1987 ANNUAL REPORT

CLACKAMAS/HOOD RIVER HABITAT ENHANCEMENT PROGRAM

Mt. Hood National Forest
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PROGRAM OVERVIEW

Fisheries habitat improvement work is being done on priority drainages in the Clackamas and Rood River sub-basins under program measure 704(c), Action Item 4.2 of the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program. This report describes the work completed in 1987 for Bonneville Power Administration (BPA) project number 84-11, the Clackamas/Hood River Habitat Enhancement Program. The program is composed of six projects: Collawash River Habitat Improvement Project; Collawash River Falls Passage Improvement Project, Oak Grove Fork Habitat Improvement Project; Lake Branch/West Fork Hood River Habitat Improvement Project; Fifteenmile Creek Habitat Improvement Project; and Abundance, Behavior, and Habitat Utilization by Coho Salmon and Steelhead Trout in Fish Creek, Oregon, As Influenced by Habitat Enhancement. This ongoing program was initiated in 1984, although some of the projects were begun with BPA funding support as early as 1983. The projects are complemented by a variety of habitat improvement and management activities funded from a variety of Forest Service sources.

This report describes the activities implemented for five of the six projects. A separate annual report on the 1987 habitat improvement and monitoring/ evaluation efforts in the Fish Creek drainage has been prepared.

Species for management emphasis include spring chinook and coho salmon, and summer and winter steelhead trout. Project work in 1987 primarily focused on increasing the quantity and quality of available rearing habitat, and improving access at passage barriers. The underlying theme of the improvement work has been to increase habitat diversity through the introduction of “structure”.

Structure provided by logs and boulders serves to deflect, pond, or otherwise disrupt flow patterns within a stream channel. This alteration of flow patterns results in formation of an increased number of habitat niches (i.e. pools, glides, alcoves, etc.) in which a variety of species and age group: of salmon and trout can rear. It also results in the sorting of gravel, rubble, and boulders being transported downstream, creating high quality spawning and rearing habitats, and food producing areas.

In 1987, a total of 11.0 miles of stream were treated; 334 log structures (Including: “deflector”, “digger”, "sill", and “cover” logs) and 141 boulder structures (including: single boulder placement, “berms”, “alcoves”, and “clusters”) were completed to meet habitat improvement objectives.

In addition to these direct habitat improvement activities, BPA and the Forest Service financed a number of project and program assessment activities that have improved the efficiency and effectiveness of the Forest's fisheries management program. Notable findings relate to the durability of habitat improvement structures, the associated changes in physical habitat, and biological response to the improvement activities.

A discussion of the 1987 habitat monitoring and evaluation program results can be found in the supplemental document, Appendix: Monitoring and Evaluation of Mt. Hood National Forest Stream Habitat Improvement and Rehabilitation Projects: 1987 Annual Report (Forsgren, Heller, and Ober, 1988).

REPORT CONTENTS

Annual Reports for the individual projects of the Clackamas/Hood River Habitat Enhancement Program were prepared by the biologists implementing the projects. The reports are presented in the following order:

1. Collawash River Habitat Improvement Project, Hot Springs Fork; Tom Cain and Dave Rohler

2. Collawash River Falls Passage Improvement Project; Ron Medel

3. Oak Grove Fork Clackamas River Rabitat Improvement Project; Ron Medel

4. Lake Branch/West Fork Hood River Habitat Improvement Project; Ken MacDonald and Corey Sue Hutchinson

5. Fifteenmile Basin Habitat Improvement Project; Corey Sue Hutchinson and Ken MacDonald

Collawash River Habitat Improvement Project

Annual Report FY 1987

by

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and
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Mt. Hood National Forest
Estacada Ranger District
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Prepared for

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U.S. Department of Energy
Bonneville Power Administration
Division of Fish and Wildlife

Project No. 84-11

March 1988

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ACKNOWLEDGEMENTS

We would like to thank the following people who provided valuable input and manpower during the course of the project:

Harvey Forsgren	Fishery Biologist Mt. Hood National Forest Supervisor's Office
Dave Heller	Fishery Biologist Mt. Hood National Forest Supervisor's Office

Abstract

The Hot Springs Fork of the Collawash River is a major sub-drainage in the Clackamas River drainage. Emphasis species for natural production are spring chinook, coho salmon, and winter steelhead. Increased natural production appears limited by a lack of quality rearing habitat. Over the last 40 years, habitat complexity has been reduced in approximately 70% of the area accessible to anadromous fish. The reasons for this reduction are numerous and include both natural events and management related activities. Natural passage barriers limit anadromous fish access to over 7 miles of high quality habitat.

In 1987, the third year of a multi-year effort to improve fish habitat in the Hot Springs Fork drainage, efforts were centered on planning and preparing for out-year projects, post project monitoring and maintenance of structures built in 1986, and completion of a passage project begun in 1986. No new project:; were implemented in 1987.

Introduction

Fish habitat In the Hot Springs Fork drainage has been impacted by a variety of natural events and management activities which have resulted in a general lack of channel complexity and poor rearing habitat quality. In 1985, under the Northwest Power Planning Council, Fish and Wildlife Program (measure 703 (c), Action Item 4.21, the USDA Forest Service and Bonneville Power Administration (BPA) entered into a multi-year agreement to improve fish habitat in the Hot Springs Fork drainage. In the first year of the agreement, efforts focused on improving passage conditions in two tributaries, Pansy Creek and Nohorn Creek, and channel rehabilitation in a 0.3 mile reach of Pansy Creek (Cain, 1985). Rehabilitation of the mainstem habitat began in the second year with the construction of approximately 135 structures to increase channel complexity and rearing habitat (Cain and Hohler, 1986). Selection of the project areas in the first two years was based on opportunities Identified in stream surveys conducted in 1981 and a winter/spring survey of the Hot Springs Fork in 1985.

Before the program continued and additional work was implemented, two needs were identified. First, a drainage enhancement plan was needed which would guide future enhancement efforts. Second, more specific baseline data was needed to further describe existing habitat conditions in the basin to aid in determining project effectiveness.

In 1987 the enhancement plan was completed in cooperation with the Oregon Department of Fish and Wildlife (ODFW) [1988/1991 Implementation Plan and Work Statement, Hot Springs Fork, Collawash River Habitat Improvement]. The baisn Inventory will be completed early in the 1988 field season using techniques developed by the Pacific Northwest Forest and Range Experiment Station (PNW) [Hankin and Reeves, In Publication].

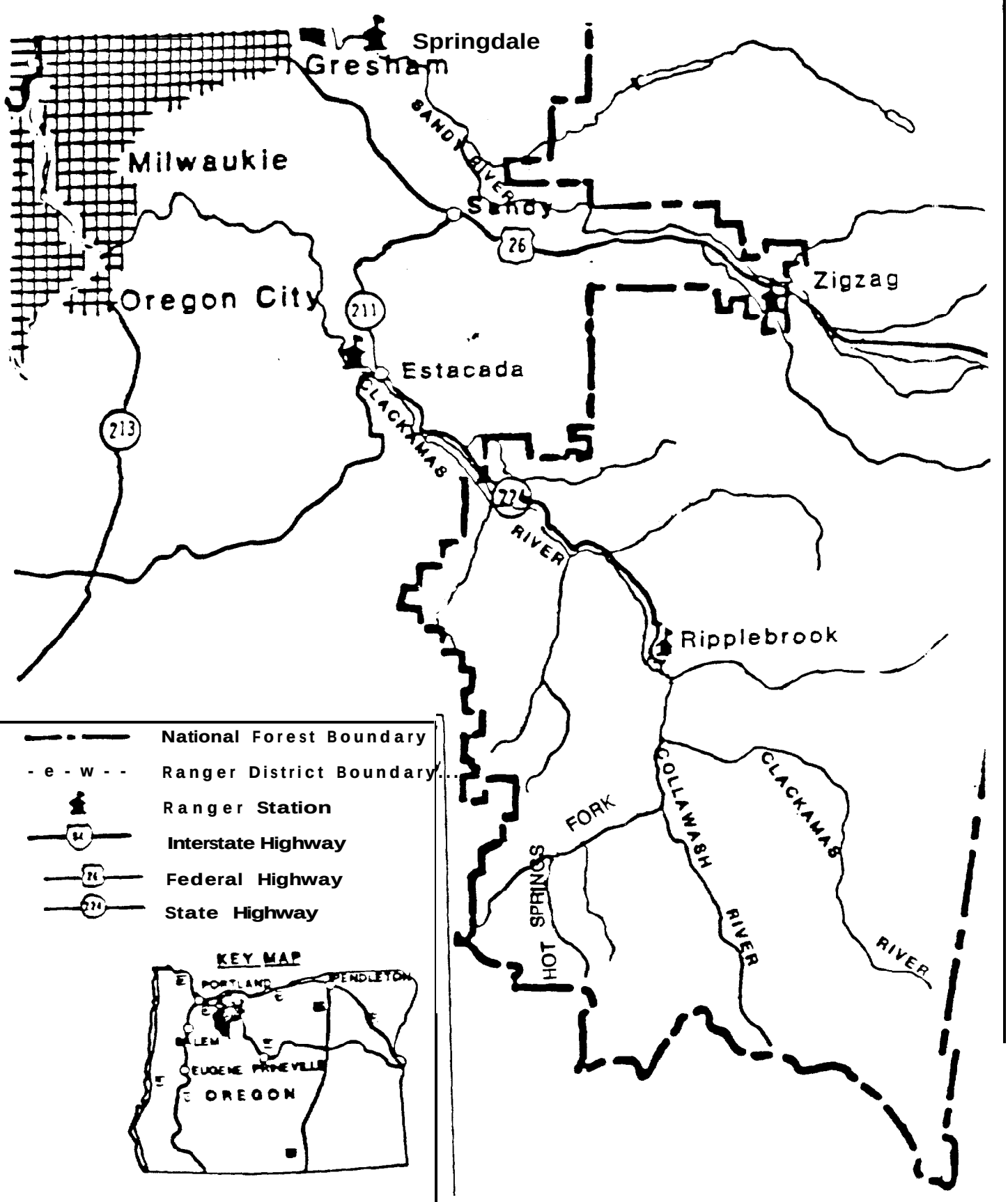
In addition to the implementation plan and inventory, maintenance was completed on the structures built in 1986, and a passage project begun in 1986 was completed. Post project monitoring of the 1986 project area was initiated.

Description of Study Area

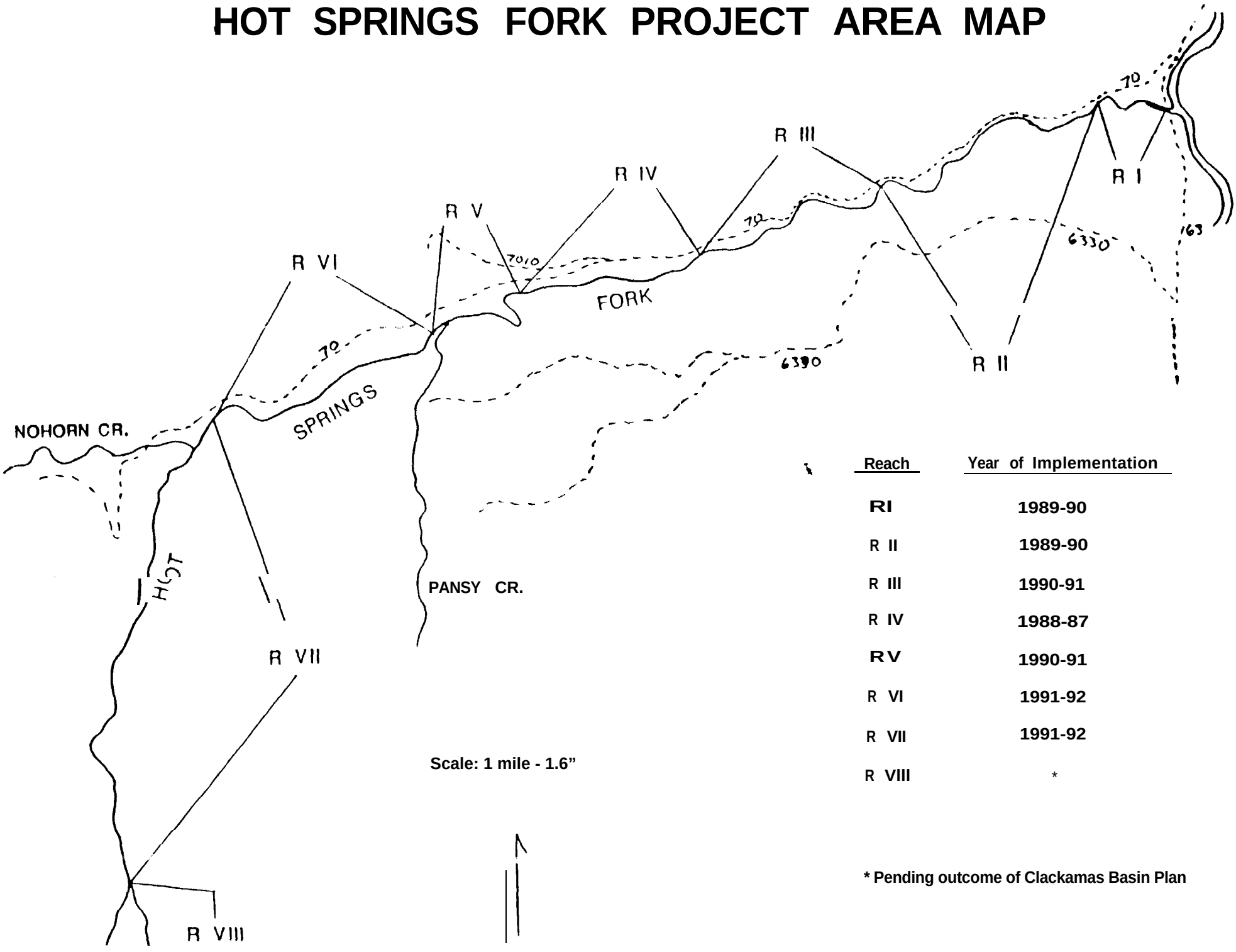
The Hot Springs Fork is a fourth order tributary to the Collawash River, entering the mainstem at RM 4.0. Mainstem length is 14.6 miles, with 10.1 miles accessible to anadromous fish. The basin area is 60 square miles and is entirely on public lands administered by the U.S. Forest Service. The Hot Springs Fork heads on Mother Lode Mountain (elevation 5,251') and flows north-northwest before it swings and flows northeast approximately six miles to its mouth (elevation 1,624'). The topography is steep, forested sideslopes dissected by numerous first and second order streams. The drainage is in the rain-on-snow zone and precipitation largely occurs as snow in the headwaters and as rain in the lower drainage. Timber harvest and associated road building

VICINITY MAP.

HOT SPRINGS FORK DRAINAGE



HOT SPRINGS FORK PROJECT AREA MAP



Reach	Year of Implementation
RI	1989-90
R II	1989-90
R III	1990-91
R IV	1988-87
RV	1990-91
R VI	1991-92
R VII	1991-92
R VIII	*

Scale: 1 mile - 1.6”

* Pending outcome of Clackamas Basin Plan

has occurred in much of the watershed with the exception of the headwaters which are within the Bull of the Woods Wilderness.

The Hot Springs Fork supports natural production of spring chinook, coho salmon, and winter steelhead. In addition, ODFW annually outplants summer steelhead to provide a summer sport fishery. Major tributaries to the Hot Springs Fork include Pansy, Nohorn, Alice, and Whetstone Creeks. Migration barriers on the mainstem and tributaries and reductions in rearing habitat complexity limit anadromous fish production In the drainage. Reductions in habitat complexity, primarily through the loss of instream wood from natural and management related activities, has effected approximately 70% of the area accessible to anadromous fish. The loss of channel structure has resulted in a broad, shallow channel during low flows with limited hiding cover in pools and riffles. Some reaches of the Hot Springs Fork are deeply incised and scoured to bedrock. Spawning habitat is patchy in distribution, although there are about 2,400 square meters of gravel, much of it is located in the lower 2.5 miles The reach between RM 2.5 and 5.0 has virtually no spawning habitat and very little hiding cover. Passage is obstructed by a nine foot falls at RM 7.1.

Fish habitat improvement work on the Hot Springs Fork prior to 1985 concentrated on passage improvement. Pegleg Falls was bypassed by the completion of a fish ladder in 1966. Access to Pansy and Nohorn Creeks, major tributaries to the Hot Springs Fork, was improved in 1985 in a cooperative effort between BPA and the Forest. In 1986 the waterfall at RM 7.1 of the Hot Springs Fork was worked on to improve passage conditions. Channel rehabilitation effort3 to improve spawning and rearing conditions have been conducted in the lower reach of Pansy Creek (1985) and on the mainstem Hot Springs Fork from RM 2.9 to 3.8 (1986).

Methods and Materials

IMPLEMENTATION PLAN: Data collection for the implementation plan involved a two person crew walking the stream course, evaluating potential project areas in the lower 7 miles of the Hot Springs Fork. The primary objective was to identify project areas, map them, and prioritize them according to need for rehabilitation. Additional information was collected regarding access for heavy equipment Including, track-mounted backhoes and loaders, rubber tired backhoes with articulated “legs”, and truck access to deliver boulders to the project sites. The information gathered was used to refine project work by reach, based on the need for treatment, the treatment techniques to be used, heavy equipment needed, and access. Project reaches requiring similar treatment and equipment needs were then grouped and an implementation schedule was developed to present a logical approach to rehabilitating the Hot Springs Fork drainage. This information was also utilized in the development of the Statement of Work (SOW) and Implementation Plan for out-year projects to be funded under the agreement with BPA.

BASIN INVENTORY: The basin inventory is similar to the inventory developed and used by PNW. A description of the methodology can be found in the Fish Creek 1986 annual report published by BPA (Everest, et al., 1986).

PASSAGE PROJECT: Minor modifications of a waterfall at RM 7.1 were planned in 1986 to improve upstream passage for anadromous fish. The waterfall is a partial passage barrier which limits anadromous fish access to three miles of habitat. The waterfall is located adjacent to the Bagby Hot Springs Trail. A foot bridge for the trail passes immediately over the waterfall. The plan to improve passage involved removal of a piece of bedrock, approximately one cubic yard, that deflected attraction flows for the second jump in the waterfall. In order to lessen the risk of damaging the bridge and to try a new technique, a portable rock drill and a non,-explosive expansion agent were used to modify the falls. Due to the poor quality of the rock, the rock fractured but did not break away as planned. Using the four holes that were originally drilled and taking advantage of the fracturing that was started, it was felt the rock could be broken away with a small charge of explosives with little risk to the bridge, The rock was blasted using 60% gel dynamite loaded with one stick each in two holes and one-half stick in the remaining two holes. A piece of fly rock did hit the bridge and crack a portion of 2"x4" railing, which was replaced .

MAINTENANCE : Maintenance in the 1986 project area consisted of additional anchoring of structures. One-half inch diameter cable and cable clamps were used to secure the structures to standing timber. The structures that received additional cabling were not originally cabled to standing timber during the implementation of the project due to high flows restricting the cabling crews access to those areas. Floatable pieces of wood which were entrapped by structures during high flows in the winter of 1986-87 were also secured by cables to the structures. Soils disturbed during implementation of the project were seeded with grass.

MONITORING: Post project monitoring of the 1986 project area consisted of a two person crew measuring and mapping habitat units in the project area. The methodology and results of the monitoring can be found in the supplemental document, Appendix A: Monitoring and Evaluation of Mt. Hood National Forest Habitat Improvement and Rehabilitation Projects: 1987 Annual Report (Forsgren, Heller, and Ober 1988).

Results and Discussion

Host of the major work items scheduled were completed within the time and budget estimates in the contract between the Forest and BPA. The basin inventory will be completed in 1988.

The inplementation plan was completed for the Hot Springs Fork Drainage, and was reviewed by the ODFW district biologist responsible for the Clackamas

River drainage. The plan identifies project opportunities in eight project reaches along the mainstem and provides a schedule for the planning, impletation, monitoring, and maintenance of the reaches. Project work will begin in the lower mainstem and proceed upstream. Treatment techniques and structure design will be driven by the limiting factors identified within the project reaches. The primary technique will be to add trees and boulders to the channel to increase the cover and complexity in the stream.

Minor maintenance was performed on the 1986 structures and the passage project was completed on the waterfall located at RM 7.1. The passage project appears successful following the removal of a bedrock knob that deflected the attraction flow. The removal of the knob, using dynamite, consolidated the attraction flow in a chute that forms the second jump in the waterfall. The flow through the chute now properly aligns fish for the jump and provides a solid column of water for fish to "drive" through.

Post project monitoring of the 1986 project area measured habitat changes in the project area and a control reach. Analysis of the collected data will help determine if the structures are performing as designed and if the project objectives are being met.

Summary of Expenditures

The Bonneville Power Administration funded the 1987 program as part of the Clackamas/Hood River Habitat Enhancement (Project 84-11) agreement. A total of $13,093 was budgeted for project planning, basin inventory, monitoring, and maintenance. Expenditures for completion of project planning, monitoring, and maintenance totalled about $8,600. Additional charges are anticipated pending the completion of the basin inventory in the 1988 field season. These charges are estimated to be $5,000.

Personnel	$5,694.82
Travel	9.52
Training	8.10
Expendable equipment	66.93
Sub-contracts	<2.00>
G&A Overhead (12%)	693.53
Total Cost	6,470.90

Cain, T. 1985. Collawash River habitat Improvement project. In, Natural Propogation and Habitat Enhancement Volume 1 - Oregon, Final and Annual Report 1985. Bonneville Power Administration, Division of Fish and Wildlife. pp 1-38.

Cain, T. and D. Hohler. 1986. Collawash River habitat Improvement project- Hot Springs Fork Collawash River. In, Natural Propogation and Habitat Improvement Volume 1 - Oregon, Final and Annual Report 1986. Bonneville Power Administration, Division of Fish and Wildlife. pp 1-19.

Forsgren, A., D. Heller, and N. Ober. Appendix A: Monitoring and evaluation of Mt. Hood National Forest Stream Habitat Improvement and Rehabilitation projects: 1987 Annual Report. In, Natural Propagation and Habitat Improvement Volume 1 - Oregon, Final and Annual Report 1987. Bonneville Power Administration, Division of Fish and Wildlife.

COLLAWASH RIVER FALLS FISH PASSAGE PROJECT

1987 ANNUAL REPORT

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Division of Fish and Wildlife
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Particular thanks are due to Greg Overturf and his assistant Kevin Reed, the project work supervisors. They are responsible for successfully completing this project phase in a timely, safe, and highly professional manner.

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INTRODUCTION

The Collawash Falls Fish Passage Project was initiated in August of 1987, and resulted in completion of Phase I of the construction of the fish passage facility. A core team of Forest Service personnel, led by fish passage specialists from R-10, Alaska, excavated a trench In the bedrock face of the falls that is approximately 95 feet long, 8 feet deep and 10 feet wide.

The project is being implemented by the Mt. Hood National Forest (N.F.) through funding by the Bonneville Power Administration (BPA) under the Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, Measure 703(c) Action Item 4.2, in consultation with the Oregon Department of Fish and Wildlife (ODF&W). Succesful modification of the Collawash Falls will allow anadromous fish full access to over 10 miles of acknowledged high quality spawning and rearing habitat located above the falls. The total anadromous fish production benefits gained from utilization of this habitat, assuming a 10 year project life with a 4% discount factor of 8.11, is $1,690,019.00.

In 1974, several partial barriers to anadromous fish in the form of small falls and cataracts, located immediately above the 1987 project site, were modified for full passage by blasting. The 1974 work was conducted by the Forest Service and was fully successful for all but the main barrier, Coliawash Falls.

