John Day River Fish Habitat Enhancement

Annual Progress Report

bY

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ABSTRACT

This project, initiated July 1, 1984, under Bonneville Power Administration (BPA) contract number DE A179-84 BP17460, provides initital landowner contacts agreement development, project design, budgeting, and implementation for an anadramous fish habitat improvement program on privately owned lands within the John Day Basin. The purpose of the project is to provide offsite mitigation for spring chinook and summer steelhead adult and juvenile losses from hydroelectric dams on the Columbia River. Implementation of the major segment of improvement work in 1987 occured after July 1. Activities under the first phase of the contract period (January 1, 1987 through June 30, 1987, state FY 87) included landowner contacts and agreement development, personnel training, equipment purchase, physical habitat inventory, planning and design, and construction contract development. Activities in the second phase (July 1, 1987 through December 31, 1987, state FY 88) included layout of contract work and contract implementation, physical habitat inventory and photopoints, construction of instream structures and riparian fence, budget development, annual report, and landowner contacts for 1988 work.

Because of the agreement and association between the Bonneville Power Administration (BPA), Grant Soil and Water Conservation District (GSWCD), the Soil Conservation Service (SCSI and the Oregon Department of Fish and Wildlife (ODFW), lease agreements were signed with 3 landowners on 3 properties in 1987. An easement was obtained with 6 landowners for a fishway project on Fivemile Creek.

Instream habitat improvement was completed on 4 miles of the mainstem John Day River and included construction of 4.0 miles of riparian exclosure fence and 2 miles of fence reconstruction for a total of 5.5 miles of fence. Deer Creek fishway project was completed and Fivemile Creek fishway was also completed. One mile of instream habitat work and two miles of riparian fence were completed tin Fox Creek.

INTRODUCTION

The John Day River system (Figure 1) supports the largest remaining totally wild runs of spring chinook and summer steelhead in Northeast Oregon. The genetic component of these runs must be maintained to reserve the option for future rebuilding of runs in other Columbia tributary systems and for effective utilization of habitat in the John Day system.

ODFW personnel first conducted spawning ground surveys in the John Day system for spring chinook and summer steelhead in 1959. Few chinook salmon redds were found. Gradually over the next 14 years, counts of redds in the basin increased and by 1974, there were 8.2 redds per mile. The redd counts declined from 1978 through 1984 and have increased since then to levels seen during the 60's. The 28 year average from 1959 - 1987 is 11.2 redds per mile. Sport fishing for chinook salmon has been closed in the John Day basin since 1978. (Table 1)

During the 1960's and early 1970's, summer steelhead redd counts remained fairly stable (6 - 8 redds per mile) with a peak of 16 redds per mile in 1966 (Table 2). Index counts for steelhead then declined to a low of one redd per mile in 1979. Some improvement has occurred since then. Sport catch of steelhead has varied in recent years and a reduced annual bag limit is currently in effect on the system. (Table 3)

A variety of man's activities have impacted salmon and steelhead habitat in the John Day system. Placer mining in the late 1800's left many streams with little or no shade, high silt loads, and diverted flows. Later, dredging overturned the stream channels in the larger streams changing stream course, silting gravel, and destroying stream cover. In the more recent past, overgrazing, road building, logging, clearing of land for agriculture, increased water withdrawals, and channelization have created further fish habitat problems by disturbing or destroying riparian vegetation and destabilizing streambanks and watersheds. The results are wide, shallow channels: low, warm summer flows; high, turbid spring flows: and decreased fish production. This situation is improving with proper management on many streams, but much remains to be done to return the John Day system to its once productive state. In addition to the in-basin problems, the Columbia River hydroelectric complex, particularly the John Day Dam, is taking its toll on wild smolts migrating from, and adults returning to, the John Day River system, further compounding in-basin problems.

The purpose of the instream habitat structures and riparian restoration work is to enhance production of the indigenous wild stocks of spring chinook and summer steelhead in the basin to mitigate for the production losses incurred at the mainstem Columbia River hydropower dams.

Funds provided to ODFW by the BPA contract number DE A179-84 BP17460 are for landowner contacts and agreements, physical habitat inventory, planning and design work, contract development, budgeting, in-stream

