pachic Cryoborolls, Argic Lithic Cryoborolls, Boralfic Cryoborolls, Mollic Cryoborolls, Typic Cryorthents, Typic Cryaquolls, Argic Cryaquolls, Cululic Cryaquolls and Typic Cryoboralfs. Families are sandy-skeletal, mixed; loamy-skeletal, mixed; fine-loamy, mixed; fine, montmorillonitic, clayey-skeletal, montmorillonitic; coarse-loamy, mixed and loamy-skeletal, mixed, nonacid.

Because of the variability of inherent erosion on these soils, project level on-site assistance for soils is advisable prior to major soil-disturbing activities.

Landtype Association 30V - Cryic Uplands (V109)

Landform - This association contains the broad, gently-sloping ridgetops and mountain slopes which occur at high elevations (above 7,500 feet usually) in the volcanics. The dominant slope-forming process has been the action of freezing and thawing. Slope gradients generally range from 15 to 50 percent. These lands do not show evidence of glaciation, however, the influence of glacial climates has been a very important element in their formation.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures range from loam to sandy loams. Coarse fragments are mainly gravels with some cobbles that occur in moderate amounts, generally greater than 35 percent.

The inherent erosion hazard of these soils is moderate, the debris slide hazard is very low to low, the surface creep hazard is very low to low, the slump hazard is low to moderate, and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the south aspects.

The major soils are Argic Cryoborolls, Pachic Cryoborolls, and Argic Lithic Cryoborolls. Families are loamy-skeletal, mixed; sandy-skeletal, mixed; and clayey-skeletal, montmorillonitic.

Landtype Association 50V - Glacial Troughlands (V111a, 111b, 111c)

Landform - This association includes the U-shaped valleys that have been carved and shaped in volcanic bedrock by moving valley glaciers. They are generally in elevations above 7,600 feet. These valleys have steep concave sideslopes and gently sloping, wide valley bottoms. These lands occur adjacent to and below high peaks, rocky ridges and cirque basins. Moraines occur within the valleys and on lower sideslopes of these glaciated lands.

Soils - The soils developed on these lands are mostly shallow (less than 20 inches) on the sideslopes with some moderately deep (20-40 inches) soils in the valley bottoms. Soil textures range from sandy loam to loam. Coarse fragments are mainly gravels and stones that occur in moderate amounts, greater than 35 percent.

The inherent erosion hazard of these soils is moderate, the debris slide hazard is low to moderate, the surface creep hazard is low, the slump hazard is low to moderate, and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the south aspects. The major soils are Argic Cryoborolls, Argic Pachic Cryoborolls and Argic Cryaquolls. Families are fine-loamy, mixed and clayey-skeletal, montmorillonitic.

Because of these hazards and the high amounts of water handled by these lands, soil-disturbing activities (especially on the sideslopes) could lead to significant erosion and sedimentation.

Landtype Association 60V - Strongly Glaciated Lands (V110, 111d, 113)

Landform - This association is comprised of the high-elevation lands which have been strongly modified by alpine glaciation. Cirques, cirque basins, headwalls, high peaks, and ridges adjacent to the cirques have been carved by glaciers and dominate the landscape. Elevations are above 8,700 feet. In this landtype association is Timber Creek Pass in the Lemhi Mountain Range, at approximately 9,300 feet elevation. Bedrock is volcanics and sideslopes are often in excess of 60 percent. The cirque basins have gentler slopes. Talus and rock outcrop are common in these lands.

Soils - The soils developed on these lands are mostly shallow (less than 20 inches) on the sideslopes with moderately deep (20-40 inches) to deep (greater than 40 inches) soils in the cirque basins. Topsoil texture is a loam over a loamy to sandy loam. Coarse fragments are mainly cobbles and gravels that occur in moderate amounts, generally greater than 35 percent.

The inherent erosion hazard on these soils is moderate to high, the debris slide hazard is moderate to high, the surface creep hazard is moderate, the slump hazard is moderate and the revegetation potential is fair to good on the cool-moist aspects and fair to poor on the south aspects.

Proposed soils are Typic Cryoboralfs, Argic Cryoborolls and Argic Cryaquolls. Families are sandy-skeletal, mixed; loamy-skeletal mixed, and fine, montmorillonitic. Argic Cryaquolls are found in the wet bottoms.

Because of the short growing seasons and relatively poor soil development, the effects of soil disturbance are generally longer-lived here than in other types of land.

Landtype Association 70V - Dissected Foothill Lands (V126bs, 126cs)

Landform - This association consists of the low-relief hills that lie adjacent to the higher mountain slopes. They are in elevations between 5,800 to 7,600 feet. Fluvial action has formed dissections on this volcanic material. The slope gradients are between 35 and 60 percent. Vegetation is primarily sagebrush and grass with small inclusions of timber on the cooler and moist northern aspects. These lands were formed on old erosion surface by the Challis Volcanics flowing onto this surface and being eroded away leaving these low-relief foothill lands as remnants. The ridges are well rounded and the valley bottoms tend to be U-shaped.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures include: clay, clay loam, silty clay loam, silty clay, silty loam, loam, sandy loam and sandy clay loam. Coarse fragments are mainly gravels that occur in moderate amounts (greater than 35 percent) and cobbles and stones that occur in low (less than 35 percent) to moderate amounts (greater than 35 percent).

The inherent erosion hazard of these soils is moderate to high, the debris slide hazard is low to moderate, the surface creep hazard is low to moderate, the slump hazard is moderate, and the revegetation potential is fair to good on the northern aspects and fair to poor on the southern aspects. There is evidence of considerable soil pedestaling behind the bunchgrass.

The soils are Typic Haploxeralfs, Typic Cryoboralfs, Mollic Cryoboralfs, Argic Cryoborolls, Pachic Cryoborolls, Calcic Pachic Cryoborolls, Typic Cryaquolls, Argic Cryaquolls, Typic Cryochrepts and Entic Pelloxerets. Families are fine-silty, mixed; loamy-skeletal, mixed; clayey-skeletal, montmorillonitic; very-fine, montmorillonitic and fine, montmorillonitic.

Sedimentary

Landtype Association 20S - Mountain Slope Land (S120's, 125, 130, 133, 140)

Landform - This association is comprised of the moderately-steep mountain slopes which have been formed primarily by stream-cutting action in the sedimentary bedrock. Slopes may be smooth or may be dissected by many V-shaped drainages. Slope gradients generally range between 40 and 65 percent. Valleys are V-shaped and ridges are fairly sharp. These lands are usually found at elevations between 6,300 and 9,800 feet. In this landtype association in the Beaverhead Mountain Range is Bannock Pass, at an elevation of 7,681 feet.

Soils - The soils developed on these lands are usually moderately deep (20-40 inches) to deep (greater than 40 inches). Soil textures range from sandy loam to loams. Coarse fragments are mainly cobbles and gravels that occur in moderate to high amounts, generally greater than 35 percent. Some areas may contain inclusions of calcareous soils with pH above 8.0.

The inherent erosion hazard of these soils is moderate to high, the debris slide hazard is moderate, the surface creep hazard is moderate, the slump hazard is low to high, and the revegetation potential is fair to good on the northern aspects and fair to poor on the southern aspects.

The soils within this association are: Typic Cryoborolls, Argic Cryoborolls, Argic Pachic Cryoborolls, Calcic Pachic Cryoborolls, Calcic Cryoborolls, Lithic Cryoborolls, Typic Cryorthents, Typic Cryochrepts, Mollic Cryoborolls, Typic Cryoborolls, Mollic Haploxerolls, Typic Xerorthents, Typic Calcixerolls and Entic Haploxerolls. Families are sandy-skeletal, mixed; loamy-skeletal, mixed; loamy-skeletal, mixed, frigid; loamy-skeletal, mixed, nonacid; loamy-skeletal, mixed, calcareous; loamy-skeletal, carbonitic; loamy-skeletal, mixed, calcareous, frigid; loamy-skeletal, carbonitic, frigid; fine-loamy, mixed; clayey-skeletal, montmorillonitic and coarse-loamy, carbonitic.

Landtype Association 30S - Cryic Uplands (S109's)

Landform - This association contains the broad, gently-sloping ridgetops and mountain slopes which occur at high elevations above 7,300 feet. The dominant slope-forming process has been the action of freezing and thawing. Slope gradients generally range from 15 to 50 percent. These lands do not show evidence of glaciation, however, the influence of glacial climates has been a very important element in their formation.

Soils - The soils developed on these lands are usually deep (greater than 40 inches). Soil textures range from loam to silt loam. Coarse fragments are mainly gravels and cobbles that occur in moderate to high amounts, generally greater than 35 percent. Some areas may contain inclusions of calcareous soils with pH above 8.0.

The inherent erosion hazard of these soils is low to high, the debris slide hazard is very low to low, the surface creep hazard is low to moderate, the slump hazard is low to high, and the revegetation potential is fair to good on the northern aspects and fair to poor on the southern aspects.

The major soils are Typic Cryoborolls, Argic Cryoborolls, Argic Pachic Cryoborolls, Pachic Cryoborolls, Calcic Cryoborolls, Calcic Pachic Cryoborolls, Argic Cryaquolls and Cumulic Cryaquolls. Families are loamy-skeletal, mixed; loamy-skeletal, mixed, calcareous; loamy-skeletal, carbonitic; sandy-skeletal, mixed and fine-loamy, mixed. Argic Cryaquolls and Cumulic Cryaquolls are found in the wet bottom areas.

Landtype Association 50S - Glacial Troughlands (S111's)

Landform - This association includes the U-shaped valleys that have been carved and shaped in sedimentary bedrock by moving valley glaciers. They are generally in elevations between 7,900 and 10,700 feet. These valleys have steep concave sideslopes and gently-sloping, wide valley bottoms. These lands occur adjacent to and below high peaks, rocky ridges and cirque basins. Moraines occur within the valleys and on lower sideslopes of these glaciated land.

Soils - The soils developed on these lands are mostly shallow (less than 20 inches) on the sideslopes with some moderately deep (20-40 inches) soils in the valley bottoms. Soil textures range from loam to silt loam. Coarse fragments are mainly gravels and cobbles that occur in moderate to high amounts, generally greater than 35 percent. Some areas may contain inclusions of calcareous soils with pH above 8.0.

The inherent erosion hazard of these soils is moderate to high, the debris slide hazard is low to moderate, the surface creep hazard is low to moderate, the slump hazard is low, and the revegetation potential is fair to good on the northern aspects and fair to poor on the southern aspects.

The major soils are Lithic Cryoborolls, Pachic Cryoborolls, Argic Lithic Cryoborolls, Calcic Cryorthents and Argic Cryaquolls. Families are loamy-skeletal, mixed and loamy-skeletal, carbonitic.

Vegetation

Riparian areas within the Big Timber Creek and Leadore Hill allotments were identified as needing improvement in the Lemhi RMP (1987). An interdisciplinary team scoped the issue in 1993, and identified Basin Creek as the only area requiring a change in management to improve riparian condition. Big Timber Creek has a fairly narrow riparian corridor, but it is heavily vegetated with cottonwoods and willow, with a sparser *Carex/Juncus* component, which is typical of this site type. A lack of a middle age class of woody plants, but a healthy younger component, indicates a dramatic shift in management or use some time in the past. Basin Creek has a mix of dense willow communities and open *Poa* benches, with the stream widening and downcutting in the latter. Upper portions of Big Timber Creek and its tributaries are in good ecological condition, except at cross fences where livestock congregate on the creek.

Within areas of allotments with a history of season long grazing, many riparian conditions are generally characterized as having a mature to over-mature woody component with little reproduction, a depauperate *Carex/Juncus* community, considerable bare ground in some reaches, dominance of upland species (e.g., bluegrasses, cheatgrass) on immediate streambanks in many areas and frequent sloughing raw banks.

Table 6. Riparian habitat condition classes for streams within the Big Timber Creek watershed.

bluegrasses, cheatgrass, or

Table 6. Riparian habitat condition classes for streams within the Big Timber Creek watershed.

Stream	Length (miles)	Condition												
		Proper Functioning Condition				Fractional At Risk/Trend				Non-Functional				Downstream
		0.1-0.5	0.5-1.0	1.0-2.0	2.0+	0.1-0.5	0.5-1.0	1.0-2.0	2.0+	0.1-0.5	0.5-1.0	1.0-2.0	2.0+	
Big Timber	19.1	3.0	10.5	0.0	1.0	0.0	2.01	0.0	2.1-	0.0	0.0	0.0	0.0	0.5
Little Timber	4.2	0.0	0.0	0.0	0.0	0.51	0.0	0.0	2.0-	0.0	0.0	0.0	0.0	1.7
Middle Fork	5.1	0.0	3.0	0.0	0.0	0.0	1.1-	0.0	1.0-	0.0	0.0	0.0	0.0	0.0
North Fork	3.8	0.0	2.0	0.0	0.0	0.0	0.9	0.0	0.9-	0.0	0.0	0.0	0.0	0.0
Basin	4.9	0.5	1.7	0.0	0.0	0.31	0.0	0.0	1.9	0.0	0.0	0.0	0.5	0.0
TOTAL:	37.1	3.5	17.2	0.0	1.0	0.8	4.0	0.0	7.9	0.0	0.0	0.0	0.5	2.2

- Indicates a static trend
+ Indicates an upward trend

The condition and trend are Unknown for the majority of the small tributaries.

Elevation, aspect, precipitation and soil type are the primary factors determining the upland vegetative community present on a given site. Big Timber Creek has timber on the north facing slopes of Leadore Hill, with a sagebrush/grass community on south facing slopes. The lower portion of the watershed is nearly flat sagebrush grass communities dominated by Wyoming big sagebrush with an understory of bluebunch wheatgrass. There are numerous, very old irrigation ditches that bisect the uplands and give the appearance of streams since they have riparian vegetation along the ditch banks. The upper portions of the watershed, above Swan Basin are heavily timbered. Swan Basin is a large sagebrush/grass bowl with stringers of riparian vegetation running through it. Large stands of aspen are also a dominant feature of this area of the watershed.

Table 7. Condition class for BLM administered lands within the Big Timber Creek watershed, based upon the 1983 Ecological Site Inventory. The trend was Static to Downward throughout the watershed. Ecological health is unknown on Forest and Private lands.

AREA	CONDITION CLASS (ACRES)				
	EXCELLENT	GOOD	FAIR	POOR	UNMAPPED
Big Timber Creek Allotment	0	2,069	4,793	0	85
Leadore Hill Allotment	0	884	1,212	0	617
Overall BLM	0%	30%	67%	0%	3%

Upland areas within both the Big Timber Creek and Leadore Hill Allotments were identified as needing improvement in the Lemhi RMP (1987). Except for small scattered inclusions of Good condition range, Fair condition uplands tend to be primarily the norm on the Big Timber Creek allotment. Fair upland conditions are evidenced by low vigor, generally sparse stands of bluebunch wheatgrass and Idaho fescue. A review of the uplands within the allotment during 1992 indicated potential for erosion in the Leadore Hill Allotment. This observed potential may not have been as evident had the area not been subjected to consecutive droughts in recent years. The need for an improved grazing system was also identified in the Lemhi RMP (1987). The current grazing system, however, has allowed the riparian areas to recover and continue to function properly. The generally limited grass/forb component on the uplands within the watershed is reducing habitat quality for numerous game and non-game species.

No rare plant populations are known to occur within this watershed.

Noxious weed infestations along the Mill Creek road are being addressed by a cooperative agreement between the USFS and the BLM to spray for three target species, black henbane, musk thistle, and leafy spurge.

Aquatic Resources

The Big Timber Creek watershed has been identified as having mountain whitefish, cutthroat, rainbow and bull trout present. It is also critical habitat for the Endangered Snake River spring/summer chinook salmon and Snake River steelhead trout. There are currently no anadromous fish using the Big Timber Creek watershed, as it's dewatered when migration and spawning would occur. Big Timber Creek was historically used for spawning and rearing, but has not been used for either during the past 30 years. The bull trout has been deemed Warranted but Precluded for proposal for federal listing. The status of all fish populations within the watershed are currently unknown, except that any migratory portions have been lost.

In 1997, the BLM and IDFG sampled fish densities at two sites in Big Timber Creek. Densities of rainbow trout at these site was estimated at 5.1 fish/100m². Bull trout were only found at the upper site. Densities of bull trout were estimated at 0.3 fish/100m².

Dewatering of lower Big Timber Creek prevents access to or from the Lemhi River for the majority of the year. Several tributaries to Big Timber Creek are also partially or completely dewatered for significant periods, severely restricting any migrations of any fish within the system to summering or wintering areas. None of the diversions within the watershed are screened to prevent access by fish. If fish could enter the creek to spawn, fish loss would occur as the juveniles could enter the ditches on their downstream migration. BLM biologists have noted fish trapped in diversion ditches after the irrigation season (Jude Trapani, BLM, pers. comm.).

Irrigation diversions have the biggest impact on the fish resources in the watershed. They pose barriers to all fish during times of potential migration. This factor has eliminated the migratory portion of any fish populations, so that resident populations in the headwaters remain the only portion of any historic presence. As such, catastrophic events could jeopardize the resident populations.

Although most of Big Timber Creek has received a Proper Functioning Condition rating, its peak summer temperatures still exceed those recommended in Idaho State Water Quality Standards and PACFISH Standards and Guidelines. Temperatures do not reach lethal levels, but warmer temperatures increase the metabolic needs of fish, increase the effect of any stressors already found within the environment and decrease the fishes' ability to deal with disease.

Wildlife

Deer make very little summer use on BLM. They winter in a rather limited area lying between Leadore and the USFS boundary. Elk make essentially no use on the BLM, but use the headwaters extensively, as do moose. Antelope use the lower half of the watershed for some summer use and limited winter range. Sage grouse make limited summer/fall use in the area.

Roads

The Big Timber Creek watershed has 67.1 miles of roads, of which 0.1 miles are paved (0.1%), 7.6 miles (11.4%) are improved gravel, 31.8 miles (47.4%) are unimproved and 27.8 miles (41.1%) are two-tracks. Road densities have been calculated at 0.78 miles per square mile.

The Little Big Timber Creek road, a USFS/County maintained road, has been identified in the BLM's PACFISH Road Maintenance Plan as a Moderate sediment producer. This road has the potential to input sediment to Little Big Timber Creek.

LAND USE

Historical

There are four prehistoric or historic sites recorded on BLM lands within the watershed. None of these have been evaluated for potential listing on the National Register of Historic Places.

Recreation

Recreation within the watershed is generally dispersed and associated primarily with guided and unguided big game hunting, and some sportfishing. Public lands in the area primarily give recreationists access to the timbered Forest lands in the upper portions of the watershed. Relatively flat dirt roads give access to the roads and trails of the mountains. The Forest Service has installed sanitary facilities for the more intensive camping which occurs at Stone Reservoir and the nearby vicinity. Approximately 1500 visitor days are spent at Forest Service facilities in this watershed.

Special Uses

Big Timber Creek is a mix of private, public, State and Forest lands. BLM is currently working on some possible exchange proposals with private land owners. Some parcels are under Land Use Permits pending exchanges. There are many ditches on Big Timber Creek that are pre-FLPMA ditches. There is a large diversion and ditch which fall under the Carey Act of 1894. There is also one hydro project application currently being reviewed. Big Timber Creek has a large historical dump area which is in the

process of being cleaned up. A five acre parcel was sold to Lemhi County for a household refuse transfer site. There are some rights-of-way and trespass issues to be resolved in the Big Timber Creek watershed.

Livestock Grazing

There are two BLM administered allotments within the watershed, Big Timber Creek and Leadore Hill. Big Timber Creek has a two pasture deferred grazing system with fall trailing. Leadore Hill Allotment has season long grazing with no defined schedule. The USFS has one allotment, Big Timber Creek Cattle and Horse, with three pastures. There is no allotment management plan for this allotment, however Forest Grazing Standards are applied. Grazing preference for the watershed is 540 AUM's (est.) for the Forest and 1766 on BLM.

Energy and Mineral Exploration

There are several historic mining prospects and low level explorations on federally administered lands, as well as some patented lands. None of the sites are located in the flats, nor are felt to affect the ecological health of the watershed.

Timber Harvest

There is no salable Big Timber on the BLM portion of the watershed, although there have been historic sales on the Forest.

MONITORING DATA

The BLM has established vegetation monitoring sites at two locations within the watershed. Monitoring has been conducted at these sites since 1993, and consists of stubble heights, photographs and water temperature. Color infrared photographs were obtained and a detailed riparian inventory was conducted in 1995 to help evaluate conditions and determine valid objectives. Each year the collected data and a synopsis of that year's management are presented in a monitoring report. In general, the vegetative monitoring shows overall good conditions.

The USFS also conducts vegetative monitoring at multiple sites on their allotments within the watershed. Monitoring has been conducted since 1993 and includes water temperature, greenlines, bank stability, cross-sections, woody species regeneration, utilization levels and photographs. Management for the next grazing season is based on the trend studies and utilization levels. The data indicates a positive trend in condition ratings.

The Idaho Division of Environmental Quality sampled water quality parameters at three sites on Big Timber Creek in 1994 and 1995. Sampling was conducted using the Beneficial Use Reconnaissance Program protocols. The upper most site is approximately 3 miles upstream from the Warm Springs BLM road crossing (T 14N R 26E NE 1/4 SE 1/4 of Section 6 on the Sheephorn Peak Quadrangle). The next site downstream is at the Warm Springs BLM road crossing (T15N R 26E SW 1/4 SW 1/4 NW 1/4 of Section 20 on the Sheephorn Peak Quadrangle). The lowest BURP survey site is approximately 1.3 miles below the confluence of Little Timber Creek (T 15N R 26E SW 1/4 SE 1/4 NE 1/4 of section 5 on the West of Leadore Quadrangle). McNeil sediment core samples were collected approximately 1/4 mile below the lowest BURP site. Erosion Inventory Estimates were conducted at two sites: 1) from the Warm Springs BLM road crossing downstream 1,162 feet to the private land boundary, and on 2,325 feet of Big Timber Creek working upstream from approximately 1/2 mile below the lowest BURP site. Nutrient

samples were not collected on Big Timber Creek due to dewatering of the lower section of the 303d segment.

Sediment analysis includes Wolman Pebble Count, McNeil Core Sampling, and a Bank Erosion Inventory. The Wolman Pebble Count is an evaluation of surface substrate particle size. There appears to be little correlation between surface and subsurface fines (R. Rose, USFS, personal communication). Three sites were evaluated for % surface fines in the watershed. The uppermost BURP site showed a Wolman Pebble Count of 39% less than 1/4". The middle site was 3% and the most downstream site was 9%. The data at the upper site indicates a likely reduction in fry survival based on professional judgements and comparison to the McNeil sampling data. The McNeil sampling data evaluates subsurface fines, to a depth of 4" for resident fish species, and indicates expected fry survival as it relates to percentage of intragravel fines less than 1/4". Two sites were sampled on mainstem Big Timber Creek in 1997, one by IDEQ on the lower BLM and one by the USFS, downstream of Basin Creek. At the upper site, below Basin Creek, the mean % fines, including substrate 2 1/2" and greater, was 24.6%. This site has been sampled since 1993 and has shown a statistically significant decrease in % fines since that time. At the lower site, the mean % fines, including substrate 2 1/2" and greater, was 18.2%, with a standard deviation of 4.3. The USFS also sampled sites on the North Fork and Middle Fork of Little Big Timber Creek in 1993 and 1994. At both sites, a decrease in percent fines occurred between the two years. Chapman (1988) suggested that fine sediment < 0.85 mm is most responsible for suffocation and abrasion of salmonid eggs and coarser sediment, < 9.5 mm can create a survival barrier preventing salmonid fry emergence from the redd (Tappel and Bjornn 1983). The mean % fines less than 0.85 mm including substrate 2 1/2" and greater was 5%. The mean % fines less than 0.85 mm not including substrate 2 1/2" and greater was 7.6%. Hall (1986) found survival (eyed egg to emergence) of coho, chinook and chum salmon to be only 7-10% in gravel mixtures made up of 10% fines as compared to 50-75% survival in gravel mixtures with no fines less than 0.85 mm. Reiser and White (1988) observed little survival of steelhead and chinook salmon eggs beyond 10-20% fines less than 0.85 mm.

The Bank Erosion Inventory is a qualitative evaluation of channel shape, bank stability and riparian vegetation developed by the NRCS as a tool to evaluate erosion condition on streambanks, gullies and roads. In 1987, surveys were conducted along 8% (0.66 miles) of the listed reach length. The evaluation was done along two different reaches, one near the Carey Act dam, and one down on the lower BLM, to provide a more comprehensive overview. Streambanks along the upper reach were classified as having a slight erosion potential, with an overall rating of 3.5 out of a potential 15. This equates to a lateral recession rate of 0.035 feet per year, resulting in an estimated sediment yield of 4.98 tons per year for this reach. Streambanks along the lower reach were classified as having a slight erosion potential as well, with an overall rating of 4 out of a potential 15. This equates to a lateral recession rate of 0.05 feet per year, resulting in an estimated sediment yield of 6 tons per year for this reach.

The Stream Erosion Condition Inventory conducted on the upper section of Big Timber Creek estimates 22.63 tons per stream mile of sediment from stream bank erosion over the sample reach. This ranks 16th out of 27 sample reaches surveyed on 13 streams in the Lemhi watershed. The average estimate of tons of sediment contributed by stream bank erosion per mile for all stream sample sections was 110 tons per mile. Of the total 303d listed mainstem stream miles, the upper site is likely representative of approximately 2 miles. This equates to 45.25 tons of sediment from stream bank erosion from the Carey Act Dam to the confluence of Little Timber Creek.

The Lower sample site estimate is 12.6 tons per mile of sediment from stream bank erosion over the sample reach. This ranks 18th out of the 27 sample reaches surveyed. The lower sample site is most closely representative of 5.36 miles of Big Timber Creek. This equates to 72.9 tons of sediment from stream bank erosion from the confluence of Little Timber Creek with Big Timber Creek to the confluence of Big Timber Creek with the Lemhi River.

Aquatic insect communities sampled at the upper, middle, and lower sites on Big Timber Creek showed scores of 4.4, 4.7 and 4.6, respectively. Scores greater than 3.5 are indicative of non-impaired macroinvertebrate communities. These samples score high due to the presence of macroinvertebrate species which require cold water to survive.

The Habitat Index gives a score based on the natural fish habitat conditions. The sites on Big Timber Creek fall within two ecoregions, the Northern Rockies Ecoregion (upper site) and the Snake River Basin/High Desert Ecoregion (middle and lower sites). The score of 81 at the upper site fails to meet the necessary criteria, requiring further evaluation of conditions in order to make a determination. This score could be influenced by the management of the Carey Act dam, as each fall water is quickly released causing a strong, short duration impulse of high water that likely increases the width to depth ratio for some distance down stream also reducing bank stability. The scores of 104 (middle) and 88 (lower) at the other two sites indicate non-impaired conditions within the listed reach.

The BLM and USFS have recorded water temperature at various sites within the watershed since 1993. Maximum water temperatures at the lowermost BLM/private boundary average 66.2° F between 1994 and 1997. Maximum water temperatures recorded in Big Timber Creek at Grove Creek, have averaged 59.3° F since 1993, with an annual average increase of 6.5° F over this nine mile distance. Maximum water temperatures at the mouth of Basin Creek have averaged 65.8° F since 1994, fluctuating on an annual basis. Maximum temperatures in the Middle Fork of Little Timber Creek have averaged 58° F since 1993, again, fluctuating on an annual basis.

WATER QUALITY CONCERNS

Big Timber Creek is on the 303d list for sediments and nutrients from the US Forest Service Boundary to its confluence with the Lemhi River. This listing definition encompasses the lower third of the stream. The primary land use along the listed section includes grazing and irrigated agriculture. Land ownership adjacent to the 303d listed segment of Big Timber Creek is approximately 25% BLM and 75% private.

Designated beneficial uses for the listed reach include, Primary Contact Recreation, Industrial Water Supply, Wildlife Habitat, and Aesthetics. Existing beneficial uses include Coldwater Biota, Salmonid Spawning and Agricultural Water Supply. The listed reach on Big Timber Creek has been determined to Fully Support beneficial uses. The effect of acute sediment pulses, resulting from rapid release of water impounded by the Carey Act dam, on fish habitat needs to be investigated further.

MANAGEMENT DIRECTION

General management direction is found in the FLRMP (1988) and RMP (1987). The PACFISH and INFISH management strategies provide more specific, aquatic health related direction. More specific direction is found in the allotment management plans and salmon biological opinions. The general focus is to improve riparian habitat and maintain it in good ecological condition.

POLLUTION CONTROL EFFORTS

In 1997, the Big Timber Cr pipeline, a water distribution system to facilitate livestock management away from Basin Cr., a tributary to Big Timber Creek, was installed and the source fenced. This project will allow woody and herbaceous vegetation on Basin Creek to recover at an increased rate.

ANALYSIS

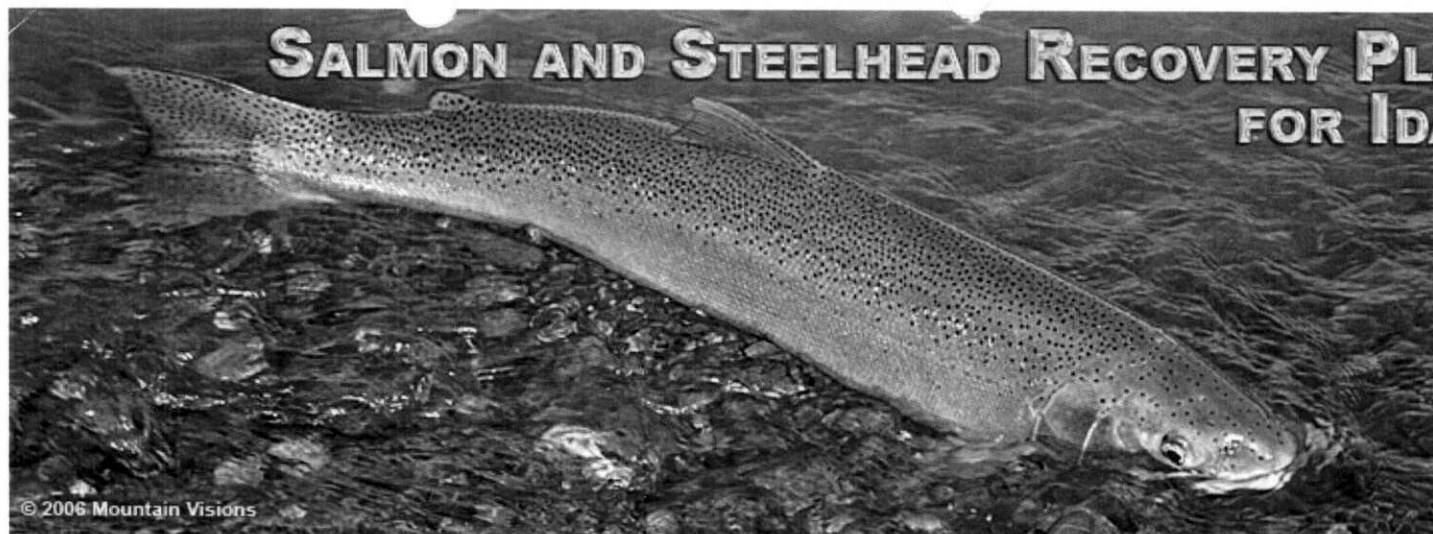
Sediment production from within the watershed has the potential to reach the Lemhi River affecting the spawning and rearing habitat of chinook salmon. Utilization of riparian habitat by livestock has slightly reduced both the younger age class of woody riparian vegetation and the established woody vegetation. This affects the ability of the riparian habitat to slow the water down and filter sediment during peak flows and overland events. In places, livestock grazing has resulted in a widening of the stream channel and streambank trampling, increasing sediment production. Sediment combined from all sources has an adverse effect on the potential of chinook spawning/rearing in Big Timber Creek, although it appears by current information and observation that most deposition in the lower reaches occurs from irrigation practices (Scott Feldhausen, BLM, pers. comm.). Suspended sediment settles out behind the Carey Act dam during the irrigation season. At the end of this season, the opening of the dam and subsequent release of impounded water deposits accumulated sediment for miles downstream. The acute effects of this sediment release, on fish physiology and aquatic insect communities, are significantly more substantial than potential effects from activities discretionary to federal agencies. BLM biologists have noted deposits up to two inches deep five miles downstream from the dam after impounded water is released in the fall (Scott Feldhausen, BLM, pers. comm.).