Since 1974, Collawash River f'isheries projects include the 1984 construction of a fish liberation access site above the falls for the PGE/ODFW spring chinook trap and haul program. funding for the project came from revenues generated from an adjacent Forest Service timber sale. In summer of 1985, 30,000 spring chinook presmolts were stocked at this liberation site. In spring of 1987, 10,000 coho presmolts were stocked above the falls in the first of a three-year program to increase the runs of native winter run coho to the Collawash River system.

DESCRIPTION OF THE PROJECT AREA

The Collawash River is the largest tributary of the upper Clackamas River, with a mainstem length of 11.6 miles and a basin area of 150 square miles. The stream provides one third of the low flow volume of the Clackamas River. The entire Collowash River drainage is on National Forest System lands. About 35% of the watershed is in fully protected status as wilderness. Approximately 20% more is under protected riparian area status or is unsuitable for timber harvest. Overall fish habitat is rated good to excellent, with good holding and rearing habitat present throughout the system.

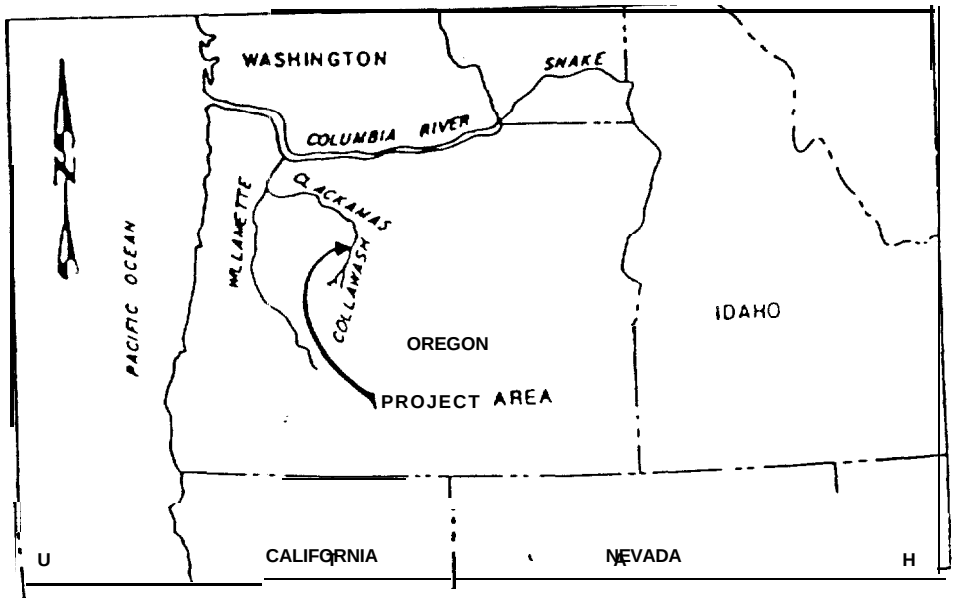
Depending on flows during migration, a 12-15 foot falls at RM 7.4 is a partial to complete barrier to spring chinook, coho salmon, and steelhead. The fal ls restrict access to approximately 10 miles of highly suitable upstream anadromous fish habitat, including an estimated 10,000-12,000 square yards of high quality spawning gravels. Native cutthroat and rainbow trout populations are present above the falls. Summer steelhead have been observed to pass the falls at an estimated 10-20% success rate.

The falls are located in a deeply incised gorge (FIGURE 1). Access and working conditi ons at the site are difficult, and earlier work (1974) on the falls was terminated due to safety concerns over stability and condition of the steep headwall adjacent to the project area. The project feasibility report of January 1986 by Ott Water Engineering identified four passage alternatives that could safely be implemented to meet the project objective of improving fish passage.

The Collawash Falls Project Environmental Assessment (EA) selecting the preferrad action alternative was developed by the Forest Service and formally signed in May of 1986. The selected alternative (No. II) was pool excavation. Other alternatives considered included placement of gabion weirs, placement of a vertical slotted fishway, and blasting of the falls. None offered the long term success probability of No. II except the fishway, which was estimated to cost three times as much as No. II.

In June of 1986, a Forest Service fisheries engineer and passage facility specialist , Dale Kanen, was detailed to the Mt Hood NF from the Chatam Area of the Tongass NF (Region 10) to produce preliminary jump pool designs and construction recommendations based on selected action alternative. Mr. Kanen developed designs for a passage structure facility to be placed in a trench blasted in bedrock at the falls, with a training wall and six concrete weirs and pools (FIGURE 2). By October 1986, Forest Service engineers on the Mt. Hood N.F. had completed intensive site surveys at the falls and produced topographic blue line project site plan maps for use in development of the final design and construction contract package (FIGURE 3).

FIGURE 1. Project location map for Collawash Falls passage improvement



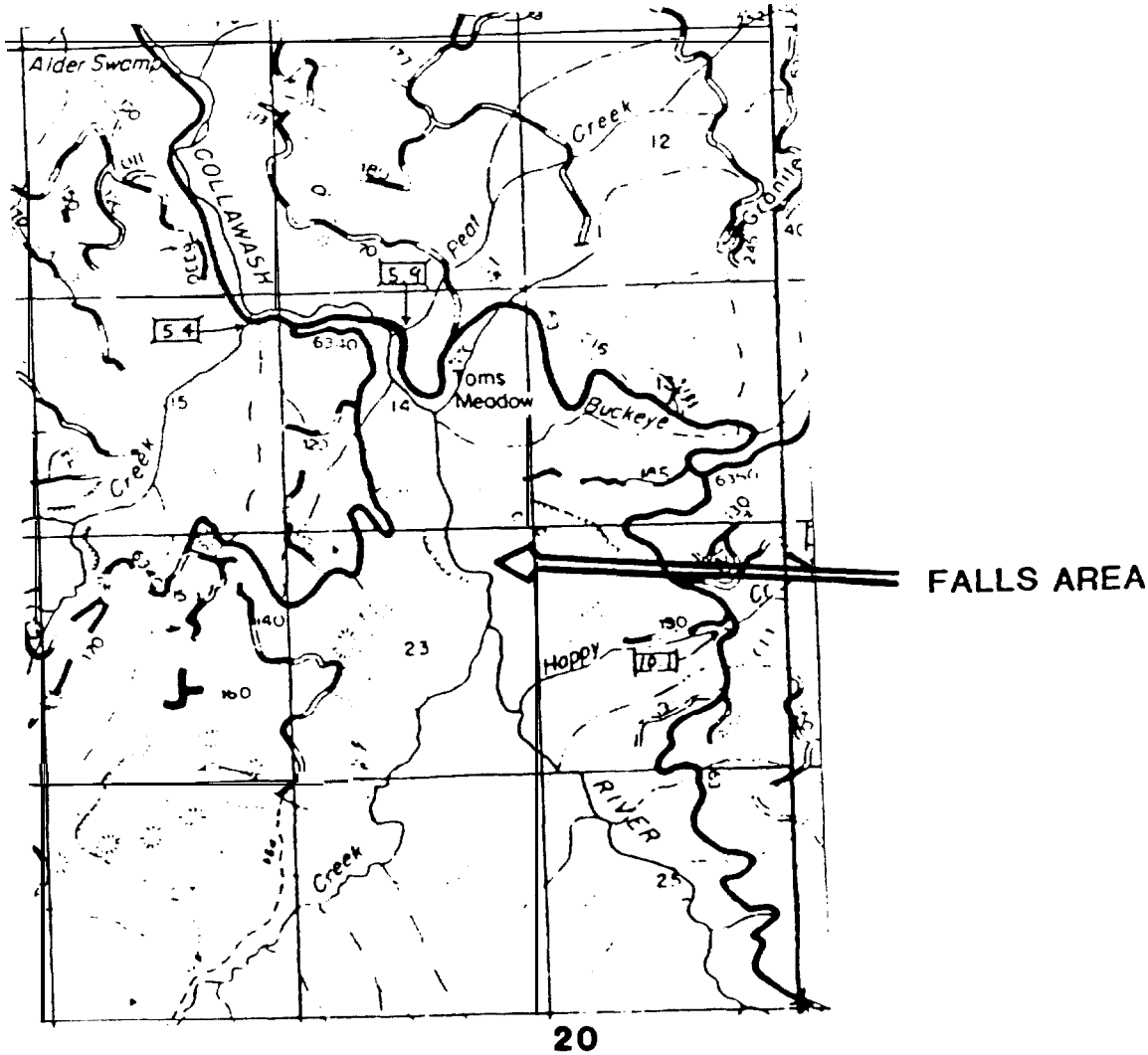
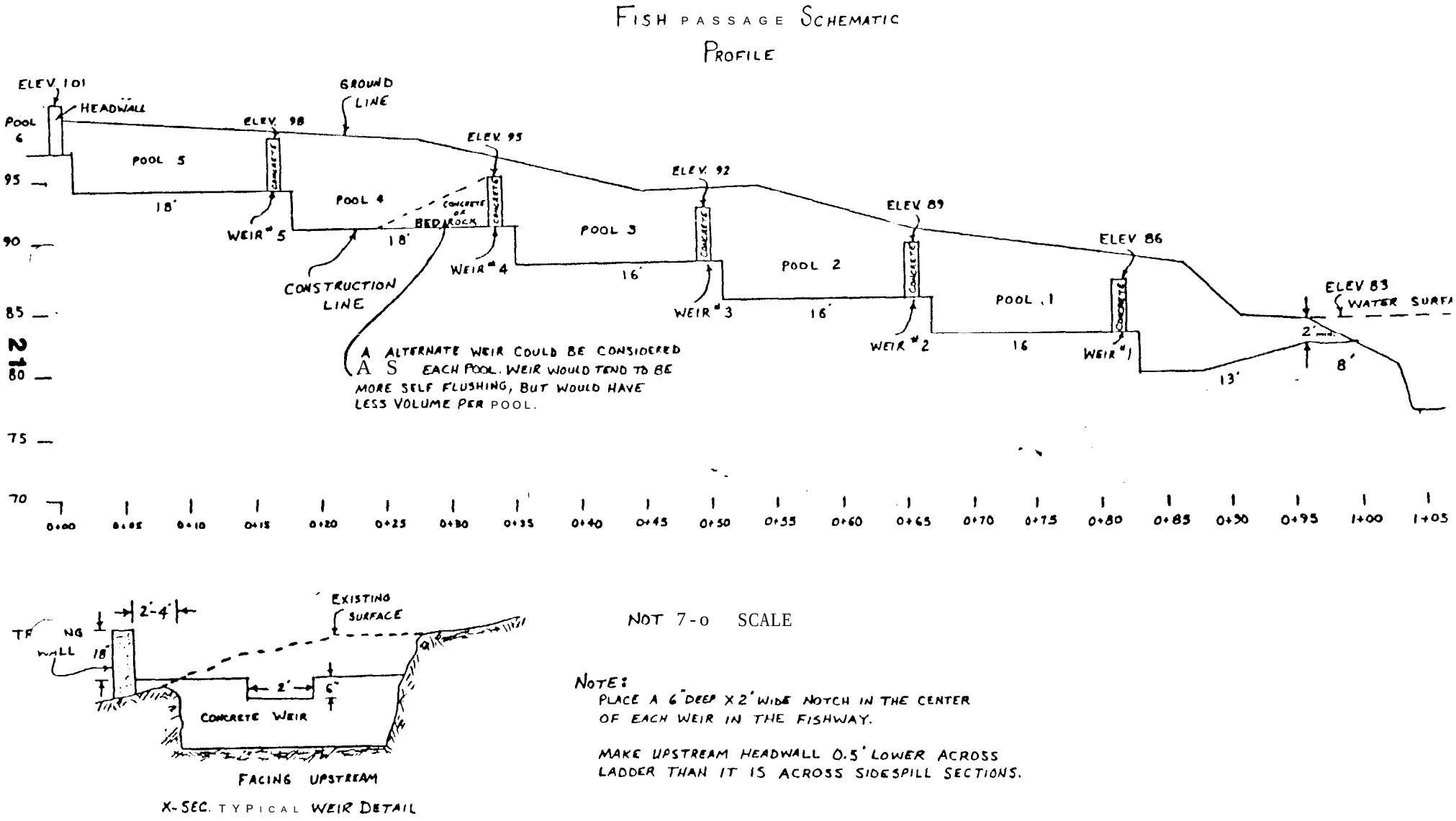


FIGURE 2. Collawash Falls fish passage facility schematic profile.



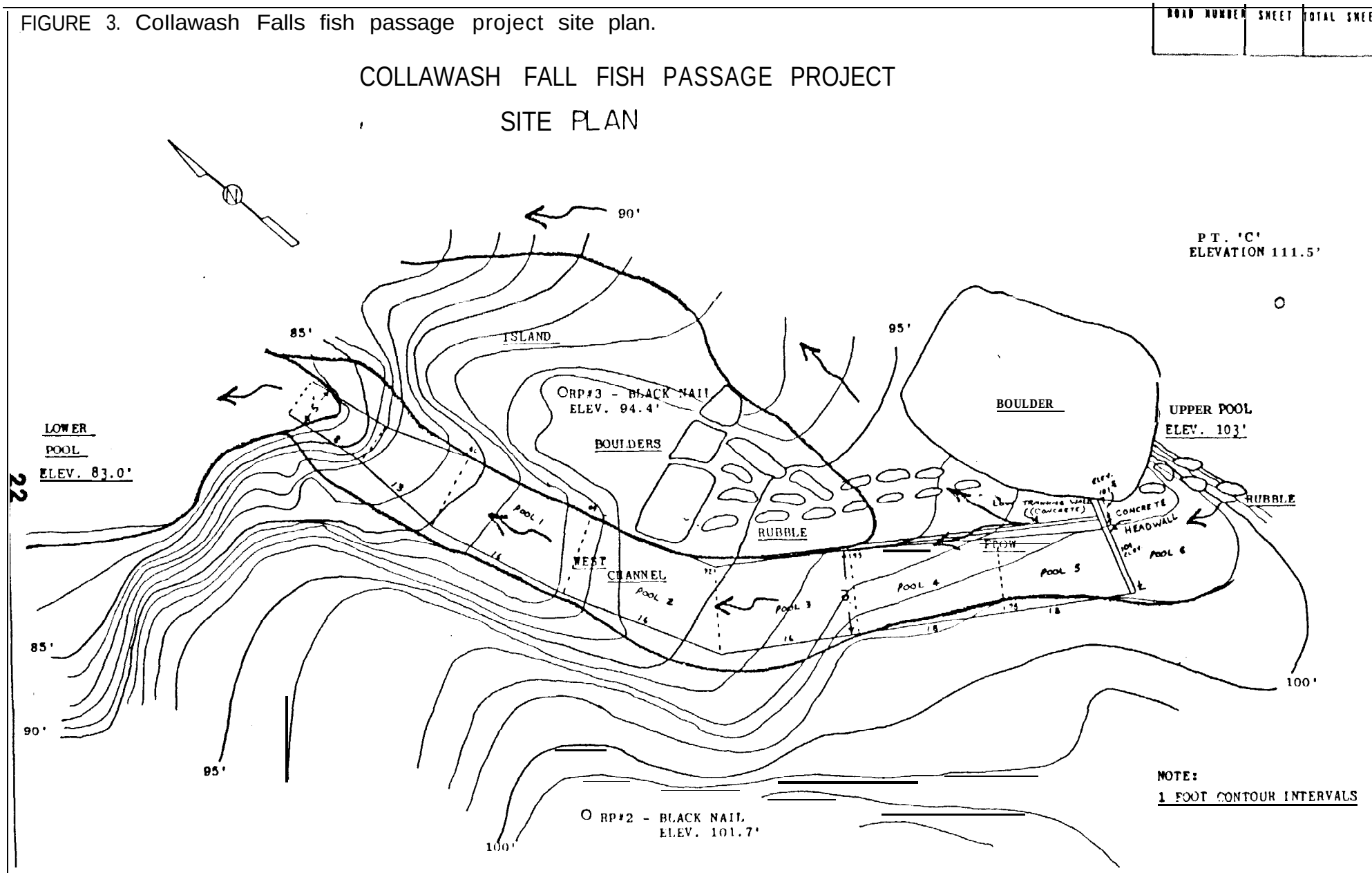
X-SEC. TYPICAL WEIR DETAIL

NOT 7-0 SCALE

NOTE:
PLACE A 6" DEEP X 2' WIDE NOTCH IN THE CENTER OF EACH WEIR IN THE FISHWAY.

MAKE UPSTREAM HEADWALL 0.5' LOWER ACROSS LADDER THAN IT IS ACROSS SIDESPILL SECTIONS.

FIGURE 3. Collawash Falls fish passage project site plan.



Management emphasis in the Collawash River drainage is to increase wild runs of anadromous fish. The current goal of anadromous fisheries management is to provide returning adult fish year-round access past the migration barrier to the extensive upstream spawning and rearing habitat. Native run winter steelhead, and coho and chinook salmon are the primary benefitting and target species.

METHODS AND MATERIALS

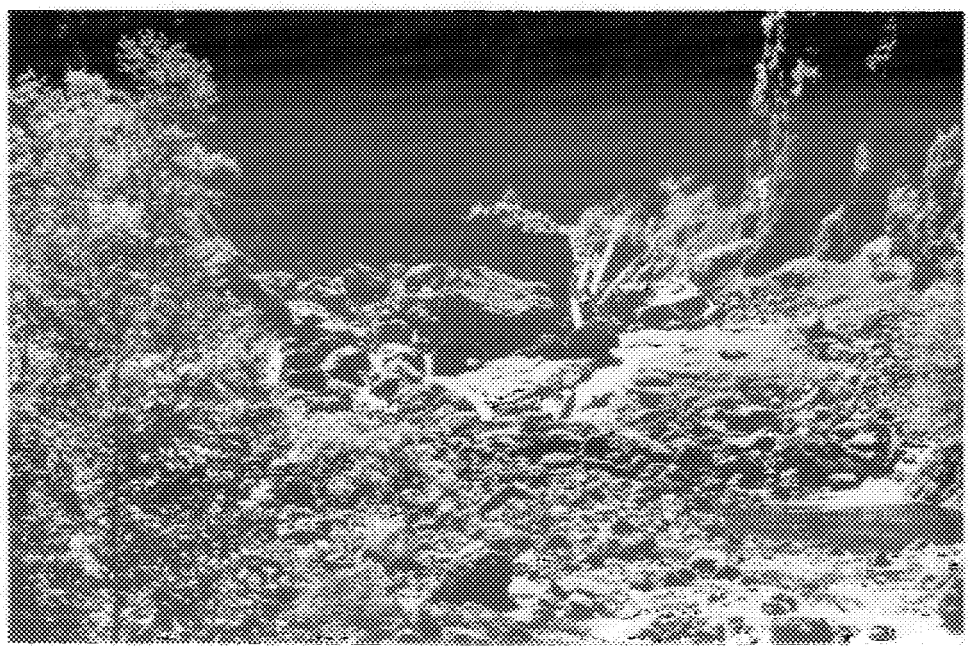
The Collawash Falls passage structure design and construction contact package was advertised in May of 1987, with a construction date of July 15 to August 30. The bid period was non-responsive, in that no bids were received on the advertised contract. A series of meetings discussing all possible options resulted in a decision to pursue implementation of the fish passage project with a core team of Forest Service fish passage specialists from Region-10 (Sitka), Alaska. Formal requests for their services were initiated through the Supervisor's Office of the Mt. Hood N.F. and, following approval, an implementation date of August 11 was scheduled.

Based on Dale Kanen's familiarity with the project, project site, and project needs, the necessary drilling and blasting equipment was shipped from Sitka and Ketchikan, Alaska. An extensive list of additional necessary materials and equipment, was developed and assembled on the Clackamas Ranger District. District personnel (two seasonal technicians) and a YCC crew constructed an 1.5 mile access trail to the falls. Additional district personnel were called to construct stream crossings and a three-tiered, hand-railed stairwell with platforms to access the site from the adjacent bluff. Scaffolding was placed over the flowing portions of the river to facilitate equipment and materials transfer. A helicopter sling load site was cleared on the bluff for fuel and explosives storage. Al! other materials and equipment would be placed on the bedrock shelf adjacent to the falls at the project site (see photos). Mobilization of project equipment and materials to the project site was accomplished using a Bell 500 helicopter.

A pre-implementation meeting was held on August 10. All accomplishments and preparations were reviewed and final project responsibilities were assigned for al 1 involved personnel. Safety measures to be applied during construction were reviewed and approved and included: safety fencing, posted watchmen, and reduced blasting loads to minimize vibration impact to the gorge sidewalls.

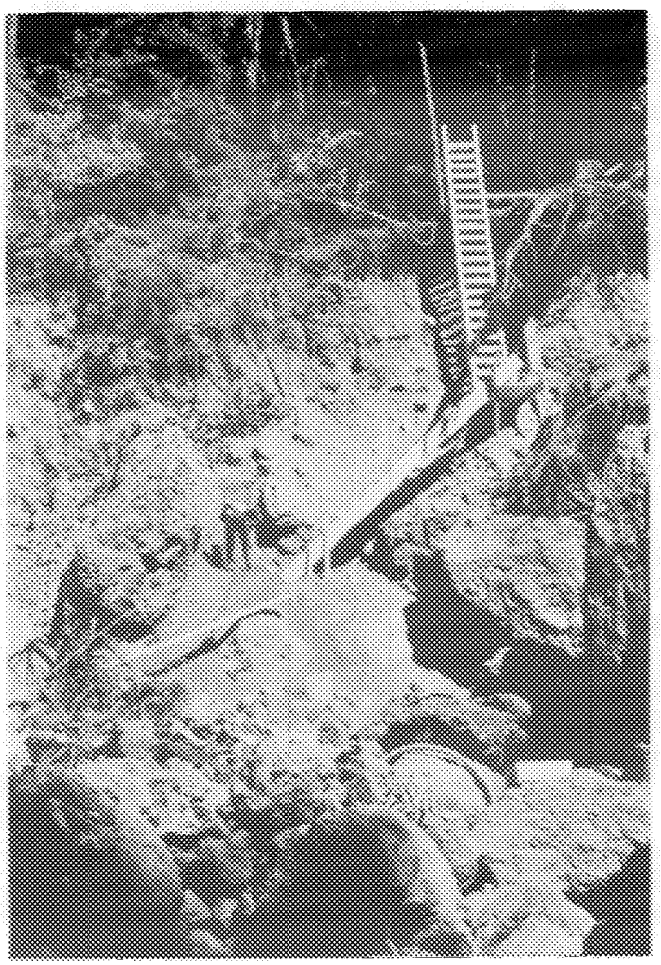
Given the time constraints and revised scheduling for construction with a Forest Service force account core crew, the project was partitioned into two phases Phase I would result in a bedrock trench completed to design specs for Phase II, the setting of the concrete weirs and headwall/training wall to complete the passage facility structure. Phase I would be completed as a minimum in 1987.

Three personal services contracts were advertised. Two were awarded and the third was non-responsive based on job specific qualifications. Noting the need for manpower, especially given the volume of shot rock to be moved, the services of the Job Corpsmen from the nearby Timber Lake Job Corps Center were promptly requested and obtained.

