SPECIES AND HABITAT: AQUATIC

Characterization

Special Status Species: Coho runs within the Watershed have followed the same fluctuating patterns as other Coastal stocks in that they showed good numbers before 1996 and declining numbers in 1997. Forecasting future run sizes is difficult because coho operate on 3-year cycles, and ocean and precipitation patterns are constantly changing. On August 10, 1998, NMFS published their final rule on the Oregon Coast Evolutionarily Significant Unit (ESU) of coast coho salmon in the Federal Register (Vol. 63, No. 153, pg. 42587-42591). NMFS found the Oregon Coast ESU to warrant listing as a threatened species. This listing pertains to naturally spawned populations of coho salmon only.

At the time we prepared this analysis, steelhead and sea-run cutthroat trout were listed as "candidate" species. For current status of these species see the NMFS Northwest Regional Office home page (< http://www.nwr.noaa.gov/ > click on publications then click on Federal Register Notices by Species; also at the home page, click on news releases).

The status of the Oregon Coast ESU of Chinook is listing as not warranted. We have very little data concerning non-game fish species except the longnose (Millicoma) dace, which is found in mainstem Coos as far up as Tioga Creek.

Federal, state or Bureau sensitive aquatic species, other than the trout and salmon, are the Millicoma dace, the red-legged frog, and the torrent salamander. Potentially occurring species include the tailed frog and torrent salamander.

Reference Conditions

Historic Relative Abundance:

Coho **-** The following is from NOAA-NWFSC Tech Memo-24: Status Review of Coho Salmon <http://www.nwfsc.noaa.gov/pubs/tm/tm24/assess.htm#cc > Commercial landings of coho salmon in Washington, Oregon, and California from 1882 to 1982 have been estimated by Shepard et al. (1985). These estimates show relatively constant landings since 1895, ranging mainly between 1.0 and 2.5 million fish, with a low of 390,000 fish (1920) and a high of 4.1 million fish (1971). Comparable recent estimates are not available, but ocean commercial troll and sport landings have been summarized from 1971 to 1994 by PFMC (1995). These data show a recent harvest decline from 4.3 million fish in 1971 to 290,000 fish in 1993, and less than 500 fish in 1994 (Figure 1). However, this decline largely reflects reductions in allowable harvest, which were imposed in response to perceived declines in production.

Introduction to Aquatic Habitat and Species Sections from Earlier Analyses

Due to time demands attributable to T&E species consultation, land exchange proposals, and project ID team obligations, completion of the aquatic species and habitat section of the North Fork Coquille Watershed Analysis will be delayed. As an interim measure, the aquatic sections from watershed analyses completed in 1995 and 1997 for the subwatersheds that make up the North Fork Coquille Watershed are attached to this document. The 1997 analysis for aquatic species and habitats for the North Coquille Mouth is from a 1997 document that also covers the Middle Main Coquille Watershed. That document is considered current. The North Coquille Mouth Subwatershed is only being revisited so that it can be addressed along with the other subwatersheds in the North Fork Coquille Watershed, and not because there is any pressing needed to update the original analysis. The aquatic species and habitat sections from the 1995 watershed analyses for the Middle Creek, Fairview, and North Coquille Subwatersheds are dated with respect restoration identification and accomplishments, and with respect to the current status of threatened and endangered species. Also, the 1995 watershed analyses were written following the format recommended in earlier watershed analysis handbooks. Otherwise, those excerpts are sufficiently current to support the work in the other chapters of the North Fork Coquille Watershed Analysis.

The aquatic species and habitat sections from the 1995 North Coquille and Fairview documents are very similar in structure and content. Therefore they were combined into a single section to save on pages and repetition. The combined section for Fairview and North Coquille was edited to facilitate the meshing original sections together. The aquatic sections from the Middle Creek analysis and from the North Coquille Mouth-Middle Main Coquille analysis stand separately resulting in a level of repetition. The North Coquille Mouth-Middle Main Coquille section contains information that applies to the Middle Main Coquille 5th Field Watershed and not to the North Fork Coquille Watershed.

North Coquille Mouth Subwatershed (also includes information for Middle Main Coquille Watershed)

Characterization

BLM land, in the analysis area (Area), consists primarily of ridge-top parcels near agricultural lands along the broad floodplain of the lower North Fork Coquille, with scattered parcels near the main stem Coquille and Catching Creek. Some perennial stream sections on and adjacent to BLM lands provide habitat for several species of fish and other aquatic life. Map FISH-I, in the 1997 North Coquille Mouth-Middle Main Coquille Watershed Analysis portrays the known distribution of anadromous and resident fish populations in the Area.