Evaluation of sediment deposition characteristics within the stream and of erosion characteristics of stream banks do not show elevated sediment deposition and erosion respectively. The primary source of sediment is stream bank erosion within the 303d segment, however sediment accumulation above the Carey Act dam indicates potential significant sources above the 303d segment, which would include roads, stream bank erosion and overland erosion. Overall, riparian vegetation appears to be adequate adjacent within the 303d segment.

Although the water temperatures at the site in lower Big Timber Creek do not meet standards, it is interesting to note that the difference between the Grove Creek site and the lower Big Timber Creek site has decreased every year since 1994. In 1994, the difference was 11 degrees, but in 1997, it was down to 4.5 degrees. The Grove Creek site, however, has shown a very slight warming trend. Efforts at improving conditions on Basin Creek need to continue to allow woody vegetation to provide the necessary shade to cool this stream and decrease the effect on the temperature regime in Big Timber Creek.

Watershed Issues:

- 1. Decreased flow and fish migration barriers resulting from irrigation coupled with rapid release of water from the Carey Act dam that destabilizes stream banks below the dam and blankets sediment from the upper 2/3 of the watershed over the lower section of Big Timber Creek.**
- 2. Lack of connectivity to the Lemhi River, and the effect on fish distribution, abundance, and long-term survival.**
- 3. Fish barriers at diversion structures in addition to the Carey Act dam. Efforts to improve passage need to be evaluated.**


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Salmon and Steelhead Recovery Planning in the Snake River Basin Early Draft Plan Chapters for Public Comment

Recovery Plan Introduction

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Chapter 1 - Recovery
Plan Introduction
(12 page 234 Kb PDF File)



Dear Friends,

What's in the Document?

This chapter describes the concept of recovery and the role of the plan as a roadmap for meeting recovery objectives.

There are discussions of the treaty obligations of the federal government as well as descriptions of the agencies and other groups that will be involved in the plan's implementation. Finally, there is a discussion of the NOAA teams involved in the technical efforts described in subsequent planning documents and how that agency intends to use the plan.

What Comments would be Helpful?

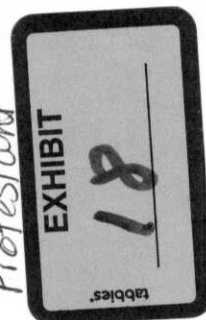
Take a look at the roles of the various public

NOAA Fisheries, in partnership with Idaho's Office of Species Conservation, is beginning to draft our state's portion of the recovery plans for four listed salmonid species: Snake River sockeye salmon (endangered), Snake River fall Chinook (threatened), Snake River spring/summer Chinook (threatened) and Snake River steelhead (threatened). This is a complex undertaking, based upon such existing studies as subbasin plans, work by our Interior Columbia Technical Recovery Team (ICTRT), and others. The draft will be completed by the end of June 2006 and a final plan is anticipated by December 2006.

Through this website, we want to share preliminary drafts in order to keep stakeholders informed of progress on the plan and to obtain comments that may help shape the plan and make it as accurate and useful as possible.

At this stage we are interested in **your review of the information we have compiled, the way we have used the information, and our conclusions.** You may see typographical errors, but those will be corrected in future revisions. We invite feedback on:

- Methods, including population identification,
- Assessments of current status of the species,
- Recovery goals,
- Limiting factors, threats, and risks,
- Priority actions that should be taken to recover the populations in which you may be interested, and,
- Our preliminary recovery strategies developed from the Subbasin plans, even though they will be modified when the limiting factors assessment is completed.



The early drafts being posted relate primarily to habitat for salmon and steelhead within Idaho. Sections of the plan dealing with the migratory corridor (including the hydropower system), ocean conditions, the estuary, hatcheries, and harvest are still in process.

As further sections of the plan are completed, they will be placed on this website, so check in frequently to see what's new. **Please send your comments to SnakeRiver.NWR@noaa.gov. Given the tight schedule for completion of these documents, we need your comments as soon as possible, preferably before May 15.**

Thank you for helping us refine a plan that meets the needs of both salmon and steelhead and of our state's citizens.

Sincerely,

agencies to assure they
are accurately described.

Dave Mabe, State Director, Habitat
NOAA Fisheries

James Caswell, Director
Office of Species Conservation

Last Updated: 9/23/06

CHAPTER 1.

Introduction to the Snake River Salmon and Steelhead Recovery Plan

Since drafting the following sections of the Snake River Recovery Plan, NOAA Fisheries has renamed the Snake River Steelhead Evolutionary Significant Unit (ESU) the Snake River Steelhead Distinct Population Segment (DPS). The other species are still referred to as ESUs. Rather than change the terminology now and further delay distribution of these sections, NOAA Fisheries is distributing these draft sections with the ESU designation. The next draft will contain the DPS designation.

This is a plan for the protection and restoration of salmon and steelhead in the Snake River subbasin of the Columbia River Basin. The plan is the product of a collaborative process initiated by the National Marine Fisheries Service and involving other federal agencies, state agencies, tribes, local governments, and the public. In order to ensure consistency in goals, strategies and actions and to eliminate needless duplication of effort, the process integrated planning for Federal Endangered Species Act (ESA) recovery, the Northwest Power and Conservation Council (NPCC) fish and wildlife program, and the states of Idaho, Oregon, and Washington watershed management and salmon recovery programs.

The anadromous salmon and Steelhead in the Snake River Basin face a multitude of perils throughout their life cycle. They begin life in the gravel of fresh water streams up to 900 miles inland and 6,500 feet above sea level. They travel downstream to the ocean, undergoing extraordinary metabolic changes on the way to adapt to salt water. After spending one to several years traveling hundreds of miles in the Pacific Ocean, they return to the place of their birth with striking fidelity. Once abundant and widespread, Snake River salmon of natural origin are now reduced to a small fraction of their former numbers and have lost major portions of their former habitat. Many of the Snake River populations are now extinct.

1.1 The Meaning of Recovery

Broad goals for Snake River salmon and steelhead would be healthy, harvestable, and sustainable populations that provide substantial environmental, cultural, and economic benefits. Delisting or recovery under the ESA can be seen as a step toward these goals and a means to help achieve them. The impetus includes state and tribal goals for salmon recovery, the federal government's treaty and trust obligations to American Indian tribes, and NOAA's obligations under the Magnuson-Stevens Fisheries Conservation and Management Act to provide sustainable fisheries.

Recovery of anadromous fish species with complex life cycles such as the Chinook, sockeye, and steelhead of the Snake River basin cannot be accomplished by addressing a single threat or limiting factor. It requires a comprehensive approach, and it must work for the people of the region as well. This plan provides a roadmap for recovery. The aim is to reverse long-term declining trends and establish a trajectory leading to recovery.

Since existing information is too uncertain to prescribe the exact course to recovery, progress will be evaluated regularly and, where necessary, the course adjusted.

1.2 What a Recovery Plan Can Do

Recovery can be defined as the process of restoring listed species and their ecosystems to the point that their future is safeguarded and protections under the ESA are no longer needed. Thus, a recovery plan serves as a road map for species recovery—it lays out where we need to go and how best to get there. Without a plan to organize, coordinate and prioritize the many possible recovery actions on the part of federal, state, and tribal agencies, local watershed councils, and private citizens, our efforts may be inefficient or even ineffective. Prompt development and implementation of a recovery plan will help target limited resources effectively.

Further, recovery plans make visible the programs and activities of all the agencies and parties working on salmon recovery. This includes programs directly managed and implemented by land management and water management agencies; grants by regulatory and natural resource agencies; and programs that rely on the voluntary participation of many other people, such as private landowners, watershed councils, and various non-governmental entities.

NMFS scientists and policymakers believe the plan should be a dynamic document, able to incorporate new information as it becomes available; therefore, we have largely focused on actions needed in the relative short-term. The plan will be reviewed periodically; the relative success of these actions in protecting Pacific salmon will be assessed and adjustments made or additional actions added.

1.3 Who is Involved

Snake River salmon and steelhead face many threats in multiple environments throughout their lives. Everyone who lives, works, or plays on land or water in the Northwest can have positive or negative impacts on these fish. In short, virtually all human activities have some kind of impact on salmon, either directly or indirectly on their habitat. No single agency or action can accomplish the recovery of these endangered or threatened species.

NMFS intends to use the recovery planning process to develop cooperative relationships that will lead to positive actions benefiting ESA listed species. For example, if limiting factors involving agriculture are identified in a subbasin, a beneficial partnership would include NMFS, the Natural Resource Conservation Services, and the Idaho Soil Conservation Commission, which has the responsibility to develop and improve best management practices for agriculture on private lands. Our intent is to work within the framework of existing efforts whenever possible and not to create duplicative efforts that may conflict with state or local programs.

1.3.1 State and other federal agencies

Some of the current or potential partner agencies with environmental responsibilities are listed below.

Idaho

Idaho Soil Conservation Commission and Districts--Develops best management practices for irrigated agriculture and grazing. Soil Conservation Districts cover all of Idaho and the Districts have long been active in implementing conservation Programs in the state. They have a long and successful history of pursuing funding and implementing on-the-ground practices with private partners.

Idaho Department of Agriculture--Regulates confined animal feeding operations and pesticides within the State of Idaho.

Idaho Department of Water Resources--Manages water rights and has been a partner with federal agencies in settling the contentious Snake River Basin Adjudication and providing mechanisms for increasing instream flows for listed fish.

Idaho Department of Lands--Regulates the Forestry and Mining in the State of Idaho. Of the 3.65 million acres originally received, endowment lands currently total nearly 2.5 million acres, including 780,000 acres of commercial timberland and about three million acres of minerals. In addition, the Department of Lands, having been assigned additional duties over the years by the State Legislature, now serves as the host agency to the Idaho Board of Scaling Practices, the Clearwater-Potlatch Timber Protective Association and the Southern Idaho Timber Protective Association. SRBA partner in section 6 agreement on Forestry.

Idaho Department of Environmental Quality. Has primary responsibility for Clean Water Act in Idaho. Develops water quality standards and TMDLs to attain the standards.

Idaho Department of Transportation--Develops best management practices for road construction and maintenance in Idaho.

Oregon

Oregon Department of Fish and Wildlife—[needs summary of responsibilities]

Oregon Soil and Water Conservation Districts--Districts in Oregon partner with landowners to implement water conservation, water quality improvement, fish passage improvement, and riparian restoration projects.

Oregon Department of Agriculture--Regulates confined animal feeding operations within the State of Oregon. The Department of Agriculture also develops Agricultural Water Quality Management Plans to implement TMDLs in rural areas.

Oregon Department of Water Resources--Manages water rights and regulates the agricultural, municipal, and industrial use of surface and groundwater in Oregon.

Oregon Department of State Lands--Regulates discharge of fill material into waters of the State and wetlands. The Department of State Lands also regulates certain types of surface mining.

Oregon Department of Environmental Quality--Has primary responsibility for implementation of the Clean Water Act in Oregon. Develops water quality standards and TMDLs to attain the standards. Also maintains the 303(d) list of water-quality-impaired streams in Oregon.

Oregon Department of Transportation--Develops best management practices for road construction and maintenance in Oregon. The Oregon Department of Transportation is currently developing a compensatory mitigation program to offset some adverse effects of road projects on fish and wildlife in Oregon.

Oregon Watershed Enhancement Board--Funds watershed restoration projects throughout the State of Oregon and supports local watershed councils.

Model Watersheds and Watershed Councils--Partner with local landowners and Federal land management agencies to fund, plan, and implement restoration projects throughout Oregon.

Oregon Department of Forestry--Regulates private land forestry and develops forest practices for Oregon.

Oregon State Police--Enforce state fish and game laws.

Oregon State University Extension Offices--Provide research and technical assistance on the management of private lands, particularly in regard to livestock grazing and agriculture.

Washington

Washington State agencies relevant to salmon recovery are reviewed in the Washington portion of the Snake River recovery plan (Snake River Salmon Recovery Board, June 2005).

Other Federal Agencies

NMFS' relationship with other federal agencies is slightly different from its relation to State agencies and private entities, because of its regulatory role, defined in Section 7 of the ESA. Section 7(a) 1 gives federal agencies the responsibility to conserve species, and 7(a)2 requires federal agencies to consult with NMFS regarding any actions that might jeopardize an endangered species or destroy its habitat. The recovery plan offers an opportunity to better describe and refine the relationship between these two sections.

Forest Service

[Add other agencies such as NRCS, Transportation and BLM BOR, USACE.]

1.3.2 Tribal Organizations and Federal Treaty and Trust Obligations

In addition to its responsibilities to state and other federal agencies, NMFS has special responsibilities to American Indian tribes. A number of Oregon, Washington, and Idaho tribes share responsibilities and rights as co-managers of the fisheries in the Columbia Basin, based upon a complex history of treaties, executive orders, legislation, and court decisions.

There are 15 federally recognized Indian tribes within the Columbia Basin. All have expressed strong interest in the restoration of salmon and the health of the ecosystem upon which the salmon depend.

In the Treaties of 1855 between the U.S. government and the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes and Bands of the Yakama Indian Nation, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe, the tribes, in exchange for the preponderance of their lands, reserved the rights to fish within their reservations and "at all other usual and accustomed places." The usual and accustomed places are understood to include the millions of acres of aboriginal land ceded to the United States in the 1855 treaties, which extends to the Upper Columbia and Snake River basins.

The Fort Bridger Treaty of 1868 with the Shoshone-Bannock Tribes, whose historical territory included much of the present-day states of Wyoming, Utah, Nevada, and Idaho, provided that these tribes "shall have the right to hunt on the unoccupied lands of the U.S. so long as game may be found thereon." ("Hunt" has since been interpreted to include fishing.) The Shoshone-Bannock Tribes historically hunted and fished within the Snake River Basin, but their present-day reservation is outside the current extent of Snake River salmon as well as outside the Snake River Domain defined for this recovery plan. The Ross Fork of the Snake River runs through the Shoshone-Bannock Fort Hall Reservation in Eastern Idaho, but it is part of the salmon habitat entirely blocked by the Hells Canyon dam complex.

The Columbia River Inter-Tribal Fish Commission (CRITFC) is the technical support and coordinating agency for the Columbia River treaty tribes' fishery management policies. CRITFC, formed in 1977, employs biologists, other scientists, public information specialists, policy analysts, and administrators who work in fisheries research and analysis, advocacy, planning and coordination, harvest control, and law enforcement. The Shoshone-Bannock tribal government is also involved in salmon recovery, with programs for habitat restoration and hatchery supplementation in the Snake River Basin.

Because of the extraordinary migratory characteristics of salmonids, the co-manager relationship crosses tribal, federal, and state boundaries. The NMFS Regional Administrator, in testimony before the U.S. Senate Indian Affairs Committee (June 2003), emphasized the importance of this co-manager relationship:

"We have repeatedly stressed to the region's leaders, tribal and non-tribal, the importance of our co-management and trust relationship to the tribes. NOAA Fisheries enjoys a positive working relationship with our Pacific Northwest Tribal partners. We view that relationship as crucial to the region's future success in recovery of listed salmon."

Examples of that "positive working relationship" can be seen in federal-tribal participation within the *U.S. v. Oregon* and *U.S. v. Washington* framework and the participation of tribes on interstate (Pacific Fisheries Management Council) and international (Pacific Salmon Commission) management bodies. Additionally, there are innumerable local and regional forums and planning efforts in which the tribes are engaged. NMFS considers the participation of the tribes to be crucial to the management and recovery of the listed species.

NMFS is committed to meeting Federal treaty and trust obligations to the tribes. These obligations are described in a July 21, 1998 letter from Terry D. Garcia, Assistant Secretary for Oceans and Atmosphere, U.S. Dept of Commerce, to Mr. Ted Strong, Executive Director of CRITFC. This letter states that recovery "... must achieve two goals; 1) the recovery and delisting of salmonids listed under the provisions of the ESA; and 2) the restoration of salmonid populations over time, to a level to provide a sustainable harvest sufficient to allow for the meaningful exercise of tribal fishing rights."

These two federal responsibilities complement one another. Both depend on a steady upward trend toward ESA recovery and delisting in the near term, while making river, harvest, and land management improvements for the long term. Furthermore, ESA delisting cannot occur until both biological objectives and the listing factors are considered and NMFS determines, based on an evaluation of the listing factors, that the listed species is no longer likely to require the protection of the Act. Therefore, NMFS will make no delisting decision until it is clear that the threats to the listed species have been addressed and that the status and trends of both the fish and their habitats will be healthy and sustainable in the long term.

Departmental and Executive policies related to the federal government's trust obligations include the following documents: Joint Secretarial Order on American Indian Tribal

Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act (Department of the Interior and Department of Commerce 1997); American Indian and Alaska Native Policy of the U.S. Department of Commerce (1995); Executive Order on Consultation and Coordination with Indian Tribal Governments (2000); Executive Order on Indian Sacred Sites (1996); Presidential Memorandum on Government-to-Government Relations with Native American Tribal Governments (1994; 59 FR 10877). See also NMFS 2004.

1.3.3 Interested public—organizations and individuals

Watershed councils, agricultural groups, environmental organizations such as Trout Unlimited, [this section needs to be written]

1.4 The Nature of this Plan

A recovery plan is not a regulatory document. It does not obligate any party, but it does establish specific responsibilities for actions that have been identified as important to fish recovery. Implementation of the plan can only be achieved through a regional partnership of local, state, federal and tribal interests. It focuses on achieving outcomes and allows implementing agencies and other entities the flexibility to craft innovative yet scientifically sound approaches that best fit local conditions and values.

This document describes:

- The institutional framework and rationale for writing recovery plans
- How NMFS expects to use the plans
- The regional domains of the Columbia Basin within which the recovery plans are written
- The relation of this plan to other planning processes and other ESA mandates
- The current status of listed salmon and steelhead in the Snake River Basin
- Recovery goals and strategy for the Idaho portion of the Snake River Basin
- Actions needed
- A framework for implementation and adaptive management

The State of Washington took responsibility for recovery planning for the portion of the Snake River basin within its borders. The state's Salmon Recovery Act established the Snake River Salmon Recovery Board in 2002; it comprises government and tribal representatives, landowners, and private citizens. With substantial funding from XXX, this group produced the *Draft Snake River Salmon Recovery Plan for SE Washington* in June 2005.

NMFS staff in eastern Oregon and Idaho compiled the information for the Oregon and Idaho portions of the Snake River basin from multiple sources, including federal, state, tribal, private, and local watershed organizations that are involved in salmon recovery. This is the first, in-house working draft of this recovery plan. It is posted chapter-by-

chapter on the Internet to provide an opportunity for informal public response during the development phase. Comments, critiques and suggestions may be submitted by e-mail to: SnakeRiver.nwr@noaa.gov or regular mail to: Snake River Salmon Recovery Plan, 10095 W. Emerald Street, Boise, ID 83704. This draft will be extensively reviewed and revised for publication as an official first draft in December 2005, with a subsequent formal period of public comment by public agencies, environmental organizations, landowners, interested public, and other stakeholders. In 2006, it will be revised and published again in final form for public reference and use.

Once this recovery plan is approved, all federal and nonfederal funding entities should develop a coordinated, prioritized, and accountable funding strategy. To facilitate implementation, NOAA intends to provide streamlined regulatory assurances for actions that are undertaken to implement recovery. As we implement recovery, monitoring, research and evaluation will have to be high priorities. Adjustments to our actions in response to new information will need to be accepted as we learn. The challenges of salmon recovery are immense, particularly in the face of increasing human populations and heavy demand for precious resources such as sufficient clean water. We will have to be prepared to monitor the benefits and costs of our actions and to tackle the hard issues.

1.5 Recovery Domains and Technical Recovery Teams

For the purpose of planning, NMFS organized the Columbia Basin into recovery “domains,” geographically distinct areas containing multiple listed salmon and steelhead, as follows: Oregon Coast, Puget Sound, Willamette/Lower Columbia River, and Interior Columbia River, which includes the Middle Columbia, Upper Columbia, and Snake River. For each recovery domain, NMFS Fisheries set up teams of experts, called Technical Recovery Teams (TRTs) to provide independent scientific consensus for the recovery plans. The TRTs are composed of scientists from NOAA Fisheries, the co-managers, and academia, with expertise relevant to the species and geographic area. In each of these domains, the states, tribes, and, in the Columbia Basin, the Northwest Power and Conservation Council (NPCC), developed local watershed and sub-basin plans. In many of the domains, local policy forums have also been established. These policy forums are using the smaller-scale watershed and sub-basin plans as building blocks to develop larger-scale recovery plans of action for the listed salmon and steelhead. The TRTs provide their recommendations to both NOAA and the local policy forums.

For more information about NMFS, the NPCC, the domains, and the TRTs, see the following Internet sites:

<http://www.nwr.noaa.gov/> <http://www.nwr.noaa.gov/1srd/Recovery/index.html>
<http://www.nwr.noaa.gov/1srd/Recovery/domains/index.html>
http://www.nwfsc.noaa.gov/trt/trt_columbia.htm

1.6 Interior Columbia TRT

The Interior Columbia TRI was formed in October 2001 along with the Interior Columbia Domain. A list of the members and their respective affiliations can be found in Appendix 3-X. Additional information about this TRI and its findings is available at: http://www.nwfsc.noaa.gov/trt/trt_background_meetings.htm

The TRI was asked to complete several tasks in this first phase of recovery planning:

- Define and describe populations within the ESUs.
- Identify goals for viable populations and viable ESUs.
- Identify factors for decline at the population level.
- Work to determine fish-habitat relationships.

The TRI posted maps on its website with preliminary identification of Interior Columbia Basin non-extirpated spring and summer Chinook populations and non-extirpated summer and winter steelhead populations, as follows:

- Snake River sockeye ESU: 1 population
- Snake River spring/summer Chinook ESU: 31 populations.
- Snake River fall Chinook ESU: 1 population
- Snake River steelhead ESU: 25 populations

The TRI has also posted viability criteria for each ESU and its component populations. http://www.nwfsc.noaa.gov/trt/may2005_update_maps.htm
http://www.nwfsc.noaa.gov/trt/trt_viability.htm

1.7 The Snake Basin Recovery Domain

The Snake Basin recovery domain includes the Snake River from its confluence with the Columbia River upstream to Hells Canyon Dam, including watersheds such as the Salmon River and Clearwater River in Idaho, the Grande Ronde River in Oregon, and the Tucannon River in Washington. **[Domain map coming from Dave Crouse]**

The domain contains four listed ESUs:

- Snake River sockeye salmon listed as endangered in 1991
- Snake River spring/summer Chinook salmon listed as threatened in 1992 (corrected notice)
- Snake River fall Chinook salmon listed as threatened in 1992 (corrected notice)
- Snake River steelhead listed as threatened in 1997

This planning area is complex and diverse. It includes three states, a number of cities, and substantial areas of agricultural and forest use, including both public and private ownership. Large areas, including the Selway (in the Clearwater drainage) and the Middle Fork Salmon Rivers lie almost entirely within designated wilderness, and other areas are within national recreation areas and national forests where preservation of anadromous fish habitat is a high priority.

1.8 How NOAA expects to use the plan

Recovery plans are guidance documents, not regulatory documents. No agency or entity is required by the ESA to implement the recovery strategy or specific recommended actions in a recovery plan. However, the ESA clearly envisions recovery plans as the central organizing tool for guiding each species' recovery process. They should also guide Federal agencies in fulfilling their obligations under section 7(a)(1) of the ESA, which calls on all Federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species." In addition to outlining strictly proactive measures to achieve the species' recovery, plans provide context and a framework for implementation of other provisions of the ESA with respect to a particular species, such as section 7(a)(2) consultations on Federal agency activities, development of Habitat Conservation Plans under section 10, special rules for threatened species under section 4(d), or the creation of experimental populations in accordance with section 10(j).

Recovery plans are intended to help NMFS and other entities to do the following:

- Judge the significance of proposed actions relative to the importance of the affected habitat and ESU survival and recovery.
- Guide and expedite ESA 7 Section consultations, HCP approvals, and permitting applications for proposed actions consistent with recovery plans.
- Ensure an integrated approach to ESA Section 7 consultations across all "H's," (habitat, hydro, harvest, hatcheries).
- Focus funding and other efforts on priority areas and subjects that must be addressed first to achieve recovery.
- Improve cost effectiveness by identifying priorities and implementing credible adaptive management frameworks.
- Articulate the reasons for a species' endangerment, as well as why the particular suite of recovery actions described is the most effective and efficient approach to achieving recovery for the species

1.9 Summary of Snake River Basin Geography

The Snake River basin encompasses an area of 107,000 square miles in the states of Idaho, Nevada, Utah, Oregon, Washington and Wyoming. This is approximately half the total area of the Columbia River basin (219,000 square miles.) The Snake River is the largest tributary of the Columbia and is considered to have been the most important drainage for production of anadromous fish in the basin (NMFS 1995). The Snake River is estimated to have produced between 39 and 45 percent of all Columbia River spring and summer Chinook, 55 percent of summer steelhead and substantial numbers of fall Chinook, sockeye, and coho (NMFS 1995).

Hydroelectric dams have blocked access and inundated important spawning and rearing areas for salmon. [See Figure 2.] In all, about 2,500 miles of anadromous fish habitat have been lost to barrier dams and inundation. However, approximately two-thirds of the historical habitat for spring/summer Chinook and steelhead remains accessible to anadromous fish—roughly 6,300 stream miles out of 9,000 miles previously available (IDFG 1985).

Within the Snake River basin, the Salmon River is the largest river system contained entirely within one state (Idaho). The Middle Fork Clearwater and its major tributaries, the Lochsa and Selway Rivers (also in Idaho), are a close second. The Imnaha and Grande Ronde in Oregon and the Tucannon in Washington are other major tributaries still available to anadromous fish.

Topography in the Snake River basin varies from 12,662 feet elevation at Mount Borah in the headwaters of the Pahsimeroi River to 340 feet at the confluence with the Columbia. Terrestrial habitats include high elevation interior deserts, alpine peaks, temperate rain forests and the deepest river canyon in North America. Land uses range from the largest contiguous wilderness in the lower 48 states to agriculture and urban areas.

Starting in the 1800s, dams that blocked anadromous fish from their habitat were constructed for irrigation, mining and milling, and hydropower. Construction of the Hell's Canyon hydroelectric complex along the Idaho-Oregon border in the 1960s completed the extirpation of anadromous species in the Snake River and all tributaries above Hell's Canyon Dam. Major tributaries upstream from Hells Canyon Dam that once supported anadromous fish include the Wildhorse, Powder, Burnt, Weiser, Payette, Malheur, Owyhee, Boise, Bruneau, and Jarbidge Rivers, and Salmon Falls Creek.

Dworshak Dam, completed in 1971, caused the extirpation of Chinook and steelhead runs in the North Fork Clearwater River drainage. Washington Water Power's Lewiston Dam, built in 1927 and removed in 1973, is thought to have caused the extirpation of native Chinook salmon, but not steelhead, in the Clearwater drainage above the dam site. Harpster Dam, located on the South Fork Clearwater River at approximately river mile 15, completely blocked both steelhead and Chinook and caused extirpation of the native populations. In 1963, this dam was removed and fish passage was restored to approximately 500 miles of suitable spawning and rearing habitat.

Loss of habitat for sockeye and fall Chinook was proportionately greater than for spring/summer Chinook and steelhead, with less than 20 percent of the historical habitat for fall Chinook remaining. The Payette Lakes (Big, Little, and Upper) at the headwaters of the Payette River system (now inaccessible to the fish) were the largest producers of sockeye in the Snake River basin (Evermann 1896). Sockeye were also extirpated from Wallowa Lake and Warm Lake by barrier dams. The remaining habitat in Redfish, Alturas, and Pettit Lakes in the upper Salmon River represents about 25 percent of the historically available sockeye rearing habitat in the basin.

In addition to anadromous salmonids, there are many other terrestrial and aquatic organisms that occupy the diverse habitats available. Ninety-nine species of large and small mammals, 15 species of amphibians, 22 species of reptiles, and 390 species of birds have been reported in the Snake River basin within Idaho (Groves et al. 1997). Nearly all of the same species would be expected to occur in the adjacent portions of the basin within Oregon and Washington. For more information on wildlife in the Snake River basin see *Atlas of Idaho's Wildlife* or visit the websites of the Idaho Conservation Data Center (www.state.id.us/fishgame/info/cdc/cdc.htm) or Idaho Museum of Natural History (imnh.isu.edu/digitalatlas). These sites include species lists, distribution data, and lists and status of state and federal species of special concern.

[Needs summary of human factors – settlement patterns and land use, economic drivers, demographics, etc]

Lemhi River Spring/Summer Chinook Salmon Population Population Viability Assessment

The Lemhi River chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings, including: Lower Snake River, Grande Ronde / Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The ESU contains both spring and summer run chinook. The Lemhi River population is a spring run and resides in the Upper Salmon River MPG.

The ICTRT classified the Lemhi River population as a “very large” population (Table 1) based on historical habitat potential (ICTRT 2005). A chinook population classified as very large has a mean minimum abundance threshold criteria of 2000 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

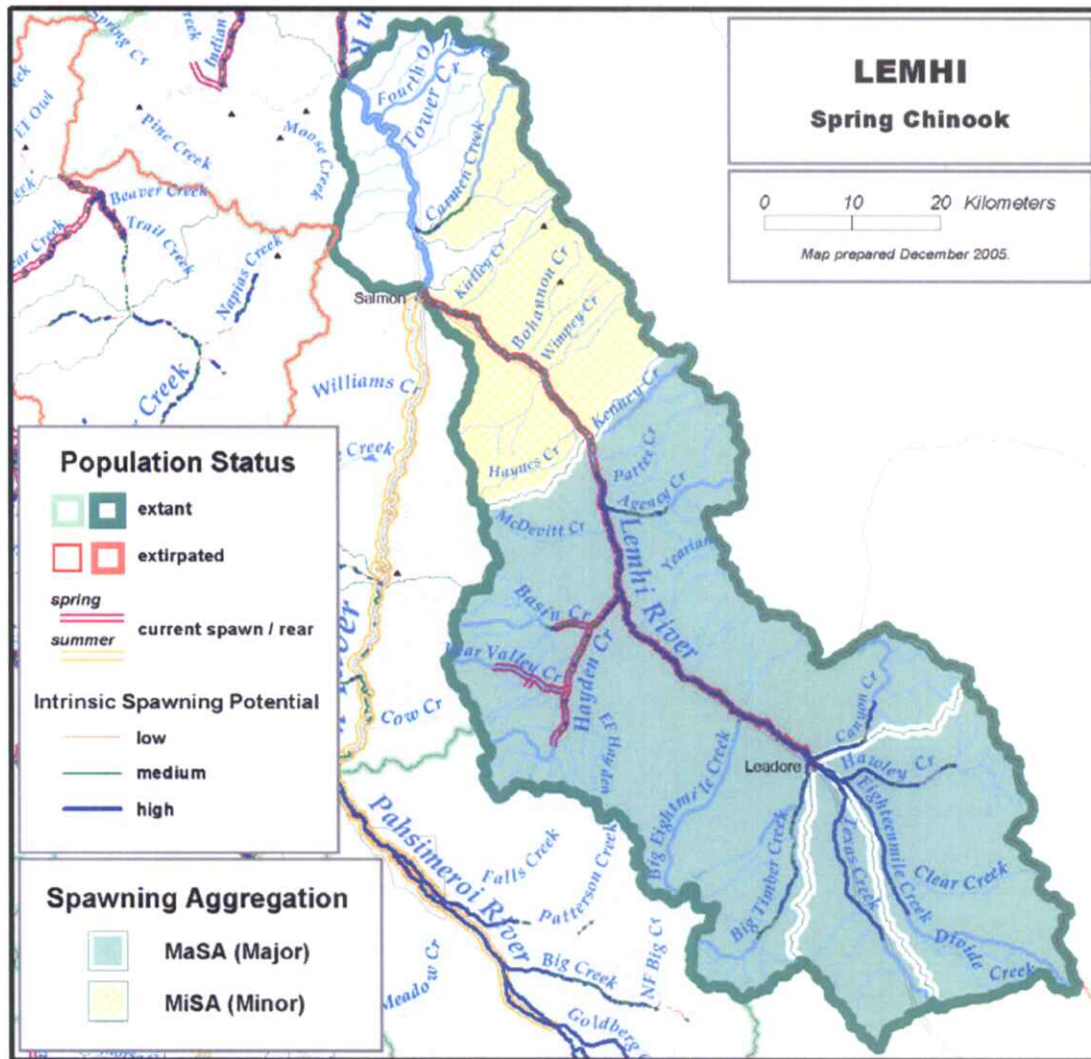


Figure 1. Lemhi River chinook major and minor spawning aggregations.

