Completion Report
Lemhi River L-44
Irrigation Diversion Replacement

Lemhi River Subbasin
Salmon, Idaho

Prepared by
Bureau of Reclamation
Pacific Northwest Region
Snake River Area Office
Salmon Field Office

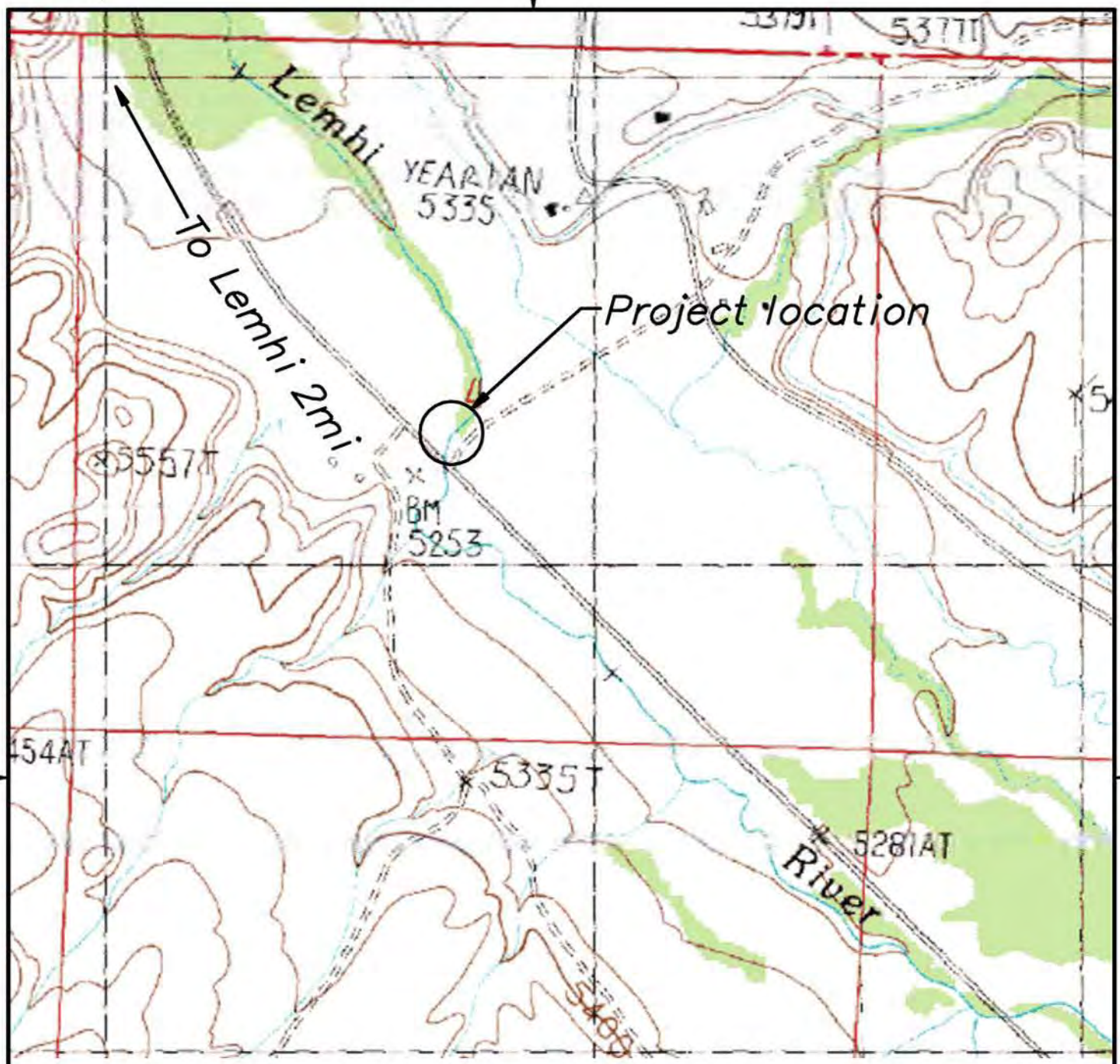
October 2007

L-44 diversion before replacement
(June 2005)

L-44 diversion after replacement
and fish passage modification
(August 2005)

This project was initiated and completed through the combined efforts of many entities, public and private. The purpose of the project was to provide for continued use of water while enhancing conditions for anadromous fish listed under the Endangered Species Act. The Bureau of Reclamation prepared this completion report in accordance with the 2004 National Marine Fisheries Service Federal Columbia River Power System Biological Opinion to describe the design and construction of this project.