Fall and spring chinook salmon, coho salmon, steelhead trout, and both anadromous and resident forms of cutthroat trout inhabit the main-stem and North Fork Coquille. However, most of the fish-bearing stream sections on BLM contain only resident cutthroat trout. The relative abundance of fish populations is a data gap, but the following sections in this chapter contain information regarding the known status of salmonid stocks as a whole in the Coquille River system.

Other fish species in the Area include four sculpin species, the largescale sucker, speckled dace, and three-spine stickleback. Pacific lamprey, listed as a vulnerable species in Oregon, and western brook lamprey, are also present. The endemic salmonid species are in the following streams and stream types:

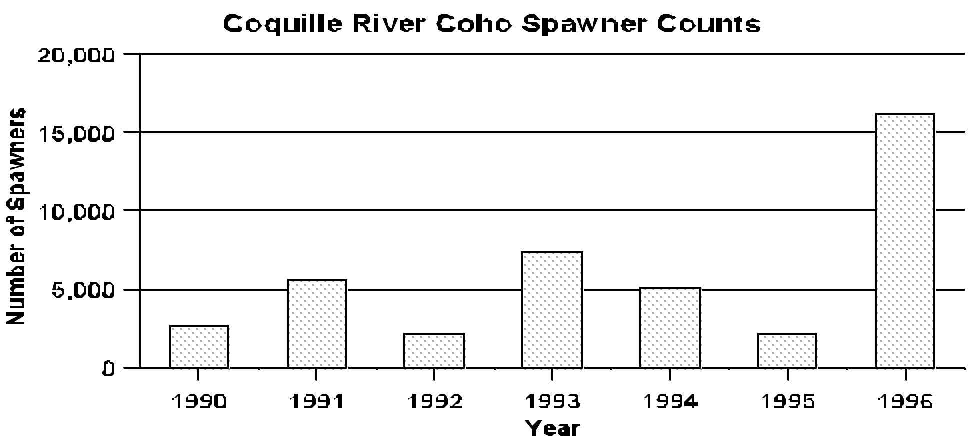
- The District hydro-theme shows the chinook salmon range in the Area limited to the main-stem North Fork Coquille and the lower reaches of Catching Creek. Chinook spawned and reared in the lower reaches of Wimer Creek in the past, but none have been observed for several decades (Don Rowlan, pers. com.) The reasons for their current absence are unknown.
- Coho salmon and steelhead trout use the main-stem North Fork Coquille, Wimer Creek, Catching Creek, John's Creek and Cunningham Creek. These species also likely inhabit the lower reaches of several 3rd and 4th order streams on private lands within the area. Until recently, the range of anadromous fish in Johns Creek was believed to be limited to the lower reaches of Johns Creek below the falls approximately ¾ mile upstream of the confluence with the North Fork Coquille. However, steelhead trout were observed above the falls in recent years, which indicates that their actual range is limited to the impassable culverts on BLM lands identified below.
- Cutthroat trout are found in essentially all stream types, but their presence has not been verified in many smaller streams on private lands in the Area. Recent surveys show resident cutthroat ranging farther up stream on BLM land than previous. The precise range of searun cutthroat trout is unknown, but it does include the main-stem and North Fork Coquille, and the lower reaches of tributaries used by other anadromous salmonid species.

