2003 Restoration Project Effectiveness Monitoring Report

The South Coast and Lower Rogue Watershed Councils are in their third cycle of submitting a Project Effectiveness Monitoring Report for Fish Passage. A representative sample has been monitored for each type of fish passage structure, and the following report applies to all of the grants listed below which contain one or more of those project types.
Fish Passage Improvements.

DEQ 037-00 Priority Stream Monitoring
DEQ 120-01 Curry Sediment Abatement
EPA: Rural Sustainability
GWEB 97-096 South Coast Fish Passage
GWEB 97-242 Riparian Demo Project II (Little Bio) - Jenny Creek
GWEB 98-025 Pistol River Project
GWEB 99-067 Lower Rogue Sediment Reduction
GWEB SC-42 Indian Creek Watershed Restoration
GWEB SC-51 Bagley Creek
GWEB SC-74 Deadline Creek Fish Passage
National Fish and Wildlife Foundation: Curry Agricultural Restoration Package
National Fish and Wildlife Foundation: Bring Back the Natives
OEDD(a)/USFWS Boulder Creek Fish Ladder
OEDD(c)/USFWS Schoolhouse Creek Fish Passage
OEDD(h)/USFWS South Fork Hubbard Creek Bridge Replacement Project
OEDD(P)/USFWS North Fork Hubbard Creek
OEDD(S) Squaw Creek Fish Passage and Wetland Enhancement
OWEB 97-095 South Coast Riparian Restoration Project
OWEB 97-148 Stream Partnership
OWEB 98-208 Floras/Morton Package
OWEB 200-122 Curry Technical Assistance Package
USFWS 196-670 Hubbard Creek Fish Passage (Fir Road)
USFWS 00-J117 Elk Chetco Habitat Optimization
USFWS 01-122 Turner Creek Fish Passage
USFWS 01-J128 Swanson Creek Fish Passage

2003 Restoration Project Effectiveness Monitoring Report
Fish Passage Improvement Projects

South Coast and Lower Rogue Watershed Councils May 2003
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Summary

This report is an update of the 2000-2001 report. It reflects the Councils' monitoring efforts that took place in 2001,02', and 03'. Monitoring of physical characteristics and/or biological populations was completed on 25 projects out of the 41 completed as of 2002. A rating of "ineffective" indicates that the category of passage was not improved as a result of the project. Projects were rated as "improved" if the passage category was improved over pre-project conditions. An "effective" project meets all of the physical specifications for the target species and life stages. For the jump pool weirs and Alaskan Steep Pass projects, adults were the target life stage for passage. Due to the nature of the barriers at these sites, juvenile upstream migration was not considered to be a feasible goal, so the effectiveness rating is based on adult passage only.

Monitored sites with jump pool weirs included two improved and two ineffective ratings. Of the improved sites, one was designed as an improvement until funds could be secured for a permanent structure, and the other attempted to improve access to the base of another barrier. At both of the sites rated as ineffective, rocks were displaced out of the weirs. Jump pool weir sites have been reconstructed as a result of extreme site conditions, poor design and/or implementation problems. Weirs that were placed within the turbulent flow close to a barrier tended to fail. Scour from eddies around the base of the rocks likely contributed to failure, but it is unknown whether rock was placed below the depth of scour to help stabilize the structures. Jump pool weirs were an early alternative to expensive engineered passage structures. New designs that use constructed riffles to correct jump heights should be considered for sites where jump pool weirs would have been used in the past. In addition, boulders should be placed below the depth of scour.

Monitored sites with countersunk (embedded) culverts included seven effective sites, two improved sites, and one unknown. In general these designs were used at appropriate sites, and where the rating was only improved, the culvert width, or the channel upstream, was the limiting factor. In those situations the velocity inside the culvert was too high for juvenile passage for some portion of the flows up to the 10% exceedence flow. "Seeding" the culvert with small boulders could be the most effective means of addressing the improved culverts by establishing resting areas for juveniles that would enable them to successfully pass through the site. The one unknown rating is on a reach with a 4% stream gradient, which required seeding the culvert with 2'-3' diameter rock. Further monitoring of that site is required to determine if juvenile passage is possible.

Two baffled culverts were monitored, and each was rated effective. One site is an old Forest Service project that is being monitored because the Council has funded jump pool weirs leading up to the culvert, so that adults can make the jump into the culvert.

One Alaskan Steep Pass structure was installed, and monitored, and the project was rated as effective. Coho were observed spawning above the Alaskan Steep Pass. At the Alaskan Steep Pass site, the current inlet may not prevent overflow of the structure and erosion of the fill. Of the bridge replacing a culvert sites that were monitored, six were rated as effective, and one site was rated as uncertain if effective. The uncertain site needs additional monitoring to determine if the riffle under the bridge needs to be "seeded" for juvenile passage. Bridges, and to a lesser extent embedded culverts, are subject to the channel upstream downcutting as gradient nick points migrate up from the site. Five of the sites monitored for downcutting show some degree of scour, and at least three of those sites have cut down through historic streambed layers. Two of these sites were monitored using a long profile survey of the channel thalweg that displays before and after conditions.

Two crossings were pulled, and not replaced. Of those two, one site was monitored and rated as effective. Costs limited the amount of fill that could be removed, resulting in a narrow, incised channel between two wet meadow reaches.

Pre-project conditions, results of the physical and biological surveys, and overall habitat considerations are summarized for each project site. Adaptive Management recommendations include revisions to the Fish Passage Evaluation Forms, and additional monitoring needs are identified.

Introduction

The South Coast and Lower Rogue watershed councils have been involved with fish passage improvements since 1995, when a three-person crew surveyed many of the road-stream crossings within the range of fish distribution in Curry County. This “Hire the Fishermen” survey provided a systematic look at adult and juvenile fish passage barriers. Some of the projects listed below resulted from the “Hire the Fishermen” surveys, while others have come from interested landowners, the Guide to Project Selection: Southwest Fish Management District (Prepared by the Oregon Wildlife Foundation and ODFW; printed November 1, 1995), the Curry County Road Department, and the Councils’ Road Inventory program.

Our project files include 41 fish passage projects that were installed as of 2002. The passage types include 7 jump pool weir sites, 16 countersunk culverts, 4 baffled culverts, 11 bridges that replaced culverts, 1 Alaskan steep pass, and 2 pulled culverts. We have not included passage projects that were completed by other agencies without South Coast Watershed Council funding, except for two projects that were readily accessible and of interest to our current partners (North Fork Hubbard and Rose Creek). Of these sites, 25 were monitored between 1999 and 2003. The goal of these projects was to provide access to available habitat. The type of habitat (spawning, over-wintering, summer rearing), the intended life stage, and the target species vary by site.

The method of monitoring used to evaluate a site varied by target species and by the type of structure. The different methods included juvenile surveys, spawning surveys, and physical surveys of the structure.

The table below lists the completed fish passage projects by project type.

Project Type:	Jump Pool Weirs	Countersunk Culvert	Baffled Culvert	Bridge Replacing Culvert	Alaskan Steep Pass	Excavated Crossing
Project Location	Jenny Cr Bagley Cr NF Hubbard Cr Deadline Cr Schoolhouse Cr Squaw Cr Indian Cr (Rogue)	Bagley Cr Rose Cr Ismert Cr Deer Cr Elk Cr Ranch Cr (2) Turner Cr Indian Cr (Rogue) Gallagher Cr Taylor Cr Edson Cr (Rogue) Squaw Cr NF Hubbard Trib EF Squaw Cr Squaw Cr Trib	School-house Cr Swamp Cr (2) Deadline Cr	"Dan's" Cr Hoog Cr Beaver Cr Cedar Cr (Elk) SF Hubbard Cr MS Hubbard Cr Deep Cr Turner Cr Swanson Cr Boulder Cr (Euchre) Morton Cr	Boulder Cr (Floras)	NF Boulder Cr (Floras) Beaver Cr Trib.

Methods Used to Evaluate the Structures

Physical specifications used to evaluate the adequacy of the structures were adopted from ODFW's Guidelines and Criteria for Stream-Road Crossings and Oregon Road/Stream Crossing Restoration Guide: Advanced Fish Passage Training, June 8, 1999. Although physical specifications alone may be used to rate the effectiveness of each project (the "build it and they will come" philosophy), we have also conducted biological sampling, with the intent of demonstrating fish presence. These physical and biological criteria form the measurable objectives of the projects.

Survey Types

Physical Surveys

Thus far physical surveys have only been conducted during the winter months where they've been timed with peak migration periods, and with high streamflows. Where jump heights and/or water depths are limiting, additional site visits during higher flows will be needed to determine if there is a passable range of flows. In some cases spring flows may be a limiting factor to the downstream migration of juveniles, and low summer flows may be limiting juveniles from accessing cold water refugia, but as of this report no surveys have been conducted to evaluate these conditions. The physical measurements were recorded on Evaluation Forms for each site visit (see Appendix for format).

The results of the physical measurements could be made more accurate by measuring the discharge during the site visit, and tying that discharge to ODFW's high flow design discharge (the flow that is not exceeded more than 10% of the time during the months of adult migration) By determining how close the site visit discharge is to the design discharge, one can than claim that the site is passable during "X" % of the adult migration, or conversely, one can claim that it is not passable at least "X" % of the adult migration. Because small stream gauges are lacking in Curry County (none currently operating on watersheds smaller than 9900 acres), the 10% flow is difficult to identify. The ODFW guidelines provide methods for estimating this flow. On streams where the two-year flood event (Q2) is less than 44 cubic feet per second (cfs), the design flow equals Q2. Where the Q2 is greater than 44 cfs, the 10% flow = 0.18 x Q2 + 36. The June 1999 version of Advanced Fish Passage Training notes that Q2 is approximately 40-50% of the Q50, which can be obtained from ODF's streamflow maps. Our efforts thus far have relied on visually estimating the discharge relative to bankfull (on the assumption that bankfull and Q2 are very close). If discharge was measured, it is possible that some sites would require additional measurements to determine if their "effective" rating was valid at a Q2 flow. Between 1999 and 2003 physical surveys were used to evaluate 4 jump pool weir sites, 5 countersunk culvert sites, 2 baffled culvert sites (1 of which was a pre-existing Forest Service project from the mid 1980's), 1 bridge, and the Alaskan Steep Passage fish ladder. Of the 12 site visits, only the results for the bridge, and 1 countersunk culvert, were inconclusive and required a second visit. In some cases, biological surveys also took place with the intent of demonstrating usage, and thus adding support to the results of the physical surveys.

It should be noted that culvert gradients from the Hire the Fishermen surveys were measured using clinometers, and are approximate.

Biological Survey
Spawning surveys were employed to demonstrate the presence of salmon and/or trout above a project site. The surveys were conducted by a previous ODFW employee, using the ODFW spawning survey protocol. Presence of the target species above the structure clearly demonstrated that it was functioning, under certain flows, but it did not imply that the structure was functioning under the full range of flows up to the Q2 flow. For example, in the case of the Deadline Creek boulder weirs, spawning Chinook and Coho were consistently present above the culvert following a large storm event (i.e. 70% bankfull). Prior to the event, though, they were most likely blocked by the jump height. Conversely, absence of spawning fish above a structure did not conclude that the project was ineffective. On small tributaries, run timing, especially with Steelhead and trout, is difficult to determine, and even when the survey is well timed, Steelhead and trout can be very hard to detect. It is also important to account for the rate at which a species will re-colonize a section of habitat that was completely blocked for a significant amount of time. Thus far our surveys suggest the rate is quite variable.

From 1999 to 2003 Chinook/Coho spawning surveys were used on 11 sites, and Steelhead/Sea-Run Cutthroat spawning surveys were used on 4 sites. The Chinook/Coho spawning surveys were timed with peak spawning counts from previous years. ODFW Visibility Ratings were documented according to the following definitions:

1 = Can see bottom of riffles and pools
2 = Can see bottom of riffles
3 = Can't see bottom of riffles or pools

The Steelhead/Sea-Run Cutthroat spawning surveys that took place during the winter of 2000/01 were unproductive due to low flow conditions, which likely prohibited fish from using the smaller streams.

Juvenile presence/absence surveys were also used to document passage, and re-colonization, above the project sites. In 1998, when the Councils' monitoring protocols for fish passage were being designed, there was interest in certifying the Councils' surveyor in electro-shocking, and in the use of in-board plane juvenile traps. However, due to time constraints, and concerns related to the Coho listing, neither shocking nor juvenile traps were employed. Instead, snorkeling has been used to demonstrate presence of salmonids above a structure, and when possible, to identify the species. Where species identification was not possible via snorkeling, the local ODFW habitat biologist has electro-shocked the sites.

In June of 2002 juvenile surveys were conducted at 3 sites. The timing of the surveys was 3-4 weeks past the peak downstream migration, but they still proved to be a useful means of documenting presence above the project sites. Juveniles were first observed in the spring of 2002 by the Councils' road inventory crew, but it wasn't until the ODFW habitat biologist shocked the stream in June that the species' were identified.

Longitudinal Profiles
One issue related to fish passage projects that has been raised both within the Councils, and from regulatory and granting agencies, is how to address sites that create a headcut when the existing structure is replaced, or removed. Two concerns have arisen regarding these sites. The first concern relates to the bedload that has been stored upstream of the crossing as a result of the existing structure's elevation, and/or its' constrictive nature. This material, often significant in

volume, poses a risk to downstream habitat within the channel being opened up, and in general, adds unneeded bedload to the sediment laden mainstream channels of the South Coast. The second concern derives from the effects of the headcut on the instream habitat, and channel morphology, upstream of the crossing. On at least 7 of the Councils' projects, and one ODOT project, the headcut has been significant enough to isolate side channels, shorten channel lengths, and/or lead to channel confinement on previously unconfined stream reaches. In a few cases, it appears that the downcutting has left the channel bed elevation lower than historic conditions, and on one site it has taken the channel down to bedrock.

The question being raised is whether there is a need to stabilize the headcut through the construction of a 'step down channel', the placement of large wood, and/or the placement of boulders. At three of the Councils' projects wood was placed upstream and/or downstream of the crossing prior to the project being implemented, with the intent of either trapping material released through the downcutting, or to slow the migration of the headcut upstream. Two of these projects, namely Boulder Creek (Euchre) and Turner Creek, have been monitored using a longitudinal profile survey along the channel thalweg (deepest part of the channel along a channel cross section).

The thalweg longitudinal profile surveys were undertaken using a "Total Station" instrument, which is a computerized surveyor's transit. The instrument creates X, Y, Z coordinates for points that are surveyed, which are downloaded into CAD software (Computer Aided Drafting), and plotted. The points were taken along the thalweg at slope breaks, so that the software could determine where changes in the stream's gradient were occurring. These points were then displayed as a planview and a longitudinal profile. The planview is a useful way to illustrate the channel sinuosity, whereas the longitudinal profile displays stream gradient, channelbed elevation, and indirectly, habitat types. Both Turner Creek and Boulder Creek were surveyed prior to the project implementation, and following the first winter. The same control points were used between the two years so that the surveys were comparable. The planview maps were overlaid so that movement of the thalweg became apparent. In the case of the longitudinal profiles, the success of overlaying two years on the same graph is dependent on how the profiles changed between those two years. If the change in profile length was insignificant, the profiles can be placed on the same graph. Where the difference is too great, each profile must be plotted on a separate graph, and stable features (i.e. culvert placement, a stable meander, etc.) are used for reference when comparing the two profiles.

Measurable Objectives

Physical

- Reduce jump height (culvert outlet drop) to
  - less than six inches for juvenile salmon and steelhead, and for adult trout
  - less than one foot for adult salmon and steelhead
- Provide jump pool depth of at least 1.5 times the jump height:
- Structure is maintained and free of obstructions/debris
- Provide water depth during expected fish passage periods of at least 12" for adult steelhead and chinook, 10" for adult coho and sea-run cutthroat trout (>20"), and 8" for trout (<20") and juvenile salmon and steelhead (for non-embedded culverts).
- Reduce average water velocity in feet per second (at high flow design discharge) to less than the guidelines in the table below.

Average Water Velocity in feet per second

Culvert Length	Adult Salmon & Steelhead	Adult Trout (>6")	Juvenile Salmonids
< 60 feet	6.0	4.0	2.0
60-100 feet	5.0	4.0	2.0
100-200 feet	4.0	3.0	Embedded
200-300 feet	3.0	2.0	Embedded
>300 feet	2.0	1.0	Embedded

Note – in embedded (countersunk) culvert designs, substrate creates low velocity pockets

For embedded culverts, resting velocities should be adequate if

1) Culvert is placed at stream grade, and a streambed with substrate >1' deep develops
2) No outlet drop exists
3) Diameter is no less than 2/3 of the bankfull channel width (to avoid an inlet drop)

Biological

- Desired species spawn upstream of structure
- Desired species rearing upstream of structure

Project Rating

A rating of "ineffective" indicates that the category of passage was not improved as a result of the project. For example, if the site previously had a jump height of 6 feet (complete blockage), and the project decreased the jump height to 4 feet, the site is still a complete blockage, and the project is rated "ineffective." Ineffective projects typically resulted from either a failure to implement the design correctly, or from poor initial designs. Projects may be rated as "improved" if the passage category is better than the pre-project conditions. Passage categories include adult barrier (complete blockage), adult restricted (jump height >one foot), juvenile barrier, or passable. An "effective" project meets all of the physical specifications for the target species and life stages. It should be noted that although juvenile upstream migration is desirable, it was not considered to be a goal for the jump pool weirs or Alaskan Steep Pass.

