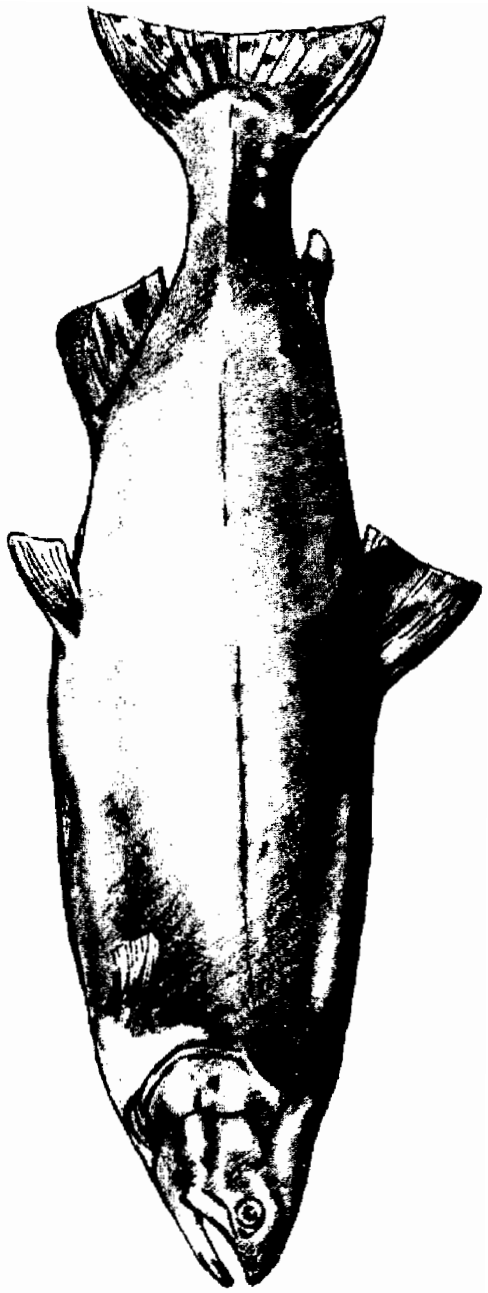


Chapter II—Need for Action

INTRODUCTION

This document addresses and focuses on only one need--reduction of salmon and steelhead loss at Savage Rapids Dam.

There has been a longstanding recognition of fish passage problems at Savage Rapids Dam. Little was known about the specific needs of the various species migrating in the Rogue River at the time the dam and the first fish ladder were built. Consequently, fish passage was far from adequate. Mortality of upstream migrating adult fish and downstream migrating smolts was high. Smolts were especially vulnerable as they were swept through the operating turbines, swept over the top of the dam onto rocks and concrete below, or diverted into irrigation canals and open fields.

Concern for fish has resulted in a notable spirit of cooperation among Federal, State and local entities, organized fishing groups, and private citizens. Volunteers have spent many hours working with biologists, engineers, and construction workers to improve the fish passage facilities. All of these efforts have helped to reduce mortalities. But, there are still significant opportunities to further improve fish passage. Under ideal circumstances, state-of-the-art facilities are capable of passing almost 99 percent of the migrating fish and smolts.

FISH AS A NATIONAL RESOURCE

Water Resources Development Act

The Water Resources Development Act of 1986 (P. L. 99-662) provides a framework for interpreting the intent of Congress regarding national resources that might be associated with Federal water resource projects. Title 9, section 906e defines two categories of national resources:

- Those resources addressed by treaties of the United States, and
- Anadromous fish.

Anadromous fish found in the Pacific Ocean off the west coast of North America can travel great distances north and south from their streams of

origin. Because of the proximity of Canada and the United States, Canadian fish are often found in U.S. water and U.S. fish are often found in Canadian waters. Management of the Canadian harvest can be crucial to U.S. anadromous fish and vice versa. As a result, the anadromous fish found in these waters are the subject of a United States/Canadian fishing treaty.

The anadromous fish of the Rogue River fit both categories of national resources defined in P.L. 99-662. As a national resource, the anadromous fish of the Rogue River are worthy of every consideration to preserve and enhance their viability and to prevent them from becoming threatened or endangered.

Other Considerations

Poor fish passage at Savage Rapids Dam is only one of many factors that affect fish populations in the Rogue River. Most of the complex factors that affect salmon and steelhead populations are not within the purview of this study but should be recognized in any planning effort. These include fresh water habitat loss, forest management practices that may affect sedimentation or water temperatures, gravel mining, boating, passage at Gold Ray Dam and other upstream dams, harvest rates in fresh water and in the ocean, hybridization of wild and hatchery fish, predation, and general ocean conditions.

Considering the problems confronting salmon and steelhead in the Rogue River, a united front is needed to help protect and maintain the diversity and genetic integrity of the individual stocks of wild fish. Efforts to improve passage at Savage Rapids Dam will complement several region-wide conservation efforts to restore fish populations to sustainable levels. For example, on the Federal level, the President's Forest Plan of ecosystems management of forests within the range of the northern spotted owl will contribute to improved habitat conditions for fish as will the Fish and Wildlife Program of the Columbia River Basin under the Pacific Northwest Electric Power Planning and Conservation Act (P.L. 96-501). On the State level, Oregon has adopted model watershed restoration efforts for the Grande Ronde basin and the southern Oregon coast.

FISH PASSAGE

A detailed description of needs associated with fish passage at Savage Rapids Dam is presented in several documents (Reclamation 1974, 1976, and 1979 and USFWS 1990, 1994). That information is summarized here.

Fish Passage Construction History

The north fish ladder was completed was in 1921 at the same time as the dam was completed. The Oregon State Game Commission built the south fish ladder in 1934.

As early as 1928, recommendations for screening the turbines were submitted. Early attempts were not only expensive but failed to protect fish. Downstream migrating salmonids passed through turbines and pumps until 1958.

In 1941, State Game Commission field agents stressed the high priority of fish protection screens. Six years later, the commission began intensive investigations of fish losses. These investigations showed 14 to 38 percent mortality rates, depending on the size of the fish. The commission claimed a conservative estimate of 210,000 fish lost annually in the Tokay and South Highline Canals along with additional losses from injured fish passing through the hydraulic turbines.