Table 1. Lemhi River chinook Basin Statistics

Drainage Area (km ²)	3,812
Stream lengths km* (total)	514
Stream lengths km* (below natural barriers)	422
Branched stream area weighted by intrinsic potential (km ²)	1.162
Branched stream area km ² (weighted and temp. limited)	1.162
Total stream area weighted by intrinsic potential (km ²)	1.346
Total stream area weighted by intrinsic potential (km ²) temp limited	1.346
Size / Complexity category	Very Large / "B" (dendritic structure)
Number of MaSAs	3
Number of MiSAs	2

*All stream segments greater than or equal to 3.8m bankfull width were included

**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1957 to 2003) natural abundance (number of adult spawning in natural production areas) has ranged from 10 (1995) to 3,357 (1961, Figure 2). Abundance estimates are based on expanded redd counts (reference). Insert expansion methodology here

Recent year natural spawners include returns originating from naturally spawning parents, and there is no evidence that hatchery strays are entering the population. Spawners originating from naturally spawning parents have comprised an average of 100% since 1953 (Table 2).

Abundance in recent years has been variable, the most recent 10-year geomean number of natural spawners was 80 (Table 2). During the period 1979-1998, returns per spawner for chinook in the Secesh River ranged from 0.08 (1990) to 12.01 (1995). The most recent 20 year (1978-1997) SAR adjusted and delimited (at 75% of the size threshold) geometric mean of returns per spawner was 1.08 (Table 2).

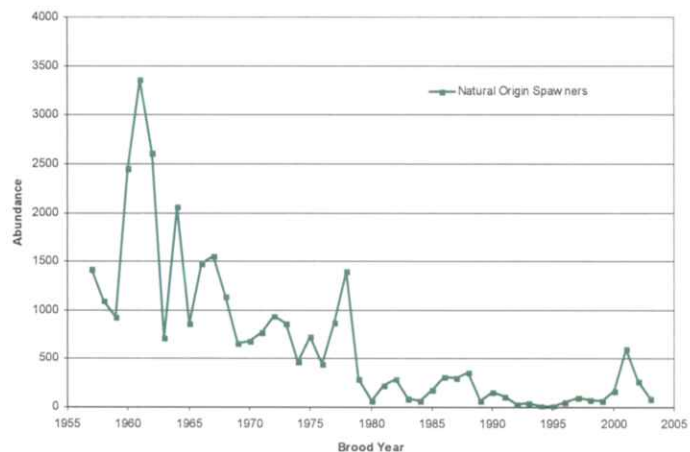


Figure 2. Lemhi River abundance trends 1957-2003.

Table 2. Lemhi River abundance and productivity measures

10-year geomean natural abundance	80
20-year return/spawner productivity	1.09
20-year return/spawner productivity, SAR adj. and delimited*	1.08
20-year Bev-Holt fit productivity, SAR adjusted	n/a
20-year Lambda productivity estimate	1.01
Average proportion natural origin spawners (recent 10 years)	1.0
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size category threshold for this population. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 1500 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Lemhi River population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

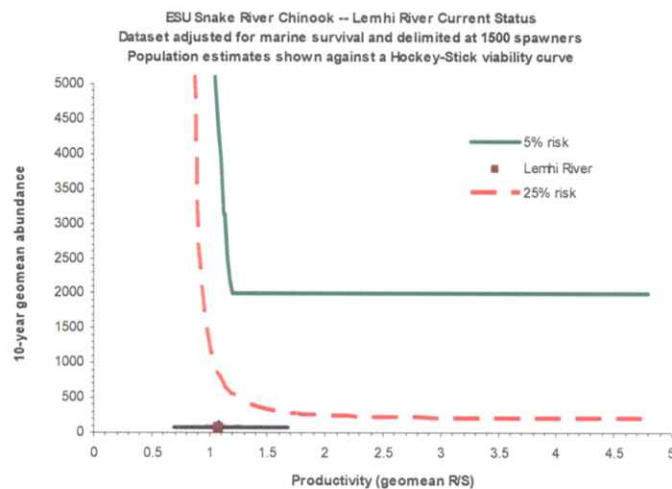


Figure 3. Lemhi River Spring/Summer Chinook abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at 75% of the size threshold. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.72 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and two minor spawning areas (MiSAs) within the Lemhi River Spring/Summer Chinook population. Most spawning occurs in the mainstem Lemhi River from the mouth of Hayden Creek upstream to the town of Leadore.

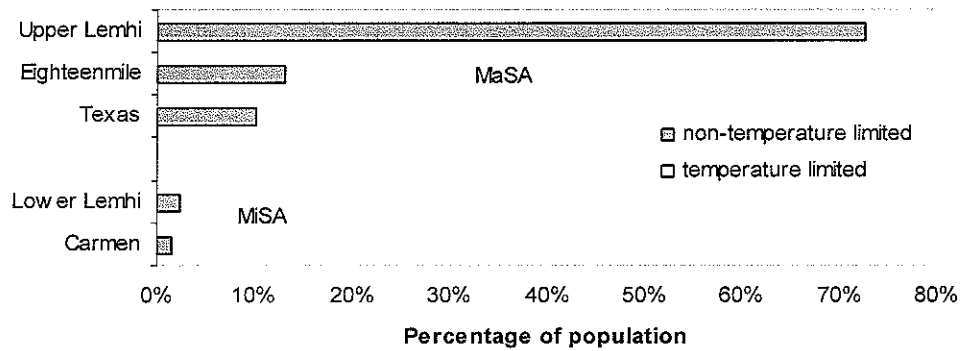


Figure 4. Proportion of major and minor spawning aggregations that make up the Lemhi River population. There are no modeled temperature limitations for the MiSA/MaSAs in this population.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.

The Lemhi River spring Chinook salmon population has three MaSAs (Upper Lemhi, Texas, and Eighteen Mile) and two MiSAs (Carmen and Lower Lemhi). This metric is rated *Low Risk* because there are three MaSAs in a non-linear configuration.

A.1.b. Spatial extent or range of population.

The IDFG has conducted annual spawner index counts since 1957 on the mainstem Lemhi River from the town of Lemhi upstream to the town of Leadore. The index area only covers spawning areas in the Upper Lemhi MaSA, not in the Texas and Eighteenmile MaSAs. This metric is rated *High Risk* because current spawning distribution occupies less than 50% of the historic MaSAs

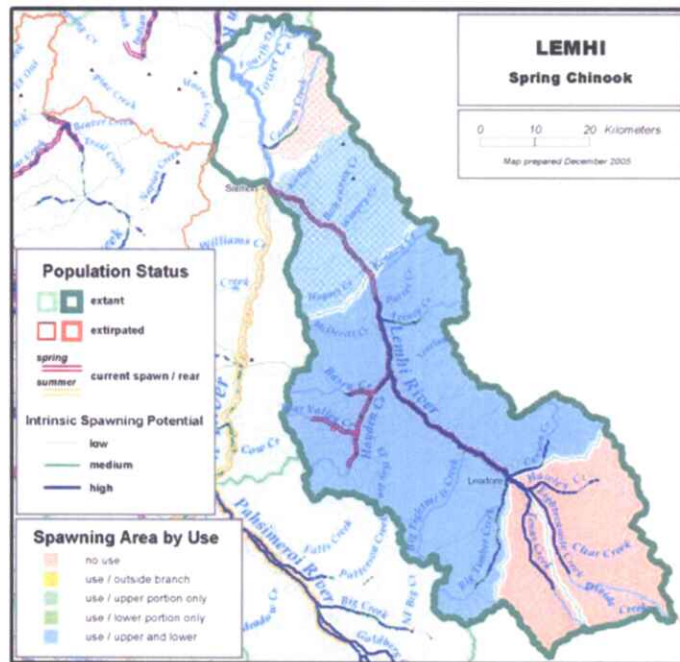


Figure 5. Lemhi River Spring /Summer Chinook distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning aggregates.

The upper MaSAs are not occupied; fish are precluded from reaching these areas because of irrigation-related impacts (barriers and flow reductions). This metric is rated *High Risk* neither of the two MaSAs in the upstream population area is occupied and the downstream-most MiSA (Carmen) is not occupied.

B.1.a. Major life history strategies.

There are limited data to allow any comparisons between historic and current life history strategies. The major adult life history strategy is spring run timing. The known major juvenile life history strategy is a spring yearling migrant. Substantial anthropogenic impacts have occurred that could have resulted in loss of variability or change in a life history strategy. Modification of the hydrologic regime as a result of irrigation practices and blockage of access to upstream areas may affect variability of life history strategies. There is evidence that the population historically also contained the adult summer run life history strategy, and those fish

primarily spawned in the lower mainstem Lemhi River downstream of Hayden Creek. Based on the evidence that the adult summer run life history strategy has been lost from the population the metric is rated *High Risk*.

B.1.b. Phenotypic variation.

Aside from the loss of the putative adult summer run life history strategy discussed previously, there is no data to indicate that any other phenotypic traits have been significantly changed or lost. Land use activities (flow reductions and blockages resulting from irrigation activities) may impart major selective pressures which would cause significant changes in or loss of traits. Based on the evidence that only one phenotypic trait has been lost from the population; this metric is rated at *Moderate Risk*.

B.1.c. Genetic variation.

Genetic ratings were based on IC-TRT analysis of allozyme data presented in Waples et al. 1993. In addition, the IC-TRT analyzed WDFW and R. Waples, unpublished allozyme data, and P. Moran, unpublished microsatellite data. The samples analyzed were not significantly different from 8 hatchery fish samples. There is moderate inter-annual variation among samples. This metric was rated *Low Risk*. The risk rating is influenced by population size and structural complexity.

B.2.a. Spawner composition.

Spawner composition is determined from spawning ground carcass recoveries. Any marked fish that are recovered are examined for the presence of a coded-wire or PIT tag.

(1) *Out-of-ESU strays*. No out-of-ESU strays have been detected spawning in the population and this sub-metric is rated *Very Low* risk.

(2) *Out-of-MPG strays from within the ESU*. No out-of-MPG strays have been detected spawning in the population, and this sub-metric is rated *Very Low* risk.

(3) *Out of population within MPG strays*. No out-of-population strays have been detected spawning in the population, and this sub-metric is rated *Very Low* risk.

(4) *Within-population hatchery spawners*. There is no within-population hatchery program, and this sub-metric is rated *Very Low Risk*.

The overall risk rating for metric B.2 a “spawner composition” is *Very Low Risk* because no strays or hatchery origin fish have been observed in the population.

B.3.a. Distribution of population across habitat types.

The Lemhi River population intrinsic potential distribution historically was distributed across three EPA level IV ecoregions, with the Dry Intermontane Sagebrush Valleys being predominant. (The Barren Mountains ecoregion was represented in less than 2% of the spawning area, and is excluded from consideration here.) All historically occupied ecoregions are currently occupied (Table 3 and Fig. 6). There are no substantial changes in ecoregion occupancy, and this metric was rated *Low Risk* for the population.

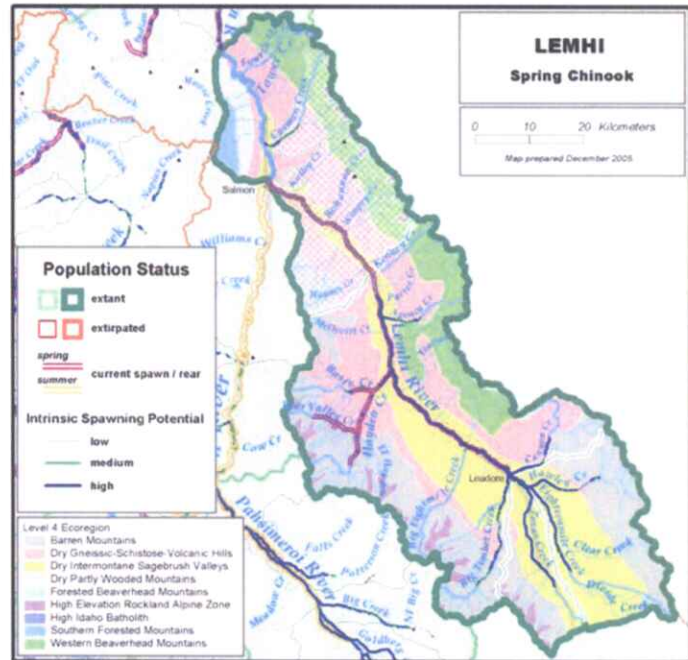


Figure 6. Lemhi River Spring/Summer chinook population distribution across various ecoregions.

Table 3. Lemhi River Spring/Summer Chinook—proportion of spawning areas across various ecoregions.

Ecoregion	% of historical branch spawning area in this ecoregion (non-temperature limited)	% of historical branch spawning area in this ecoregion (temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Barren Mountains	1.8	1.8	0.7
Dry Gneissic-Schistose-Volcanic Hills	4.6	4.6	3.2
Dry Intermontane Sagebrush Valleys	93.5	93.5	96.1

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on smolt outmigrants and adult migrants, the selective mortality is not likely to remove more than 25% of the affected individuals. The likely impacts are rated as *Low Risk* for this action.

Harvest: Recent harvest impact rates for spring/summer Chinook salmon are generally less than 10% annually. There are no freshwater fisheries directly targeting naturally produced spring/summer Chinook salmon; indirect mortalities are expected to occur in some fisheries selective for hatchery fish. It is not likely that the indirect mortality is selective for a particular

group of fish or if it is, it would not select 25% or more of that particular group and this action is as *Very Low Risk*.

Hatcheries: This action is rated *Very Low Risk*. There are no hatchery programs or hatchery fish that affect this population.

Habitat: It is unknown to what extent habitat alterations may have resulted in selective change on the population. Access to the upper two MaSAs was blocked as a result of irrigation-related effects. Because two of the three MaSAs were completely affected by habitat actions and all fish in the affected MaSAs were selected against, this metric is rated *High Risk*.

Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *High Risk* for the Lemhi River population (Table 4). This risk rating is influenced by the lack of occupancy of historically used habitat and the loss of a life history strategy

Table 4. Spatial structure and diversity scoring table

Metric	Risk Assessment Scores					
	Metric	Factor	Mechanism	Goal	Population	
A.1.a	L (1)	L (1)	High Risk (Mean=-0.33)	High Risk	High Risk	
A.1.b	H (-1)	H (-1)				
A.1.c	H (-1)	H (-1)				
B.1.a	H (-1)	H (-1)	High Risk (-1)	High Risk		
B.1.b	M (0)	M (0)				
B.1.c	L (1)	L (1)				
B.2.a(1)	VL (2)	Very Low Risk (2)	Very Low Risk (2)			High Risk
B.2.a(2)	VL (2)					
B.2.a(3)	VL (2)					
B.2.a(4)	VL (2)					
B.3.a	L (1)	L (1)	Low Risk (1)			
B.4.a	H (-1)	H (-1)	High Risk (-1)			

Overall Viability Rating

The Lemhi River spring/summer Chinook salmon population does not currently meet viability criteria because neither Abundance/Productivity risk nor Spatial Structure/Diversity risk meets the criteria for a viable population (Table 5). The 20-year delimited recruit per spawner point estimate essentially is at replacement (1.08), and is significantly less than the 1.45 required at the minimum threshold abundance. The 10-year geometric mean abundance (80) is only 4% of the minimum threshold abundance. Substantial improvements in abundance/productivity status (reduction of risk level) and spatial structure/diversity status will need to occur before the population can be considered viable.

Table 5. Viable Salmonid Population parameter risk ratings for the Lemhi River spring/summer Chinook salmon population. The current status of the population does not meet the criteria for a viable population.

		Spatial Structure/Diversity Risk			
		Very Low	Low	Moderate	High
Abundance/ Productivity Risk	Very Low (<1%)	HV	HV	V	
	Low (1-5%)	V	V	V	
	Moderate (6 – 25%)				
	High (>25%)				Lemhi

Viability Key: HV – Highly Viable; V – Viable; Shaded cells – does not meet viable criteria

Lemhi River Spring Chinook – Data Summary

Data type: Redd count expansions
SAR: Averaged Williams/CSS series

Table 6. Lemhi River Spring Chinook run data (used for curve fits and R/S analysis). Data used in the productivity calculation (years where the parent escapement was less than 1500) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1979	289	1	289	82	0.28	0.9	71	0.25
1980	64	1	64	127	1.99	0.6	74	1.16
1981	228	1	228	246	1.08	0.6	155	0.68
1982	295	1	295	308	1.04	0.5	157	0.53
1983	91	1	91	331	3.63	0.6	191	2.09
1984	69	1	69	208	3.01	1.7	345	4.97
1985	184	1	184	114	0.62	1.6	179	0.97
1986	311	1	311	133	0.43	1.4	187	0.60
1987	307	1	307	70	0.23	1.8	127	0.41
1988	354	1	354	38	0.11	0.7	29	0.08
1989	63	1	63	30	0.47	1.8	53	0.84
1990	158	1	158	12	0.08	4.7	57	0.36
1991	109	1	109	34	0.31	3.0	102	0.93
1992	30	1	30	78	2.62	1.7	129	4.33
1993	46	1	46	89	1.95	1.6	143	3.13
1994	14	1	14	74	5.37	1.0	78	5.61
1995	10	1	10	119	12.01	0.6	71	7.20
1996	57	1	57	100	1.73	0.5	54	0.94
1997	99	1	99	702	7.09	0.3	208	2.10
1998	79	1	79	204	2.57	0.3	60	0.76
1999	69	1	69					
2000	168	1	168					
2001	607	1	607					
2002	270	1	270					
2003	94	1	94					

Table 7. Geomean abundance and productivity measures. Abundance and productivity values used in the current status assessment are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
	median	75% threshold	median	75% threshold	1987-1998	1979-1998	geomean
delimited	2.61	1.09	2.29	1.08	1.02	1.02	80
Point Est	0.26	0.31	0.27	0.26	0.54	0.35	0.36
Std Err	10	20	10	20	12	20	10
count							

Table 8. Poptools stock-recruitment curve fit parameter estimates.

SR Model	Not adjusted for SAR							Adjusted for SAR						
	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	1.09	0.33	n/a	n/a	1.21	0.58	73.7	1.08	0.27	n/a	n/a	1.01	0.44	65.9
Const. Rec	104	21	n/a	n/a	n/a	n/a	58.0	104	14	n/a	n/a	n/a	n/a	40.8
Bev-Holt	50.00	199.70	108	28	0.45	0.69	60.8	23.84	36.40	112	20	0.30	0.37	43.1
Hock-Stk	10.44	10.45	10	10	0.44	0.69	60.8	1.08	0.18	1613	0	1.01	0.44	68.6
Ricker	3.70	1.31	0.00857	0.00196	0.63	0.58	63.0	3.54	0.82	0.00829	0.00128	0.36	0.30	45.0

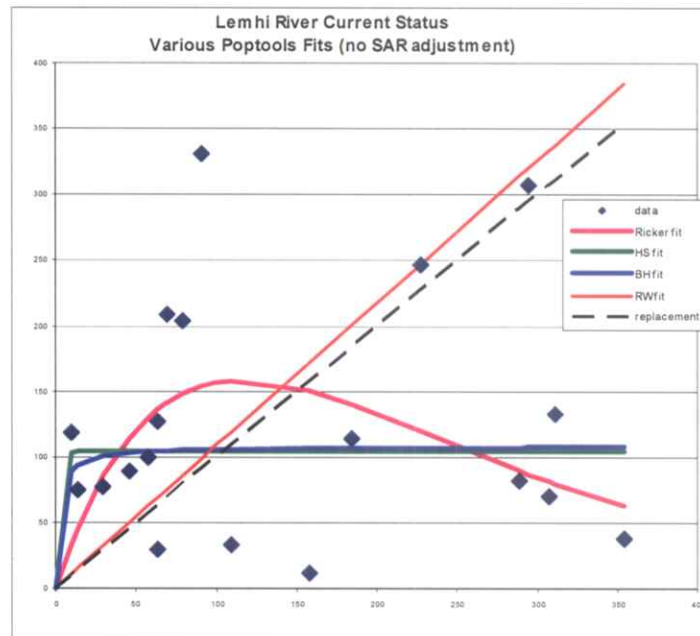


Figure 7. Stock recruitment curves for the Lemhi River Spring/Summer Chinook population. Data not adjusted for marine survival. Points used in the current productivity calculation are bolded (all data are used for this population).

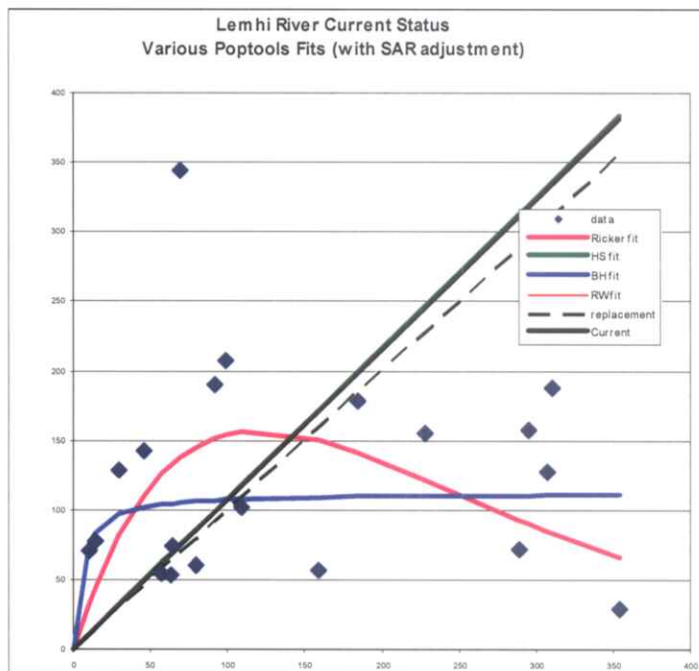


Figure 8. Stock-recruitment curves for the Lemhi River Spring/Summer Chinook population. Data adjusted for marine survival. Points used in the current productivity calculation are bolded (all data are used for this population).

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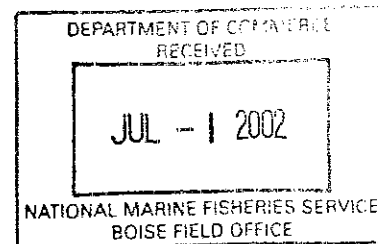
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STATE OF IDAHO
OFFICE OF THE ATTORNEY GENERAL
ALAN G. LANCE



June 28, 2002

Don Anderson
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R. J. Smith
P.O. Box 65
Tendoy, ID 83648

Mike Donahoo
Northwind Environmental
P.O. Box 51174
Idaho Falls, ID 83405

RE: 2002 Lemhi Conservation Agreement

Dear Gentlemen:

Enclosed is a copy of the final 2002 Lemhi Conservation Agreement. Please distribute copies of the agreement as necessary within your agencies or organization.

While the agreement provides two years to develop a long-term conservation plan, this is not much time to complete the task. Thus, we have scheduled the next meeting for development of the long-term conservation plan for July 10, 2002, starting at 9:30 a.m. The meeting will be at the U.S. Forest Service Office in Salmon. Mike Donahoo will be preparing and distributing an agenda for the meeting on or before July 3, 2002.

Sincerely,

CLIVE J. STRONG
Deputy Attorney General
Chief, Natural Resources Division

CJS/pb

Enclosure

cc: Michael Bogert, Governor's Office
Cindy Robertson, IDFG
Tom Curet, IDFG

Natural Resources Division
P.O. Box 83720, Boise, Idaho 83720-0010
Telephone: (208) 334-2400, FAX: (208) 334-2690
Located at 700 W. Jefferson Street Suite 210



2002-2003 CONSERVATION AGREEMENT IN THE LEMHI RIVER BASIN

SIGNATORIES

Idaho Office of Species Conservation	Water District 74Q
Idaho Department of Water Resources	Water District 74W
Idaho Department of Fish and Game	Water District 74Z
Upper Salmon Basin Watershed Project	National Marine Fisheries Service
Lemhi Irrigation District	National Oceanic and Atmospheric Administration
Water District 74	U.S. Fish and Wildlife Service

INTRODUCTION

The National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (Service), and various Idaho parties have been working to agree on and implement long-term conservation actions needed to minimize the risk of “take” of Endangered Species Act (ESA) listed salmon, bull trout, and steelhead in the Lemhi River. Efforts leading to the appropriate ESA authorization of incidental take continue. The parties have settled on interim flows and other actions that demonstrate both commitment and good faith progress toward reaching the long-term objectives. This agreement is organized around three implementation tiers. Tier I includes past actions taken to conserve species in the Lemhi River Basin. Tier II lists actions that will be taken in 2002 through 2003. Tier III identifies actions that will be addressed in a long-term plan.

AGREEMENT

I. Tier 1: Measures That Have Been Completed To Date

- A. In the mainstem Lemhi River, the Upper Salmon Basin Watershed Project (“Project”), the Idaho Department of Fish and Game (“IDFG”), and cooperating water users have eliminated 17 diversions through consolidation. In the Hayden Creek tributary, these groups have eliminated 3 diversions through consolidation.
- B. Using IDFG’s fish screen development shop and NMFS’s screening criteria for the last decade, the Project and IDFG have installed new screens or replaced outdated screens for 65 diversions in the mainstem Lemhi River, 7 diversions in Big Springs Creek tributary, and 12 diversions in Hayden Creek tributary. Additionally, the Project and IDFG have installed new screens on 21 pumps in the Lemhi River Basin.
- C. Throughout the Lemhi River Basin, the Project and IDFG have eliminated 19 push-up dams and improved 4 others to allow fish passage.

- D. The Project has installed over 30 miles of fence in the Lemhi River Basin, for two types of projects: (1) riparian grazing systems, which seasonally protect spawning and rearing habitat, and (2) corridor fencing, which provides year-around protection for riparian habitat.
- E. The Project and IDFG have developed passage and rearing habitat for use by resident and anadromous fish by reconnecting Canyon Creek and Pattee Creek tributaries to the Lemhi River and improving access to Agency Creek tributary.
- F. Idaho Department of Environmental Quality ("IDEQ") has developed Total Maximum Daily Loads ("TMDLs") for the Lemhi River Basin.
- G. In June 2000, the Project, IDFG, Idaho Department of Water Resources ("IDWR"), Lemhi Irrigation District and Water District 74 signed a Memorandum of Understanding ("MOU") to provide water flows for passage of anadromous fish in the Lemhi River between the L-6 diversion and the confluence with the Salmon River. Throughout the 2000 irrigation season, the MOU promised to provide for an instream flow of 10 cubic feet per second ("cfs") to aid downstream migration of juvenile fish as well as "fish flushes" of 35 cfs to aid upstream migration of adult fish. The MOU further directed IDFG to carefully monitor water flows and fish movement to determine when water flushes are needed for fish passage in the lower reaches of the Lemhi River. Finally, the MOU embodied a commitment of the Lemhi water users and state resource agencies to establish a long-term agreement to address fish flow management.
- H. In 2001, the Idaho Water Resource Board filed an application for an instream flow water right of 35 cfs in the Lemhi River from the L-6 Diversion to the confluence of the Lemhi River with the Salmon River under Chapter 15, Title 42 of the Idaho Code.
- I. In 2001, the Idaho Water Resource Board appointed a local rental committee to facilitate operation of a water supply bank for the Lemhi River Basin to rent water to maintain flows in the lower Lemhi River.
- J. In 2001, local water users, through rental of water, successfully maintained, in accordance with the 2001 Conservation Agreement, target flows in the Lemhi River from the mouth to one mile below the Leadore Bridge and in Hayden Creek.
- K. In 2001, IDFG inspected seventy-two (72) diversion structures and determined that all structures allowed for adult and juvenile passage during the period of the 2001 Conservation Agreement.
- L. In 2001, IDFG inspected seventy-two (72) screens for compliance with NMFS bypass criteria.
- M. In 2001, the water users and the IDFG coordinated on ramping down water diversions and implemented salvage operations where appropriate.

- N. Dissolved oxygen levels were measured throughout the study period of the 2001 Conservation Agreement.
- O. Temperature data were collected at five sites on the Lemhi River.
- P. In 2001, the local parties and the Bureau of Reclamation began engineering studies necessary to change the points of diversion for approximately 16.5 cfs of water rights from the lower Lemhi River to S-14 on the Salmon River. These studies are expected to be completed in the Spring of 2002.
- Q. In 2001, the remaining unscreened diversion on the East Fork of Hayden Creek was screened.
- R. A structural and biological evaluation of the LBSC 1 diversion structure was completed in 2001.
- S. The L6 headgate was automated to maintain constant flows through the river.
- T. A manager was hired for the Town and Slough canals to regulate diversions in those canals.
- U. IDFG salvaged 648 juvenile and 2 adult chinook salmon. IDFG also salvaged 1,287 rainbow, cutthroat, bull and brook trout. Nongame species salvaged included suckers, sculpin, whitefish and dace.
- V. In 2001, a ramp down procedure was developed for the LHC11 diversion.
- W. One mile of riparian fence was completed on the Lemhi River and approximately one mile of riparian fence was completed on Canyon Creek.
- X. The Project completed the Whitefish ditch structure to provide passage and connection between the Lemhi River and Canyon Creek.

II. Tier 2: Habitat Measures For 2002 and 2003

- A. Established Instream Flows in the Lemhi River and Hayden Creek for the term of the Agreement.
 - 1. The non-Federal parties will maintain at least a 25 cfs average daily flow for 20% of the days between April 15 through June 30 and at least a 35 cfs average daily flow for the remaining days of this period. The ten-year hydrologic record at the L-5 gage shows that the flows below L-6 were 35 cfs or greater more than 80% of the time between April 15th and June 30th. The non-federal parties will be responsible for arranging for assignment of sufficient water to the Lemhi Water Rental Bank to maintain at least a 20 cfs flow in the Lemhi River from the mouth to L-6 during the remainder of the irrigation season. The federal parties shall provide the funds to rent at least 20 cfs for the late summer instream flow.

2. The non-federal parties will maintain at least a 25 cfs average daily flow from one mile below the Leadore Bridge to the L-6 diversion during the irrigation season to be measured at the McFarland Campground.
3. The non-federal parties will maintain a flow of 8 cfs in Hayden Creek.
4. The parties will avoid dropping more than 2 cfs below the target flows noted in paragraphs 1-3.
5. All water rentals will be on a willing lessor basis under state laws and water bank rules.
6. The Bureau of Reclamation will conduct, in conjunction with the local water users, a study to identify potential physical and management solutions to low flow conditions that occur.