Project Results

Effectiveness Ratings

The ‘miles of habitat’ indicates the total stream miles with a gradient of 16% or less (as determined by a 7.5 min. topographic quad) that were opened up by the project. If the project was rated as ineffective, then these miles were not opened up. Likewise, if the project was rated as improved, then these miles were only opened up to the species and life stages that can mitigate the improved situation. Though some habitat may exist at gradients greater than 16%, a field visit is needed to adequately determine where the terminus of usable habitat exists. Conversely, it is possible that a natural barrier limits access to all the habitat identified with a gradient of 16% of less. Where there is a human-made barrier upstream, only the miles up to that barrier have been counted.

Location	Structure Type	Rating	Miles of Habitat	Granting Agency	Comments
Bagley Creek	Jump Pool Weirs	Improved	0*	GWEB SC-51 OWEB 97-148	Reduced jump at base of fish ladder.
North Fork Hubbard Creek	Jump Pool Weirs	Ineffective	1.0	USFWS – OEDD P	Rock smaller than design. Is design distance below step adequate?
Deadline Creek	Jump Pool Weirs	Improved	1.6	GWEB SC-74	Reduced jump height to culvert. Barrier log jam 450' upstream
Schoolhouse Cr	Jump Pool Weirs	No Monitoring	See Countersunk Culvert	USFWS - OEDDc	
Jenny Cr	Jump Pool Weirs	No Monitoring	2.5	GWEB 97-242 OWEB 97-095	
Squaw Cr	Jump Pool Weirs	No Monitoring			
Indian Creek	Jump Pool Weirs	Ineffective	2.9	GWEB SC-42	Canyon immediately above – limits passage. Boulders blown out twice.
Bagley Creek	Countersunk	Improved	0.2*	OWEB 97-096	Juvenile velocity barrier.
Ranch Creek (lower)	Countersunk	Effective	1.6	NFWF - BBN	Re-colonized by Coho
Ranch Creek (upper)	Countersunk	Effective	0.6*	NFWF - BBN	Re-colonized by Coho
Turner Creek	Countersunk	Effective	0.5	USFWS 01-J122 NFWF – CARP EPA – Rural	Coho, Steelhead and cutthroat observed upstream
Rose Creek	Countersunk	Effective	0.1	None	
Ismert Creek	Countersunk	Effective	0.2	OWEB 97-096	
Deer Creek	Countersunk	Effective	0.05*	OWEB 97-096	
Elk Creek	Countersunk	Improved	0.4	OWEB 97-096	Velocities at high flows unknown. Juvenile passage is limited.
Indian Cr (Rogue)	Countersunk	Unknown	0.15	GWEB 99-067 NFWF - BBN	Passable for adults, juveniles unknown – need physical survey
Gallagher Cr	Countersunk	Effective	0.4*	DEQ 120-01 NFWF - CARP	
Taylor Cr	Countersunk	No Monitoring	0.15	NFWF - BBN	
Edson Cr (Rogue)	Countersunk	No Monitoring	0.7	NFWF - BBN	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

Schoolhouse Creek	Baffled Culvert	Effective	1.1	USFWS - OEDDc	
Deadline Creek	Culvert with Retrofitted Weirs	Effective	Same as J. Pool Weirs	None	Forest Service weirs from the 1980's – culvert for which the jump pools were constructed
Swamp Cr (lower)	Baffled Culvert	No Monitoring	0.3	USFWS 00-J117	
Swamp Cr (upper)	Baffled Culvert	No Monitoring	1.6	USFWS 00-J117	
Dan's Creek	Bridge	Effective	0.3	OWEB 97-096	
Turner Creek	Bridge	Effective	0.1	USFWS 01-J122 EPA – Rural NFWF - CARP	See comments for countersunk culvert.
Swanson Creek	Bridge	Effective	0.4	USFWS 01-J129 NFWF – CARP GWEB 98-208 OWEB 200-221	
Hoog Creek	Bridge	Effective	0.8	OWEB 97-096	Log jam 0.5 miles upstream.
Cedar Cr (Elk)	Bridge	Effective?	1.2	OWEB 97-096	Juvenile barrier 0.6 mile upstream
Boulder (Euchre)	Bridge	Effective	1.4	OWEB 97-096	
Morton Cr	Bridge	No Monitoring	3.8	NFWF - BBN	
Beaver Cr	Bridge	No Monitoring	2.65	OWEB 97-096	
SF Hubbard Cr	Bridge	No Monitoring	2.8	USFWS - OEDDh	
MS Hubbard Cr	Bridge	No Monitoring	10.0	USFWS 196-670	Possibly other culverts blocking small tributaries.
Deep Creek	Bridge	Effective	1.9	GWEB 98-025	
Boulder Creek	Alaskan Steep Pass	Effective	2.6*	USFWS – OEDDa OWEB 97-096	
Beaver Cr Trib.	Pulled Crossing	No Monitoring	1.2	OWEB 97-096	
NF Boulder Cr	Pulled Crossing	Effective	0.2*	DEQ 120-01 GWEB 98-208	* HWY 101 culvert a barrier

* Other human-made barriers are present upstream which limit the available habitat.

Jump Pool Weirs

Jump pool weirs are intended to reduce the jump height at a barrier by raising the water level downstream over a series of smaller steps. Nearly all of these structures were relatively inexpensive attempts to provide adult passage without reconstructing the barrier. An exception is at Schoolhouse Creek, where the jump pool weirs were also designed to provide grade control to prevent downcutting below the culvert. Juvenile passage may be restricted at these sites by jump heights exceeding six inches, by high velocities in the constrictions at the weirs (high flows), and/or by a lack of water depth as flows go subsurface (low flows).

Bagley Creek (tributary to Elk River)

Bagley Creek has been altered by a series of man-made structures from the county road to its confluence with Elk River. The stream flows into a fire pond approximately 700' downstream of the county road. The spillway exits the pond into a 25' long concrete raceway, down a four-step fish ladder and over four boulder jump pool weirs into an orphaned log pond. As a result of years of sediment deposition the log pond is now a wetland with two or more dominant channels winding through it. The downstream extent of the wetland is defined by an earthen berm. The braided channel merges at a narrow gap in the berm where an old crossing was removed. From there it passes over some habitat log weirs before its rendezvous with Elk River.

Elk/Sixes Watershed Council, Marsh Ranch, Curry SWCD and the Hire the Fisherman program contributed to construction of the boulder weirs located just downstream of the fish ladder. In 1996, one large boulder weir was placed to raise the water level and control downcutting under the fish ladder. In 1997, three boulder weirs were added to reduce the drop at the first boulder weir. The weirs were functioning as intended as of January 1999 (see photos pg31).

Physical Surveys:
On 2/14/00 a physical survey of the boulder weirs was conducted during an 85-90% bankfull event. The two downstream boulder weirs were evaluated because the two upstream weirs were unreachable, but the surveyed weirs closely resemble the upstream weirs in size and function. The downstream weirs both had adequate jump pool depths, but the jump heights were 1.1' and 1.3'(see photos pg32). These jump heights will increase at lower flows. As a result the project is rated as improved.

The fish ladder to the fire pond is not a watershed council project, but because it poses the greatest hurdle to migrating fish, it was also examined on 2/14/00. Velocity measurements indicate the existence of resting opportunities but the jump heights ranged from 50% to 80% greater than the allowable maximum heights (ODFW criteria), and the spacing between steps was inadequate. In addition, a 25' long concrete raceway, ending in a 2'-3' jump, exists between the top of the ladder and the fire pond. The water depth inside the raceway was also inadequate according to the ODFW criteria. The overall conclusion is that the combination of fish ladder and concrete raceway greatly reduce, if not completely eliminate, the possibility of upstream migration (see photos pg32). This is the most significant obstacle on Bagley Creek.

Biological Surveys
Based on the size of Bagley Creek, ODFW expects to find Steelhead and possibly Coho, but not Chinook. If Chinook did spawn in Bagley Creek, it would be at high flows in the lowest section (ODFW, T. Confer, oral communication). Elk/Sixes watershed council members and ODFW hatchery personnel reported seeing Steelhead in Bagley Creek (3/5/97 letter from Paul Hammerberg, Chairman). It is difficult to conduct a spawning survey that is able to indicate the limiting point in the migration path due to the following:
- If passage is possible it will be so only at high to very high flows (particularly with Chinook). This means the water clarity will be too low to see most fish.
- Under low visibility only spawners can be consistently seen or roused, and even those fish can be evasive. There are no suitable spawning beds in which to observe fish between the different passage structures, so at best we can only determine if all the structures are passable.

On 3/1/01, a Steelhead spawning survey extended upstream from the county road approximately 0.3 mile, and no fish, nor redds, were observed (low flow conditions and ODFW visibility rating 1). Though the survey was timed with the Steelhead run in the mainstem, caution should be used in drawing any inferences from the zero counts because it was low flow winter.

During the 2001/02 Chinook and Coho spawning season, six surveys were conducted between the mouth of Bagley Creek and the remnant log pond. On two occasions 1 Chinook was seen near the mouth resting during high flows, but no fish were observed spawning, or moving through, the channel below the log pond. Though these surveys are not indicating whether the jump pool weirs are functioning, they do suggest that there is not an actively colonizing population of salmon in Bagley Creek. As a result, salmon spawning surveys will no longer be used as a means of documenting passage.

Overall Habitat:
The length of habitat upstream of Elk River Road was estimated as 1.6 miles up to 16% slope on the topographic map. Two culvert barriers are located within this section, about 0.3 miles and 0.7 miles upstream. We understand that BPA intends to fix these barriers (Hire the Fishermen sites 45 and 46). Within the 0.3-mile reach between the road and the first culvert barrier, most of the habitat would provide good spawning for Steelhead and cutthroat, though the level of fines mixed into the gravels/cobbles was excessive.

North Fork Hubbard Creek (tributary to Hubbard Creek)
The City of Port Orford and the Port Orford Watershed Council modified the spillway on the dam that creates the municipal water supply reservoir (see photo pg 33). Design drawings dated June 7, 1995 call for three rock weirs downstream of a new concrete wall (see Appendix). The rock weirs were each designed to create a 12” drop, spaced eight feet apart. The first two weirs were to be constructed with 24” boulders, and the downstream weir with 12” boulders. The weirs were spaced eight feet apart. During installation in 1995?, the equipment was not adequate to place 24” boulders, so 18” boulders were approved (Alan Wagner, Port Orford City Public Works).

Physical Surveys: On 2/2/99, it was apparent that the upper rock weir had washed out so that the water level did not allow adult access to the fish ladder on the dam. The weir location is subject to turbulence from the first step on the dam. For this reason the project is rated as ineffective.

Biological Surveys: none

Overall Habitat: An ODFW fish presence survey on 6/1/99 documented cutthroat trout usage to the upstream limit of water for an estimated 1.55 miles of habitat on the North Fork above the dam. The South Coast Watershed Council, in conjunction with the City of Port Orford, replaced a barrier culvert in 2001 on a tributary to the reservoir that drains from the east. No monitoring has been conducted on that culvert to determine whether that additional habitat is available.

Deadline Creek (tributary to Lobster Creek, Lower Rogue River):
In the mid 1980’s the Forest Service installed seven concrete baffles inside the 10’ diameter culvert near the mouth of Deadline Creek to assist in adult migration. A 5’ jump height (estimated at 2 feet during bankfull flow) prevented Chinook from entering the culvert, although Steelhead had been found upstream. In August 1995, the estimated gradient was 2%, the culvert was 106’ long, the bankfull channel was 17’ wide, the jump pool was 5’ deep and at bankfull flow would be 8’ deep (Hire the Fishermen Survey site 140).

In 1995, the Lower Rogue Watershed Council, in cooperation with other partners, installed boulder weirs downstream of the culvert outlet to raise the stream elevation and decrease the outlet drop. The project was not intended to pass juveniles. Three boulder step pools were constructed with drops from 18”-24”, using boulders ranging in size from one cubic foot to one cubic yard. After the boulder steps were installed, ten adult Chinook and one Steelhead were observed upstream (ODFW, Todd Confer, Nov. 1995 supplemental spawning survey). The November 1996 storm partially blew out the weirs, but they were reconstructed with larger boulders in summer 1997. Although passage has been improved, the culvert still restricts adult salmonids (see photos pg 34). Deadline Creek was included on the Rogue Basin Fish Access Team's list of priority sites, but plans to replace the culvert with a bridge were scrapped because of comments made by ODFW biologists suggesting that the quantity and quality of habitat upstream did not justify the project costs (B. Follansbee, former Lower Rogue Coordinator, oral communication).

Physical Surveys: The flow level was estimated at 40% of bankfull on December 15, 2000. The outlet drop height was 2.5', which was improved over the pre-project drop of 5', but still not meeting the guidelines for adult passage. An adequate jump pool existed at the outlet as a result of the boulder weirs. The weir closest to the culvert is approximately 20' downstream. The culvert length was measured at 120'. Velocity was measured to assess the concrete baffles installed in the mid 1980's by the Forest Service. The baffles are spaced 17'-18' apart, and the invert is lined with metal wire grating to trap bedload. (see Appendix). At this flow, velocities were reduced by 1-1.5 fps upstream of each baffle, and turbulence was created just downstream. Average velocity and water depths met the guidelines established by ODFW for adult Chinook, Coho, Steelhead, and trout.

Biological Surveys:
Since the installation of the boulder weirs a number of attempts have been made to document passage.
1.) In 1995, adult Chinook were spawning above the culvert (M. Weinhold, Lower Rogue Watershed Coordinator).
2.) ODFW documented the presence of juvenile Chinook above the culvert the following season.
3.) On 11/18/99, during a Chinook spawning survey above the culvert, no live fish, redds or carcasses were observed. Lobster Creek had been near bankfull 4 days prior, and the survey was during the height of the Lobster Creek Chinook run. These results indicate that passage is restricted to a relatively narrow set of conditions.
4.) On 12/15/00, six Chinook adults and one jack were observed downstream of a log jam approximately 450 feet upstream of the culvert, in addition to a few small trout 3-4" long (unable to identify species). The spawning survey followed a storm peak by approximately 10 hours, and the ODFW visibility rating was 1. The survey extended upstream from the culvert approximately 1/4 mile. The flows must have resulted in the right combination of velocity and jump height to make the culvert passable.
5.) On 3/15/01, no fish, carcasses or redds were observed during a Steelhead/cutthroat survey that covered the same ground as the Chinook survey. The absence of Steelhead and cutthroat should not be considered as evidence of a passage failure, though, because the timing of the run is difficult to intersect, the fish are very stealthy, and the number of fish expected to utilize a stream of this size is low. Conversely, the lack of redds does suggest that fish did not access the stream because storms during the preceding month were insufficient to mobilize the bedload and obliterate redds. The low flow conditions of the winter drought of 00'/01' probably rendered Deadline Creek low value spawning habitat, which could have been as much, or more, of a limiting factor than the jump height.
6.) In November 2001, two Chinook/Coho spawning surveys were conducted. On the first survey (Nov. 14), Chinook were observed spawning above the culvert, but below the natural log jam located approximately 450' upstream of the culvert. On the second visit (Nov. 19), both Chinook and Coho were observed upstream of the culvert, though the log jam remained a barrier. The culvert outlet drop was still greater than 1', so the project status remains at improved (see photos pg 35).

Consecutive juvenile surveys over a period of years would indicate the scope of passage for all four species of Salmonids.

Overall Habitat:
Approximately 450’ upstream of the culvert, a log jam with a 4’-5’ jump presently is acting as a barrier to Chinook and Coho. Upstream of the log jam approximately 1/3 miles are two unconfined, low gradient reaches that amount to 100 yds of high quality spawning habitat. The flats would benefit from the addition of large wood, which could be done using a high line cable from the logging road to the north. Immediately upstream of these flats the creek becomes a step pool channel. The surveys ended at this point, though, and therefore cannot provide insight about the remainder of the stream. The total habitat (<16% gradient on topographic map) is estimated at 1.5 miles.

Indian Creek (tributary to Lower Rogue River):
The water intake at the Indian Creek Fish Hatchery has been maintained by a dam structure for many years, but the jump height became a barrier in the mid-1980’s due to downcutting below the dam. Prior to that time Steelhead were seen upstream in addition to cutthroat trout (Landowner, S. Knox, oral communication). The old dam was identified as a definite barrier to migrating adult Chinook and a partial obstruction to adult Steelhead migration.

Boulders were placed to raise the water level and reduce the jump over the dam in 1995. The rocks in the boulder steps moved (failed) in the winter of 1995-96 after installation. This was attributed to “underestimating stream power and associated pool-pool spacing” in the postproject report (D. Godwin, OSU Watershed Extension Agent). Another design problem was that the distance between the footbridge access and the dam is too short to create real steps, so the boulders were used to create more of a fish ladder than step pools (J. Wilson, former South Coast Watershed Council Coordinator, oral communication). Three steps were reconstructed with larger rock in 1996, and performed well in the November 1996 event. The boulder steps were successful in reducing the jump over the dam. In 1999 an ODFW biologist judged that Steelhead are able to negotiate the steps, but that Chinook can only pass intermittently at high flows (C.Barber, oral communication). More recent photos (April 23, 2001) show a change in the appearance of the structure, but it is difficult to determine how many rocks have changed position because the flows are higher in the 1999 photos (see photos pg 36). Close-up photos of the jump at the water intake show a complete blockage on April 23, 2001. At higher flows, the site may not be a complete blockage, but the biological survey results are discouraging enough to rate this project as ineffective.

<u>Physical Surveys: None</u>

Biological Surveys:
In November 1999, approximately 50 adult Chinook were observed passing over the boulder weirs during an “active channel”, or “bankfull”, event (communication with John Wilson). Two Chinook jacks were observed beyond the boulder weirs three days after the high flows (stream survey on 11/14/99, ODFW rating 1-2). No fish were observed above the boulder weirs during a second survey on 11/18/99. In October 2000, a small storm brought over 200 Chinook up to the hatchery. Following the storm 36 adults and 4 jacks were observed below the boulder weirs, and 77 adults and 5 jacks were observed above the weirs. No fish were observed above the hatchery’s intake, beyond the last boulder weir (Chinook spawning survey on 10/31/00, ODFW rating 1).