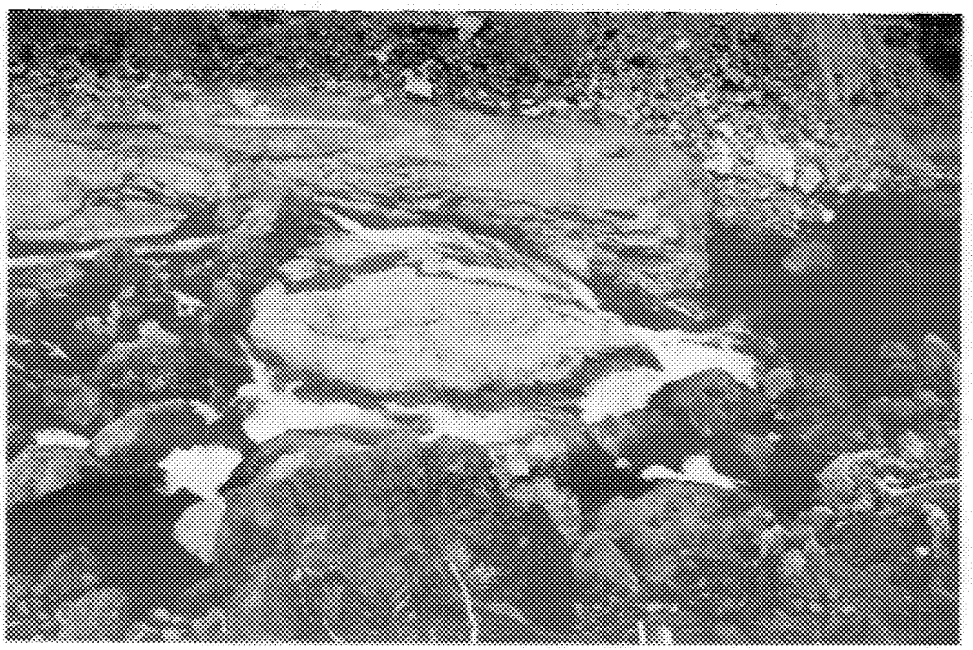


COLLAWASH RIVER FALLS, FROM APPROXIMATELY 200 YARDS DOWNSTREAM.

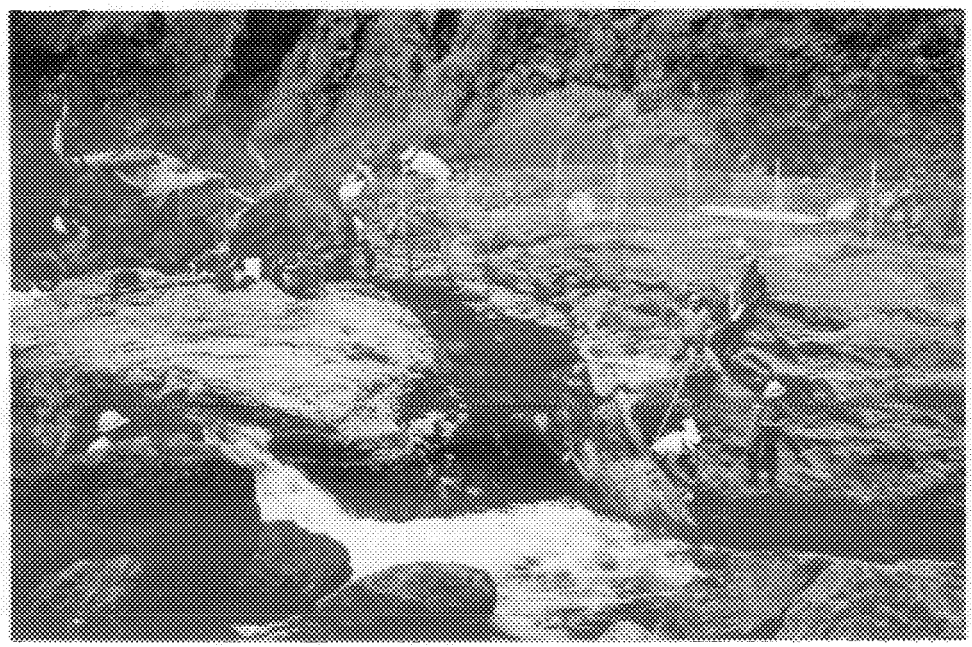
COLLAWASH FALLS PROJECT SITE, FROM THE NORTH BANK. NOTE BLUFF OVER-LOOKING SITE ON THE SOUTH BANK.



CONSTRUCTION OF THE PROJECT SITE ACCESS STAIRWELL.

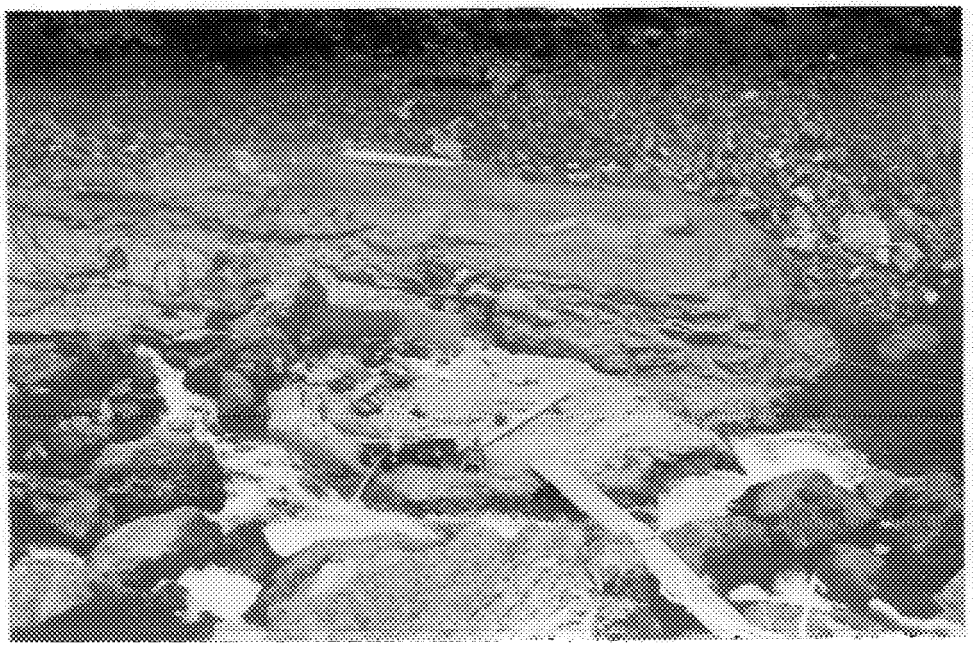


COLLAWASH FALLS, VIEW FROM THE SOUTH BLUFF. NOTE MARKING AND FLOWING WATER ALONG THE PROPOSED PASSAGE FACITLITY (TRENCH) SITE.

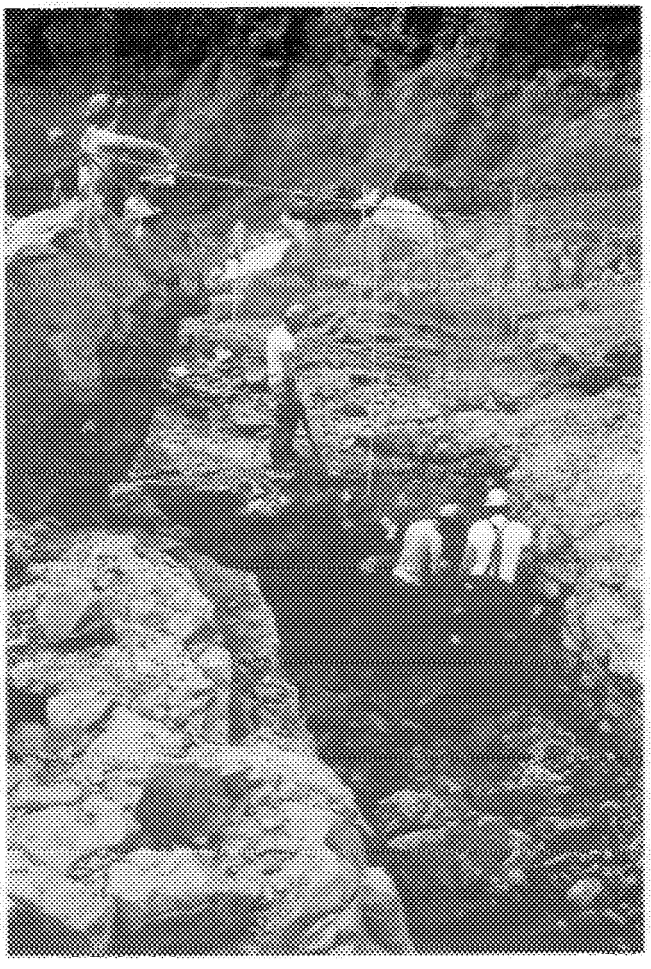


PRE-DRILLING PREPARATIONS INCLUDED REMOVAL OF A PORTION OF A LOG AT THE BASE OF THE PASSAGE FACILITY (FISHWAY). NOTE SAFETY FENCING IN BACKGROUND.

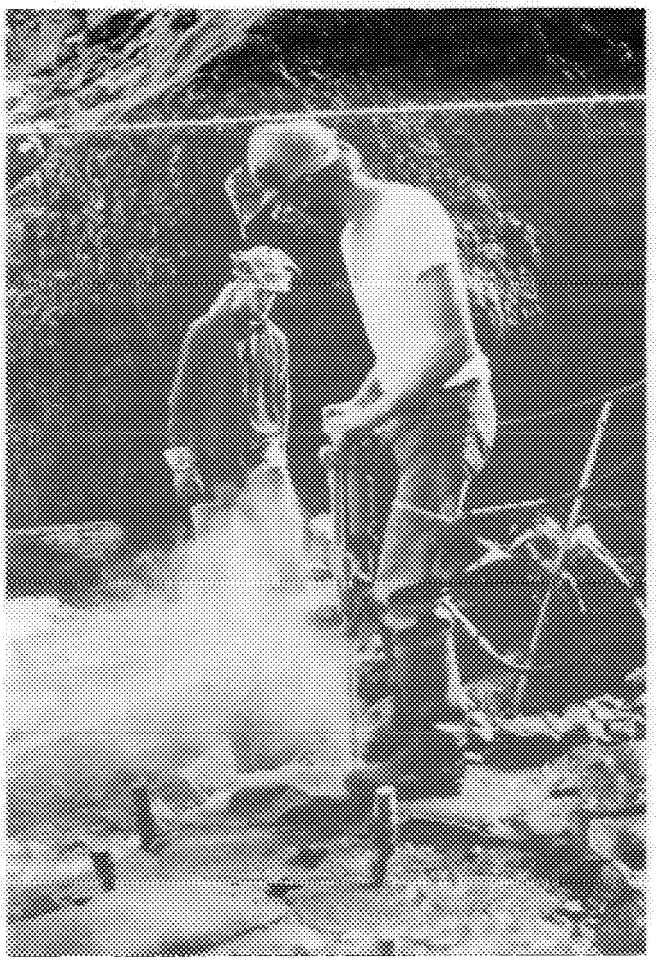
EXCAVATION OF THE FIRST OF THE SIX FISHWAY POOLS.



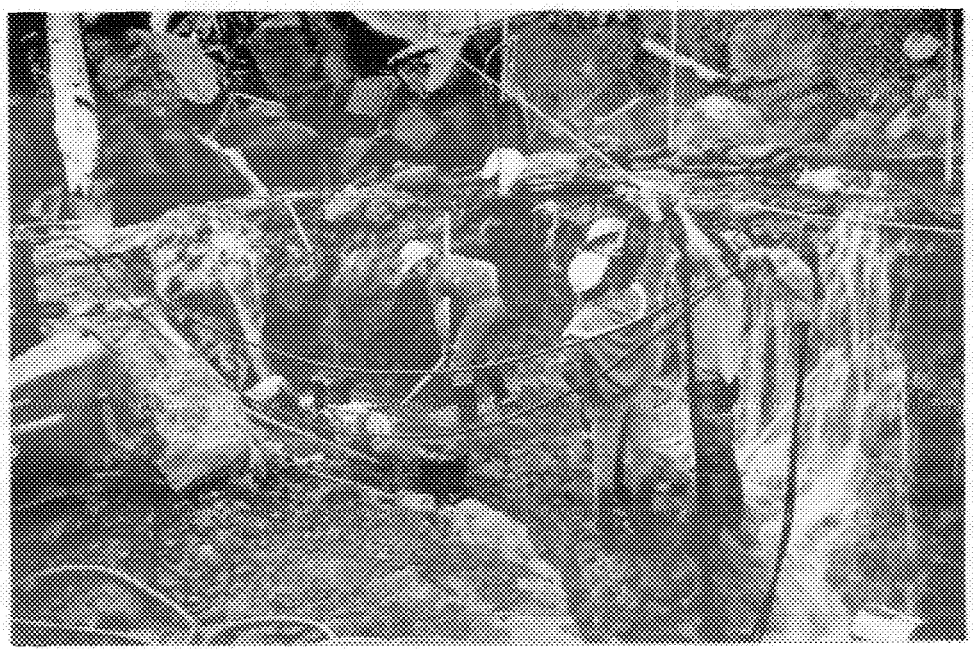
OVERVIEW OF THE DEVELOPING FISHWAY TRENCH DURING PRE-SPLIT BLAST HOLE PACKING FOR POOL 2.



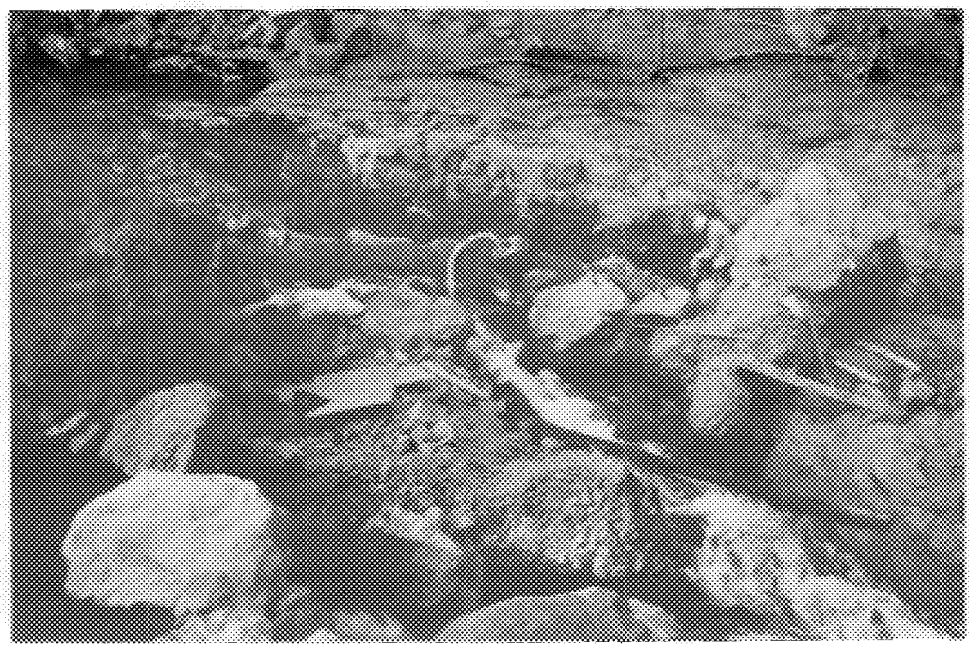
TRENCH AT THE HALFWAY POINT. NOTE WATCHMAN ON LARGE BOULDER.



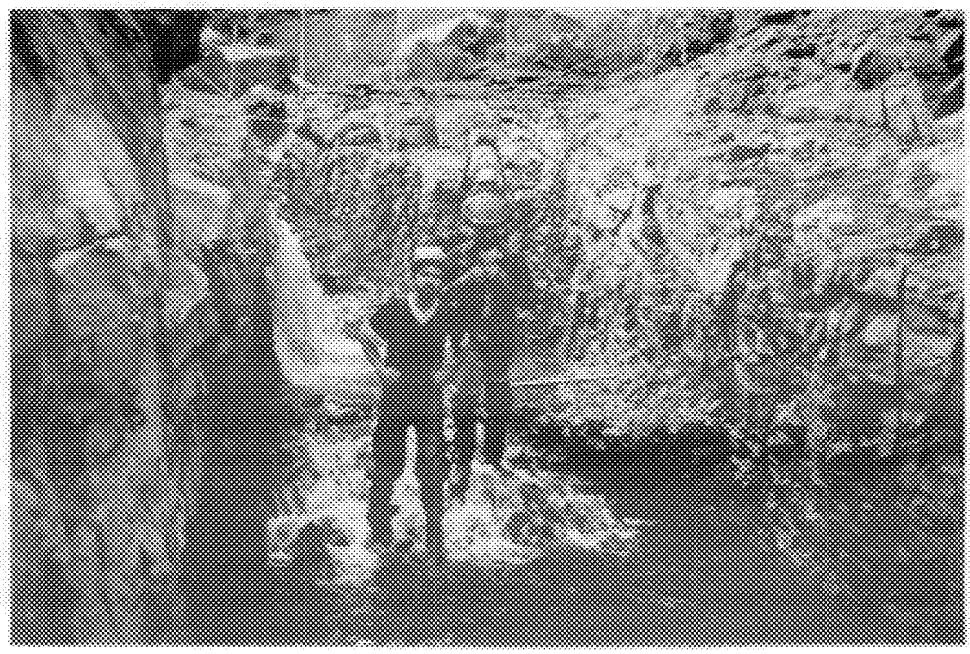
PRODUCTION BLAST HOLE DRILLING, CREW MEMBER IN BACKGROUND IS WATCHING FOR STRAIGHTNESS OF DRILL HOLE.



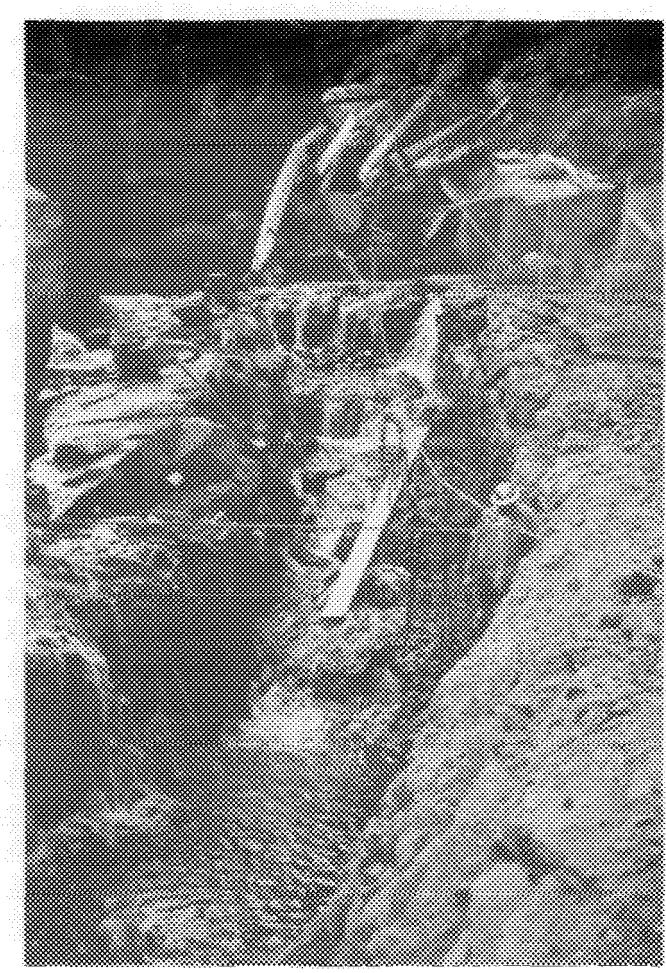
COMPRESSOR AND HYDRAULIC LINE ADJUSTMENT AT HEAD OF THE FISHWAY TRENCH.



GREG OVERTURF, PROJECT WORK SUPERVISOR, MAKES NOTES FOR PHASE II INPUT. NOTE DRILL PLUGS IN BLAST HOLES OF BOULDER TO BE SHOT FOLLOWING EQUIPMENT REMOVAL (DEMOBILIZATION).



THE PROJECT'S PRIMARY DRILL OPERATORS, NICK BECKER (LEFT) AND JOHN SOBOLEWSKI (RIGHT), WALK THE COMPLETED TRENCH. KEVIN REED, ASSISTANT PROJECT WORK SUPERVISOR FROM R-10, IS IN BACKGROUND.



GREG OVERTURE INSPECTS THE TRENCH SIDEWALLS. "FINE-TUNE" BLASTING OF THE. BOTTOM OF THE TRENCH WILL TAKE PLACE NEXT SUMMER AFTER HIGH FLOWS HAVE REMOVED REMAINING FINE SHOT ROCK AND MATERIALS.

Greg Overturf, a fish passage structure and blasting specialist from R-10 (Sitka) was assigned as project work supervisor and lead blaster. He was assisted by Kevin Reed (also R-10). Dale Kanen provided input during final design and construction staking. The project work base crew consisted of four district personnel (as many as eight forest service personnel were on site during project mobilization and set-up), three Job Corpsmen from the Timber Lake Job Corp Center, and two drill operators with blasting experience (under personal services contracts). The district fisheries biologist served to coordinate the project logistics including equipment procurement, maintenance and/or repairs, work crew coordination, and project budgeting. All the crew members except the Job Corpsmen were housed in the bunkhouses at the Clackamas Ranger District Station. All vehicles and transportation to and from the worksite were and provided by the district.

On August 12, materials and equipment were transferred to a Forest Service approved helicopter landing site within 3 miles of the falls. Under contract, the Bell 500 helicopter, equipped with a 250 ft. radio controlled cable sling, made 25 round trips to and from the project site carrying an average load weight of 500 pounds. The materials and equipment transported to the site includes the following:

surveying instruments
klean-cutt and giant gel explosives
portable powder magazine
detonating cord (2500 ft.)
drill steels (2-10 ft.)
electric generators
hydraulic pumps (2)
gasoline (350 gal.)
burlap bags (100)
gas-powered rock dril ls
PVC (28 ft., schedule 40)
hydraulic fluid (40 gal.)
safety horns (24)
5-gal plastic fuel jugs
No. 8 reba- (120 ft.)
No.4 rebar (50 ft.)
ear plugs
leather gloves
fence ties, stretcher bars, bolts
60” pinch bars (1 1/4' dia.)
cultivator rakes
claw hammers
3” trash/volume pumps
wheel -barrows(4)
blasting zone safety signs
water-proof spray paint
had hats w/ face screens and ear protectors (6)
assorted dimension lumber
blasting caps (#2, #3, #5, #7's)
detonating cord (2500 ft.)
1 1/2" dia. water pumps (2)
polypropylene tarp covers
assorted hydraulic fittings
copper tubing
chains saws, chaps, files
hydraulic rock drills
hip waders and safety felts (6)
heavy duty engine oil (10 gal.)
2 cycle engine oil (5 gal.)
gas-powered air compressors
3/8" steel cable (175 ft.)
3/8" steel clamps
long-handled shovels (6)
cotton gloves
rubber (explosives) glove
l/2” dia. manila rope (250 ft.)
l/2" dia. nylon rope (75 ft.)
5/8" garden hose (200 ft.)
come-a-long (1 ton)
black plastic sheeting (100 ft.)
sledge hammers (3)
2-man nylon tent
sleeping pads

chain link fencing (#9 gauge, schedule 40, 150 ft.)
tubular steel posts (#9 gauge, 1 5/8" dia., 160 ft.)

All equipment was situated on the bedrock shelf in the middle of the channel (see photos). Most materials (except the lumber) were stored at the base of the bluff along the river channel. Fuel was stored in 50 gal. drums on the bluff overlooking the project site and brought down as needed. All explosives were stored in a powder magazine on the bluff. Watchmen were posted with safety horns on rotating shifts at the work site. Several mock drills were run in anticipation of loose rock material falling down against the safety fencing. Watchmen were also assigned night duty shifts to prevent theft or damage to the project materials and equipment. The work shifts were 8 10-hour days, followed with 6 days off.

By August 17,a 110 foot long, 6 feet high safety fence consisting of the Schedule 40 chain-link fencing and 1 5/8 inch diameter posts had been erected adjacent to the proposed trench site. Elevations and measurements were retaken by Dale Kanen and staking of the trench and blasting of weir sites were completed .

The drilling of the holes for the explosives began on August 18, starting at the lower end of the trench. Prior to each blast,,all sensitive equipment was covered with plywood sheeting. One crew member would walk downstream, another upstream, to the blasting zone signs so as to alert anyone recreating in the area. Additional crew members were posted on the access trail. All were in radio contact of the impending blest activity with the lead blaster who, stationed under cover up on the bluff, would alert all to readiness and initiate the blast. After a 25 minute wait, the project site was reentered, assessed, cleared of shot rock, and drilling resumed.