Contents



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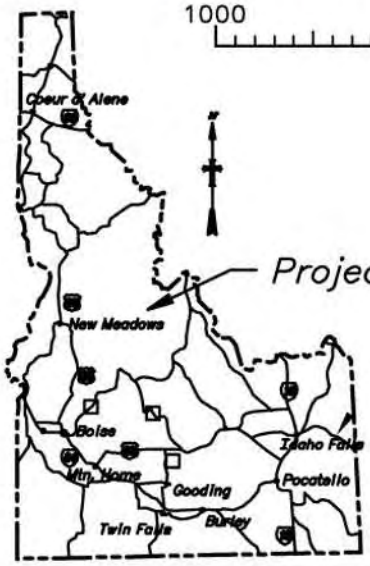

ALWAYS THINK **SAFETY**

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT--IDAHO
FCRPS HABITAT IMPROVEMENT PROGRAM--LEMHI SUBBASIN

L44 DIVERSION IMPROVEMENT

BROAD CRESTED WEIR

LOCATION MAP

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PROGRAM MANAGER

CADD SYSTEM	CADD FILENAME
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1. Introduction

Throughout the Lemhi River subbasin, irrigation diversions, combined with other domestic uses of water, have negatively affected salmonids by reducing water flow, entrapping juvenile fish in the unscreened diversions as they migrate downstream, and impeding upstream migration of adult fish. The primary objective of the L-44 irrigation diversion replacement project and subsequent modification was to implement actions to improve the passage of adult and juvenile salmon and steelhead in the Lemhi River.

The Lemhi River provides habitat for several species of fish listed as either threatened or endangered under the Endangered Species Act (ESA), as well as resident fish. Section 7(a)(2) of the ESA requires that all Federal agencies consult with the National Marine Fisheries Service (NMFS), or the U.S. Fish and Wildlife Service (USFWS), to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in adversely modifying their critical habitat. The NMFS oversees the implementation of the ESA for certain listed species including anadromous salmon and steelhead.

Currently, there are 12 listed anadromous evolutionarily significant units (ESU) and one ESU proposed for listing within the Columbia River. Consultation with NMFS was completed on these ESUs and a Biological Opinion (BiOp) was issued in 2002 and a subsequent BiOp issued on November 30, 2004.[1] This consultation contained an Updated Proposed Action by the action agencies including a Tributary Habitat Program.[2]

1.1 Background

Irrigation diversions have long been identified as having potential for causing harm to resident and migratory fish. Irrigators in the Lemhi subbasin typically use push-up diversion dams to raise water levels and/or direct water into irrigation conveyance canals or "ditches." Push-up diversion dams are usually constructed out of large rock that is placed, or streambed gravel material that is pushed up in a linear fashion across the stream channel. Water diverted from the river or creek channel is then conveyed

[1] Biological Opinion on the Operation of the Federal Columbia River Power System including the 19 Bureau of Reclamation Projects in the Columbia Basin, November 30, 2004 (revised and reissued pursuant to court order, NWF v. NMFS, Civ. No. CV 01-640-RE (D. Oregon).

[2] Final Updated Proposed Action for the FCRPS Biological Opinion Remand, U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration, November 24, 2004.

via the ditch and distributed to agricultural fields. If diverted water is unscreened, fish can be carried into fields or entrapped in ditches.

Two existing rock weir (push-up) diversions in the Lemhi River were identified by Idaho Department of Fish and Game (IDFG) as having potential for impeding migration and causing harm to resident and migratory fish. Reclamation approached the owners and obtained permission to pursue replacement. The two diversions (L-44 and L-45) were located in close proximity to one another and therefore, considered by Reclamation to be good candidates for removal and consolidation into one point of diversion. However, eventual reluctance of the L-45 landowner to participate required abandonment of efforts to pursue consolidation. Project development was then refocused on replacing solely the L-44 irrigation diversion. Reclamation developed a project proposal that was subsequently reviewed and ranked by the Upper Salmon Basin Watershed Project (USBWP) Technical Team, and submitted to Bonneville Power Administration for funding consideration.