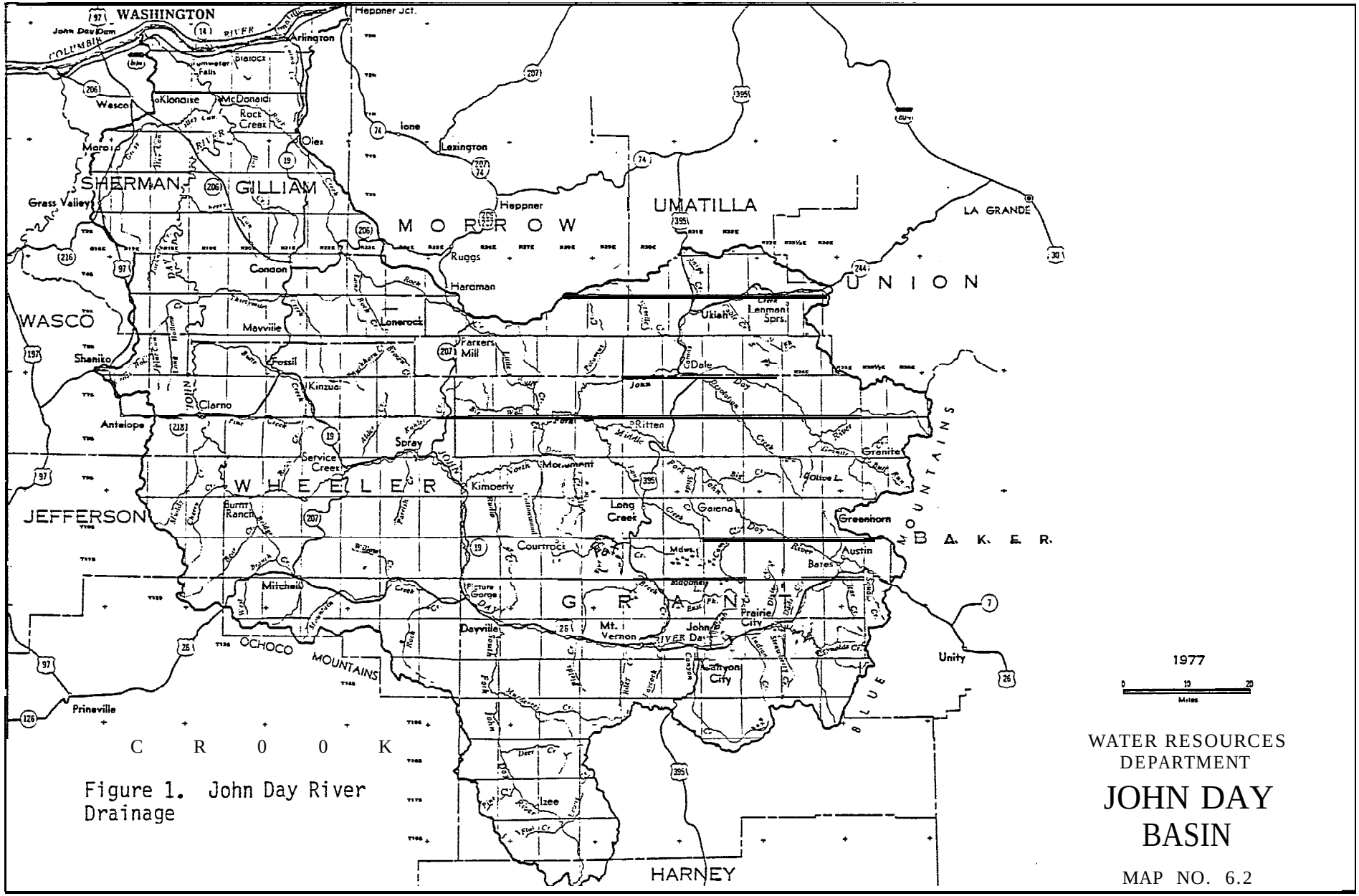

Figure 1. John Day River Drainage

WATER RESOURCES DEPARTMENT

JOHN DAY BASIN

MAP NO. 6.2

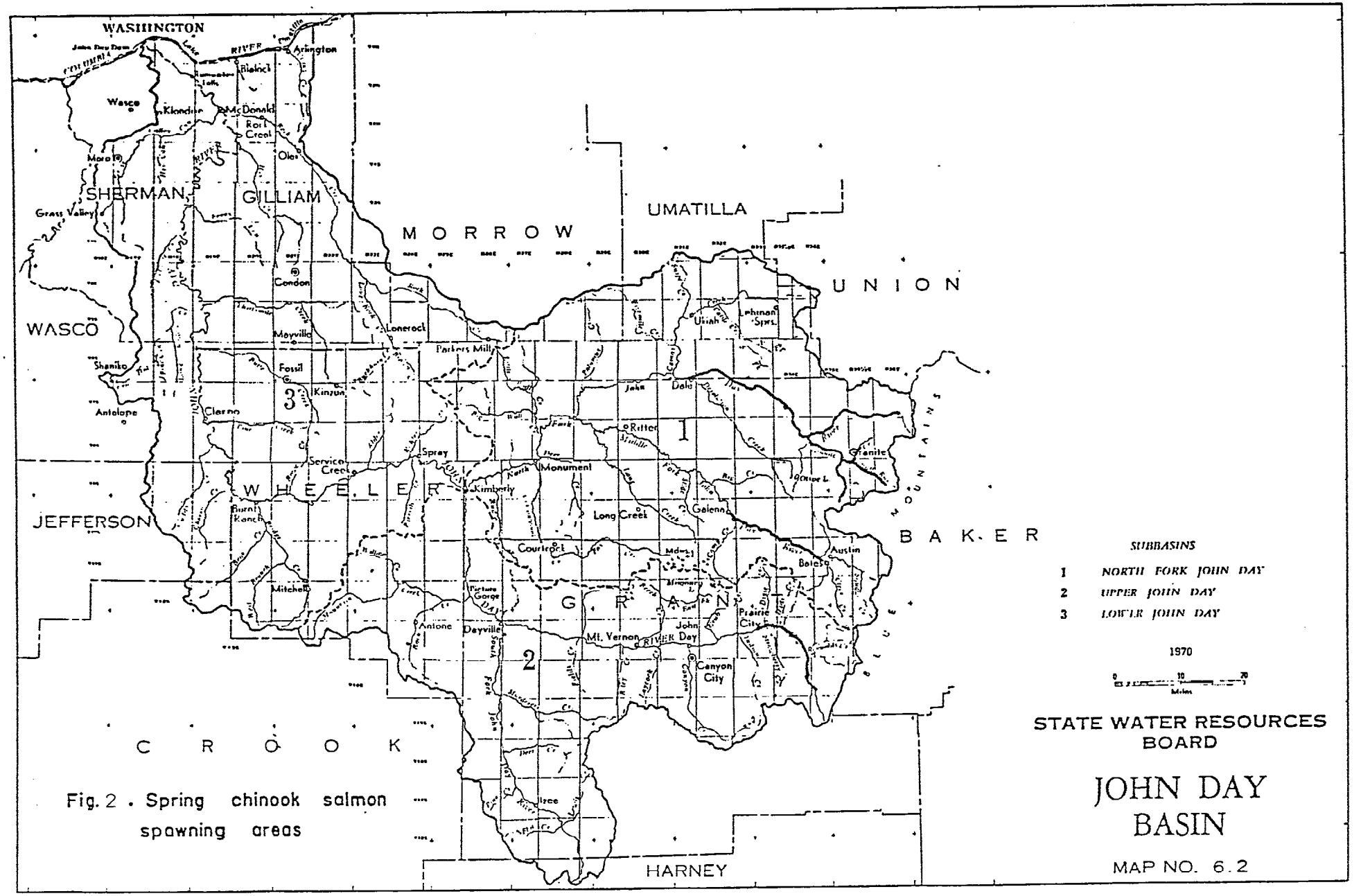

Fig. 2 . Spring chinook salmon spawning areas

SUBBASINS

1 *NORTH FORK JOHN DAY*
2 *UPPER JOHN DAY*
3 *LOWER JOHN DAY*

1970

STATE WATER RESOURCES BOARD

JOHN DAY BASIN

MAP NO. 6.2

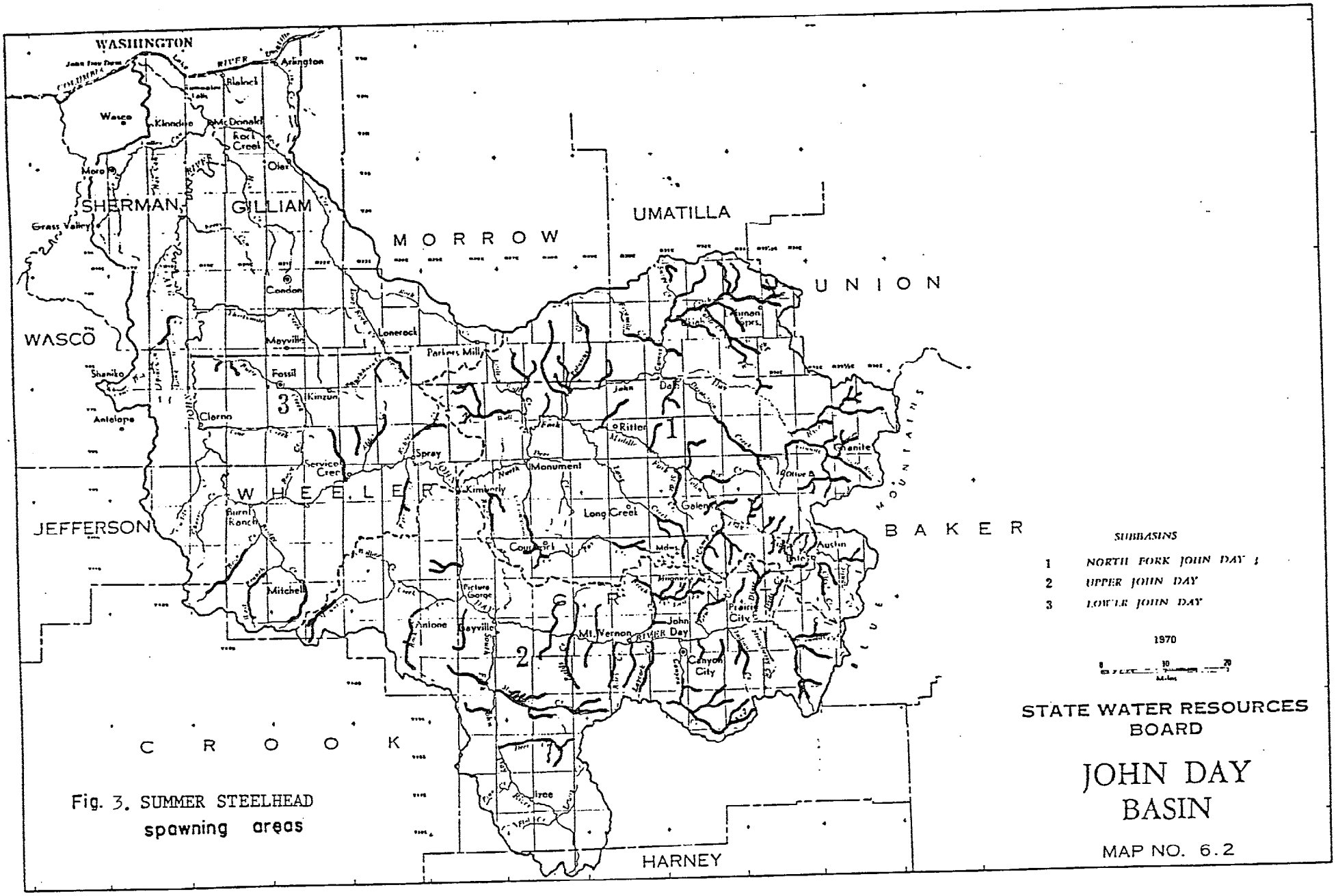

Fig. 3. SUMMER STEELHEAD spawning areas

Table 1. * Twenty-Seven Year Summary of Chinook Salmon Spawning Density*

John Day District 3.959 Through 1987

Year	Bull Run Creek	Clear Creek	Granite Creek	John Day River	Middle Fork John Day River	North Fork John Day River	Average
1959	*	4.3	6.0	0.3	0.0	*	2.6
1960	*	16.3	10.0	0.7	3.2	*	7.5
1961	*	3.3	5.3	3.0	1.1	*	3.2
1962	2.0	49.7	44.2	12.2	2.8	*	22.2
1963	7.0	29.2	26.4	0.8	0.4	*	12.7
1964	10.0	49.7	34.8	1.3	3.6	7.8	17.8
1965	7.5	16.7	24.4	5.8	3.7	8.1	11.0
1966	0.3	43.5	31.0	9.3	6.5	10.3	16.8
1967	6.0	38.5	19.4	7.4	1.7	5.5	13.0
1968	6.4	60.5	50.2	0.7	0.4	8.8	14.4
1969	15.6	13.7	16.8	9.3	4.8	20.5	13.3
1970	26.4	18.7	33.6	8.3	7.6	16.8	14.1
1971	11.6	18.8	31.2	7.0	4.1	11.8	11.5
1972	24.4	39.5	43.5	3.9""	5.1	10.5	14.2
1973	7.2	27.0	36.0	8.9	4.3	19.4	15.7
1974	7.6	8.0	25.5	2.5	8.1	7.2	8.2
1975	18.8	11.5	24.7	7.1	8.9	11.7	11.7
1976	9.2	7.0	20.2	4.6	6.6	6.2	7.5
1977	11.6	12.8	23.1	4.9	5.8	16.4	11.1
1978	12.4	6.3	19.8	4.5	10.7	5.9	8.3
1979	6.4	7.0	15.6	5.2	11.8	11.1	9.7
1980	1.2	7.0	8.5	1.2	5.8	4.3	4.3
1981	2.8	11.3	10.6	3.9	2.6	7.7	6.1
1982	5.2	10.8	12.0	3.8	6.2	5.5	6.4
1983	0.8	1.0	7.3	10.2	5.1	4.2	5.8
1984	3.2	2.0	5.8	5.6	6.7	3.5	4.4
1985	6.4	8.2	15.1	8.9	4.0	6.1	7.5
1986	2.4	11.5	20.2	12.2	6.3	14.3	11.9
1987	5.6	14.0	12.9	19.0	28.3	20.8	20.2

* No Survey.

**Count low due to rain and increased river flows which delayed survey and caused poor counting conditions.

Table 2 - *Steelhead Spawning Ground Summary*

Twenty-Eight Year Periods

Year	Number of Streams Surveyed	Miles Surveyed	Steelhead	Redds	Per Mile
1959	6	14.5	30	108	7.4
1960	10	22.0	60	194	8.8
1961	8	24.5	56	166	6.8
1962	10	26.5	56	184	6.9
1963	11	30.5	47	216	7.1
1964	13	43.5	51	266	6.1
1965	19	45.0	88	344	7.6
1966	23	69.0	141	1,103	16.0
1967	25	78.0	61	905	11.6
1968*	23	74.5	19	358	4.8
1969	27	91.5	76	806	a.9
1970	21	65.0	58	530	8.1
1971	8	22.5	18	181	8.0
1972	16	53.5	41	409	7.6
1973	25	76.4	22	402	5.3
1974""	14	38.0	4	167	4.4
1975**	14	34.0	21	302	8.9
1976	21	59.8	8	308	5.2
1977	30	75.5	69	535	7.1
1978	35	102.7	21	438	4.3
1979	29	78.7	4	81	1.0
1980	34	90.1	11	305	3.4
1981	33	86.1	12	319	3.'7
1982	32	71.8	34	301	4.2
1983	31	89.3	39	438	4.9
1984	29	76.7	33	299	3.9
1985	39	120.3	88	1,016	8.5
1986	42	117.6	127	1,286	10.9
1987	61	154.3	82	1,757	11.4
Totals and Averages	690	1,934.80	1,379	13,761	7.1

*Nineteen hundred and sixty eight was low water with an absence of spring runoff. Irrigation took entire stream flows on several tributaries causing steelhead spawning escapement to be nill in some areas. The poor count is reflected in redd/mile figure for that season.