Overall Habitat:

A series of boulder cascades begins about 100 feet upstream of the dam, continuing through a bedrock constriction (approx 0.25 miles upstream), which creates a partial barrier to several miles of habitat. It is unknown whether a Chinook run ever consistently passed through the canyon. Conditions at the cascade improved after a jump created by a logjam and sediment deposit washed out prior to 1999 (Landowner, S. Knox, oral communication). In 1999, it appeared that Steelhead could pass, but it was uncertain whether the velocities and short jump pools would allow Chinook to migrate upstream. None of the Chinook jacks on 11/14/99 could pass through the canyon. However, one adult was observed above the canyon, demonstrating that passage is at least feasible under some conditions. No fish were observed above the canyon on 11/18/99. The survey extended approximately one mile upstream through the most suitable Chinook spawning grounds. Given the timing of the survey in relation to the previous high flows, any Chinook in the system above the canyon should have been actively spawning or spawned out. It appears that most of the Chinook making it above the boulder weirs are not able to pass through the canyon, and as a result, are dropping back down toward the hatchery. The weirs do not provide measurable benefit to the migration of Chinook, nor should there have been expectations given the proximity of the boulder cascade canyon. Whether they make a difference for Steelhead and/or Searun Cutthroat is unknown at this time. In 2001, a barrier culvert was replaced on a tributary to Indian creek that opened up at least 0.15 miles of habitat to adults. Additional monitoring is needed to determine if it is passable to juveniles.

Schoolhouse Creek (tributary to Lower Rogue River)

Two jump pool weirs were installed downstream of the project to control the jump height. See Baffled Culverts. Not monitored for jump heights.

Squaw Creek (tributary to Lower Rogue River)

Two jump pool weirs were placed below a double culvert site on Squaw Creek to improve access to approximately one-half mile of habitat. Not monitored.

Jenny Creek (tributary to Lower Floras Creek)

Eight rock weirs were installed with the intention of transforming the stream type from a gully into a step-pool channel so that fish (juveniles and adults) could access the stream during flows less than bankfull (see photos pg 37). Not monitored.

Countersunk Culverts

By countersinking, a natural streambed can develop within the pipe and juvenile salmonids can find low velocity areas within the substrate. According to ODFW Guidelines for Fish Passage Design, countersunk or embedded culverts are appropriate designs for streams up to gradients of 8%. The embedded design reduces the flow capacity of the culvert, but ensures no outlet drop. At the upper range of gradients, or if flow is constricted by the culvert, velocities may prevent substrate from accumulating in the culverts. Washington designers are embedding round pipes for gradients up to 6%, and filling the pipe with substrate in advance (seeding). Seeding the culverts also helps to avoid the development of a headcut upstream. Gradient is critical. If the pipe is flatter than the downstream gradient, it creates a jump.

Although it is recommended that culverts be embedded two feet, Curry County Road Department has been trying one foot due to concerns with losing too much capacity. Design capacity is estimated using the ODF maps for 50-year flow. The objective is to size the pipes for a 100-year flow and to approximate the natural channel widths. These wider designs save money associated with maintenance and flood patrols, because they don't plug as often. When evaluating the costs and benefits of these projects, it should be noted that culvert replacements are part of routine road maintenance, and the portion of the costs that could be attributed to fish passage have not been estimated.

Bagley Creek (tributary to Elk River)
In 1998, the Curry County Road Department, in partnership with South Coast Watershed Council, replaced a culvert at MP 6.5 on Elk River Road at a cost of $9,282 (see photos pg 38). The former 4' diameter, 50' long culvert had no outlet drop, but its 9% gradient was likely a velocity barrier to adult fish passage (Hire the Fishermen Survey site 41).

Physical Surveys:
The new 6' diameter, 50' long culvert was installed at about 2.5%. The inlet is an excavated fire pond where Bagley Creek is forced into a 90-degree turn into the culvert. The 6' wide culvert constricts the 9.3' to 11' wide bankfull channel. On 2/14/00 velocities were measured during a 85-90% bankfull flow. Velocities inside the culvert ranged from 1.5-2.9 fps, with at least one measurement below 2.0 fps on all cross-sections except one (representing a 10' interval). The average water depth was only 6". The gravel and sand substrate may be caused by deposition of the coarse particles in the inlet pond. If this is occurring, the inlet pond may fill with sediment within a short period of time. The lack of resting areas creates a velocity condition that is marginal for juvenile passage. Seeding the culvert with boulders would ensure the existence of resting opportunities. The site should be checked during summer conditions to see if water flows subsurface through the substantial accumulation of sand in the downstream half of the culvert.

Biological Surveys: See Jump Pool Weirs

Overall Habitat: The County Road is located upstream of the remnant log pond, jump pool weirs, fish ladder, and concrete raceway. Two barrier culverts exist upstream (See jump pool weirs). The overall habitat between the County Road and the first upstream barrier is 0.2 miles.

Rose Creek (tributary to Hunter Creek)
The unnamed tributary at MP 5.2 on the Hunter Creek Road, is known locally as Rose Creek. The Hire the Fishermen survey identified this crossing as an adult barrier due to a lack of depth in the jump pool (site 20). It is likely that the backwater from Hunter Creek reduced the outlet jump to a level that made this stream accessible for adults during at least some higher flows. The site had a 60", 56' long culvert set at 1% gradient. The bankfull width was estimated as ten feet. In 1999, the Curry County Road Department installed a 70' long, 137" X 87" squash pipe. This is the largest fish passage pipe installed by the County to date (as of 2001). A gravity dewatering system added to the complexity and expense of this project, for a total cost of $42,717. South Coast Watershed Council was not a funding partner.

Physical Surveys: On 12/15/00 the upstream 50' of the culvert was accumulating gravel and cobble substrate, with a developing point bar creating some sinuosity within the culvert. The downstream end of the culvert was acting as a backwater for the Hunter Creek mainstem. Based on a random sampling of velocities inside the culvert, it appears that juveniles can migrate through.

Biological Surveys: No fish were observed.

Overall Habitat: Approximately 0.1 miles of habitat suitable for steelhead and cutthroat is accessible upstream before reaching a waterfall that is a complete barrier to adults.

Ismert Creek (tributary to Pistol River)
The Hire the Fishermen survey identified conditions for a juvenile barrier on Ismert Creek on the South Bank Pistol River Road at MP 1.2 (site 112). The old 6' diameter culvert was only 32' long (too short), and set at a 2% gradient; with a 5"-25" jump height (varying with flow). Prior to culvert installation in 1998, the jump height was estimated as 3'-4'. The jump pool depth varied from 40"-60", depending on flow. In 1998, the Curry County Road Dept., in partnership with the South Coast Watershed Council, installed a countersunk squash pipe culvert at a cost of $14,899 (see photos pg 39). This was the first county road project in which the natural channel width was accounted for in a fish passage design. The culvert was dented during installation, and it rotated during backfilling, so that it is slightly out of level, shifting the channel to the side of the pipe.

Physical Surveys: The new pipe is 9' wide, 60' long, and embedded at 3.3% gradient (as-built drawings from county). The bankfull width is estimated as ten feet (Hire the Fishermen survey). In September 1999, the well-graded substrate included sand through boulder sizes. On 12/15/00 a random sampling of velocities in the pipe indicated that juveniles could pass.
Biological Surveys - none.

Overall Habitat: Habitat conditions upstream of the culvert are suitable for Steelhead and cutthroat, with a distance of 0.2 miles up to the 16% slope break (by topographic maps).
Deer Creek (tributary to Winchuck River)

Deer Creek is located approximately 5.5 miles up the Winchuck River Road. The previous structure was a 4' diameter, 47' long culvert set at a 1.5% gradient, and had a 24"-36" jump height (varying with flow). The jump pool depth of 28"-40" would restrict adults for all but bankfull flows (data from Hire the Fishermen site 60). In 1998, the culvert was replaced with a 10' wide squash culvert, 60' long, for a cost of $19,763 (see photos pg 40). The project was a joint effort between the Curry County Road Dept. and the South Coast Watershed Council. Drawings provided by the County show the as-built gradient as 4.4%.

Physical Surveys:
The culvert width is 80% of the active channel width (12-12.3'), and is not creating a significant constriction. In September 1999, no substrate was present in the upstream-most 6-8 feet. On 1/12/00, velocities were measured during a 50% bankfull flow. Under those flow conditions numerous resting holes were present behind boulders in the upstream half of the culvert, and large cobbles were present in the downstream half. Velocities within the highest velocity laminar flow averaged 2-3 fps. Overall, the substrate is a mix of 40% boulders, 20% cobbles and 30% gravel.

Biological Surveys - none.

Overall Habitat: Just upstream, a private road culvert with a 3'-4' drop is visible. Excluding that culvert, an estimated 0.5 miles of habitat is available, up to a 16 % gradient (by topographic maps).

Elk Creek (tributary to Winchuck River)
Elk Creek is located approximately 7.1 miles up the Winchuck River Road. The project was a joint effort between the Curry County Road Dept. and the South Coast Watershed Council, at a cost of $26,169 (see photos pg 41). The previous 4' diameter, 74' long culvert had a gradient of 5%, and was a complete barrier (Hire the Fishermen site 61 data). It was replaced in 1998 with an 8' diameter round counter sunk culvert, 80' long. Drawings provided by the Road Department show the as-built gradient at 1.5%.

Physical Surveys:
As of September 1999, a 3'-4' deep headcut had migrated upstream, exposing logs in the channel.
The culvert diameter is approximately 55% of the averaged active channel width, which is creating a slight constriction and probably an increase in the velocity within the culvert. Velocities were measured within the culvert on 1/12/00 during a 50% bankfull flow. Cobbles and a few small boulders created resting opportunities spaced at 15'-20' apart. Near the invert of the culvert, velocities ranged from 0 fps, to a negative fps. Higher in the water column, where the flow was more laminar, velocities ranged from 2.3 fps, down to 0.6 fps where there was bedload material. Some boulders building up near the inlet created a scoured pool in the culvert. Later it was observed that the boulders have been transported into the culvert (D. Crumley, 5-2-01). The outlet was embedded to a depth of 1.35', and there is no drop before the stream exits onto a bedrock streambank. At high flows, the Winchuck may backwater into this culvert.

On February 7, 2002, flows were measured inside the culvert during a 60%-70% bankfull event. Eight cross sections were established within the 80' culvert, and three measurements were made along each cross section. At all but two of the cross sections the velocity exceeded the 2.0 fps standard established for juvenile passage. These measurements, in combination with the January 12, 2000 data, suggest that the culvert is acting as a barrier to the upstream migration of juveniles during at least 50% bankfull flows. Therefore, the status of the project is improved because it was intended to pass juveniles at all flows.

The situation could be remedied by creating resting opportunities inside the culvert through the placement of boulders. This depends, however, on whether the culvert has the capacity to accept additional bedload and still pass a 50 yr event.

Biological Surveys: - none, but juveniles have been observed within the culvert (D. Crumley).

Overall Habitat: An estimated 0.4 miles of habitat is available, up to a gradient of 16% (by topographic map).

Wedderburn Ranch Creek (tributary to Lower Rogue)
Weddernburn Ranch Creek is a tributary to the Lower Rogue River, entering at a slough approximately 2 miles upstream from the mouth. The stream is primarily Steelhead and cutthroat spawning and overwintering habitat, though there is some Coho colonization, as evidenced by recent spawning surveys. There are approximately 3.5 miles of usable habitat in the watershed,

though 0.17 miles are located behind a culvert that is acting as an impediment to the upstream migration of adults, and two additional culverts exist above that which are complete barriers to 0.58 miles.

In the late 1990's the Curry County Road Department added a second 6' diameter culvert to their crossing under the North Bank Rogue River Road, which improved fish passage.

In 2000 the Lower Rogue Watershed Council, in conjunction with the landowner, replaced a crossing near the upper end of the valley with a 7.5' wide countersunk arch pipe (upper crossing). The existing crossing consisted of a pair of 24" diameter culverts that were acting as a complete barrier to juveniles, and at least a partial barrier to adults (according to B. Follansbee, former Lower Rogue Watershed Coordinator). Upstream of the crossing bedload had aggraded, and downstream the bedload was scoured out and the channel was incised. The new culvert was embedded to depth of 2.5'. As of the spring 2002, the channel was adjusting it's gradient through the upstream migration of a headcut, though the headcut was momentarily being checked by the slow rate of erosion of the siltstone that underlies the channel.

In 2001 the Lower Rogue Watershed Council, in conjunction with the landowner, replaced a second crossing, which was located just upstream from the county road (lower crossing). The crossing was an impediment to adults, and a full barrier to juveniles (see photos pg 42). A 10.5' X 7' countersunk arch pipe was installed, and the culvert invert was seeded with a mixture of bedload, including small boulders.

<u>Physical Surveys</u>: No comprehensive physical surveys have been done for either site, though both sites were observed when the Wedderburn Ranch road network was inventoried in the spring of 2002. At that time both culverts had developed a natural streambed inside, to a depth of 10" or greater, and both culverts were at least 80% of the active channel width. At both sites, though, the channel was incised. As a result, the existing active channel width does not reflective the width that would exist if the stream was restored to an unconfined channel type.

<u>Biological Surveys</u>: On June 20, 2002, an ODFW Habitat Biologist electro-shocked Wedderburn Ranch Creek in three locations upstream of the upper crossing. Juvenile trout and Coho were observed in low numbers. Given the size of the juvenile Coho, it was apparent that they had emerged from the gravels in the vicinity.

On December 18, 2002, a Coho spawning survey took place from the county road upstream through both countersunk arch pipes, to the uppermost road crossing (very near to the upstream limit of usable habitat). The visibility was an ODFW 2/3, and the flow was moderate. In total, 11 adults, one jack, and 4 redds were observed, all of which were located upstream of the upper countersunk culvert. On December 23 a survey extending from downstream of the upper countersunk culvert, upstream to the uppermost road crossing, was undertaken. During the survey 10 live and 3 dead adults, 2 jacks, and 6 redds were seen in the same stream reach as the December 18 survey.

Given the juvenile findings, and the Coho spawning data, it is apparent that adults are able to pass through both sites, during at least some portion of the Q2 flow. The observation of substrate retention in both culverts also suggests juvenile passage, though a complete physical survey is needed to be conclusive.

Overall Habitat: The lower site opened up access to a significant tributary to the west, as well as the mainstem channel up to the upper site, for a total of 1.6 miles (Topographic map to 16%). The upper site provided access to 0.6 miles of the mainstem, at which point a partial barrier and two complete barriers block 0.75 miles of additional habitat.

Turner Creek (tributary to Hunter Creek)
Turner Creek is a small tributary of the Hunter Creek estuary. The project entailed the replacement of two culverts. The downstream site was replaced with a bridge (see Turner Creek Bridge), while the upstream site received a counter sunk culvert (see photos pg 43). The countersunk culvert, measuring 142" wide, 91" high, and 45'long, replaced a round 60" x 40' culvert, which was acting as a complete barrier to juvenile migration, and a partial barrier to adult migration of Steelhead and trout. The existing culvert had a summer outlet drop of 3.3', and a winter drop of 2.2' (based on road inventory data).

Physical Surveys: No formal physical surveys have been conducted on the countersunk culvert, though through observation it is apparent that the culvert was not set at a low enough elevation to collect 1'+ of bedload. During the project implementation, the culvert was seeded with a scattering of small boulders. As of the summer of 2002, bedload had deposited on one side of the culvert invert to a depth of 0.5'.

Biological Surveys: On November 20, 2001, a spawning survey took place extending upstream from the mouth of Turner Creek through the end of the project area (approximately .35 miles). One dead Coho was observed between the bridge and the countersunk culvert. The reach was surveyed two more times during the season, but no other spawners were seen. In December 2002 the same reach was surveyed twice, during the peak of the Hunter Creek Chinook run, but no spawning fish were observed.

On June 20, 2002 an ODFW biologist shocked Turner Creek upstream of the countersunk culvert and found both Coho and trout juveniles. Judging by the size of both species, it was apparent that they were the product of fish spawning in Turner Creek (as opposed to having moved upstream from Hunter Creek that spring). Juvenile salmonids have also been observed inside the arch pipe at numerous times throughout the 2001 and 2002 summers.

Longitudinal Profiles: A longitudinal profile of the thalweg was surveyed before the project implementation in 2001, and following the first winter in 2002 (See Profile Pg 63). The results of the surveys highlight a significant headcut that migrated upstream from the countersunk culvert. The incision began at a depth of 3'-4' at the culvert inlet, and continued upstream for 450' before tying in with the existing gradient. Large wood was placed upstream of the arch pipe when the project was implemented. At the first wood site the thalweg migrated approximately 10' toward the outside bend, which increased the channel sinuosity but also resulted in bank erosion. At the second site the wood was outside the active channel, and as a result, it had no effect on the migration of the headcut. The third large wood placement site was installed largely to protect an eroding bank on the outside bend of the channel. The wood had little effect on the headcut, but it did effectively move the thalweg away from the outside bend. The headcut stopped at the fourth large wood site, though it appears to be more a product of the stream gradient than the large wood. None of the large wood placed in the stream had branches, or rootwads, and sites 1 & 2 were largely placed outside of the active channel.

Overall Habitat: The focus of the project was to open up passage for adult and juvenile salmonids. The stream's proximity to the estuary, and cool temperatures, make it valuable summer rearing habitat, and during high flows, it can serve as winter refugia for juveniles in Hunter Creek (oral communication with ODFW, 2000). In addition to juvenile habitat, Turner Creek also has approximately .5 miles of potential spawning habitat above this site, which is most suitable for Steelhead and cutthroat.