1.2 Problems and Solutions

The L-44 diversion was constructed of rock, located adjacent to a State highway bridge abutment, and spanned the entire width of the river. As constructed, it contributed to fish passage problems such as channel dewatering, fish passaage, and entrainment of fish in the irrigation ditch. Typical of this type diversion, it was necessary to enter the river channel with heavy equipment to conduct periodic maintenance. The existing fish screen in the ditch was compliant with NMFS screening criteria and therefore was not replaced.

1.3 Participation and Cooperation

Reclamation implemented the Tributary Habitat Program for the Lemhi River subbasin, as set forth in the Updated Proposed Action, as a conservation measure to provide for early actions to assist with recovery of the ESUs within the Columbia River. The upper Salmon and Lemhi subbasin ESUs include the Snake River steelhead and the Snake River spring/summer Chinook. Within these conservation measures, Reclamation addresses limiting factors such as instream flow, barriers, channel morphology, and entrainment. For this program, Reclamation works with willing partners to provide technical assistance and logistical help with implementation of habitat projects leading to correction of tributary, spawning, and rearing deficiencies associated with these limiting factors.

Reclamation's participation in the L-44 project was funded under the direction of the Tributary Habitat Program. Technical assistance provided by Reclamation included project coordination, environmental compliance, development of contract design documents, and construction inspection.

Funding for construction of the L-44 diversion project was provided by Bonneville Power Administration (BPA). The Lemhi Soil and Water Conservation District (LSWCD) was the project sponsor and handled distribution and administration of BPA funding. The USBWP provided assistance on behalf of the LSWCD with environmental compliance. Landowners granted permission to complete the project, provided access to their property and participated in design review.

1.4 Environmental Compliance

Staff in Reclamation's Salmon Field Office and in the USBWP office assisted BPA with completion of National Environmental Policy Act (NEPA) documents and BPA/NMFS Habitat Improvement Project BiOp and Section 7 ESA compliance requirements. Reclamation also contracted with a local consulting firm on behalf of BPA to prepare a Biological Assessment (BA) for submission to USFWS for ESA consultation. Work in the river to replace the diversion was authorized pursuant to the Clean Water Act (CWA) and Idaho Department of Water Resources (IDWR) stream alteration permit exemptions. This exemption, referred to locally as the "irrigator's exemption," authorizes irrigators or their assigns to perform maintenance on diversions and appurtenances.

1.5 Contract Specifications and Bidding

Reclamation's Pacific Northwest (PN) Region design office developed and provided to the LSWCD separate draft and final project drawings. Preliminary and draft designs were widely circulated by Reclamation for review and comment prior to finalization and project implementation.

Contract design specifications developed for construction at L-44 called for construction of the following features: a double drop A-weir diversion to be constructed of rock, a concrete headworks, and a water measurement structure in the ditch. The project was advertised and the construction contract administered by the LSWCD. Probst Construction of Tendoy, Idaho was the successful low bidder for the project and completed the construction.

2. Project Description

The project is located on the Lemhi River in central Idaho, approximately 34 miles southeast of the town of Salmon, in Lemhi County (Frontispiece). As is common with all diversions on the mainstem Lemhi, L-44 is on a reach of the river that flows through privately-owned ranch land. The L-44 diversion is adjacent to a Highway 28 bridge located between mileposts 106 and 107. Existing features consisted of a rock diversion weir, metal headgate, and a rotary drum fish screen in the ditch. The L-44 project features included construction of a new diversion weir, new headgate, and a water measurement device (ramp flume) in the ditch.

The primary purpose of the L-44 irrigation diversion replacement was to improve fish passage of adult and juvenile salmon and steelhead and still meet irrigation delivery requirements.

2.1 L-44 Construction

During construction of the L-44 diversion, Reclamation provided an inspector from the Yakima Construction Office. A field engineer from the Salmon office was onsite during construction. The design engineer from the PN Region office was also involved during construction.

Construction of L-44 began in the summer of 2005 during the irrigation season. Fish passage and irrigation water delivery were maintained during construction by placement of a temporary cofferdam to bypass river flow around the construction area. Construction was completed in the late summer prior to the end of the 2005 irrigation season.