**Counts low due to high water in spring which smoothed out early redds and caused poor counting conditions.

Table 3 - *Twenty-Nine Year Steelhead Creel Summary*

John Day River

Year	Anglers Checked	Hours Angled	Number of Fish	Hours Per Landed Fish	Fish Landed Per Angler
1958	197	457	72	6.3	0.36
1959	373	1,499	78	19.2	0.21
1960	270	993	99	10.7	0.36
196:	200	654	29	22.5	0.14
1962	193	639	35	18.2	0.18
1963	263	991	42	23.6	0.16
1964	430	1,386	53	26.1	0.12
1965	278	946	79	11.9	0.28
1966	495	1,505	153	9.3	0.31
1967	437	1,523	104	14.6	0.24
1968	298	1,171	62	18.8	0.21
1969	500	1,351	122	11.1	0.24
1970	229	597	50	11.9	0.21
1971	111	401	34	lo.8	0.31
1972	341	928	38	24.4	0.11
1973	581	1,966	69	28.5	0.12
1974	353	1,094	44	24.9	0.12
1975	517	1,628	128	12.7	0.25
1976	242	1,002	46	21.8	0.19
1977	613	2,200	139	15.8	0.23
1978	454	1,330	63	21.1	0.14
1979	166	436	4	109.0	0.02
1980	296	1,094	32	34.2	0.11
1981	365	1,054	41	25.7	0.11
1982	489	2,096	136	15.4	0.28
1983	373	1,604	54	29.7	0.15
1984	468	1,801	131	13.8	0.28
1985	540	1,765	127	13.9	0.24
1986	626	2,242	183	12.3	0.29
1987	1,053	3,175	514	6.2	0.49
Totals and Averages	11,749	39,528	2,699	14.6	0.23

habitat work, riparian enhancement, and post construction review and maintenance for anadramous fish habitat improvement on private lands within the John Day Basin. The program will compliment ongoing BPA habitat programs on Forest Service and BLM lands in the basin.

DESCRIPTION OF PROJECT AREA

The John Day drainage contains 8,010 square miles in east central Oregon and is the third largest drainage in the state (Figure 1). The basin includes a major part of Gilliam, Grant, and Wheeler Counties and portions of Crook, Harney, Jefferson, Morrow, Sherman, Umatilla, Union, and Wasco Counties.

The mainstem John Day River flows 284 miles from its source in the Strawberry Mountains into the Columbia River just above the John Day Dam. The largest tributary, the North Fork, enters the John Day at Kimberly (RM 184) and extends 112 miles to its headwaters in the Elkhorn Mountains at elevations near 7,500 feet. The Middle Fork John Day River originates just south of the headwaters of the North Fork and flows roughly parallel to it for 75 miles until they merge at RM 31 of the North Fork. The South Fork originates from Snow Mountain, elevation 7,163 feet, and drains the south side of the Aldrich Mountains.

Salmon and steelhead runs in the John Day River consist entirely of wild stocks. Spring chinook salmon spawn in the mainstem John Day River above Indian Creek (Figure 2), in the North Fork above Dale including Granite Creek and its tributaries Clear and Bull Run Creeks, and in the Middle Fork above Mosquito Creek. Summer steelhead utilize virtually all accessible tributaries in the basin (Lindsey, et al. 1981) (Figure 3). Summer steelhead spawn and rear in the South Fork up to RM 28 at South Fork Falls, an impassable barrier.

Specific areas included in the project during FY 1987 are: a) the Mainstem John Day River above the town of John Day, RM 250-254 and b) Fox Creek, RM 16-17, c) Deer Creek Falls, RM 8, and d) Fivemile Creek at RM 1.

METHODS AND MATERIALS

Work continued with the assistance of the GSWCD and SCS on landowner contacts and 15 year lease agreements, stream inventory, planning and designing habitat treatments, procuring equipment and materials, hiring seasonal personnel, budgeting, and contract development and administration.

Baseline physical stream measurements were taken on FY 87 properties and included stream width, depth, cover area, length of bank vegetative cover and pool/riffle ratio using Platts, et. al. 1987 for comparison to post treatment conditions. Stream width and depth were measured using three randomly located transects per stream reach. Each transect consisted of 10 cross sections in a 300 foot reach. The individual transect consisted of a high water elevation shot and continuing every foot to the other high water

mark. Channel morphology (i.e. high water, cut bank, undercut banks, islands, braids, wetted width, etc.) were all recorded. Cover area, bank vegetation, and pool/riffle ratio were quantified for all reaches. Cover criteria included any submerged or overhanging material providing in-stream cover in an area of water where velocities would allow a fingerling fish to hold. Woody vegetative cover providing shade to any portion of stream was measured in lineal feet. Pool area was determined to be an area of stream with reduced velocities allowing a fingerling fish to hold in at least one-half of the stream width.

Stream reaches planned for work in FY 87 and 88 were surveyed to identify areas of poor instream habitat and riparian cover, and subsequently determine quantities and types of instream structures and riparian fencing. Engineering support personnel from GSWCD made measurements to determine bank stabilization needs and locations for jetties, boulder strings, riprap, and check dams. Measurements included length of bank, average bank height, and stream gradient, which were used to calculate quantity of rock and juniper riprap required for construction and contract costs.

Jetties, rock riprap,and juniper riprap were used to stabilize actively eroding banks and reduce stream channel erosion, as well as provide more "edge effect" for rearing juvenile salmonids. Boulders were placed instream to provide more pool area and winter cover for rearing juveniles. Check dams were constructed to raise the water table and promote riparian vegetation as well as provide better pool and riffles for rearing juveniles. Fencing was constructed to exclude cattle and allow full recovery of the riparian area (see Appendix A for photographs, Appendix B for technical specification)

Mileage and materials were determined for fencing, number of jetties, boulders, length of riprap, check dams, livestock watergaps, and crossings. Maps and technical specifications were developed for specific stream reaches. Rock sources meeting minimum weight and size gradation specifications were located by GSWCD personnel. This information was submitted to the ODFW engineering section for contract review, advertisement, and award. Pre-bid tours were conducted for prospective contractors by personnel from the John Day ODFW office, contracts were opened for bidding, and construction began in late June.

Following surveys that identified sites needing instream work: jetty, boulder, checkdam, and riprap locations were staked. The contractor excavated these locations, and rock and juniper were placed and shaped under the supervision of ODFW or GSWCD personnel.

Mainstem John Day River

Based on information from stream habitat surveys and the John Day spring chinook research study, limiting factors on the mainstem river include holding pools for spring chinook adults, and rearing for juvenile chinook and steelhead. Present rearing conditions are less than optimum for juveniles due to low pool:riffle ratios (i.e. 10:90 with 60:40, 50:50 optimal), little instream cover, limited riparian vegetation, shading,

instream diversity, and high summer stream temperatures (i.e. 70 - 80 degrees fahrenheit, and optimally would be between 50 - 60 degrees fahrenheit). In addition, unstable, eroding banks add to sedimentation problems by reducing egg and juvenile survival and extending the time frame of vegetative recovery.

Bank stabilization structures, jetties, rock and juniper riprap were constructed to enhance vegetative recovery. Jetties develop scour holes off the tip, providing cover and edge effect. Sediment accumulates on the downstream side and provides soil for regrowth of vegetation. Riprap stabilizes severely eroded banks from continued erosion. Large rock at the toe of the riprap blanket increases channel roughness and edge effect.

The juniper riprap was placed on two reaches of the mainstem John Day River to substantially reduce stream channel erosion, and protect the riparian fence from potentially being undercut before riparian vegetation had a chance to re-establish itself. Juniper riprap provides multiple benefits of bank protection, cover for juvenile salmonids, and increased nutrient cycling. Additionally, juniper riprap limbs trap sediment, aiding in bank stabilization bank and ripraian enhancement. Trees were placed in a shingled, overlapping pattern from downstream working upstream, and secured with number 9 smooth wire to steel posts sunk flush with the ground.

The contractor under direct supervision from John Day ODFW or GSWCD personnel placed boulders instream. Boulder placements included 1) locating singly or in clusters in the thalweg of the channel or a minimum of 6 feet from the bank, 2) near large root masses to reduce stream velocities to provide cover and holding areas for juveniles and adults, 3) near jetties or rock riprap to provide additional scour holes and cover, 4) clustered in deeper riffles for scour and flow diversity, and 5) in deep pools for cover ' Boulders placed in these manners provide scour holes, small rearing pools, resting cover for fish, increased edge effect, deflect flow away from eroded banks, increase channel roughness, and provide excellent interstitial space for overwintering the fish.

Downed logs and root wads with sound wood found along the bank were used to provide additional instream cover, habitat diversity, and nutrient cycling. Woody debris was placed using contract equipment rental time and later cabled to a deadman with 1/4 inch steel cable by ODFW personnel.

Fox Creek

Fox Creek provides marginal spawning and rearing habitat for summer steelhead and resident trout. Based on stream habitat surveys and discussions with the ODFW district biologist (Errol Claire, personal communication), present conditions on private lands are less than optimum for fish. Riparian cover is almost non-existent and unstable banks exist along major segments of the stream. High summer temperatures (i.e. 80 degrees fahrenheit) and sedimentation are major problems within the stream reach.

Check dams were constructed to raise the water table to enhance riparian vegetative recovery, increase pool area for juvenile rearing, and control erosion by decreasing stream slope and velocity. Small check dam sites were excavated and riprap grade rock was placed and shaped to provide an increase in upstream water depth of no greater than 18 inches to ensure passage for juveniles. Large check dams were constructed in the old Fox Creek channel to raise the water to bank full capacity in order to force the water back into the original meandering channel. This will provide more stream miles within this reach and restores the old meandering channel morphology and riparian system back to the original or pre 1964 channelization project.

Fence

Riparian corridor fencing was constructed on one mainstem river property and a portion of the upper Fox Creek property to eliminate livestock grazing and allow vegetation to rebuild along stream banks. One mainstem property was fenced on one side of the river because the other side is hay ground with limited cattle usage. A portion of upper Fox Creek is total exclosure and the upper end is in a 20 acre riparian pasture management system which has a monitoring program. Two monitoring programs using plant community transects and photopoints has been developed by ODFW and SCS. The transects provide data for the percentages of grasses, forbes, trees, shrubs and bare ground. The photopoints provide analysis of aria1 vegetation. These methods will be used to insure an upward trend in the riparian areas. If necessary, additional fences will be constructed and or stocking rates adjusted to achieve the recovery.