Indian Creek (tributary to Lower Rogue River)
The project site is located on Indian Creek approximately 2.6 miles upstream from the Rogue River. In 2001 a 60" diameter culvert, acting as a complete barrier to upstream migration of all Salmonids, was replaced with a 170" x 110" countersunk culvert (see photos pg 44). The culvert was placed at a gradient of 4.5% (according to the design), and large angular rock was placed inside the culvert near the inlet and outlet. The site is intended to benefit Steelhead and trout.

Physical Surveys: On January 28, 2003 the site was visited as part of an effort to monitor all the road upgrades in the Indian Creek watershed. The rock placed in the culvert was creating resting pools, with an average depth of 1', and they were collecting some additional substrate. A headcut had moved up the channel approximately 150' before being checked by a natural constriction. The conclusion from the Jan. 2003 site visit is that the site most likely can pass adult Steelhead and trout, though it may still act as a partial barrier to juveniles. Additional monitoring, including a physical survey with flow measurements and a juvenile survey, should occur before rating the project.

<u>Biological Surveys</u>: None

<u>Overall Habitat</u>: According to the topographic map 0.15 miles of habitat were opened up, though the channel should be walked to ground truth this estimate.

Gallagher Creek (tributary to N. Fork Floras)
In 2002 a road crossing on Gallagher Creek, consisting of a 48" culvert and a 24" culvert, was replaced with an 86" x 63" countersunk culvert (see photos pg 45). The culverts were an impediment to juvenile migration during higher winter flows, and were a sediment concern because they were undersized and failing. The countersunk culvert was seeded with 1' diameter boulders.

<u>Physical Surveys</u>: None have been conducted, though the as-built measurements show the culvert at 0.25% and embedded to a depth of 12". Flows should be measured inside the culvert to evaluate velocities and identify resting opportunities for juveniles.

<u>Biological Surveys:</u> None

<u>Overall Habitat</u>: There are 0.4 miles of habitat up to the Langlois Mtn. Road crossing, which is a complete barrier. The quantity of habitat upstream of that crossing is unknown.

Taylor Creek (tributary to Hunter Creek)
In 2000, the Curry County Road Department, in partnership with the South Coast Watershed Council, replaced a culvert at MP 0.29 on Mateer Road at a cost of $19,490. The former culvert was a round 72" pipe, 50' long, acting as a complete barrier to juveniles and adults. The new

pipe is a countersunk culvert 114” wide, 77” high, and 50’ long. No monitoring has taken place, though juvenile trout have been observed inside, and upstream of, the culvert.

Overall Habitat: According to ODFW 0.6 miles of Steelhead and cutthroat habitat exist upstream.

Edson Creek (tributary to the Rogue River)
In 2000, the Curry County Road Department, in conjunction with the Lower Rogue Watershed Council, replaced a crossing at MP 1.56 (from HWY 101) on the Edson Creek Road at a cost of $16,364. The former crossing consisted of two 24” x 60’ culverts that were acting as a complete barrier to juveniles and adults. The new pipe is a countersunk culvert 98” wide, 69” high, and 60’ long. No monitoring has taken place, though a headcut has been observed.

Overall Habitat: According to ODFW 0.7 miles of Steelhead and cutthroat habitat exist upstream.

Squaw Creek (tributary to the Rogue River)
In 2000, the Curry County Road Department, in conjunction with the Lower Rogue Watershed Council, replaced a crossing at MP 1.87 (from the North Bank Road) on Squaw Valley Road at a cost of $23,048. The former crossing consisted of two 4’ wide by 3’ tall arch pipes, 44’ and 48’ long, that were acting as a complete barrier for juveniles and adults. The new pipe is a countersunk culvert 114” wide, 77” high, and 60’ long. No monitoring has taken place.

Overall Habitat: According to ODFW 0.6 miles of cutthroat habitat exist upstream.

East Fork (EF) Squaw Creek (tributary to Squaw Creek)
In 2001, the Curry County Road Department, in conjunction with the Lower Rogue Watershed Council, replaced a crossing at MP 2.14 (from the North Bank Road) on the Squaw Valley Road. The former crossing consisted of a round 24” x 44’ pipe and a 30” wide, 19” tall, 40’ long arch pipe. The new pipe is a countersunk culvert 53” wide, 41” tall, and 50’ long. No monitoring has taken place.

Overall Habitat: Approximately 0.2 miles of cutthroat habitat exist upstream (topographic map).

Squaw Creek Trib. (tributary to Squaw Creek)
In 1999, the Curry County Road Department, in conjunction with the Lower Rogue Watershed Council, replaced a crossing at MP 1.87 (from the North Bank Road) on the Squaw Valley Road at a cost of $26,848.89. The former crossing was a 24” x 30’ culvert. The new pipe is a countersunk culvert 73” wide, 55” tall, and 140’ long. No monitoring has taken place.

Overall Habitat: Approximately 0.25 miles of cutthroat habitat exist upstream (topographic map).

North Fork (NF) Hubbard Trib. (tributary to NF Hubbard Creek)
In 2001, the City of Port Orford, in partnership with the South Coast Watershed Council, replaced a culvert acting as a complete barrier to a tributary entering the NF Hubbard Creek Reservoir. No monitoring has taken place.

Baffled Culverts

Schoolhouse Creek (tributary to Lower Rogue River)
Schoolhouse Creek flows into the Lower Rogue from the north near river mile 9. In 1998, the Lower Rogue Watershed Council in partnership with Curry County Road Department and Olympic Resources Management (for Hancock Timber Resources Group) replaced a 48” diameter culvert that was 80’ long, at 4% gradient with a 4, vertical drop at the outlet (jump height). The new structure is a 112” x 75” corrugated arch pipe, 91’ long, placed at 6.6% and fitted with nine steel baffles (weirs), at a cost of $52,492 (see photos pg 46). The pipe also has a 36” diameter riser at 75’ upstream to allow light to enter the pipe.

Physical Surveys: Water depths and velocities were measured at 8.6 cfs on 2/21/99, 22.3 cfs on 2/23/99, and 24.3 cfs on 1/15/00. The results indicate that sufficient resting pools exist below the weirs during moderate to high water (see report in Appendix).

Biological Surveys: The project was intended to provide access for Steelhead and Sea-run Cutthroat. A Steelhead spawning survey on 3/15/01 extended 1/3 mile upstream. The most suitable spawning habitat occurs in the upstream end of the survey where the gradient drops out significantly. The flow conditions were low and the visibility was an ODFW 1. No fish, nor redds, were observed. The absence of fish above the culvert may be the result of the low flow conditions. With so little water in the stream its suitability for spawning is greatly reduced. In addition, the low flows may have made the first 1/4 mile of stream difficult to navigate.

In the summer of 2002 ODFW shocked the upper reaches of the creek and found juvenile trout. According to Todd Confer, acting Gold Beach District Biologist, it is difficult to say for sure whether these fish are anadromous or resident, but given the absence of any barriers downstream, he feels that this population contains some mixing with anadromous Sea-run Cutthroat.

Overall Habitat: Approximately 0.5 mile of salmon habitat exist upstream according to Russ Stauff, ODFW biologist. The habitat is mostly step pools and boulder cascades for the first 1/4 mile, at which point the gradient drops considerably and the channel develops quality spawning habitat for Steelhead and cutthroat. It is quite possible that during low flows, the boulder cascades present a barrier to these spawning grounds.

Deadline Creek (tributary to Lobster Creek)
In the mid 1980’s the Siskiyou Forest Service retrofitted the existing 10’ diameter culvert with seven baffles. Flows inside the culvert were measured in 2000 as part of the physical monitoring of the jump pool weirs located directly downstream. See Deadline Creek jump pool weirs for more detail.

Swamp Creek (tributary to Elk River)
Culverts with baffles were installed on two existing reservoirs (see photos pg 47). The intent of the culverts is to provide juvenile passage for summer and winter rearing. No monitoring has taken place.

Overall Habitat: The lower crossing opened up 0.3 miles of habitat, while the upper crossing opened up 1.6 miles of habitat (topographic map up to 16% gradient).

Bridge Replacing Culvert

"Dan's" Creek (tributary to Fourmile Creek)
The bridge replaced double culverts, both plastic and about 20' long with no outlet drop – set at approximately 0% gradient (see photos pg 48). One culvert was filled with silt so that the stream only flowed through one 36" diameter plastic pipe. Stream surveys measured a bankfull width of 10.5 feet upstream of the site. The stream has re-established a natural gradient, flow depth and substrate through the bridge, which is conducive to fish migration. The width of the bridge between abutments is similar to the bankfull width in the vicinity.

Physical Surveys: None

Biological Surveys: None

Overall Habitat: Stream disappears within a wetland approximately 0.3 miles upstream.

"Hoog" Creek (tributary to Dry Creek, Sixes River)
Hoog Creek flows into Dry Creek from the east approximately 450 feet downstream of the wilderness boundary. The South Coast Watershed Council, in partnership with Westbrook Land and Timber and ODFW, replaced a complete barrier-culvert with a bridge in 1998, providing access to both adults and juveniles (see photos pg 49).

Physical Surveys: The stream has re-established a natural gradient and substrate through the bridge which is conducive to fish migration; so we are assuming the bridge is passable at this time. As of February 2001, the bridge was still functioning well, although some of the road fill around the abutment had eroded. According to the Westbrook's land manager, Jeff Mace, the bridge is long enough that this is not a concern.

Biological Surveys: A spawning survey was conducted in early December 1999 during the Chinook run on Dry Creek. One adult Chinook was seen holding near the mouth below the bridge, but none were observed above. Hoog Creek is not considered a Chinook stream, but is more suitable for Steelhead and cutthroat (according to ODFW biologist, H. Crombie). In 2000, no spawning surveys were undertaken during the Steelhead run in Dry Creek. A Steelhead spawning survey on 2/20/01 extended 1/2 mile upstream from the mouth. Flow conditions were very low (ODFW visibility rating 1). No fish, nor redds, were observed, though fish were seen in the mainstem. The absence of fish, and redds, from the stream is probably the result of the low flow conditions. Hoog Creek's value as viable spawning grounds will be highest during high flow winters.

On June 20, 2002 the local ODFW habitat biologist shocked Hoog Creek. Coho, Steelhead, and cutthroat were all present at the time. Given their size, it was apparent that they were the product of successful spawning in Hoog Creek, and not migrants from the mainstem.

Overall Habitat: A significant headcut (>5' at the bridge) associated with the culvert removal extends upstream approximately 0.5 miles to a possible natural barrier. In 1999, this reach was largely devoid of large wood, lacking in habitat complexity, and unstable. Between late 1999 and early 2001, no additional downcutting was evident. In the summer of 2000, four clusters of large wood were placed in the initial 600 feet of stream (see photos pg 50). As of a 2002 site visit, those clusters were beginning to trap bedload, scour pools, and increase channel sinuosity. The possible natural barrier 0.5 miles upstream of the bridge, made up of wood at a boulder constriction, appears to be restricting further migration of the headcut. This could increase the difficulty of the barrier if more substrate is washed out from its base. At some point, though, the removal of material from the base should weaken the barrier to the point where it could wash out. The survey continued 0.5 miles above the barrier. Through this stretch large woody debris was prevalent, leading to the creation of pools, channel sinuosity, and the sorting of bed material into viable spawning habitat.

Cedar Creek (tributary to Lower Elk River)
A crossing on Cedar Creek was upgraded from a culvert to a railcar bridge, providing passage to both adults and juveniles (see photos pg 51). In 1995 the site was an uncertain juvenile barrier with a 4' diameter, 43' long corrugated metal culvert set at approximately 1% gradient, with no outlet drop (Hire the Fishermen site 88). The channel was ponded to a width of 50'-60' upstream. Prior to replacement in 1999, a new black plastic culvert had been installed, but it had developed an outlet drop.

Physical Surveys: The bridge constricts the channel slightly, creating a 2-3% riffle under the bridge, while the pond-like habitat remained upstream as of winter 1999-2000. The bridge is suitable for passage of adult salmonids during high flow conditions. Juvenile passage needs to be evaluated during winter and summer flows. The riffle under the bridge may need to be seeded with boulders to create resting opportunities.

Biological Surveys: In early December 1999, the stream was surveyed for spawning adult Chinook and Coho on two different dates at high and medium flows. On neither occasion were fish observed; but the timing of the survey was early in relation to other surveys on Elk River. Given the low numbers of Coho natural seeding is expected to take time, so it may be premature to draw a conclusion about adult usage from these surveys.

Overall Habitat: The bridge has the potential to open access to approximately 0.85 miles of suitable coho overwintering habitat (sand/gravel substrate), and approximately 0.3 miles of suitable coho spawning grounds upstream of the overwintering reach. Approximately 1.15 miles above the bridge, a 5' jump creates a natural barrier to Chinook, Coho, and possibly Steelhead. The barrier appears to be the result of a headcut through soil and may or may not persist in the future. Additional spawning beds continue above the barrier for at least 150', but further survey is needed to determine their extent. A juvenile barrier is located approximately 0.6 miles upstream of the bridge (Hire the Fishermen site 90). At this site a 3' diameter culvert constricts the flow and has a 2% gradient.

Deep Creek (tributary to Pistol River)
In 1999, the Curry County Road Department, in partnership with South Coast Watershed Council and South Coast Lumber Co., replaced a baffled culvert with a bridge at MP 4.9 on Pistol River Road, at a cost of $309,000 (see photos pg 52). The former juvenile barrier was a

12’ diameter, 76’ long culvert at a 2% gradient with a 12” outlet drop at low flow. STEP program volunteers had constructed gabion weirs to reduce the jump height. Wood often plugged the inlet and had to be removed under dangerous conditions. Maintenance costs had been high, and patching the baffles again was estimated to cost $30,000 (D. Crumley, Curry Co. Roadmaster).

Physical Surveys: Between the bridge abutments, the designed streambed width is 25’ to match the upstream natural channel. The design gradient was 5-6%, and "as built" is about 0.5% flatter. It was difficult to inset the toe trench for riprap side slopes, because bedrock was only 2-5 feet below the surface. A concern prior to the first winter was that at this gradient, velocities might scour the streambed and expose bedrock. If local velocities are too great for passage, the bedrock could be roughened up (but in this geologic type, the bedrock is likely to have a rough surface already). Substrate is accumulating on the streambed after two winters. Under high flow conditions, Pistol River backwaters into Deep Creek.

Biological Surveys: Deep Creek is an ODFW index stream for spawning surveys. Since 1959, peak counts for adults have been extremely variable, e.g. averaging 32 with a range of 8-81 from 1993-1998, before the bridge was installed. The 1999 and 2000 counts, 58 and 26, respectively, are within the pre-bridge range.

Longitudinal Profiles: Surveys were conducted in 1999 and 2001, but the CAD drawings have not yet been plotted. A headcut has migrated upstream, though its’ length and severity cannot be estimated until the profiles are plotted.

Overall Habitat: An estimated 1.9 miles of habitat is available up to a gradient of 16% on the topographic map.

Turner Creek (tributary to Hunter Creek)

In 2001 a 60” aluminized steel culvert with baffles was replaced with a glue laminate wooden bridge (see photos pg 52). The culvert was acting as a barrier to juveniles during high and low flows. The project occurred in conjunction with the replacement of an upstream barrier-culvert. For more details, see Turner Creek countersunk culvert.

Physical Surveys: No surveys have been undertaken, though the channel has developed a natural streambed and a stable gradient underneath the bridge, and the channel width mirrors the channel immediately upstream.

Overall Habitat: There are 0.1 miles of habitat between the bridge location and the upstream countersunk culvert.

Swanson Creek (tributary to Floras Lake)

Swanson Creek is one of two significant tributaries to Floras Lake. In 2002, two culvert crossings upstream of Highway 101 were pulled. Both sites were identified in the Guide to Project Selection: Southwest Fish Management District (Prepared by the Oregon Wildlife Foundation and ODFW; printed November 1, 1995). The upper crossing was replaced by a railcar bridge in 2002, while the lower crossing was left fallow for the winter to allow the channel to establish a stable gradient (see photos pgs 53-4). The lower crossing consisted of two 24” culverts set side by side (one of which was plugged), with an outlet drop of 2’ and a jump pool depth of 2’. The crossing was acting as a complete barrier to juveniles and a partial barrier to adults. The upper crossing was a 48” culvert set 2’ below the elevation of the streambed as a result of bedload that had accumulated upstream and downstream of the crossing. The crossing was likely a velocity barrier to juveniles during higher flows, and was constantly plugging. In addition to these two crossings, ODOT replaced the crossing under Highway 101, which was acting as a juvenile barrier and an adult impediment.

Physical Surveys: No formal surveys have been conducted, though the bridge placed at the upper crossing is not constricting the channel. The average active channel width is 12’, whereas the span between the bridge abutments is 31’ (according to the design). A 2’-3’ headcut has worked its’ way upstream from the lower crossing. By mid January it had reached a split channel located just downstream of the bridge. At that point the erosive power of neither channel was enough to maintain the same rate of downcutting. Presently both channels have a 2’+ nickpoint that is acting as a barrier to the upstream migration of juveniles. When the headcut reaches the bridge location there is a slight possibility that it could undermine the west abutment as the streambed elevation drops.