Major project features for the L-44 construction included:

- Placement of a temporary ecology block cofferdam in the river channel to divert water around the construction area for fish passage and irrigation delivery.
- Demolition and removal of the existing L-44 rock weir diversion and headgate structure.
- Construction of a double drop, A-weir diversion with a geo-textile liner placed on the upstream face. The new diversion weir was constructed of concrete ecology block (instead of rock) and included a stoplog sluiceway.
- Construction of a rock berm to maintain pool elevation upstream of the weir.
- Construction of a new headworks with trashrack at the ditch inlet.

- Installation of a metal ramp flume water measurement structure in the ditch.
- Removal of the temporary cofferdam.
- Construction of two short sections of wooden crossbuck “jack” fence.
- Installation of a cattle guard.
- Seeding and mulching.

Soon after award of the construction contract, a request by the contractor was approved for the substitution of ecology block in place of the large rock that was specified in the design for weir construction. Additional design and contract modifications were made by the field engineer during construction to address structural concerns regarding the long-term stability of the weir. Changes included placement of additional footer blocks and rock streambed armoring to prevent scour below the footer block, modification of the alignment of the rock berm to better maintain upstream pool elevation, and placement of riprap around the headgate.

Mitigation measures to reduce construction impacts included provision of fish passage during construction, removal of the cofferdam, re-seeding adjacent river banks, construction of two short sections of jack fence, and installation of a cattle guard to exclude cattle from the riparian area where construction occurred.

On the last day of construction at L-44, Reclamation was contacted by a local representative of the IDFG regarding concerns of passing biologists that the completed diversion weir did not appear passable by all life stages of migratory fish. Subsequent evaluation by Reclamation and IDFG revealed that pool drop heights and water surface elevations of the new diversion differed from what were predicted by design models and specified in the contract design. Data collected revealed that water surface elevations and flow over portions of the diversion weir exceeded NMFS criteria for height, depth, and velocity. However, monitoring of the structure and redd counts upstream by IDFG did not reveal any evidence of the new structure being a fish passage barrier for adult or juvenile migratory fish. Non-compliance with NMFS criteria and concern for juvenile fish passage over the new weir required the eventual development of modifications to improve fish passage conditions.

2.2 Conclusions

For the purpose of irrigation water diversion and delivery, the new L-44 diversion weir, headgate, and ramp flume performed very well. The owner was pleased with the outcome of the project and the new structure's ability to deliver irrigation water. The owner has not had to enter the river with equipment to do annual maintenance since the new weir was constructed.

Ecology block can be a viable alternative for rock for weir construction since very large rock can be difficult to obtain in some areas. Ecology block is readily available from local concrete vendors, is uniform in size and shape, and with proper equipment is easy to haul and place. Substitution of ecology block for rock at L-44 after the contract was awarded resulted in the LSWCD receiving some complaints from unsuccessful project bidders. Some criticism has been voiced that ecology block is unattractive and has an artificial appearance when compared with rock boulders.

3. Fish Passage Modification

3.1 Problems and Solutions

Determination of measures sufficient to satisfy concerns about fish passage at L-44 were developed collaboratively by an inter-agency team assembled by Reclamation. Representatives from Reclamation, IDFG, NMFS, USFWS, and USBWP met and agreed upon additional measures for implementation at L-44 to improve fish passage for juveniles. Fish passage modifications consisted of the following:

1. Removal of an ecology block from the middle of the lower weir drop to equalize pool water surface elevations.
2. Placement of a row of boulders to create a third weir also to equalize pool water surface elevations.
3. Placement of boulder clusters to reduce velocity over the drops.
4. Excavation of a plunge pool below the lower drop.

3.2 Contract Specification and Bidding

Design drawings for fish passage modifications were completed by Reclamation's PN Region Design office. Construction funding for fish passage modifications was provided by BPA.

Agency coordination and assistance with environmental compliance/permit application for fish passage modifications was provided to BPA by Reclamation staff in the Salmon Field Office. Reclamation also contracted locally for the completion of an amendment to the original project BA for BPA's use in Section 7 ESA consultation with USFWS and NMFS.

Project coordination, bid solicitation, boulder and material acquisition, contract administration, and construction oversight was completed by Reclamation staff from the Salmon Field Office and the PN Region Design and Contracting Offices. Funding

for construction labor and materials was provided per the terms of a reimbursable contract between Reclamation and BPA.