The electric fence on Fox Creek was partially rebuilt to exclude livestock usage and will be rebuilt in 1988 to a barb wire fence. During the summer of 1987, soil moisture was low and it was impossible to keep the fence grounded and hot. As a consequence, cattle passed through the fence and stream cross fences used for watering due to the flexible nature of this electric fence design. The cattle went over, under and through the fence and physically broke through the stream cross fences as they tended to key up in the watering sites. In 1987 we reconstructed the stream cross fences into barb wire gates and built additional rock jacks to stiffen up the flexible nature of the fence.

Riparian recovery will provide benefits to salmonids from increased shading and reduced summer stream temperatures, increased woody debris for cover, improved nutrient cycling, and increased bank storage of water.

The spring developments on lower Fox Creek from 1986 were completed by the contractor in the spring of 1987.

Riparian grass seed mix was planted by GSWCD personnel along the streambank on areas disturbed by heavy equipment and construction activities. SCS personnel recommended a mixture of 6 grass species, and application rates. The mix included hard fescue (Festuca ovina. duriuscula) and pubescent wheatgrass (Agrioyron trichophorum) both sod-forming species that develop a good root stucture; ladak alfalfa (Medicago falcata ladak) , white dutch clover (Trifolium repens), and sweet clover (melilotus

officinalis), nitrogen-fixing species that provide rapid establishment of good cover and high quality wildlife food: and tall wheatgrass (Agropyron elongatum) which produces large amounts of foliage and cover for surface stabilization, good nesting cover for birds, and fawning cover for deer. The mainstem rock pits were also seeded with bitterbrush (Purshia tridentata) .

Deer Creek Falls

Deer Creek has considerable potential for steelhead spawning and rearing habitat that has been largely unavailable to anadramous species due to a partially impassable waterfalls (RM 6). Passage improvement was completed over the 8 foot waterfall barrier in 1987. To improve passage for steelhead, five cement weirs were constructed creating a series of jump pools. An estimated 10 miles of spawning and rearing habitat became available with completion of the project. This work will compliment a riparian pasture fencing system constructed in 1985 designed to improve riparian vegetation.

Fivemile Falls

Fivemile Creek has considerable potential for steelhead spawning and rearing habitat that has been largely unavailable to anadromous species due to a partially impassable waterfall (RM 1) Passage improvement was completed over a 12 foot waterfall barrier. Three wooden weirs and 2 cement weirs were constructed to create a series of jump pools to provide passage for adult and juvenile summer steelhead and resident trout. An estimated 20 - 25 miles of spawning and rearing habitat became available with the completion of the project.

RESULTS AND DISCUSSION

Field Activities

With the assistance of the GSWCD, 15 year lease agreements were made with 2 landowners, and addendums with 1 landowner, involved in the 1985 program to continue habitat improvement work on additional areas (Table 4). Instream and fencing habitat work was completed in cooperation with by 2 landowners on 2 properties on the Mainstem John Day River and with 1 landowner on 1 property on Fox Creek. A 25 year easement was also obtained for construction of the passage project on Fivemile Creek. This project will complement future habitat work to be done by the Umatilla National Forest.

Habitat improvement work was completed on 2 reaches of the mainstem John Day River for a total of approximately 4.00 stream miles (Table 4). On these 2 reaches, 72 jetties, 739 boulders, 975 feet of juniper riprap, 1430 feet of rock riprap, 4 water developments, and several pieces of woody debris were installed for fish habitat and bank stabilization purposes. Approximately 5.5 miles of riparian fence were completed on these properties.

Habitat improvement work was completed on 1 reach of Fox Creek for a total of approximately 1 stream mile (Table 4).Instream structures completed include 8 large check dams, 7 small check dams, 498 feet of rock riprap and three water developments. Approximately 2 miles of riparian fence was completed to exclude cattle from the riparian area. Approximately half of this area is in total exclosure and the other half is a riparian pasture.

The construction of the Deer Creek Falls passage improvement project for steelhead was partially completed in FY 86 (Table 4) and was completed in FY 1987.

Administrative

Monthly progress reports and the 1986 annual report for the John Day Basin habitat improvement project were submitted to BPA during 1987. The John Day program hired 3 temporary technicians from June to October 1987 to assist with physical inventory, transects, construction, and repair of miscellaneous sections of fence not included under contract work.

Table 4 - Work Completed for the John Day Basin in 1987

Private Lands Habitat Improvement Project

***	Mainstem			Fox		Deer Creek	Fivemile Creek
Structure	Carter	Dow	McGirr	McGirr	Bentley	Bentley	
Stream Length (c)	**2.0**	**2.0**	1.0		1.0		
Fence (c)	**2.0**	**4.0**	**2.0**				
Rebuild Fence (c)					**2.0**		
Boulder	**377**	**362**					
Jetty	**37**	**35**					
Rock (a) Riprap	410	1430	498				
Juniper Riprap (a)	**616**	**358**					
Large Check Dam			**8**	1			
Small Check Dam			**6**		3		
Watergap		**4**	3		3		
Cul de Sac	**1**						
Rootwads (bf	2	2					
Passage Project						**1**	**1**

(a) riprap rock and juniper riprap measured in lineal feet
(b) woody debris cabled by ODFW
(c) stream length and fencing measured in miles

Interagency Coordination/Education

Considerable time was spent touring or meeting with other resource organizations.

Consultation and review was provided to personnel of the Malheur National Forest on instream construction projects on tributaries of the Middle Fork John Day River.

Monthly Grant Soil and Water Conservation District meetings were attended to participate in local issues and keep board members infomed of the progress of the BPA habitat project.

A tour was conducted for BPA on the John Day project. Information was presented at the tour on types and benefits of fencing and instream structures implemented on private lands in the John Day basin.

Several workshops and conferences were attended by members of the ODFW/GSWCD staff for consultation with professional associates and training.

SUMMARY AND CONCLUSIONS

Activities under the first half of 1987 included landowner contacts and lease agreements, personnel hiring and training, physical habitat inventory, procurement to of equipment and materials, planning and design of stream treatments, and contract development. Fifteen year lease agreements were obtained with 3 landowners and addendums with landowners from 1985 construction projects to do habitat work on additional properties in 1986. Activities during the second half of 1986 were contract layout and administration, physical habitat inventory, transects and photopoints, construction of instream habitat and bank stabilization structures and riparian fencing, 1988-89 budget development, annual report, and landowner contacts for the 1988 construction season. Contacts have been made with 9 prospective landowner cooperators for habitat improvement work in 1988 and 1989.

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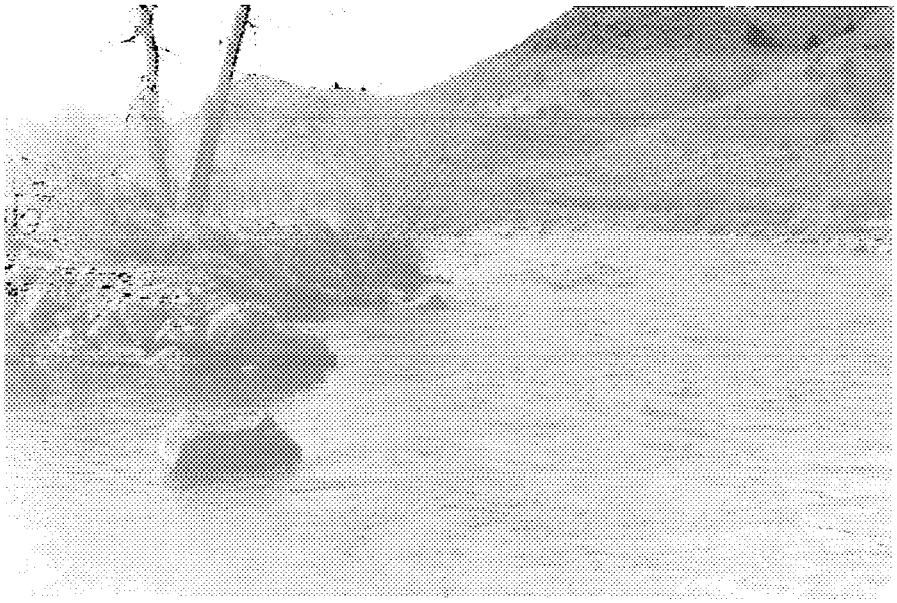
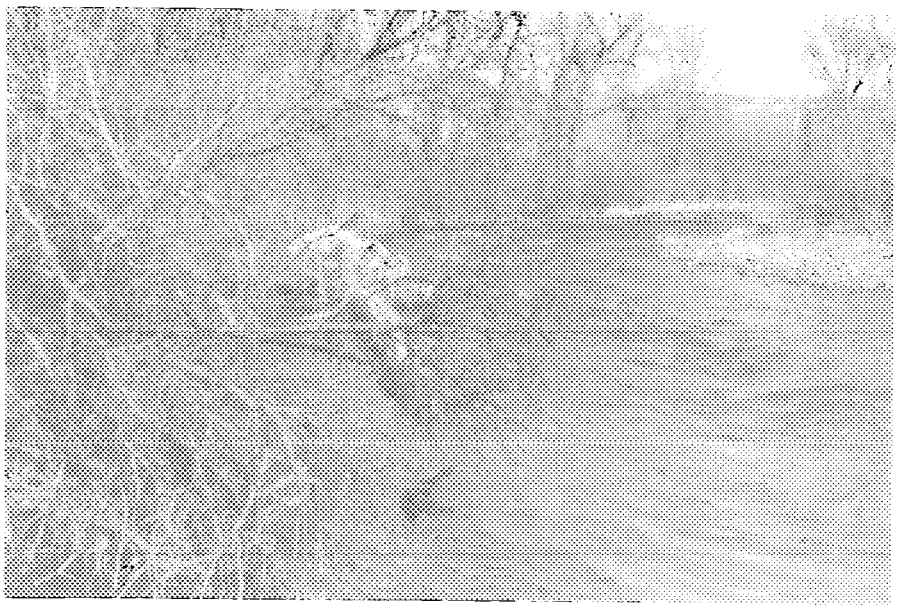
APPENDIX A