Biological Surveys: Coho spawning surveys were conducted during the winter of 2001/02, prior to the removal of the barriers, to generate an idea of the distribution of spawning adults. The survey extended from Highway 101 upstream to the confluence of the “forks”, located 0.4 miles above the bridge. The peak spawning numbers showed 47% of the run had made it upstream of the lower crossing. This percentage probably represents a favorable year for passage because numerous storm events nearing bankfull flows occurred during the migration period. In low water years it is doubtful that any fish would have made it through the lower crossing. In the winter of 2002/03 the peak spawning numbers showed 11% of the run went upstream of the lower crossing. Though these numbers are discouraging, they should not be weighed heavily. November and early December of 2002 were without rain on the South Coast, which greatly altered the timing, and most likely the distribution, of the Coho run. Overall numbers of Chinook and Coho were down on north county surveys, though reports from commercial fishers and Coho surveys farther north suggest a strong year for both species. This suggests that the fish were spawning lower down in the system. The value of these surveys will be much greater after a number of years of spawning data have been collected.

Overall Habitat: There are 0.4 miles of usable Coho habitat upstream of the bridge, and at least that much Steelhead and cutthroat habitat. Just prior to the forks is a low falls that is a likely barrier during many winters.

Boulder Creek (tributary to Euchre Creek)

In 2000, South Coast Lumber Company, in conjunction with the South Coast Watershed Council and the OR Wildlife Heritage Foundation, replaced an 84” culvert with a double railcar bridge (see photos pg 55). The former culvert had a 33” outlet drop at bankfull flow, and a 57” drop at summer flow, with a jump pool depth of 7’-9’ (Hire the Fisherman). The active channel width was 9’ upstream of the crossing. The culvert was considered a complete barrier.

Prior to replacing the culvert, large wood was placed both upstream and downstream of the site. Habitat surveys were conducted documenting pre-existing conditions. In the summer of 2001 a habitat survey was undertaken to register change that had occurred during the first postimplementation winter, but it was aborted because long stretches of the channel were dry.

Physical Surveys: None

Biological Surveys: None

Longitudinal Profile: Surveys were conducted in 1999 and 2001 using a Total Station transit, and plotted in March 2003. The winter of 2000/01 was exceptionally dry, which resulted in low flows that had little energy to move bedload. As a result the profile does not highlight any significant downcutting. The planview of the profiles, however, does indicate that a straighter, shorter channel is developing (see profile pg 62). This is significantly more pronounced since the winters of 2001/02 and 2002/03 have resulted in considerable downcutting. The wood placements upstream have had little effect on the migration of the headcut, and for the most part have been left suspended over the newly formed channel. None of the wood had rootwads or branches, and none were fully placed in the channel. Via visual inspection, the wood placements downstream do appear to have trapped a large amount of the bedload that was mobilized by the headcutting. Future longitudinal profile surveys will be more effective at displaying the depth and extent of downcutting, and can be used to assess the wood placements downstream.
Overall Habitat: There are 1.4 miles of habitat upstream of the crossing.

Beaver Creek (tributary of Sixes River)
According to the Hire the Fishermen survey, two 48" culverts existed at the site in 1995. Neither culvert had an outlet drop and both were set at a 1% slope. Their status as a barrier is unknown. In 1998 (?) the culverts were replaced with a railcar bridge (see photos pg 56). No monitoring has taken place.

Overall Habitat: There are 2.65 miles of habitat up to a gradient of 16% (topographic map).

Morton Creek (tributary to New River)
In 2000 (?) a culvert that was a partial barrier to adults and a complete barrier to juveniles was replaced with a bridge. No monitoring has taken place.

Overall Habitat: There are 3.8 miles of habitat up to a gradient of 16% (topographic map).

South Fork (SF) Hubbard Creek (tributary to Hubbard Creek)
According to the Hire the Fishermen survey, two 48" culverts existed at the site in 1995 (see photos pg 56). One of the culverts had a 15" outlet drop at summer flow, and the other had a 7" outlet drop at summer flow, with a jump pool 24" deep. Both of these drops would be nonexistent at bankfull flows. The culvert lengths were 33' at 5% gradient, and 27' at 3% gradient, respectively. Based on this information the culverts were acting as a complete blockage to adults and juveniles in the summer (based on jump height, and water depth inside the culverts), and were most likely a complete blockage to juveniles and a partial blockage to adults during winter flows. In 1997 the culverts were replaced with a bridge. No monitoring has taken place.

Overall Habitat: There are 2.8 miles of habitat up to a gradient of 16% (topographic map).

Mainstem (MS) Hubbard Creek (Coastal Basin)
According to the Hire the Fishermen surveys, three 48" culverts existed at the site in 1995 (see photos pg 57). At the time of the survey (7/5/95) one of the culverts wasn't carrying water, one had a water depth of 21" and a gradient of 3%, and the third culvert had a water depth of 10" and

a gradient of 1%. None of the culverts had an outlet drop. The two culverts with water were also noted as failing. Given this information it is hard to determine whether the site posed a passage issue, though it is reasonable to conclude that the crossing was unstable. In 1997 the culverts were replaced with a bridge. No monitoring has taken place.

Overall Habitat: According to the topographic map, 10 miles of habitat exist above this site up to a gradient of 16%. Upstream there are three other crossings identified by the Hire the Fishermen surveys which have not been addressed, one of which appears to be a partial barrier to juveniles.

Alaskan Steep Pass

Boulder Creek (tributary to Floras Lake)
Historically Coho, Steelhead, and Sea-run Cutthroat used Boulder Creek, but a number of structures were built that blocked passage to the majority of the stream. The farthest downstream barrier is a dam that impounds a reservoir used in the production of cranberries. In 1998, an Alaskan Steep Pass was installed at the spillway of the reservoir (see photos pgs 58-9). Implementation challenges cited by the project engineer, Don Porior, included 1) incorrect staking that had to be resolved on site by the installers, and 2) leaks in the aluminum structure that had to be patched on site. Porior commented that project costs could have been reduced by using a 48"-diameter culvert (rather than a 60") under the road. The oversized pipe was based on a perceived need for more light. The reservoir was stocked with coho fry in 1998 and 1999 by ODFW. In 2001 ODOT replaced the Highway 101 culvert with a fish passable pipe, opening up the best spawning grounds in the watershed. In 2002 the ladder and vertically sunk culverts were retrofitted with a metal grate to prevent migrating fish from jumping out of the structure. However, the grate did not cover the lowest two rungs of the ladder, and in the spring of 2003 it was observed that rearing Coho juveniles were being thrown out of the ladder by the turbulence, as they tried to move upstream. This problem is being addressed by the ODFW habitat biologist. Also in 2002, a barrier culvert to the North Fork was pulled (see below for details).

Physical Surveys: On 2/14/00 a physical survey of the Steep Pass concluded that it was working as designed. Flow measurements documented turbulence throughout both lengths of ladder, and definite resting opportunities existed in the intervening vertically sunk culverts. The Alaskan Steep Pass design ensures that velocities will be within an acceptable range, but the gradient also dictates the flow capacity of the structure. This is critical because an overflowing structure will erode the fill. An adjustable slotted weir, designed for the inlet control, has yet to be installed and would minimize the risk of erosion (D. Porior, 5-2-01, per phone conversation).

Biological Surveys: Coho were seen spawning upstream of the reservoir in the winter of 1999/00 (local landowner, Jake Lang, oral communication). On 12/21/00, Coho were observed upstream 0.55 miles, at relatively low flows, between the North Fork Boulder confluence and US Highway 101. Three adults, four jacks, and six redds were observed (C.Barber Memorandum, ODFW visibility rating 2). In the winter of 2001/02, separate Coho spawning surveys, conducted on different dates by ODFW, ODOT and the South Coast Watershed Council, all indicated significant numbers of spawners directly below, and above the Highway 101 culvert. In addition, road surveys conducted in the spring of 2002, highlighted extensive distribution of Coho fry throughout the tributaries upstream of the Alaskan Steep Pass.

Overall Habitat: Approximately 2.6 miles of habitat exist up to a gradient of 16% (topographic map). A barrier exists at the North Fork Boulder Highway 101 culvert that would open up a small amount of habitat before encountering a cranberry reservoir that is a complete blockage. On Mainstem Boulder Creek, upstream of the Highway 101 crossing approximately 2000', there is a remnant man-made diversion that was used for generating hydroelectricity. The main channel was dammed with a concrete wall, and as a result the stream has cut a narrow chute through a boulder cluster that is acting as a barrier.

Pulled Crossings

North Fork (NF) Boulder Creek (tributary to Boulder Creek, Floras Lake)
In the spring of 2002, a crossing on North Fork Boulder Creek was identified through the Councils' Road Inventory program as a fish barrier culvert, in addition to a sediment issue. The road was built on a north-south property line, and as a result, it indiscriminately crossed a 100'+ wide wet meadow floodplain, and the North Fork, through the construction of a 30' berm. The culvert was undersized, and had been dammed by beaver in the past, which caused it to overtop and erode the berm. In the summer of 2002 the crossing was pulled as part of a sediment abatement project (see photos pg 60). The quantity of fill that was removed was limited by costs. The result was the creation of a narrow, incised channel where the culvert had existed, that ties two reaches of the wet meadow together. Shore Pine with rootwad and limbs were placed in the channel to create cover and complex channel hydraulics. At the upstream end of the newly formed channel the beaver dam still exists, and is impounding an acre, or more, of pond.

Physical Surveys: No flow measurements have been taken within the channel. The sideslopes have been monitored for erosion, and as of the spring of 2003, no significant rills have developed.

Biological Surveys: No surveys have been undertaken, though one adult Coho was observed in the channel in January 2003, trying to negotiate the beaver dam. Juvenile Coho were also observed in the channel in the spring of 2003.

Overall Habitat: There are 0.2 miles of habitat upstream before reaching a barrier culvert at Highway 101. One-quarter or more of the available habitat is comprised of the beaver dam.

Beaver Creek Trib. (tributary of Beaver Creek, Sixes River)
In 1998 a culvert was pulled at the same time that the bridge on the Mainstem Beaver Creek was installed. No monitoring has taken place.

Overall Habitat: There are 1.2 miles of habitat up to a gradient of 16% (topographic map).

Bagley Creek – Jump Pool Weirs

Boulder weir constructed to raise water level at fish ladder upstream, 11/96 View of original weir and first new downstream weir, 01/99

Original boulder weir with smaller step after more weirs installed, 01/99 Closeup of first new downstream weir, 01/99

Bagley Creek – Jump Pool Weirs cont.

One of two downstream weirs showing jump height, 02/14/00 Other downstream weir showing jump height, 02/14/00

Fish ladder needing maintenance and bottom jump too high, 08/95 New fish ladder with water level raised by boulder weirs, 01/99

North Fork Hubbard Creek Reservoir Spillway and Jump Pool Weirs

Looking downstream at jump pool weirs. Top weir not intact. 02/02/99

Deadline Creek – Jump Pool Weirs, 02/23/99

View from road looking downstream at three boulder weir steps Culvert outlet drop with reduced height due to boulder steps

Looking upstream at two of the steps

Deadline Creek – Jump Pool Weirs, 2001

Large wood placement downstream of jump pool weirs, 09/05/01

Looking downstream at the inlet, 11/14/01

Looking upstream at the log jam 450' from the culvert, 11/14/01

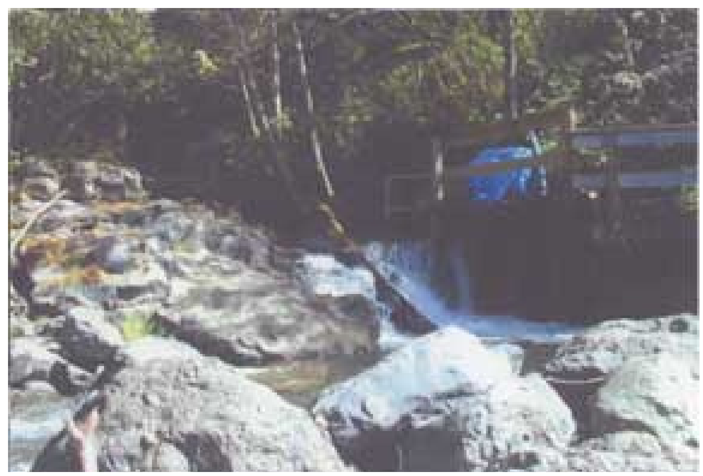
Looking upstream at outlet and two jump pool weirs, 11/14/01

Indian Creek (tributary to the Lower Rogue) – Jump Pool Weirs


Steps formed by boulder weirs, 03/22/99


Boulders not performing as weirs, 04/01


Front view of top jump over intake dam, 04/01


Side view of top jump over intake dam, 04/01

Jenny Creek – Jump Pool Weirs, pre-2001

Weirs during construction, looking at Jenny Cr/Floras Cr confluence

Weirs during construction, looking upstream from the mouth

Upstream weir following construction

Bagley Creek—Countersunk Culvert

Inlet from upstream showing 90 degree turn, fire pond access, 02/14/00 Outlet, showing sand and silt-dominated substrate, 09/07/99

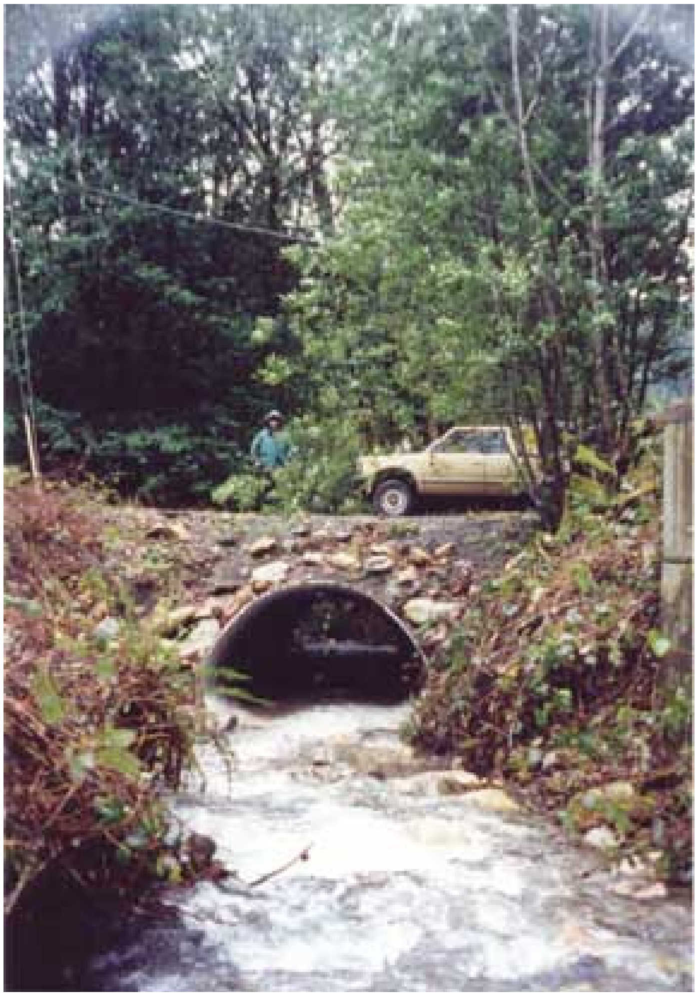
View into inlet, 02/14/00

Ismert Creek – Countersunk Culvert, 09/30/9

Looking upstream at headcut, where nick point migrated upstream. Looking downstream at mitered (beveled) inlet

Looking upstream at outlet from riprap

Deer Creek – Countersunk Culvert, 01/12/00



Looking downstream at the beveled inlet

Another barrier with 3-4' drop, upstream on a private road

Looking upstream through the culvert at boulders

Elk Creek – Countersunk Culvert

Looking upstream from inside the inlet, 01/12/00

Substrate in culvert, 01/12/00

Looking downstream at the material collecting at the inlet, 09/30/99 Outlet, no drop, 09/30/99

Wedderburn Ranch Creek – Countersunk Culvert

Outlet of the downstream culvert following installation, 08/30/01

Inlet of downstream culvert following installation, 08

Inlet of the downstream countersunk culvert, 04/15/03

Outlet of the downstream countersunk culvert, 04/15/03

Turner Creek - Countersunk Culvert

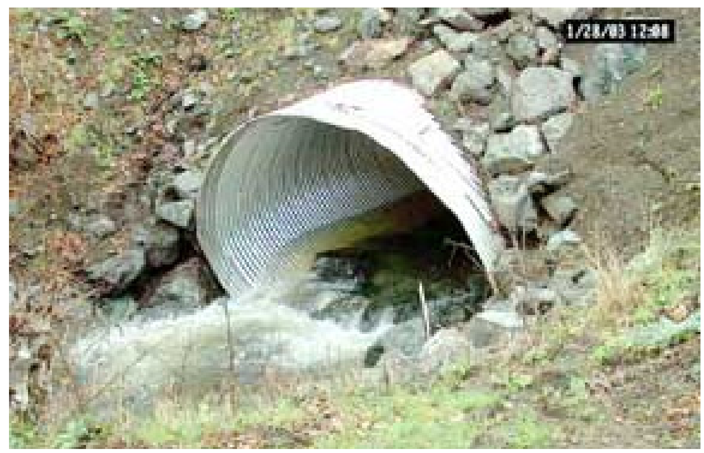
Looking at the outlet of the former culvert, upper crossing, 07/06/01