B. Other Enhancement Measures

1. The non-federal parties will retain a consultant to assist them in developing a long-term conservation plan consistent with the objectives identified in Tier III. The non-federal parties, the consultant, the State and the federal agencies will meet and mutually agree upon a scope of work. The intent of the parties is to negotiate a long-term conservation plan during the term of this Agreement.
2. The parties will seek to change the points of diversion for approximately 16.5 cfs from the lower Lemhi River to S-14 diversion on the Salmon River, allowing the previously diverted Lemhi River flow to partially satisfy the instream flow created by Idaho Code § 42-1506.
3. Explore the opportunity to restore connectivity to the main-stem Lemhi River for fish populations seasonally or perpetually isolated to tributaries. The following bull trout and cutthroat streams have been identified for possible reconnection:

Hawley Cr. (Upper Salmon Basin Watershed Project)

Bohannon Cr. (IDFG Screen Program)

4. Work with the USFWS during the 2002 field season to identify and pursue additional measures that would enhance habitat primarily for bull trout and other resident fishes.
5. Pursue funding from State, Federal and private sources to complete the experimental design and implement research directed towards understanding fluvial trout movement (bull, cutthroat, and redband/rainbow trout) in the Lemhi and upper Salmon River Basin. This proposed effort, using radio telemetry, would identify primary spawning,

migration, and holding areas for resident fishes in the Lemhi and upper Salmon Basin. Information gathered from this research will guide and help prioritize future habitat enhancement, screening actions, and other recovery measures within the basin.

6. The parties will seek funding and implement the following projects during the term of this Agreement:
 - a. IDFG and the U.S. Bureau of Reclamation will identify and design appropriate diversion structure for L13 and L35A.
 - b. IDFG will pursue final design options for the update of the LBSC 1 diversion.
 - c. The parties will develop and construct alternatives to push-up dams.
7. The parties will seek funding to implement water saving mechanisms in the mainstem Lemhi River below L7, such as conversions from gravity to sprinkler irrigation systems and from surface to groundwater diversion systems, in a manner that will not negatively impact Lemhi River return flows.
8. The Project and the IDFG will pursue the elimination of the L-11 and the L-12 diversion.
9. The Project will pursue installation of two miles of corridor fencing on Lemhi and Big Springs Creek.
10. The Project will continue installation of off stream watering systems for livestock.
11. IDWR and IDFG will draft a written water turn-on and turn-off agreement and ensure water users accomplish the turn-on and turn-off procedures.
12. The parties will meet prior to January 1, 2003 to determine whether the existing near-term measures set forth in paragraphs A. and B. of Tier II are effective and appropriate for implementation in 2003 and whether implementation of other near-term measures is appropriate.
13. IDWR shall ensure that water users below L-6 are diverting in accordance with their entitlements during the irrigation season.
14. The non-federal parties will reset screens prior to the diversion of water into irrigation canals and will leave screens in until diversions are curtailed or until water in the ditches begins to freeze.

C. Planning and Monitoring

1. The parties will implement the Monitoring Plan, attached hereto as Appendix A.
 2. The parties will ensure that all instream structures, such as diversions, road crossings, berms and dams will be designed, constructed and operated so that they are passable by upstream and downstream migrating fish, and screens will be installed, all consistent with the NMFS criteria.
 3. The State will develop with the federal agencies a monitoring plan to determine whether adult salmonids migrate up the Lemhi River from the Salmon River after July 1. IDFG will implement the study and report the findings to the parties annually.
 4. The parties agree to notify NMFS and/or the Fish and Wildlife Service of incidental take of a listed species within 48 hours of discovery of the take.
- D. The flows set forth in this Agreement are based upon the 10 year hydrologic records at L-5. In the event the hydrologic conditions during the term of this Agreement differ materially from the historic record because of events beyond the control of the parties, the parties agree to meet and review the flow provisions of this Agreement.
- E. Any party who believes that a provision of this Agreement is not being met will notify the other parties of the alleged noncompliance. The parties agree to implement a resolution process to address any issues regarding implementation of this Agreement. This requirement shall be satisfied when, upon notification that an issue exists, representatives from each party meet promptly and attempt to resolve the issue.

III. Tier 3: Long Term Conservation Agreement

- A. The parties are negotiating a long-term agreement for the conservation of ESA-listed fish species in the Lemhi River Basin, consistent with the framework set forth below to be completed by December 31, 2003. Measures included in Tier 3 may be completed prior to negotiation of a long-term agreement, should the opportunity arise. The long-term agreement is intended to establish a process for voluntary compliance with the ESA, resulting in appropriate incidental take authorization. Such agreement will address, but not be limited to, the following subjects:
1. Enhancing Instream Flows
 - a. Through the water bank and other mechanisms, the parties will seek to provide sufficient water for flows for appropriate life stages in the Lemhi River Basin without adversely affecting other surface waters that are important for anadromous and resident species.

- b. The parties will identify and implement projects to improve migration, restore connectivity and increase spawning and rearing habitat in the Lemhi River Basin. The projects may include the following:
 - 1. Installation and renovation of fish screens;
 - 2. Construction or replacement of diversion works;
 - 3. Consolidation of diversion works that will enhance flows through stretches of streams that are prone to dewatering or flows insufficient for fish passage;
 - 4. Elimination or modification of upstream and downstream passage obstacles;
 - 5. Conservation easements to reduce water usage, reduce fish loss to diversion, enhance riparian or flood plain values or other purposes; funding will only be used for those projects that will not result in a reduction of the summer flows of the Lemhi River;
 - 6. Negotiation of water sharing and conservation agreements;
 - 7. Seeking legislation to encourage more efficient water diversion practices where such practices will enhance the flow of the Lemhi River.

2. Other Enhancement Measures

- a. Restore/enhance riparian vegetation.
- b. Install riparian fencing and/or special grazing systems for critical riparian habitat.
- c. Utilize water gaps or off-stream watering to distribute livestock use.
- d. Identify and replace the headgates and diversion structures as needed.
- e. Pursue implementation of TMDLs with Idaho Soil Conservation Commission, IDEQ, and other responsible agencies.
- f. Investigate projects to reestablish more natural stream morphology, such as: connecting streams to their floodplains; re-opening previously closed flood channels; and allowing natural stream-shaping functions to occur where practicable.

3. Planning and Monitoring

- a. Monitor instream passage effectiveness, including whether negotiated flow targets and habitat improvement measures are achieved.
- b. Continue ongoing watershed planning.
- c. Provide funding for adult passage monitoring (perhaps with new technology) in lower Lemhi River.
- d. Ensure water is being diverted in accordance with Idaho law.
- e. Sampling regimes and monitoring stations will be designed and maintained to research and validate flow, habitat, and fish survival relationships and the success of protection measures.

B. The parties will conduct the following analysis to the extent necessary to support development of the long-term agreement:

1. Hydrological analysis (water quantity and quality, water use, data gaps).
2. Fish habitat assessment.
3. Fish passage barrier assessment.
4. Fish screen and passage assessment.
5. Instream flow requirements.
6. Identify and prioritize critical low water areas related to water diversion.
7. Fish population response.

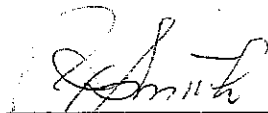
C. The parties will develop the following processes to the extent necessary to support development of the long-term agreement:

1. Schedule and work plan for Lemhi River Basin planning.
2. Composition and procedures of committee that develops the agreement/plan and technical groups.
3. Process to allow participation by interest groups.
4. Dispute resolution mechanisms.

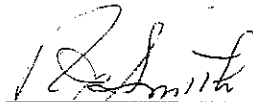
IV. ENFORCEMENT DISCRETION. It is the responsibility of the Service, and the National Oceanic and Atmospheric Administration ("NOAA") and NMFS to investigate and take appropriate enforcement action with respect to potential violations of the ESA. Based on the commitments described in this memorandum, including the parties' commitment to secure appropriate authorization for any incidental take of ESA-listed species that may occur, enforcement action is not the preferred course in this instance. However, if water use or any other activity intended to be covered by this memorandum results in a potential "take" of listed species, the Service and NMFS will investigate and document the apparent violation.

The Service and NOAA and NMFS will exercise their enforcement discretion relative to initiating prosecution if measures identified in Tier 2 are implemented as discussed in this Agreement. This exercise of enforcement discretion will apply to the diversion activities of water users exercising otherwise lawful rights within the boundaries of the Lemhi River Basin, and shall not apply to any intentional "take" of ESA-listed species.

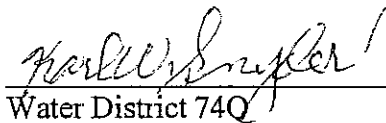
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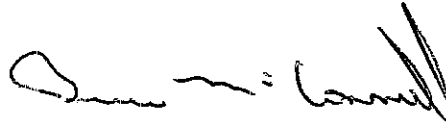
Lemhi Irrigation District



Water District 74



Water District 74Q



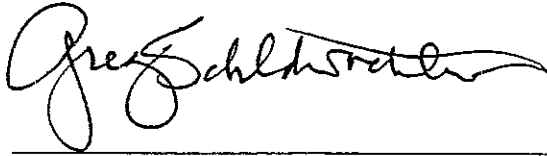
Water District 74Z



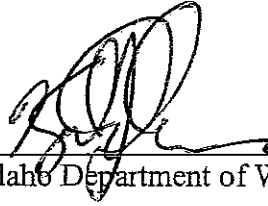
Water District 74W



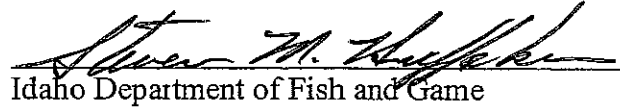
Upper Salmon Basin Watershed Project



Idaho Office of Species Conservation



Idaho Department of Water Resources



Idaho Department of Fish and Game



National Oceanic and Atmospheric
Administration



U.S. Fish and Wildlife Service



National Marine Fisheries Service

Date of last signature: May 15, 2002

Bull Trout (*Salvelinus confluentus*)

Draft Recovery Plan

CHAPTER 1: Introduction

(October 2002)

**Region 1
U.S. Fish and Wildlife Service
Portland, Oregon**

Approved: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Regional Director

Date: _____



DISCLAIMER

Recovery plans delineate reasonable actions that are believed necessary to recover and protect listed species. Plans are prepared by the U.S. Fish and Wildlife Service, sometimes with the assistance of recovery teams, contractors, State agencies, Tribal agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in plan formulation, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service only after they have been signed by the Director or Regional Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature Citation:

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*In: Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan.* U.S.
Fish and Wildlife Service, Portland, Oregon. 137 pps.

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Selena Werdon, U.S. Fish and Wildlife Service
Chip Corsi, Idaho Department of Fish and Game
Jeri Wood, Team Leader, U.S. Fish and Wildlife Service

The Bull Trout Recovery Team gratefully acknowledges the numerous individuals who participated on recovery unit teams. Those who contributed to the recovery unit teams are listed in the chapters for each recovery unit.

EXECUTIVE SUMMARY FOR THE BULL TROUT RECOVERY PLAN

Current Species Status

The bull trout (*Salvelinus confluentus*) in the coterminous United States was listed as threatened on November 1, 1999 (64 FR 58910). Earlier rulemakings had listed distinct population segments of bull trout as threatened in the Columbia River, Klamath River, and Jarbidge River basins (63 FR 31647, 63 FR 42757, 64 FR 17110). Bull trout distribution, abundance, and habitat quality have declined rangewide. Several local extirpations have been documented, beginning in the 1950's. Bull trout continue to occur the Klamath River, Columbia River, Jarbidge River, St. Mary-Belly River, and Coastal-Puget Sound, in the states of Idaho, Montana, Nevada, Oregon, and Washington.

Habitat Requirements and Limiting Factors

Bull trout have more specific habitat requirements than most other salmonids. Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, substrate for spawning and rearing, and migratory corridors. Bull trout are found in colder streams and require colder water than most other salmonids for incubation, juvenile rearing, and spawning. Spawning and rearing areas are often associated with cold-water springs, groundwater infiltration, and/or the coldest streams in a watershed. Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools. Alterations in channel form and reductions in channel stability result in habitat degradation and reduced survival of bull trout eggs and juveniles. Channel alterations may reduce the abundance and quality of side channels, stream margins, and pools, which are areas bull trout frequently inhabit. For spawning and early rearing bull trout require loose, clean gravel relatively free of fine sediments. Because bull trout have a relatively long incubation and development period within spawning gravel (greater than 200 days), transport of bedload in unstable channels may kill young bull trout. Bull trout use migratory corridors to move from spawning and rearing habitats to foraging and overwintering habitats and back. Different habitats provide bull trout with diverse resources, and migratory corridors allow local populations to connect, which may increase the potential for gene flow and support or refounding of populations.

Declines in bull trout distribution and abundance are the results of combined effects of the following: habitat degradation and fragmentation, the blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion structure or other device) into diversion channels and dams, and introduced

nonnative species. Specific land and water management activities that continue to depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development. Some threats to bull trout are the continuing effects of past land management activities.

Organization and Development of the Recovery Plan

Because bull trout in the coterminous United States are widely distributed within a large area, the recovery plan is organized into multiple chapters. This introductory chapter (Chapter 1) describes our overall recovery strategy for the species, defines recovery, and identifies recovery actions applicable for all listed bull trout in the coterminous United States. Each successive chapter focuses on bull trout in specific geographic areas (recovery units), and describes conditions, defines recovery criteria, and identifies specific recovery actions for the recovery unit.

Recovery Objectives

The goal of this recovery plan is to describe the actions needed to achieve the recovery of bull trout, that is, to ensure the long-term persistence of self-sustaining, complex interacting groups (or multiple local populations that may have overlapping spawning and rearing areas) of bull trout distributed across the species' native range. Recovery of bull trout will require reducing threats to the long-term persistence of populations, maintaining multiple interconnected populations of bull trout across the diverse habitats of their native range, and preserving the diversity of bull trout life-history strategies (*e.g.*, resident or migratory forms, emigration age, spawning frequency, local habitat adaptations). To recover bull trout, the following four objectives have been identified:

- ▶ Maintain current distribution of bull trout within core areas as described in recovery unit chapters and restore distribution where recommended in recovery unit chapters.
- ▶ Maintain stable or increasing trend in abundance of bull trout.
- ▶ Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
- ▶ Conserve genetic diversity and provide opportunity for genetic exchange.

These objectives apply to bull trout in all recovery units. Additional objectives may be necessary to achieve recovery in some recovery units and will be identified in the respective recovery unit chapters.

Recovery Criteria

Criteria are established to assess whether recovery objectives are being achieved. Criteria specific to each recovery unit are defined in each recovery unit chapter. Individual chapters may contain criteria for assessing the status of bull trout and alleviation of threats that are unique to one or several recovery units. However, every recovery unit chapter will contain criteria that address the following characteristics:

- ▶ The **distribution of bull trout** in identified and potential local populations in all core areas within the recovery unit.
- ▶ The **estimated abundance of adult bull trout** within core areas in the recovery unit, expressed as either a point estimate or a range of individuals.
- ▶ The **presence of stable or increasing trends** for adult bull trout abundance in the recovery unit.
- ▶ The **restoration of passage** at specific barriers identified as inhibiting recovery.

We expect recovery of bull trout to be a dynamic process occurring over time. The recovery objectives are based on our current knowledge and may be refined as more information becomes available. Some local populations of bull trout, and possibly core area populations, may be extirpated even though recovery actions are being implemented. If reestablishment of recently extirpated populations is not feasible or practical, recovery criteria for a given recovery unit will be revised on a case-by-case basis. Meeting the four recovery criteria is not intended to be precluded where localized extirpations of bull trout are offset by sufficiently strong improvements in other areas of a recovery unit in meeting the four recovery objectives.

The determination of whether a distinct population segment of bull trout is recovered will rely on an analysis of the overall status of the species, threats to the species, and the adequacy of existing regulatory and conservation mechanisms. For example, it may be possible for the Columbia River Distinct Population Segment, which has 22 recovery units, to be recovered prior to all recovery unit criteria being met in all recovery units. Success in accomplishing the recovery

criteria will be reviewed and considered for the impacts both within a recovery unit and throughout a distinct population segment.

Actions Needed

Specific tasks falling within the following seven categories will be necessary to initiate recovery within all recovery units:

- ▶ Protect, restore, and maintain suitable habitat conditions for bull trout.
- ▶ Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
- ▶ Establish fisheries management goals and objectives compatible with bull trout recovery and implement practices to achieve goals.
- ▶ Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
- ▶ Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.
- ▶ Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.
- ▶ Assess the implementation of bull trout recovery by recovery units and revise recovery unit plans based on evaluations.

Recovery Priority Number

The recovery priority number for bull trout in the coterminous United States is 9C, on a scale of 1 to 18, indicating that (1) taxonomically, these populations are distinct population segments of a species, (2) the five populations are subject to a moderate degree of threat(s), (3) the recovery potential is high, and (4) the degree of potential conflict during recovery is high.

Estimated Cost of Recovery

The total cost estimate of recovery for bull trout in the coterminous United States is presented in the individual recovery unit chapters. The costs presented in each chapter are attributed to bull trout conservation but other species will also benefit.

Date of Recovery

Expected time to achieve recovery varies among recovery units because of differences in bull trout status, factors affecting bull trout, implementation and effectiveness of recovery tasks, and responses to recovery tasks. Achieving bull trout recovery in all recovery units will be a complex process that will likely take 25 years or more.

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WHAT IS A RECOVERY PLAN?

A recovery plan is a template for the recovery of a threatened or endangered species and its habitats. The recovery plan describes a process to remove the threats to the long-term survival and reverse the decline of a listed species. Recovery is the restoration of listed species such that they become secure, self-sustaining components of their ecosystem. For bull trout, recovery will require reducing threats to the long-term persistence of populations, maintaining multiple interconnected populations across the diverse habitats of the native range of bull trout, and preserving the diversity of bull trout life-history strategies (*e.g.*, resident and migratory forms, emigration age, spawning frequency, local habitat adaptations).

An approved recovery plan is not a decision document but is intended to provide information and guidance that the U.S. Fish and Wildlife Service believes will lead to recovery of a listed species, including its habitat. A recovery plan provides information necessary to describe the current status of the listed species as well as ongoing or proposed actions designed to aid in the ultimate recovery of the species. Many of the recovery actions (or tasks) in this document will require further environmental analysis and public review, especially those actions taken by Federal agencies.

DEVELOPMENT AND ORGANIZATION OF THE BULL TROUT RECOVERY PLAN

Because the threatened bull trout population segments are widely distributed over a large area and because population segments were subject to listing at different times, the U.S. Fish and Wildlife Service adopted a two-tiered approach to develop the draft recovery plan for bull trout. The first tier addresses broad aspects of bull trout recovery that apply at the level of population segments. The second tier addresses bull trout recovery in smaller areas, such as specific river basins or collections of river basins within population segments, termed "recovery units". There are 22 recovery units in the Columbia River, 1 in the Klamath River, 1 in the Jarbidge River, 1 in the St. Mary-Belly River, and 2 in the Coastal-Puget Sound Distinct Population Segments. This document includes the Columbia River, Klamath River, and the St. Mary-Belly River segments. Recovery plans for the remaining two segments will be released individually at a later time.

We relied on two types of teams to assist in developing the draft recovery plan. To address overall recovery issues, such as identifying an overall recovery strategy, designating recovery units, and providing guidance in developing the recovery plan, we convened an "overall" recovery team. Membership on the recovery team consisted of U.S. Fish and Wildlife Service biologists, a representative from State fish and wildlife resource agencies in each of the four northwestern states (Idaho, Montana, Oregon, and Washington), and a representative from the Upper Columbia United Tribes (Confederated Tribes of the Colville Reservation, Coeur d'Alene Tribe, Kalispel Tribe, Kootenai Tribe of Idaho, and Spokane Tribe).

To develop local recovery strategies at the recovery unit level, we enlisted the assistance of recovery unit teams, one for each recovery unit. Membership on the recovery unit teams consisted of persons with technical expertise in various aspects of bull trout biology within each recovery unit, typically representing Federal and State agencies, Tribes, and industry and interest groups. Major tasks of recovery unit teams included defining recovery for recovery units, including unit-specific objectives and criteria; reviewing factors affecting bull trout; estimating costs; and identifying site-specific actions. Members of the recovery team coordinated with recovery unit teams to ensure consistency among recovery units (see Figure 1 and Table 1 for recovery units).

Figure 1. Bull trout recovery units in the United States.

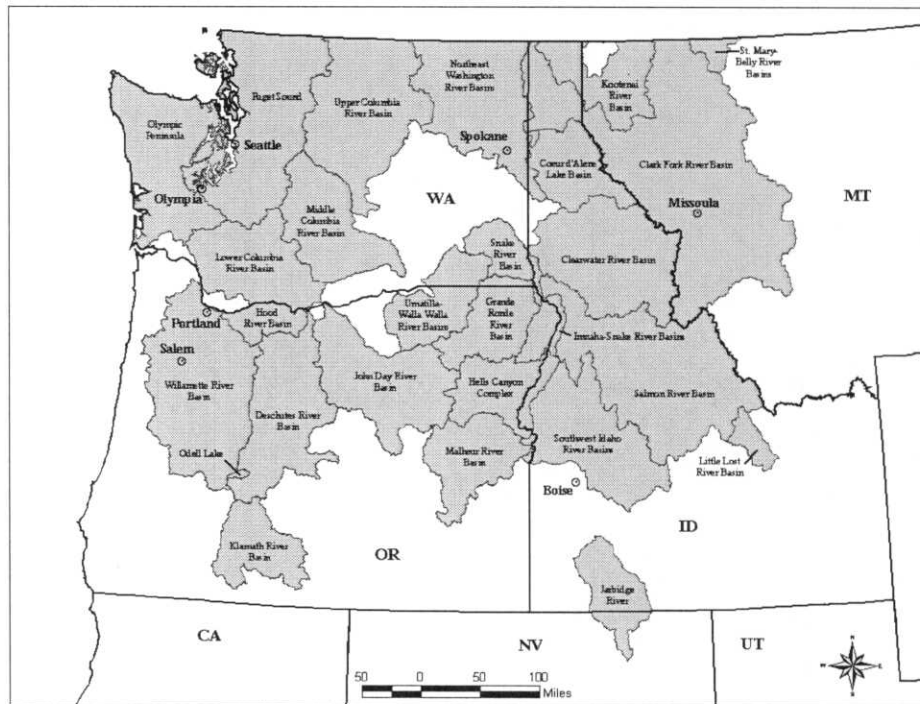


Table 1. Bull trout recovery units by distinct population segment and State(s).

Recovery unit	Distinct population segment	State(s)
Klamath River	Klamath River	Oregon
Clark Fork River	Columbia River	Idaho, Montana, Washington
Kootenai River	Columbia River	Idaho, Montana
Willamette River	Columbia River	Oregon
Hood River	Columbia River	Oregon
Deschutes River	Columbia River	Oregon
Odell Lake	Columbia River	Oregon
John Day River	Columbia River	Oregon
Umatilla-Walla Walla River	Columbia River	Oregon, Washington
Grande Ronde River	Columbia River	Oregon
Imnaha-Snake River ¹	Columbia River	Idaho, Oregon
Hells Canyon Complex ²	Columbia River	Idaho, Oregon
Malheur River	Columbia River	Oregon
Coeur d'Alene Lake Basin	Columbia River	Idaho
Clearwater River	Columbia River	Idaho

Table 1. Bull trout recovery units by distinct population segment and State(s).

Recovery unit	Distinct population segment	State(s)
Salmon River	Columbia River	Idaho
Southwest Idaho ³	Columbia River	Idaho
Little Lost River	Columbia River	Idaho
Lower Columbia River ⁴	Columbia River	Washington
Middle Columbia River ⁵	Columbia River	Washington
Upper Columbia River ⁶	Columbia River	Washington
Northeast Washington ⁷	Columbia River	Washington
Snake River Washington ⁸	Columbia River	Oregon, Washington
Jarbridge River	Jarbridge River	Idaho, Nevada
Puget Sound	Coastal-Puget Sound	Washington
Olympic Peninsula	Coastal-Puget Sound	Washington
St. Mary-Belly River	St. Mary-Belly River	Montana

¹Includes Imnaha River and Snake River and tributaries in Idaho

²Includes Pine Creek, Powder River, and Snake River and tributaries in Idaho

³Includes Boise River, Payette River, and Weiser River basins

⁴Includes Klickitat River, Lewis River, and White Salmon River basins

⁵Includes Yakima River basin.

⁶Includes Entiat River, Methow River, and Wenatchee River basins.

⁷Includes mainstem Columbia River and tributaries upstream of Chief Joseph Dam (Washington), Pend Oreille River basin (Washington), and Spokane River basin upstream of Post Falls (Idaho)

⁸Includes Asotin Creek basin and Tucannon River basin

The bull trout recovery plan differs from many recovery plans in that it is organized into multiple chapters. This introductory chapter (Chapter 1) discusses programmatic issues that broadly apply to bull trout in the coterminous United States. This chapter describes the U.S. Fish and Wildlife Service's recovery strategy for the species, defines recovery, and identifies recovery tasks applicable to bull trout throughout its range.

Each following chapter (Chapters 2 through 24 and Chapter 28) addresses a specific recovery unit and includes an executive summary, describes current conditions of the habitat and species within the recovery unit, outlines the strategy for recovery, defines recovery objectives and criteria, identifies specific recovery tasks, and estimates time and cost required to achieve recovery for a particular recovery unit. For a complete list of chapters, see Appendix 4 in this chapter or the last appendix in any of the following chapters.

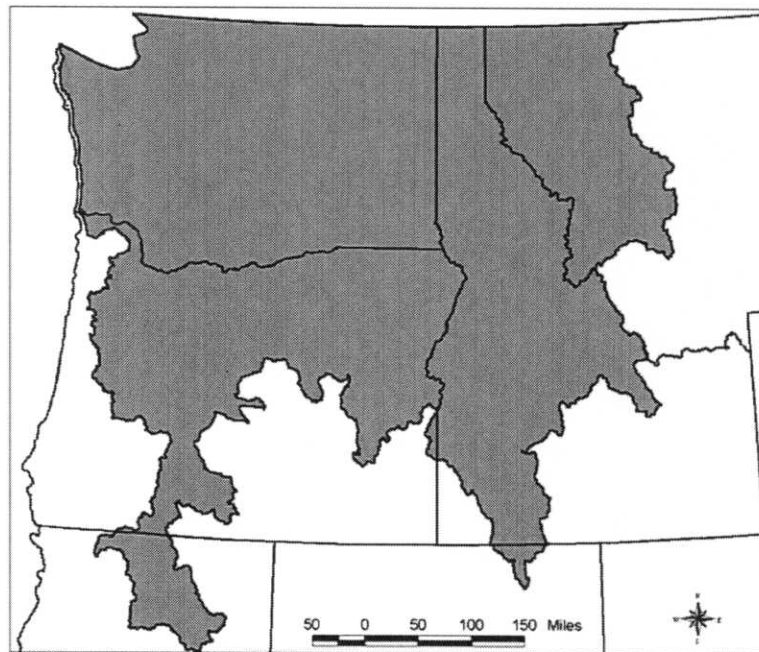
Many of the states have their own bull trout conservation plans in varying stages of development and implementation. These plans each have unique attributes, but may not meet all statutory requirements for the contents of recovery plans, as described in section 4(f)(1)(B) of the Endangered Species Act including "(i) a description of such site-specific management actions as may be necessary to achieve the plan's goal for the

conservation and survival of the species; (ii) objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this section, that the species be removed from the list; and (iii) estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal." The U.S. Fish and Wildlife Service's recovery planning process for bull trout builds upon the foundation established in State conservation plans and adopts portions of those plans, where appropriate.

INTRODUCTION

Bull trout (*Salvelinus confluentus*, family Salmonidae) are char native to the Pacific Northwest and western Canada. The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978; Bond 1992). To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada, (Cavender 1978; Brewin and Brewin 1997). The historical range of bull trout in the coterminous United States is shown in Figure 2.

Figure 2. Estimated historical range of bull trout in the coterminous United States.

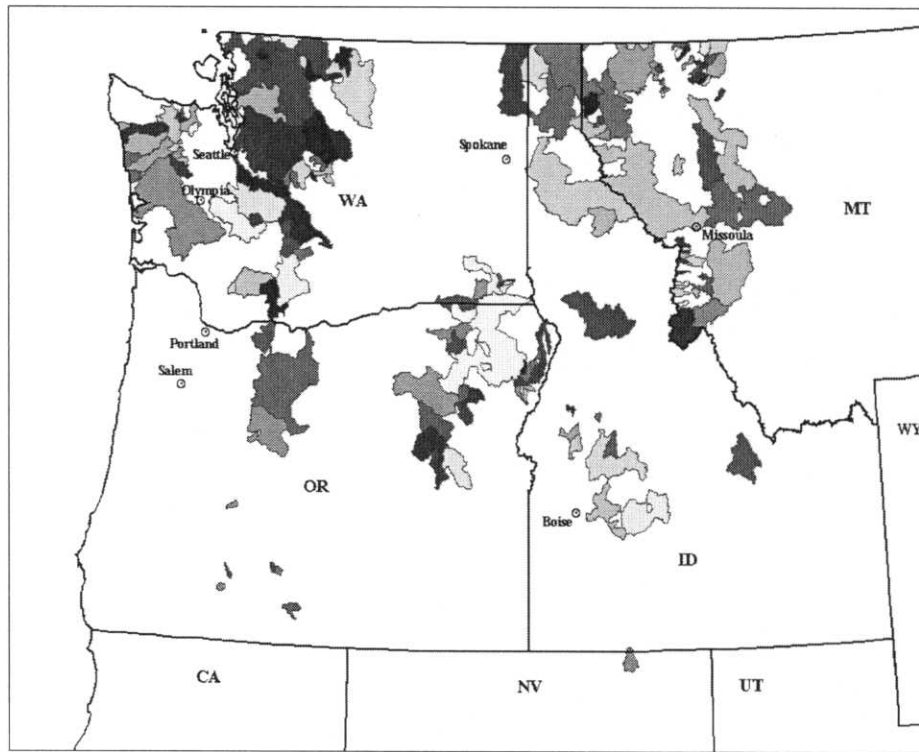


Although bull trout are presently widespread within their historical range in the coterminous United States, they have declined in overall distribution and abundance during the last century. For example, bull trout have been extirpated in

the McCloud River basin, California, as well as locally in tributaries of other river basins. Declines resulted largely from habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, and the introduction of nonnative species. These factors resulted in the reduction or elimination of migratory bull trout. Retaining migratory forms of bull trout in a population is important because these forms allow fish access to more resources (*i.e.*, food and habitat), opportunities for genetic exchange, and the ability to recolonize habitats after local extirpations (*e.g.*, by a watershed-wide disturbance affecting all bull trout in a resident population).

On June 10, 1998, the U.S. Fish and Wildlife Service issued a final rule listing the Columbia River and Klamath River populations of bull trout as threatened (63 FR 31647) under the authority of the Endangered Species Act of 1973. This decision conferred full protection of the Endangered Species Act on bull trout occurring in four northwestern States. The Jarbidge River population was listed as threatened on April 8, 1999 (64 FR 17110). The Coastal-Puget Sound and St. Mary-Belly River populations were listed as threatened on November 1, 1999 (64 FR 58910), which resulted in all bull trout in the coterminous United States being listed as threatened. The five populations discussed above are listed as distinct population segments, *i.e.*, they meet the joint policy of the U.S. Fish and Wildlife Service and National Marine Fisheries Service regarding the recognition of distinct vertebrate populations (61 FR 4722). We do not consider recovery of bull trout in the McCloud River basin in this recovery plan.