PHOTOGRAPHS

FIVE MILE CREEK PASSAGE PROJECT



TYPICAL JETTY WITH JUNIPER RIPRRP, SINGLE BOULDER PLACEMENT, AND BOULDER STRINGS. MAINSTEM JOHN DAY RIVER

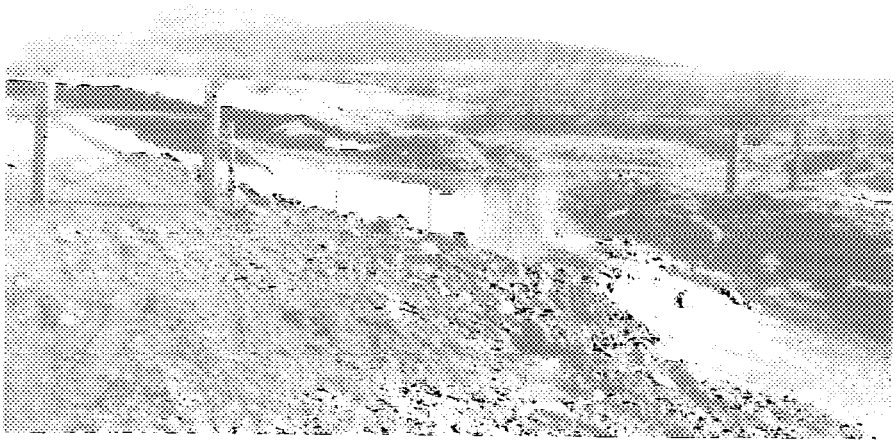


CABLED TREE WITH ROOT WAD ATTACHED. MAINSTEM JOHN DAY RIVER

OLD CREEK CHANNEL. FOX CREEK

NEW MEANDERING CREEK CHANNEL. FOX CREEK

TYPICAL H-BRACE, MAINSTEM JOHN DAY RIVER



STREAM CROSSING GATE AND NEW MEANDERING CHANNEL, FOX CREEK

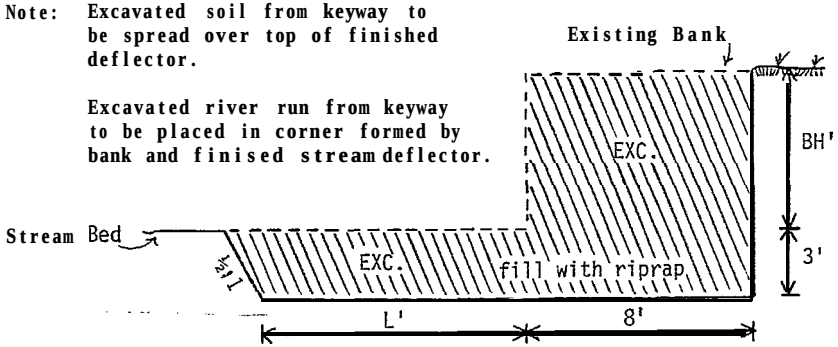
APPENDIX B

CONTRACT SPECIFICATIONS

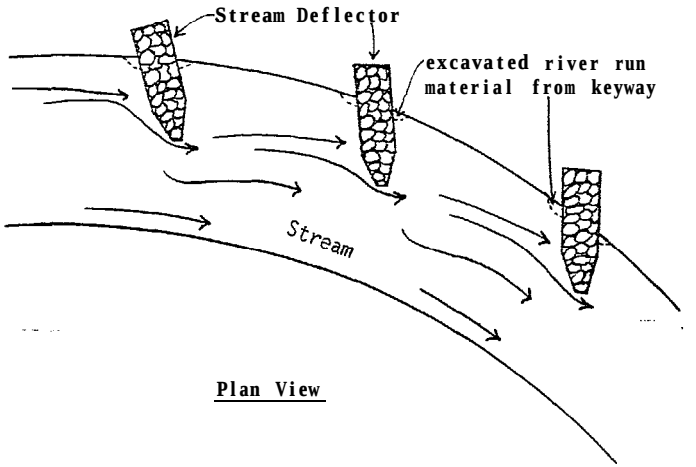
STREAM DEFELCTOR TYPICALS

Note: Excavated soil from keyway to be spread over top of finished deflector.

Excavated river run from keyway to be placed in corner formed by bank and finised stream deflector.



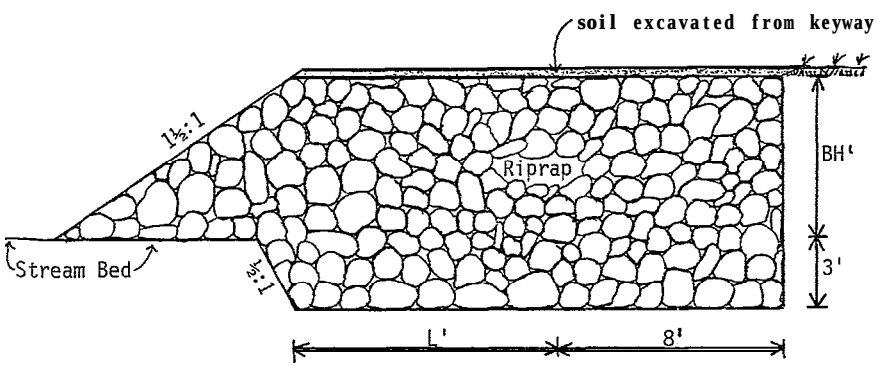
Keyway Excavation



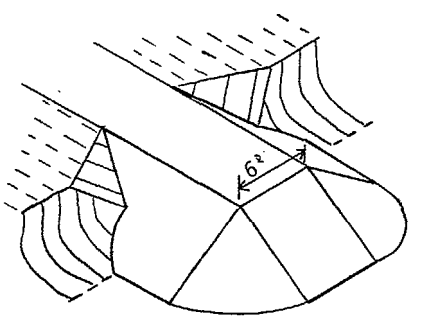
Plan View

--BH=Vertical height from stream bottom to mean high water mark

L =Deflector length to be determined by COR to achieve the desired hydraulic effect.