Current Conditions

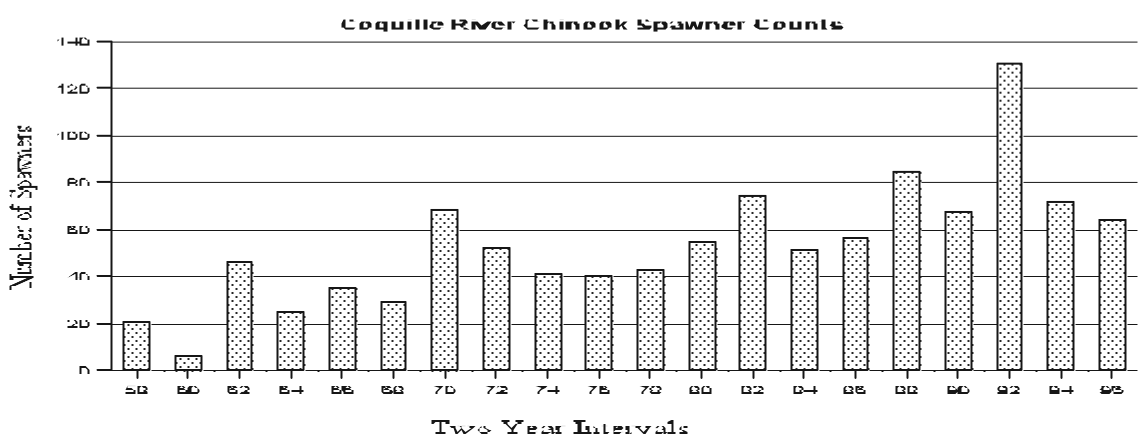
<u>Special Status Species</u>: On April 25, 1997, the National Marine Fisheries Service (NMFS) designated coho salmon north of Cape Blanco, which includes the Area, as a Candidate species under the Endangered Species Act. Steelhead trout are proposed and NMFS's decision on this species is pending with a determination expected in July 1997. [In 1998, NMFS listed the Oregon Coast ESU coho as threatened.]

NMFS determined that compliance with the Standards and Guidelines of the Northwest Forest Plan (NFP) is adequate to ensure that BLM's land management practices will not threaten the continued existence of coho salmon on public lands. However, BLM will probably comply with the more restrictive *Biological Opinion and Conference Opinion on the Coos Bay District RMP* (March 18, 1997). No conference with NMFS is required for Candidate species, but BLM will likely submit project proposals to the agency for their review.

Salmonid Populations: Little information is available concerning the populations of salmonid stocks in the Area, but counts from coho spawning surveys conducted in the Coquille River by Oregon Department of Fish and Wildlife (ODFW) since 1958 have varied considerably, and a decline is evident over the long term. The following graph depicts the variability of spawner escapement since 1990, with a sharp increase occurring in 1996 (estimates for 1996 are preliminary).



According to ODFW, there are two spring chinook populations in the Coquille Basin that are very small, with breeding populations probably smaller than 200 fish each. Fall chinook salmon numbers, like coho, have been variable over the long term, but with an increasing trend, as portrayed in the following chart:



Relative to historical levels, the current status of the cutthroat trout population is unknown. ODFW believes the numbers are presently lower based on anecdotal accounts. Genetic analysis, conducted by ODFW during 1991, indicates that there are several populations in the Coquille basin with an exceptionally high level of genetic divergence, even without physical barriers.

Except for the Umpqua River, winter steelhead populations in all mid-coast streams appear to have experienced a mild decline from historical levels, but all steelhead populations are thought to be smaller than they were historically. The recent down trend, observed in coastal steelhead populations, is probably influenced by the current low ocean productivity (ODFW, 1995a).

In-stream Habitat Conditions: The only recent stream habitat inventory within the Area was completed on John's Creek in 1993. Copies of the inventory are on file at the Coos Bay District Office. The confidence level for these data, is unknown because the stream habitat conditions documented in the survey probably were altered by the floods and landslides since late 1995. Table FISH-1 in the appendix [of the 1997 Middle Main Coquille - North Coquille Mouth - Catching Creek Watershed Analysis] summarizes the inventory results and compares the observed conditions with benchmark levels formulated by ODFW. Key findings from the inventory are given below.

- Within the 2 stream miles inventoried, there were only 2 pools with a maximum depth ? 3 feet. The percent of pool area is rated fair for the 4th order reaches, and poor in the .2 miles of third order channel.
- The width/depth ratio of riffles was fair for all stream reaches. The amount of silt, sand and organics on riffles was fair over approximately half the inventory area, and poor in the remainder.
- The amount of gravel on riffles rated as good and was close to 50% over most of John's Creek.
- The total number of LWD pieces is rated as fair to good. When only conifer pieces are considered, approximately half the total stream lengths inventoried rated as poor.

The high percent silt, sand and organics on riffles probably reflects the fact that gravel derived from the sandstone/siltstone parent material is not very competent and breaks down fast in streams. The inventory data showed only minor amounts of silt, with sand being the primary substrate type in this category.

Stream habitat conditions were also evaluated using the Matrix of Factors and Indicators for the Southwest Province Tyee Sandstone Physiographic Area. NMFS published the original matrix early in 1996. It was modified at the regional level mid-1996. Table FISH-3 in the appendix [of the 1997 Middle Main Coquille - North Coquille Mouth - Catching Creek Watershed Analysis] evaluates the results of the 1993 John's Creek stream habitat inventory using this matrix.