Looking upstream at the countersunk culvert, notice shallow deposition, 02/27/02

Indian Creek-Countersunk Culvert

knox1 mp 1.130 Looking at inlet knox 1 mp1.130

Looking at rip rap forming pools



knox1 mp 1.130

Looking through culvert at inlet knox 1 mp 1.130 Outlet

knox 1 mp 1.130 Runoff mining road fill

Gallagher Creek - Countersunk Culvert

Looking downstream at the inlet following installation, 01/31/03

Looking upstream at the outlet following installation, 01/31/03

Close-up of outlet following installation, 01/31/03

Schoolhouse Creek – Culvert with Baffles, 02/02/99

Exposed fill adjacent to inlet eroding during rainstorm

Outlet with jump pool weirs, and straw mulch on road fill

Culvert inlet, "daylight" riser noticeable in the upper center of photo

Swamp Creek – Culverts with Baffles

Culvert inlet at the downstream reservoir, 5/15/03

Culvert outlet at the downstream reservoir, 5/15/03

Full view of culvert placed at the downstream reservoir, 5/15/03

Looking upstream into the baffled culvert during installation, 2002

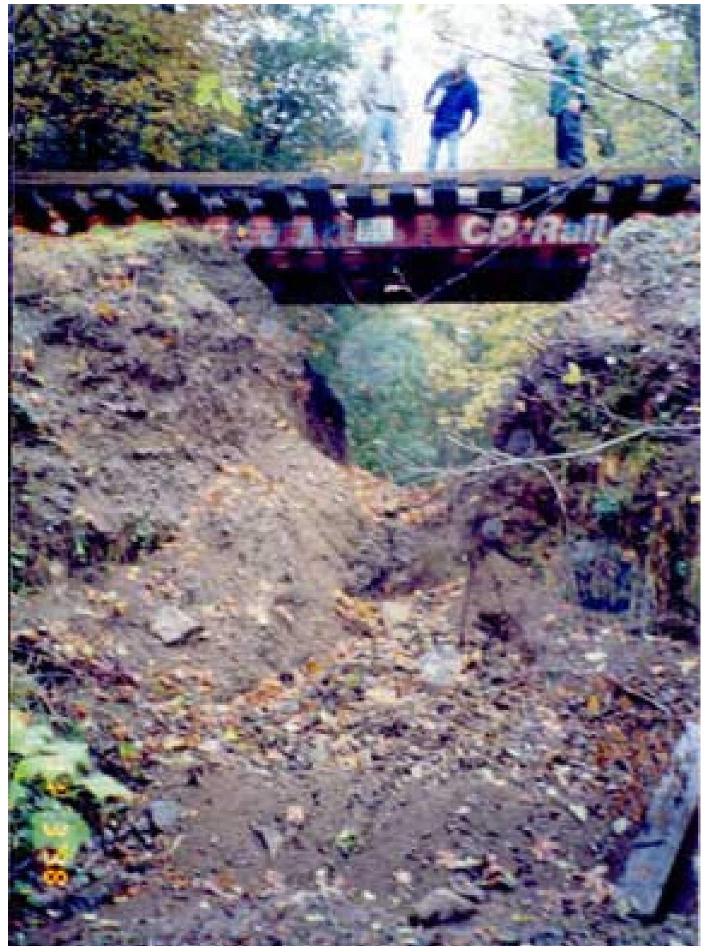
Dan's Creek (tributary to Fourmile Creek) – Bridge Replacing Culvert

Looking downstream from above, 07/21/00

Looking upstream, 12/15/00

Hoog Creek (tributary to Dry Creek on Sixes) – Bridge Replacing Culvert

Outlet before replacement, 02/13/98



Outlet side after replacement but before first winter, 11/03/98

Inlet side after replacement but before first winter, 11/03/98

Hoog Creek - Wood Placement associated with the Bridge Replacing Culvert, 05/24/02

Looking upstream at wood placement, note bridge in background

Looking downstream from beneath the bridge at wood placement

Looking upstream at wood placement, notice degree of downcutting

Looking downstream at wood placement, note bridge in background

Cedar Creek (tributary to Elk River) – Bridge Replacing Culvert

Looking upstream before installation of bridge, 04/23/99

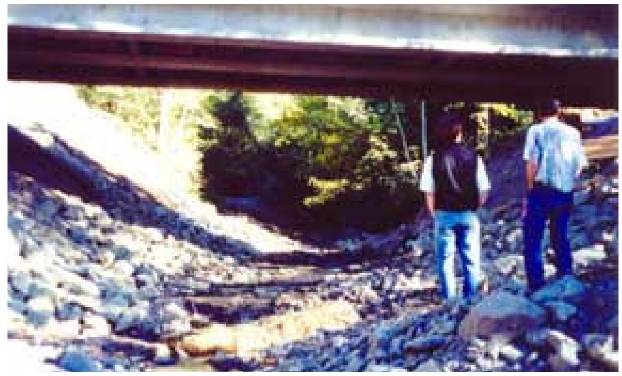
Looking upstream after installation of bridge, 03/15/00

Looking upstream, 12/07/99

Looking downstream at the riffle formed under the bridge, 12/07/99

Deep Creek—Tributary to Pistol Rive

Looking upstream before installation of bridge, note gabion weirs, summer 99



Looking upstream after bridge installation, 09/30/99

Looking upstream, 05/03/01

Looking upstream, autumn 2002

Turner Creek - Bridge Replacing Culvert

Looking at the former inlet of the lower crossing, 07/06/01

Looking upstream at the bridge placed at the lower crossing, 03/05/02

Looking downstream at the bridge placed at the lower crossing, 03/05/02

Looking from the SE at the lower crossing bridge, 03/05/02

Swanson Creek (tributary to Floras Lake) – Bridge Replacing Culvert

Looking at the former inlet of the lower crossing, 01/28/02

Looking at the former outlet of the lower crossing, 01/28/02

Looking at the former inlet of the upper crossing, 01/28/02

Looking at the former outlet of the upper crossing, 01/28/02

Swanson Creek (tributary to Floras Lake) – Bridge Replacing Culvert

Looking upstream at bridge installed at the upper site, 12/20/02

Sediment released from culvert removal - stored at large wood, 2003

Looking upstream at split channel - terminus of the headcut migration from culvert removal, 12/20/02

Boulder Creek (tributary to Euchre Creek) – Bridge Replacing Culvert

Looking upstream newly formed channel prior to the first winter, 07/31/00

Looking upstream from bridge – notice the start of downcutting, 01/31/00

Beaver Creek – Bridge Replacing Culvert

Looking downstream at the railcar bridge

South Fork Hubbard – Bridge Replacing Culvert

Outlet of former crossing – acting as a complete blockage during summer flows

MS Hubbard Creek – Bridge Replacing Culvert

Outlet of former crossing – notice 3 culverts, 2 of which are failing

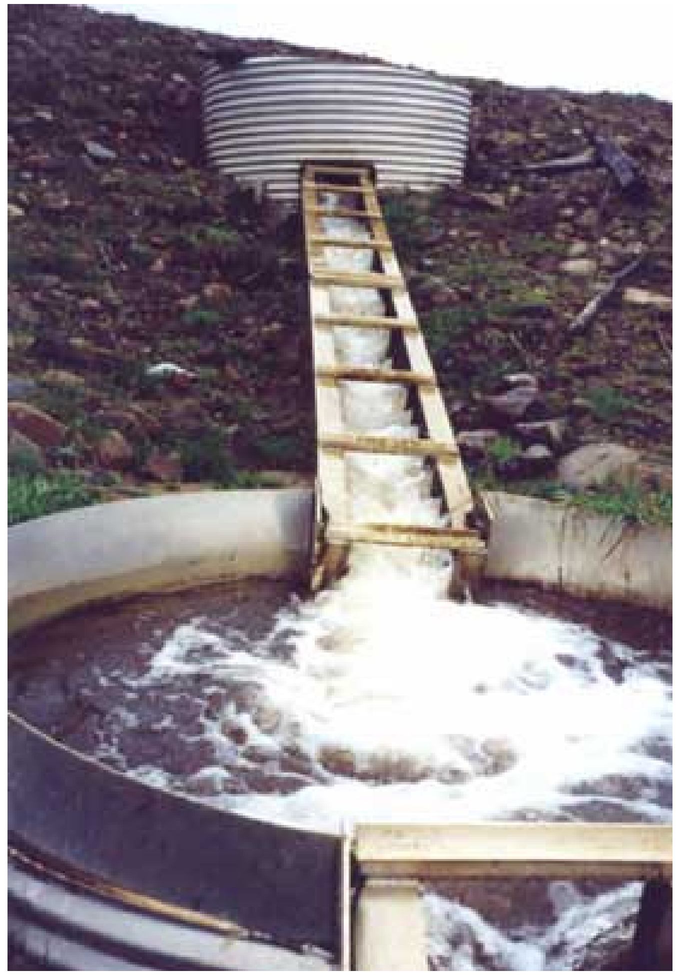
Looking from upstream at the bridge

Looking from downstream at the railcar bridge

Looking at the bridge decking (notice no running boards)

Boulder Creek (tributary of Floras Lake) - Alaskan Steep Pass

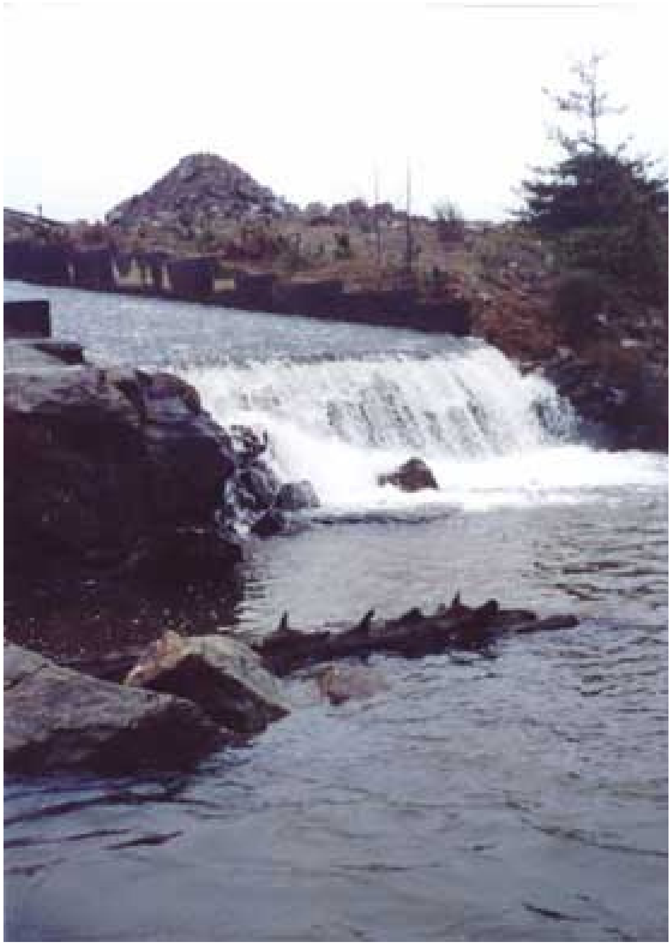
Steep Pass looking upstream, 02/02/99



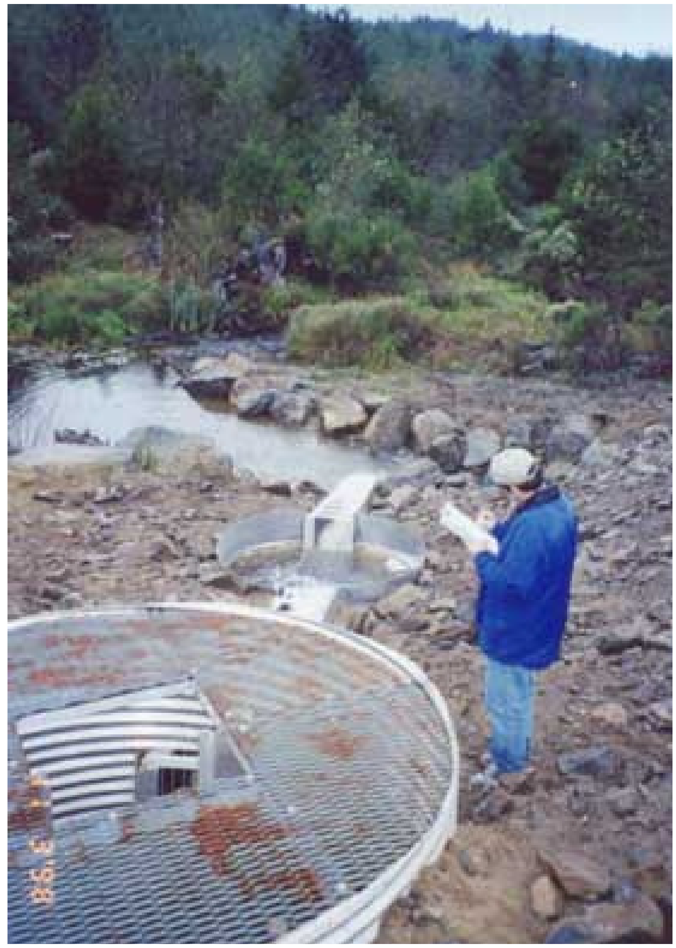
Close-up of flow in resting riser looking upstream, 02/02/99

Steep Pass post screen placement, 09/18/02

Boulder Creek - Alaskan Steep Pass



Impassable spillway, 02/02/99



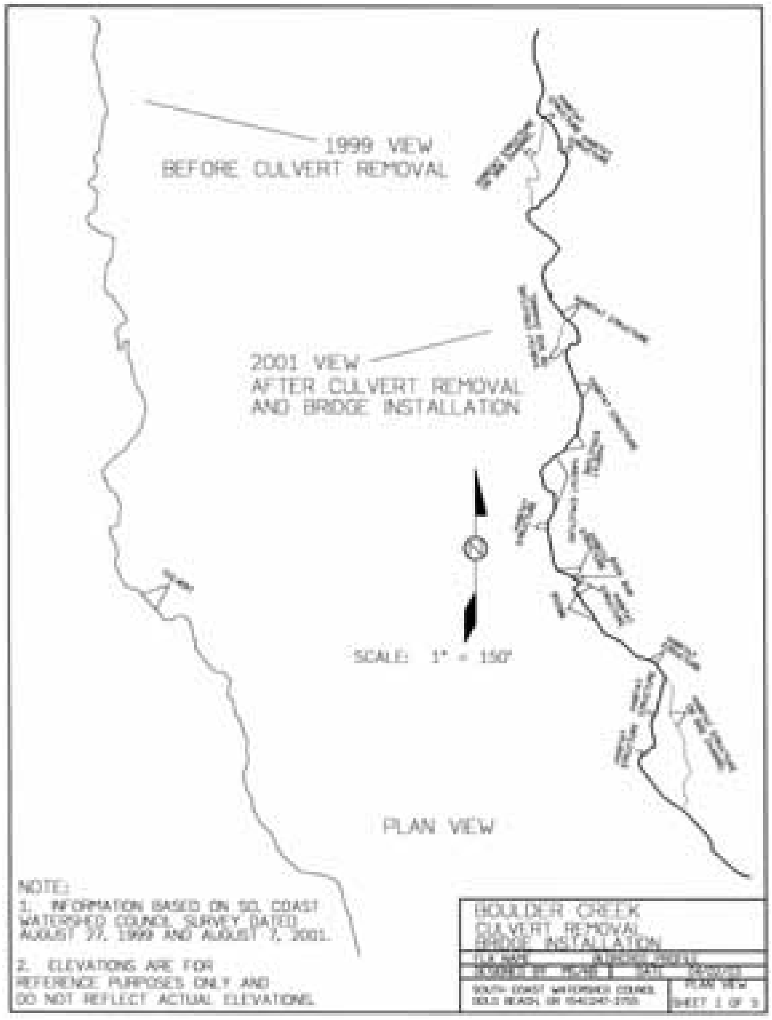
Looking downstream at resting risers and chutes, 11/03/98

NF Boulder Creek (tributary to Boulder Creek, Floras Lake) – Pulled Crossing

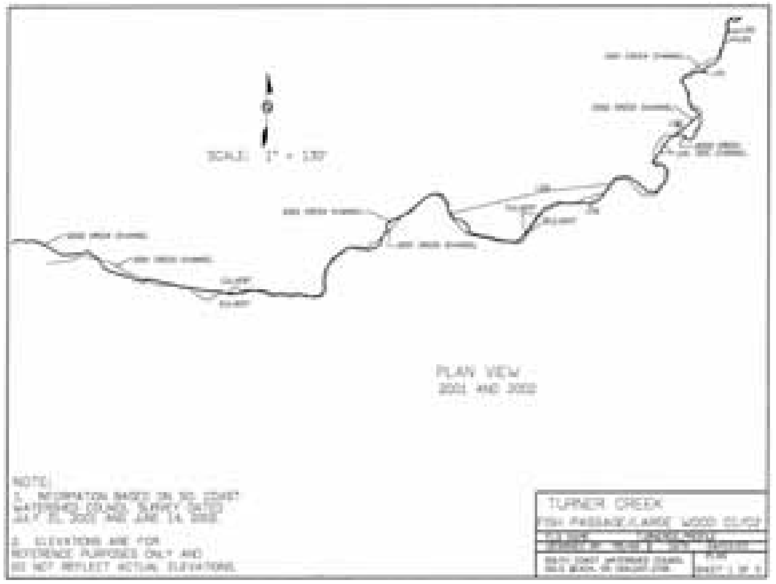
Looking upstream from the new channel at the beaver pond, 12/20/02

Looking from the south at the excavated channel and placed trees, 12/20/02

Boulder Creek (tributary to Euchre Creek)
Planview of Longitudinal Profile (not to scale)



Turner Creek
Plan View of Longitudinal Profile (not to scale)



Future Monitoring Needs

Thus far the Councils' have addressed their project effectiveness monitoring responsibilities by monitoring a subset of projects within a "project type". In the case of Road Stormproofing, Large Wood, and Riparian Restoration projects, this approach has been an effective means of capturing the overall performance of the project type. Though this is also true with Fish Passage projects, there is enough financial investment, and potential impact on the fisheries, that it would be in the best interest of the Councils, and the resource, to monitoring each site individually. In addition, past monitoring has shown that many of the conditions limiting the effectiveness of a fish passage site can be easily corrected. The table on page 9/10 of this report indicates which projects were not monitored, and of those that were monitored, the "unknown" status indicates which projects require more monitoring. These sites, in addition to new fish passage projects, should be monitored in the future.