Plans for a link-belt screen were completed in 1950 and incorporated in a 1951 Reclamation report (Reclamation 1951). However, the 82d Congress did not provide funds for fish screens. Construction of radial gates in 1954 required cofferdams to block and divert riverflow. This action blocked the spring chinook salmon run at the time. In addition, the base of the cofferdam remains in the river below the tailrace on the north side of the dam and maintains a pool level in the tailrace that is 24 inches too high for the entrance to the northside ladder. This combined with the 800-cfs discharge from the turbines which masks the north ladder entrance, results in an inadequate entrance attraction flow.

The 85th Congress appropriated $208,000 (P.L. 85-641) on a nonreimbursable basis to construct and install vertical traveling screens on the previously unscreened hydraulic turbines. Reclamation completed this project in April 1958. Thus, the 1958 irrigation season marked the first time since 1921 that downstream migrants were protected from losses in the turbine and pumping system. Some gaps in the screen structure were discovered and filled late in 1958. However, fish passage problems still remained. The velocity of flows moving through the screens and into the turbine bays was too great for many of the smaller fish to resist. These migrants were impinged (pushed) against the upstream face of the screen and injured or killed. A 1960 investigation further revealed that numerous gaps in screen side seals caused turbulence and backflows in front of the side seals and next to the bypass ports, which attracted fish away from the bypass ports and through the side seal gaps where they were then flushed through the turbines, suffering high mortality rates.

In 1971-73, Reclamation studied interim fish passage improvements. Congress authorized these interim improvements in 1974. In 1976, the final environmental statement (Reclamation 1976) for these interim improvements was filed with the Environmental Protection Agency (EPA). Some of these improvements, including new bulkhead gates, modifications on the south fishway, and new fish screens, were completed in 1981. In 1984, the fisheries study was deferred due to uncertain hydropower development on the Rogue River.

In 1986, minor modifications were made to the south fish ladder by local fishery groups under the overview of ODFW.

Migration Losses

By the mid-1960's, and after 19 years of investigation, ODFW became convinced that Savage Rapids Dam caused more fish passage damage than any other single factor on the Rogue River. Fish counting data resulted in the determination that runs using the river above Savage Rapids Dam declined, while runs below the dam increased. In 1981, the USFWS estimated that elimination of all fish passage losses at Savage Rapids Dam would result in a 22 percent increase in fish escapement at the site. The USFWS considers that estimate to be still valid today.

View of Savage Rapids Dam looking north at full pool elevation with flow over the crest.

View of Gravity Canal showing rotary drum fish screens.

Upstream Migration

Other than removing the dam, fish ladders are the only practical solution to provide a way for anadromous fish to continue their upstream migration. However, at present, the fish ladders do not function through a wide enough range of flows and conditions to adequately accommodate the year-round migration of several anadromous fish species.

North Fish Ladder.—The north fish ladder operates only during the irrigation season and is generally inadequate. Few fish use it due to insufficient attraction flows, improper entrance location, inability to control flows in the ladder, sediment and debris in the ladder, and shallow pool depth. Turbulence caused by discharge flows of about 800 cfs from the turbines occurs next to and under the ladder entrance and masks the ladder attraction flows.

South Fish Ladder.—The south fish ladder is a combination of pools and a fish ladder. This fishway is the primary anadromous fish path over the dam. Regulation of flows in the ladder is difficult, which causes passage conditions to vary greatly with fluctuating water levels in the river. Flows which exceed the capacity of the fishway overtop the walls and pour into an area of irregular rock outcropping containing willows and debris. Fish entering the fishway at high flows may become stranded in this area when flows decrease. Fish entering at low flows may have to jump as much as 3 feet vertically to enter some sections of the ladder. Constant attention is required to assure fish passage over the dam. Given the available personnel and operating practices at the dam, this level of close monitoring is not always feasible.

The reservoir is drawn down in the spring and fall to accommodate installing and removing stoplogs, flushing sediment from the turbine/pump intake area, and general maintenance activities. These operations tend to delay upstream migration for varying lengths of time because the south fish ladder is dewatered when the reservoir is lowered.

Radial Gates.—The radial gates in the dam are normally raised for a few days in April and again in October to install and remove the stop logs (raise or lower the reservoir surface level). GPID works with ODFW to time these events to the extent possible to minimize adverse fishery impacts. Salmon cannot swim against a velocity greater than 10 feet per second which is exceeded at the radial gates whenever the riverflow exceeds 2,000 cfs. Since the completion of Lost Creek Dam by the Corps, the flow in the river drops below 2,000 cfs only during the driest months

of the year, July-October, or during droughts. Thus, salmon cannot swim upstream through the open radial gates during the April maintenance period. A flow duration analysis indicates that riverflow exceeds 2,000 cfs about 25 percent of the time in October when the gates are opened to remove the stoplogs. Thus, the upstream passage through the radial gates is minor.

Downstream Migration

Loss of juvenile fish is a major concern at Savage Rapids Dam, aggravated by the fact that downstream migration peaks in the middle of the irrigation season. Earlier investigations by ODFW found that the highest mortality rates were associated with fish ranging from 4 to 8 inches long. Sample counts showed 38,000 fish lost in July 1959 alone, and that up to 10 percent of juvenile salmon and steelhead were impinged. Attempts to reduce losses by plugging some bypass ports to generate a stronger current toward the remaining bypass ports generally failed; fish impingement losses remained unchanged. New traveling screens in the 1970's helped reduce losses due to poor screens but the impingement problems remain uncorrected and these losses continue. Current downstream losses at the site are due to the following:

- Impingement on the traveling screens when the turbines are operating. There are annual losses of significant numbers of fingerlings and smolts, primarily spring chinook. This occurs because the large volume of water required by the turbines and pumps creates a flow velocity through the screens that is too great for small fish to overcome.

- Impingement on the rotary screens of the Gravity Canal. The flow velocities in the Gravity Canal system often cause juvenile fish to impinge on the rotary fish screens.