Pre-split blasts defining the trench sidewalls were completed one pool at a time (the structure design calls for six pools). Approximately 1.5 pounds of explosive were placed in drill holes 1 foot apart, 8 to 10 feet deep. Production blasts were started at 10 loaded holes per shot, each shot peeling off layers of the “pool” up to the lip of the next pool. (weir site). This was increased to 16 loaded holes as it became apparent that all sidewall rock in the gorge were holding firm and no material had fallen down to the project site. All shot rock was moved by hand (shovels, rakes, wheelbarrows) and deposited downstream.

A meeting was held in late September to confirm Phase I had been achieved, but that mobilization and implementation of Phase II (including equipment and materials procurement, transport, contract preparations, plus final site design work) could not be accomplished without considerable trade-offs and risks. Project demobilization was initiated and all equipment was removed from the site. Some materials, especially lumber, were moved to the bluff for winter storage.

RESULTS AND DISCUSSION

Under Phase I, a trench,approximately 95 feet long, 8 feet deep and 10 feet wide was excavated Into the bedrock face of the falls. A minor amount of back-break occurred along the trench edge, but basically the trench was shot as specified. Much of the fine shot material remaining along the bottom of the trench is expected to be flushed clean by winter flows. Following an early spring assessment, any high flow impacts to the trench will be incorporated into the finai design for setting of the weirs and training wall.

Implementation of the Collawash Project was scheduled to take place under contract. The non-responsive bid on the contract left little time (or funding) to re-advertise, but also opened for full evaluation the opportunity of detailing highly qualified, trained, and experienced fish passage experts already employed by the Forest Service in Region 10 (Alaska). The crew was available only because of unanticipated schedule changes with projects in R-10. The Mt. Hood N.N. and Clackamas District support and coordination assignments would be increased, but considerable cost savings (especially in design) would be realized on the expected contract costs of a yet approved on advertised new contract package.

Setting up a work camp at the project site was considered but rejected due to available housing at district bunkhouse and acceptable trail access. The projects cost savings of not running a work camp were slightly negated by the extra time required for crew transport and trail access (Forest Service and Job Corps personnel).

The project work crew required three work trips to complete the trench (240 hours); two weeks of work for project mobilization, set-up, break down, and demobilization; and several weeks of work from various project crew individuals to access trail construction, equipment and materials assembling and transport, and work site and trail cleanup. A rotation of the Job Corps individuals (no one worked consecutive days) served the project well since their primary assignment was to move shot rock.

Phase II if implemented in 1987, would have had to overlap with the end of Phase I. This would have called for increased work efforts to allow for review of a fully completed, cleaned trench for the passage structure final design. Weather conditions were suitable for-work through the month of October and into November, but effects of an increased work effort would have caused increased safety risks. In addition, materials and equipment for Phase II were not yet ordered, nor contract specs developed and ready for helicopter mobilization of a considerable amount (18 cubic yards) of cement, aggregate, and associated concrete work materials and equipment. Finally, arrangements had been made and confirmed that the R-10 passage team leaders would be available to complete the project in the summer of 1988.

The expertise of the R-10 fish passage structure team from the Sitka Area of the Tongass N.F. was substantiated by the results of Phase I. All work was completed on time with a perfect safety record in a project area considered to be "hazardous". Considering the backgrounds of the overall work crew, the site conditions, and the nature of this type of project, the crew and supervisors are to be commended.

In winter of 1988, a Statement of Work for the Collawash Falls project was prepared, detailing all work assignments and items (materials, equipment, contracts) requiring funding to complete Phase II. Monitoring and maintenance plans are included in the Work Statement, which is scheduled for implementation in the 1988 BPA project. year.

SUMMARY AND CONCLUSIONS

The trench and construction site for the passage structure weirs and training wail at Collawash River Falls were prepared in a project area once abandoned due to safety concerns. Phase II of the Collawash Falls Fish Passage Project, providing native run anadromous fish full passage at all flows to extensive upriver spawning and rearing habitat, will occur as planned in late summer of 1988.

SUMMARY OF EXPENDITURES

1987 project costs ran approximately even ($260.26) with 1987 funding. The funding was requested for full project completion, but the project is currently at the half way point. It is important to note that contract cost estimates obtained following the non-responsive bid period averaged more than twice what was originally projected for full project completion. The cost of completing Phase I was approximately 70% for personnel,including the personal services contracts.

1987 EXPENDITURES

Personnel	$55,052.88
Travel /Per Diem	$4,354.83
Training	$12.82
Expendable equipment	$12,865.85
GA Overhead	$8,674.37
Sub Contracts	$14,996.50
Total Project Costs	$95,957.26

OAK GROVE FORK HABITAT IMPROVEMENT PROJECT

1987 ANNUAL REPORT

by

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March 1988

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ACKNOWLEDGEMENTS

Appreciation is expressed for the assistance of Harv Forsgren, Dave Heller, Ron Auler, Don Palmer, Dave Hohler, and Tom Cain.

INTRODUCTION

The Lower Oak Grove Fork of the Clackamas River is a fifth order tributary of the Clackamas River drainage supporting depressed runs of coho and chinook salmon, and summer and winter steelhead. Habitat condition rating for the Lower Oak Grove is good, but smolt production estimates are below the average for Clackamas River tributaries. Limiting factors in the 3.8 miles of the Lower Oak Grove supporting anadromous fish include an overall lack of quality spawning and rearing habitat.

Beginning in 1986, programmed measures to improve fish habitat in the Lower Oak Grove were developed in coordination with the Oregon Department of Fish and Wildlife (ODF&W) and Portland General Electric (PGE) fisheries biologists. Prior to 1986, no measures had been applied to the stream to mitigate for PGE'S storage and regulation of flows in the Oak Grove Fork (Timothy Lake, Harriet Lake). During the trout fishing season, ODF&W irregularly stocks (2 or 3 times per season) the lowermost portion of the Oak Grove Fork near two Forest Service campgrounds (Ripplebrook and Rainbow) with catchable rainbow trout.

The 1987 field season marked the third year of multi-year efforts to improve fish habitat of the Lower Oak Grove Fork and restore anadromous fish production. The efforts included the development of an implementation plan for habitat improvement activities in the Lower Oak Grove Fork, post-project monitoring, and maintenance of the 1986 improvement structures. No new structures were constructed or placed in 1987.

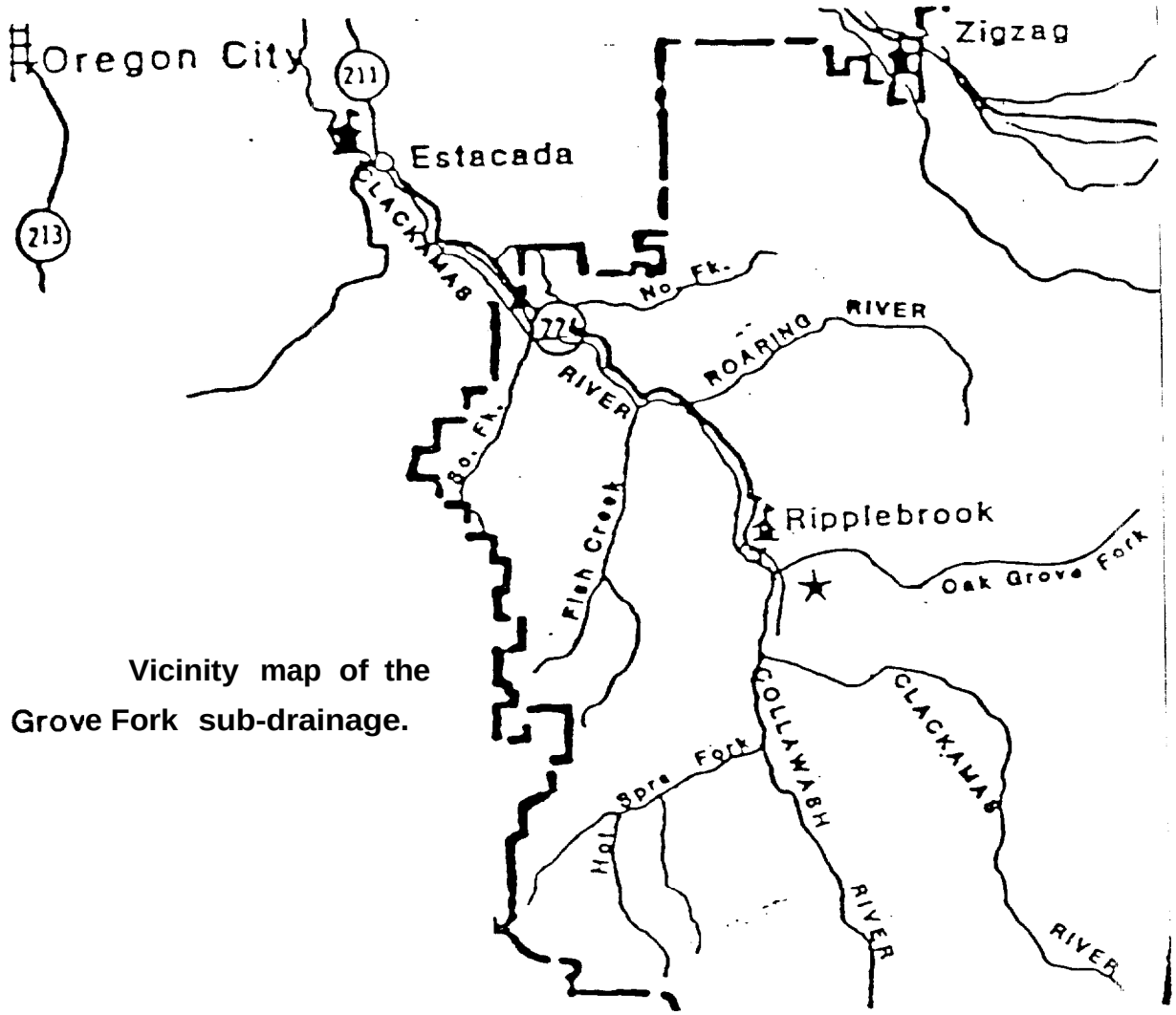
DESCRIPTION OF STUDY AREA

The Oak Grove Fork is a major, fifth order, anadromous fish producing tributary of the Clackamas River (refer to Project Area Map). Basin area is 140 sq. miles and mainatem length is 21 miles. Flow entering the Clackamas, however, is less than 10% of the river's low flow due to nearly complete diversion of the Oak Grove Fork at Harriet Dam over and down to the Three Lynx Power Station Complex. This occurs at River Mile (RM) 4.8 for all but peak flow periods. Seepages at Harriet Dam and inflow from several second order tributaries near the Dam increase the low base flow to approximately 15 cfs. A 15 ft. fall at RM 3.8 has historically linited anadromous fish migration, but the lower stream supports runs of chinook and coho salmon, and winter and summer steelhead. The immediate drainage basin of the Lower Oak Grove Fork is currently not programmed by the Forest Service for scheduled timber harvest activities due to proposed status as a Spotted Owl Habitat Area (SOHA).

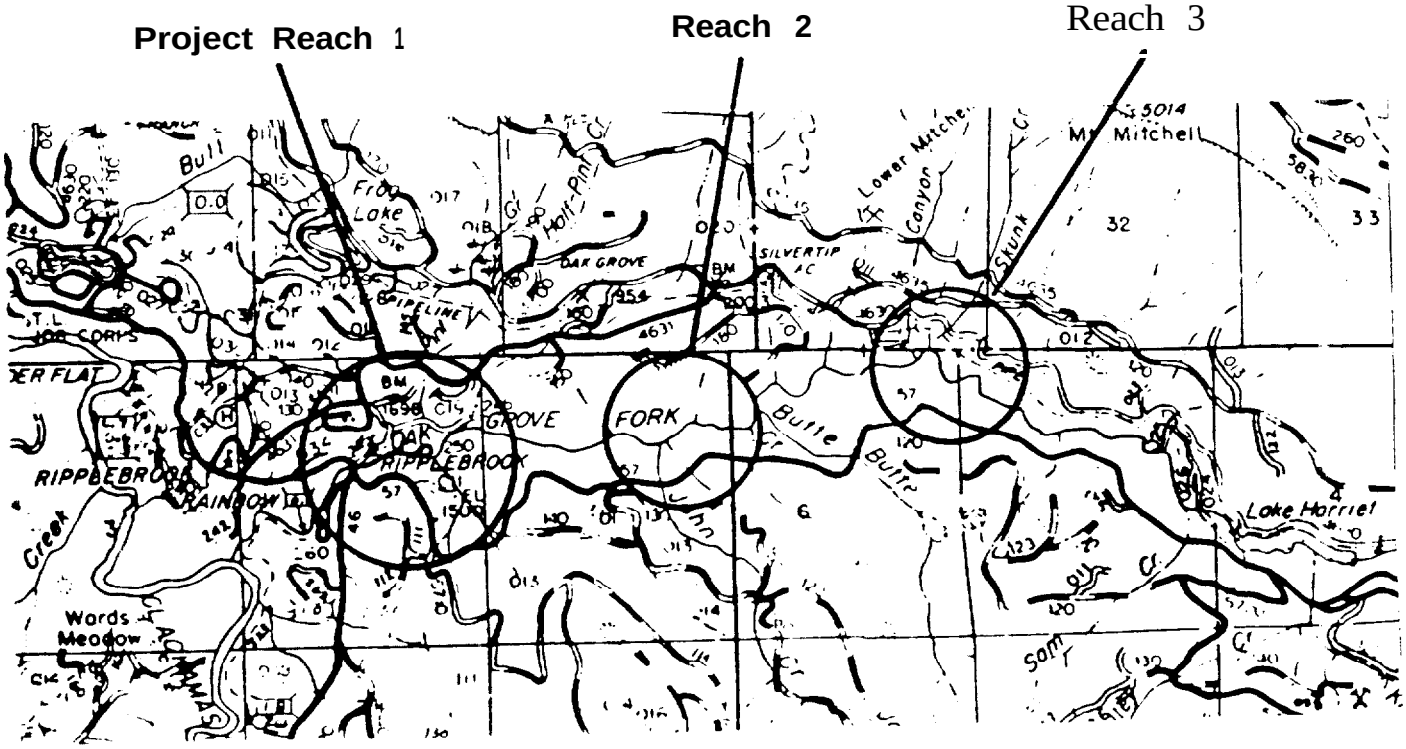
The salmon populations in the Lower Oak Grove Fork are currently very depressed with no scheduled introductions or supplementary smolt outplants. Smolt production is presently estimated to be below average for a Clackamas River tributary. Although spawning habitat is of marginal quality and low in quantity, averaging only 130 square yard per stream mile, anadromous fish production is primarily limited by rearing habitat quantity and quality. Previous habitat inventories also show the stream to have limited pool, deep glide, and of f-channel habitats.

Habitat improvement activities planned and proposed for 1988 and 1989 were developed to improve habitat conditions for natural production of coho salmon and steelhead trout. The proposed activities will be similar to those accomplished in 1986 in RM 0.25 to 0.75 of the Lower Oak Grove Fork. These included channel rehabilitation (boulder placement) of a 1650 ft. section of the stream immediately below the Hwy 224/FS Road 46 bridge crossing and the development of a 1100 foot side channel (1825 sq. yards of rearing ponds) through placement of a diversion structure located 2000 feet upstream from the same FS Road 46 bridge.

In addition, selection of the reaches for the proposed activities centered on meeting criteria specific to the Lower Oak Grove. The two main criteria were access for materials and equipment, and the presence of channel characteristics having high potential for application of enhancement techniques (wide flood plain with side channels).



Vicinity map of the Oak Grove Fork sub-drainage.



METHODS AND MATERIALS

Implementation Plan

Habitat inventories of the Lower Oak Grove Fork were conducted in 1982. In addition to this data, surveys were again conducted in 1987 specifically to identify stream reaches meeting the habitat improvement activity criteria of equipment access and high improvement potential. The channel was walked two times; the first time to map and locate all reaches, the second time to measure distances, widths, and flag the priority treatment reaches. In addition, an extensive ground survey of the adjacent upslope areas on both sides of the stream was conducted to locate available wood sources and areas of potential sensitivity to equipment access and operation.

The SOHA status of the stream adjacent side slopes served to define limits in types of equipment and materials to be used in the improvement activities. Project reaches were then separated by treatment needs, assigned project reach identification listings, and scheduled for implementation to meet logistics and other constraints for rehabilitation the Lower Oak Grove Fork.

Maintenance

No maintenance was required in 1987 on any of the instream structures, mainstem diversion/control structure, or side channel sills placed in 1986 in the first project reach (Project Reach 1, RM 0.23 to 0.75 - see area map). Riparian plantings and grass seeding was conducted to further improve vegetative recovery of the equipment affected riparian areas of 1986.

Monitoring

Post-project monitoring of the 1986 project reach was conducted by a two-person crew measuring and mapping habitat units within the project area. Salmonid density counts for all occurring species were conducted as part of the intensive monitoring effort. Base-level monitoring was also conducted and consisted of the taking of photos at designated project reach stations to track structure performance and general habitat changes over time.

RESULTS AND DISCUSSION

Implementation Plan

The Implementation plan for the Lower Oak Grove Fork was completed in consultation and coordination with the ODF&W district and PGE fisheries biologists. The walking of the stream two times proved effective in allowing the project fisheries biologist (Forest Service) to fully review the lower drainage basin while specifically locating project areas meeting the Improvement activity criteria. The plan identified two specific reaches to be worked in 1988 and 1989, and they were listed as Project Reach 2 and 3 of the Lower Oak Grove (see area map). Reach 2 is located at RM 1.5 to 2.0. Reach 3, is at RM 2.5 to 3.5.

Both stream reaches have existing roads (logging spurs) extending down from a Forest Service maintained "arterial" road, the 4630, to 1000 feet or less distance from the stream. The side slopes of the lower immediate drainage basin are generally steep (20 to 70%), but the south side is noticeably steeper and without access spurs descending further down into the basin.

Both reaches exhibit wide channels that are contained only partially by the occasional south side bedrock sidewall. Old flood plains only a few feet above the existing channel are extensive. Side channels are common but most are non-flowing except during the highest flow events. Each have very good potential for development of rearing habitat through sill log placement. Gravel bars are common but recruitment of gravel from the bars is also limited to high flow events. Downed woody material, especially whole logs, are abundant in much of the adjacent upland areas, older flood plains, and side channels. Use of this material for log sills and similar instream structures will be coordinated to meet SOHA management standards and guidelines.

The implementation plan provides an opportunity to review out-year project emphasis areas for further increasing the natural runs of anadromous fish in the Lower Oak Grove. An area of major significance discussed in the plan was a need for coordinated efforts to review the benefits of establishing regulated minimum flows from Harriet Lake to the Lower Oak Grove.

Maintenance

The winter of 1986-87 preceded a record low precipitation year. The resulting runoff did not cause any noticeable damage to the structures placed in 1986 and no maintenance was therefore required. This also resulted in a considerable savings in anticipated 1987 expenditures, as costs were calculated for at least 10 to 15 hours of equipment rental. The cross-channel diversion/control structure was fully intact and functioning as designed, moving approximately 5 cfs of flow down the developed side channel throughout the summer. All 9 sill log structures and rearing ponds were also holding good water levels with no observed leaks, In part due to "maintenance" by now resident beavers.

Monitoring

The base-level monitoring effort showed similiar and limited impact or effects from 1987 seasonal high flows, with all structures intact and minimal habitat changes. Monitoring results within the habitat units and the salmonid density counts can be found in the Monitoring and Evaluation of Mt. Hood NF Stream Habitat Improvement and Rehabilitation Projects: 1987 Annual Report (Forsgren, Heller, and Ober, 1988).

SUMMARY AND CONCLUSIONS

Development of the implementation plan provided a timely, in-depth review of anadromous fish habitat improvement potential and deficiencies of the Lower Oak Grove Fork of the Clackamas River. The proposed 1988 and 1989 activities will have a positive benefit versus cost ratio for their respective project lives (20 years), and have been scheduled for implementation through application of state-of-the art improvement techniques to Increase anadromous fish spawning and rearing habitat.

SUMMARY OF EXPENDITURES

The 1987-1988 operating budget for the Oak Grove Fork was $12,700. Total expenditures were $6,038.06. Personnel costs in 1987-88 were $5,266.81 (87% of the total) and reflect time and effort required to Inventory proposed project treatment reaches (reach 2 and 3), monitoring, and the preparation of reports. The total expenditures were 50% of of anticipated operating costs primarily because no maintenance was required on the structures of project reach 1 that were placed in 1986.

1987 EXPENDITURES

Personnel	$5,266.81
Travel/Per Diem	$15.71
Training	$13.36
Contract Costs	0
Expendable Equipment	$95.24
GA Overhead	$646.94
Total Project Costs	$6,038.06

REFERENCES

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Forsgren, H., D. Heller, and N. Ober, 1988. Appendix A: Monitoring and Evaluation of Mt. Hood National Forest Stream Habitat Improvement and Rehabilitation Projects: 1987 Annual Report. In, Natural Propagation and Habitat Improvement Volume 1 - Oregon, Final and Annual Report 1987. Bonneville Power Administration, Division of Fish and Wildlife.

LAKE BRANCH/WEST FORK HOOD RIVER HABITAT IMPROVEMENT PROJECT

by

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Rick Ragan	Hydrologist Mt. Hood National Forest Hood River Ranger District

ABSTRACT

The Lake Branch/West Fork Hood River habitat improvement project, in 1987, was in the fifth year of a coordinated effort between the Oregon Department of Fish and Wildlife and the USDA Forest Service, Mt. Hood National Forest to improve anadromous fish production in the West Fork Hood River drainage. The project has been divided into three sub-projects: 1) Lower Lake Branch rearing habitat enhancement ; 2) Upper Lake Branch channel rehabilitation; and 3) West Fork Hood River habitat enhancement.

In 1987 most activities centered on the Upper Lake Branch component. Forty-two wood structures were installed to stabilize the channel and banks, provide low flow pool habitat, and maintain summer surface flows in a reach that flows subterranean during summer low flows. Habitat was quantified throughout the upper West Fork basin as part of the monitoring and project planning process, A West Fork Habitat Rehabilitation Implementation Plan was completed.

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INTRODUCTION

The Lake Branch/West Fork project is a multi-year, fish habitat improvement effort coordinated between the USDA Forest Service, Mt. Hood National Forest (Forest Service) and Oregon Department of Fish and Wildlife (ODFW), in cooperation with the Bonneville Power Administration (BPA), to increase anadromous fish production in the Hood River system. The project is part of the NWPCC Fish and Wildlife program (Measure 703(C), Action Item 4.2). Habitat improvement work completed prior to 1987 has included: a 1985 ODFW project funded by BPA to improve passage at the "moving" falls on the West Fork Hood River; a 1985 STEP project al lowing low flow passage through a boulder drop at RM 2.8 of Lake Branch; and a variety of habitat improvement projects funded by BPA and implemented by the Forest Service on Lake Branch in 1983, 1984, 1985, and a 1986 project on McGee Creek, a West Fork tributary. In addition to the BPA funded work, the Forest Service has completed road rehabilitation projects to improve watershed conditions. Complementary KV projects have also been completed and are planned for 1988 in Lake Branch and 1989 in McGee Creek.

This report summarizes progress made toward completion of tasks identified to be completed under the 1987 work agreement with BPA. These tasks were:

1. Complete contract preparation and implement the 1987 channel rehabilitation project on Upper Lake Branch. A minimum of 15 structures were to be constructed to improve low flow rearing habitat.

2. Conduct a coordinated ODFW/Forest review of completed project sites and untreated sites to determine if project objectives have been fully met, or if additional cost effective opportunities exist to increase anadromous fish production capability.

3. Pending the outcome of the peer review by ODFW and Forest Staff, complete the project design and environmental assessment for any 198811989 projects.