In regard to the "overall habitat" available upstream, the accuracy of measuring the channel up to 16% gradient on a topographic map is limited. Unknown human and natural barriers upstream of the site could lead to an overestimation of available habitat, whereas on other sites, there may be additional flats upstream of a steep section that are accessible, and thus the overall habitat is underestimated. Though it is possible that these inaccuracies could average out when looking at the cumulative habitat opened up in the county, for any one project it could be significant. This would effect how a site was evaluated when looking at the project's cost/benefit ratio (discussed below). For this reason, surveying the habitat above each site would be beneficial. Along that same line of thinking, expanding the program's biological monitoring (especially with juveniles) could identify whether newly "opened up" habitat was being re-colonized. As of this report, there are a number of sites have been rated as effective based on physical measurements, but we have no information on the fisheries.

Finally, it would be very useful to develop a cost/benefit analysis that could be used to evaluate each project. The analysis should factor in the quantity of "known" habitat opened up by the project site, the value of the habitat based on objective data (i.e. biological surveys, habitat surveys), whether the project was effective, improved, or ineffective, the cost of the project, and the estimated life span of the project. Developing project costs should occur first. This information can be used immediately to evaluate future projects. Some of the remaining information already exists, whereas other variables (i.e. know habitat) will take time to gather, and thus, it is unlikely that all the necessary data will be available by the next fish passage report.

Conclusions and Adaptive Management

Jump Pool Weirs

Four out of seven sites were monitored. Of the monitored sites, three had been blown out due to extreme site conditions, poor design, and/or poor implementation. Two of those sites were reconstructed. Overall, 2 of the monitored sites were improved, and 2 were ineffective. In two cases (Indian Creek, Bagley Creek) the nature of the barrier being addressed limited the projects ability to succeed. Spawning surveys were conducted on 3 sites, though fish were only observed at one site. In general, jump pool weirs were an early alternative to expensive engineered passage structures (for example, a bridge on Deadline Creek). Design issues that may have led to the failure of the weirs were 1.) underestimating stream power, and therefore specifying too small of rock, 2.) not setting the rock below the depth of scour, and 3.) constructing the weirs within the turbulent flow of spillways/outlet drop (the recommended distance downstream is twice the width of bankfull flow).

Perhaps more important than the adequacy of the jump pool weir design, is to question why jump pool weirs have been used when they impede juvenile passage. We have learned that ODOT and Bureau of Land Management are implementing designs that use constructed riffles to correct jump heights up to five feet below culverts. These designs involve placing rock and streambed materials to simulate 5% gradient, full-width, streambeds (D. Porior, phone conversation). Designed riffles could be an effective step down channel where there is concern about the migration of a headcut.

Countersunk Culverts

Sixteen countersunk culverts have been installed, of which 10 have been monitored. Of those 10, 7 were rated as effective, 2 as improved, and one as unknown. For the 2 sites rated as improved, juvenile passage is being limited by high flows and a lack of resting opportunities. Spawning surveys were conducted on 5 sites, 3 of which documented Coho re-colonizing the habitat opened up by the project. Design concerns that have limited some sites are 1.) the culvert did not meet the 2/3 bankfull criteria, 2.) the culvert was not seeded with boulders that could trap substrate and create resting opportunities, and 3.) the culvert was not set low enough to develop a substrate invert 24” deep.

Baffled Culverts

Three baffled culverts were installed by the watershed councils, and a 4th was retrofitted with baffles by the Forest Service. The Forest Service culvert, and one of the Councils’ culverts, were monitored, and both were determined to be effective. Spawning fish have consistently been observed upstream of the Forest Service culvert (Deadline). When designed and installed properly, baffled culverts can be a cost-effective alternative to a bridge or fish ladder, and baffles can be retrofitted to an existing “standard” culvert so that replacement is not necessary.

Bridges Replacing Culverts

Eleven bridges have been partially, or fully, funded by the Councils, of which 7 have been monitored. All 7 of those sites have been rated as effective, although one site should be revisited to determine if low or high flows limit juvenile passage. Biological surveys were conducted on 4 of the sites, 3 of which produced fish. In particular, Hoog Creek has shown significant recolonization in year four. Design concerns to consider are 1.) is the length of the bridge adequate to account for the entire active channel width, plus stable side slopes, 2.) is the bridge’s bearing capacity well matched to the intended use, and 3.) is the decking material well suited to the use, and if it is wood, are there running boards.

Alaskan Steep Pass

The Alaskan Steep Pass has proven to be effective, both based on physical measurements and biological surveys, though there have been issues related to both adult and juvenile fish jumping out of the chute as they try to migrate upstream. A metal grate is being installed on the top of the chute to alleviate this problem. There is talk of adjusting the volume of flow entering the Steep Pass in the spring to decrease the incentive for juveniles to enter the chute, but more monitoring of the fish runs would be needed before this could occur.

The designer has expressed a concern that the current inlet may not control flow adequately to prevent overflow of the structure and erosion of the fill. In addition, he has acknowledged that during installing it is necessary to water test the structure in the field, and be capable of repairing leaks on site that resulted during the transportation.

Pulled Crossings

Two crossings have been pulled, of which one was monitored. In general, pulling a fish barrier is the most cost effective and sure proof methodology, though it is rarely an option. Design concerns related to pulling a crossing include 1.) pulling enough material so that the side slopes can be laid back to a stable gradient, 2.) pulling enough material so that downcutting does not occur through the site, which could destabilize the side slopes, and 3.) ensuring that surface runoff does not erode the newly exposed surfaces.

General Issues

Bridges, and to a lesser extent embedded culverts, are subject to upstream migration of gradient nick points. At sites with extensive bedload deposition behind culverts, channel adjustments may cause downcutting and headcutting through old deposits (for example, at Hoog Creek). Through pre- and post- project longitudinal profiles, and visual observation, it is apparent that the degree and extent of downcutting can be significant, and can lead to the loss of valuable habitat upstream and downstream. The question that has arisen is whether "step-down" channels should be constructed to stabilize the existing channel gradient, which in turn would preserve the high value depositional habitats upstream? And if step-down channels are appropriate, what should the design look like?

For all types of structures, soil disturbance can expose materials that will erode directly into fish-bearing streams unless appropriate erosion control measures are used. At the Schoolhouse Creek site, the extent of disturbance exceeded expectations due to the excavation with a cat. Erosion control and revegetation plans need to be in effect prior to installation.
As a result of several years of fish passage project monitoring, we plan to revise our Evaluation Forms to reflect the following:

- Measure discharge during field visits (not just velocity). Compare with estimated 50-year flows from ODF maps, and with calculated bankfull flows.
- Measure distance between barrier and jump pool weirs to determine if weirs are located more than two bankfull widths downstream.
- Determine if weirs create a backwater into the structure, and if the mainstem creates a backwater into the structure, at what flow levels this may occur.

Acknowledgements

We appreciate the support of the US Fish and Wildlife Service and the Oregon Watershed Enhancement Board, whose funding made this monitoring possible. Our partners and cooperators include Curry County Road Department, Olympic Resource Management for Hancock Timber Resource Group, the Campbell Group, Westbrook Land and Timber, South Coast Lumber Company, Dan Wilson, Sea Wind Farms, Oregon Department of Transportation, Marsh Ranch, Scott McKenzie, City of Port Orford, Knox Family, George Fleming, Carl Foster, Rick McKenzie, David Yates, Tim Tuttle, the Lower Rogue Watershed Council and the individual Watershed Councils under the South Coast Coordinating Watershed Council. Thanks to Derek Godwin of Oregon State University Extension Service, Hire the Fishermen surveyors Carol Davis, Janice Emery and Ann Smith, Cecil Ashdown of Curry Soil and Water Conservation District, and Don Porior, Bureau of Land Management engineer. Oregon Department of Fish and Wildlife personnel, including Todd Confer, Clayton Barber, Howard Crombie, Steve Mazur, John Weber, and Russ Stauff, assisted with surveys, field reviews, designs, permits, and invaluable fish information. Former and current Watershed Coordinators/Fish Passage Project Managers that pulled these projects together include Gary Susac, Rob Ashdown, Rick Hazard, Mark Weinhold, John Wilson, Dan Crumley, Howard Crombie, Jennifer Dwyer, Harry Hoogesteger, and Bruce Follansbee. Oregon Department of Forestry and ODFW provided training materials in advanced fish passage criteria. Special thanks to volunteers Jake Lang, who reported coho passage, and to Terry Cochran, who assisted with monitoring on the Winchuck River projects, and to Erin Minster, who helped pull the report together and get it up on the Web.

Appendices

Fish Passage Evaluation Forms
Deadline Creek Velocity Measurements
Schoolhouse Creek Velocity Measurements
North Fork Hubbard Creek Spillway Modification design drawings

Jump Pool/Boulder Weir Evaluation Form

Project Name: ______ Date ______

Location ______

Project Ownership: ______

Landowner: ______

Surveyor(s): ______

Survey Type: ______

Flow Conditions: ______

Jump Pool Data

Pool Length: ______

Pool Depth: ______

Jump Height: ______

Note: If boulder weirs are being used to create approach pools before the main jump pool or barrier; collect the jump height, pool length, and depth for the approach pools. Use slashes (/) to seperate the pool data.

Notes

Need also - horizontal distance from jump to weir(s)
- rock diameters

Fish Passage Culvert Evaluation Form

Project Name: ________ Date: ________

Location: ________

Project Ownership: ________

Landowner: ________

Surveyor(s): ________

Survey Type: ________

Flow Conditions: ________

General Data

Culvert Length ________

Gradient (%) ___ / ___ / ___

Culvert Height ________

Culvert Width ________

Active Channel Width: ___ / ___

Countersunk Culverts

Average Water Depth: ________

Velocities in Resting Holes: ________

Distance Between Holes: ________

Substrate Composition: ________

Embedded Depth: ________

Culverts with Baffle

Baffle Spacing: ________

Resting Pool Velocities: ________

Velocities in the Chute ________

Water Depths in the Chute ________

Notes:

Bridge Evaluation Form

Project Name: ______ Date ______

Location ______

Project Ownership: ______

Landowner: ______

Surveyor(s): ______

Survey Type: ______

Flow Conditions: ______

Does the Bridge Create a Constriction ______

Notes:

Fish Ladder Evaluation Form

Project Name: ______ Date: ______

Location: ______

Project Ownership: ______

Landowner: ______

Surveyor(s): ______

Survey Type: ______

Flow Conditions: ______

Fish Ladder Data

Jump Heights: ______

Pool Lengths: ______

Pool Depths: ______

Pool Velocities: ______

Note: Write the data for all the pools in the above spaces; use slashes (/) to seperate them. Work from the top pool down or bottom up, and indicate your direction in the notes below.

Approach to the Ladder

Percentage of Flow: ______

Approach Length: ______

Average Velocity: ______

Gradient(%) ______

Notes

Biological Survey Form

Project Name: Date

Location

Project Ownership:

Landowner:

Surveyor(s):

Survey Type:

Flow Conditions:

Effectiveness Monitoring Salmonid Spawning Survey Form

Below the Structure

Species	Live Adults	Dead Adults	Live Jacks	Dead Jacks	Redds

Above the Structure

Species	Live Adults	Dead Adults	Live Jacks	Dead Jacks	Redds

Effectiveness Monitoring Juvenile Salmonid Survey Form

Species	Abundance (by 10's)	Survey Method	Date		

Notes:

Deadline Creek (tributary to Lobster Creek, Lower Rogue River)

Velocities were measured within the Deadline Creek culvert to assess the concrete baffles installed in the mid 1980's by the Forest Service. The baffles are spaced 17-18 feet apart, and the invert is lined with metal wire grating to trap bedload. Velocity (feet per second) was measured on the tail end of a small storm using a Pygmy Flow Meter. The flow level was visually estimated as approximately 40% of the bankfull volume at the time of the measurements.

Deadline Creek Velocity Data - December 15, 2000 - pygmy meter:

Position in Culvert	Right Side Velocity/ Depth (ft)	Middle Velocity/ Depth (ft)	Left Side Velocity/ Depth (ft)	Substrate
inlet	turbulent 1.5-3.5/?	turbulent 1.5-3.5/?	turbulent 1.5-3.5/?	none
½ way to baffle 1	2.75/1.4	2.75/1.4	2.75/1.4	none
above baffle 1	2.0/1.4	1.74/1.4	.17/.9	none
below baffle 1	turbulence 2-7/1.0	turbulence 2-7/1.0	turbulence 2-7/1.0	none
½ way to baffle 2	2.11/1.4	2.11/1.4	2.11/1.4	none
above baffle 2	.71/1.2	2.1/1.3	2.0/1.2	none
below baffle 2	turbulence 3-5/1.0	turbulence 3-5/1.0	turbulence 3-5/1.0	sand/gravel
½ way to baffle 3	2.44/1.4	2.44/1.4	2.44/1.4	sand/gravel
above baffle 3	1.15/1.2	1.7/1.5	.54/1.2	sand/gravel
below baffle 3	turbulence 1-4/1.3	turbulence 1-4/1.3	turbulence 1-4/1.3	cobbles/debris
½ way to baffle 4	2.14/1.5	2.14/1.5	2.14/1.5	cobbles/debris
above baffle 4	3.0/1.3	2.7/1.4	0.8/1.0	cobbles/debris
below baffle 4	turbulence 3-5/1.0	turbulence 3-5/1.0	turbulence 3-5/1.0	cobbles
½ way to baffle 5	3.14/1.2	3.14/1.2	3.14/1.2	cobbles
above baffle 5	1.09/1.2	2.35/1.4	1.54/1.21	cobbles
below baffle 5	turbulence 4-6/1.0	turbulence 4-6/1.0	turbulence 4-6/1.0	a few cobbles
½ way to baffle 6	2.55/1.3	2.55/1.3	2.55/1.3	a few cobbles
above baffle 6	1.7/1.0	2.4/1.3	2.2/1.1	a few cobbles
below baffle 6	turbulence 1.5-5/1.0	turbulence 1.5-5/1.0	turbulence 1.5-5/1.0	none
½ way to outlet	1.12/1.2	1.12/1.2	1.12/1.2	one small bldr
at outlet	1.53/1.2	1.7/1.5	2.66/1.2	none

Memo

To: Cindy Ricks

From: Mark Weinhold

CC: Matt Swanson

Date: 4/27/00

Re: Schoolhouse Creek Project Effectiveness Monitoring

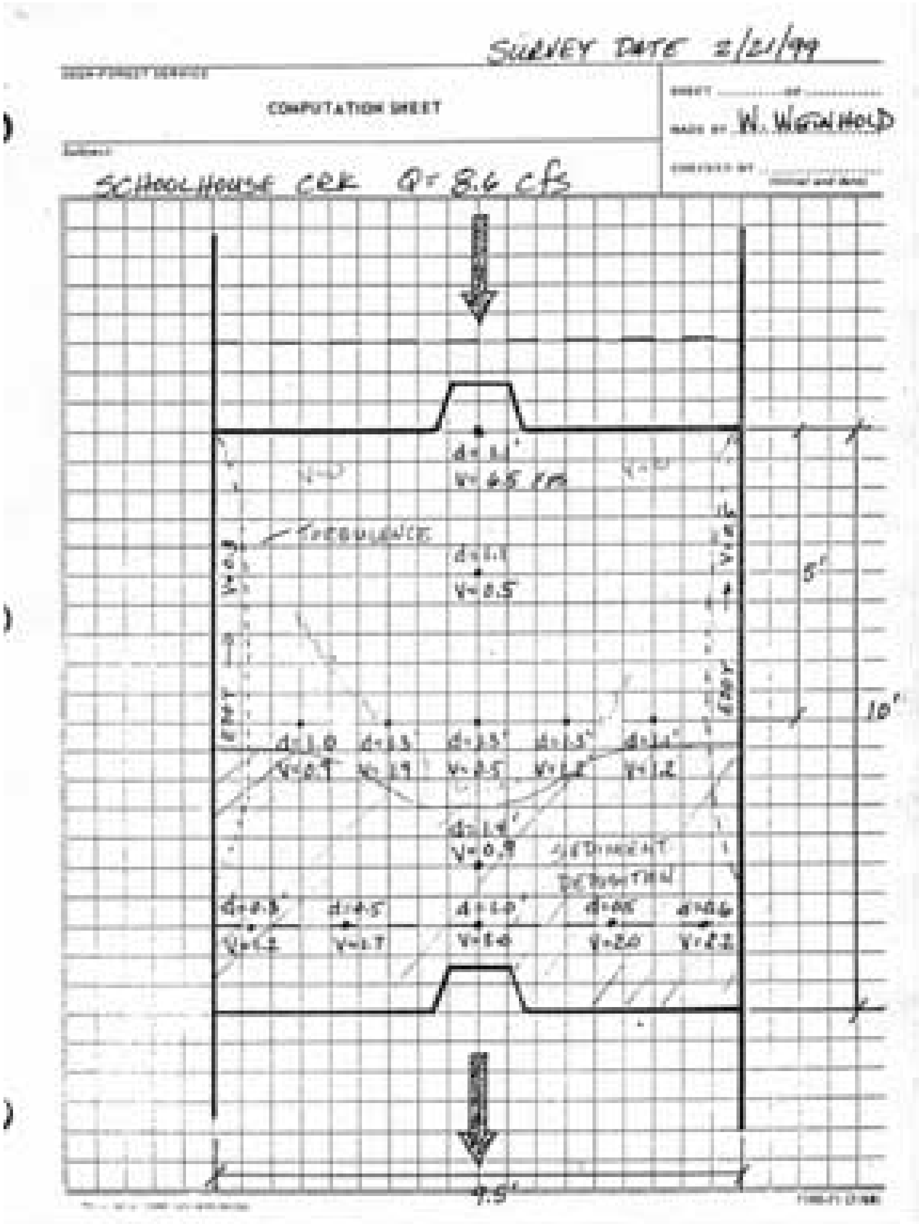
Attached are three schematics of velocity grids taken at *Schoolhouse Creek* during the winters of 1999 and 2000. The schematics show water depths and associated average velocities (measured at 0.6*depth) at various locations in a representative pool. Even though the measured discharges varied between 8 and 24 cfs, there was not a proportional increase in velocities. In all cases there was an area of high energy dissipation that extended from the upstream weir crest downstream to over half the pool length. This region was characterized by high turbulence (multi-directional velocity components) as expected from a plunging flow regime and generally had low downstream velocities. In all cases the lower1/3 of the pool had a natural stream bed that varied in gradation from fine/medium gravel to large cobble.