- Fish screens malfunctioning or are damaged. Although not a frequent occurrence, the loss of fingerlings and smolts can be quite high before the diversion can be stopped, and losses are reminiscent of the losses that occurred before screens were installed and:

- Fish were pumped or diverted into irrigation canals and diverted out to fields or trapped at the end of the canal. When fish are diverted into the canal system, it is nearly impossible for them to escape back to the Rogue River.

- Fish were damaged by the turbines.

- Rapid release of pressure in the turbine and pumping systems cause internal hemorrhages. (Fish losses stemming from pressure hemorrhaging cannot be estimated, and these fish are not counted in total fish losses.)

- Juvenile fish pass over the dam and strike the sill at the bottom of the spillway.

- Predation. Juvenile fish, especially the smaller fry, are particularly vulnerable to predation when their downstream migration is slowed while passing through the slower moving water of the reservoir.

ENDANGERED SPECIES

At the time of this writing, none of the anadromous fish in the Rogue River system were listed as threatened or endangered under the ESA. However, on March 16, 1995, NMFS proposed the "Klamath Mountains Province Steelhead" (all steelhead stocks between Cape Blanco, Oregon and Cape Mendocino, California) for listing as threatened under the ESA. This proposal to list includes all steelhead runs in the Rogue River. On July 19, 1995, NMFS proposed three distinct populations of Coho salmon (from the San Lorenzo River in California to the Columbia River) for listing as threatened under the ESA; this includes the coho run of the Rogue River. In addition, all other anadromous trout species and Pacific salmon of Oregon, Idaho, Washington, California, and Montana (sea-run cutthroat trout and pink, chum, sockeye, and chinook salmon) are currently the subject of comprehensive status reviews. These are expected to be completed in 1995 and 1996.

The seriousness of depleted stocks of salmon, especially coho, prompted the Pacific Fishery Management Council to prohibit all ocean fishing for salmon in 1994 along the Washington and northern Oregon coasts and banned all fishing for coho. For 1995, coho fishing is again banned and ocean fishing for other salmon is open but the allowable catch is severely restricted compared to historic levels. Under these circumstances, any action available to enhance salmon and steelhead populations should be given serious consideration.

SUMMARY

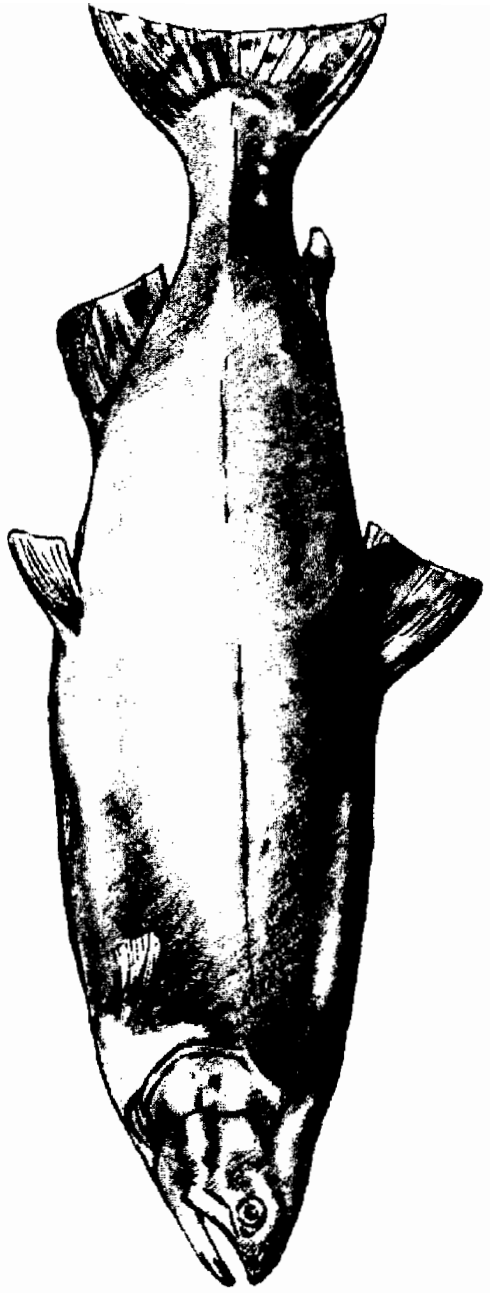
Savage Rapids Dam continues to be a major impediment to salmon and steelhead in the Rogue River basin. The significant fish losses mean that the full potential of basin production is not being realized. The existing fish passage facilities are inadequate, especially considering the dam's location on a major migration route. Table II-1 summarizes the continuing problems at Savage Rapids Dam.

The need for improving fish passage and reducing fish losses at Savage Rapids Dam is recognized by essentially all sectors of the public.

Table II-1.—Fish passage problems at Savage Rapids Dam
[Source: USFWS Planning Aid Memorandum, April 1990]

Item	Problem
1.	Poor regulation of flows in the south ladder.
2.	Unfavorable entrance to and exit conditions from the south ladder under all flows, i.e., ladder now exits through canal headworks; at high flows fish approach through channel behind ladder towards shore, and at low flows, fish may have to jump to enter some sections of ladder, etc.
3.	Poor attraction flows result in marginal use of the north ladder during operation.
4.	North ladder does not operate between irrigation seasons.
5.	Drawdown of the reservoir (after irrigation the season) dewaters the south ladder delaying upstream migration.
6.	Reservoir dewatering for removal or addition of stoplogs causes increased turbidity during fall and spring.
7.	Impingement of juvenile fish on screens.
8.	Increased trash and vegetation buildup because of flow regulation with Lost Creek Project or people dumping debris into Savage Rapids reservoir.
9.	Loss of juvenile fish and steelhead kelt[1] that pass over the dam and strike the sill or rocks below.
10.	Smolt losses due to pressure changes when the sluice gates are opened and the reservoir is at full pool.

[1]A kelt is an adult steelhead that returns to the ocean after spawning.



Chapter III—Preferred Alternative

DESCRIPTION

This chapter discusses the Preferred Alternative (Pumping Alternative) to resolve fish passage problems at Savage Rapids Dam.