Riprap Stream Deflector & keyway

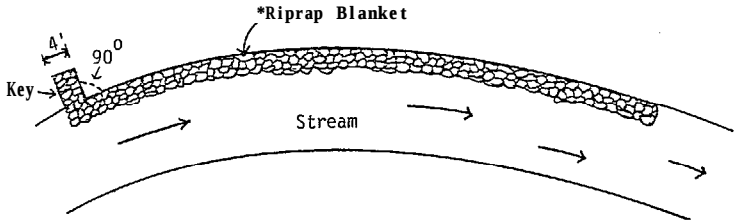


Slopes = 1½:1

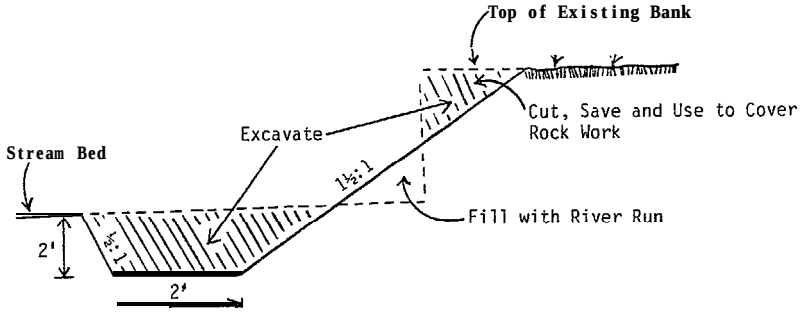
Isometric View

NOT DRAWN TO SCALE

RIPRAP BLANKET TYPICALS

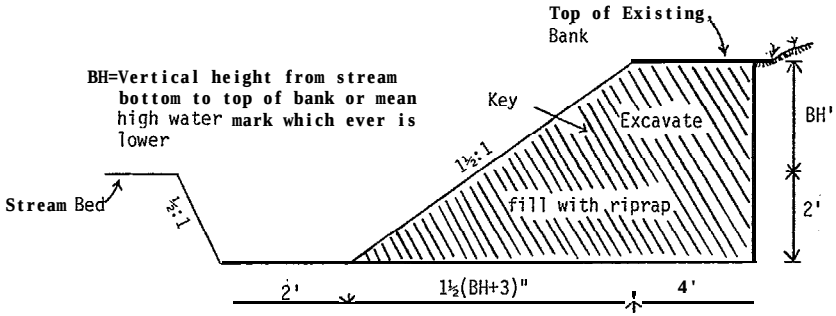


Plan.View
of
Typical Installation

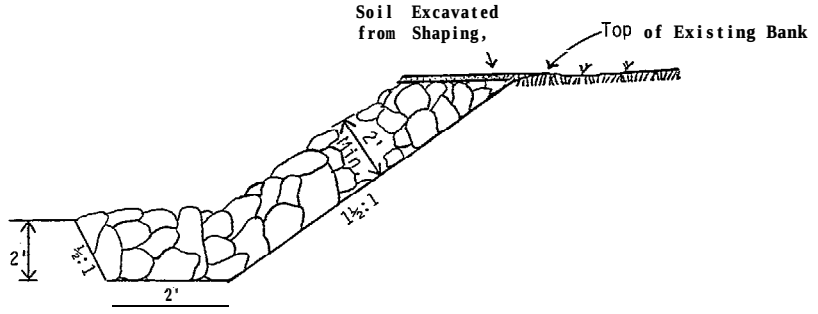


Shaping

Bank and Toe Trench Excavation



Key Excavation

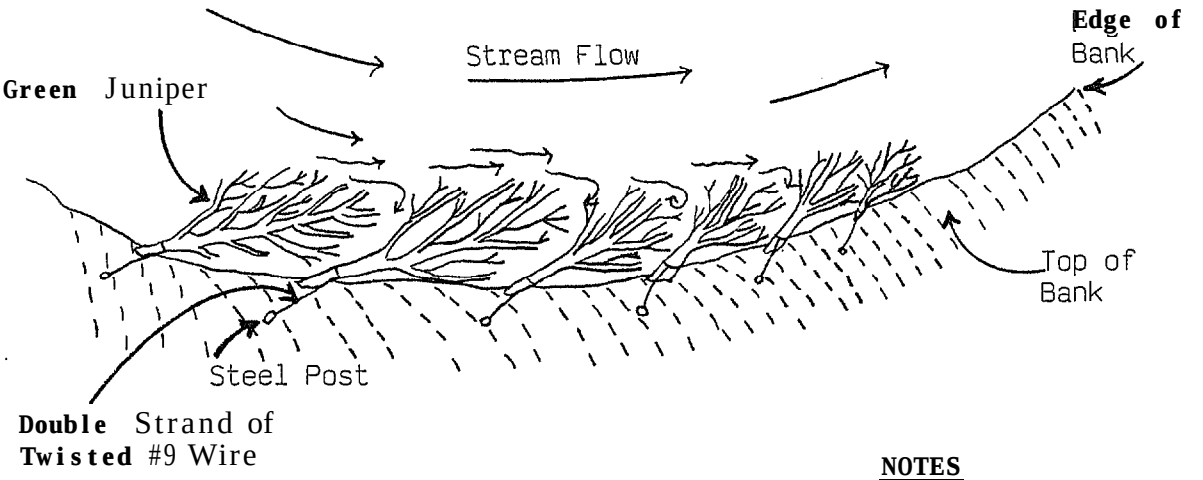


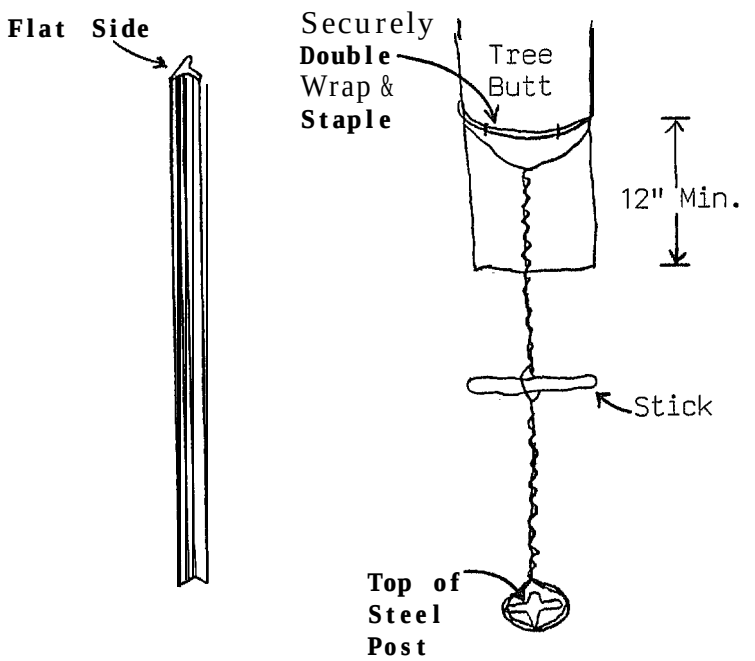
Riprap Blanket

NOT DRAW TO SCALE

PLATE 6

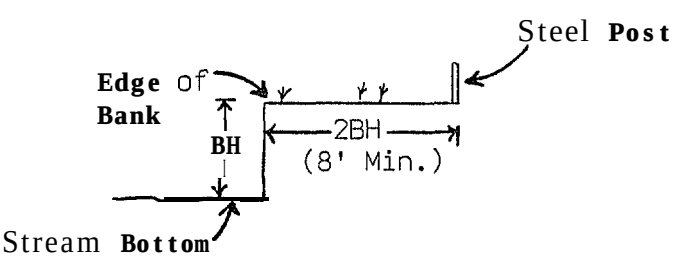
JUNIPER RIPRAP TYPICAL





Steel Post
3'Min. Length
1.33 lb./ft. Min.

Wiring



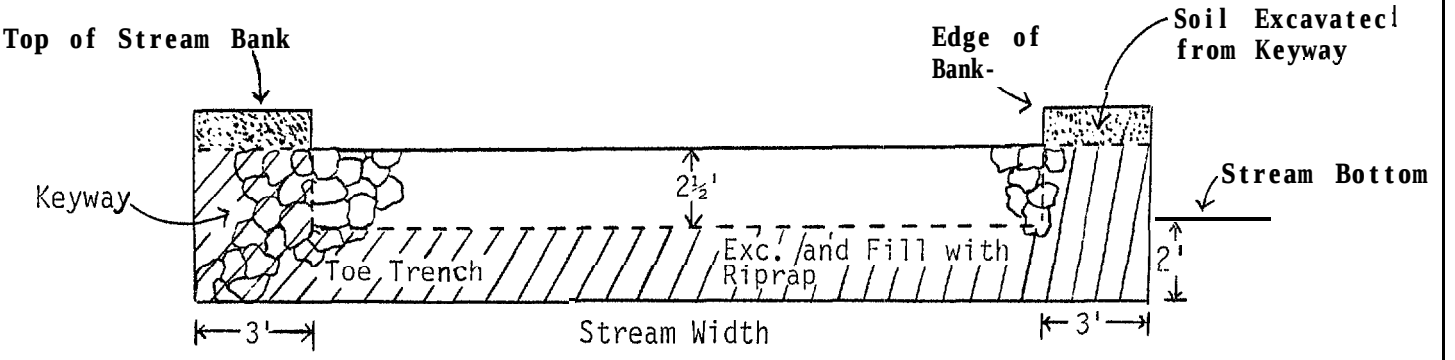
NOTES

1. **Place juniper trees in a shingled, overlapping pattern, tightly packed, beginning downstream. Use green, full limbed** trees.
   Min. Size: Butt Dia. 6", **Length** *
   Max. Size: Butt Dia. 12", **Length** *
2. **Double** wrap **and staple** #9 **smooth wire around butt end of tree, to steel post and back to tree.** Twist **#P wires until tree is tight against bank.**
3. Drive steel **posts a min. of 2BH back** from **edge of bank-in undisturbed soil. Drive** 2" **below ground level. Place flat side of post away from stream.**
4. **Drive posts at an angle such that the post top is further from the** stream **than the post bottom.**

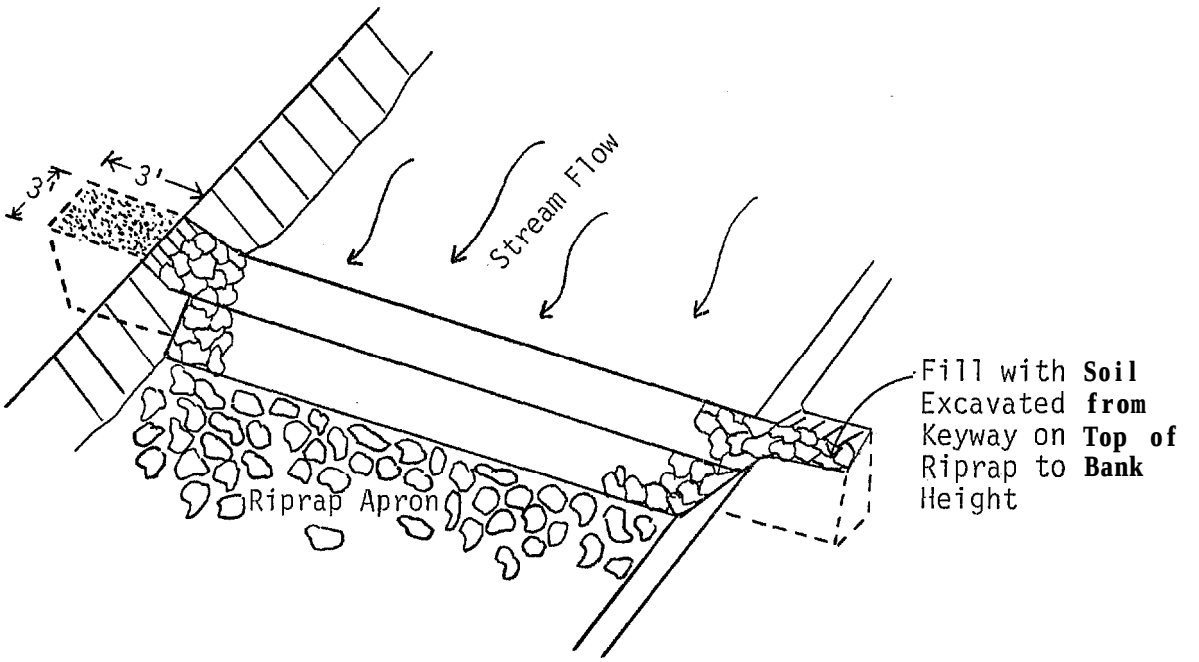
* **TREE LENGTH shall be adequate to allow no more than** 1' **of the butt end to** rest **on the bank and** 3' **to** 4' **of the** tree **top to lay in the flowing stream channel.**