4. Maintenance of past; projects on Lake Branch. Planned maintenance included reconstruction of the inlet control device and replacement of some in-channel structures on lower Lake Branch side channel and minor maintenance of structures placed in the upper Lake Branch project area.

5. Continue monitoring/evaluation of past projects within the West Fork/Lake Branch project area, including physical habitat and biological evaluation, spawning surveys, and resting hole surveys.

6. Develop an upper West Fork Hood River drainage fish and fish habitat management plan and incorporate it into the Hood River Fish Management/Rehabilitation Plan.

DESCRIPTION OF PROJECT AREA

The West Fork Hood River is a major anadromous fish producing tributary to the Hood River (Figure 1). The West Fork enters the Hood River at river mile (RM) 12.1 with an average annual low flow of 267 cfs. Approximately 75 percent of the drainage is within the contiguous Mt. Hood National Forest boundary. Lake Branch is the largest anadromous fish tributary to the West Fork.
The primary anadromous fish species inhabiting the West Fork system is summer steelhead trout. The drainage is also utilized by winter steelhead trout. ODFW is working to re-establish spring chinook salmon through hatchery outplants and hatchboxes operated by STEP (Salmon Trout Enhancement Program) volunteers.

Anadromous fish habitat quality within the West Fork drainage ranges from poor to good. Past removal of large woody debris and the resulting loss of habitrt diversity, instream structure and cover is felt to be the major factor limiting anadromous fish habitat. Steelhead habitat capability is generally diminished by a lack of pool/glide habitat and cover for l+ and older juvenile steelhead summer rearing. Secondary limiting factors are believed to be poor distribution of spawning habitat and adult holding water. Spring chinook salmon habitat quality is diminished by a lack of spawning habitat, a lack of pool habitat and cover for summer rearing and winter refuge, and a lack of adult holding water. All of these limiting factors are related to the removal cf large woody debris from the channels and subsequent loss of habitat diversity.

The primary focus of habitat improvement activities in the West Fork drainage is to re-introduce instream structure to create a diverse aquatic habitat, providing low flow pool habi tat, high flow refuge, increased cover, and to collect spawning gravel.

The Lake Branch/West Fork project has been divided into three sub-projects based upon geographic location and habitat improvement objectives:

1) Lower Lake Branch Rearing Habitat Improvement (RM 3.4-8.0)
2) Upper Lake Branch Channel Rehabilitation (RM 8.0-9.0)
3) West Fork Hood River Habitat Improvement

Lower Lake Branch (RM 3.4-8.0)

Lake Branch originates at Lost Lake and flows approximately 11 miles before joining the West Fork near the community of Dee, Oregon (FIGURE 2). Lake Branch is the largest anadromous fish producing tributary to the West Fork Hood River.

Summer steelhead are the management emphasis species in Lake Branch, but there is suitable habitat for spring chinook salmon, which are being re-introduced. Winter steelhead are probably also present in Lake Branch. Large instream woody debris is important in lower Lake Branch, especially above RM 5.0, to

VICINITY MAP

HOOD RIVER DRAINAGE

Figure 1

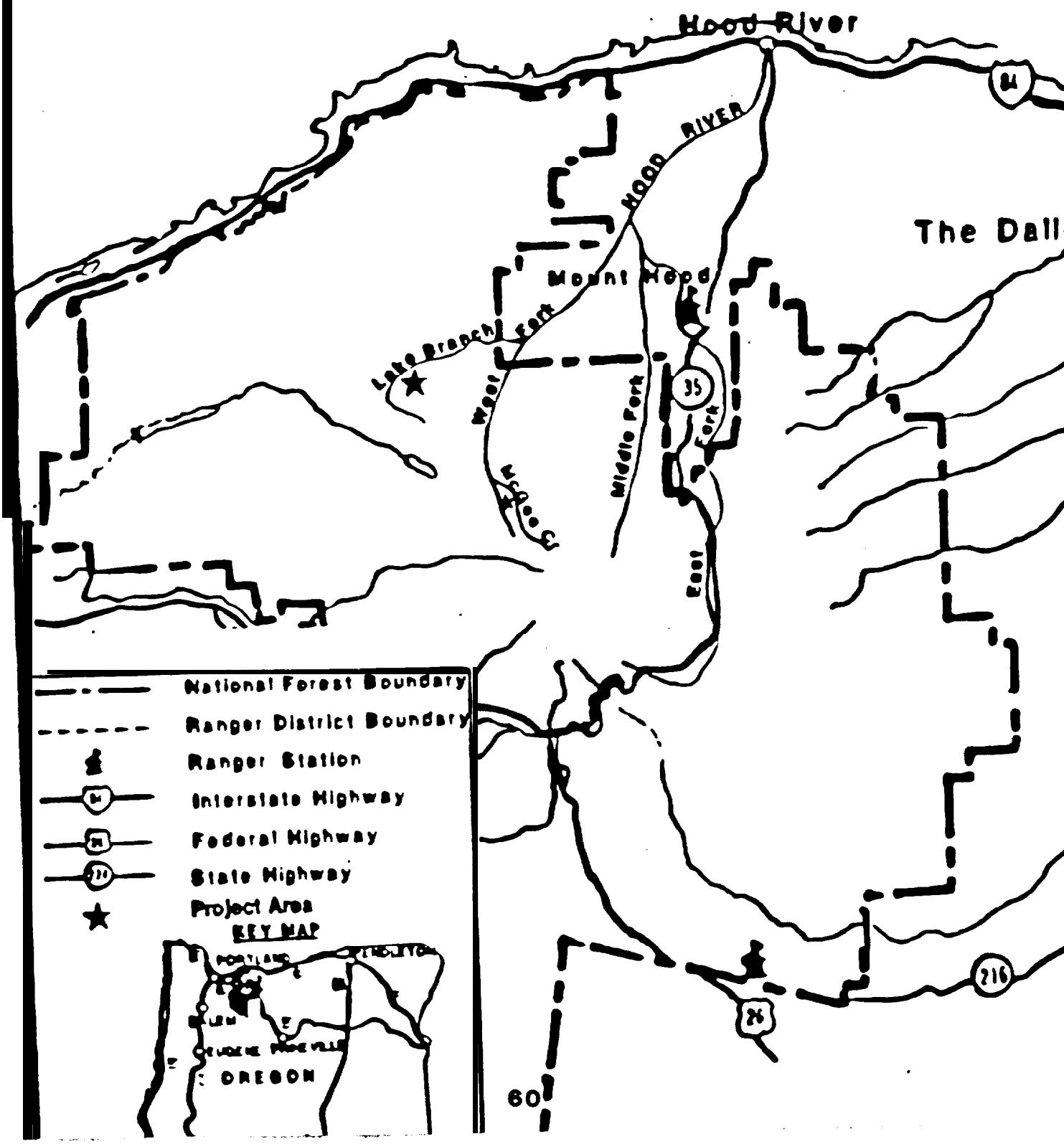
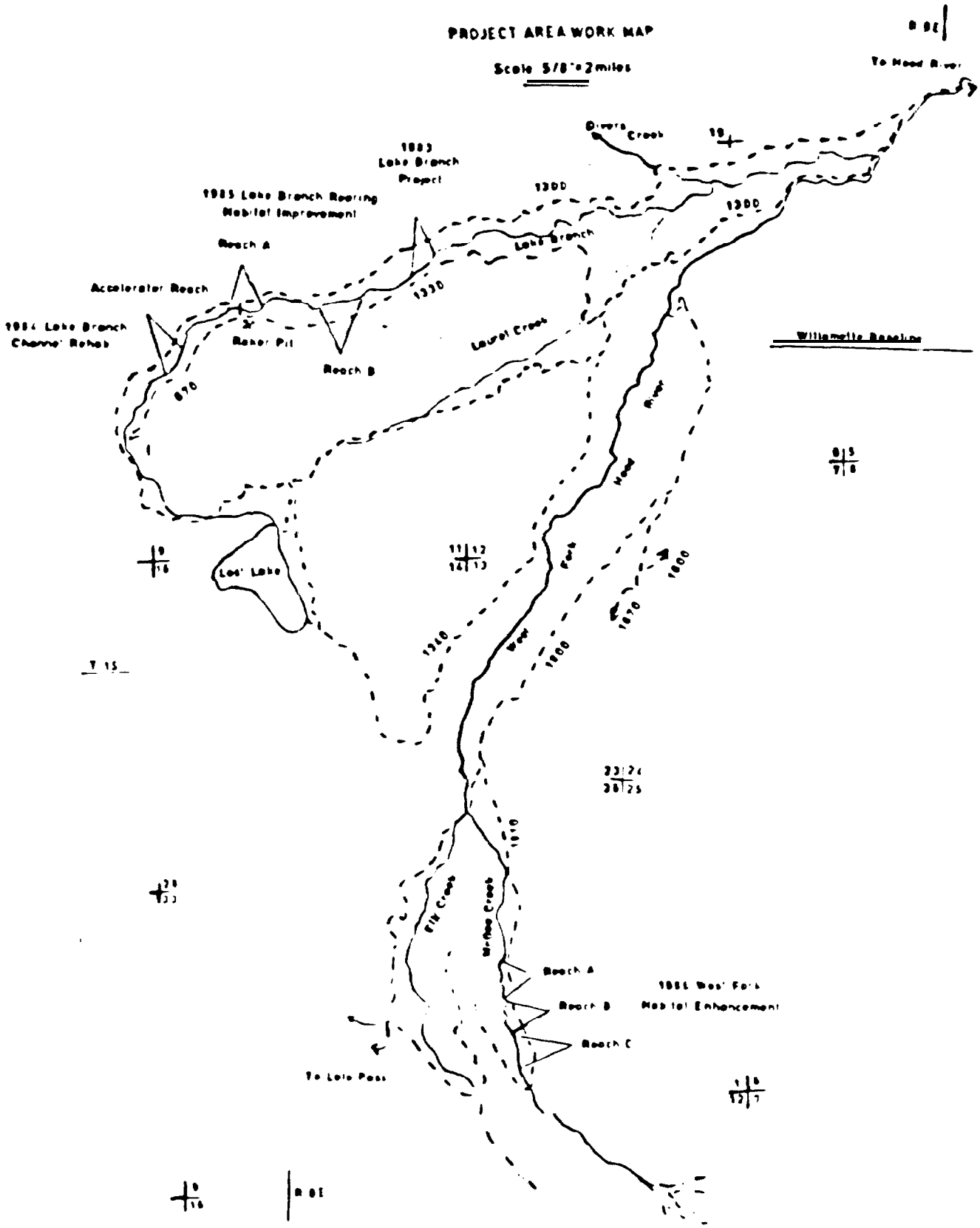


Figure 2


PROJECT AREA WORK MAP
Scale 5/8" = 2 miles
To Hood River
Divers Creek
1983 Lake Branch Project
1985 Lake Branch Rearing Habitat Improvement
Reach A
Lake Branch
Accelerator Reach
1984 Lake Branch Channel Rehab
Baker Pit
Reach B
Laurel Creek
Willamette Baseline
Lost Lake
West Fork
Fir Creek
Reach A
Reach B
Reach C
1985 West Fork Habitat Enhancement
To Lolo Pass

provide the structural control necessary to form a diverse, quality aquatic habitat. Below RM 5.0 stream gradient and energy increases. Boulders become the dominant hydraulic control feature. Although wood is still important, it is generally associated with large, infrequent log jams. Fish habitat quality in lower Lake Branch is generally rated as being good, although anadromous fish habitat capability appears to be locally limited by poor low flow rearing habitat for 1+ and older juvenile steelhead trout. Hood River steelhead smolt as 1+, 2+ and 3+ fish (Howell et al,1985) making the presence of diverse, quality rearing habitat important.

Abundant combinations of large wood material and boulders provide a variety of diverse habitat for this span of smolt age classes, especially during summer. low flows. Local reaches of habitat rated as poor to fair appear to be associated with past stream clean out practices. These “barren”, uniform areas do not provide adequate rearing habitat, little spawning gravel retention, and few pools. The objectives of the Lower Lake Branch sub-project are to use instream structures to improve rearing habitat and increase habitat diversity.

Upper Lake Branch (RM 8.0-9.0

Fish habitat quality in upper Lake Branch is rated as poor except where instream habitat improvement projects have been completed. Much of this reach uas obtained by the Mt. Hood National Forest within the last ten years through a land exchange. Prior to transfer of the land to the Forest Service, the stream corridor and floodplain had been logged and the channel “cleaned”. The stream channel is now dominated by shallow riffle, flowing over a small boulder/cobble substrate. Low flow rearing habitat is limited to a few pools, spawning habitat is scarce, and an approximately one-quarter mile long reach flows subterranean in summer. The channel banks are unstable and the streambed is constantly shifting. It is believed that the channel and habitat condition are due to past removal of large woody debris. Because of past land use practices there is also a very limited source of future woody debris.

The objectives for the upper Lake Branch component was to provide year round habitat in the subterranean portions of Upper Lake Branch by restoring summer surface flow and improve spawning/rearing habitat in areas with year round flow by increasing the amount of low flow pool/glide habitat and generally low flow volume and cover.

West Fork Hood River

This project area includes the uppermost reaches of the West Fork Hood River and McGee Creek (FIGURE 2). Initial rehabilitation efforts have focused or: McGee Creek. McGee Creek is a headwater tributary to the West Fork. Originating on the northwestern slopes of Mt. Hood, McGee Creek flows approximately four miles before joining Elk Creek, forming the West Fork Hood River. The lower two miles of McGee Creek flow through private forest land, confining Forest Service activities to above RM 2.0. The upper West Fork flows through a patchwork of National Forest and private forest. Due to the mixed

land ownership and potentlal land exchanges, habitat rehabilitation efforts are being closely coordinated with ODFW.

Fish habitat quality in McGee Creek is rated as fair (Cain and Kinzey, 1984). Habitat condition is limited by a lack of quality low flow pools (the pool to riffle ratio is about 2:8) and poor habitat diversity. Summer steelhead trout are the emphasis species in McGee Creek and habitat is potentially available for spring chinook salmon. A lack of instream large woody debris accounts for the preponderance of shallow riffle habitat and poor diversity.

METHODS AND MATERIALS

Spawning Surveys

Spawning surveys for steelhead were conducted on Lake Branch, McGee Creek, and the upper West Fork Hood River. The surveys were performed in late April and May of 1987. Lake Branch was surveyed on 4/2 1 and 5/6 between RM 5.4 and 8.4. The West Fork Hood River was surveyed from Ladd Creek upstream to the confluence of McGee and Elk Creeks, (RM 13.9) on 4/27 and 5/8. McGee Creek was surveyed from the mouth upstream one-half to two miles on 4/22,4/27, and 5/8.

The surveys were performed by one or two people walking the stream usually proceeding upstream. One Lake Branch survey was snorkeled downstream. Surveyors recorded visibility, relative discharge, weather, number of redds, and number of live and dead adult fish by species (Appendix C).

Resting hole counts were not performed as abnormally low water in Fall, 1987 prevented completing the surveys. Information on past resting hole counts is contained in the 1986 BPA Accomplishment Report (MacDonald and Hutchinson, 1987).

Physical and Biological Monitoring

For a discussion of the physical and biological monitoring see the separate document, Appendix A : Monitoring anad Evaluation of Mt. Hood National Forest Stream Habitat Improvement and Rehabilitation: 1987 Annual Report (Forsgren, Heller, and Ober, 1988). A modification of the method reported by Harlin and Reeves (In publishing) was employed.

Project Implementation - Upper Lake Branch

The services of hydrologic consultant, Dr. John Orsborn, were retained in 1986 to recommend measures to re-establish surface flow in the subterranean reach. Dr. Orsborn supported the Forest Service hypothesis that the existing habitat and channel conditions were the result of logging the area without leaving a buffer and stream cleanout practices (MacDonald and Hutchinson, 1987).

Removal of channel roughness elements resulted in an increase in stream velocities during high flows, a decrease in bank stability, and the removal of organic and inorganic fines which helped seal the channel. These factors caused the channel to widen and increase deposition as banks unravelled. The Forest Service drilled five wells above, below, and throughout the sub-terranean reach to monitor the elevation of the water table in relation to the channel bottom. Monitoring the wells in addition to observations over several years seemed to support both the channel filling and loss of seal hypothesis. It appeared that the area of surface flow was increasing as the stream headcut at the upper end, and as surface flow was extending downstream at the lower

end. Well data in summer, 1986, a dry summer,, showed that the water table was near the surface at the lower end and 12 feet below the surface at the well just upstream of where flow goes subterranean.

General steps recommended (MacDonald and Hutchinson, 1987) to achieve channel restoration and were to:

1) reduce the permeability of the substrate by collecting fines to seal the channel ;

2) restore habitat and woody debris structure to the stream;

3) increase bank and bed stability;

4) change the predominate form of energy dissipation in the channel from primarily friction to expansion losses in plunge pools and around obstructions;

5) reduce the amount of flood flow in the main channel in order to reduce the impact on channel modification and allow more rapid recovery;

60 concentrate the low flow in the main channel to maximize summer habitat

The objectives of the 1987 Upper Lake Branch Channel Rehabilitation Project were twofold. First, to provide year around habitat in the subterranean portions of Upper Lake Branch by restoring summer surface flow. Improve spawning/rearing habitat in areas with year around flow by increasing the amount of low flow pool/glide habitat, and generally low flow volume and cover.

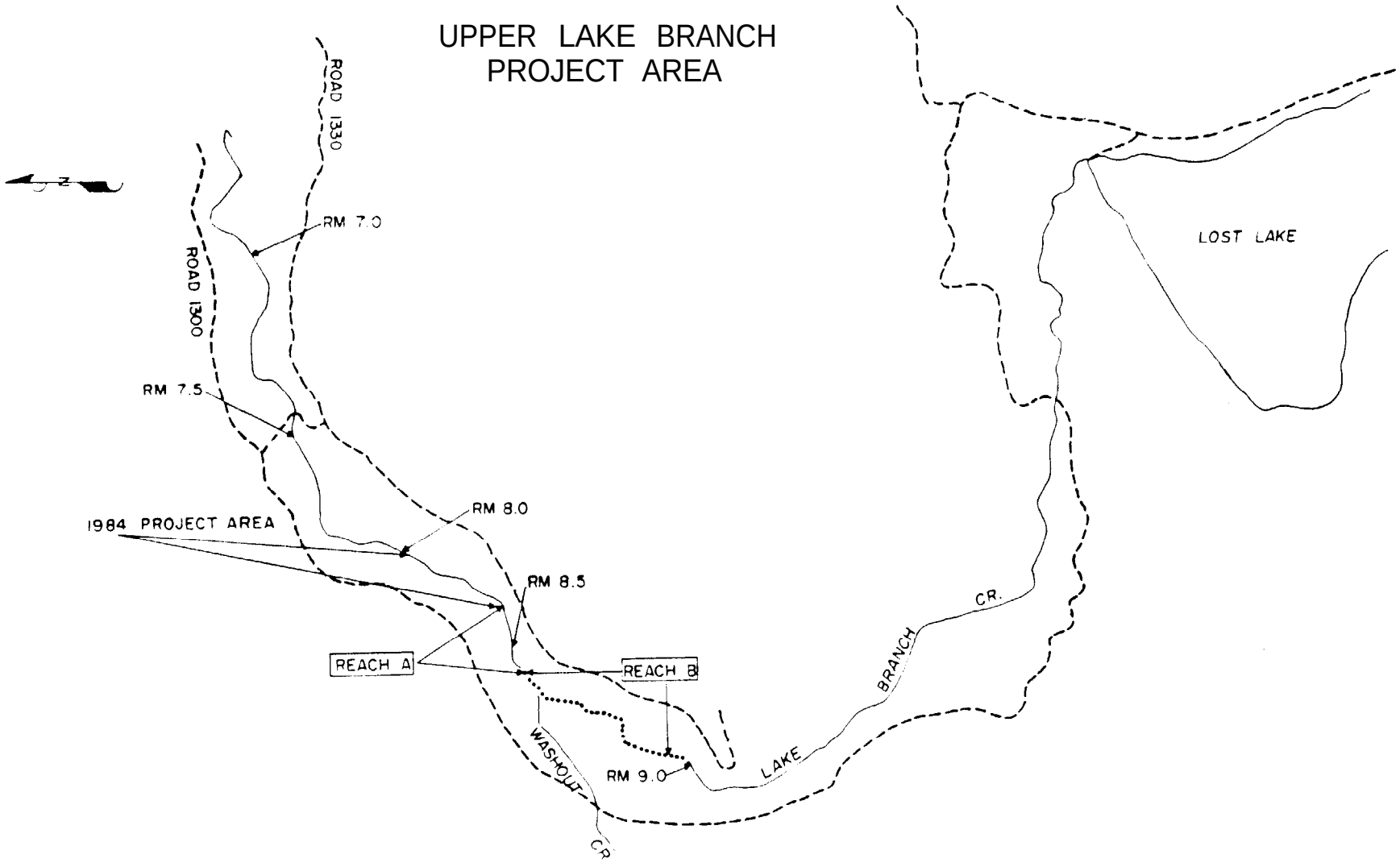
The project area was divided into two main parts, Reach A, an area of year around flow downstream of the subterranean reach and the subterranean reach (Figure 3). Fish habitat in Reach A was poor. The summer channel was dominated by shallow riffle (less than 1 foot depth) with little pool habitat, cover, or spawning gravel.

The approach in Reach A was to use log wings, accelerators, and sills to narrow and deepen the channel (reduce width/depth ratio), increase pool/glide habitat, and increase riffle volume. Structure logs were excavated into the banks at least as far as they extended into the channel for stability. The structures were designed so that the end of the log in the channel was approximately one foot lower in elevation than where the structure entered the bank. Logs were joined using l/4 inch sheet metal and six to eight inch lag bolts (Appendix A).

The approach in the subterranean reach was to install wood structures to stabilize stream channels and banks. It also would increase channel roughness to dissipate high flow energies to allow fine material to settle and seal the channel, provide pool habitat, and collect gravel, and generally increase bed and bank stability. Structures included log sills, double, log wings, "K" and half “K” structures (Appendix A).

FIGURE 3

UPPER LAKE BRANCH
PROJECT AREA



The upstream sides of the sills and "K" structures were lined with hog wire (actually dog fence) and filter cloth to prevent undercutting and seal the structure. Pools were excavated below the structures to hasten plunge pool development and the excavated material used to rip-rap each end of the structures. It was attempted to extend the sill logs ten feet into each bank. When it was not possible excavate the ten feet or bank material seemed to be too erodible, wings were placed for stability (Appendix A).

Project work was completed under a Forest Service administered equipment rental contract. The contract specified a large track-mounted backhoe/excavator (equivalent to a CAT 225) with operator. The excavator bucket was equipped with an opposable thumb. Forest Service personnel directed the operator during construction and performed the necessary hand labor.

The channel was excavated through the entire subterranean reach to help accelerate scouring and develop a low flow channel. Spoils were used to backfill structures. Excavated banks were shaped at an approximate one to one slope or less to facilitate establishment of vegetation and allow high flows access to floodplain.

Logs for structures were obtained from nearby timber stands. Structures needed to be made of large material in order to withstand flows and provide sufficient roughness to influence channel and bank stability. Twenty-four old growth trees were felled by a contract faller. The logs were bucked to desired length (up to 95' long). The Logs were skidded to structure sites by a D-6 CAT with integral arch.

RESULTS AND DISCUSSION

Project Implementation- Upper Lake Branch

A total of 42 structures were installed in upper Lake Branch, 14 in Reach A and 28 in the subterranean reach. Structures in Reach A consisted of two log sills, one small rock berm, five single log wings, five double log accelerators, and one double log wing. Structures in the subterranean react. Included four single log wings, seven double log wings, one double log accelerator, four “k” structures, eight one-half “k” structures, and four log sills (Figure 4).