The Pumping Alternative maximizes net national economic benefits as defined by Federal water project guidelines (Water Resources Council 1983). These guidelines generally require that Federal agencies recommend the alternative plan with the greatest net economic benefits; therefore, the Pumping Alternative is the Federally preferred alternative. State and Federal fish and wildlife agencies have indicated that the Pumping Alternative is their choice (see Attachments C and D). In January 1994, the GPID announced that it concurred and selected the Pumping Alternative as their preferred alternative (see Attachment E).

The Preferred Alternative consists of three parts: (1) replacement of GPID pumping and diversion facilities at the dam with two new pumping plants, one each on the north and south sides of the river; (2) removal of the dam and appurtenant structures and restoration of the site, and (3) forgiveness of the remaining debt to the Federal Government amounting to $290,525 as of 1994. (See Summary for an artist's conception of the pumping plants and associated facilities including service road access to the river inlets.)

ACCOMPLISHMENTS

The Preferred Alternative focuses on the area just downstream from Savage Rapids Dam upstream to the city of Rogue River (about 3.5 miles upstream). The accomplishments are confined to (1) fish passage improvement, (2) reestablishment of a free-flowing reach of river, and (3) extension of the useful life of irrigation diversion facilities. In addition, there would be minor changes in wildlife habitat, vegetation, recreation, and social and economic activities associated with that river reach, and there would be temporary adverse effects associated with construction.

With the Preferred Alternative, salmon and steelhead escapement[1] past Savage Rapids Dam would increase by about 22 percent. For this analysis, Reclamation is using the USFWS estimate that the increased escapement would be 26,700 salmon and steelhead and the accompanying increase in

[1]Fish escapement is the number of adult fish successfully returning to spawn.

harvest would be about 87,900 fish. A 1981 study by the USFWS (USFWS 1981) estimated that if all fish passage problems at Savage Rapids Dam were eliminated, salmon and steelhead escapement past the dam would increase by 26,700 fish, about 22 percent of the estimated total escapement at that time of 120,500 adult salmon and steelhead.

Because of criticism that the 1981 estimates were outdated, the ODFW recently undertook an analysis of potential anadromous fish escapement with the Preferred Alternative. This analysis is based on more recent efforts to model fish mortality associated with the dam and uses updated information on life cycle and abundance of the fish species. The ODFW analysis includes high, medium, and low estimates of increased anadromous fish escapement; the results range from a low of 7,624 fish to a high of 29,407 fish (see attachment D). Since the 1981 estimate falls within this range, Reclamation did not recalculate monetary benefits which are based on the 1981 estimate in this report. (See chapter VI for detailed discussion of fish passage and losses.)

The Rogue River from the site of the existing Savage Rapids Dam to the upper reach of the impoundment would be restored to a natural free-flowing, unobstructed river. This would provide additional spawning habitat for fall chinook salmon, eliminate impediment to fish movement, eliminate the current loss of anadromous fish due to passage problems, and benefit resident fish which would be free to move up and down the river to find suitable habitat as flow conditions change.

Removal of the dam and associated facilities eliminates the physical capability for gravity diversion and hydraulic power to drive pumps for irrigation diversions. Existing irrigation diversion facilities are replaced by construction of new electric pumping facilities which will provide a useful life of more than 50 years.

This alternative does not affect water rights, amount and timing of water diversions, annual river flow, ground water, or other natural resources and uses other than those identified above.

FACILITIES

Designs for the Preferred Alternative were made during the course of this study which was initiated in 1989. These designs are adequate for authorization but not for specifications or construction. Final designs would be completed in consultation with NMFS, USFWS, and ODFW during preconstruction.

Pumping Plants

Two pumping plants, one on the right or north bank and one on the left or south bank, would be constructed to provide a total pumping capacity of 150 cfs. Except for the intake, all facilities would be constructed above the 100-year flood level. Drawings 1313-D-1 and 1313-D-2 show the facilities.

The north pumping plant would have three equal-capacity pumps to serve the Tokay/Evans Canal system. The south pumping plant would have two sets of three equal-capacity pumps; three to serve the Highline/Savage Canal system and three to serve the Gravity Canal system. Serving each canal system with three equal-capacity pumps allows greater flexibility in operation.

Table III-1 summarizes pumping plant data.

Table III-1.—Pumping plant data

Item	North plant	South plant	
	Tokay/Evans	Highline/Savage	Gravity
Number of pumps	3	3	3
Pumping capacity (cfs)	32	59	59
Each pump			
Flow (cfs)	10.67	19.67	19.67
Flow (gallons per minute)	4,788	8,827	8,827
Total dynamic head (feet)	190	122	34
Motor size (horsepower)	300	350	100

Vertical turbine pumping units operating in a wet sump would be used and represent the simplest and possibly the quietest arrangement for ease of maintenance and operation. Each sump, the river inlet, and the connecting box culvert would be located at an elevation that would have the hydraulic capability to realize the pumping capacities shown in table III-1 under all reasonable conditions. The size of the inlet requirements are dictated by incoming flow velocities which must be no more than 0.4 feet per second in order to prevent the impingement of small fish. The inlet for the north pumping plant would be 4 feet high and 22 feet long while the inlet for the south pumping plant would be 4 feet high by 75 feet long. Each inlet would be equipped with 1/8-inch mesh fishscreen and trashracks to protect the screens.

Power for the pumps would be provided from an existing 12-kilovolt distribution line located next to State Highway 99 on the south side of the river. A pad mounted transformer would provide the needed voltage adjustment for the pumps. Simple "H" frame poles would support the powerline as it spans about 550 feet over the river from the south to the north pumping plant. No center support would be needed, and clearance would exceed the overhead minimum of 25 feet.

Since the pump motors would be located outside, noise abatement walls which reflect sound directly upward would be provided to reduce the overall noise level in the immediate vicinity. Careful attention to landscaping would also help attenuate pump noise as well as obscure the pumping plants from river or road view.

Discharge pipelines from the new pumping plants would be buried and would follow the general alignment of pipelines from the existing pumping plant. The north pipeline would terminate at the freeway where it would connect with the existing steel pipe under the freeway. The two south pipelines would terminate at new outlet structures at the heads of the Gravity and Highline Canals. The lengths and diameters of the pipelines are shown in table III-2.