In the rules listing bull trout as threatened, the U.S. Fish and Wildlife Service identified subpopulations (*i.e.*, isolated groups of bull trout thought to lack two-way exchange of individuals), for which status, distribution, and threats to bull trout were evaluated. Because habitat fragmentation and barriers have isolated bull trout throughout their current range, a subpopulation was considered a reproductively isolated group of bull trout that spawns within a particular river or area of a river system. Overall, we identified 187 subpopulations in the 5 distinct population segments, 7 in the Klamath River, 141 in the Columbia River, 1 in the Jarbidge River, 34 in the Coastal-Puget Sound, and 4 in the St. Mary-Belly River populations. Although subpopulations were an appropriate unit on which to conduct evaluations for listing purposes, alternative population units have been defined for recovery planning (see the Strategy for Recovery section for further detail). Therefore, subpopulations are not used in this draft recovery plan. The distribution of bull trout subpopulations identified by the U.S. Fish and Wildlife Service at the times of listing is shown in Figure 3.

Figure 3. Bull trout sub populations.

General Description and Life History

Bull trout have been defined as a distinct species (Cavender 1978), however, the genetic relationship among various groups of bull trout within the species can be complex (Rieman and Allendorf 2001). Biologists had previously confused bull trout with Dolly Varden (*Salvelinus malma*), largely because of the external similarity of appearance and the previous unavailability of adequate specimens of both species to any one taxonomist. Morphological (form and structure) analyses have confirmed the distinctiveness of the two species in their different, but overlapping, geographic distributions (Haas and McPhail 1991). Several genetic studies have subsequently confirmed the species distinction of bull trout and Dolly Varden (Phillips *et al.* 1989; Crane *et al.* 1994). Both species occur together in western Washington, for example, with little or no interbreeding (Leary and Allendorf 1997). Lastly, bull trout and Dolly Varden each appear to be more closely related genetically to other species of *Salvelinus* than they are to each other (Phillips *et al.* 1989; Greene *et al.* 1990; Phillips *et al.* 1991; Pleyte *et al.* 1992). For example, bull trout are most closely related to Japanese char (*S. leucomaenis*) whereas Dolly Varden are most closely related to Arctic char (*S. alpinus*).

With genetic theory, bull trout can be grouped into population units that share an evolutionary legacy, termed metapopulations and local populations (Kanda and Allendorf 2001). Metapopulations are composed of one or more local populations. For this recovery plan, bull trout have been grouped into distinct population segments, recovery units, core areas and local populations. Core areas are composed of one or more local populations, recovery units are composed of one or more core areas, and a distinct population segment is composed of one or more recovery units. The manner in which bull trout were grouped in the recovery plan represents an adaptive comparison of genetic population structure and management considerations. (See Strategy for Recovery section for additional discussion of recovery units, core areas, local populations and genetic structure of bull trout.)

Bull trout exhibit both resident and migratory life-history strategies (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989; Goetz 1989), or in certain coastal areas, to saltwater (anadromous) (Cavender 1978; McPhail and Baxter 1996; Washington Department of Fish and Wildlife *et al.* 1997). Resident and migratory forms may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993).

The size and age of bull trout at maturity depends upon life-history strategy. Resident fish tend to be smaller than migratory fish at maturity and produce fewer eggs (Fraley and Shepard 1989; Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

Essential Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these

specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), fish should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997b1).

Migratory corridors link seasonal habitats for all bull trout life histories. For example, in Montana, migratory bull trout make extensive migrations in the Flathead River system (Fraley and Shepard 1989), and resident bull trout in tributaries of the Bitterroot River move downstream to overwinter in tributary pools (Jakober 1995). The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993; M. Gilpin, *in litt.* 1997; Rieman et al. 1997) (see also The Role of the Mainstem Columbia and Snake Rivers discussion). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed, or stray, to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants.

Bull trout are found primarily in the cold streams, although individual fish are found in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997). Water temperature above 15 degrees Celsius (59 degrees Fahrenheit) is believed to limit bull trout distribution, a limitation that may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997; Baxter *et al.* 1999). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8 degrees Celsius (44 to 46 degrees Fahrenheit) and optimum water temperatures for egg incubation of 2 to 4 degrees Celsius (35 to 39 degrees Fahrenheit). For Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 to 9 degrees Celsius (46 to 48 degrees Fahrenheit), within a temperature gradient of 8 to 15 degrees Celsius (46 to 60 degrees Fahrenheit). In Nevada, adult bull trout have been collected at 17.2 degrees Celsius (63 degrees Fahrenheit) in the West Fork of the Jarbidge River (S. Werdon, pers. comm. 1998) and have been observed in Dave Creek where maximum daily water temperatures were 17.1 to 17.5 degrees Celsius (62.8 to 63.6 degrees Fahrenheit) (Werdon, *in litt.* 2001). In the Little Lost River, Idaho, bull trout have been collected in water having temperatures up to 20 degrees Celsius (68 degrees Fahrenheit); however, these fish made up less than 50 percent of all salmonids when maximum summer water temperature exceeded 15 degrees Celsius (59 degrees Fahrenheit) and less than 10 percent of all salmonids when temperature exceeded 17 degrees Celsius (63 degrees Fahrenheit) (Gamett 1999).

All life-history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (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). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restricted than summer habitat. Maintaining bull trout habitat requires stability of stream channels and of flow stability (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5 to 9 degrees Celsius (41 to 48 degrees Fahrenheit) in late summer to early fall (Goetz 1989). In the Swan River, Montana, abundance of bull trout redds (spawning areas) was positively correlated with the extent of bounded alluvial valley reaches, which are likely areas of groundwater to surface water exchange (Baxter *et al.* 1999). Survival of bull trout embryos planted in stream areas of groundwater upwelling used by bull trout for spawning were significantly higher than embryos planted in areas of surface-water recharge not used by bull trout for spawning (Baxter and McPhail 1999). Pratt (1992) indicated that increases in fine sediment reduce egg survival and emergence.

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Water temperatures during spawning generally range from 4 to 10 degrees Celsius (39 to 51 degrees Fahrenheit). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Migratory bull trout frequently begin spawning migrations as early as April and have been known to move upstream as far as 250 kilometers (155 miles) to spawning grounds in Montana (Fraley and Shepard 1989; Swanberg 1997). In Idaho, bull trout moved 109 kilometers (67.5 miles) from Arrowrock Reservoir to spawning areas in the headwaters of the Boise River (Flatter 1998). In the Blackfoot River, Montana, bull trout began spring migrations to spawning areas in response to increasing temperatures (Swanberg 1997). 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 emergence of fry may surpass 200 days. Fry

normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Growth varies depending upon life-history strategy. Resident adults range from 150 to 300 millimeters (6 to 12 inches) total length, and migratory adults commonly reach 600 millimeters (24 inches) or more (Pratt 1985; Goetz 1989). The largest verified bull trout is a 14.6-kilogram (32-pound) specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

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, macro-zooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout feed on various fish species (Leathe and Graham 1982; Fraley and Shepard 1989; Brown 1992; Donald and Alger 1993). In coastal areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasii*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) in the ocean (WDFW *et al.* 1997).

Aquatic Community

In the Columbia River and Klamath River basins, bull trout occur with native cutthroat trout (*Oncorhynchus clarki* subspecies), resident (redband) and migratory (steelhead) rainbow trout (*O. mykiss*), chinook salmon (*O. tshawytscha*), sockeye salmon (*O. nerka*), mountain whitefish (*Prosopium williamsoni*), and various sculpin (Cottidae), sucker (Catostomidae), and minnow (Cyprinidae) species (Mauser *et al.* 1988; WDF *et al.* 1993; WDFW 1998). In the Jarbidge River basin, bull trout occur with native redband trout, mountain whitefish, sculpin, bridgelip sucker (*Catostomus columbianus*), and various minnow species (Warren and Partridge 1993; Johnson and Weller 1994; Zoellick *et al.* 1996; Partridge and Warren 1998; Johnson 1999). In the Coastal-Puget Sound areas, bull trout occur with native cutthroat trout, steelhead, chinook salmon, coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), sockeye salmon, mountain whitefish, pygmy whitefish (*P. coulteri*), and various sculpin, sucker, and minnow species (R2 Resource Consultants, Inc. 1993; WDF *et al.* 1993; WDFW 1998). In the St. Mary-Belly River system, bull trout occur with native westslope cutthroat trout, lake trout (*S. namaycush*), mountain whitefish, northern pike (*Esox lucius*), trout-perch (*Percopsis omiscomaycus*), and various sculpin, sucker, and minnow species (Fredenberg 1996; Holton and Johnson 1996).

Bull trout habitat within the coterminous United States often overlaps with the range of several fishes listed as threatened, endangered, or proposed for listing under the Endangered Species Act, including endangered Snake River sockeye salmon (56 FR 58619), threatened Snake River spring/summer and fall chinook salmon (57 FR

14653), endangered Kootenai River white sturgeon (*Acipenser transmontanus*) (59 FR 45989), threatened and endangered steelhead (62 FR 43937), threatened Puget Sound chinook salmon (63 FR 11481), and threatened Hood Canal summer-run chum salmon and Columbia River chum salmon (64 FR 14507).

Nonnative salmonids (members of the trout and salmon family) have been widely introduced and have become established in numerous areas throughout the range of bull trout. These species include brook trout (*S. fontinalis*), lake trout (west of the Continental Divide, *i.e.*, excluding the St. Mary-Belly River system where they are native), brown trout (*Salmo trutta*), Arctic grayling (*Thymallus arcticus*), and lake whitefish (*Coregonus clupeaformis*). Kokanee (a freshwater form of *O. nerka*), nonnative strains of rainbow trout, and nonnative subspecies of cutthroat trout have also been introduced into areas where they did not occur naturally.

Reasons for Decline

Bull trout distribution, abundance, and habitat quality have declined rangewide (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; Newton and Pribyl 1994; Idaho Department of Fish and Game, *in litt* 1995; McPhail and Baxter 1996). Several local extirpations have been documented, beginning in the 1950's (Rode 1990; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994; Newton and Pribyl 1994; Berg and Priest 1995; Light *et al.* 1996; Buchanan *et al.* 1997; WDFW 1998). Bull trout were extirpated from the southernmost portion of their historic range, the McCloud River in California, around 1975 (Moyle 1976; Rode 1990). Bull trout have been functionally extirpated (*i.e.*, few individuals may occur there but do not constitute a viable population) in the Coeur d'Alene River basin in Idaho and in the Lake Chelan and Okanogan River basins in Washington (USFWS 1998a).

These declines result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta *et al.* 1987; Chamberlin *et al.* 1991; Furniss *et al.* 1991; Meehan 1991; Nehlsen *et al.* 1991; Sedell and Everest 1991; Craig and Wissmar 1993; Frissell 1993; Henjum *et al.* 1994; McIntosh *et al.* 1994; Wissmar *et al.* 1994; USDA and USDI 1995, 1996, 1997; Light *et al.* 1996; MBTSG 1995a-e, 1996a-f).

Threats to bull trout in the coterminous United States fall into several categories including habitat isolation, loss or blockage of migratory corridors, poor water quality, and the introduction of nonnative species (63 FR 31647, 64 FR 17110, 64 FR 58910). The Jarbidge River population segment is additionally threatened by habitat degradation from past and ongoing land management activities such as road construction and maintenance, mining, and grazing; other activities such as recreational fishing (intentional and unintentional harvest); and interactions with stocked rainbow trout (64 FR 17110). Threats to the St. Mary-Belly River population also include irrigation dams, unscreened diversions, and interactions with nonnative brook trout (64 FR 58910). Additional threats to bull trout are the continuing effects of activities conducted in the past, activities that have been discontinued or modified in recent years to lessen negative effects.

Dams

Dams affect bull trout by altering habitats; flow, sediment, and temperature regimes; migration corridors; and creating additional interspecific interactions, mainly between bull trout and nonnative species (Rode 1990; WDW 1992; Craig and Wissmar 1993; Rieman and McIntyre 1993; Wissmar *et al.* 1994; T. Bodurtha, U.S. Fish and Wildlife Service, *in litt.* 1995; USDA and USDI 1996, 1997). Impassable dams have caused declines of bull trout by preventing migratory fish from reaching spawning and rearing areas in headwaters and recolonizing areas where bull trout have been extirpated (Rieman and McIntyre 1993; MBISG 1998).

The extirpation of bull trout in the McCloud River basin, California, has been attributed primarily to construction and operation of McCloud Dam, which began operation in 1965 (Rode 1990). McCloud Dam flooded bull trout spawning, rearing, and migratory habitats. The dam also resulted in elevated water temperatures.

Although dams negatively affect bull trout (Rieman and McIntyre 1993; Gilpin, *in litt.* 1997), some dams can benefit bull trout by blocking introduced nonnative species from upstream areas (MBTSG 1995e). Some dams also increase the potential forage base for bull trout by creating reservoirs that support prey species (Faler and Bair 1991; Pratt 1992).

Some of the major effects to bull trout resulting from the Federal Columbia River Power System and from operation of other hydropower, flood control, and irrigation diversion facilities (see also Agricultural Practices) include the following: (1) fish passage barriers, (2) entrainment of fish into turbine intakes and irrigation canals, (3) inundation of fish spawning and rearing habitat, (4) modification of stream flows and water temperature regimes, (5) dewatering of shallow water zones during power peaking operations, (6) reduced productivity in reservoirs, (7) periodic gas supersaturation of waters downstream of dams, (8) water level fluctuations interfering

with retention of riparian vegetation along reaches affected by power peaking operations, (9) establishment of nonnative riparian vegetation along reaches affected by power peaking operations, and (10) severe reductions in reservoir levels to accommodate flood control operations.

Hungry Horse, Libby, Albeni Falls, Dworshak, Chief Joseph, Keechelus, Tieton, and Grand Coulee dams, as well as others in the Columbia River basin and throughout the range of bull trout in the coterminous United States, were built without fish passage facilities and are barriers to bull trout migration. These barriers have contributed to the isolation of local populations of migratory bull trout. The lower Snake, middle Columbia, and lower Columbia River hydropower projects have both adult and juvenile fish passage facilities, but these fishways were designed specifically for anadromous salmonids, not for resident fish such as bull trout. The designs, therefore, address the migration needs of anadromous, primarily semelparous (*i.e.*, fish that spawn only once in a lifetime) of the genus *Oncorhynchus* (except steelhead, which in some instances can spawn more than once in a lifetime), but do not include consideration for iteroparous fish (*i.e.*, those that can spawn more than once), or fish that merely wander both upstream and downstream as adults to forage. Bull trout have been observed using upstream fish passage facilities at many of the hydropower projects on the Snake and Columbia rivers. However, as indicated above, even dams with fish passage facilities may be a factor in isolating bull trout local populations if they are not readily passable by bull trout and/or if the dams do not provide an adult downstream migration route.

Entrainment of bull trout may also occur at various projects in the Columbia River basin including Libby, Hungry Horse, Albeni Falls, Rocky Reach, Rock Island, Wells, Dworshak, Bonneville, Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams. Fish can be killed or injured when passing the dams. Potential passage routes include through spill, the turbines, or the juvenile bypass systems, but the relative passage success of these routes for adult salmonids has not been thoroughly investigated. However, one study conducted in the early 1970's revealed that passage through turbines resulted in a 22 to 41 percent mortality rate for adult steelhead (Wagner and Ingram 1973). Additionally, a 40 to 50 percent injury rate for adult salmonids passing through the juvenile fish bypass system at McNary Dam has been noted (Wagner 1991; Wagner and Hilson 1993). Adult bull trout may experience similar mortality rates. In addition, those adult fish that survive passage at projects that do not have upstream passage facilities are isolated in downstream reaches away from their natal (native) streams. As indicated above, the loss of these larger, more fecund migratory fish is detrimental to their natal populations.

The creation of mainstem Columbia and Snake river pools (*i.e.*, the areas of slow moving water behind the dams) combined with introductions of piscivorous species (*e.g.*, bass, walleye) have also affected the habitat of bull trout and other

salmonids. An increase in predator populations, both native (*e.g.*, northern pikeminnow) and nonnative, as a result of creating artificial habitat and concentrating prey is discussed as a factor for the decline of each listed Snake River salmon species (NMFS 1991a, b, and c). Ideal predator foraging environments have been created in these pools, particularly for warm water species in the summer. Smolts that pass through the projects are subjected to turbines, bypasses, and spillways, that may result in disorientation and increased stress, conditions that reduce their ability to avoid predators below the dams. Creation of the pools above the dams has resulted in low water velocities that increase smolt travel time and increase predation opportunity. Increased water temperatures, also a result of the impoundment of the river, have also been shown to increase predation rates on salmonid smolts (Vigg and Burley 1991). Because bull trout are apex (top) predators of other fish, negative effects to the salmonid smolt prey base, and the resulting decline in adult returns, are likely to affect bull trout negatively as well. Additionally, increased water temperatures, influenced by the presence of dams, also decreases the suitability of the lower Snake and Columbia river pools for bull trout in the late spring through early fall.

Uncontrolled spill, or even high levels of managed spill, at hydropower projects can produce extremely high levels of total dissolved gas that may impact bull trout and other species. These high levels of gas supersaturation can cause gas bubble disease trauma in fish. Gas bubble disease is caused by gas being absorbed into the bloodstream of fish during respiration. Effects can range from temporary debilitation to mortality, and supersaturation can persist for several miles below dams where spill occurs. The states of Oregon and Washington have established a 111 percent total dissolved gas level as State water quality standards. However, total dissolved gas levels of up to 120 percent have been experienced during recent years of managed spill in the Federal Columbia River Power System, with involuntary spill episodes resulting in total dissolved gas levels of as high as 140 percent at some sites (NMFS 2000). At levels near 140 percent, gas bubble disease may occur in over 3 percent of fish exposed. At levels of up to 120 percent the incidence of gas bubble disease decreases to a maximum of 0.7 percent of fish exposed (NMFS 2000).

Manipulated flow releases from storage projects alter the natural flow regime, affect water temperature, have the potential to destabilize downstream streambanks, alter the natural sediment and nutrient loads, and cause repeated and prolonged changes to the downstream wetted perimeter (MBISG 1998). Power peaking operations, which change the downstream flow of the river on a frequent basis, cause large areas of the river margins to become alternately wet and then dry, adversely affecting aquatic insect survival and production (Hauer and Stanford 1997). Changes in water depth and velocity as a result of rapid flow fluctuations, and physical loss or gain of wetted habitat, can cause juvenile trout to be displaced, thus increasing their vulnerability to predation. Additionally, rapid flow reductions can strand young fish

if they are unable to escape over and through draining or dewatered substrate. These effects also indirectly adversely affect bull trout by degrading the habitat of their prey (small fish) and the food upon which they depend (aquatic insects).

Reservoirs created by dams have also inundated bull trout habitat. For example, reservoirs created by the construction of Libby and Hungry Horse dams have inundated miles of mainstem river and tributary habitat previously used by many local populations of bull trout (BPA *et al* 1999). Reservoir water level manipulations can create migration barriers at the confluence of tributaries entering the reservoir, as well as negatively affecting littoral rearing habitats for prey species of bull trout. Reservoir levels are often drawn down substantially during drought years, or annually as operators evacuate flood control reservoirs to make room for spring snowmelt runoff. Reduced volumes of water in reservoirs can affect their overall productivity, that may ultimately reduce the food base of predators such as bull trout. Some reservoir levels have periodically been reduced so severely that bull trout and other species have had to be physically removed and relocated to ensure their survival. Other reservoirs are unproductive and provide poor habitat for bull trout compared to natural riverine habitats (*e.g.*, Noxon and Cabinet Gorge). However, reservoirs such as Libby, Hungry Horse, and Dworshak now provide suitable habitat for adfluvial populations of bull trout that was not available prior to dam construction.

Forest Management Practices

Forest management activities, including timber extraction and road construction, affect stream habitats by altering recruitment of large woody debris, erosion and sedimentation rates, runoff patterns, the magnitude of peak and low flows, water temperature, and annual water yield (Cacek 1989; Furniss *et al* 1991; Wissmar *et al* 1994; Spence *et al* 1996; Spencer and Schelske 1998; Swanson *et al* 1998). Activities that promote excessive substrate movement reduce bull trout production by increasing egg and juvenile mortality, and reducing or eliminating habitat (*e.g.*, pools filled with substrate) important to later life-history stages (Fialey and Shepard 1989; Brown 1992). The length and timing of bull trout egg incubation and juvenile development (typically more than 200 days during winter and spring) and the strong association of juvenile fish with stream substrate make bull trout vulnerable to changes in peak flows and timing that affect channels and substrate (Goetz 1989; Pratt 1992; McPhail and Baxter 1996; MBTSG 1998).

Roads constructed for forest management are a prevalent feature on managed forested and rangeland landscapes. Roads have the potential to adversely affect several habitat features, (*e.g.*, water temperature, substrate composition and stability, sediment delivery, habitat complexity, and connectivity) (Baxter *et al* 1999; Trombulak and Frissell 2000). Roads may also isolate streams from riparian areas,

causing a loss in floodplain and riparian function. The aquatic assessment portion of the Interior Columbia Basin Ecosystem Management Project provided a detailed analysis of the relationship between road densities and bull trout status and distribution (Quigley and Arbelbide 1997). The assessment found that bull trout are less likely to use streams in highly roaded areas for spawning and rearing, and do not typically occur where average road densities exceed 1.1 kilometers per square kilometer (1.7 miles per square mile).

Although bull trout occur in watersheds where timber has been harvested, bull trout strongholds primarily occur in watersheds with little or no past timber harvest, such as the wilderness areas of central Idaho and the South Fork Flathead River drainage in Montana (Henjum *et al.* 1994; MBTSG 1995e; USDA and USDI 1997; Rieman *et al.* 1997b). However, the Swan River basin, Montana, has had extensive timber harvest and road construction, and is a bull trout stronghold (Watson and Hillman 1997). The overall effects of forestry practices on bull trout in parts of this basin are difficult to assess because of the complex geomorphology and geology of the drainage (MBTSG 1996a).

Roads may affect aquatic habitats considerable distances away. For example, increases in sedimentation, debris flows, and peak flows affect streams longitudinally so that the area occupied by a road can be small compared to the entire downstream area subjected to its effects (Jones *et al.* 2000; Trombulak and Frissell 2000). Upstream from road crossings, large areas of suitable habitats may become inaccessible to bull trout due to fish passage barriers (*e.g.*, culverts).

Livestock Grazing

Improperly managed livestock grazing degrades bull trout habitat by removing riparian vegetation, destabilizing streambanks, widening stream channels, promoting incised channels and lowering water tables, reducing pool frequency, increasing soil erosion, and altering water quality (Howell and Buchanan 1992; Mullan *et al.* 1992; Overton *et al.* 1993; Platts *et al.* 1993; Uberuaga 1993; Henjum *et al.* 1994; MBTSG 1995a,b,c; USDA and USDI 1996, 1997). These effects reduce overhead cover, increase summer water temperatures, and promote formation of anchor ice (ice attached to the bottom of an otherwise unfrozen stream, often covering stones, etc.) in winter, and increase sediment in spawning and rearing habitats.

Negative effects of livestock grazing on bull trout habitat may be minimized if grazing is managed appropriately for conditions at a specific site. Practices generally compatible with the preservation and restoration of bull trout habitat include fences to exclude livestock from riparian areas, rotation schemes, relocation of water and salting facilities away from riparian areas, and use of herders.

Agricultural Practices

Agricultural practices, such as cultivation, irrigation diversions, and chemical application, contribute to nonpoint source pollution in some areas within the range of bull trout (IDHW 1991; WDE 1992; MDHES 1994). These practices can release sediment, nutrients, pesticides, and herbicides into streams; increase water temperature; reduce riparian vegetation; and alter hydrologic regimes, typically by reducing flows in spring and summer. Irrigation diversions also affect bull trout by altering stream flow and allowing entrainment. The effects of the myriad of small irrigation diversion and hydropower projects throughout the range of bull trout are likely of even greater significance than the large hydropower and flood control projects. Many of these are located further up in watersheds and either physically block fish passage by means of a structure (*i.e.*, a dam), or effectively block passage by periodically dewatering a downstream reach (*e.g.*, diversion of flows through a penstock to a powerhouse; diversion of flows for the purposes of irrigation). Even if diversions are not so severe as to dewater downstream reaches, reduced flows can result in structural and thermal passage barriers. Other effects include water quality degradation resulting from irrigation return flows and runoff from fields and entrainment of bull trout into canals and fields (MBTSG 1998). Some irrigation diversion structures are reconstituted annually with a bulldozer as “push up” berms and not only affect passage, but also significantly degrade the stream channel. The prevalence of these structures throughout the range of bull trout has resulted in the isolation of bull trout populations in the upper watersheds in many areas.

Bull trout may enter unscreened irrigation diversions and become stranded in ditches and agricultural fields. Diversion dams without proper passage facilities prevent bull trout from migrating and may isolate groups of fish (Dorratcaque 1986; Light *et al.* 1996). Other effects of agricultural practices on aquatic habitat include stream channelization, and large woody debris removal (Spence *et al.* 1996).

Transportation Networks

Roads degrade bull trout habitats by creating flow constraints in ephemeral, intermittent, and perennial channels; increasing erosion and sedimentation; creating passage barriers; channelizing stream reaches; and reducing riparian vegetation (Furniss *et al.* 1991; Ketcheson and Megahan 1996; Trombulak and Frissell 2000). In the Clearwater River basin of Idaho, for example, Highway 12 is adjacent to much of the Clearwater River, and crosses the river at eight different bridge sites. The highway has constrained the river in some areas and highway maintenance may negatively affect bull trout and their habitats (CBBTTAT 1998). Moreover, the proximity of the highway to the Clearwater River increases the likelihood of hazardous materials or fuel spills entering the river. For example, in January, 2002, a truck overturned and spilled approximately 11,000 gallons in the Clearwater River

upstream of Lewiston. Similar situations exist along primary and secondary highways across the range of bull trout

A dirt road is adjacent to much of the West Fork of the Jarbidge River in Nevada and Idaho. McNeill *et al.* (1997) determined that construction and maintenance of the Jarbidge Canyon Road has influenced the morphology and function of the river. Within a single 4.8 kilometer (3 mile) reach, there are seven bridge crossings, and the largest bridge spans only 62 percent of the average width of the river (McNeill *et al.* 1997). Maintenance of the road and bridges requires frequent channel and floodplain modifications that affect bull trout habitat, such as channelization; removal of riparian trees and beaver dams; and placement of rock, sediment, and concrete (McNeill *et al.* 1997; J. Frederick, U.S. Forest Service (USFS), pers. comm. 1998; J. Frederick, U.S. Forest Service, 1998).

Transportation networks also affect bull trout habitats in protected areas such as National Parks. Roads have been constructed to provide access to the Hoh River and Quinault River basins, including areas within Olympic National Park. These roads were typically built following river valleys and often constrain the floodplains. As a result, these roads have been subjected to high flow events and shifts in river channels, forcing extensive streambank armoring to maintain them (Chad 1997; U.S. National Park Service 2000). Bank armoring impairs bull trout habitats through reduced habitat complexity, stream channelization, reduced riparian vegetation, and bank erosion downstream. Within Olympic National Park, about 1,770 meters (5,476 feet) of rip-rap were documented along the Hoh River in 1997 (Chad 1997), and additional bank stabilization projects have occurred since then.

Mining

Mining degrades aquatic habitats used by bull trout by altering water chemistry (*e.g.*, pH); altering stream morphology and flow; and causing sediment, fuel, and heavy metals to enter streams (Martin and Platts 1981; Spence *et al.* 1996). The types of mining that occur within the range of bull trout include extraction of hard rock minerals, coal, gas, oil, and sand and gravel. Past and present mining activities have adversely affected bull trout and bull trout habitats in Idaho, Oregon, Montana, Nevada, and Washington (Johnson and Schmidt 1988; Moore *et al.* 1991; WDW 1992; Platts *et al.* 1993; MBISG 1995a, c, 1996b, c; McNeill *et al.* 1997; Ramsey 1997).

For example, it is thought that bull trout were widely distributed in the Coeur d'Alene River drainage, Idaho (MacLay 1940). However, extensive mining and associated operations have modified stream channels and floodplains, created barriers to fish movement, and released toxic substances, especially in the South Fork Coeur d'Alene River (PBIIAT 1998). Portions of the system were essentially devoid of

aquatic life during surveys conducted in the 1940's. Bull trout have been functionally extirpated in the Coeur d'Alene River basin since 1992 (USFWS 1998a).

Residential Development and Urbanization

Residential development is rapidly increasing within portions of the range of bull trout. Residential development alters stream and riparian habitats through contaminant inputs, stormwater runoff, changes in flow regimes, streambank modification and destabilization, increased nutrient loads, and increased water temperatures (MBTSG 1995b). Indirectly, urbanization within floodplains alters groundwater recharge by rapidly routing water into streams through drains rather than through more gradual subsurface flow (Booth 1991).

Urbanization negatively affects the lower reaches of many of the large rivers and their associated side channels, wetlands, estuaries, and near-shore areas of Puget Sound, Washington. Activities such as dredging; removing large woody debris (*e.g.*, snags, log jams, drift wood); installing revetments, bulkheads, and dikes; and filling side channels, estuarine marshes, and mudflats have led to the reduction, simplification, and degradation of habitats (Thom *et al.* 1994; Spence *et al.* 1996; PSWQAT 2000). Pollutants associated with urban environments such as heavy metals, pesticides, fertilizers, bacteria, and organics (oil, grease) have contributed to the degradation of water quality in streams, lakes, and estuaries (NRC 1996; Spence *et al.* 1996).

Fisheries Management

Introductions of nonnative species by the Federal government, State fish and game departments, and private parties, across the range of bull trout have contributed to declines in abundance, local extirpations, and hybridization of bull trout (Bond 1992; Howell and Buchanan 1992; Leary *et al.* 1993; Donald and Alger 1993; Pratt and Huston 1993; MBTSG 1995b,d, 1996g,h; Platts *et al.* 1995; J. Palmisano and V. Kaczynski, Northwest Forest Resource Council, *in litt* 1997).

Introduced brook trout threaten bull trout through hybridization, competition, and possibly predation (Thomas 1992; WDW 1992; Clancy 1993; Leary *et al.* 1993; Rieman and McIntyre 1993; MBTSG 1996h). Hybridization between brook trout and bull trout has been reported in Montana (MBTSG 1995a, b, 1996a, c, e; Hansen and DosSantos 1997), Oregon (Markle 1992; Ratliff and Howell 1992), Washington (WDFW 1998), and Idaho (Adams 1996; I. Burton, Boise National Forest, pers. comm. 1997). Hybridization results in offspring that are frequently sterile (Leary *et al.* 1993), although recent genetics work has shown that reproduction by hybrid fish is occurring at a higher level than previously suspected (Kanda 1998). Hybrids may be competitors; Dunsmoor and Bienz (L. Dunsmoor and C. Bienz, Klamath Tribe, *in*

litt. 1997) noted that hybrids are aggressive and larger than resident bull trout, suggesting that hybrids may have a competitive advantage. Brook trout mature at an earlier age and have a higher reproductive rate than bull trout. This difference may favor brook trout over bull trout when they occur together, often leading to replacement of bull trout with brook trout (Clancy 1993; Leary *et al.* 1993; MBTSG 1995b). The magnitude of threats from nonnative fishes is highest for resident bull trout because they are typically isolated and exist in low abundance.

Brook trout apparently adapt better to degraded habitats than bull trout (Clancy 1993; Rich 1996; Dunsmoor and Bienz, *in litt.* 1997), and brook trout also tend to occur in streams with higher water temperatures (Adams 1994; MBTSG 1996h). Because elevated water temperatures and sediments are often indicative of degraded habitat conditions, bull trout may be subject to stresses from both interactions with brook trout and degraded habitat (MBTSG 1996h). In laboratory tests, growth rates of brook trout were significantly greater than those for bull trout at higher water temperatures when the two species were tested alone, and growth rates of brook trout were greater than those for bull trout at all water temperatures when the species were tested together (McMahon *et al.* 1998, 1999).