Wings, double log wings and accelerators were designed to narrow the channel, create a low flow channel and scour pools. Double log structures were used where it was felt added stability was needed and to help stabilize banks. Water flowing over a wing has a tendency to form a plunge pool on the downstream side of the log. The plunging action can cause bank cutting and jeopardize the structure. The double log structure will help dissipate energy over the structure while allowing acceleration at the tip, thus encouraging deposition of fine material. This fine material will provide an area for vegetation growth to become established, thus stabilizing the bank, but wil not inhibit development of a scour pool.

Log sills and the small rock berm were designed as channel control structures to collect spawning gravel on the upstream sides and form plunge pools downstream of the structure as well as provide roughness elements to dissipate high flow energy and prevent head cutting. The "k" structures and l/2 “k” structures were designed to create plunge pools and stabilize banks.

Originally, it was hoped that the whole channel could be excavated to intercept the water table at the lower end. Unfortunately, the large amount of spoils prevented this, ao instead, the channel was just excavated to establish a low flow channel and start pool development. The summer of 1987 was abnormally dry and resulted in a water table lower than previously measured in the subterranean reach. Water table elevation in late summer, 1986, (a dry summer) was four feet below the surface. In 1987, the water table was at 11 feet below the surface near the middle of the project area. It may take several years for the channel to sufficiently stabilize and seal to maintain surface flow year around.

Maintenance Needs

Project work, completed in 1983, 1984, and 1985 in Lake Branch and 1986 on McGee Creek, was reviewed for maintenance needs. The winter of 1986/87 did not produce significant flows to test the structures, and they remained in a similar condition as after the winter 1985/86 when the Hood River system experienced a ten to fifteen year event (MacDonald and Hutchinson, 1987). The structures did not need any maintenance. The only maintenance need observed in 1987 was the center boulders on three boulder berms had partially washed-out. Since the berms were still functioning no maintenance is planned at this time.

FIGURE 4

UPPER LAKE BRANCH - REACH B
STRUCTURE LOCATIONS

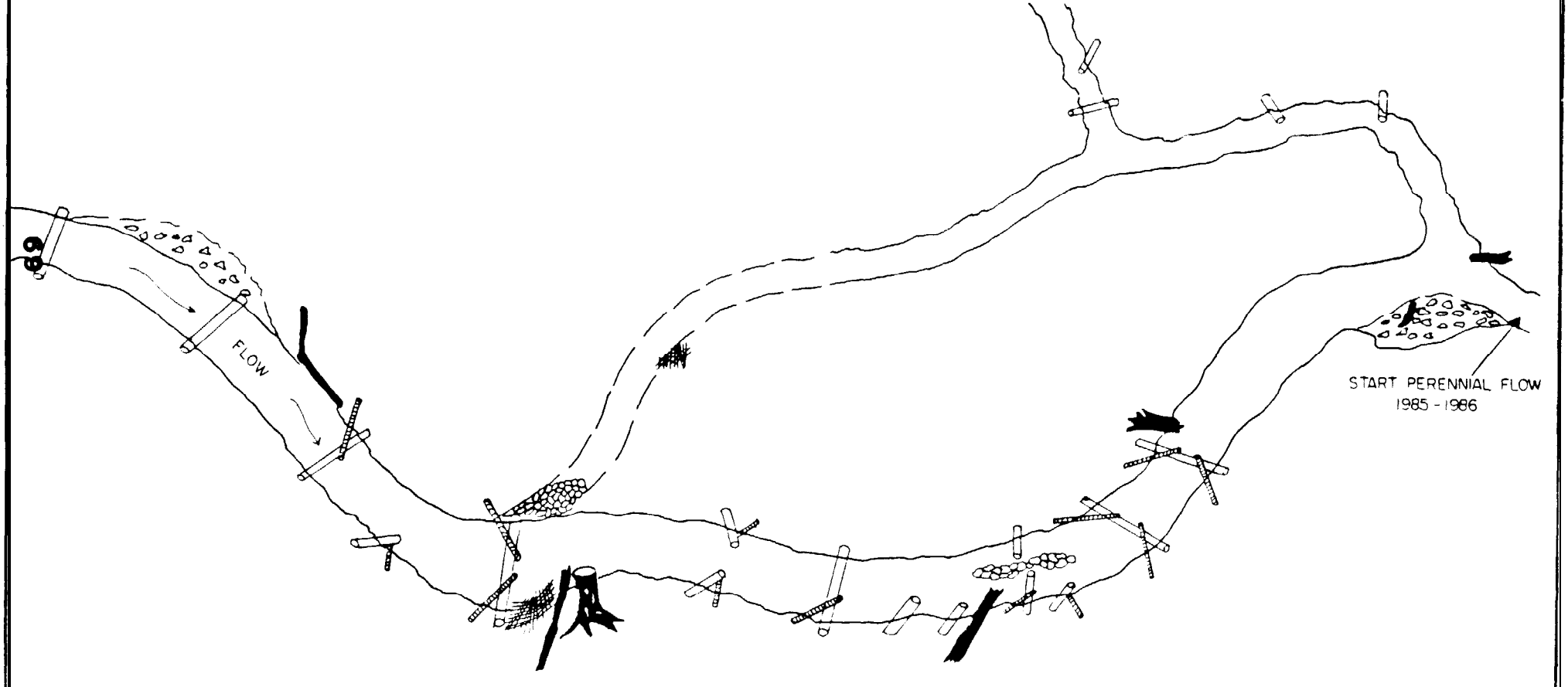
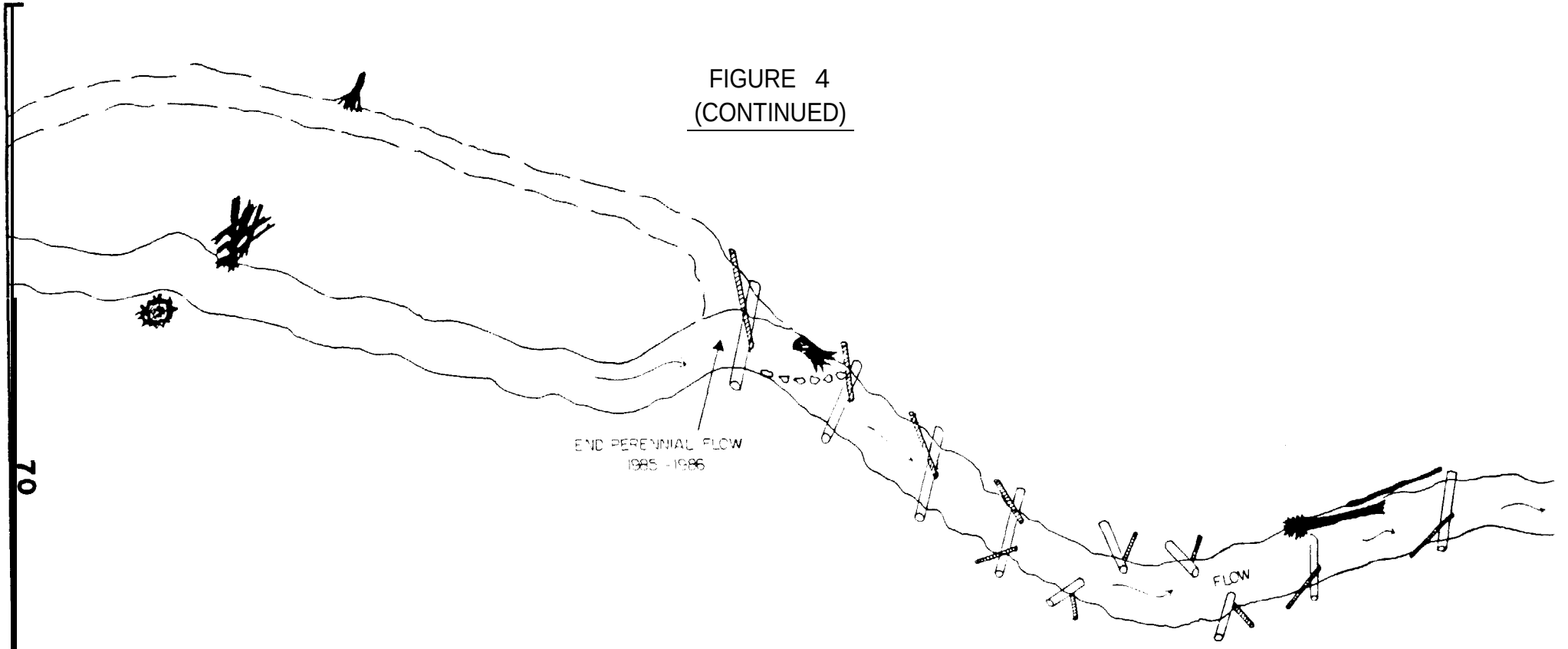


FIGURE 4
(CONTINUED)



One log sill was added in 1987 as maintenance (improvement) of work completed during the 1984 Lake Branch Channel Rehabilitation Project. The sill was installed downstream of two accelerators to act as a downstream control to hasten scour pool development associated with the structures (MacDonald and Ragan, 1985).

No maintenance was performed on the Lake Branch Rearing Habitat Improvement Project site completed in 1985 even though the inlet control of a side channel had been breached and several boulder berms washed out (MacDonald and Ragan, 1985). The original plan was to repair these structures in 1987, but after further investigation and review it was decided to redesign portions of the work and include these activities in the proposed 1988 Lake Branch Project.

Physical and Biological Monitoring

Results of the physical and biological monitoring are contained in the supplemental document, Appendix A: Monitoring and Evaluation of Mt. Hood National Forest Stream Habitat Improvement and Rehabilitation Projects: 1987 Annual Report (Forsgren, Heller, and Ober, 1988).

Spawning Surveys

Two spawning surveys, April 21 and May 6, were conducted on Lake Branch. The survey between RM 5.5 and 8.4, recorded seven redds and one adult steelhead. One of the redds was associated with a boulder berm constructed at RM 5.5 in 1983. Another redd was associated with a log sill constructed in 1984 at about RM 8.0. The redd at RM 8.0 is the farthest point upstream that steelhead have recently been observed. Fineen redds were counted on the May 6 survey between RM 5.4 and 7.8. This represents a threefold increase in redd numbers in the same section surveyed in 1986. In addition to the redd associated with the 1983 berm, three redds were associated with boulder berms constructed in 1985 and two were associated with habitat improvement work completed in 1985 at RM 5.4. The most redds previously counted In between RM 5.4 and 7.8 was five.

The West Fork Hood River was surveyed on April 27 and May 8. Only three redds were counted on the May 8 survey between Ladd Creek and the confluence of Elk and McGee Creeks (RM 13.9). This compares to eight redds and three adult steelhead observed during the snorkel survey of the same reach in 1986 (MacDonald and Hutchinson, 1987).

McGee Creek was surveyed three times in 1987 (4/22, 4/27 and 5/8). All surveys proceeded upstream from the mouth, the longest being two miles. Only one redd and one adult steelhead were observed in McGee Creek,but this is noteworthy in that it is the first recent documentation of steelhead in McGee Creek.

The spawning surveys are being used in conjunction with resting hole counts to provide information on population trends in the West Fork system. However the spawning surveys may not be an accurate reflection of all spawning activity in the surveyed reaches. Summer steelhead may spawn anywhere from January through May in the system, while winter steelhead are a late running fish and appear to spawn in April and May. It is possible that many of the observed redds are winter steelhead and many of the summer steelhead redds, constructed in March or earlier, are not distinguishable during the surveys. Unfortunately, snow pack and flows usually prevent surveys earlier than April. It should also be noted that the adults observed appear to be in good condition and don't look like summer fish that have been in the river for almost a year. It is possible that the observed adults are winter fish.

SUMMARY AND CONCLUSION

The upper Lake Branch channel rehabilitation project was completed. The combination of 1984 and 1987 project work in the Upper Lake Branch reach has introduced a total of 53 structures between RM 8.0-9.0. Monitoring of this reach in 1988 will provide quantitative data on increased spawning and rearing habitat. Assessment of the 1984 project shows the majority of the structures functioning as designed and they have increased pool area, spawning gravels, and overall diversity (MacDonald and Hutchinson, 1987).

A peer review was conducted on Lake Branch. The review team was comprised of the Hood River Ranger District fish biologist and hydrologist, two biologists and a hydrologist from the Mt. Hood National Forest Supervisor's Office, and the ODFW District Biologist. The team looked at Lake Branch from about the Forest Boundary (RM 3.4) to about the upstream limit of anadromous fish habitat (RM 8.0). Based upon the review, it was determined that further habitat rehabilitation work is warranted and feasible in Lake Branch. An environmental assessment and project plan are being formulated and will be completed by March 31, 1988.

Maintenance of the lower Lake Branch side channel was postponed and will be completed as part of the 1988/1989 project work when machinery will be working adjacent to the site. The work was postponed pending the peer review and formulation of plans for adjacent reaches. A log sill was placed below two double wing accelerators constructed in 1984. The objective of the sill is to provide a downstream control to stop headcutting and facilitate scour pool development by the accelerators. The sill will also create a plunge pool and should collect spawning gravel.

Monitoring of past project work was continued. Habitat was quantified in reaches where habitat rehabilitation work was completed. The habitat was also quantified throughout most anadromous stream reaches in the West Fork drainage as baseline information for future habitat work and project planning. Both Forest Service and BPA funds were used for the habitat evaluation. Results of the monitoring activities are contained in the Mt. Hood National Forest Monitoring Report found in the Appendix.

Spawning surveys were completed in Lake Branch, the upper mile of the West Fork Hood River, and McGee Creek. Of the 15 redds counted in Lake Branch, seven were associated with habitat rehabilitation structures. Steelhead redds were documented above RM 7.8 in Lake Branch and in McGee Creek for the first time in recent years.

Resting hole counts were not completed. Abnormally low water prevented snorkeling of the streams and made the surveys impractical.

A upper West Fork Hood River Fish Habitat Rehabilitation Plan has been completed and sent to BPA for approval. Efforts to develop a fish management plan for the Hood River are ongoing as part of the Northwest Power Planning Council's Columbia River Basin Planning process.

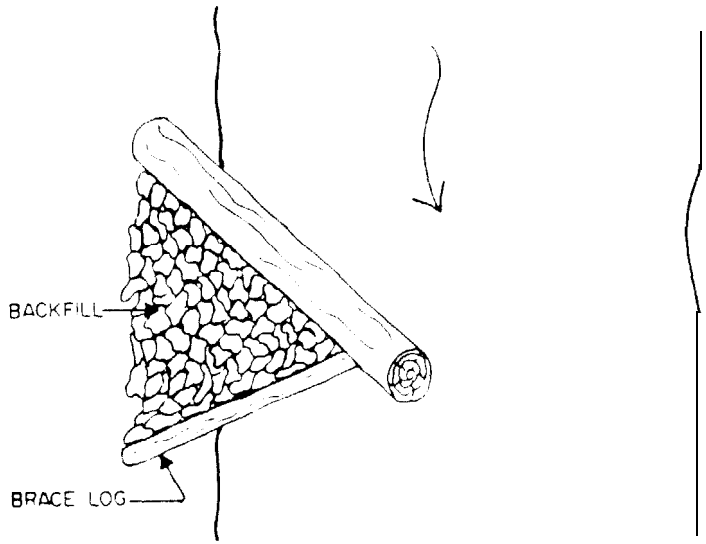
SUMMARY OF EXPENDITURES

Personnel	$24,603.93
Travel/Per Diem	134.07
Training	167.80
Cointract Costs	13,500.00
General Services	12.74
Expendable Equipment	3,944.58
GA Overhead	3,463.58
Total Project Costs	45,826.70

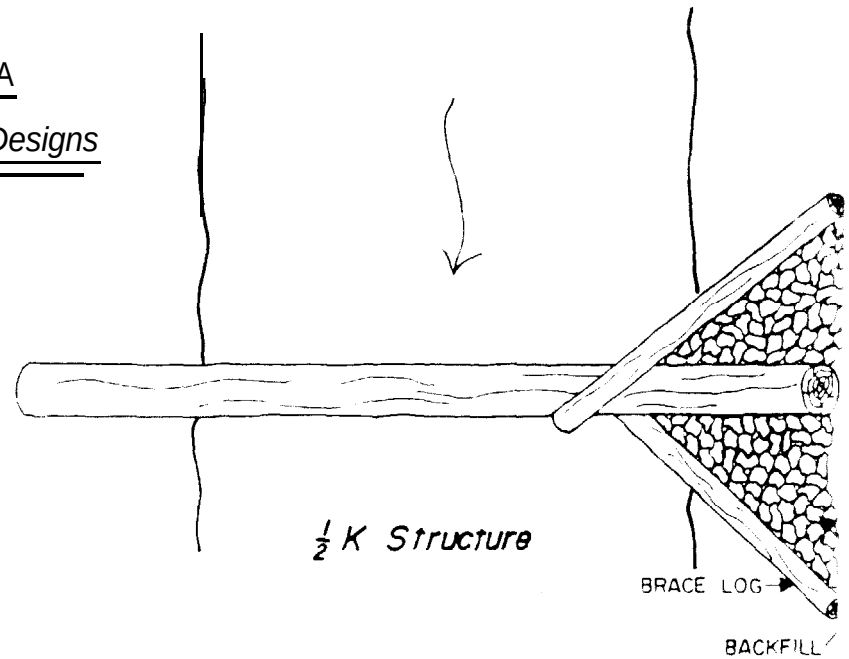
APPENDIX

APPENDIX A

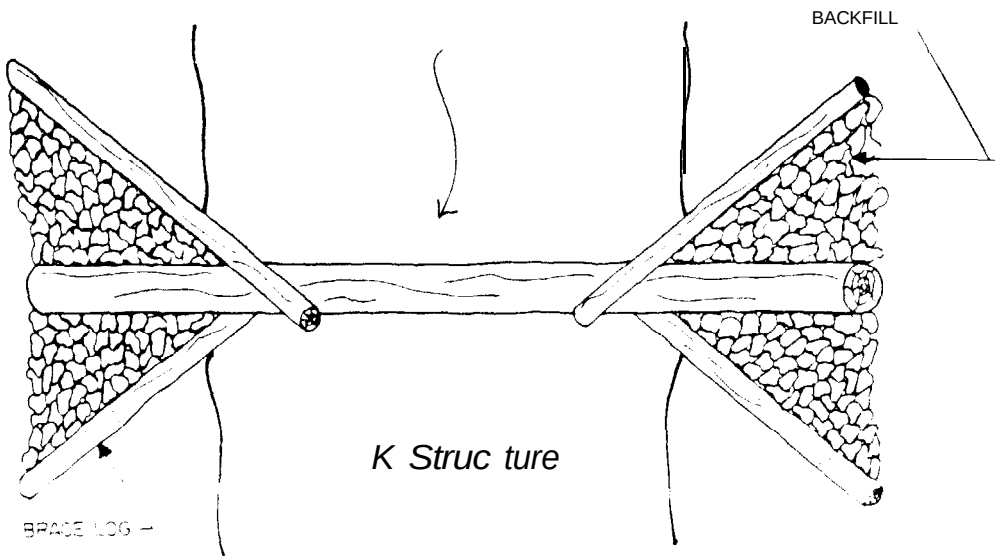
Typical Structure Designs



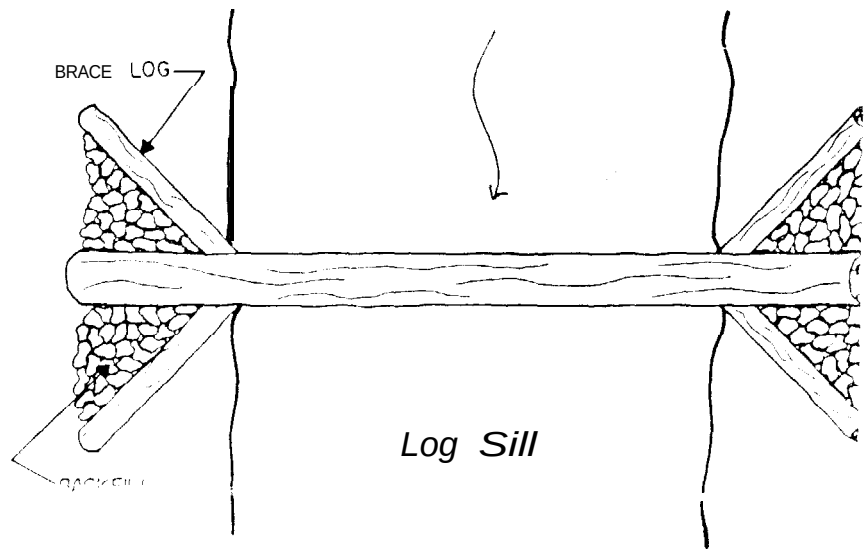
Double Log Wing



½ K Structure



K Struc ture



Log Sill

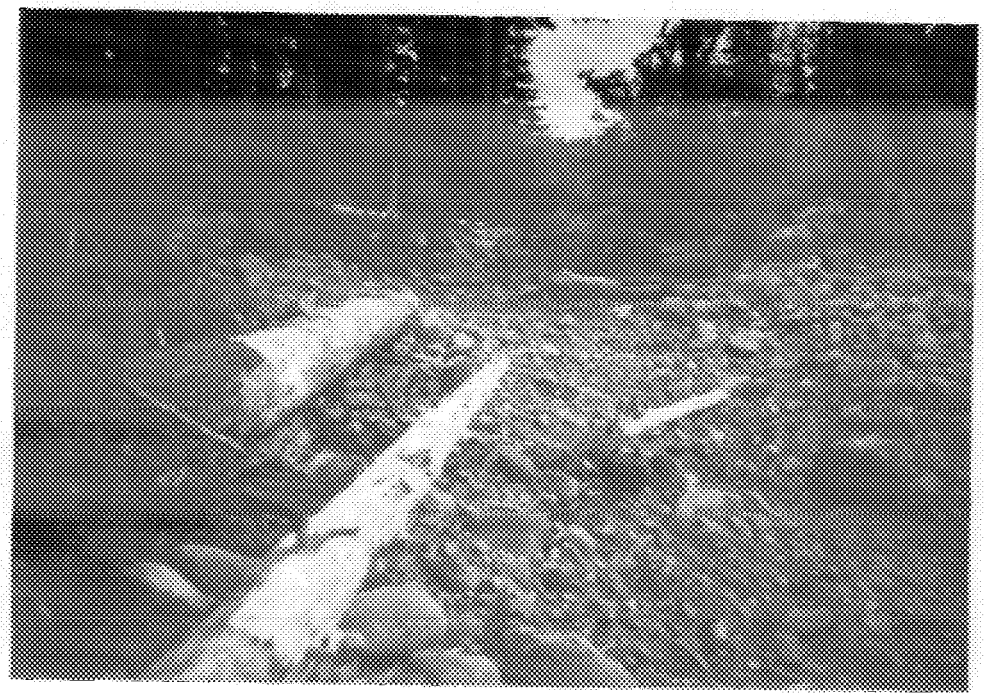
APPENDIX B

PHOTOGRAPHS

Before Work

After Silt Construction

Site 1/2 K—4 Before Work



Site 1/2 K After Constuction

APPENDIX C

WEST FORK HOOD RIVER
1986

Date	Distance Surveyed	Water Temp / Air Temp	Visi-bility	Flow	Weather	# Redds	# Adults	Comments
4/16	confluence of McGee& Elk to Ladd.		1	M	C	8	3	adults appear to be wild, winter fish.smolts numerous,mouth of June Cr.has good gravel.
	Ladd to Dry Run.					9	2	Difficult to snorkel,steep gradient.