Table III-2.—Pipe dimensions

Location	Diameter (inches)	Length (feet)
North plant to Tokay Canal[1]	28	1,450
South plant to South Highline Canal	38	478
South plant to Gravity Canal	38	30

[1]Connects to existing pipeline at freeway

TOTAL SLOPE LENGTH OF PIPE FROM THE CONCRETE BOX TO OUTLET IS 1,300 FEET
ELEV. OF BRASS CAP ON PIPE OUTLET BOX IS 1110.21 FEET
ELEV. OF TOP OF PIPE AT OUTLET IS 1108.53 FEET
ELEV. OF THE BOTTOM (0.00) OF THE TOKAY CANAL STAFF GAGE IS 1105.81 FEET
ELEV. OF THE BOTTOM (0.00) OF THE EVANS CREEK LATERAL STAFF GAGE IS 1105.26 FEET

℄ SOUTHERN PACIFIC R.R.

REPLACE EXISTING PIPELINE WITH NEW 28" PIPELINE

CONCRETE BOX

42" I.D. WOOD STAVE PIPE

3'X 5' BOX CULVERT

HOIST HOUSE

SOUTHERN PACIFIC RAILROAD R.O.W.

GRAVELED AREA

NEW NORTHSIDE PUMPING PLANT

TRANSFORMER

EXACT LOCATION OF THE TRANSITION FROM STEEL PIPE TO WOOD STAVE PIPE IS UNKNOWN

RIVETED STEEL PIPE

STOPLOG STORAGE AREA

STOPLOG GUIDE STORAGE AREA

1.1' ELEV. DIFFERENCE BETWEEN ALL FIXED WEIRS

EDGE OF WATER (NOV 2, 1972)

CONCRETE SLAB

PUMP ROOM

TURBINE ROOM

FISH SCREENS

TRASH RACKS

STA 4+77.1

FISH SCREEN

ROGUE RIVER

PIER

BAY

CONCRETE APRON

42" DIA. RIVETED STEEL PIPE

4,000 LBS CAP CABLEWAY

AXIS OF DAM

JACKSON COUNTY

JOSEPHINE COUNTY

REMOVE ALL EXISTING FISH LADDERS, DAM, AND OTHER STRUCTURES

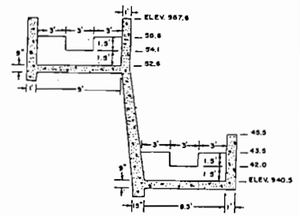
T.36 S., R.4 W.

T.36 S., R.5 W.

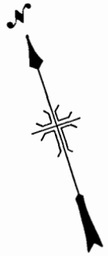
24 | 19
25 | 30

LENGTH OF BAYS (FEET)

STOPLOGS REMOVED	BAY NUMBER	STOPLOGS INSTALLED
23	1	23
23	2	48
23	3	
23	4	48
23	5	
23	6	48
23	7	
23	8	48
23	9	
23	10	48
23	11	
23	12	48
23	13	
23	14	48
23	15	
19	16	19



SECTION A-A
FISH LADDER
(SHOWING TYPICAL WIDTHS)



10 0 10 20 30 40 50
SCALE OF FEET

FOR ADDITIONAL DETAILS SEE THE FOLLOWING DRAWINGS:

DRAWING NUMBER	DATE	DETAILS SHOWN
712-D-9	REV JAN. 16, 1953	STRUCTURES AND TOPOGRAPHY
712-104-2	REV JULY 10, 1953	TOPOGRAPHY
712-PT-113-2	NOV. 9, 1972	TOPOGRAPHY REVISION AND EXTENSION
196C	MAR. 25, 1921	POWER HOUSE LAYOUT (PUMP ROOM)
184C	OCT. 18, 1920	POWER HOUSE TAILRACE DETAILS
712-D-57	REV MAY 5, 1955	SLUICEWAY REPAIR DETAILS
214C	APR. 9, 1921	FISHWAY DETAILS
712-D-76	APR. 1, 1957	FISH SCREEN STRUCTURE
712-D-69	MAR. 12, 1957	24-INCH DIA. STEEL DISCHARGE PIPE (FROM FISH SCREEN STRUCTURE)

MATCHLINE TO DRAWING NO. 1313-D-2

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

GRANTS PASS DIVISION
ROGUE RIVER BASIN PROJECT, OREGON

NORTH BANK PUMPING PLANT
PUMPING ALTERNATIVE

DENVER, COLORADO JANUARY 1994

DRAWING NO. 1313-D-1

MATCHLINE TO DRAWING NO. 1313-D-1

EDGE OF WATER (NOV 3, 1972)

FISH SCREEN

ROGUE RIVER

NEW SOUTH SIDE PUMPING PLANT

TIMBER BRIDGE

TRANSFORMER

GRAVELED AREA

GRAVITY CANAL

GAGING STATION
GAGE DATUM ELEV. IS 958.76 FEET

WATER WHEEL
5' DIA X8' FISH SCREENS

CONCRETE

24" DIA MANHOLE

PIER

BAY 8

4000 LBS. CAP CABLEWAY

TWO 16'x7' TOP SEAL RADIAL GATES

AXIS OF DAM

B.M.
ELEV. 968.00

STA. 0+79.4
TWO 4'x4' SLIDE GATES
(ELEV. OF BOTTOM OF GATES IS 958.3)

42" DIA. CONCRETE

42" DIA. RIVETED STEEL PIPE

30" DIA STEEL PIPE

REMOVE ALL EXISTING FISH LADDERS, DAM, AND OTHER STRUCTURES

15" DIA HIGHWAY DRAIN PIPE

REPLACE EXISTING PIPELINE WITH NEW 38" PIPELINE

PAVED STATE HIGHWAY 99

NOTE: THE 42" DIA. PIPE THROUGH THE DAM IS RIVETED STEEL UNDER THE ARCHES, STEEL THROUGH BAYS 10 AND 11, AND CONCRETE IN OTHER AREAS. THE LOCATIONS OF THE TRANSITIONS BETWEEN STEEL AND CONCRETE SEGMENTS IS UNKNOWN.