Nonnative lake trout (*i.e.*, west of the Continental Divide) also negatively affect bull trout (Donald and Alger 1993; MBTSG 1996h; Fredenberg 2000). A study of 34 lakes in Montana, Alberta, and British Columbia, Canada, found that lake trout likely limit foraging opportunities and reduce the distribution and abundance of migratory bull trout in mountain lakes (Donald and Alger 1993). Over 250 introductions of lake trout and other nonnative species have occurred in nearly 150 western Montana waters within the range of bull trout (J. Vashro, Montana Fish, Wildlife and Parks, *in litt.* 2000). The potential for introduction of lake trout into the Swan River basin and Hungry Horse Reservoir on the South Fork Flathead River, both in Montana, is considered a threat to bull trout (MBTSG 1995e, 1996a). The presence of several lake trout has been recently documented in Swan Lake (Montana Fish, Wildlife and Parks, *in litt.* 1999). In Idaho, lake trout and habitat degradation were factors in the decline of bull trout from Priest Lake (Mauser *et al.* 1988; Pratt and Huston 1993). Lake trout have invaded Upper Priest Lake and are a threat to the bull trout there (Fredericks 1999). Juvenile lake trout are also using some riverine habitats in Montana, possibly competing with bull trout (MBTSG 1996h).

Introduced brown trout are established in several areas within the range of bull trout and likely compete for food and space and prey on bull trout (Ratliff and Howell 1992; Platts *et al.* 1993; Pratt and Huston 1993). In the Klamath River basin for example, brown trout occur with bull trout in three streams and have been observed preying on bull trout in one (Light *et al.* 1996). Brown trout may compete for spawning and rearing areas and superimpose redds on bull trout redds (Pratt and Huston 1993; Light *et al.* 1996; MBTSG 1996h). Elevated water temperatures may

favor brown trout over bull trout in competitive interactions (MBTSG 1996h). Brown trout may have been a contributing factor in the decline and eventual extirpation of bull trout in the McCloud River, California, after dam construction altered bull trout habitat (Rode 1990).

Nonnative northern pike have the potential to negatively affect bull trout. Northern pike were introduced into Swan Lake in the 1970's (MFWP 1997), and predation on juvenile bull trout has been documented (MBTSG 1996a) but the bull trout population has not declined. Northern pike were also introduced into Salmon, Inez, Seeley, and Alva lakes in the Clearwater River basin, and a tributary to the Blackfoot River, Montana (MFWP 1997). Northern pike numbers have increased in Salmon Lake and Lake Inez, having a negative effect on bull trout (R. Berg, MFWP, pers. comm. 1997). Northern pike in Seeley Lake and Lake Alva are also expected to increase in numbers (Berg, pers. comm. 1997).

Introduced bass (*Micropterus spp.*) may negatively affect bull trout (MFWP 1997). In the Clark Fork River, Montana, Noxon Rapids Reservoir supports fisheries for both smallmouth bass (*M. dolomieu*) and largemouth bass (*M. salmoides*). Both have been high priority sport fish species in management of Noxon Rapids Reservoir. The Montana fishery management objective for Cabinet Gorge Reservoir, downstream of Noxon Rapids Reservoir, is to enhance bull trout while managing the existing bass fishery (MFWP 1997). However, a 1999 Federal Energy Regulatory Commission settlement with the Avista Corporation for dam relicensing makes recovery of bull trout a management priority (Kleinschmidt Associates and Pratt 1998).

Managers are now attempting to balance these potentially conflicting objectives. In the North Fork Skokomish River, Washington, Cushman Reservoir supports largemouth bass, that may prey on juvenile bull trout rearing in the reservoir and lower river above the reservoir (WDFW 1998).

Opossum shrimp (*Mysis relicta*), a crustacean native to the Canadian Shield area, was widely introduced in the 1970's as supplemental forage for kokanee and other salmonids in several lakes and reservoirs across the northwest (Nesler and Bergersen 1991). The introduction of opossum shrimp in Flathead Lake changed the lake's trophic dynamics resulting in expanding lake trout populations and causing increased competition and predation on bull trout (T. Weaver, Montana Fish, Wildlife and Parks, *in litt.* 1993; MBTSG 1995d). Conversely, in Swan Lake, Montana, introduced opossum shrimp and kokanee increased the availability of forage for bull trout, contributing to the significant increase in bull trout numbers in the Swan River basin (MBTSG 1996a).

Nonnative fish threaten bull trout in relatively secure, unaltered habitats, including roadless areas, wildernesses, and national parks. For instance, brook trout occur in tributaries of the Middle Fork Salmon River within the Frank Church-River of No Return Wilderness, including Elk, Camas, Loon, and Big creeks (Thurrow 1985) and Sun Creek in Crater Lake National Park (Light *et al.* 1996). Glacier National Park has self-sustaining populations of introduced nonnative species, including lake trout, brook trout, rainbow trout, Yellowstone cutthroat trout, lake whitefish, and northern pike (MBTSG 1995d). Although stocking in Glacier National Park was terminated in 1971, only a few headwater lakes contain exclusively native species, including bull trout. The introduction and expansion of lake trout into the relatively pristine habitats of Kintla Lake, Bowman Lake, Logging Lake, and Lake McDonald in Glacier National Park has nearly extirpated the bull trout due to predation and competition (L. Marnell, National Park Service, *in litt* 1995; MBTSG 1995d; Fredenberg 2000).

Some introduced species, such as rainbow trout and kokanee, may benefit large adult bull trout by providing supplemental forage (Faler and Bair 1991; Pratt 1992; Vidregar 2000). However, introductions of nonnative game fish can be detrimental due to increased angling and subsequent incidental catch and harvest of bull trout (Rode 1990; Bond 1992; WDW 1992; MBTSG 1995d).

Isolation and Habitat Fragmentation

Although bull trout are widely distributed over a large geographic area, the effects of human activities over the past century have reduced their overall distribution and abundance. Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders *et al.* 1991). Burkey (1989) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth for local populations may be low and probability of extinction high (Burkey 1989, 1995).

Metapopulation concepts of conservation biology theory have been applied to the distribution and characteristics of bull trout (Rieman and McIntyre 1993; Dunham and Rieman 1999). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). Local populations may be extirpated, but can be reestablished by individuals from other local populations. Thus, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout in the headwaters of tributaries

(Rieman et al. 1997b; Dunham and Rieman 1999; Spruell *et al.* 1999; Rieman and Dunham 2000). Based on population genetics, there is more divergence among bull trout than among salmon (Leary and Allendorf 1997), indicating less genetic exchange among bull trout populations. The recolonization rate for bull trout is very low and recolonization may require a very long time, especially in light of the man-made isolation of various bull trout populations.

Migratory corridors allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbances (Saunders *et al.* 1991). Maintenance of migratory corridors for bull trout is essential to provide connectivity among local populations, and enables the reestablishment of extinct populations. Where migratory bull trout are not present, isolated populations cannot be replenished when a disturbance makes local habitats unsuitable (Rieman and McIntyre 1993; USDA and USDI 1997). Moreover, limited downstream movement was observed for resident bull trout in the Bitterroot River basin (Nelson 1999; Nelson *et al.* in review) suggesting that reestablishment of migratory fish and potential refounding of extinct bull trout populations may be a slow process, if it occurs at all.

Because isolation and habitat fragmentation resulting from migratory barriers have negatively affected bull trout by: (1) reducing geographical distribution; (2) increasing the probability of losing individual local populations (Rieman and McIntyre 1993); (3) increasing the probability of hybridization with introduced brook trout (Rieman and McIntyre 1993); (4) reducing the potential for movements in response to developmental, foraging, and seasonal habitat requirements (MBTSG 1998); and (5) reducing reproductive capability by eliminating the larger, more fecund migratory form from many subpopulations (MBTSG 1998; Rieman and McIntyre 1993), restoring connectivity and restoring the frequency of occurrence of the migratory form will be an important factor in providing for the recovery of bull trout. The manner and degree to which individual dams and diversions affect specific bull trout local populations is likely to vary depending on the specific physical factors at play and the demographic attributes of the local population in question. The individual recovery unit chapters specifically address dam and diversion issues affecting their respective local populations.

Evidence suggests that landscape disturbances, such as floods and fires, have increased in frequency and magnitude within the range of bull trout (Henjum *et al.* 1994; USDA and USDI 1997). Passage barriers and unsuitable habitat that prevent recolonization, have resulted in bull

trout extirpation through these landscape disturbances (USDA and USDI 1997). Also, isolated populations are typically small, and more likely to be extirpated by

local events than larger populations (Rieman and McIntyre 1995), and can exhibit negative genetic effects.

Land management activities have also altered the frequency and duration of floods or high flows (USDA and USDI 1997). Roads and clear cutting of forested areas tend to magnify the effects of floods, leading to higher flows, erosion, and bedload that scour channels McIntosh *et al.* 1994; USDA and USDI 1997; Spencer and Schelske 1998; Swanson *et al.* 1998), and degrade bull trout habitat (Henjum *et al.* 1994). Erosion from road landslides increases bedload to stream flows (Furniss *et al.* 1991). Increased bedload increases the scouring effect of high stream flows, increasing channel instability and loss of habitat diversity, especially pools (Henjum *et al.* 1994; McIntosh *et al.* 1994). Bull trout eggs and fry in the gravels during scouring likely survive at low rates (Henjum *et al.* 1994). For instance, hundreds of landslides associated with roads on the Clearwater National Forest and Panhandle National Forests resulted from high water in 1995 (R. Patten and J. Penzkover, Panhandle National Forest, *in litt.* 1996), likely reducing survival of bull trout eggs and fry. Habitat degradation has also reduced the number and size of bull trout spawning areas (USDA and USDI 1997).

Inadequacy of Existing Water Quality Standards

Temperature regime is one of the most important water quality factors affecting bull trout distribution (Rieman and McIntyre 1995; Adams and Bjornn 1997). Given the temperature requirements of bull trout (Buchanan and Gregory 1997), existing water quality criteria developed by the States under sections 303 and 304 of the Clean Water Act may not adequately support spawning, incubation, rearing, migration, or combinations of these life-history stages (see Montana 1996; Oregon 1996; 62 FR 41162; Washington 1997; NDEP, *in litt.* 1998; Hicks 2000).

The U.S. Environmental Protection Agency is working with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, State environmental quality agencies, and tribes in Oregon, Idaho, and Washington to develop regional temperature guidance. The goals for this project are to develop U.S. Environmental Protection Agency regional temperature criteria guidance that: (1) meet the biological requirements of native salmonid species for survival and recovery pursuant to the Endangered Species Act, provide for the restoration and maintenance of surface water temperature to support and protect native salmonids pursuant to the Clean Water Act, and meet the Federal trust responsibilities with treaty tribes for rebuilding salmon stocks, (2) recognize the natural temperature potential and limitations of water bodies, and (3) can be effectively incorporated by states and Tribes in programs concerned with water quality standards. States and Tribes will use the new criteria guidance to revise their temperature standards, and if necessary, the U.S.

Environmental Protection Agency and other agencies will use the new criteria guidance to evaluate State and Tribal standard revisions.

The Environmental Protection Agency is currently engaged in formal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service regarding their approval of numeric water quality criteria for (nonconventional) toxic pollutants in the State of Idaho. Consultation on conventional pollutants (pH, dissolved oxygen, temperature) for the State of Oregon was completed in July 1999. We anticipate formal consultation on water quality criteria for temperature, dissolved oxygen, ammonia, and antidegradation in the State of Washington in 2003. Water quality criteria establish water column concentrations for various constituents, above which any waters of the State (excluding those waters on Tribal lands) should not exceed for the protection of aquatic life. These criteria will be used to evaluate discharge permits (National Pollution Discharge Elimination System and Total Maximum Daily Limits) and formulate consumption advisories where appropriate. Many states' waters contain elevated levels of toxic pollutants that are present in fish tissues and have resulted in fishing advisories throughout the range of bull trout (www.epa.gov/ost/fish). We do not anticipate formal consultation on current surface water quality standards for nonconventional pollutants in the states of Washington, Oregon, Nevada, and Montana in the near future.

Elevated levels of contaminants may result in either lethal (e.g. mortality) or sublethal effects to bull trout. Sublethal impacts may include reduced egg production, reduced survival of any life stage, reduced growth, impaired osmoregulation, and many subtle endocrine, immune, and cellular changes. Contaminants may also affect the foodchain and indirectly harm bull trout by reducing prey availability due to reduced habitat suitability for prey species. Lethal impacts from contaminant inputs are most likely from spills, whereas sublethal impacts may occur from such land uses as agriculture, residential/urban, mining, grazing, and forestry.

Conservation Measures

At present, there are several State, Federal, Tribal, and Canadian programs and conservation efforts that may help achieve recovery objectives for bull trout in the coterminous United States. Recovery planning for bull trout will proceed under the direction of an overall recovery team as well as individual recovery unit teams working to address bull trout conservation needs in specific geographic locations. Membership of the recovery unit teams has generally been extended to any and all interested parties, including biologists and experts in related disciplines from local, State, Tribal and Federal entities, stakeholder groups representing timber interests, water users, agriculture, power producers and distributors, landowners, conservation groups, tourism advocates and local government. The bull trout recovery planning

process has built upon previous State and locally-driven processes throughout the range of the species. Some of these measures are described below.

State Bull Trout Conservation Actions

The following is a brief summary of the existing and ongoing conservation activities by the States of Idaho, Montana, Nevada, Oregon, and Washington.

Idaho. The Idaho Department of Fish and Game, in cooperation with several Federal and State agencies, developed a management plan for bull trout in 1993 (Conley 1993), and the State of Idaho approved the State of Idaho Bull Trout Conservation Plan for the conservation of bull trout in July 1996 (Batt 1996). The Plan identified an overall mission of maintaining or restoring interacting groups of bull trout throughout the species' native range in the State, and four goals to accomplish the mission: (1) maintenance of habitat conditions in areas supporting bull trout, (2) instituting cost-effective strategies to improve bull trout abundance and habitats, (3) establishing stable or increasing bull trout populations in a set of well-distributed sub-watersheds, and (4) providing for the economic viability of industries in Idaho (Batt 1996). The overall approach of the plan was to use existing, locally-developed groups established by Idaho legislation, *i.e.*, watershed advisory groups and basin advisory groups, which were formed to strengthen water quality protection and improve compliance with the Clean Water Act. The draft chapters of the bull trout recovery plan for Idaho rely on information contained in the draft and final problem assessments for the key watersheds developed under the State of Idaho Bull Trout Conservation Plan.

The watershed advisory groups have drafted 21 problem assessments throughout Idaho, which address all 59 key watersheds. To date, a conservation plan has been completed only for the Pend Oreille key watershed.

Angling regulations in Idaho have become more restrictive than in the past. Several conservation actions identified in the problem assessments have been completed or are ongoing, *e.g.*, activities improving bull trout access to habitat, investigations of methods to reduce abundance of nonnative fish species in bull trout habitats, and angler education.

Montana. Development of the bull trout recovery plan in Montana relied heavily upon, and was integrated with, State processes for bull trout conservation that began in 1992 with the implementation of the Montana Bull Trout Restoration planning process and resulted in the Montana Bull Trout Restoration Plan issued in 2000 (MBTRI 2000). In 1993, the Governor of Montana appointed the Montana Bull Trout Restoration Team to produce a plan that maintains, protects, and increases bull trout populations. These sources represent State input, as well as that of local

and regional individuals and entities participating in the restoration team, basin workgroups, and the Montana Bull Trout Scientific Group. The team appointed a scientific group, the Montana Bull Trout Scientific Group, to provide the restoration planning effort with technical expertise. The scientific group produced 11 basin-specific status reports (MBTSG 1995a-e, 1996a-f) and 3 technical, peer-reviewed papers concerning the role of hatcheries (MBTSG 1996g), suppression of nonnative fish species (MBTSG 1996h), and land management (MBTSG 1998). A restoration plan, completed in June 2000, defines and identifies strategies for ensuring the long-term persistence of bull trout in Montana and provided the foundation for the Montana portion of the recovery unit chapters.

Watershed groups have been formed in some areas to lead local bull trout restoration efforts, and some habitat restoration projects, such as removal of fish passage barriers, screening irrigation diversions, riparian fencing, stream restoration projects, and habitat monitoring, have been completed or are underway (P. Graham, Montana Fish, Wildlife, Parks, and B. Clinch, Montana Department of Natural Resources and Conservation, *in litt.* 1997). Some recovery measures are occurring throughout the State with funding from State and Federal resource management agencies, as well as from habitat improvement funds (*e.g.*, Montana Fish, Wildlife, Parks Future Fisheries Improvement Program and the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program), and from mitigation projects (*e.g.*, in the Clark Fork, Flathead, and Kootenai Rivers). Also, angling regulations have become more restrictive than in the past, brook trout are no longer stocked, and there are ongoing genetic studies to assess bull trout populations.

Nevada. The Nevada Division of Wildlife wrote a Bull Trout Species Management Plan that recommends management alternatives to ensure that human activities will not jeopardize the future of bull trout in Nevada (Johnson 1990). The recommended program identifies actions including bull trout population and habitat inventories, life history research, and potential population reestablishment; State involvement in watershed land use planning; angler harvest assessment; official State sensitive species designation for regulatory protection; nonnative fish stocking evaluation and prohibition; and potential nonnative fish eradications. The Nevada Division of Wildlife scheduled these activities for implementation from 1991 to 2000, although many have yet to be initiated or fully implemented.

State angling regulations have become more restrictive in an attempt to protect bull trout in the Jarbidge River in Nevada. Bull trout harvest prohibitions and reduced daily and possession limits on other trout within the basin are in place throughout the Jarbidge River system. The State has also initiated public and angler awareness and education efforts relative to bull trout identification. The Nevada Division of Wildlife did not stock rainbow trout in the Jarbidge River system in 1999 (G. Weller, Nevada Department of Wildlife, pers. comm. 1999).

Oregon. Since 1990, the State of Oregon has taken several actions to address the conservation and recovery of bull trout. Initially, working groups were established that consisted primarily of State, Federal, and private individuals with bull trout expertise. After gathering initial information, membership on the working groups was expanded when the Oregon Department of Fish and Wildlife bull trout coordinator was hired in 1995, and included a range of people representing affected interests.

More restrictive harvest regulations were implemented beginning in 1990; by 1994 the harvest of bull trout was prohibited throughout the State with the sole exception of Lake Billy Chinook in central Oregon. Bull trout working groups have been established in the Klamath, Deschutes, Hood, Willamette, Odell Lake, Umatilla and Walla Walla, John Day, Malheur, and Pine Creek river basins for the purpose of developing bull trout conservation strategies. The Oregon Department of Fish and Wildlife reduced the stocking of hatchery-reared rainbow trout and brook trout in areas where bull trout occur, and genetic analysis for most bull trout populations was completed in 1997. Angler outreach and education efforts were also implemented in river basins with bull trout. Bull trout identification posters were placed at various campgrounds and trail heads, and bull trout identification cards were produced for distribution by the Malheur National Forest and the Oregon Department of Fish and Wildlife. Research to examine life history, genetics, habitat needs, and limiting factors of bull trout in Oregon was initiated in 1995, supported by funding from the Fish and Wildlife Program of the Northwest Power Planning Council. In 1998, a project was initiated to transfer bull trout fry from the McKenzie River watershed to the adjacent Middle Fork Willamette River, which is historical unoccupied, isolated habitat. Recent surveys documented several age classes of bull trout at release sites in the Middle Fork Willamette River.

The Oregon Department of Environmental Quality sets standards for water quality and administers Oregon's water quality program. Surface water temperatures may not exceed 10.0 degrees Celsius (50.0 degrees Fahrenheit) in waters that support or are necessary to maintain the viability of bull trout (Oregon 1996).

On January 14, 1999, Governor Kitzhaber expanded the Oregon Plan for Salmon and Watersheds (Oregon 1997) to include all at-risk wild salmonids throughout the State. The goal of the Oregon Plan is to "restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits". Components of this plan include (1) coordination of efforts by all parties, (2) development of action plans with relevance and ownership at the local level, (3) monitoring progress, and (4) making appropriate corrective changes in the future. This process included chartering 84 locally-formed and represented "watershed councils" across the State. Membership on the watershed

councils includes: landowners, businesses interests, agricultural interests, sport fishers, irrigation/water districts, individuals, State, Federal, and Tribal agencies, and local government officials. Information on watershed conditions prepared by local councils and working groups has been applied to developing bull trout recovery unit chapters in Oregon.

Washington. The draft Statewide Strategy to Recover Salmon, Extinction is not an Option, produced by the Washington Governor's Salmon Recovery Office (Washington Governor's Salmon Recovery Office 1999) and Joint Natural Resources Cabinet, served as the template for recovery unit chapters in the Washington portion of the bull trout recovery plan. While the Washington Governor's plan focuses primarily on salmon, many of the same factors affecting salmon also impact bull trout. The plan describes how State agencies and local governments will work together to address habitat, harvest, hatcheries, and hydropower as they relate to recovery of listed species. Overall goals and strategies identified in this document for restoring healthy populations of salmon are consistent with actions needed for bull trout recovery. In addition, recovery unit teams incorporated information from the Washington State Salmonid Inventory for Bull Trout/Dolly Varden (WDFW 1998) and the Bull Trout and Dolly Varden Management Plan (WDFW 2000), both prepared by the Washington Department of Fish and Wildlife.

The Washington State legislature established the Salmon Recovery Act (ESHB 2496) and Watershed Management Act (ESHB 2514) to assist in salmon recovery efforts. The Watershed Management Act provided funding and a planning framework for locally based watershed management addressing water quality and quantity. The Salmon Recovery Act provides the direction for the development of limiting factors analyses on salmon habitat and creates a list of prioritized restoration projects at the major watershed level. While not specifically targeting limiting factors for bull trout, these documents have played an important role in the development of bull trout recovery unit chapters. As offshoots of the Statewide Strategy to Recover Salmon, members of the Lower Columbia Fish Recovery Board and the Upper Columbia Salmon Recovery Board have been involved in the development and review of bull trout recovery unit chapters.

The Washington Department of Fish and Wildlife no longer stocks brook trout in streams or lakes connected to bull trout waters. Fishing regulations prohibit harvest of bull trout, except for a few areas where stocks are considered "healthy," within the State. The Washington Department of Fish and Wildlife is also currently involved in a mapping effort to update bull trout distribution data within the State of Washington, including all known occurrences, spawning and rearing areas, and potential habitats. The salmon and steelhead inventory and assessment program is currently updating their database to include the entire State, which consists of an inventory of stream

reaches and associated habitat parameters important for the recovery of salmonid species and bull trout.

In January 2000, the Washington Forest Practices Board (2000) adopted new emergency forest practice rules based on the "Forest and Fish Report" development process. These rules address riparian areas, roads, steep slopes, and other elements of forest practices on non-Federal lands. Although some provisions of forest practice rules represent improvements over previous regulations, the plan relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. Research and monitoring being conducted to address areas of uncertainty for bull trout include protocols for detection of bull trout, habitat suitability, forestry effects on groundwater, field methods or models to identify areas influenced by groundwater, and forest practices influencing cold water temperatures. The Forest and Fish Report development process relied on broad stakeholder involvement and included State agencies, counties, Tribes, forest industry and environmental groups. A similar process is also being used for agricultural communities in Washington and is known as "Agriculture, Fish, and Water."

Overall, the States within the range of bull trout have developed, or are engaged in developing, conservation plans or strategies for the species. The U.S. Fish and Wildlife Service has, and continues to, encourage States to implement strategies and conservation actions that benefit bull trout.

Federal Activities

Endangered Species Act. Bull trout in the coterminous United States occur on lands administered by the Federal Government (*e.g.*, Bureau of Land Management, Forest Service, and National Park Service), various State-owned properties, and private and Tribal lands. The majority of bull trout spawning and rearing habitat occurs on Federal lands. Federal agency actions that occur on Federal lands or elsewhere with Federal funds or authorization may require consultation under the Endangered Species Act. These actions include U.S. Army Corps of Engineers involvement in projects such as the construction of roads and bridges, the permitting of wetland filling and dredging projects subject to section 404 of the Clean Water Act, construction, maintenance, and operation of dams and hydroelectric plants; Federal Energy Regulatory Commission-licensed hydropower projects authorized under the Federal Power Act; Forest Service and Bureau of Land Management timber, grazing, and recreation management activities; Environmental Protection Agency-authorized discharges under the National Pollutant Discharge Elimination System of the Clean Water Act; U.S. Housing and Urban Development projects; U.S. Bureau of Reclamation projects; and National Park Service activities. Because there are various policies, directives, and regulations providing management direction to Federal agencies and opportunities to conserve bull trout, *e.g.*, roadless area conservation on

Forest Service lands (66 FR 3244), we provide the following types of activities as examples.

Bull Trout Interim Conservation Guidance. The purpose of the Bull Trout Interim Conservation Guidance is to provide U.S. Fish and Wildlife Service biologists with a tool that is useful in conducting Endangered Species Act activities, including section 7 consultations, negotiating Habitat Conservation Plans that culminate in the issuance of section 10(a)(1)(B)-incidental take permits (see section 10(a)(1) discussion below), issuing recovery permits, and providing technical assistance in forest practice rule development and other interagency bull trout conservation and recovery efforts. This document is not intended to supersede any biological opinion that has been completed for Federal agency actions. Rather, it should be used as another tool to assist in consultation on those actions.

PACFISH/INFISH. Land management plans for the Bureau of Land Management and Forest Service lands within the range of bull trout have been amended by the Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH; USDA and USDI 1995) and the Interim Strategy for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and Portions of Nevada (INFISH; USDA 1995). PACFISH, developed by the Bureau of Land Management and Forest Service, is intended to be an ecosystem-based, aquatic habitat and riparian-area management strategy for Pacific salmon, steelhead, and sea-run cutthroat trout habitat on lands administered by the two agencies that are outside the area subject to the Northwest Forest Plan. INFISH was developed by the Forest Service to provide an interim strategy for inland native fish in areas outside those where PACFISH and the Northwest Forest Plan apply. The U.S. Fish and Wildlife Service issued a programmatic non-jeopardy biological opinion on land and resource management plans of the Bureau of Land Management and Forest Service, as amended by PACFISH and INFISH, for the Klamath and Columbia River population segments of bull trout that endorsed implementation of additional commitments made by the two agencies (USFWS 1998b). The commitments included habitat restoration and improvement; standards and guidelines of PACFISH and INFISH; evaluation of key and priority watershed networks; completion of watershed analysis and monitoring; establishing goals for long-term conservation and recovery; and conducting section 7 consultation at the watershed level. The biological opinion also identified additional actions to help ensure conservation of bull trout. Consultations for site-specific actions are continuing, as are consultations for land and resource management plans in other bull trout population segments.

In December, 1998, the regional executives for the U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Forest Service and Bureau of Land Management chartered The Interagency Implementation Team. This Team is integral

to the implementation of PACFISH and INFISH, under the direction of the regional executives, and is responsible for coordinating implementation of the biological opinions on the effects of the aquatic conservation strategies on listed salmon, steelhead and bull trout. The Team has directed the development of a PACFISH/INFISH Monitoring Task Team to develop a monitoring program for tracking implementation and effectiveness of PACFISH/INFISH.

Northwest Forest Plan. On April 13, 1994, the Secretaries of the Department of Agriculture and the Department of the Interior adopted the Northwest Forest Plan for management of late-successional forests within the range of the northern spotted owl. This plan contains objectives, standards, and guidelines to provide for a functional late-successional and old-growth forest ecosystem. Included in the plan is an aquatic conservation strategy involving riparian reserves, key watersheds, watershed analysis, and habitat restoration. The U.S. Fish and Wildlife Service issued a programmatic non-jeopardy biological opinion on the plan for the Coastal-Puget Sound, Columbia River, and Klamath River population segments of bull trout (USFWS 2000). The biological opinion also identified additional actions to be taken by the Federal land managers to help ensure conservation of bull trout. These actions included clearly documenting that proposed actions are consistent with the aquatic conservation strategy objectives, developing and implementing guidance for reducing effects of road management programs on bull trout, and responding quickly to mining notices on lands administered by the Bureau of Land Management in order to advise operators how to prevent adverse effects to bull trout. Consultations for site-specific actions are ongoing.

Federal Columbia Power System Biological Opinion. On December 15, 2000, the U.S. Fish and Wildlife Service issued a biological opinion to the U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration on the operation and maintenance of Federal hydroelectric and water storage dams within the Columbia River basin. The biological opinion was developed after consultations with the U.S. Army Corps of Engineers and the Bureau of Reclamation, which operate the Federal dams, and the Bonneville Power Administration, which sells the electricity generated at the dams. The dams included in the biological opinion are: Bonneville, The Dalles, John Day and McNary dams (Lower Columbia River facilities); Ice Harbor, Lower Monumental, Little Goose, Lower Granite and Dworshak dams (Lower Snake River and Clearwater facilities); Grand Coulee, Albeni Falls, Libby, Hungry Horse, and Chief Joseph dams and Banks Lake Pump Storage (Upper Columbia River facilities). These projects are located in the states of Oregon, Washington, Idaho, and Montana.

Impacts to bull trout occur mostly in the upper reaches of the Columbia River basin and the biological opinion recommended changes in operations that focus on the Upper Columbia River dams. Bull trout are known to occur in the mainstem

Columbia and lower Snake Rivers but their use of these areas is not well known (See the discussion of the mainstem Columbia and lower Snake Rivers in section G, Strategy for Recovery.) The focus of the consultations on operations at Libby and Hungry Horse dams and their effects to bull trout has been on 1) ramping rates; 2) minimum flows; 3) seasonal water management; 4) total dissolved gas concerns; and 5) fish passage and entrainment. The action agencies and the U.S. Fish and Wildlife Service have agreed on the need for ramping rates and minimum flows. Operations at Albeni Falls Dam to benefit kokanee salmon, a key food source for bull trout in Lake Pend Oreille, are also addressed in this opinion.

Coordination between the National Marine Fisheries Service and the U.S. Fish and Wildlife Service has been ongoing during the preparation of the draft and final biological opinions for the Federal Columbia River Power System. Specifically, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service have agreed to operations (ramping rates and minimum flows) at Hungry Horse and Libby dams that will benefit all resident species, and implementation of modified flood control operations at both dams to store additional water for resident fish and salmon. In low water years, the agencies have agreed to work out details of operation through the Technical Management Team process to balance the needs of listed species.

The U.S. Fish and Wildlife Service has also been coordinating with the Montana Department of Fish, Wildlife and Parks to better address listed species and reservoir management issues. Specifically, the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the action agencies, in coordination with Montana Department of Fish, Wildlife and Parks, have slightly revised the minimum flows and ramping rates to address Montana Department of Fish, Wildlife and Parks concerns. Other Columbia River basin consultations are addressing or have addressed operations of Federal dams and related activities in tributaries, including the Yakima, Willamette, and the Umatilla river basins, and in the Snake River upstream of Lower Granite Reservoir.

Section 10(a)(1) Permits. Permits, authorized under section 10(a)(1) of the Endangered Species Act, may be issued to carry out otherwise prohibited activities involving endangered and threatened wildlife under certain circumstances. Permits are available for scientific purposes to enhance the propagation or survival of a species and for incidental "take" (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species) in connection with otherwise lawful activities. Private landowners seeking permits for incidental take offer a means of protecting bull trout habitat through the voluntary development of Habitat Conservation Plans and Safe Harbor Agreements.

Habitat Conservation Plans. Incidental take permits are required when non-Federal activities will result in "take" of threatened or endangered species. A

habitat conservation plan must accompany an application for an incidental take permit. The purpose of the Habitat Conservation Planning process is to ensure there is adequate minimization and mitigation of effects from the authorized incidental take. The purpose of the incidental take permit is to authorize the incidental take of a listed species. For example, the Plum Creek Timber Company developed a Habitat Conservation Plan with the U.S. Fish and Wildlife Service addressing bull trout and other native salmonids occurring on over 688,500 hectares (1.7 million acres) of corporate lands, primarily in the Columbia River basin. The majority of the land under consideration occurs in Montana (87 percent) with the remainder in Idaho and Washington.