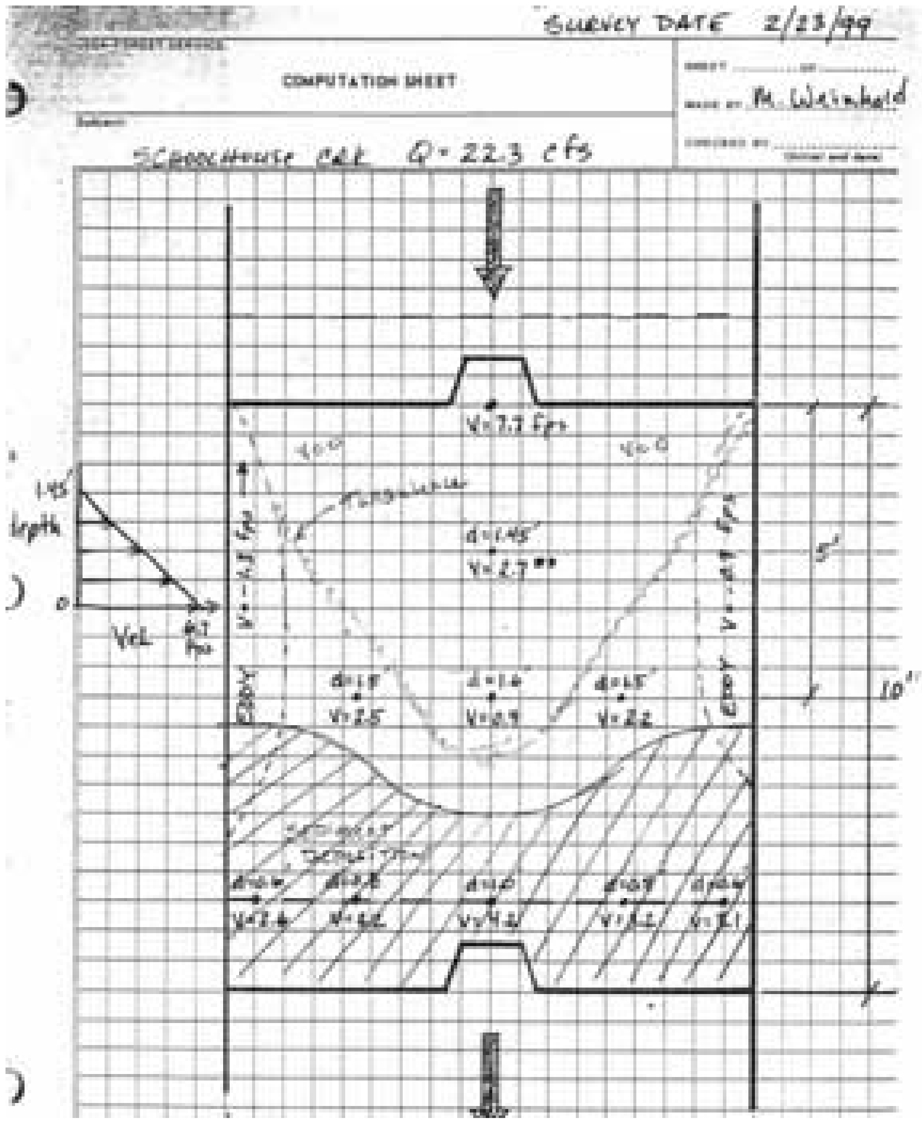
At all three of the flows measured, upstream eddies were present along the margins of the pipe. The upstream velocities in these regions ranged from 0.3 to 1.3 ft/s. The highest velocities, outside of the weir plunge, were at the bottom of the pools where the plunging flow had ceased and the flow direction had become more uniform in the downstream direction. Velocities in this region at the high discharges ranged from1.8 to 4.2 ft/s, the variation likely related to the location across the pipe cross section and roughness changes from variations in the size and amount of sediment deposited in the area.

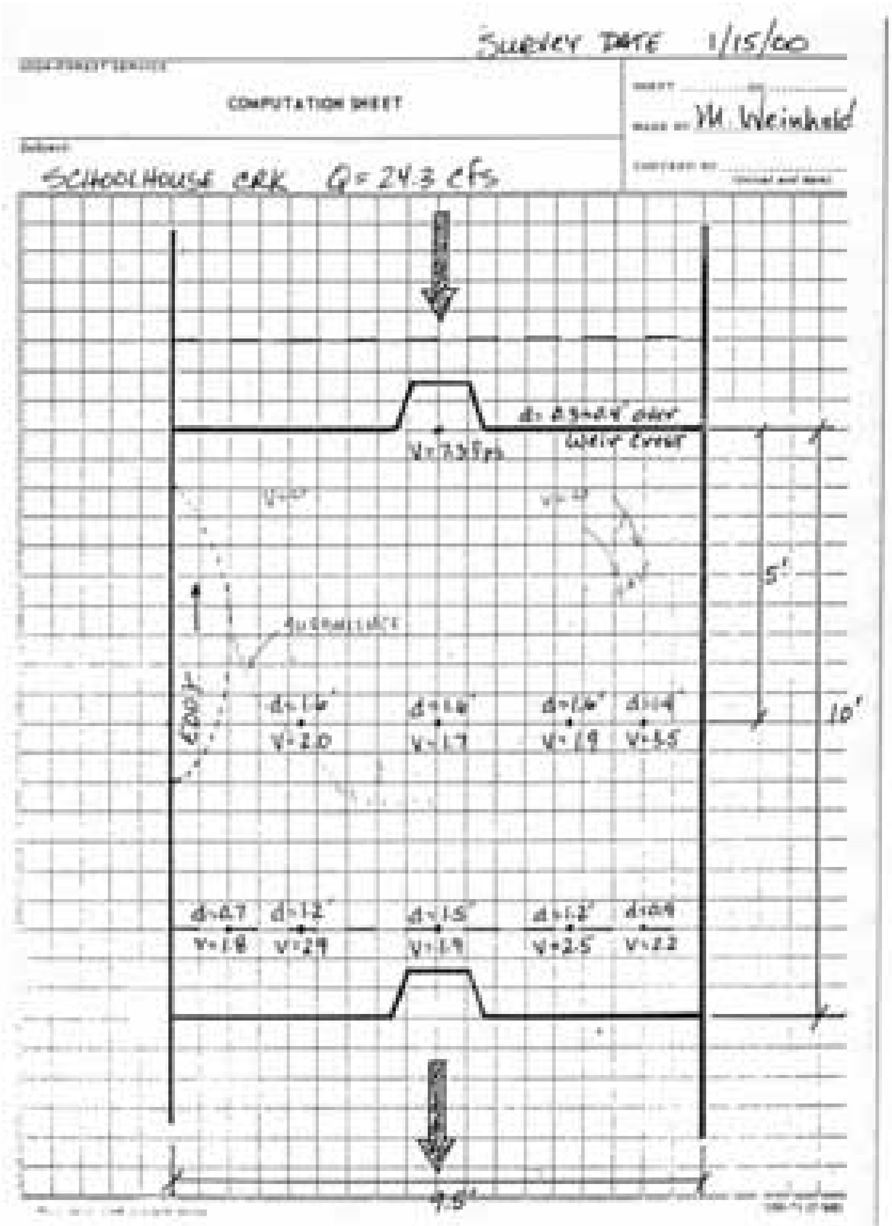
The highest point velocities in each measurement were at the weir plunge, which varied marginally from 6.5 ft/s at a flow of 8 cfs to 7.3 ft/s at a flow of 24 cfs. An interesting artifact of that flow constriction impinging on an immovable culvert bottom is that the vertical velocity distribution approximately 2-ft downstream of the plunge had an inverted profile. That is, the surface velocity was zero while the velocities adjacent to the bed were over 6 ft/s. This condition would completely reverse back to a typical velocity profile near the bottom 1/3 of the pool.

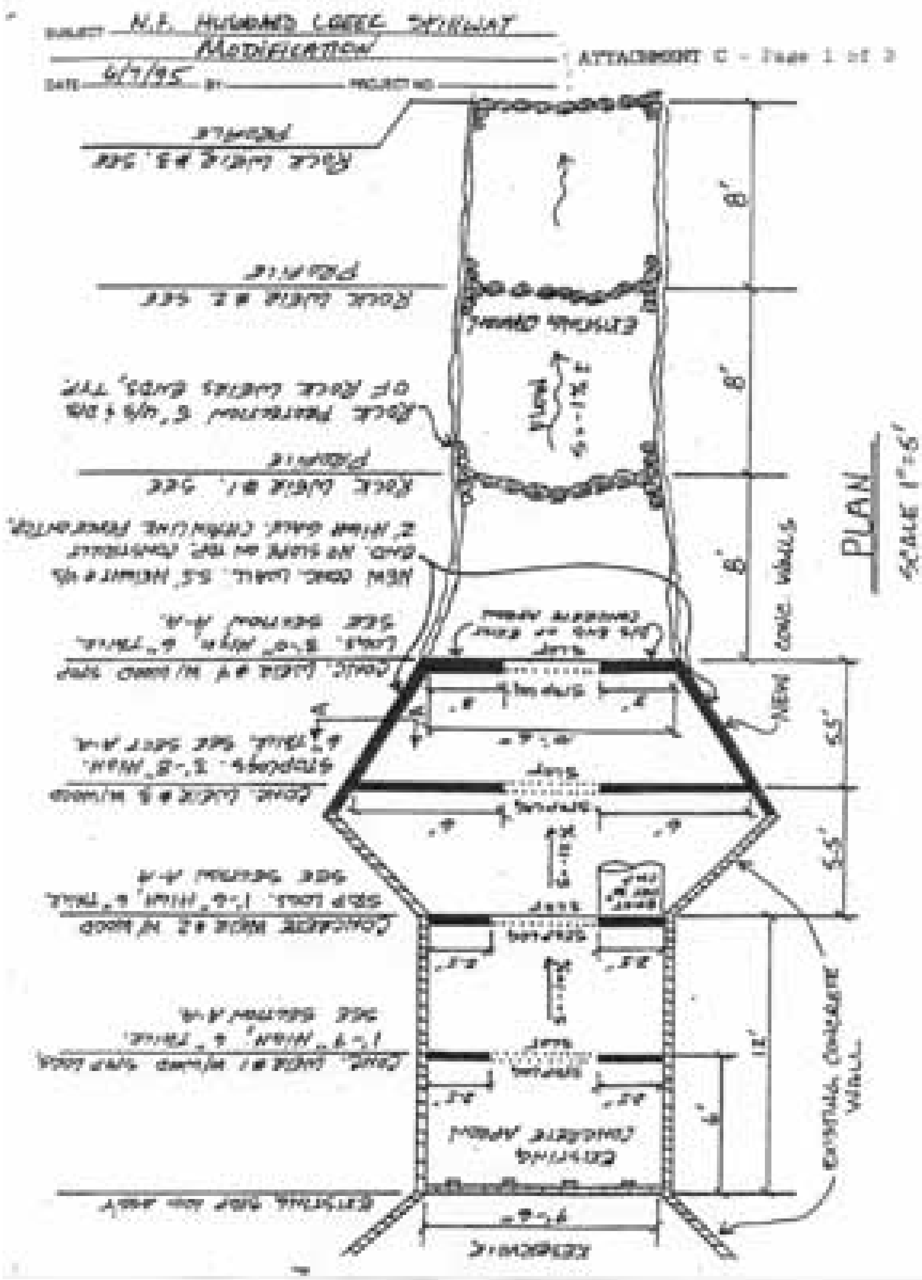
It will be interesting to look for juvenile fish above the pipe this summer to see what success we are having. The presence/absence monitoring I have done on similar installations with gradients ranging from 7 to 10+ percent has been very encouraging. It is difficult to tell whether the young fish are steelhead or cutthroat, but fish are successfully spawning above the road crossings each year. Additionally, it is not uncommon to see the juveniles hiding among the gravel within the lower ends of the pools.

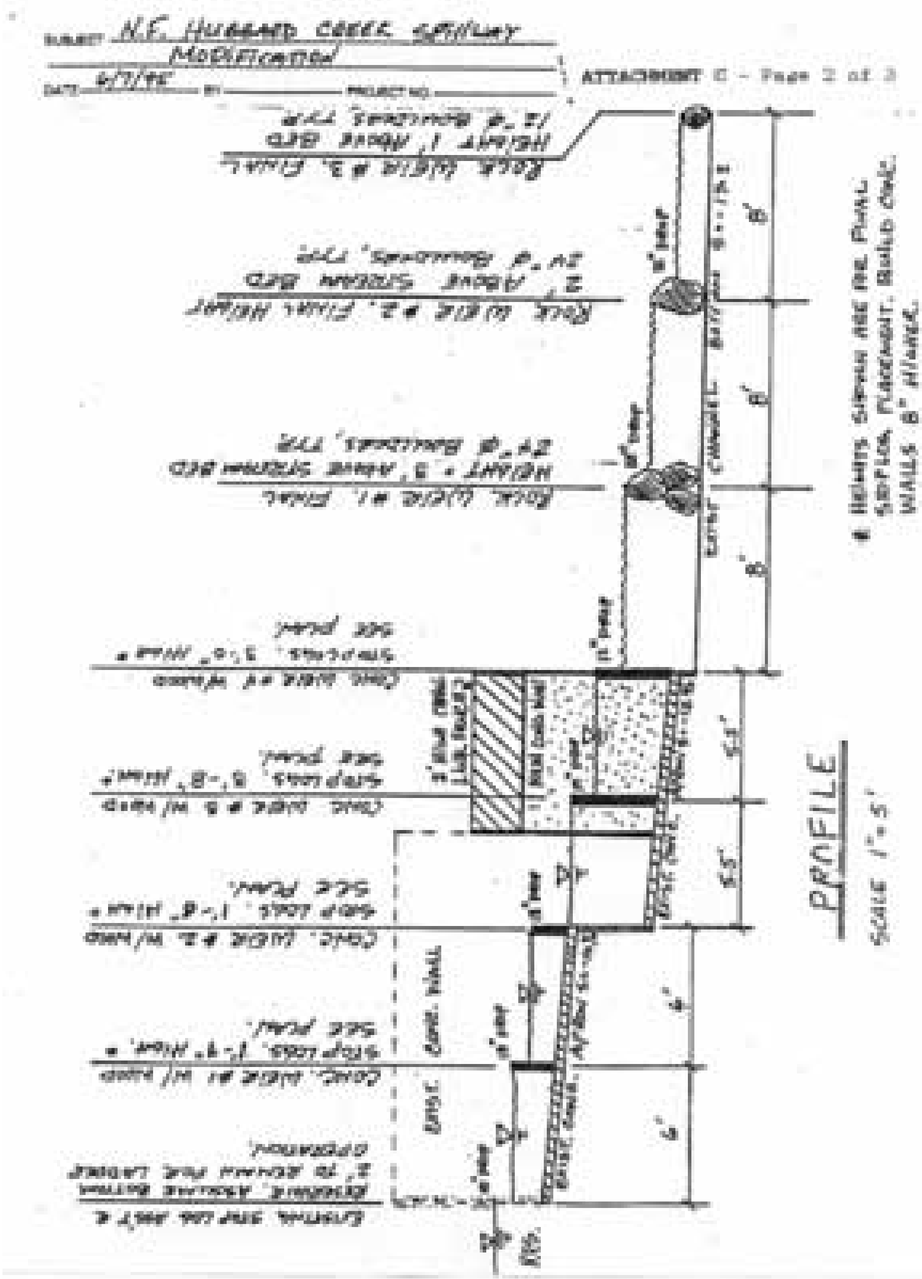
I would be curious to hear about the results of other passage monitoring that you did this season.


SURVEY DATE 2/21/99
COMPUTATION SHEET
W. WEINHOLD
SCHOOLHOUSE CRK Q = 8.6 cfs
TURBULENCE
SEDIMENT DEPOSITION
5'
10'
9.5'


SURVEY DATE 2/23/99
COMPUTATION SHEET
M. Weinhold
SCHOOLHOUSE CRK Q = 223 cfs
V=7.7 fps
TURBULENCE
d=1.45'
V=2.7
EDDY
d=1.5
V=2.5
d=1.6
V=2.9
d=1.5
V=2.2
SEDIMENT DEPOSITION
5'
10'
Vel
Depth


SURVEY DATE 1/15/00
COMPUTATION SHEET
M. Weinhold
SCHOOLHOUSE CRK Q= 24.3 cfs
5'
10'


N.F. HUBBARD CREEK SPILLWAY
MODIFICATION
6/7/95
ATTACHMENT C - Page 1 of 3
PLAN
SCALE 1"=5'
NEW CONC WALLS
EXISTING CONCRETE WALL


N.E. HUBBARD CREEK SPILLWAY
MODIFICATION
ATTACHMENT E - Page 2 of 3
PROFILE
SCALE 1"=5'

SUBJECT N.F. HUBBARD CREEK SPILLWAY MODIFICATION

DATE 6/1/95 BY ________ PROJECT NO ________

ATTACHMENT C - Page 3 of 3