3.3 Fish Passage Modificiation

Fish passage modifications were implemented on August 13, 2007. Boulders were pre-selected by Reclamation personnel and transported to the site by the contractor prior to the day of placement. Prior to construction, an erosion control plan was prepared by the contractor and approved by BPA as required by NMFS. Measures were taken by the contractor to protect the streambank from damage caused by the excavators entry into the stream channel. Prior to beginning work in the stream, sediment absorption mats were anchored to the streambed downstream of the construction area. As required by NMFS, the IDFG conducted electrofishing and erected a block net to remove fish from the construction area. During the course of conducting fish removal, several adult rainbow trout were observed but no fish were captured or mortalities observed. Also in accordance with NMFS BiOp requirements, water quality samples were collected and sediment monitored during construction. The excavator was cleaned prior to use and a spill containment kit was onsite.

Fish passage modifications were completed in the live stream channel utilizing a four-step adaptive approach. Each step was implemented and necessary adjustments were made until satisfactory results were obtained. Work began with removal of header and footer ecology blocks from the lower weir drop and was followed by placement of boulder clusters and a row of boulders across the stream channel to create a third weir pool. Additional boulders were placed in the pool until velocity was satisfactorily reduced. Excavation for the purpose of creating a plunge pool was unnecessary. Biological and engineering personnel from Reclamation and IDFG were onsite to direct work and monitor results. Velocity measurements were taken after each step to monitor results. Total time working in-stream with an excavator was about two hours.

4. Summary

Upon completion of fish passage modification, both the owner and agency personnel present expressed satisfaction with the results. As expected, ecology block removal and boulder placement resulted in improved equalization of water surface elevations between weir drops, reduction of velocities, and increased pool depth. Boulder clusters also provided localized areas of calm water for juvenile fish to stage in prior to swimming over the lower drop structure.

Due to preplanning and care taken by the contractor, no damage was done to streambanks or riparian vegetation. Therefore, no seeding or site rehabilitation was necessary.

As required by NMFS, efforts to remove fish from the site were made by IDFG biologists. Electrofishing was conducted to herd fish from the area and a block net was erected to prevent fish re-entry. Biologists present onsite agreed that commotion associated with work taking place in the stream was sufficient to have caused fish to temporarily vacate the area and that fish salvage was not necessary.

As expected, temporary pulses of sediment were released into the water column while work was occurring. However, the amount of sediment released into the water column was minimal and of short duration. Sediment absorption mats placed downstream of the work area were only marginally beneficial in capturing suspended sediment. The relatively small amount of sediment that was collected by mats washed out upon their removal from the stream. Sediment mats may prove more beneficial if used in sites where stream velocities are very low.

Reclamation is grateful to BPA for providing the funding necessary for the construction of the L-44 diversion project and subsequent fish passage modifications.

Reclamation wishes to thank the LSWCD and USBWP for the assistance provided in completion of the HIP BiOp requirements and administration of funding for construction of the L-44 diversion. Thanks go to employees of the NMFS and USFWS for providing assistance with development of fish passage modifications and timely review of preliminary design and completion of consultation. The monitoring and fish removal assistance provided by IDFG is greatly appreciated. Special thanks go to the landowners for their willingness to allow Reclamation to develop this project and their patience and participation throughout the process of planning and implementation.

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Lemhi River Subbasin
Salmon, Idaho

Attachment A

Construction Photographs and Design Drawings of L-44 Irrigation Diversion

Photographs by the Bureau of Reclamation
Pacific Northwest Region Design Group
Boise, Idaho
and
Salmon Field Office
Salmon, Idaho