The combined impacts of agricultural practices, past timber harvest practices, and the associated land management activities have degraded stream habitat conditions in the Area. These impacts are common throughout much of the Oregon coast and the following lists some of the general effects:

- Harvest of large conifers next to streams and from up-slope areas that could have fed large wood and gravel to the stream network has reduced the potential LWD recruitment in the future.
- The removal of large wood through stream cleaning, salvage, and to facilitate road construction has greatly reduced the amount of wood currently in the streams.
- Many culverts in the subwatershed partially or entirely block fish and amphibian passage.
- Roads paralleling streams and crossing tributaries restrict interactions between the aquatic and riparian areas, and can be barriers to woody debris and gravel recruitment to streams from up-slope areas.
- Road construction along streams has resulted in the establishment of alders next to the stream channels, thus reducing the future recruitment of large, durable conifers.

Agricultural practices in the lower reaches of the tributary streams and along the North Fork Coquille have also impacted the quality of aquatic habitats. Some of the primary reasons for the degraded conditions are stream-bank damage from livestock, down-cutting of streams due to the removal of stream-side vegetation and in-stream structure, the confinement of stream channels, and a decrease in future recruitment potential of durable large woody debris.

Barriers: Improperly placed and under-sized culverts can be barriers to fish and other aquatic-dependant organisms such as macroinvertebrates, crustaceans, and salamanders. Barriers greatly limit these organisms' access to areas within their historical range that once served as important rearing and breeding habitat, as well as refuge areas during flood events or when water temperatures increase to critical levels in other portions of a drainage. Barriers also isolate gene pools and reduce the range of unique populations. Although downstream migration is possible, no genetic interchange can occur with populations below barriers.

There are several natural and unnatural barriers to fish passage within John's Creek and Wimer Creek. The management-caused barrier locations, all are culverts, are listed in the fisheries recommendations section. The following list summarizes the barriers and some of their effects:

- There is a series of waterfalls on BLM land approximately ¾ mile from the mouth of John's Creek. These falls were once believed to be barriers to all fish passage, but steelhead were observed above them in the recent past, and resident cutthroat trout are found throughout the drainage upstream. The 10' diameter culvert on the east fork of John's Creek in section 7 is probably a barrier to fish passage because the outlet of the pipe spills approximately 3 feet. Although adult steelhead could possibly pass through at some flow stages (several small boulders are present in the pipe), no other aquatic species can migrate upstream of this location.
- The culvert on the west fork of John's Creek in section 7 is not a barrier to fish passage, but retrofitting the pipe with baffles would allow passage of other aquatic species.
- In the NW corner of section 19, T. 28 S., R. 11 W., an abandoned road crosses 3 small tributaries to Wimer Creek. One of the culverts under the road is a barrier to upstream movement of resident cutthroat trout and all other aquatic species. The other two culverts are not on fish-bearing reaches, but prevent the upstream migration of all other aquatic organisms.

Reference Conditions

Salmonid populations: The 1995 Wild Fish Biennial Report (ODFW 1995a) contains historical information on the salmonid populations in the Coquille River. Although the information is not specific to the analysis area, the overall population trends are probably similar.

The Coquille Basin historically supported a large and healthy wild population of coho salmon, but their abundance has declined significantly since 1950, with most of the decrease occurring in the 1950's and 1960's. Historically high harvest rates, particularly in the 1970's, probably impacted the wild populations. Harvest rates declined after adoption of the Oregon Coho Management Plan in 1982. The coho catch dropped to incidental harvest in the chinook fishery in 1994.

Instream Habitat Conditions: There are no undisturbed drainages near the Area that are usable as reference sites, but the Matrix of Factors and Indicators for the Southwest Province Tyee Sandstone Physiographic Area does provide a reference standard for the region. The 1993 John's Creek stream habitat inventory does not contain sufficient data to evaluate all factors contained in the Matrix, but, where possible, indicators for watershed and instream conditions were analyzed and listed in table FISH-3 in the appendix [of the 1997 Middle Main Coquille - North Coquille Mouth - Catching Creek Watershed Analysis].