Because silvicultural activities, logging road construction and maintenance, and open range cattle grazing by the Plum Creek Timber Company may result in harm to bull trout, seven categories of conservation commitments were included in the Habitat Conservation Plan. The seven categories are: (1) road management, (2) riparian management, (3) livestock grazing, (4) land-use planning, (5) legacy management and other restoration opportunities, (6) administration and implementation measures, and (7) monitoring and adaptive management. The conservation benefits of activities in the seven categories include reducing sediment delivery to streams from roads and grazing, increasing canopy cover in riparian areas, restoring stream bank integrity and overall habitat complexity, and providing fish passage at road culverts and water diversion structures.

In Washington, the Washington Department of Natural Resources developed a Habitat Conservation Plan that was adopted on January 1, 1999. The plan covers the approximately 647,500 hectares (1.6 million acres) of forested State trust lands that lie within the range of the northern spotted owl. The Habitat Conservation Plan contains riparian conservation strategies that were designed to protect salmonid and riparian species for lands west of the Cascade Mountains crest. It includes a streamside no-harvest buffer strategy, a minimal-harvest area for ecosystem restoration, and a low-harvest area for selective removal of single trees or groups of trees and thinning and salvage operations. In addition to riparian buffers, road management standards were developed to ensure that mass-wasting (erosion and landslides) is not artificially accelerated and that sediment delivery remains near natural levels. The Habitat Conservation Plan also includes monitoring and adaptive management components. The minimization and mitigation actions of the plan will address habitat requirements of bull trout and cumulatively will reduce the adverse effects to bull trout in comparison to previous forest management practices (USFWS 1998d).

Safe Harbor Agreements. Safe Harbor Agreements between the U.S. Fish and Wildlife Service and non-Federal landowners are another voluntary mechanism to encourage conservation of listed species and authorize incidental take permits. In general, these agreements provide (1) conservation benefits for listed species that

would otherwise not occur except for the agreement, and (2) Endangered Species Act regulatory assurances to the landowner through a section 10 permit. Safe Harbor Agreements are intended for landowners who have few or no listed species (or listed species' suitable habitat) on their property, but who would be willing to manage their property in such a way that listed species may increase on their lands, as long as they are able to conduct their intended land-use activities. An example of how Safe Harbor Agreements may be used to further bull trout conservation can be found with fish passage barriers in streams. If a landowner owns a stream with a fish passage barrier that prevents access to their property by bull trout, they may be unwilling to remove the barrier, and thereby allow access by bull trout, for fear of the "take" prohibitions under section 9 of the Endangered Species Act and potential restrictions on land-use activities. Under a Safe Harbor Agreement, the landowner would agree to removal of the barrier, allow bull trout access to their property, and the landowner and U.S. Fish and Wildlife Service would negotiate other conservation measures necessary to ensure suitable bull trout habitat conditions are maintained on the property while allowing the landowner's land-use activities to occur. The landowner would receive a section 10 permit authorizing incidental take of bull trout consistent with the agreed upon conservation measures in the Safe Harbor Agreement. Safe Harbor Agreements for bull trout may be developed in the future.

Clean Water Act. The Clean Water Act provides some regulatory mechanisms for protection and restoration of water quality in waters that support bull trout. Under sections 303 and 304, states or the Environmental Protection Agency set water quality standards, which combine designated beneficial uses and criteria established to protect uses. States or the Environmental Protection Agency designate water bodies that are failing water quality standards as water quality limited under section 303(d) (*e.g.*, MDHES 1994; USEPA 1994; ODEQ 1996), and are required to develop management plans. Management plans include total maximum daily loads with implementation plans that define site-specific actions and timelines for meeting water quality goals (65 FR 43586). The total maximum daily loads assess and allocate all the point and nonpoint sources of pollutants within a watershed. Best management practices are used with total maximum daily loads to address nonpoint sources of pollution, such as mining, forestry, and agriculture. Regulatory authority to enforce the best management practices, however, varies among the states. It is estimated that 10 percent of the total length of streams within the interior Columbia River basin and the Klamath River basin are listed as water quality limited, and this estimate may be below the true extent and distribution of streams with impaired water quality potentially affecting bull trout (USDA and USDI 1997). The U.S. Environmental Protection Agency requests that states give higher priority to polluted waters that are sources of drinking water or support listed species, when developing total maximum daily loads and implementation plans (65 FR 43586).

In accordance with section 319 of the Clean Water Act, states also develop programs to address nonpoint sources of pollution such as agriculture, forestry, and mining. The effectiveness of controlling water pollution from these activities has been mixed. The State of Washington monitored the effectiveness of riparian prescriptions under past forest practices regulations in meeting water quality temperature criteria for streams on forest lands and concluded that regulations for stream shading were inadequate to meet criteria (Sullivan *et al.* 1990).

Northwest Power Planning Council Fish and Wildlife Program. Congress, through the Pacific Northwest Electric Power Planning and Conservation Act of 1980, directed the Northwest Power Planning Council to develop a Fish and Wildlife Program. The program is intended to give the citizens of Idaho, Montana, Oregon, and Washington a stronger voice in the future of electricity generated by the Federal hydropower dams in the Columbia River basin and fish and wildlife affected by the dams and their operation.

One of the Northwest Power Planning Council's major responsibilities is to develop a program to protect and rebuild fish and wildlife populations affected by hydropower development in the Columbia River basin. State, Tribal, and local governments often work closely with the Northwest Power Planning Council as it develops power and fish and wildlife plans. The Bonneville Power Administration provides funding for implementation of the Council's Fish and Wildlife Program. In 2000, the Council amended its Fish and Wildlife Program to include development of subbasin plans. Subbasin planning, beginning in 2002, is a means for identifying projects that will be funded to protect, mitigate, and enhance the Columbia River basin's fish and wildlife resources. These plans are viewed as crucial efforts for implementing the Endangered Species Act responsibilities of the Bonneville Power Administration, U.S. Corps of Engineers, and the Bureau of Reclamation in the Columbia River basin.

The primary objective of subbasin planning is to develop a unifying element for implementation of the Northwest Power Planning Council's Fish and Wildlife Program. It will also assist in the implementation of Endangered Species Act recovery activities. One of the goals of the subbasin planning process is to provide specific products that can be integrated directly into the Endangered Species Act recovery planning process. We will provide specific recovery unit chapters from the bull trout recovery plan to the applicable subbasin planning teams that have the responsibility for developing subbasin plans.

Federal Caucus Fish and Wildlife Plan. The Federal Caucus is a group of nine Federal agencies, formed as a result of the Federal Columbia Power System Biological Opinion, that have responsibilities for natural resources affecting species listed under the Endangered Species Act. The agencies are the National Marine

Fisheries Service, U.S. Fish and Wildlife Service, Bureau of Reclamation, Bonneville Power Administration, U.S. Army Corps of Engineers, Bureau of Indian Affairs, Forest Service, Bureau of Land Management, and Environmental Protection Agency. The Federal Caucus has drafted a basin-wide recovery strategy for listed anadromous fish in the Columbia River basin which addresses management of habitat, hatcheries, harvest, and hydropower. This recovery strategy, titled 'The Conservation of Columbia River Basin Fish: Final Basin-Wide Recovery Strategy', will provide the framework for development of recovery plans for individual species and for effects determinations for actions under consultation. As recovery plans for individual species are developed following the basin-wide strategy, and measures to address biological needs of all stages of the life cycle are implemented, conditions for listed aquatic species are expected to improve sufficiently to provide for their survival and recovery. The Basin-Wide Salmon Recovery Strategy concludes that restoring tributary and estuary habitat is key to recovering listed fish. Actions focus on restoring tributary (both Federal and non-Federal), mainstem, and estuary habitat. The Salmon River basin would be a target for recovery efforts under this strategy.

For long-term actions, the Basin-Wide Salmon Recovery Strategy endorses the Northwest Power Planning Council strategy of conducting subbasin assessments and developing subbasin plans and prioritizing actions based on those plans. Once the assessments are complete, the Federal agencies will participate with State agencies, local governments, Tribes and stakeholders to develop subbasin plans. Draft subbasin summaries were used extensively in the preparation of bull trout recovery unit chapters.

While the salmon recovery framework has only recently been adopted, and thus the benefits of this recovery framework have not yet been realized, the U.S. Fish and Wildlife Service envisions significant improvements in habitat conditions for listed salmonids as recovery activities are implemented. Because bull trout often use the same areas, we expect bull trout to similarly benefit from improved habitat conditions.

U.S. Department of Agriculture. The U.S. Department of Agriculture offers landowners financial, technical, and educational assistance to implement conservation practices on privately owned land. Using this help, farmers and ranchers apply practices that reduce soil erosion, improve water quality, and enhance forest land, wetlands, grazing lands, and wildlife habitat. U.S. Department of Agriculture assistance also helps individuals and committees restore after floods, fires, or other natural disasters.

This assistance is provided to landowners via Farm Bill programs administered by the U.S. Department of Agriculture, Farm Service Agency and the Natural Resources Conservation Service. The implementation of practices associated with

these programs may improve conditions for bull trout. In particular, the Conservation Reserve Enhancement Program is targeted to areas in Oregon and Washington where other listed fish occur and may provide direct benefits to bull trout.

The Conservation Reserve Easement Program is an addition to the Conservation Reserve Program. A Conservation Reserve Enhancement Program for the State of Oregon and the State of Washington was approved October 1998, in a Memorandum of Agreements between the United States Department of Agriculture, the Commodity Credit Corporation and the states of Oregon and Washington. The Conservation Reserve Easement Program is a partnership between Federal agencies, State agencies, and private landowners. Land enrolled in this program is removed from production and grazing, under 10 to 15 year contracts. In return, landowners receive annual rental, incentive, maintenance and cost share payments.

The Oregon Conservation Reserve Easement Program is a voluntary program offering annual payments to landowners for establishment of riparian buffers along streams and for restoration of wetlands. The Oregon Conservation Reserve Easement Program seeks to enroll up to 40,469 hectares (100,000 acres) located along streams inhabited (or once inhabited) by listed fish under Federal law as threatened or endangered. Up to 5,000 of these acres may be cropped wetlands which are either hydrologically connected to these streams or located in coastal estuaries.

In Washington, eligible stream designations were originally based on spawning habitat for stocks designated as critical or depressed under the 1993 Salmon and Steelhead Stock Inventory. Approximately 9,656 kilometers (6,000 miles) of eligible streams were included. Recent changes allow for the nomination of additional stream segments where riparian habitat is a significant limiting factor, and a new cap of 16,093 kilometers (10,000 miles) of eligible streams.

Other Farm Bill programs encourage farmers to convert highly erodible cropland or other environmentally sensitive acreage to native vegetative cover, provide incentives for landowners to restore function and value to degraded wetlands on a long-term or permanent basis, assist landowners with habitat restoration and management activities specifically targeting fish and wildlife (including threatened and endangered species), provide technical and financial assistance to farmers and ranchers that face threats to soil, water, and related natural resources, and support forest management practices on privately owned, nonindustrial forest lands.

Native American Tribal Activities

In Oregon, members of the Confederated Tribes of the Umatilla Reservation, Confederated Tribes of the Warm Springs Reservation, Burns Paiute Tribe, and Klamath Tribe all participate on bull trout working groups in their geographic areas of

interest. The Confederated Tribes of the Warm Springs Reservation and the Burns Paiute Tribe both have projects funded through the Bonneville Power Administration focused on bull trout. The Confederated Tribes of the Umatilla Indian Reservation has multiple projects funded through the Bonneville Power Administration that address anadromous fish, but that also benefit bull trout, *e.g.*, habitat surveys, passage at dams and diversions, habitat improvement, and movement studies.

In Montana, the Confederated Salish and Kootenai Tribes were a full participant in the Montana Bull Trout Restoration Team and the Montana Bull Trout Scientific Group. They have been actively involved in recovery unit teams for the Clark Fork River Recovery Unit, including activities both on and off the Flathead Reservation. The Blackfeet Nation will be a pivotal player in the St. Mary-Belly River Recovery Unit Team. Much of the St. Mary River drainage in Montana occurs on Tribal lands.

In Idaho, the Coeur d'Alene Tribe, Kootenai Tribe of Idaho, Nez Perce Tribe, and Shoshone-Bannock Tribe are participating on various recovery unit teams.

The Spokane Tribe, Confederated Tribes of the Colville Reservation, and Kalispel Tribe participated in the Northeast Washington Recovery Unit Team. The Kalispel Tribe has projects funded through the Bonneville Power Administration, Salmon Recovery Funding Board, and Pend Oreille County Public Utility District that benefit bull trout (*e.g.*, habitat surveys and habitat improvement projects). The Yakama Nation participates on the Mid, Upper, and Lower Columbia recovery units teams. The Yakama Nation has many projects that address anadromous fish, but that also benefit bull trout (*e.g.*, habitat surveys, habitat improvement projects, and passage at dams and diversions). In western Washington, the Quinault Indian Nation and the Skokomish Tribe participate in the Olympic Peninsula Recovery Unit Team for the Coastal-Puget Sound population segment of bull trout. The Stillaguamish Tribe and Nooksack Tribe participate in the Puget Sound Recovery Unit Team. These Tribes as well as other Tribes within western Washington are currently involved in habitat restoration, watershed assessment, habitat and fisheries monitoring, and management forums focused on recovery and maintenance of anadromous salmon populations within the Puget Sound region and on the Washington Coast. Many of these efforts will also benefit bull trout.

Canadian Government Activities

Bull trout currently receive no legal protection in Canada, although legislation to protect wildlife species at risk has been introduced in the House of Commons. The provinces of Alberta (Berry 1994) and British Columbia (British Columbia Environment 1994) have both developed strategic plans for the recovery of bull trout. Both provinces have increased research and management efforts for the species in

recent years and have implemented site-specific activities to improve bull trout habitat, increase migratory capabilities, and enforce stricter angling regulations. Alberta has adopted bull trout as the Provincial fish and has developed an extensive public relations campaign.

STRATEGY FOR RECOVERY

Recovery of bull trout will require reducing threats to the long-term persistence of self-sustaining, complex interacting populations of bull trout across the species' native range, and preserving the diversity of bull trout life-history strategies (*e.g.*, resident or migratory forms, emigration age, spawning frequency, local habitat adaptations). Migratory fish allow genetic exchange between populations and colonization of unoccupied habitats.

The main threats to bull trout persistence are habitat fragmentation and degradation, passage barriers that isolate populations, competition and predation from nonnative fishes, angling mortality, and effects resulting from isolation and small population sizes. The recovery strategy is to restore habitats and connectivity, reduce effects of nonnative fishes, and reduce angling mortality (Table 2). Restoring bull trout habitats will require identifying habitats for all bull trout life history stages; identifying site-specific threats (*e.g.*, unsuitable water quality and habitat conditions); and protecting, restoring, and maintaining suitable watershed, riparian area, and stream channel habitats. Restoring connectivity will require identifying and correcting passage barriers, where appropriate (*e.g.*, where restoring passage would not encourage invasion of nonnative species). Restoring habitats and providing passage will also provide opportunities for genetic exchange among local populations and expand the resources available to bull trout.

Development of standardized guidance for monitoring and assessment of bull trout populations is an important component of the recovery strategy. Accurate assessment of population trends, distribution, and response to recovery actions is essential for evaluating recovery implementation. For instance, the recovery criterion - "stable or increasing trends for adult bull trout abundance" requires estimating the magnitude and direction of the population trend. Estimates made for current conditions can be compared to estimates made at some future time to evaluate whether implemented actions have contributed to recovery and can also help identify which recovery units or core areas require the most protection, or most urgent action.

Table 2. Relationship of Recovery Actions and Criteria to Threats and Listing Factors to Bull Trout Recovery Planning.

LISTING FACTOR	THREAT	RECOVERY CRITERIA*	RECOVERY ACTIONS
A	Dams	1,2,,3,4	1.2 barriers, 1.4dam operation, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.5improve info on distribution & status, 7.1-3assess implementation by recovery units & revise plans
A	Forest Management Practices	1,2,,3	1.1water quality, 1.3 restore stream & riparian, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.3evaluate BMP's for habitat, 6.1use partnerships to protect & restore core area functions, 7.1-3assess implementation by recovery units & revise plans
A	Livestock Grazing	1,2,,3	1.1water quality 1.3 restore stream & riparian, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.3evaluate BMP's for habitat, 6.1use partnerships to protect & restore core area functions, 7.1-3assess implementation by recovery units & revise plans
A	Agricultural Practices	1,2,,3,4	1.1water quality 1.2 barriers 1.3 restore stream & riparian, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.3evaluate BMP's for habitat, 6.1use partnerships to protect & restore core area functions, 7.1-3assess implementation by recovery units & revise plans
A	Road Construction and Maintenance	1,2,,3,4	1.1water quality 1.2 barriers, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.3evaluate BMP's for habitat, 6.1use partnerships to protect & restore core area functions, 7.1-3assess implementation by recovery units & revise plans
A	Mining	1,2,,3,4	1.1water quality 1.3 restore stream & riparian, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.3evaluate BMP's for habitat, 6.1use partnerships to protect & restore core area functions, 7.1-3assess implementation by recovery units & revise plans

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LISTING FACTOR	THREAT	RECOVERY CRITERIA*	RECOVERY ACTIONS
A	Residential Development	1,2,,3,4	1.1 water quality 1.2 barriers 1.3 restore stream & riparian, 5.2 research BT abundance, habitat & tasks, 5.3 evaluate BMP's for habitat, 6.1 use partnerships to protect & restore core area functions, 7.1-3 assess implementation by recovery units & revise plans
B	Illegal and incidental harvest	1,2,,3	3.1 fish mgmt. plans, 3.2 evaluate angling, 3.3 evaluate fisheries effects 3.4 evaluate sport fishing reg.s, 5.1 monitor recovery efforts, 7.1-3 assess implementation by recovery units & revise plans
C	Interspecific interactions, including predation where non-native salmonids are introduced	1,2,,3	2.1 fish stocking, 2.2 illegal transport, 2.3 educate about illegal intro., 2.4 effects of non-native control, 2.5 control non-native, 2.6 tasks to reduce effects, 3.3 evaluate fisheries effects, 5.1 monitor recovery efforts, 6.1 use partnerships to protect & restore core area functions, 7.1-3 assess implementation by recovery units & revise plans
C	Disease(not currently a threat, but will be monitored)		5.4 evaluate effects of disease & parasites & minimize effects
D	The Inadequacy of Existing Regulatory Mechanisms	1,2,,3,4	1.1 water quality 2.1 fish stocking, 2.2 illegal transport, 2.5 control non-native, 3.1 fish mgmt. plans, 3.2 evaluate angling, 3.4 evaluate sport fishing reg.s, 4.1 incorporate genetic conservation, 4.3 genetic plans for transplantation & propagation, 5.1 monitor recovery efforts, 5.3 evaluate BMP's for habitat, 5.5 improve info on distribution & status, 6.1 use partnerships to protect & restore core area functions, 6.2 use Federal authorities for BT, 6.3 enforce reg.'s & evaluate, 7.1-3 assess implementation by recovery units & revise plans
E	Introduced Non-native species	1,2,,3	2.1 fish stocking, 2.2 illegal transport, 2.3 educate about illegal intro., 2.4 effects of non-native control, 2.5 control non-native, 2.6 tasks to reduce effects, 3.3 evaluate fisheries effects, 5.1 monitor recovery efforts, 7.1-3 assess implementation by recovery units & revise plans

LISTING FACTOR	THREAT	RECOVERY CRITERIA *	RECOVERY ACTIONS
E	Isolation and Habitat Fragmentation	1,2,,3,4	1.2 barriers, 1.4dam operation, 4.2mainatin gene flow, 4.3genetic plans for transplantation & propagation, 5.1monitor recovery efforts, 5.2research BT abundance, habitat & tasks, 5.3evaluate BMP's for habitat, 5.5improve info on distribution & status, 5.6improve understanding of genetics & local populations, 6.1 use partnerships to protect & restore core area functions, 7.1-3assess implementation by recovery units & revise plans

Listing Factors:

- A. The Present or Threatened Destruction, Modification, or Curtailment Of Bull Trout Habitat or Range
- B. Overutilization for Commercial, Recreational, Scientific, Educational Purposes
- C. Disease or Predation (disease not a major factor)
- D. The Inadequacy of Existing Regulatory Mechanisms
- E. Other Natural or Manmade Factors Affecting Its Continued Existence

Recovery Criteria * All recovery units meet their criteria, as identified in the recovery unit chapters.

- 1. The distributed abundance of bull trout in identified and potential local populations in all core areas within the recovery unit
- 2. The estimated abundance of adult bull trout within core areas in the recovery unit, expressed as either a point estimate or a range of individuals
- 3. The presence if stable or increasing trends for bull trout abundance in the recovery unit
- 4. The restoration of passage at specific barriers identified as inhibiting recovery.

Tasks - General (see plan for details)

- 1 - Protect, restore, and maintain suitable habitat conditions for bull trout
- 2 - Prevent and reduce negative effects of non-native fishes and other non-native taxa on bull trout
- 3 - Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.
- 4 - Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
- 5 - Conduct research and monitoring to implement and evaluate bull trout activities, consistent with an adaptive management approach using feedback from implemented site-specific recovery tasks.
- 6 - Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.
- 7 - Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

Research is also an important component of the recovery strategy. Conducting research on the biological and habitat responses to recovery actions will improve on-the-ground application of future actions through adaptive management. Research will also be necessary to develop monitoring programs.

Ultimately, bull trout recovery is dependent upon using cooperative partnerships and interagency collaboration. Because most bull trout habitats occur on federally-managed lands, more opportunities and responsibilities to conserve bull trout under the Endangered Species Act occur on these lands compared to those under other ownerships. The U.S. Fish and Wildlife Service developed land management guidance (USFWS 1998c) promoting bull trout conservation to assist in consultations while this draft recovery plan was being developed. The U.S. Fish and Wildlife Service recommends consideration of the guidance, as well as the management direction and intent contained in PACFISH, INFISH, Northwest Forest Plan, and additional conservation provisions (summarized in Appendix 3), by Federal agencies when planning and implementing activities affecting bull trout and bull trout habitats.

Habitat and Population Terminology

Various terms to describe bull trout habitat and population units have been used in the literature, agency reports, and documents for ongoing conservation efforts. In many instances there is considerable overlap and ambiguity in the terminology. To ensure consistency throughout the recovery plan and define the scope of recovery, we developed standardized terminology for bull trout habitat and population units. Terms for population units are hierarchical, allowing recovery efforts to be focused at various spatial scales.

Local populations: Groups of bull trout that spawn in various tributaries are generally characterized by relatively small amounts of genetic diversity within a tributary but high levels of genetic divergence between tributaries (Leary *et al.* 1993; Taylor *et al.* 1999; Spruell *et al.* 2000). This suggests that many bull trout have a high fidelity (attachment) to specific streams (Kanda and Allendorf 2001) and can be characterized as local populations. The results of many studies support the hypothesis that many streams support local populations that are isolated reproductively (Kanda *et al.* 1997; Kanda 1998; Spruell *et al.* 1999; Kanda and Allendorf 2001; Neraas and Spruell 2001). As noted by Spruell *et al.* (1999), these widespread patterns of genetic variation most likely reflect historical population structures, past evolutionary events, and the general life history of bull trout.

Core Areas: The recovery plan considers local populations of bull trout to be partially isolated, but have some degree of gene flow among them. Such groups

meet the definition of (Meffe and Carrol 1994) and function as (Dunham and Rieman 1999) a metapopulation. The intent of the recovery plan is to have core areas reflect the metapopulation structure of bull trout. Within a bull trout metapopulation, local populations are expected to function as one demographic unit (Hanski and Gilpin 1997). All local populations within a bull trout metapopulation would be at a common risk of extinction and have a relatively high degree of genetic relatedness (Kanda and Allendorf 2001). In theory, bull trout metapopulations can be composed of two or more local populations. However, Rieman and Allendorf (2001) have suggested that between 5 and 10 local populations are necessary for a bull trout metapopulation to function effectively.

Recovery Units: Bull trout may be grouped so that they share genetic characteristics as well as management jurisdictions (See Dunham and Rieman 1999; Rieman and Allendorf 2001). Such groups have been classified as recovery units. They can range from one local population to multiple core areas. The recovery units identified in this plan are the units at which recovery efforts are specified and evaluated. As such, it was important to consider the genetic relationships between populations as well as how populations should be grouped to foster effective management. For example, most recovery units do not cross state boundaries nor do they include mainstem areas of the Snake or Columbia rivers. This grouping was designed to promote local management decisions concerning populations of bull trout that are demographically dependent. In addition, most recovery units are composed of multiple core areas and single or multiple recovery units compose a distinct population segment.

There are 27 bull trout recovery units (Table 1) in the coterminous United States (1 for the Klamath River, 22 for the Columbia River, 1 for the Jarbidge River, 2 for the Coastal-Puget Sound, and 1 for the St. Mary-Belly River distinct population segments).

For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations that contained fewer than 100 spawning adults per year were classified at risk from inbreeding depression. Bull trout core areas that contained fewer than 1,000 spawning adults per year were classified as at risk from genetic drift. Further details and guidelines regarding these minimum population sizes are provided in the recovery plans for each recovery unit. In some instances these guidelines depart from the theoretical and reflect the judgment of the recovery unit teams based on current habitat limitations, appraisals of prospects for developing and achieving recovery criteria, and best available information.

Recovery Goals and Objectives

The goal of the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species native range so that the species can be delisted**. Recovery of bull trout will require reducing threats to the long-term persistence of populations, maintaining multiple interconnected populations of bull trout across the diverse habitats of their native range, and preserving the diversity of bull trout life-history strategies (*e g.*, resident or migratory forms, emigration age, spawning frequency, local habitat adaptations). To accomplish this goal, the following four objectives have been identified:

- ▶ Maintain current distribution of bull trout within core areas as described in recovery unit chapters and restore distribution where recommended in recovery unit chapters.
- ▶ Maintain stable or increasing trends in abundance of bull trout. Abundance levels will be defined in individual recovery units.
- ▶ Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
- ▶ Conserve genetic diversity and provide opportunity for genetic exchange.

Actions and tasks described in the recovery plan address these objectives, or generate information useful in refining and evaluating them.

Recovery Criteria

Recovery criteria for bull trout address quantitative measurements of bull trout distribution, population characteristics, and threats that are linked to recovery objectives. Recovery criteria are developed on a recovery unit basis. Criteria specific to each recovery unit are presented in each recovery unit chapter. Individual chapters may contain criteria for assessing the status of bull trout and alleviating threats that are unique to one or several recovery units. However, every chapter will contain criteria addressing the following characteristics:

- ▶ The distribution of bull trout in identified and potential local populations in all core areas within the recovery unit;

- ▶ The estimated abundance of adult bull trout within core areas in the recovery unit, expressed as either a point estimate or a range of individuals;
- ▶ The presence of stable or increasing trends for adult bull trout abundance in the recovery unit; and
- ▶ The restoration of passage at specific barriers identified as inhibiting recovery.

Criteria are established to gauge achievement of recovery objectives and assess whether actions have resulted in the recovery of bull trout. Recovery criteria reflect the stated objectives and consideration of population and habitat characteristics within the recovery unit. The current status of bull trout was evaluated based on four population elements. The four elements were: 1) number of local populations, 2) adult abundance (defined as the number of spawning fish present in a core area in a given year), 3) productivity, or the reproductive rate of the population (as measured by population trend and variability), and 4) connectivity (as represented by the migratory life history form and functional habitat). For each element, bull trout were classified based on relative risk categories.

These elements were derived from the best scientific information available concerning bull trout population and habitat requirements (Rieman and McIntyre 1993; Rieman and Allendorf 2001) (see also Appendix 4, Effective Population Size). Levels of adult abundance and the number of local populations needed to spread extinction risk should be viewed as a best estimate given limited information on bull trout. Based on the best data available and professional judgment, recovery unit teams then evaluated each element under a potential recovered condition. Evaluation of these elements under a recovered condition assumed that actions identified within this chapter had been implemented. This approach acknowledges that, even when recovered, the status of bull trout populations in some core areas may remain short of ideals described by conservation biology theory. Some core areas under recovered conditions may be limited by natural attributes or patch size, and may always remain at a relatively high risk of extirpation.

Number of Local Populations

Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events. Distribution of local populations in such a manner is, in part, an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than five local populations are at increased risk; core

areas with between 5 to 10 local populations are at intermediate risk; and core areas which have more than 10 interconnected local populations are at diminished risk.

Some recovery units also use the term "potential" local populations in the number of local populations or distribution criteria. A potential local population is defined as a local population that does not currently exist, but which might exist and contribute to recovery in a known or suspected unoccupied area, if spawning and rearing habitat or connectivity is restored in that area.

Adult Abundance

Recovered abundance levels were evaluated by considering theoretical estimates of effective population size, historic census information, and the professional judgment of recovery unit team members. In general, effective population size is a theoretical concept that allows prediction of potential future losses of genetic variation within a population, due to small population sizes and genetic drift. For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations that contained fewer than 100 spawning adults per year were classified at risk from inbreeding depression. Bull trout core areas that contained fewer than 1,000 spawning adults per year were classified as at risk from genetic drift.

Productivity

A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*, productivity over the entire life cycle) that indicate a population is consistently failing to replace itself, indicate increased extinction risk. Therefore, the reproductive rate should indicate the population is replacing itself, or growing.

Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population.

The population growth rate is also an indicator of extinction probability. The probability of going extinct cannot be measured directly; it can, however, be

estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. The growth rate must indicate a stable or increasing population for a period of time for the population to contribute to recovery.

Connectivity

The presence of the migratory life history form of bull trout was used as an indicator of the functional connectivity of the system. If the migratory life form was absent from a core area, or if the migratory form is present but local populations lack connectivity, the core area was considered to be at increased risk. If the migratory life form persists in at least some local populations, with partial ability to connect with other local populations, the core area was judged to be at intermediate risk. Finally, if the migratory life form was present in all, or nearly all, local populations, and had the ability to connect with other local populations, the core area was considered to be at diminished risk.

Distinct Population Segment Structure and Population Units

Population units of bull trout exist in which all fish share an evolutionary legacy and which are significant from an evolutionary perspective (Spruell *et al.* 1999). These population units can range from a local population to multiple recovery units and theoretically should represent a distinct population segment. Although such population units are difficult to characterize, genetic data have provided useful information on bull trout population structure. For example, genetic differences between the Klamath and Columbia river populations of bull trout were revealed in 1993 (Leary *et al.* 1993). Based largely on this 1993 information and the lack of additional information, the current distinct population segment structure of bull trout in the Klamath and Columbia rivers, Jarbidge River, St. Mary-Belly rivers and Coastal-Puget Sound was developed for the listings in 1998 and 1999.

Since the 1998 listing, genetic analyses have suggested that bull trout populations may be organized on a finer scale than previously thought. Additional genetic data has revealed genetic differences between coastal populations of bull trout, including the lower Columbia and Fraser rivers, and inland populations in the upper Columbia and Fraser river drainages, east of the Cascade and Coast mountains (Williams *et al.* 1997; Taylor *et al.* 1999). There is also an apparent genetic differentiation between inland populations within the Columbia River basin. This differentiation occurs between the (a) mid-Columbia (John Day, Umatilla) River and lower Snake River (Walla Walla, Clearwater, Grande Ronde, Imnaha rivers, etc)

populations and the (b) upper Columbia River (Methow, Clark Fork, Flathead River, etc.) and upper Snake River (Boise River, Malheur River, Jarbidge River, etc.) populations (Spruell *et al.* 2000; Paul Spruell, University of Montana, pers. comm. 2002). Genetic data indicate bull trout inhabiting the Deschutes River drainage of Oregon are derived from coastal populations and not from inland populations in the Columbia River basin (Leary *et al.* 1993; Williams *et al.* 1997; Spruell and Allendorf 1997; Taylor *et al.* 1999; Spruell *et al.* 2000). In general, evidence since the time of listing suggests a need to further evaluate the distinct population segment structure of bull trout populations being considered in this recovery plan. (See further discussion in Bull Trout Recovery and Delisting.)