Photograph 1. L-44 diversion before replacement

Photograph 2. L-44 diversion before replacement

Photograph 3. L-44 diversion after replacement

Photograph 4. L-44 diversion after replacement

Photograph 5. L-44 headgate before replacement

Photograph 6. Cofferdam and irrigation bypass utilized during construction

Photograph 7. Cofferdam and river bypass

Photograph 8. Early stage of weir construction

Photograph 9. Placement of header block

Photograph 10. Header and footer blocks and wasteway guide plate in place

Photograph 11. Filling voids between blocks with gravel

Photograph 12. Installation of geomembrane liner on upstream face of weir

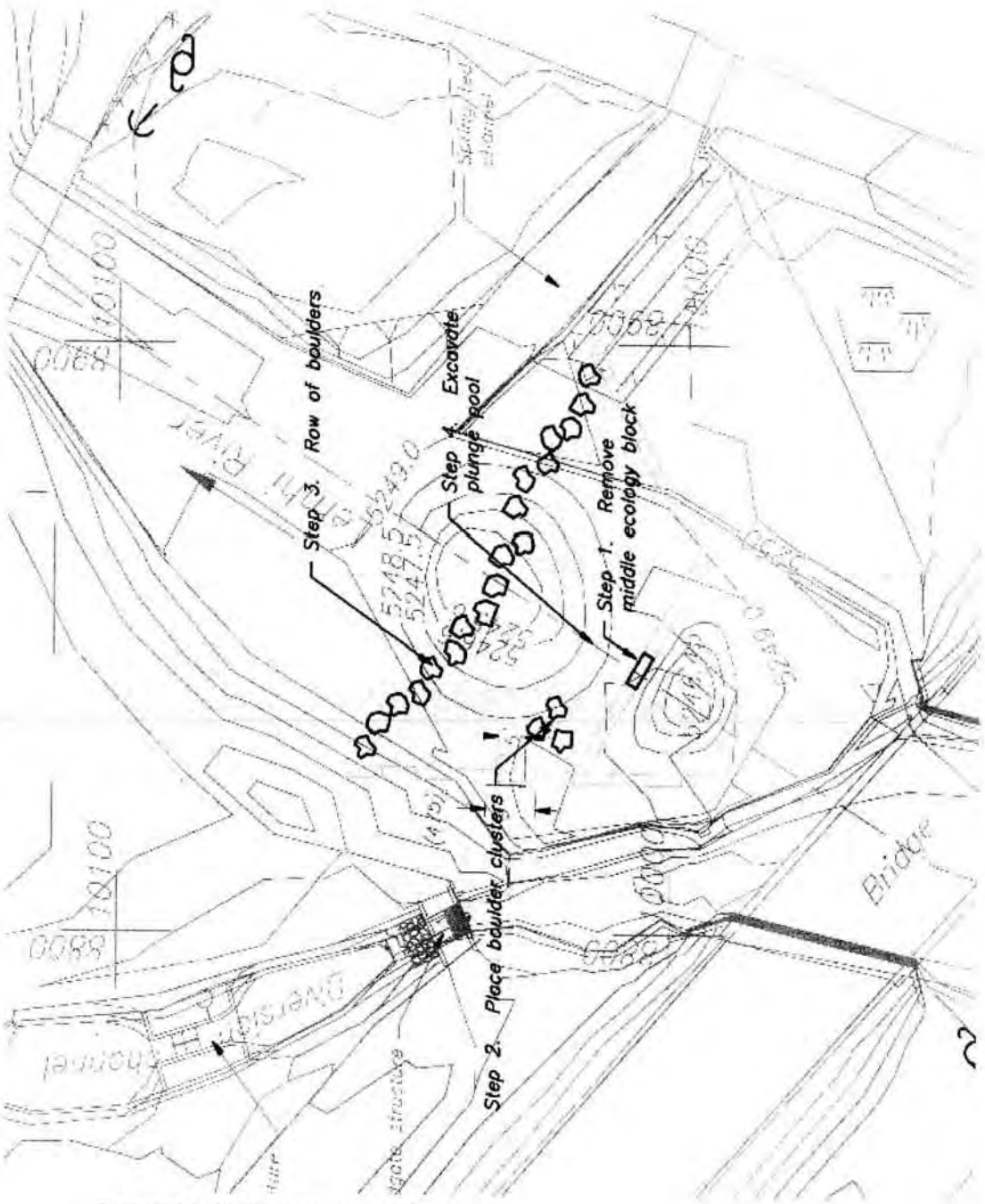
Photograph 13. Completed diversion under high flow

Photograph 14. Completed headgate and ramp flume

Attachment B

Figure and Construction Photographs of L-44 Fish Passage Modifications

Photographs by the Bureau of Reclamation
Pacific Northwest Region Design Group
Boise, Idaho
and
Salmon Field Office
Salmon, Idaho



Proposed L-44 fish passage modifications.

Photograph 1. Fish removal from construction area

Photograph 2. Sediment mats anchored to the streambed

Photograph 3. Velocity being measured

Photograph 4. Removal of ecology block

Photograph 5. Result of ecology block removal

Photograph 6. Boulder placement

Photograph 7. Engineer and biologist directing placement of boulders

Photograph 8. Complete fish passage modification looking upstream

Photograph 9. Completed fish passage modification looking downstream