The 1993 stream habitat inventory shows most of the large wood pieces in John's Creek are in the upper portions of the 4th order reaches where there has been less human encroachment. Chart FISH-II in the appendix [of the 1997 Middle Main Coquille - North Coquille Mouth - Catching Creek Watershed Analysis] illustrates the approximate locations and total length of conifer pieces for each of the three stream reaches surveyed.

Beaver ponds provide pool habitat for fish and other aquatic life. Beaver populations were probably much higher and more widely distributed in the Area before Euro-American settlement. Cadastral surveyors frequently noted beaver activity in the broad valley areas now used extensively for agriculture (Flint 1871 cited in ODEQ 1991). Although surveys documenting beaver activity have not been conducted, recent dams were observed in lower John's Creek on BLM lands and on lower Wimer Creek on private lands. None were observed in the more narrow valleys in upper Cunningham Creek.

Synthesis and Interpretation
Because BLM manages a relatively small portion of the total acreage in the Area, federal land management activities that degraded aquatic habitats constitute a relatively minor impact when considering the entire analysis area. However, because most of the stream miles on private lands are in marginal condition at best, stream segments on BLM lands are extremely important components of the aquatic ecosystems.

On BLM lands in the Area, Wimer Creek, John's Creek and upper Cunningham Creek are important streams for ensuring long-term protection of water quality and aquatic habitats for anadromous and resident fish. Resident cutthroat trout populations occur above natural barriers in the headwater areas of these 3 drainages. The small numbers of trout observed during surveys conducted in the spring of 1997 represent the keystone for these isolated populations. Whether it is through habitat degradation or natural processes, the loss of these fish would be permanent and the important role they play in seeding downstream populations would cease.

Other than the culvert modifications or removal mentioned in the recommendations section, there are few opportunities for in-stream restoration projects on BLM lands. To have the greatest affect, BLM aquatic restoration efforts should compliment work on private land, and be done in cooperation with private landowners and/or through the Coquille Watershed Association. At the time of the writing of this document, there are tentative in-stream projects planned for Wimer Creek through cooperation with BLM staff, a private agricultural landowner, and the Menasha Corporation. The planned projects include fence construction along each side of the stream where cattle are now grazing, the replacement of two culverts that impair fish passage, and the placement of logs and root-wads within the stream channel to provide rearing habitat for anadromous and resident fish species.

Based on ground and aerial photo reviews, riparian buffers were retained and are still intact along almost all fish-bearing stream reaches on BLM lands in the Area. The 40-50 year-old stands regenerated on sites cut before logging practices included the retention of protection buffers, but can contribute some moderate size debris to streams. The future recruitment potential for large woody debris appears to be good, and maintaining riparian reserves in accordance with the ROD should ensure long-term protection of all aquatic resources.

Habitat trends for the fish species of concern are expected to improve considerably through time for the following reasons:

- On BLM managed lands, riparian reserves required by the ROD-RMP (USDI 1995) should ensure the long-term protection of all aquatic resources. BLM is also required to incorporate Best Management Practices for Maintaining Water Quality and Soil Productivity, which are listed in Appendix D for that document.
- Conifers dominate many stream-side and headwall sites and will become future sources of LWD.
- On private lands, the Oregon State Forest Practices Act requirements for riparian buffers will aid in the recovery of in-stream and riparian habitat conditions. At present, agricultural practices are not regulated to ensure the protection or recovery of aquatic habitats. However, private landowner cooperation with the Coquille Watershed Association is increasing with positive benefits to riparian areas, fish passage culverts, and stream channel restoration.
- The Coos Bay District is carrying out a program to replace culverts that are undersized or block fish passage, as required by the ROD-RMP (USDI 1995). Based on field surveys, the number of culverts in the Area that restrict fish passage is relatively small.

Culverts are the most common type of human-caused barrier that limits fish and other aquatic animal distribution. In both the short- and long-term, the number of barrier culverts should decrease considerably because of the pro-active approach of BLM and private landowners in the Area. Although private landowners are not required to replace barrier culverts until they fail, the long-term trend should be toward reestablishing historical aquatic migration routes. The BLM has no jurisdiction over these factors on private lands, but can assist watershed associations in the identification of barriers and make recommendations for corrective measures.