NOT DRAWN TO SCALE

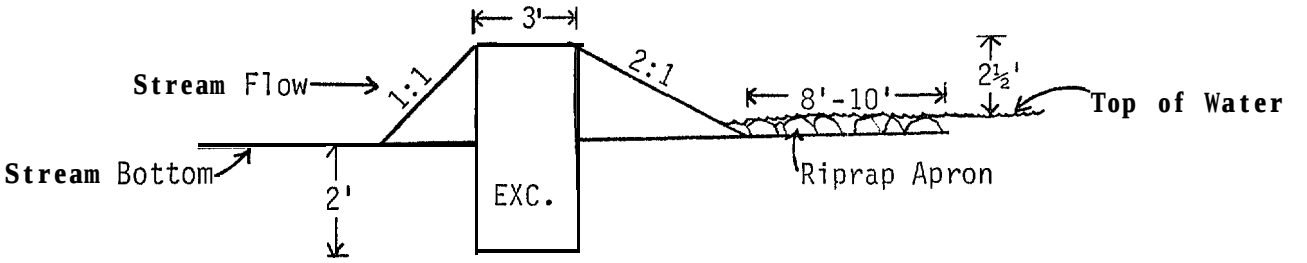
SMALL CHECK DAM



FRONT VIEW



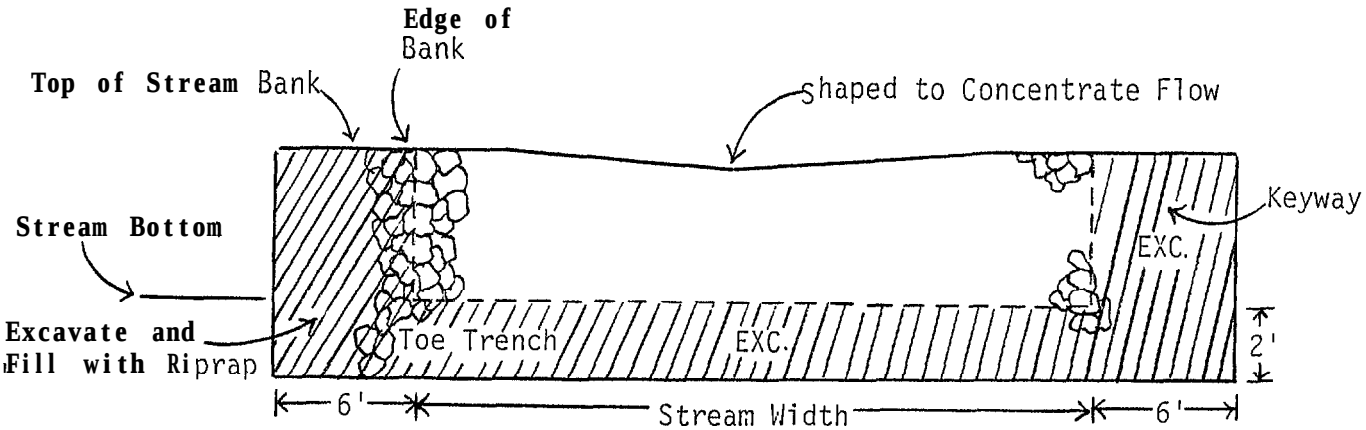
ISOMETRIC VIEW



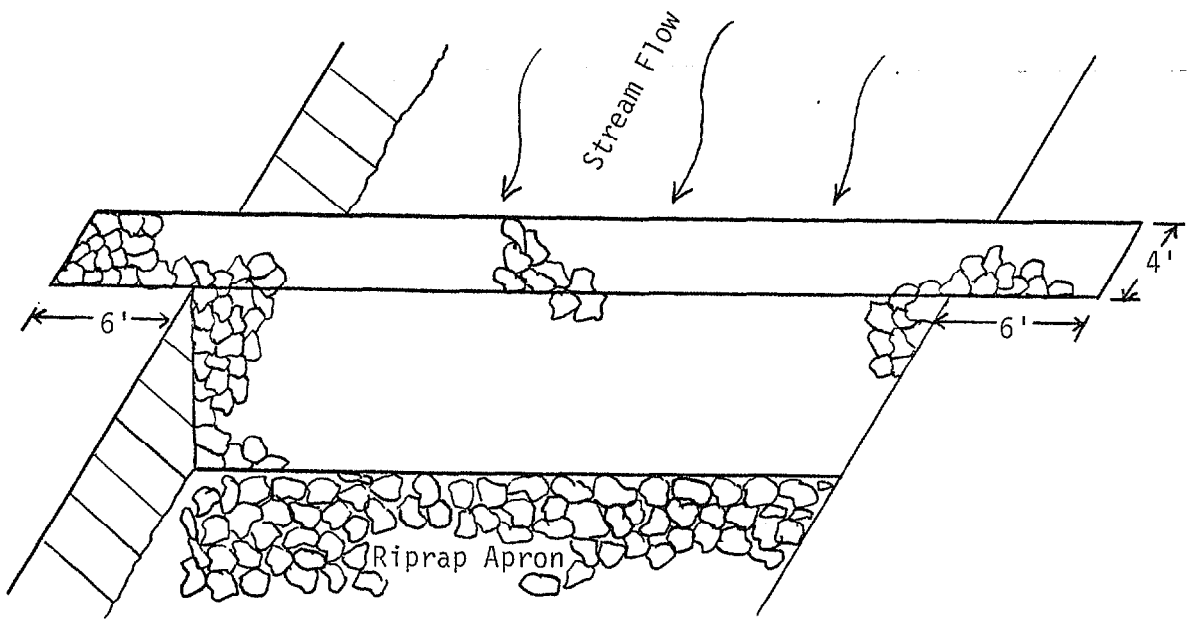
SIDE VIEW

PLATE 5

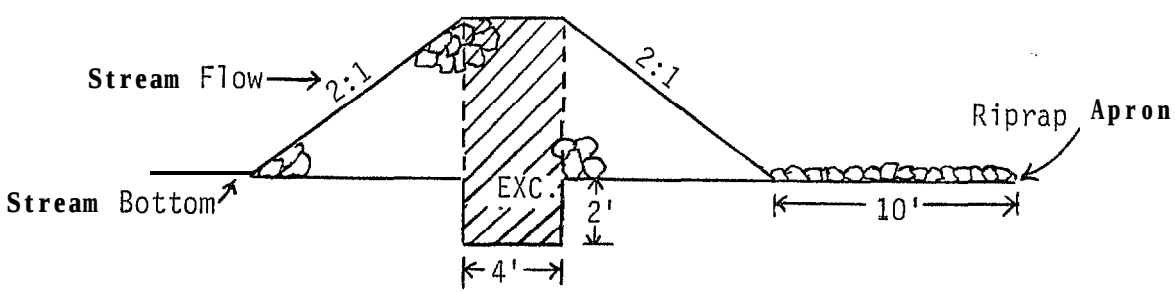
LARGE CHECK DAM



FRONT VIEW



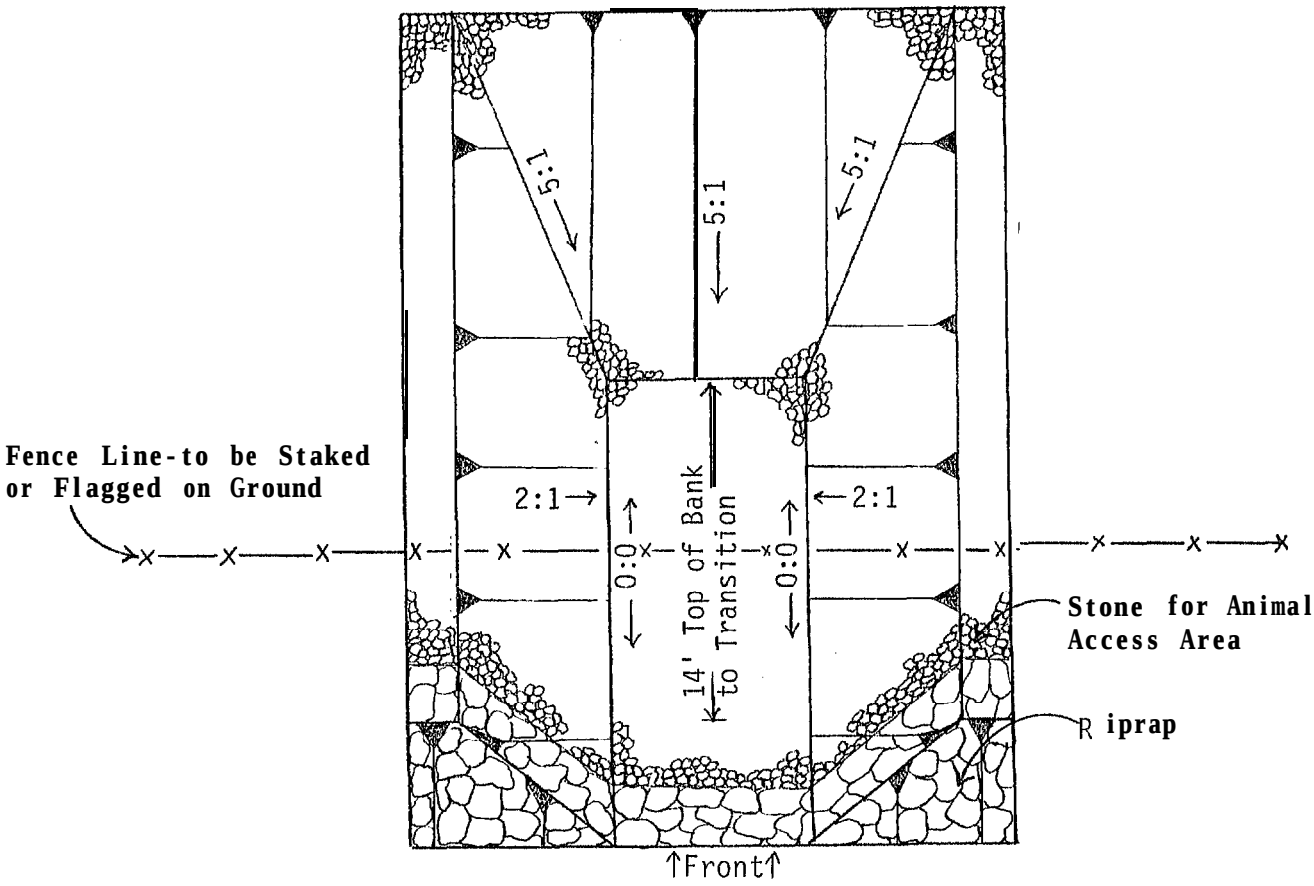
ISOMETRIC VIEW



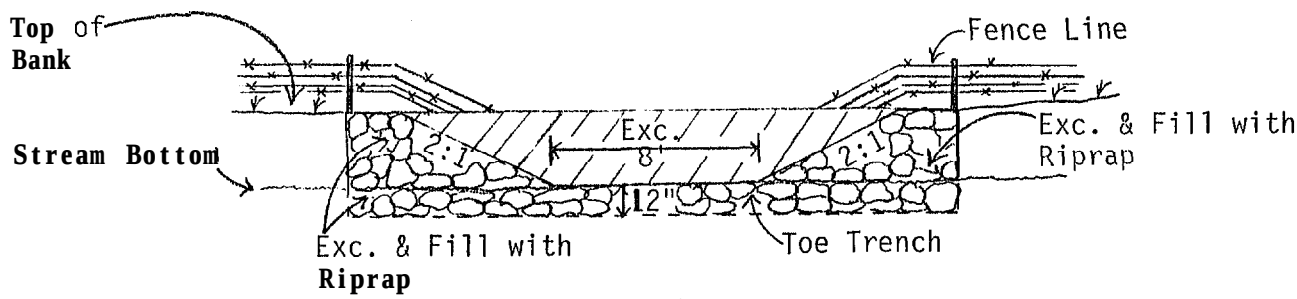
SIDE VIEW

PLATE 4

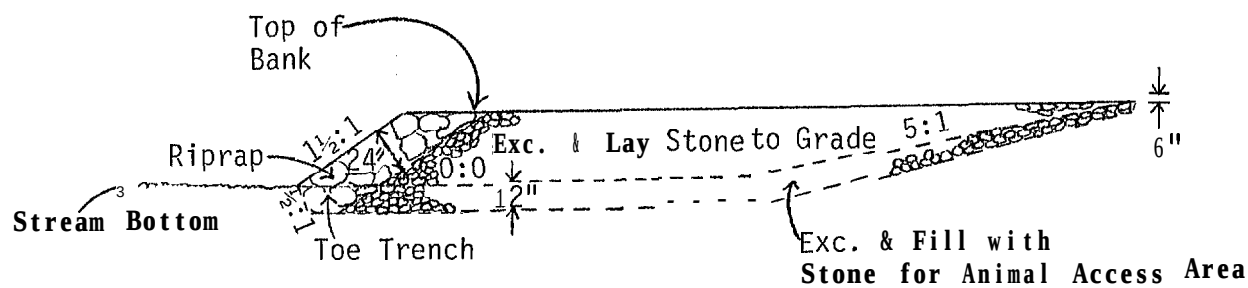
WATER GAP TYPICALS



Plan View



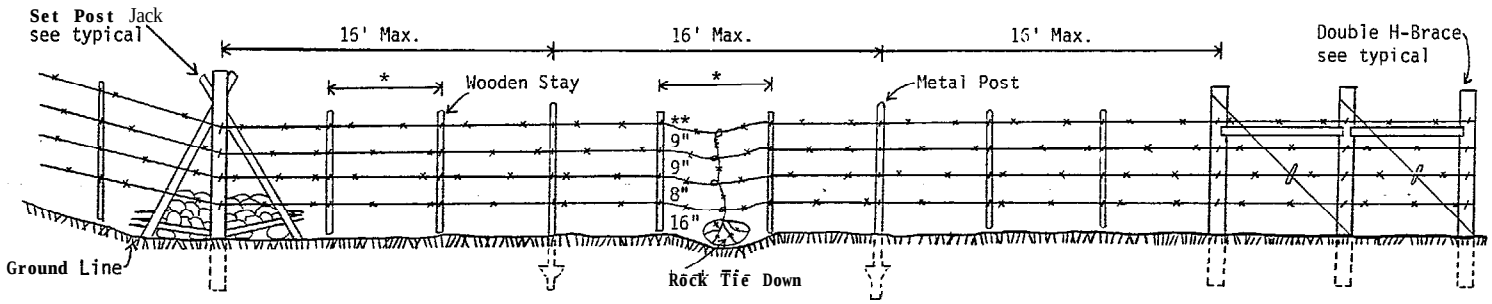
Front View



Side View

NOT DRAWN TO SCALE

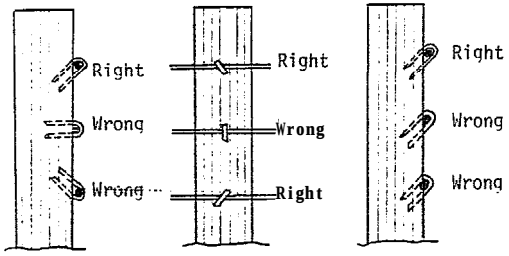
FENCING TYPICAL



*stays to be evenly placed between posts

**wire spacing may vary by landowner - confirm by COR

numoer of wires may vary by landowner

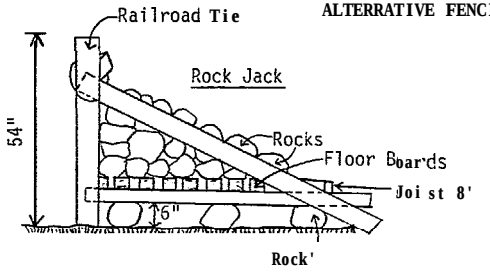


Drive staples at an angle.