TOTAL SLOPE LENGTH OF PIPE FROM B.M. ON DAM TO OUTLET IS 258 FEET
ELEV. OF BRASS CAP ON PIPE OUTLET BOX IS 1050.99 FEET
ELEV. OF TOP OF PIPE AT OUTLET IS 1049.76 FEET
ELEV. OF THE BOTTOM (0.00) OF THE SOUTH HIGHLINE CANAL STAFF GAGE IS 1046.62 FEET
ELEV. OF THE BOTTOM (0.00) OF THE SAVAGE LATERAL STAFF GAGE IS 1047.06 FEET

LENGTH OF BAYS (FEET)

STOPLOGS REMOVED	BAY NUMBER	STOPLOGS INSTALLED
23	1	23
23	2	23
23	3	48
23	4	48
23	5	48
23	6	48
23	7	48
23	8	48
23	9	48
23	10	48
23	11	48
23	12	48
23	13	48
23	14	48
23	15	48
19	16	19

ROCK OR CONCRETE WALL

TYPICAL SECTION OF FISH LADDER

MAG. NORTH

SCALE OF FEET
10 0 10 20 30 40 50

FOR ADDITIONAL DETAILS SEE THE FOLLOWING DRAWINGS:

DRAWING NUMBER	DATE	DETAILS SHOWN
712-D-9	REV JAN. 16, 1953	STRUCTURES AND TOPOGRAPHY
712-104-2	REV. JULY 10, 1953	TOPOGRAPHY
*12-PT-119-2	NOV. 9, 1972	TOPOGRAPHY REVISION AND EXTENSION
712-D-12	REV JAN. 19, 1953	FISH RESTING POOL PIPELINE

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

GRANTS PASS DIVISION
ROGUE RIVER BASIN PROJECT, OREGON

SOUTH BANK PUMPING PLANT PUMPING ALTERNATIVE

DENVER, COLORADO JANUARY 1994

DRAWING NO. 1313-D-2

Access Roads

Access to all construction sites, including the pumping plants, pipelines, and electric transmission lines, would be from existing county roads or State highways. Access to the north pumping plant site, just downstream from the dam on GPID-owned land, would be across the existing railroad right-of-way. Access to the south pumping plant site would be by the existing access road and across the uppermost reach of the Gravity Canal. The portion of Gravity Canal from the existing headworks to the outlet structure of the discharge pipelines would be filled in for parking and access. Access to these sites would be limited to operating personnel and not open to the public.

SAVAGE RAPIDS DAM REMOVAL

All existing structures would be demolished and removed from the site, including the dam, powerhouse and related facilities, hoist house and cable works, north and south fish ladders, and a portion of the Gravity Canal. The existing structures would be demolished primarily by mechanical means (jackhammer, bulldozer, and crane with wrecking ball) with minimal blasting. Blasting may prove faster and less obtrusive to humans and wildlife than the more prolonged demolition by mechanical means and may warrant further consideration at the time final designs are prepared. (See also "Construction Schedule.")

Disposal of Excavated and Other Materials

Excavated rock, concrete, and other waste materials would be removed and disposed of in a landfill within 10 miles of the construction site. The potential for salvaging has not been evaluated.

Any materials that are categorized as hazardous would be handled in accordance with Federal, State, and local laws.

Damsite and River Channel Restoration

The damsite and area immediately adjacent to GPID-owned land would be rehabilitated by revegetation and minimal landscaping to retain the approximate configuration and condition of a free-flowing river.

Portions of the river channel through the damsite area may need restoration. Shaping, stabilizing, revegetation, and landscaping that may be required would be carried out in consultation with the Jackson County Parks Department, ODFW, NMFS, and USFWS.

River Recreation Option

An option identified is to develop a challenging river course for rafts, drift boats, and kayaks in the vicinity of Savage Rapids. The design would depend on the as-yet-unknown configuration of Savage Rapids. If properly developed, visitors would be attracted to the area. The reach could be designed to allow jet boat passage or to act as a jet boat barrier. Conceptual plans would require considerable public involvement and interagency coordination to determine feasibility.

Costs have not been developed for this option. Cost sharing responsibilities would need to be in accordance with P.L. 89-72 as amended by Section 16 of P.L. 102-575.

CONSTRUCTION

The Preferred Alternative assumes a total construction period of 5 years including 2 years preconstruction activities and 3 years of actual construction.

Construction Cost

Construction costs for the Preferred Alternative are summarized in Table III-3. These costs include standard cost factors of 10 percent for unlisted items, 25 percent for contingencies, and 30 percent for noncontract (indirect) costs. Removal and disposal costs are included in the unit costs based on a haul distance of 10 miles. No values are included for salvaging existing materials or equipment.

Table III-3.—Construction cost of the Preferred Alternative[1]
(January 1993 Price Level)

Item	Cost
Remove Savage Rapids Dam	$4,967,000
North Pumping Plant	
Pumping plant (3 pumps), screens, T-lines, etc.	1,891,000
Tokay/Evans Canal discharge line	301,000
North total	$2,192,000
South Pumping Plant	
Pumping plant, (6 pumps) screens, etc.	$3,662,000
Gravity Canal discharge line	37,000
South Highline/Savage Canal discharge line	347,000
South total	$4,046,000
Total construction cost	$11,205,000

[1]Includes allowances for unlisted items, contingencies, and indirect costs

Materials

Sand, gravel, rock and other raw materials for construction are readily available from commercial sources in the area.

Construction Schedule

Three primary considerations affect scheduling construction activities:

- Safety of contractors performing the work.
- Effect of construction activity on migrating fish.
- Effect on the capability to deliver irrigation water.

Much of the construction activity would require work within the river channel but also requires a dry-site condition. To achieve dry-site conditions, temporary earth cofferdams would be needed at construction sites to divert the riverflow. The safest time of year for such work is during times of low flow. However, fish considerations may require that the in-river construction period take place during higher flow periods, and, as a result, increased safety features may be necessary.

Scheduling of actual construction and demolition activities would be determined in consultation with the Corps, Oregon Department of Environmental Quality (ODEQ), GPID, and the three agencies who have a major interest in fish (NMFS, ODFW, and USFWS). The State has determined that the period from June through about mid-September would be the least disruptive for migrating fish. In-river work and removal of the dam and appurtenant structures would be accomplished on schedules where the least potential damage to fish would occur.