The Role of Recovery Units in Survival and Recovery of Bull Trout

Recovery units were designated to facilitate development of the recovery plan by placing the scope of bull trout recovery on smaller spatial scales than the larger distinct population segments. Focusing recovery on smaller areas is advantageous because bull trout are widely distributed, and their habitats and factors affecting them vary greatly throughout their distribution. Thus, a narrower scope allows recovery tasks to be tailored to specific areas and encourages implementation of tasks by local interests. Although biological and non-biological issues (*i.e.*, jurisdictional and logistical concerns) were considered in identifying the 27 recovery units, recovery units generally have a biological basis in that they are groupings of bull trout for with historical or current gene flow. Thus, isolated basins, major river basins, and collections of basins represent the boundaries of recovery units

Individual recovery units are important to bull trout recovery by providing for the distribution of bull trout across their native range and maintaining adaptive ability to ensure long-term persistence. Similarly, individual core areas are the foundation of recovery units, and maintenance of these areas is critical to recovery. Genetic diversity enhances long-term survival of a species by increasing the likelihood that the species is able to survive changing environmental conditions. For instance, a local population of bull trout may contain individuals with genes that enhance their ability to survive in the prevailing local environmental conditions. Individuals with a different genetic complement may persist in the local population in much lower abundance than those with locally adapted genes.

Each recovery unit is important; and recovery units are an appropriate scale at which to gauge progress toward recovery for individual distinct population segments and the species within the coterminous United States. Recovering bull trout in each recovery unit will maintain the overall distribution of bull trout in their native range. Conserving core areas and their habitats within recovery units should preserve genotypic and phenotypic diversity and allow bull trout access to diverse

habitats. The continued survival and recovery of individual core areas is critical to the persistence of recovery units and their role in the recovery of a distinct population segment. Recovered conditions and tasks for core areas are described in recovery unit chapters.

The Role of Artificial Propagation and Transplantation in Bull Trout Recovery

Section 3(3) of the Endangered Species Act lists artificial propagation and transplantation as methods that may be used for the conservation of listed species. Hatcheries have played an important role in recovery efforts of other listed fish species (Rinne *et al.* 1986). The bull trout recovery plan recognizes that certain recovery units within the distinct population segment may require the use of artificial propagation techniques in order to meet recovery criteria. Artificial propagation could involve the transfer of bull trout into unoccupied habitats or could involve the use of Federal, State, or Tribal hatcheries to assist in recovery efforts (Buchanan *et al.* 1997; USFWS 1998e). The use of artificial propagation programs for bull trout must be authorized by the U.S. Fish and Wildlife Service and meet applicable State and Tribal fish-handling and disease policies.

The Montana Bull Trout Scientific Group evaluated seven strategies for the potential use of artificial propagation in the recovery of bull trout (MBTSG 1996g). The report evaluated the use of hatcheries in establishing genetic reserves, restoration stocking, research activities, supplementation programs, introductions to expand distribution, and the establishment of “put, grow, and take” fisheries. The report concluded that the potential use of hatcheries in bull trout recovery could include the establishment of genetic reserves for declining populations, restoration stocking, and some research activities including the evaluation of hybridization. However, the report concluded that the use of hatcheries for bull trout supplementation programs, “put, grow, and take” stocking, and introductions outside historic range were not appropriate. The bull trout recovery plan recommends that a study be initiated to determine the effectiveness and feasibility of using artificial propagation in bull trout recovery. Specific goals and objectives for the use of hatcheries in the recovery and conservation of bull trout should be identified. Information gained from this study will help guide proposed artificial propagation programs identified in individual recovery unit chapters.

Any artificial propagation program instituted for bull trout will follow the joint policy of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding controlled propagation of listed species (65 FR 56916). The overall guidance of the policy is that every effort should be made to recover a species in the wild before implementing an artificial propagation program. Because recovery for bull trout entails the identification and correction of threats affecting

bull trout, artificial propagation programs should not be implemented until the reasons for decline have been addressed.

The Role of Fire and Aquatic Habitats in Bull Trout Recovery

Bull trout evolved under historic fire regimes, in which disturbance to streams from forest fires resulted in a mosaic of diverse habitats. However, forest management and fire suppression over the past century have increased homogeneity of terrestrial and aquatic habitats, increasing the likelihood of large, intense forest fires in some areas. Because the most severe effects of fire on native fish populations can be expected where populations have become fragmented by human activities or natural events, an effective strategy to ensure persistence of native fishes against the effects of large fires may be to restore aquatic habitat structure and life history complexity of populations in areas susceptible to large fires (Gresswell 1999).

Rieman and Clayton (1997) discussed relations among the effects of fire and timber harvest, aquatic habitats, and sensitive species. They noted that spatial diversity and complexity of aquatic habitats strongly influence the effects of large disturbances on salmonids. For example, Rieman, Lee, Chandler, and Myers (1997a) studied bull trout and redband trout responses to large, intense fires that burned three watersheds in the Boise National Forest in Idaho. Although the fires were the most intense on record, there was a mix of severely-to-unburned areas left after the fires. Fish were apparently eliminated in some stream reaches, whereas others contained relatively high densities of fish. Within a few years after the fires and after areas within the watersheds experienced debris flows, fish had become reestablished in many reaches, and densities increased. In some instances, fish densities were higher than those present before the fires or in streams that were not burned (Rieman, Lee, Chandler, and Myers 1997). These responses were attributed to spatial habitat diversity that supplied refuge areas for fish during the fires, and the ability of bull trout and redband trout to move among stream reaches. For bull trout, the presence of migratory fish within the system was also important (Rieman and Clayton 1997; Rieman, Lee, Chandler, and Myers 1997).

For bull trout recovery, the appropriate strategy to reduce the risk of fires on bull trout habitats is to emphasize the restoration of watershed processes that create and maintain habitat diversity, provide access to habitats, and protect or restore migratory life-history forms of bull trout. Both passive (*e.g.*, encouraging natural riparian vegetation and floodplain processes to function appropriately) and active (*e.g.*, reducing road density, removing barriers to fish movement, and improving habitat complexity) recovery actions offer the best approaches to protect bull trout from the effects of large fires.

The Role of the Mainstem Columbia and Snake Rivers

Historically, the mainstem Snake and Columbia rivers were likely used as migration corridors, foraging areas, and overwintering habitat by fluvial bull trout that originated in tributary streams throughout the basins. Presently, mainstem habitat may or may not be used by bull trout depending on the strength of their populations in tributary streams and the availability of migration corridors that connect to the Columbia and Snake rivers.

Bull trout have multiple life history strategies, including migratory forms, throughout their range (Rieman and McIntyre 1993). Migratory forms appear to develop when habitat conditions allow movement between spawning and rearing streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993). For example, multiple life history forms (*e.g.*, resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993; MBTSG 1998; Frissell 1999;).

In the mid-Columbia River, bull trout have been observed passing the fish ladders at Wells, Rocky Reach, and Rock Island dams. Bull trout have also been observed in the fish ladder counting stations at Bonneville Dam in the lower Columbia River (Sprague, *in litt.* 2002). In the Snake River, bull trout have been observed in the fish ladder counting stations at Little Goose and Lower Monumental dams (Richards 2002) and at the juvenile fish collection facilities at Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams (Baxter 2002).

Bull trout use of the mainstem Columbia River has recently been documented by radio-tagging studies conducted by the U.S. Fish and Wildlife Service (Kelly-Ringel and DeLaVergne 2000, 2001) and the Chelan, Douglas, and Grant County public utility districts (Kreiter 2001, 2002). This information indicates that bull trout are likely foraging and/or overwintering throughout the mainstem Columbia River (Kreiter 2002; T. Dresser, Grant County Public Utilities District, pers. comm. 2002; D. Ward, ODFW, pers. comm., 2002; Oregon Department of Fish and Wildlife *in litt.* 2001; J. Wachtel, WFW, *in litt.* 2000).

Studies by the Oregon Department of Fish and Wildlife (Hemmingsen *et al.* 2001a, b) and Idaho Power Company (Chandler and Richter 2001) have verified movements of bull trout between tributary streams and the mainstem Snake River (Buchanan *et al.* 1997; J. Chandler, IPC, pers. comm. 2002).

Radio-tag studies have also shown evidence of bull trout movement between Pine and Indian creeks as well. One fish that was radio-tagged in Indian Creek was found to have moved to a tributary of the North Fork of Pine Creek (Chandler and Richter 2001). Chandler and Richter (2001) also reported that two bull trout that were radio-tagged in the reservoir moved into the Pine Creek system. One fish was tracked as far as the confluence of Lake Creek and North Pine Creek and then moved back to the reservoir. The other fish moved about 4.97 miles (8 kilometers) into Pine Creek before being lost to predation.

Restoring and maintaining connectivity between existing populations of bull trout is important for the persistence of the species (Rieman and McIntyre 1993), as well as providing for expression of the migratory life history form. Migration and occasional spawning between populations increases genetic variability and strengthens population variability (Rieman and McIntyre 1993).

In summary, foraging and migratory habitat are important to bull trout. Although currently fragmented by the presence of dams, the mainstem Columbia and Snake rivers provide habitat that potentially helps to maintain interactions between populations of bull trout in the tributaries, and provides for foraging and overwintering opportunities. Migratory corridors such as these allow individuals access to unoccupied but suitable habitats, foraging areas, and refuges from disturbances (Saunders *et al.* 1991). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbance makes local habitats temporarily unsuitable, the range of the species is diminished, and the potential for enhanced reproductive capabilities are lost (Rieman and McIntyre 1993). The relationship of the mainstem Snake and Columbia rivers to individual recovery units and the local populations within those units are discussed in the respective recovery unit chapters.

Recovery Monitoring and Evaluation

A key component of recovery planning is an effective monitoring and evaluation program. Monitoring involves systematic observation, detection, and recording of conditions, resources, and environmental effects of management programs and actions. It allows determination of trends in fish populations and how well the elements of the strategy are working, and enables the testing of key assumptions and resolution of important questions. Specific goals of bull trout monitoring include characterization of the status of recovery units by describing population abundance, trends in abundance, distribution of bull trout within core habitat, and connectivity. Accurate characterization of the status of bull trout populations, before and after implementation of recovery actions, enables estimation of the effectiveness of those actions. A description of work done to date on bull trout monitoring, and proposals for future approaches, is provided in the (Bull Trout Workshop Report *in litt.* 2002)

Monitoring and evaluation efforts can be divided into different categories, depending upon what kinds of questions are being addressed. *Baseline monitoring* is intended to depict the reference conditions in fish population abundance, trend, distribution, and habitat, from which a change that might be due to management activities could be detected. *Implementation monitoring* is aimed at determining whether strategy elements of a management plan are being implemented correctly. *Effectiveness monitoring* addresses the question of whether strategy elements and actions, having been implemented, are achieving their objectives. *Validation monitoring* is designed to explore key assumptions underlying conservation actions and strategies, by ascertaining cause-and-effect relationships.

It may be impractical to monitor the effectiveness of each and every recovery action, or the status of populations in every core area in every recovery unit, to the same extent. The health of populations and the quality of bull trout habitat will need to be inferred from indicators. Potential indicators include both biological and physical measures, which can be divided into five categories: (1) *Fish* – measures of abundance, distribution, genetic diversity, age structure, fecundity, etc., (2) *Physical (instream) habitat* – gravel size, channel morphology, etc., (3) *Water quantity* – minimum flows, seasonal response, etc., (4) *Water quality* – temperature, sediment, etc., and (5) *Land use/cover* – amount of vegetation in stream buffers, percentage of watershed covered by impervious surfaces, etc. Indicators may in some instances be identical to actual characteristics of interest; in other instances, they will be surrogates for key features, intended to provide a reasonable representation of the attribute of interest.

Efficient use of monitoring and recovery resources and effort will require adhering to the principles and procedures of adaptive management. Adaptive management is a science-based management approach, incorporating continuing review of how well actions are achieving their objectives. Adaptive management recognizes uncertainties are unavoidable and that action cannot wait for uncertainties to be eliminated. The approach seeks to find actions that maximize the ability to achieve conservation and recovery objectives, while facilitating learning about key uncertainties relevant to selecting long term management actions. Based on results of monitoring and evaluation efforts, it can help suggest what steps are necessary to increase chances for successful recovery. Over time, a better understanding of what is working and what is not should be gained, which ideally will lead to improvement in the quality and efficacy of management decisions and actions. The course of adaptive management can be encapsulated in a series of steps, which describe one of multiple iterations in the process (that is, after the last step, start again with step #1, incorporating the new data):

1. Identify what is known and unknown in the various recovery units (scientific foundation).
2. Identify strategies/key actions for implementation (conservation actions).
3. Identify the performance standards that need to be measured to determine population status and efficacy of conservation strategies.
4. Identify and prioritize key technical and policy questions related to the scientific foundation and conservation strategies.
5. Determine the most efficient allocation of resources (funding and personnel) to achieve conservation and information objectives, using chosen performance measures.
6. Design (or update) a detailed monitoring plan to meet the identified objectives, consistent with available resources.
7. Implement conservation strategy and monitoring plan.

Planning a regional monitoring program will require coordination and prioritization of diverse efforts by a number of different agencies. This involves several tasks, among them (1) inventorying and evaluating existing monitoring programs, (2) defining the ultimate objectives of bull trout monitoring and

evaluation for all of the involved parties, (3) improving coordination between monitoring programs and responsible agencies, (4) addressing key design elements, such as sampling frame (where/when to measure), what to measure, and how to measure (protocol), and (5) coordinating efforts of recovery monitoring with those of other statutory requirements of the Endangered Species Act (*e.g.*, section 4d rules, section 7 consultations, habitat conservation plans).

To help direct and prioritize future monitoring efforts, and to maximize the amount of information useful to recovery planning garnered from current studies, the U.S. Fish and Wildlife Service will establish a Recovery Monitoring and Evaluation Technical Group. The Monitoring and Evaluation Technical Group will be a multi-agency body chaired by the U.S. Fish and Wildlife Service. Desirable skills of potential members include expertise in field studies, population dynamics, char biology, biometrics, and experimental design. Guidance and oversight will be provided by the U.S. Fish and Wildlife Service's Bull Trout Coordinator and the overall recovery team to the Monitoring and Evaluation Technical Group. General, ongoing objectives and tasks of the Monitoring and Evaluation Technical Group will include: (1) increase utility of current data collection for recovery planning, (2) guide and prioritize future studies, (3) summarize monitoring and evaluation needs of cooperators, (4) foster coordination among monitoring programs, (5) help develop and standardize design elements, and (6) review analytical methods of characterizing population and habitat status.

The advice and guidance of the Monitoring and Evaluation Technical Group will be formalized in reports. The reports may include reviews of specific monitoring proposals, summaries of the monitoring and evaluation needs of cooperators, recommendations of appropriate scale and protocols for various management questions, and critiques of analytical methods for estimating population status and monitoring effectiveness. Certain key products of the Monitoring and Evaluation Technical Group will also be subject to independent scientific review.

Bull Trout Recovery and Delisting Determinations

Achieving recovery objectives and making formal delisting decisions are two separate processes. Recovery occurs when threats to a species, or to a distinct population segment, have been removed, and the species is a secure, self-sustaining component of the ecosystem. The recovery criteria established in a recovery plan describe recovery conditions for a listed species in clear and measurable terms. Delisting is the subsequent regulatory rulemaking process that the U.S. Fish and Wildlife Service uses to remove the recovered species, or distinct population segment, from the list of threatened and endangered species, and therefore removing the protections that apply to listed species. A delisting determination must demonstrate

that the species is no longer threatened or endangered, through an analysis of the five listing factors (destruction of habitat, over-utilization, disease or predation, inadequacy of existing regulatory protections, and other natural and man-made factors) set forth in the Endangered Species Act. A delisting determination can only be made on a "listable entity." Listable entities include species, subspecies, or distinct population segments of any species or vertebrate fish or wildlife that interbreeds when mature. Criteria for applying the definition of distinct population segment are found in the joint U.S. Fish and Wildlife Service and National Marine Fisheries Service "Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act" (61 FR 4722). Currently, the rules that listed the Klamath River, Columbia River, Jarbidge River, Coastal Puget-Sound, and St. Mary-Belly River bull trout as threatened, establish those populations as distinct population segments. Subsets of those populations would have to be shown to meet the definition of distinct population segment before the U.S. Fish and Wildlife Service could propose delisting those populations or groups of populations.

Consideration of interim regulatory relief may be provided for recovery units that meet their recovery criteria prior to recovery criteria being achieved in every unit in the overall distinct population segment through an exemption from take prohibitions for bull trout in that recovery unit through the special rulemaking process under section 4(d) of the Endangered Species Act. In that case, bull trout would remain listed as threatened in that recovery unit, but the prohibitions against take of bull trout would be removed through an exemption applying to that recovery unit.

We expect recovery of bull trout to be a dynamic process occurring over time. The recovery objectives are based on our current knowledge and may be refined as more information becomes available. The recovery team acknowledges that some local populations, and possibly core area populations, may be extirpated even though recovery actions are being implemented. Bull trout populations may be extirpated by naturally occurring events and factors due to human activities influencing populations (*e.g.*, habitat degradation, population fragmentation, and nonnative species introductions). Because recovery unit teams develop specific recovery criteria, they should consider extirpations on a case-by-case basis and forward recommendations to the recovery team. If reestablishment of recently extirpated populations is deemed infeasible or impractical by the recovery unit teams, then recovery criteria for a given recovery unit will be revised to reflect the current condition.

ACTIONS NEEDED TO INITIATE RECOVERY

Recovery for bull trout will entail reducing threats to the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access to them that allow for the expression of various life-history forms. Specific tasks falling within the following seven categories will be necessary to initiate recovery across all recovery units:

- ▶ Protect, restore, and maintain suitable habitat conditions for bull trout.
- ▶ Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.
- ▶ Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.
- ▶ Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
- ▶ Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.
- ▶ Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.
- ▶ Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

Recovery Measures Narrative

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follow a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. Second-tier tasks that do not include specific third-tier actions are most often programmatic activities that are applicable across the species' range and appear in *italicized font*. These tasks are explained more fully in this chapter. Some second-tier tasks may not be sufficiently developed to apply to a particular recovery unit at this time and they appear in *an italicized shaded font (as seen here)*. These tasks are included to preserve consistency

in numbering tasks among recovery unit chapters and intended to assist in generating information during the comment period for the draft recovery plan, a period during which additional tasks may be developed. Third-tier entries are tasks specific to recovery unit chapters. They appear in the implementation schedule that follows the narrative section and are identified by three numerals separated by periods.

The recovery plan should be updated as recovery tasks are accomplished, or revised as environmental conditions change, monitoring results become available, and adaptive management evaluations are conducted. The recovery team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service.

- 1 Protect, restore, and maintain suitable habitat conditions for bull trout.**
 - 1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.
 - 1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.
 - 1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their functions.
 - 1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.
 - 1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.
- 2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.**
 - 2.1 Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

Activities should include an evaluation of all fish stocking programs including public and private hatchery practices to minimize the risk of further introductions of nonnative species within the range of the bull trout and increased enforcement of fish policies to reduce the threat of inadvertent introductions from private fish ponds.

- 2.2 Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.

We encourage agencies to review their existing policies and the enforcement of those policies for illegal transport and introductions of nonnative species to ensure that the policies are effective protection of bull trout. Where these policies do not exist, we encourage development of policies to prevent illegal transport and introduction of nonnative species.

- 2.3 Provide educational opportunities to the public about ecosystem concerns of introductions of nonnative fishes.

A program should be implemented in each State to provide educational and outreach opportunities to the public about the problems and consequences of unauthorized fish introductions.

- 2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

This evaluation should provide recommendations and protocols for experimental removal or suppression of nonnative fishes in those areas where nonnative fishes may be adversely affecting bull trout.

- 2.5 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

Steps to accomplish this task include conducting complete species composition surveys in targeted streams, evaluation of the level of competition of nonnative species on juvenile and subadult bull trout during the winter and summer months, and evaluation of the level of competition between nonnative species and bull trout prey species.

- 2.6 Implement control of nonnative fishes where found to be feasible and appropriate.

The abundance and distribution of nonnative game fishes may greatly affect bull trout survival and recruitment in a given year. Monitoring of nonnative fish populations should be implemented in conjunction with monitoring of bull trout populations (see task #5.1). Effectiveness monitoring of any control measures can be incorporated into an overall monitoring program for bull trout. Control measures can include experimental removal of nonnative species and targeted harvest of nonnatives through liberalized harvest regulations.

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

- 3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.
- 3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

Bull trout are highly susceptible to angling. Steps should be taken to assess the existing and potential impacts of angling on bull trout populations, implement and monitor compliance with existing protective angling restrictions, and provide information to anglers about bull trout identification and special regulations.

- 3.3 Evaluate potential effects of nonnative fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

Efforts should be made to evaluate the level of predation and competition of bull trout with nonnative sport fish. Research needed include assessing impacts of competition for spawning gravels, effects of competition for prey, and levels of predation on and by nonnative species. Once these negative effects have been established, efforts should focus on measures designed to minimize the effects of predation and competition of nonnative species on bull trout.

- 3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

This task applies to states with the management authority to regulate sport fishing. The states, in cooperation with the U.S. Fish and Wildlife Service, should evaluate management proposals to allow carefully regulated harvest of bull trout where monitoring of the population status provides a clear record that a harvestable surplus can be maintained and that harvest will benefit, or at least not be detrimental to, recovery goals.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

- 4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

Genetic analysis samples can be collected throughout the range of bull trout as part of an overall monitoring plan. (See the section on Recovery Monitoring and Evaluation for a more detailed discussion.) Local populations should be managed to maintain long-term viability of bull trout. Agencies and individuals should ensure that management practices and policies allow for the long-term viability of unique characteristics of bull trout local populations.

- 4.2 Maintain existing opportunities for gene flow among bull trout populations.

Where feasible or appropriate, increase the population size and distribution of existing local populations of bull trout to maintain or restore opportunity for gene flow within or between core areas. Methods to explore include, but are not limited to, removal or reduction of competing species and restoration of degraded habitat.

- 4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

Some chapters call for possible transplantation and artificial propagation in order to meet recovery goals within the 25-year time frame (see the Coeur d'Alene (Chapter 15), Deschutes (Chapter 7), and Snake River Washington (Chapter 24) chapters for examples). It will be necessary to establish genetic reserve protocols and standards for initiating, conducting, and evaluating captive propagation programs. It may also be necessary to artificially propagate bull trout to preserve fish that are likely to be extirpated or to conduct research. Protocols will be needed to standardize the process and prevent detrimental effects on the donor population and captive fish, for determining when transplantation and artificial propagation is necessary, how to conduct these activities, and how to evaluate their effectiveness.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

- 5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

For a complete discussion of monitoring, see the section in this chapter titled "Recovery Monitoring and Evaluation".

- 5.2 Conduct research that evaluates relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

The list of research needs below provides a few of the priority research projects that apply across the range of the species. The reader should bare in mind that this list is incomplete and additional research may be proposed in individual recovery units.

1) Evaluation of the effectiveness of habitat restoration techniques in restoring watershed function and bull trout cores and local populations. Land and resource management agencies should coordinate and monitor habitat restoration project with the local U.S. Fish and Wildlife Service Field Office. Habitat restoration techniques include, but are not limited to, enhancement and restoration of riparian corridors (fencing for livestock management, stream bank erosion control, alternative water sources, etc.); instream habitat restoration (large woody debris, pool size and frequency, spawning substrate, etc.); upland/forest restoration (restoration of historic contours, native plant restoration and nonnative plant control, prescribed burns, thinning, replanting, etc.); and erosion control (stream bank contouring, fiber matting, vegetation, livestock control, road maintenance and/or decommission, etc.).

2) Determine the suitability of temperature regimes in currently occupied and potentially restorable bull trout drainages.

3) Assess current and historic effects of upland management on changes to the hydrograph. Activities in upland areas such as logging, road building, and grazing have affected hydrograph regimes in bull trout watersheds. The effects of these activities include changes in the timing and magnitude of peak flows.

4) Delineation of migratory habitat in recovery units and in the mainstem Columbia and Snake Rivers. See also the discussion in Columbia and Snake River Mainstem section.

5) Evaluation of temperature as a limiting factor. For bull trout to reach recovery goals it will be necessary to evaluate the role of seasonally elevated water temperatures as a limiting factor to juvenile bull trout rearing and/or adult migration.

6) Surveys to identify suitable unoccupied habitat for bull trout. These efforts should also include development of a comprehensive list of barriers that may be blocking access to suitable habitat by upstream migrating bull trout.

- 5.3 Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

These evaluations can be conducted in conjunction with the overall monitoring effort discussed in the Recovery Monitoring and Evaluation section of this chapter. Best management practices can include those activities associated with water diversion structures and fish screens and livestock grazing and riparian management.

- 5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

- 5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

Actions associated with this task can include regular presence/absence surveys for each recovery unit. These surveys will be based on the recommendations from the Recovery Monitoring and Evaluation Technical Team discussed in the Recovery Monitoring and Evaluation section.

- 5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

In addition to research proposals associated with task 5.2 and monitoring, as discussed in the Recovery Monitoring and Evaluation section, it will be important to fully understand the habitat requirements of resident and migratory bull trout populations. This should include assessing the ability and prevalence of resident bull trout to express migratory behavior and determining the habitat characteristics necessary for the migratory life history strategy. Additional information needed includes the annual abundance of breeding adults in a local population and the total breeding adult population for a recovery unit, the population structure and connectivity, life history characteristics including age at first spawning, incidence, regularity and timing of repeat spawning, and total life span, reproductive success in production of pre-adult offspring, survival rate to breeding adults, and reproductive success in replacement breeding individuals. There should also be an effort to investigate the transitional mechanisms between resident and migratory life history forms and an assessment of the threat due to hybridization with brook trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

- 6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

Efforts can include providing technical assistance to private landowners on management of riparian areas, promoting land use planning and management that discourages the development of floodplains, promoting development of land and water management plans that minimize activities that impact bull trout habitat, inventory and promotion of groundwater inflow to key stream reaches for bull trout, and promoting, and assisting, collaborative efforts with local watershed working groups in developing and accomplishing site-specific protection and restoration activities. A necessary element to the success of any of the recovery actions discussed here will be to secure adequate funding and cooperation among interested and affected parties.

- 6.2 Use existing Federal authorities to conserve and restore bull trout.

Federal agencies should ensure continued compliance with the provisions of section 7 of the Endangered Species Act. Federal, State and private scientific research must also comply with provision under section 10 and states should continue to implement programs, in cooperation with the U.S.

Fish and Wildlife Service, under section 6. Efforts should be made to identify and develop opportunities for collaboration between the Clean Water Act and total maximum daily load planning and bull trout recovery planning and implementation.

- 6.3 Enforce existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

All existing regulations that may benefit bull trout should be evaluated and fully implemented. These regulations include State habitat protection laws, forest practices laws, lake protection laws, water quality standards, floodplain protection, and emergency flood repair guidelines.

- 7 **Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.**

- 7.1 Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.

- 7.1.1 Generate progress reports on implementation of the bull trout recovery plan in each recovery unit.

Annual reviews are necessary to track progress in implementing the recovery plan. Annual reports can be used to identify successful approaches for implementing recovery tasks and direct where efforts should be placed within recovery units.

- 7.2 Assess effectiveness of recovery efforts.

- 7.2.1 Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts (coordinate with recovery task 5.1).

A standardized monitoring program is needed to evaluate achievement of recovery objectives and provide information to adaptively manage and improve recovery efforts. See discussion in Recovery Monitoring and Evaluation.

- 7.3 Revise scope of recovery as suggested by new information.

IMPLEMENTATION SCHEDULE

Implementation schedules are contained in each recovery unit chapter. These schedules describe recovery task priorities, task numbers, task descriptions, duration of tasks, potential or participating responsible parties, estimated costs, and comments. Implementation tasks in recovery unit chapters 2 through 28, should lead to recovery of bull trout in the coterminous United States as discussed in Part II of this recovery plan.

Parties with authority, responsibility, or expressed interest to implement a specific recovery task are identified in the implementation schedule. Listing a responsible party does not imply that prior approval has been given, nor does it require that party to participate or expend funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery task identified in an approved recovery plan, and is therefore part of a coordinated effort to recover bull trout. In addition, section 7(a)(1) of the Endangered Species Act directs all Federal agencies to use their authorities to further the purposes of the Endangered Species Act by implementing programs for the conservation of threatened or endangered species.

REFERENCES CITED

- Adams, S.B. 1994. Bull trout distribution and habitat use in the Weiser River drainage, Idaho. M.S. Thesis, University of Idaho, Moscow, Idaho.
- Adams, S.B. 1996. Factors affecting distribution and co-occurrence of eastern brook trout and other fishes in the northern Rocky Mountains. Annual Progress Report for U.S. Forest Service, Intermountain Research Station, Boise, Idaho. Contract # 94953-RJVA.
- Adams, S.B. and I.C. Bjornn. 1997. Bull trout distribution related to temperature regimes in four central Idaho streams. Pages 371-380 in W.C. Mackay, M.K. Brewin and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.
- Batt, P.E. 1996. State of Idaho bull trout conservation plan. Office of the Governor, Boise, Idaho.
- Baxter, C.V. 2002. Fish Movement and Assemblage Dynamics in a Pacific Northwest Riverscape. Ph.D. Dissertation, Oregon State University. 174 p.
- Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society 128:854-867.
- Baxter, J.S. and J.D. McPhail. 1999. The influence of redd site selection, groundwater upwelling, and over-winter incubation temperature on survival of bull trout (*Salvelinus confluentus*) from egg to alevin. Canadian Journal of Zoology 77:1233-1239.
- Baxter, J.S., E.B. Taylor, R.H. Devlin, J. Hagen, and J.D. McPhail. 1997. Evidence for natural hybridization between Dolly Varden (*Salvelinus malma*) and bull trout (*Salvelinus confluentus*) in a northcentral British Columbia watershed. Can. J. Fish. Aquat. Sci. 54:421-429.
- Beauchamp, D.A. and J.J. VanTassell. 2001. Modeling seasonal trophic interactions of adfluvial bull trout in Lake Billy Chinook, Oregon. Transactions of the American Fisheries Society 130: 204-216.

- Berg, R.K. and E.K. Priest. 1995. Appendix Table 1: A list of stream and lake fishery surveys conducted by U.S. Forest Service and Montana Fish, Wildlife and Parks fishery biologists in the Clark Fork River drainage upstream of the confluence of the Flathead River the 1950's to the present. Montana Fish, Wildlife, and Parks, Job Progress Report, Project F-78-R-1, Helena, Montana.
- Berry, D.K. 1994. Alberta's bull trout management and recovery plan. Alberta Environmental Protection, U.S. Fish and Wildlife Service, Fisheries Management Division, Edmonton. May 1994.
- Beschta, R.L., R.E. Bilby, G.W. Brown, L.B. Holtby, and I.D. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. Pages 191-232 in E.D. Salo and I.W. Cundy, eds. Streamside Management Forestry and Fisheries Interactions. Institute of Forest Resources, University of Washington, Seattle, Washington, Contribution No. 57.
- Boag, I.D. 1987. Food habits of bull char, *Salvelinus confluentus*, and rainbow trout, *Salmo 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 the effects of human activity on the species. Pages 1-4 in P.J. Howell, and D.V. Buchanan, eds. Proceedings of the Gearhart Mountain Bull Trout Workshop. Oregon Chapter of the American Fisheries Society, Corvallis, Oregon.
- 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.
- Booth, D.B. 1991. Urbanization and the natural drainage systems - impacts, solutions and prognoses. The Northwest Environmental Journal 7:93-118.
- Brenkman, S. J., G. L. Larson, and R. E. Gresswell. 2001. Spawning migration of lacustrine-adfluvial bull trout in a natural area. Transactions of the American Fisheries Society 130:981-987.
- Brewin, P.A. and M.K. Brewin. 1997. Distribution maps for bull trout in Alberta. Pages 206-216 in W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the Bull Trout Conference Proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Calgary, Alberta, Canada.