References

Coquille Watershed Association, 1997. *Coquille Watershed Association Action Plan*, June 1997.
Flint. 1871. Cadastral survey notes on file at the BLM. Portland, OR.
ODEQ. 1991. *Near Coast Waters National Pilot Project "Action Plan for Oregon Coastal Watersheds, Estuary, and Ocean Waters" 1988-1991*, prepared for US EPA grant X-000382-01. Ore. Dept. of Environmental Quality, Portland, OR.
ODFW. 1995a. *1995 Wild Fish Biennial Report*. Portland, OR via the Internet)
ODFW. 1995b. Aquatic Inventory Projects for Mehl Creek, Fitzpatrick Creek, and Heddin Creek. Ore Dept. of Fish and Wildlife, Portland, OR.
USDI. 1994. *Record of Decision Standards and Guidelines*, Apr 1994. Coos Bay Dist. BLM, North Bend, OR.
USDI. 1995. *Coos Bay District Record of Decision and Resource Management Plan, May 1995*. Coos Bay Dist.-BLM, North Bend, OR. 99 pp. plus appendices and maps.

Fairview and North Coquille Subwatershed

Fish Distribution

There are nine species of fish and lamprey inhabiting the North Coquille Subwatershed and 12 in the Fairview Subwatershed:

	presence (D = documented, S= suspected)		
Species	North Coquille	Fairview	Middle Creek
Chinook Salmon (fall)	D	D	D
Chinook Salmon (spring)	-	-	S
Coho Salmon	D	D	D
Chum Salmon	-	S	S
Steelhead Trout (winter)	D	D	D
Cutthroat Trout	D	D	D
Coast Range Sculpin	D	D	D
Reticulate Sculpin	D	D	D
Threespine Sculpin	-	D	D
Largescale Sucker	-	S	S
Speckled Dace	D	D	D
Pacific Lamprey	D	D	D
Western Lamprey	D	D	D

Anadromous salmonids are socially considered to be the most important because an economic value can be put on them. They include fall chinook and coho salmon, winter steelhead, and searun cutthroat trout and Chum salmon. Nickelson and coauthors(1992) thoroughly discusses the life histories, habitat requirements, and freshwater and marine fisheries for these 5 Oregon coastal salmonids.

Because of the perceived greater value of these salmonids, a major effort was put into field surveys of spawning habitats and distribution. Other species of lesser economic value, although of significant ecological importance are suckers, dace, sculpin, stickleback, and the lamprey. Because of the perception that these fish were of little value, their documentation in past fishery surveys was almost entirely overlooked, therefore, a complete range of distribution for each species is unknown.

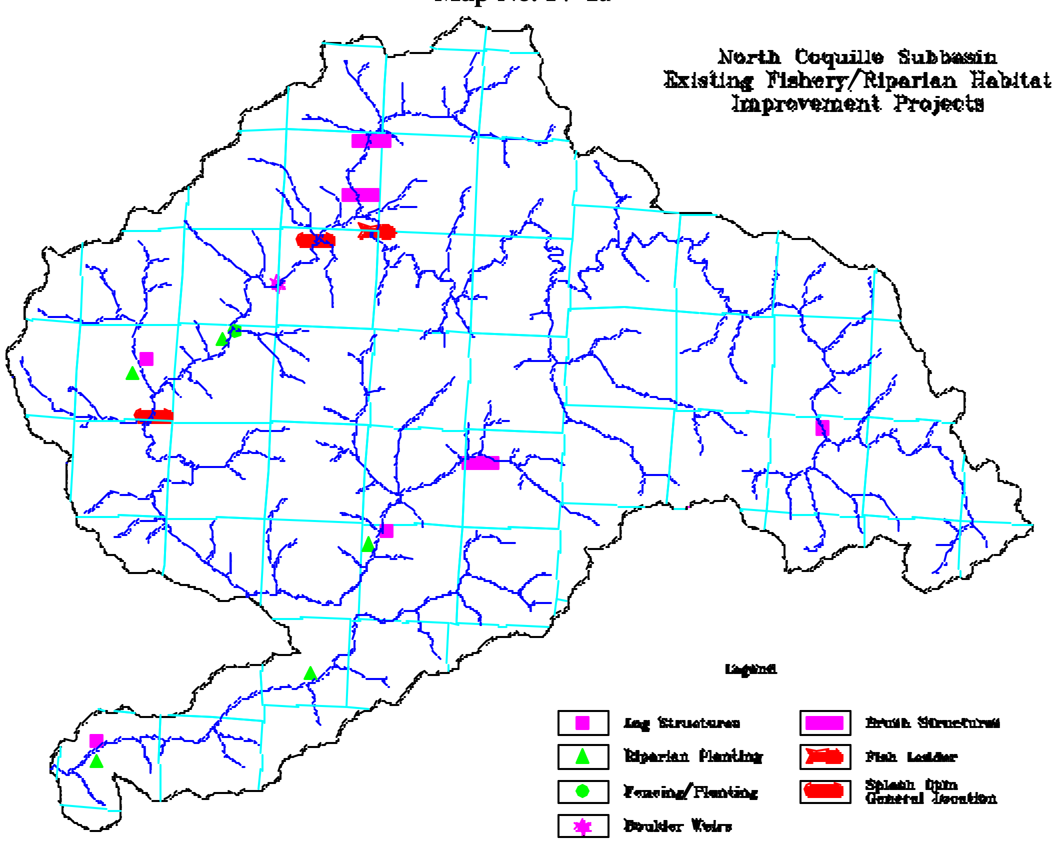
There are many factors that play a part in the survival of anadromous salmonids. These factors range from freshwater habitat quality to ocean conditions. Past and present activities in the North Fork Coquille River have impacted the quality and quantity of aquatic habitats. No one factor in the freshwater habitat has been isolated as the single limiting habitat condition. However, as a result of changes in the nature of the hydraulics of the entire Coquille Basin, including the North Fork Coquille River, the Oregon Department of Fish and Wildlife (ODFW) has suggested that wintering habitat is limiting. Habit loss or reductions can be traced to activities associated with agricultural development and mainstem river cleaning for the extensive network of splash dams and their operation of assisting log drives down river. Habitat loss continued with the effort to remove logging debris jams from tributary streams to ensure un-impeded upstream migration of anadromous salmonids. These actions have had cumulative impacts on the water quality of the North Fork Coquille River in the subwatershed, as well as contributing to the poor water quality of the lower river and estuary (ODFW, 1992). Habitat improvement measures have recently been taken in the Fairview and North Coquille Subwatersheds, and the other forks of the Coquille Subbasin, to restore some of the components lost to past agricultural, logging and river management practices (Map IV-1a&b). The measures undertaken to date have been placed on public land and the land of a few private cooperators.