1987

4/27	McGee & Elk Cr. l/4 mi.down		1	M	C	1	-	
5/8	Ladd Cr to McGee & Elk Cr.	44'f 64'F	1	M	C	3	-	

LAKE BRANCH

1986

Date	Distance	Water Temp	Visi-	Flow	Weather	#	#	Comments
4/16	RM 5.5 to RM 6.3	40'F 49'F	1	M	R	1	-	snorkle and walk redd seer in lower end of 1985 Reach I 2 groups of smolts
5/5	Skipper Cr. to NoName	41'F 43'F	1	M	O,R	2	-	gravel in log jam, (1 redd), jam not a barrier
5/6	NoName to l/4 mi.above Raker Pit Br.	40'F 50'F	1	M	C,O	5	-	

1987

4/21	RM 5.5-8.4		1	M	C	7	1	(snorkel) ,1 redd on 1984 sill& 1 on berms at RM 5.5
5/16	RM 5.4-7.8	44'F 68'F	l-2	M	C	15	-	3 redds on KV berms, 2 in Reach B, 1 above 1983 berm.

MCGEE CREEK

1986

Date	Distance Surveyed	Water Temp / Air Temp	Visibility	Flow	Weather	# Redds	# Adults	Comments
4/29	USFS Boundary up 1.3 mi.	38'F / 44'F	1	M	0			1 barrier at log jam between Reach B & C

1987

4/22	mouth up l/2 mi.	46'F / 67'F	1	M	C	-		
4/ 27	mouth up 2 mi.	45'F / 77'F	1	M	C	1	-	
5/8	mouth up 1‘5 ml.		1	M	C	1		

APPENDIX D

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FIFTEENMILE BASIN
HABITAT IMPROVEMENT PROJECT

By
Corey Sue Hutchinson, Fishery Biologist
Ken MacDonald, Fishery Biologist

Mt. Hood National Forest
Hood River Range District
Mt. Hood, Oregon

Funded by
Bonneville Power Administration
Division of Fish and Wildlife
Agreement Number: DE-AT79-84BP16726
Project Number: 84-11

March 1988

ABSTRACT

The Fifteenmile Basin Habitat Improvement Project is an ongoing multi-agent effort to improve habitat in the Fifteenmile drainage and increase production of the depressed wild, winter steelhead run. Cooperating agencies include Oregon Department of Fish and Wildlife, USDA Forest Service, USDA Soil Conservation Service, and Bonneville Power Administration, in consultation with the Confederated Tribes of Warm Springs.

The Oregon Department cf Fish and Wildlife is administering project work on state and private lands and the U.S.D.A. Forest Service is administering project work on National Forest land. Project work on the Forest has been sub-divided into four components; 1) Ramsey Creek 2) Eightmile Creek 3) Fifteenmile Creek 4) Fivemile Creek.

Forest Service activities in the Fifteenmile basin during 1987 involved hab tat, improvement work on Ramsey Creek, continuation of physical and biological monitoring, collection of spawning survey information, and macroinvertebrate sampling. The primary project objective on Ramsey Creek was to increase juvenile rearing habitat for l+ steelhead. Log structures including sills, diggers, wings, and diagonal series were placed at 28 sites. A total of 32 structures were constructed.

Project implementation will continue on Ramsey Creek in 1988 along with nontfnued watershed evaluation and identification of rehabilitation needs throughout the basin.

Complementary habitat improvement activities were implemented on Eightmile Creek with Forest Service funds. The project consisted of 25 log structures and about 40 boulders at 29 sites. Further work is planned for 1988.

AKNOWLEDGEMENTS

The authors would like to express their gratitude to the following people who provided assistance at various stages or throughout the project:

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Dave Heller	Fishery Biologist Mt. Hood National Forest Supervisors Office
Mike Lohrey	Hydrologist Mt. Hood National Forest Supervisors Office
Rick Ragan	Hydrologist Mt. Hood National Forest Hood River Ranger District

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INTRODUCTION

The Fifteenmile project is a multi-year fish habitat improvement effort aimed at increasing the wild run of winter steelhead in the basin. It is part of a joint Oregon Department of Fish and Wildlife (ODFW), USDA Forest Service, Mt Hood National Forest (Forest Service) effort, in consultation with the Confederated Tribes of Warm Springs, enhancement program in the Fifteenmile Basin. The majority of the project is funded by Bonneville Power Administration under the Northwest Power Planning Council's Fish and Wildlife program (Measure 703(C), Action Item 4.2). Fifteenmile Creek and the major tributaries, Eightmile Creek, Ramsey Cree k,and Fivemile Creek support the easternmost population cf wild winter steelheacl trout in the Oregon portion of the Columbia River Basin (Figure 1). The winter steelhead run is very depressed relative to historic levels and estimated potential production levels (Smith, et al., 1987).

Past enhancement efforts in the basin have included construction of instream structures and passage inprovements including an ODFW project to improve passage at a falls at the mouth of Fifteenmile Creek and Forest Service projects to provide passage at two culverts on Ramsey Creek. The Forest Service has also completed a road rehabilitation project on Fivemile and Ramsey Creeks to improve watershed condition. Instream structures were placed in Ramsey Creek in 1986 and 1987 on the National Forest with BPA funding and the Forest Service funded project work on Eightmile Creek in Eightmile Campground. The ODFW and USDA Soil Conservation Service were involved in rehabilitation of private agricultural lands following the 1974 flood. The Forest Service and ODFW have also been conducting spawning surveys, stream habitat surveys, and population surveys to better estimate current and potential anadromous fish production. The Forest Service, ODFW, and a biologist with the Confederated Tribes of Warm Springs completed for BPA in 1987, a detailed habitat rehabilitation implementation plan for Fifteenmile Basin. The plan includes background on the basin, factors limiting anadromous fish production, Rehabilitation strategy, and a discussion of project benefits.

Tasks identified to be completed under the 1987 work statement with BPA included:

1. Cooperate with ODFW, SCS, and the Confederated Tribes of the Warm Springs in the development of a fish habitat framework for the Fifteenmile Creek Basin. This plan would include species to be managed highlight and prioritize stream reaches needing rehabilitation, and establish a timeline to complete habitat rehabilitation projects.

2. Complete project, design and site layout for 1987 project work on Ramsey Creek.

3. Continue aquatic macroinvertebrate monitoring, in cooperation with ODFW.

4. Implement rearing habitat Improvement between RM 7.5-9.0 of Ramsey Creek. This work will include log sills,"K" weirs, wings, and cover logs. A minimum of 60 structures is anticipated.

STATE ENGINEER OF OREGON
WATERSHED PLANNING DIVISION

PROJECT MAP

F/F TEENMILE CREEK WATERSHED

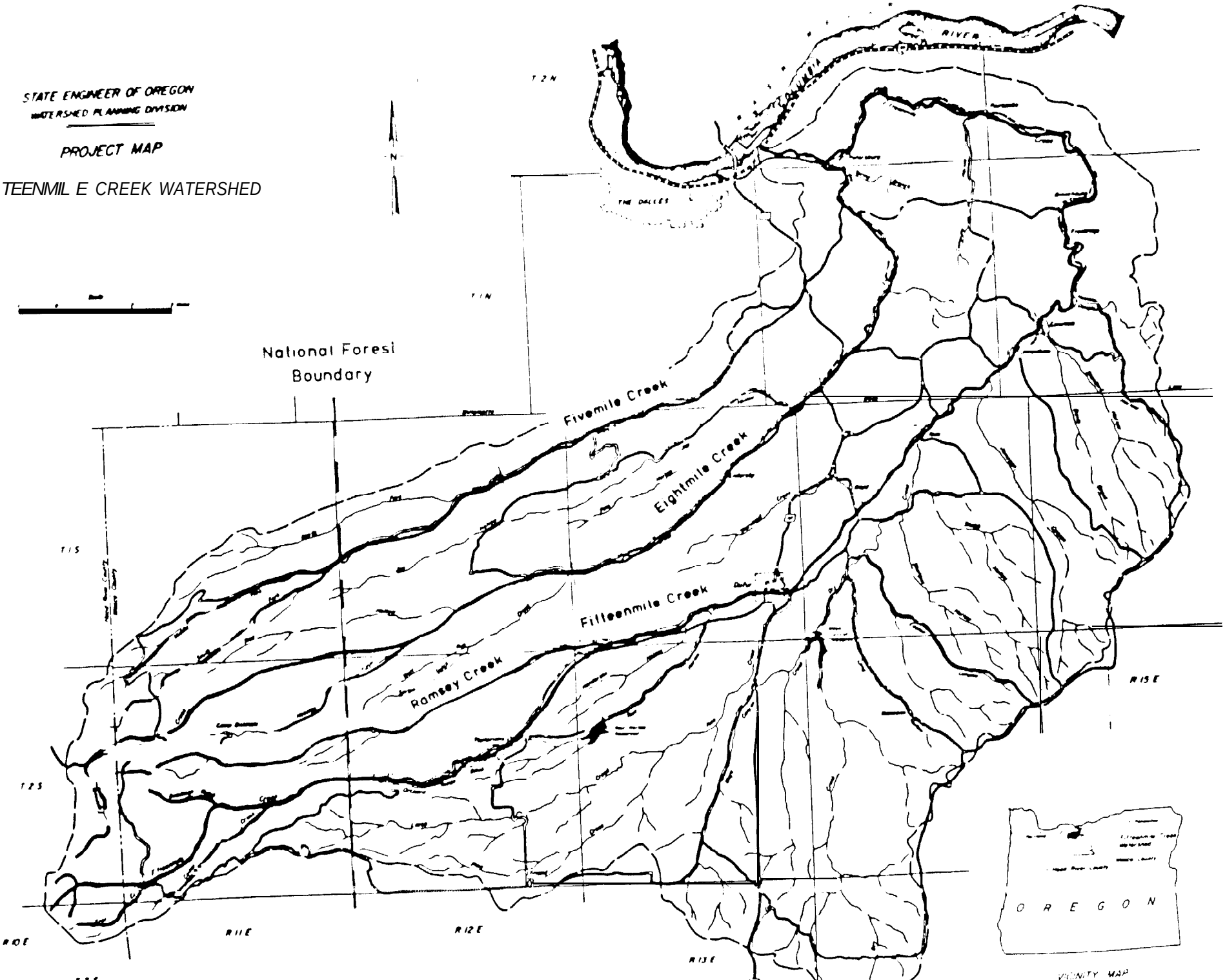


FIGURE 1

5. Complete the project plan for instream work to be implemented In 1988/1989.

DESCRIPTION OF PROJECT AREA

Fifteenmile Creek is a fifth order tributary to the Columbia River, entering the Columbia just downstream of The Dalles Dam. Fifteenmile Creek drains the northeast corner of the Ht. Hood National Forest. The upper third of Fifteenmile Creek and the above mentioned tributaries flow through National Forest land, while the lower reaches of the streams flow through private agricultural land. Fish habitat on National Forest land is generally rated as fair to good. Negative factors influencing habitat capability include low flow rearing habitat, locally limited spawning habitat, irrigation diversions, siltation, and passage obstructions. Anadromous fish habitat on the private agricultural land is severely limited by irrigation diversions, a lack of rearing habitat, poor spawning habitat, siltation, and high summer water temperatures. A detailed description of the basin and discussion of limiting factors may be found in the Fifteenmile Basin Implementation Plan (Smith et al, 1987).

The Forest Service portion of the Fifteemile Basin Project has been divided into four components.

1) Ramsey Creek
2) Eightmile Creek
3) Fifteenmile Creek
4) Fivemile Creek

Ramsey Creek

Ramsey Creek is a third order tributary to Fifteenmile Creek. The mouth is approximately 7.5 miles downstream of the National Forest Boundary. Project work on Ramsey Creek is currently being concentrated between RM 7.5-11.4. Instream structural work has been completed between RM 7.5-8.5 in 1986 and 1987; Reach B (Figure 3). According to a Forest Service stream survey (Kinney and Hutchinson, 1985), average fish habitat condition is rated as fair to moderate throughout the project area. Although there is a fairly balanced pool:riffle ratio (P:R= 4:6), existing pools are shallow with little effective cover. Twenty percent of total gravels are of suitable size class for anadromous spawning.

Shallow pool depth, little effective cover, and overall lack of diversity are limiting factors for rearing 1+ steelhead. Poor juxtaposition of pools to spawning gravels and several debris jams that could be migration barriers are other factors limiting fish production. Pool formation and gravel collection in Ramsey Creek Is dependant upon large woody debris. Past debris removal appears to have been a major factor in the degraded fish habitat between RM 7.5-11.4.

The objectives of improvement work are to increase the pool:riffle ratio to at least 5:5, increase effective cover and suitable spawning gravels, and improve passage at debris jams.

Eightmile, Fifteenmile, Fivemile Enhancement

Eightmile Creek is a fourth order tributary to Fifteenmile Creek, entering the mainstem below the National Forest boundary at about RM 2.7 of Fifteenmile Creek. The probable upstream limit of potential anadromous fish habitat is approximately RM 31.5. Fish habitat in Eightmile Creek is generally good within the National Forest boundary. Anadromous fish production potential appears to be limited by passage obstructions (log jams), locally poor low flow rearing habitat, and an unscreened irrigation diversion.

An instream habitat improvement project was implemented in Eightmile Campground (RM 29.5) during August, 1987. Objectives were to increase pool area and volume, and also increase habitat diversity and cover. Twenty-nine sites included construction of 25 log structures and placement of approximately 40 boulders. The project was funded by the Forest Service with money generated by adjacent timber sales under the KV Act.

Anadromous fish habitat condition on the National Forest portion of Fifteenmile Creek is generally rated as good, although habitat capability is suspected to be locally limited by the quality of spawning and rearing habitat. Fish habitat below the National Forest boundary is generally poor, as is true for the other streams in the basin. Below the Forest boundary, habitat is degraded by lack of instream structure, siltation, and poor riparian cover which has resulted in high summer water temperatures.

Habitat improvement is planned for Fifteenmile Creek in 1989. It is anticipated that treatment will include falling and blasting trees into the channel to increase instream cover, habitat diversity, and improve dispersal of spawning gravel. It is anticipated that approximately 80 structures in a three mile stretch will achieve the above goals.

Fivemile Creek is the northernmost tributary of the Fifteenmile system. Fivemile enters Eightmile Creek approximately 1.5 miles above the Eightmile/Fifteenmile confluence. The lower 18.2 miles of Fivemile Creek flow through private land. The confluence of the Middle and South Fork Fivemile is just upstream of the National Forest boundary at RM 18.4. The North Fork Fivemile enters Fivemile Creek below the Forest boundary and is intermittent on National Forest land.

Anadromous fish habitat on Fivemile is rated poor to fair. Major limiting factors appear to be low summer discharge, poor pool quality (shallow depth, little effective cover), and sparse spawning gravels. Irrigation withdrawals completely dewater the instream channel about two miles below the National Forest boundary for most of the summer. Future project work involving the addition of structures will provide low flow pool habitat and cover.

METHODS AND MATERIALS

Spawning Surveys

Spawning surveys of the Fifteenmile Basin were conducted during the month of April. Each stream was walked and number of redds and adult fish were tallied. Juveniles were counted where applicable and the presence of resident trout noted. Physical conditions such as relative flow, visability, and weather were noted. Air and water temperatures were also measured. The length of stream surveyed depended on whether fish or redds were present. The stream areas surveyed were the Bame as in 1986 (MacDonald and Hutchinson, 1987).

Macroinvertebrate Sampling

The Forest Service and ODFW, in 1986, contracted with Dr. Fred Mangum (Aquatic Ecologist, USDA Forest Service, Region 4), to establish a macroinvertebrate sampling program in the Fifteenmile Basin. Macroinvertebrates respond more rapidly than fish populations to changes in water quality, thus monitoring changes of macroinvertebrate populations should be a good indicator of changes in aquatic habitat as a result of habitat improvement work.

The Forest Service sampled sites on National Forest land and ODFW sampled sites or. private land. Samples were collected three times in 1987: early spring, during summer low flow, and in the fall. According to Dr. Mangum, it is best to sample in spring, summer,and fall for several years to develop baseline information. Sampling will continue in 1988. Sampling procedure and site locations were no different than in 1986 (MacDonald and Hutchinson, 1987).

Thermographs

Summer water temperatures in the lower portions of the Fifteenmile drainage can reach and maintain high levels. Temperatures in the 80 F range are common and a temperature of 85 F was recorded near the mouth of Fifteennile Creek in 1986. An objective of the Fifteenmile project is to improve riparian vegetation cover to lower summer water temperatures to 70 F at the mouth. Thermographs were placed throughout the basin in efforts to monitor temperature changes (Figure 2).

Oregon Department of Fish and Wildlife placed two thermographs in Fifteenmile Creek and one each in Eightmile and Ramsey Creeks. Water temperatures were monitored through October. The Forest Service placed thermographs in the headwaters and at the National Forest boundary on Fifteenmile, Eightmile, and Ramsey Creeks. A thermograph was placed at the National Forest boundary on Fivemile Creek. The water temperatures were monitored May through October on National Forest lands.

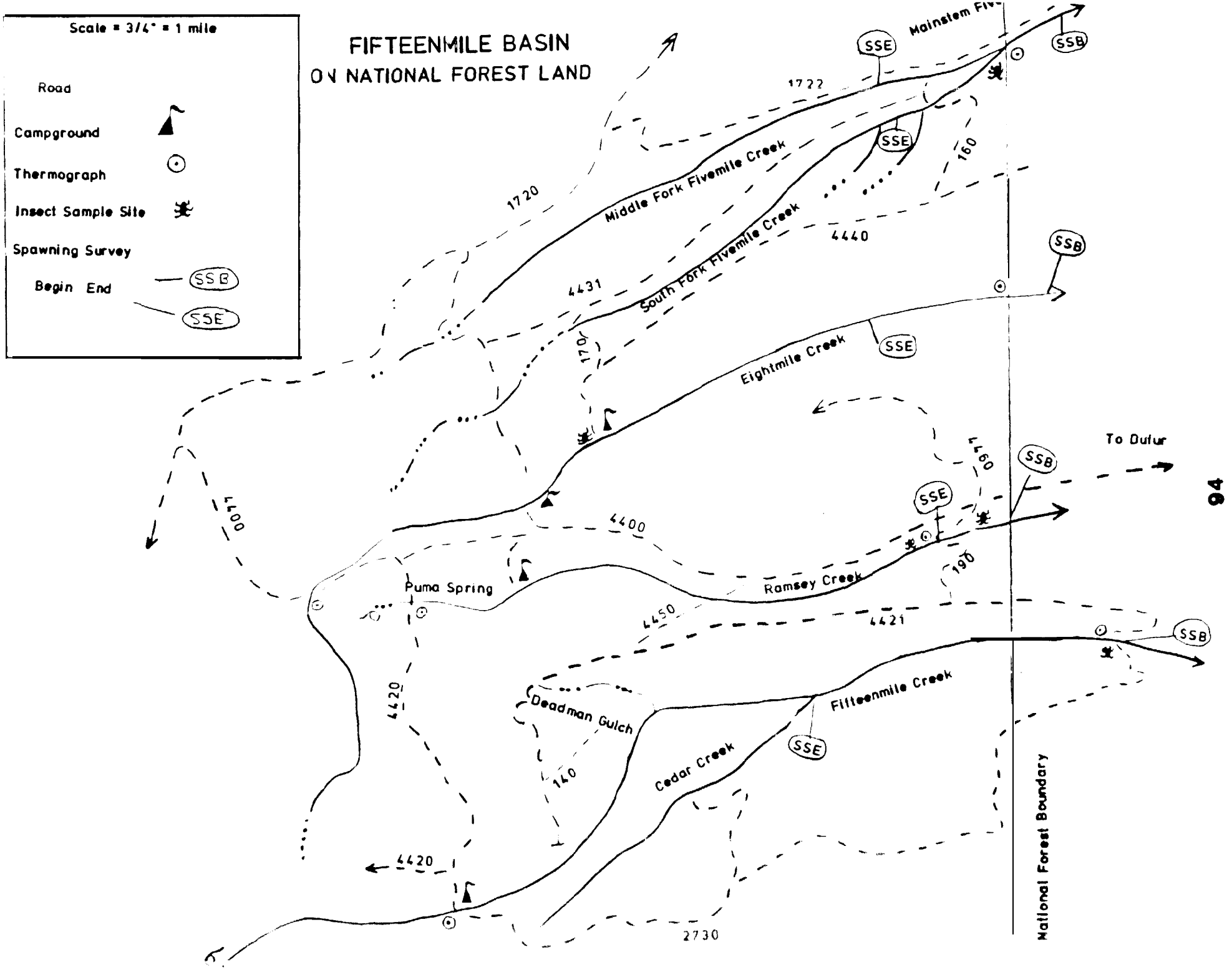

Scale = 3/4" = 1 mile
Road
Campground
Thermograph
Insect Sample Site
Spawning Survey
Begin End
SSB
SSE
FIFTEENMILE BASIN
ON NATIONAL FOREST LAND
Mainstem Fivemile Creek
Middle Fork Fivemile Creek
South Fork Fivemile Creek
Eightmile Creek
Puma Spring
Ramsey Creek
Deadman Gulch
Cedar Creek
Fifteenmile Creek
To Dufur
National Forest Boundary
1722
1720
4431
4440
4460
4400
4450
4421
4420
2730
160
170
190
140

FIGURE 2

Omnidata Datapod recorders were used at all sites except for the headwater site on Ramsey Creek and on lower Eightmile Creek. Peabody-Ryan thermographs were used in these two locations.

Physical and Biological Sampling

Project monitoring was continued for the second year on the National Forest. The objective of the monitoring is to gather baseline information on fish habitat In the basin, to monitor post treatment results, help identify limiting factors, and prioritize streams and reaches for habitat improvement. A full description of the monitoring procedures and results is contained in the Mt. Hood 1987 National Forest monitoring report.

Project Implementation

The objective of this project is to increase rearing habitat cabability by improving habitat diversity with instream structures (logs and boulders). The focus is to increase low flow pool/glide volume and effective cover for l+ and older winter steelhead. The instream structures are designed to create scour and plunge pools, accumulate spawning gravels, and provide cover.

Project work was completed under a Forest Service administered equipment rental contract. The contract specified a small track-mounted backhoe/excavator equipped with an opposable thumb along with an operator. The machine retained by the contract, a Kabota KH-28L, was fully capable of moving the necessary logs and excavating the channel. The opposable thumb is very helpful in placing logs and boulders. Unlike many small backhoes in the size class of the KH-28L, the Kabota is capable of a 360 degree pivot which is very valuable and reduces damage to riparian vegetation compared to a machine without the pivot capacity. Forest Service personnel directed the operator during construction and performed necessary hand labor.

Logs for construction were obtained from stream adjacent timber stands. Trees were selected, felled, linbed, and bucked to length by Forest Service personnel. Typical length of logs used was 20' and 24-36" diameter. Care was exercised so as not to diminish the potential for long term woody debris input. The logs were skidded to site by the backhoe. The short skid distance and capacity of the Kabota negated the need to use a skidder.

Structures Included log sills, diagonals, digger logs, "V" structures, and diagonal log series (see photographs). Log sills were placed either perpendicular to the flow or at 30-40 degree angles. The function of the sills was to create downstream plunge pools, collect gravel, or provide a downstream control to raise pool depth associated with an upstream structure. The height of pools acting as downstream controls was important to keep flow through the pool and not create a backwater situation as it is felt that plunge and scour pools are more productive for steelhead rearing than backwater pools. Diagonal

sills functioned the same as perpendicular sills, but were used to “divert” flows in a desired direction to concentrate low flow or enhance a natural condition such as an undercut bank.

Sills were generally anchored five to six feet into both banks for stability and excavated ends were rip-rapped. The upstream sides of the sills were lined with filter and hardware cloth to seal and prevent undercutting. In some cases, only hardware cloth was used as the structures sealed immediately, and the hardware cloth seemed to be sufficient to hold material to prevent undercutting. Plunge pools were excavated downstream of the sills to hasten pool development. Spoils from excavation were used to rip-rap sill ends and protect excavated banks. Large boulders were usually placed in excavated pools to provide additional cover.