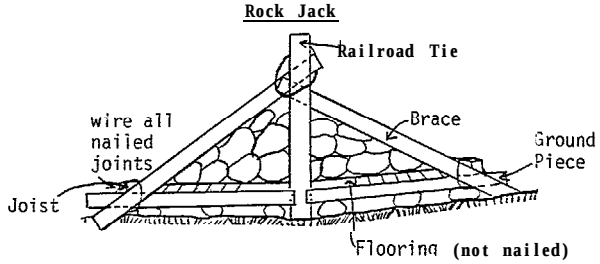
Do not drive staples parallel in side of posts.

Leave wire loose in staples except fence ends and stays.

ALTERRATIVE FENCING TYPICALS



Side View

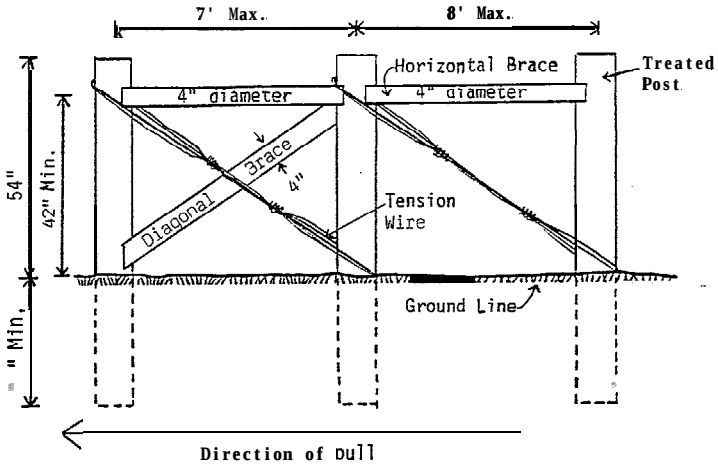


Front View

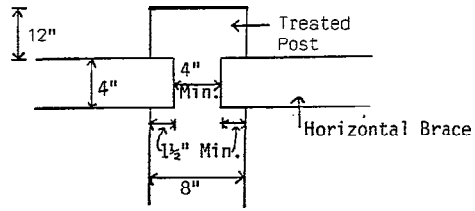
Not DRAWN TO SCALE

CORNER STRUCTURE TYPICALS

Double H-Brace



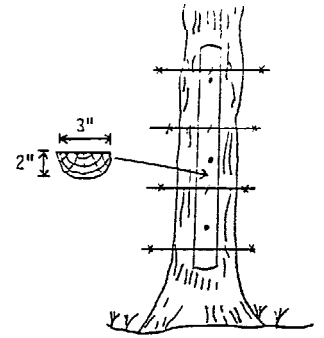
Double H-Brace Notch



Front View

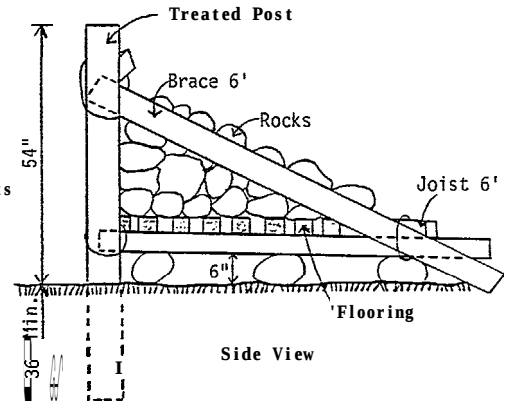
Nailer Use

Fastening Fence to Tree
Tree Size = 6" DBH Min.

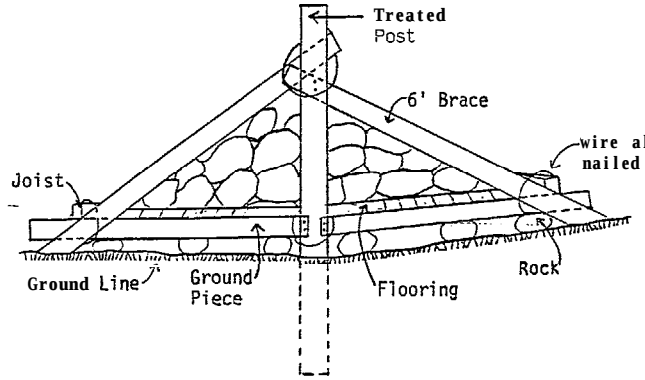


NOTE: Strip bark back on tree. Spike nailer securely with three 50d spikes to tree. Do not damage tree.

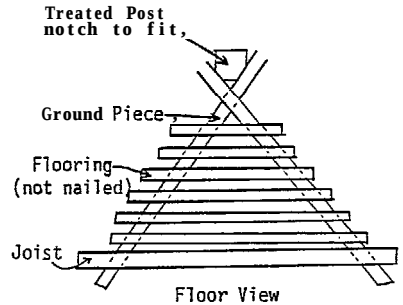
Set Post Jack



Side View



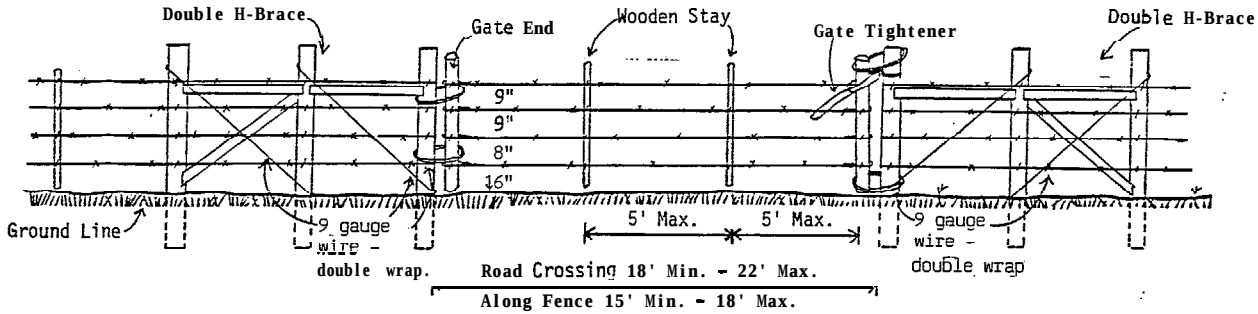
Corner View



Floor View

NOT DRAWN TO SCALE

GATE TYPICAL



WOVEN WIRE FENCE
TYPICAL