Cutthroat trout - Cutthroat trout are widely distributed throughout the subwatershed. Past surveys for salmon and steelhead included general information on the presence or absence, or a relative abundance estimate of cutthroat trout. In most cases these surveys stopped at physical barriers that block upstream passage of salmon and steelhead and whether cutthroat were present above these barriers was not investigated. The Fairview and North Coquille Subwatershed has been surveyed, however, there may be some stream reaches containing cutthroat trout that have not been surveyed and their presence is still unknown.

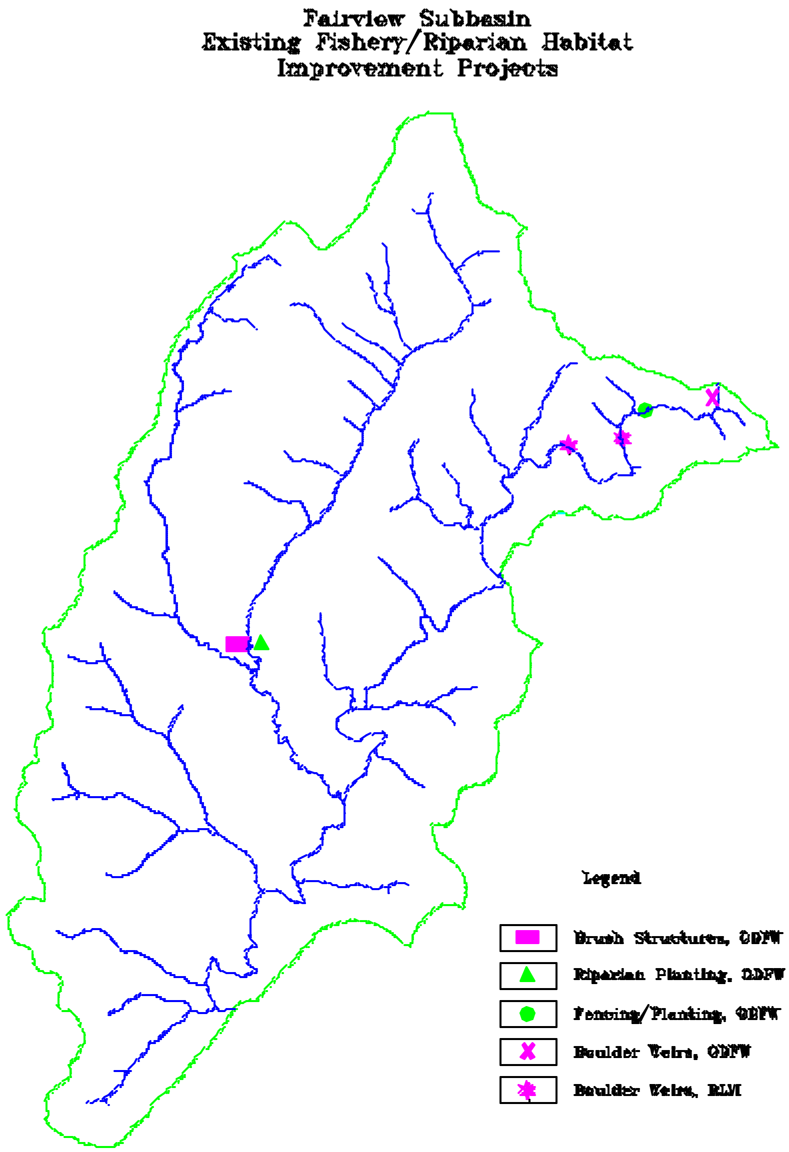
The anadromous sea-run cutthroat spend one to four years in freshwater and then move into the ocean to feed or to overwinter. Most anadromous cutthroat trout return to freshwater in the same year that they migrated to the ocean. The current status of cutthroat trout populations relative to past levels is unknown (ODFW, 1992), although it is believed the numbers are lower now, especially for the searun populations.