Digger logs (see photographs) were anchored into the banks In the same manner a8 log sills. Instead of being placed in the low flow channel, diggers were constructed to bridge the low flow channel but force higher flows under the log to create a scour pool and provide overhead cover.

Diagonal series (see photographs) were used to increase diversity, creating a plunge pool/scour pool complex with woody cover. The series consisted of two or more logs in combination. The first log was a diagonal sill constructed as described above. The next logs would either be sills or diggers, or act as a combination of sill and digger. Logs were anchored into the banks as described above and anchored to each other using l/8” strap iron as a brace and four to six inch lag bolts. Connecting logs were notched to provide a “better fit”. The diagonals were set at 30 to 45 degree angles downstream to the flow.

Several upstream "V" structures were constructed to create plunge pools. The structures consisted of two logs angled upstream at an approximately 45 degree angle from each bank, meeting in the middle. The vertex is lower in elevation than the ends to concentrate flow. The upstream side was lined with hardware and filter cloth as in a sill, and logs were joined with angle iron and lag bolts (see photographs).

All sites were accessed by walking the machine through stream adjacent timber. The small machine was very maneuverable and only brush species and very small conifers were damaged. The brush is expected to recover rapidly.

Ramsey Creek Project Implementation

Thirty-two structures were constructed at twenty-eight sites. The project area was a continuation of work started in 1986 between RM 7.5-8.4 (Figure 3-Reach B; see MacDonald and Hutchinson, 1987). Structures included 14 log sills, 5 digger logs, 5 wings, 2 upstream "V"s, 3 diagonal series, 2 “K” sills, and boulder placements . Four debris jams were modified to improve passage.

All tasks were completed except work planned for implementation in 1987 upstream of RM 8.4 (Reach C). The reasons were numerous days when the machine was shut down due to fire precaution measures. Also, machine breakdowns and expiration of the contract contributed to the delay in implementing project work above RM 8.4.

Project work on Ramsey Creek, including sites not completed in 1987, is planned between RM 8.5-11.4 for 1988. Machine access is feasible between RM 8.5 and approximately RM 9.3 where 43 sites have been identified. Tree falling and handwork will occur at 25 sites between RM 9.3 and approximately RM 10.3. Plans for machine placed structures below the 4450 (RM 10.8) road have identified ten sites. Above the 4450 road the machine is accessable to approximately ten sites (Reach A). Between the upper limit of machine access and Iceberg Lake, tree falling and hand work is planned at seven sites.

Eightmile Creek Implementation

Instream habitat improvement work was accomplished in the Eightmile Campground (RM 29.5) using Forest Service funds. Forty boulders and 25 log structures similar to those in Ramsey Creek were placed at 29 sites. The small Kubota backhoe was used, and very minimal damage occurred in the campground.

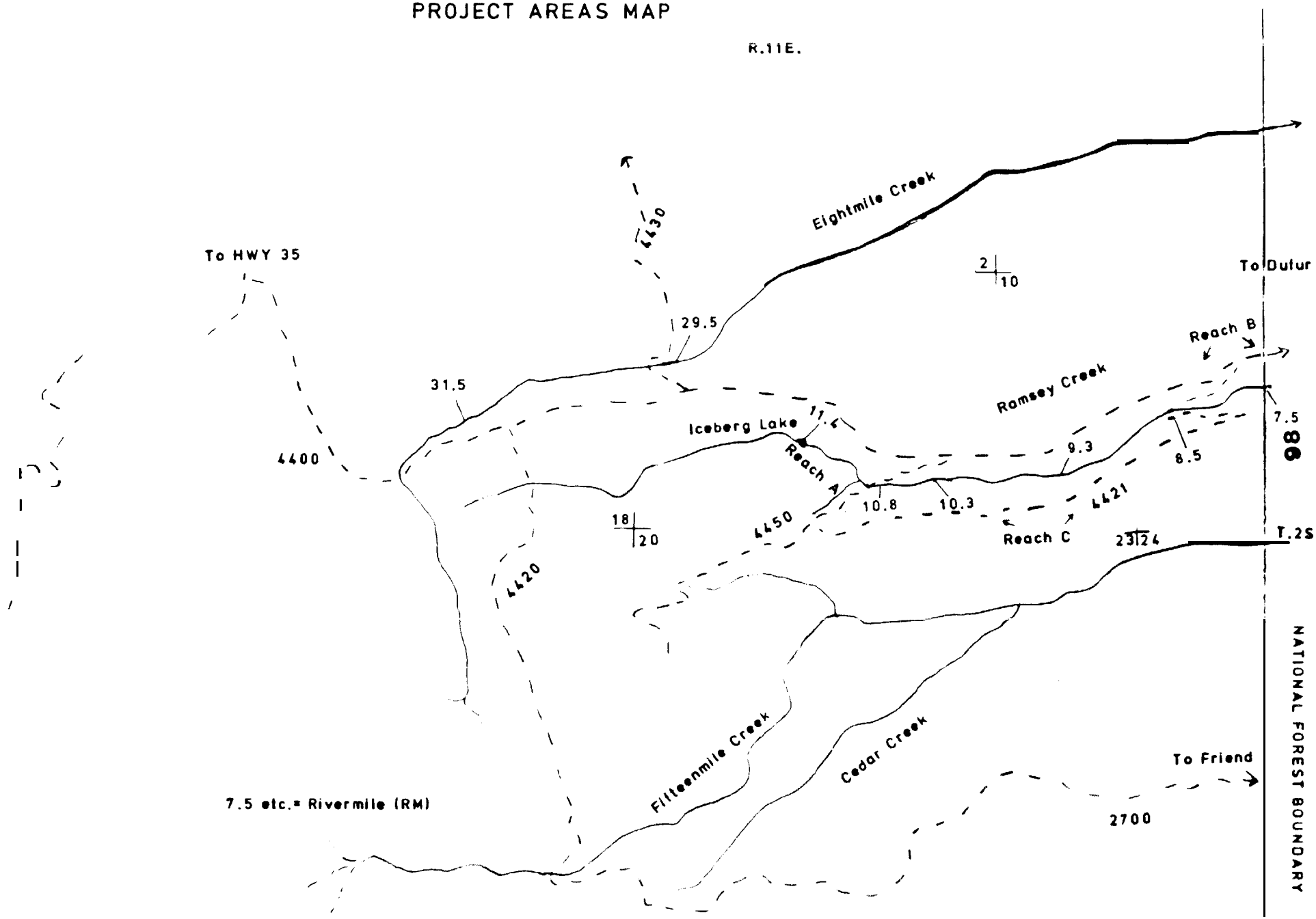
Spawning Surveys

Spawning surveys were conducted within the National Forest boundary of the Fifteenmile Basin for the third year (Appendix C).

In 1985 no adult steelhead or redds were observed in the Fifteenmile Basin above the National Forest boundary. In 1986, steelhead and redds were observed above the Boundary in Fifteenmile Creek on two occasions. During 1987, four redds were seen above the National Forest boundary and three fish and seven redds were seen within a mile below the boundary on Fifteenmile Creek.

FIFTEENMILE BASIN

PROJECT AREAS MAP



On Ramsey, Eightmile and Fivemile Creeks, no fish or redds had been recorded on National Forest in 1985 or 1986. One redd was observed in 1987 on Ramsey Creek. Several fish and redds have been noted just below the Forest Boundary on Eightmile and Ramsey Creeks in 1986 and 1987. The spawning surveys were conducted fairly early in the run (April), thus some fish and redds resulting from a later component of the run may have been missed.

Macroinvertebrate Analysis

The 1987 report from the macroinvertebrate analysis lab at Brigham Young University is presently unavailable although results from the 1986 report have been received (Appendix B). The five sample sites on the National Forest indicate a good to excellent Biotic Condition Index (BCI) (Mangum, 1985). On lands below the National Forest, the BCI ranges from poor to good. The BCI is an index that reflects the condition of aquatic, riparian, and sometimes terrestrial habitat, Sections of stream that have a poor BCI are indicative of a habitat which has been degraded below its potential capacity to produce diverse aquatic communities and support fish populations.

Water Temperature Monitoring

Water temperature results for 1986 and 1987 show that water temperatures leaving the National Forest throughout the Fifteenmile Basin are quite cool. The highest temperature recorded for either year was on Fifteenmile Creek. In July of 1987, the maximum water temperature was 18.0 C (64.4 F) but this was only for one day (monthly average was 13.1 C). Eigh tmile, Ramsey and Fivemile Creeks had maximum temperatures of 14.0,,15.5 and 15.5 C, respectively (Appendix D).

Continuous data for the entire monitoring period was not possible due to thermograph failure (Data Pods and Ryan-Peabodys), stolen thermographs, and problems with the temperature analysis program. The majority of data is complete except for Eightmile Creek at the lower station.

Physical and Biological Monitoring

Results of the physical and biological monitoring may be found in the Monitoring and Evaluation of Mt. Hood National Forest Stream Habitat Improvement and Rehabilitation Projects: 1987 Annual Report (Forsgren, Heller, and Ober, 1988).

SUMMARY AND CONCLUSIONS

Ramsey Creek

Habitat improvement work was completed from RM 7.5 to 8.5. Work included 32 structures at 29 sites. Similar work is planned for 95 sites between RM 8.5 and RM 11.4 in 1988. Sixty-three sites are accessible by machine, the remaining are tree falling and handwork sites. A plan was completed to finish project work on Ramsey Creek in 1988.

Spawning surveys and project monitoring were completed in Ramsey Creek. Monitoring included quantification of physical habitat throughout the stream.

Fifteenmile, Eightmile, and Fivemile Creeks

A final Fifteenmile Basin Fish/Habitat Rehabilitation Implementation Plan was completed and approved by BPA. The management plan is on-going and will incorporate results of survey work and monitoring completed by ODFW and the Forest Service in 1986 and 1987. The plan includes species emphasis, habitat deficiencies, and production goals of stream reaches.

Spawning surveys and baseline monitoring of habitat and production were completed. The monitoring consisted of physical habitat measurements. Macroinvertebrate samples were collected three times during the year and sent to Fred Mangum for analysis. Results are included in the Appendix.

Most planning activity focused on Ramsey, and project work will continue in 1988. An instream habitat improvement project for Eightmile Creek was accomplished in Eightmile Campground with Forest Service funding in 1987.

Initial scoping for Fifteenmile Creek projects was begun and further planning, will continue in 1988.

1987 SUMMARY OF EXPENDITURES

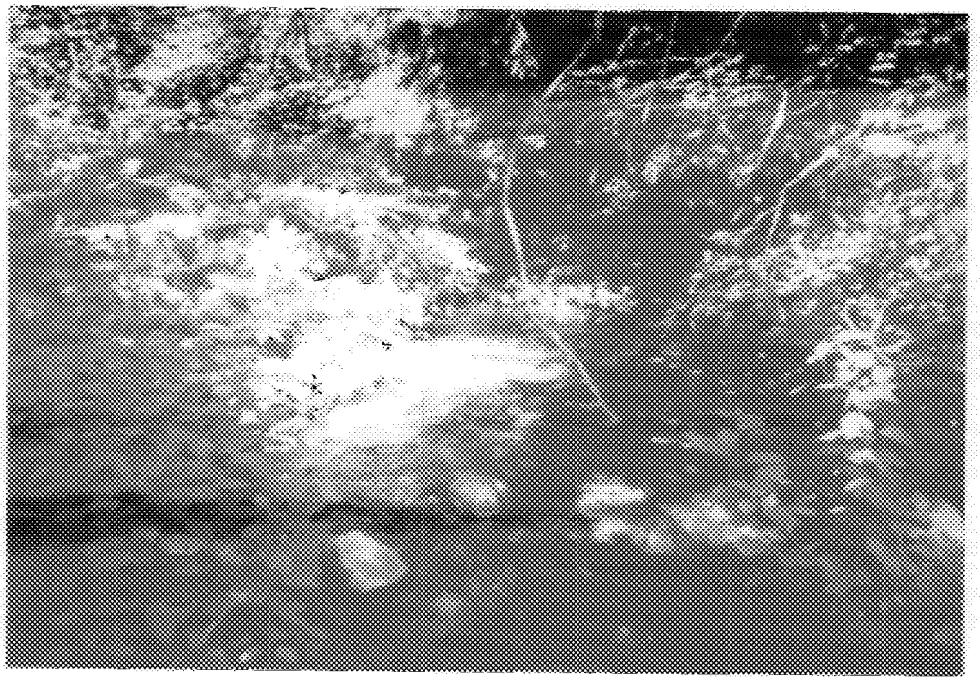
Personnel	$19,148.41
Travel/Per Diem	452.96
Training	39.02
Contract Costs	6,454.26
Expendable Equipment	2,309.20
GA Overhead	2,633.96
Total Project Costs	$31,037.81

APPENDIX

A. Photos of Ramsey Creek Implementation
B. Data Macroinvertebrate Analysis
C. Spawning Survey Data
D. Temperature Data
E. Literature Cited

APPENDIX A

PHOTOGRAPHS



Typical Shallow Riffle

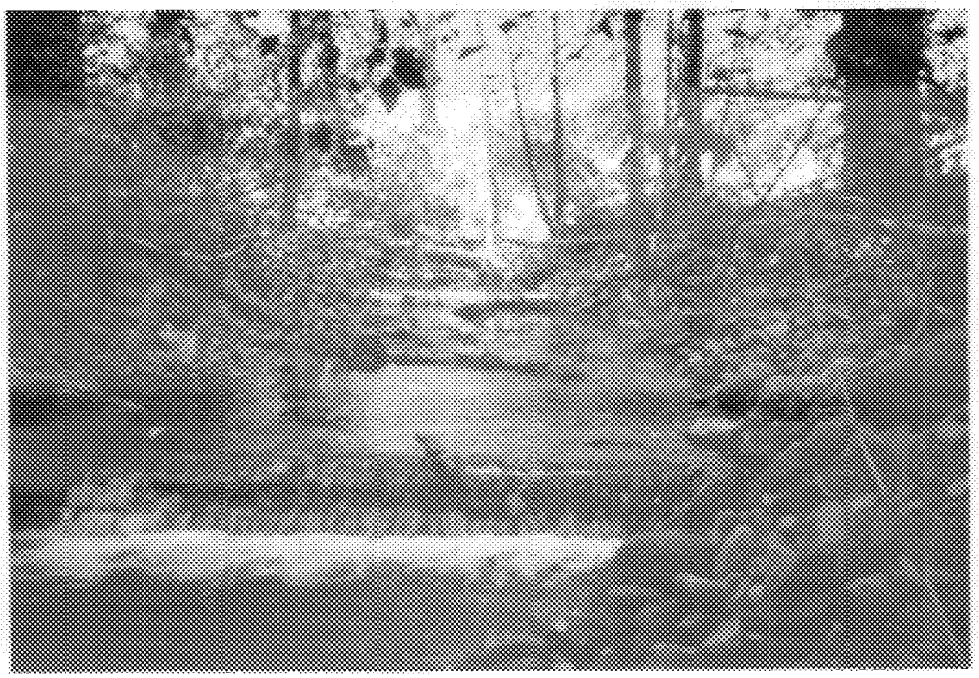
Kubota Backhoe Placing Structure Log

Two Deflector Wings and Cover Log

"K" Sill Structure

Sill, Digger & Cover Log Combo

Upstream "V"



Digger and Sill Combo

Digger Log With Boulders

"K" Sill Structure

Sill, Digger &Cover Log Combo

USFS - INTERMOUNTAIN REGION - ANNUAL PROGRESS REPORT

MACROINVERTEBRATE ANALYSIS

Prior to field season fill in Sections A and C for each stream that will be sampled and forward to:

Aquatic Ecosystem Analysis Laboratory
105 Page School
Brigham Young University
Provo, Utah 84602

A. Investigator Dave Heller/Ken McDonald/Harvey Forsgren

Forest/District Mount Hood National Forest

Stream 8-MILE CREEK

State/County Oregon, Wasco County

Forest Service Cat. No.

B.

Station	Date(s)	Diversity Index DAT (mean)	Standing Crop g/m^2 (mean)	Biotic Condition Index BCI 50	No. of taxa
(mouth) 1	9-24-86	14.3	0.5	66	31
(abv HW 197) 2	9-24-86	7.5	0.3	59	21
(rd 4440) 3	9-18-86	27.4	1.2	94	40
1	11-13-86	12.0	0.5	64	25
2	11-13-86	15.2	0.5	74	27
3	11-4-86	25.6	0.7	82	42

Scale:	DAT	Standing crop	BCI
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

USFS - INTERMOUNTAIN REGION - ANNUAL PROGRESS REPORT

MACROINVERTEBRATE ANALYSIS

Prior to field season fill in Sections A and C for each stream that will be sampled and forward to:

Aquatic Ecosystem Analysis Laboratory
105 Page School
Brigham Young University
Provo, Utah 84602

A. Investigator Dave Heller/Ken McDonald/Harvey Forsgren

Forest/District Mount Hood National Forest

Stream 15-MILE CREEK

State/County Oregon, Wasco County

Forest Service Cat. No.

B.

	Station	Date(s)	Diversity Index DAT (mean)	Standing Crop g/m^2 (mean)	Biotic Condition Index BCI 50	No. of
(mouth)	1	9-23-86	9.9	5.0	54	22
(Wr. Bridge)	2	9-22-86	5.2	0.5	54	12
(p. station)	3	9-22-86	11.2	6.2	83	26
(intake)	4	9-22-86	15.7	0.9	83	32
(upper)	5	9-17-86	25.9	2.3	94	45
	1	11-14-86	11.9	4.0	61	32
	2	11-13-86	6.8	0.8	57	2
	3	11-12-86	17.7	4.7	82	3
	4	11-12-86	17.7	0.6	90	3
	5	11-4-86	23.5	1.2	93	3

Scale:	DAT	Standing crop	BCI
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

USFS - INTERMOUNTAIN REGION - ANNUAL PROGRESS REPORT

MACROINVERTEBRATE ANALYSIS

Prior to field season fill in Sections A and C for each stream that will be sampled and forward to:

Aquatic Ecosystem Analysis Laboratory
105 Page School
Brigham Young University
Provo, Utah 84602

A. Investigator Dave Heller/Ken McDonald/Harvey Forsgren

Forest/District Mount Hood National Forest

Stream 5-MILE CREEK

State/County Oregon, Wasco County

Forest Service Cat. No.

B.

Station	Date(s)	Diversity Index DAT (mean)	Standing Crop g/m^2 (mean)	Biotic Condition Index BCI 50 No. o
(ab HW 197) 1	9-24-86	7.6	0.5	57
(blo 4431) 2	9-18-86	26.2	0.3	92
1	11-13-86	11.9	8.7	62
2	11-13-86	21.8	6.9	88

Scale:	DAT	Standing crop	BCI
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

USFS - INTERMOUNTAIN REGION - ANNUAL PROGRESS REPORT

MACROINVERTEBRATE ANALYSIS

Prior to field season fill in Sections A and C for each stream that will be sampled and forward to:

Aquatic Ecosystem Analysis Laboratory
105 Page School
Brigham Young University
Provo, Utah 84602

A. Investigator Dave Heller/Ken McDonald/Harvey Forsgren

Forest/District Mount Hood National Forest

Stream RAMSEY CREEK

State/County Oregon, Wasco County

Forest Service Cat. No.

B.

Station	Date(s)	Diversity Index DAT (mean)	Standing Crop g/m^2 (mean)	Biotic Condition Index BCI 50	No. of tax
(Ems. pl.) 1	9-22-86	9.7	1.1	77	26
(abv. jam) 2	9-10-86	19.7	0.7	94	36
(abv. culv.) 3	9-10-86	23.4	1.0	86	39
1	11-12-86	10.7	0.9	79	26
2	11-4-86	24.3	0.7	96	41
3	11-4-86	23.7	2.2	96	38

Scale:	DAT	Standing crop	BCI
Excellent	18 - 26	4.0 - 12.0	above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 - 1.5	72 - 79
Poor	0 - 5	0.0 - 0.5	below 72

1987 SPAWNING SURVEYS

Fifteenmile Creek

Date	Distance Surveyed	Water temp / Air temp	Visibility	flow		#		
4/5	Below 4421 bridge to 0.5 miles above USFS Boundary.	42°F 68°F	1	mod to low	C	7	1	2 redds on Forest 1 fish .5 mi.below boundary
4/21	4421 xing to USFS Boundary.	44°F 68°F	1	mod	C	-		juvenile trout seen
4/28	4421 xing to 1 mile above USFS Boundary.	45°F 57°F	1	mod	C	4	2	2 redds above the boundary

Ramsey Creek

4/5	USFS Boundary to 190 xing.	40°F 85°F	1	low	C	1	-	
4/21	"	41°F 69°F	1	mod	C	-		juvenile trout seen
4/29	"	48°F 66°F	1	mod	C	1	-	same redd

Eightmile Creek

4/20	1 mile below USFS Boundary.	39°F 57°F	1	mod	C	juvenile trout been
4/29	"	45°F 57°F	1	mod	C	

KEY: Visbility I = Can see well into pools and riffles Weater - C = Clear

USFS TEMPERATURE DATA
1987
(`C)

Fifteenmile Creek
(At Upper Site)

MONTH	MAX	MIN	AVE
MAY (28-31)	5.5	2.0	3.7
JUNE	10.0	1.5	6.0
JULY	11.0	4.5	7.2
AUG	11.0	4.0	7.9

Fifteenmile Creek
(At Lower Site)

MAY(28-31)	9.5	5.5	7.4
JUNE	17.5	5.0	10.9
JULY	18.0	9.5	13.1
AUG	17.5	10.0	13.7
SEPT	17.0	8.0	12.6

Eightmile Creek
(At Upper Site)

JULY	10.0	3.5	6.3
AUG	10.5	2.5	7.3
SEPT	11.5	2.0	-
O C T	7.0	.05	3.3

Eightmile Creek
(At Lower Site)

SEPT(16-20)	11.0	7.0	-
OCT	9.5	3.2	-

1987 TEMPERATURE DATA CONT.

Ramsey Creek
(At Lower Site)

MONTH	MAX	MIN	AVE
MAY(27-31)	9.5	5.5	7.4
JUNE	15.0	4.5	9.9
JULY	15.5	8.0	11.0
AUG(l-10)	14.5	8.0	11.2

Ramsey Creek
(At Upper Site)

JUNE	6.5	3.8	4.4
JULY	7.8	3.5	5.3

Fivemile Creek

MAY(27-31)	9.0	6.5	7.8
JUNE	15.5	5.5	10.4

1986 TEMPERATURE DATA

Fifteenmile Creek (At Upper Site)

MONTH	MAX	MIN	AVE
JUNE(26-30)	8.0	5.0	6.7
JULY	9.0	3.0	6.5
AUG	10.5	6.5	8.7
SEPT	9.5	4.0	6.4

Fifteenmile Creek (At Lower Site)

AUG	16.0	13.0	14.8
SEPT(l-16)	13.0	11.0	11.7

Eightmile Creek (At Upper Site)

MAY(24-31)	6.8	3.5	-
JUNE	8.5	3.5	-
JULY	8.5	3.5	-
AUG	9.2	5.0	-
SEPT	8.5	3.0	-

Eightmile Creek (At Lower Site)

JUNE	14.5	6.0	-
JULY	19.0	7.0	-
AUG(25-31)	17.5	10.0	-
SEPT(l-13)	14.5	3.5	-

1986 TEMPERATURE DATA CONT.

Ramsey Creek
(At Upper Site)

MONTH	MAX	MIN	AVE
MAY(23-31)	8.0	6.0	-
JUNE	8.0	6.0	_
JULY(l-11)	8.0	6.0	-
AUG	11.0	7.5	-
SEPT	10.5	6.0	-

Ramsey Creek
(At Lower Site)

JUNE(26-30)	13.0	a.0	-
JULY(1-16)	14.5	a.0	-

Fivemile Creek

JUNE(2-6)	12.5		
JULY	15.0	9.0	-
AUG(1-20)	17.0	11.0	-

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