The pumping plants would be constructed and operational before any part of the dam is removed to assure GPID's ability to maintain water delivery.

Three parameters would control all construction activities:

1. Construction within the riverbed itself would be limited to the period from June to September. Lengthy construction activities that must take place within the riverbed require the construction of cofferdams which would be placed (and removed) only during the time allowed for in-river work. Construction work within the confines of the cofferdam would not be considered in-river and could continue past the in-river construction period.

2. Construction would be scheduled to prevent jeopardizing the ability of GPID to deliver irrigation water to its patrons. The new pumping plants would be constructed first so they would be in place and ready to deliver water when demolition of the dam begins.

3. Construction activity would not be allowed to block the migration of anadromous fish. Contractors must be flexible so as to work on one side of the river at a time.

A conservative estimate of a 5-year construction period was assumed. This includes 2 years of preconstruction activities and 3 years of actual construction. The new pumping plants would be constructed during the first year of actual construction, and the dam and other facilities would be removed during the following 2 years.

OPERATION, MAINTENANCE, REPLACEMENT, AND POWER

Power

The average annual energy consumption is estimated at 5,675,800 kilowatt-hours (kWh) over the 6-month irrigation season; the maximum demand[1] is 1,600 kilowatts (kW). Table III-4 summarizes the power requirement.

Table III-4.—Electric power requirement

Month	Days of irrigation	Average pumping (cfs)	Average demand (kW)	Energy consumption (kWh)	
				Daily average	Total
May	28	130	1,390	33,300	932,400
June	30	140	1,490	35,800	1,074,000
July	31	145	1,550	37,100	1,150,100
August	31	150	1,600	38,300	1,187,300
September	30	130	1,390	33,300	999,000
October	10	130	1,390	33,300	333,000
Total	160				5,675,800

Costs

Estimated operation, maintenance, replacement, and power (OMR&P) costs for the Preferred Alternative are based on operating the plant as a semi-attended facility at full or nearly full capacity during a 23-week operating season; pumping rates would be adjusted as needed to avoid waste of water. Estimates were modeled using computer programs and procedures as well as historical data, based on the pump sizes described earlier in this section. The OMR&P costs identified in this document are for the new facilities described (pumping plants and associated facilities) and do not include costs associated with the operation of other GPID facilities. It is

[1]Demand is the instantaneous power requirement

assumed that power would be obtained from Pacific Power and Light Company. Costs are based on Agricultural Pumping Service Schedule 41, dated 16 December 1992. These charges include the energy charge of $0.03266 per kWh and a load charge of $800 plus $4 per kilowatt based on the average demand for the 2 highest months. Table III-5 summarizes project OMR&P costs.

Table III-5.—Annual OMR&P costs for the Preferred Alternative
(January 1993 Price Level)

Item	OM&R	Power	OMR&P
North pumping plant			
Pump plant, screens, T-line, etc.	$13,200	$82,400	$95,600
Tokay/Evans discharge line	300	0	300
North side subtotal	$13,500	$82,400	$95,900
South pumping plant			
Pumping plants, screens, etc.	$27,100	$110,200	$137,300
South Main Canal discharge line	200	0	200
Highline/Savage discharge line	300	0	300
South side subtotal	$27,600	$110,200	$137,800
Total	$41,100	$192,600	$233,700

ECONOMIC AND FINANCIAL ANALYSIS

Benefits

This alternative would produce non-consumptive use benefits related to anadromous and resident fish increases and indirect or secondary benefits. Because these monetary benefits are difficult to calculate and minor compared to direct consumptive use benefits, they were not fully identified and not included in the economic analysis.

Monetary benefits of the Preferred Alternative in this analysis are limited to salmon and steelhead and are based on an estimated increase in the annual escapement at the site of 26,700 salmon and steelhead. This would

increase the annual commercial and sport harvest by 87,900 salmon and steelhead and provide annual equivalent monetary benefits of $4,998,600. Table III-6 summarizes the relationship between escapement and anticipated increase in fish harvest by species, and table III-7 summarizes estimated harvest by species and type of harvest.

Table III-6.—Increased escapement and harvest with the Preferred Alternative
[Source: USFWS Planning Aid Memorandum, 1990]

Species	Escapement at Savage Rapids Dam	Catch/escapement ratio	Harvest increase
Fall chinook	8,200	5:1	41,000
Spring chinook	9,100	3:1	27,300
Coho	400	4:1	1,600
Winter steelhead	4,600	2:1	9,200
Summer steelhead	4,400	2:1	8,800
Total	26,700		87,900

Table III-7.—Distribution of increased salmon and steelhead harvest
[Source: USFWS Planning Aid Memorandum, 1990]

Species	Commercial harvest		Sport harvest		Total harvest
	Ocean	Freshwater	Ocean	Freshwater	
Fall chinook	30,750	—	5,125	5,125	41,000
Spring chinook	20,475	—	3,413	3,412	27,300
Coho	1,056	—	462	82	1,600
Winter steelhead	—	—	—	9,200	9,200
Summer steelhead	—	—	—	8,800	8,800
Total	52,281	—	9,000	26,619	87,900

Monetary benefits for commercial fishing values are based on average fish weight and value per pound. Sport fishing values are based on an average value per angler-day and the number of angler-days to catch one fish.

Commercially caught fall and spring chinook average 9.33 pounds and have a value of $2.30 per pound; a value of $22.30 per fish. Coho caught commercially average 4.73 pounds and have a value of $1.09 per pound; a value of $5.16 per fish. Ocean sport fishery for all of the species listed in table III-7 is valued at $60 per angler-day with an average effort of 1.08 angler-days per fish; a value of $64 per fish.

Fresh water sport fishing is valued at $51 per angler-day. Fall and spring chinook salmon, coho salmon, and summer steelhead require an average effort of 3.3 angler-days per fish; a value of $168.30 per fish. Winter steelhead require an average effort of 2.9 angler-days; value of $147.90 per fish.

Annual equivalent fishery benefits of $4,998,600 accruing to the Preferred Alternative are based on a 20-year period of analysis, a 5-year build up period, and an 8 percent discount rate. Table III-8 summarizes the annual monetary benefit by species and type of harvest.

Table III-8.—Estimated annual equivalent value of increased harvest[1]

Species	Commercial[3]	Sport[2]		Total
		Ocean	Freshwater	
Fall chinook	$568,800	$275,500	$715,500	$1,559,800
Spring chinook	378,700	183,500	476,400	1,038,600
Coho	4,500	24,800	13,500	42,800
Winter steelhead	0	0	1,228,600	1,228,600
Summer steelhead	0	0	1,128,800	1,128,800
Total	$952,000	$483,800	$3,562,800	$4,998,600

[1]The annual equivalent value is based on a discount rate of 8 percent over a 20-year period with a 5-year buildup.

[2]Benefits for sport fishing are based on an angler-day value of $60 for ocean fishing and an angler-day value of $51 for freshwater fishing. Ocean sport fishing values are based on a 1970 report by Mathews and Brown, *Economic Evaluation of the 1967 Sport Salmon Fisheries of Washington*, and the Pacific Fishery Management Council's March 1978 *Final Environmental Statement and Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California Commencing in 1978*. Values for freshwater fishing were derived from a 1978 NMFS report, *Economic Benefits from Recreational Steelhead Fishing*, and a 1978 paper by Charbonneau and Hay *Determinants and Economic Values of Hunting and Fishing*. More recent values are not available for this analysis.

[3]All commercial harvest is assumed to be ocean. The methodology for quantification of economic benefits for commercially harvested salmon and steelhead is based on National Oceanographic and Atmospheric Administration Technical Memorandum NMFS F/NWR3, *Net Economic Values for Salmon and Steelhead from the Columbia River System*, P.A. Meyer, June 1982.

Costs

Project cost, consisting of construction costs plus interest during construction, totals $13,255,000. Construction costs based on a January 1993 price level are shown in table III-3. Interest during construction was calculated on the basis of a total 5-year construction period at the applicable Federal discount rate of 8 percent for 1994.

The annual equivalent cost of the Preferred Alternative, which includes the annual equivalent of the project cost and the annual OMR&P cost, is estimated at $1,583,700. Calculation of the annual equivalent of the project cost assumes a 20-year period of analysis and the 1994 Federal discount rate of 8 percent. Table III-9 summarizes project and annual costs.

Table III-9.—Project and annual costs of the Preferred Alternative

Item	Cost
Project cost	
Construction	$11,205,000
Interest during construction (8 percent over a 5-year construction period)	2,050,000
Total project cost	$13,255,000
Annual cost	
Annual equivalent of project cost[1]	1,350,000
Annual operation, maintenance, replacement, and power	233,700
Total annual cost	$1,583,700

[1]Total project cost annualized at 8 percent for a 20-year period

Benefit/Cost Analysis

A true benefit/cost analysis which compares annualized values for all of the costs to all of the benefits over the life of the project was not made for this analysis. Instead, costs and benefits were annualized over a 20-year period instead of the 100-year period that is normally used for a project life, and the only monetary benefits identified are those associated with salmon and steelhead. Although not identified, the project may produce some monetary benefits associated with recreation. The effect of using a short period for the analysis is that annualized benefits are slightly less than with

a longer period, and annualized costs are much higher than with a longer period. As a result, the comparison of benefits and costs using a shorter period is that the benefit/cost ratio is very conservative, i.e., much less than would be obtained using a longer period of analysis.

For this analysis, benefits and costs were annualized over a 20-year period using the 1994 Federal discount rate of 8 percent. Annual equivalent benefits of $4,998,600 compare with annual equivalent costs of $1,583,700 to provide a benefit/cost ratio of 3.2 to 1.

COST ALLOCATION AND REPAYMENT

A cost allocation was not made for this analysis. All of the benefits of the project are assumed to be associated with the salmon and steelhead; therefore, all of the costs were assigned to the anadromous fish function.

Costs of fish protection facilities at Savage Rapids Dam have in the past been nonreimbursable. It is assumed for this analysis that all of the costs associated with the anadromous fish function would be Federal costs and nonreimbursable. (Costs associated with the non-Federal portion of this study--the irrigation conservation function--would be paid by non-Federal entities and constitute cost share for this initiative.)

FUNDING

It was assumed for this analysis, that the capital costs of the Preferred Alternative would be 100-percent federally financed and funded and that funds would be expended as needed during the construction period. A total of $11,205,000 in actual funds would be expended over a 5-year period. About $1,345,000 would be required during the 2-year preconstruction period, and the remainder would be required during the 3 years of actual construction. Table III-10 summarizes the funding requirement by year (interest during construction is not shown).

Table III-10.—Construction funding schedule for the Preferred Alternative
(January 1993 price level)

Item	Preconstruction	Construction				
	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Pumping plants	$249,000	$500,000	$5,489,000	$0	$0	$6,238,000
Dam removal	196,000	400,000	0	2,914,000	1,457,000	4,967,000
Total	$445,000	$900,000	$5,489,000	$2,914,000	$1,457,000	$11,205,000

Funding of all OMR&P costs would continue to be the responsibility of the GPID.

PERMITS AND REGULATORY COMPLIANCE

Prior to the initiation of construction activities, certain permits and other compliance issues must be addressed. Among these is the Clean Water Act. The Corps and the ODEQ would be contacted for compliance with the permitting requirements of sections 402 and 404 of the Clean Water Act. (See Consultation and Coordination chapter for additional discussion.)

VIABILITY

The Preferred Alternative was found to meet the four criteria of viability--completeness, effectiveness, efficiency, and acceptability. (See "Formulation and Evaluation" chapter.)

The Preferred Alternative includes all investment needed to provide for safe fish passage and continued irrigation diversion and would eliminate all salmon and steelhead loss due to irrigation diversion at this site. It has a large benefit/cost ratio and is the most efficient alternative identified. This alternative is supported and preferred by Federal and State fish and wildlife agencies, environmental and fishery interest groups, and the GPID Board

and is compatible with existing laws, regulations, and public policies. Some opposition to any action alternative is expected, and there is a portion of the public that would prefer another action alternative or no action.