Hatchery releases have supplemented cutthroat populations in the Coquille River system since the 1950's and were discontinued in 1985. Most releases were legal-sized cutthroat that will immediately contribute to the sport fishery. Laverne Park was the primary location of releases in the Fairview Subwatershed. The impact of hatchery releases on the wild cutthroat population is not known, but it is not thought to be a beneficial impact.

Map No. IV-1a



Map No. IV-1b



Coho salmon - Coho salmon have been considered the most important commercially caught salmonid in Oregon (Nickelson et al. 1992). Their numbers have been drastically reduced from the turn of the century (ODFW 1994). Based on canning records, coastal coho salmon once numbered 1.7 million adults. The most recent estimates for the first four years of the 1990's show an estimate of 70,000 adults. The coastal populations have been petitioned for listing under the federal Endangered Species Act and a final ruling by the National Marine Fisheries Service is pending A proposal to list coastal coho under the state endangered species law was recently found not warranted. A factor in the finding may have been that the south coast coho populations, including the Coquille River system, are in a healthier state than the northern coast populations (ODFW 1994). [In 1998, NMFS listed the Oregon Coast ESU coho as threatened].

In the North Fork Coquille River, coho spawn and rear in the accessible perennial streams in the watershed. In the late 1940's and early 1950's up to 1000 or more coho would congregate below Laverne Falls waiting for proper stream flows that would allow upstream passage. In low water years hundreds of coho would be carried above the falls. These falls were modified in the 1960's or early 1970's to allow fish passage at lower water levels. Although their range in the North Fork Coquille River was not expanded by the construction of the ladder at Steelhead Falls in 1953 (experts say that 30 to 40 coho would make it above annually), it made it easier for coho to bypass the falls at all water levels and utilize approximately 7 more miles of river. In 1952, before the bypass was constructed, 2000 adult coho were observed concentrated in pools below the falls.

The Coquille River system has had extensive hatchery coho salmon introductions in the past. There was an attempt by ODFW in the early 1980's to establish North Fork Coquille River coho brood stock for the Coquille River system. Up to 100 fish were collected at the Steelhead Falls for egg taking and hatchery rearing. In turn the North Fork Coquille River received several thousand smolts per year (Table IV-1) from 1982 to 1989. These plants were made in the upper North Fork Coquille River above Steelhead Falls, primarily at the 608 bridge. In addition, up to 537,567 hatchbox fry were released in the North Fork Coquille River from 1983 to 1991. These releases in the North Coquille Subwatershed were in tributaries or the main river in the lower subwatershed below Steelhead Falls. It appears that all hatchery smolt releases and hatchbox releases originated from Coquille River stock.

Table IV-1: Coho Smolt Releases to the North Fork Coquille River from Steelhead Fall Adult Trapping

Brood Year	Total Releases	Date Released	Size (Fish/ lb)
1980	51,340	4/13 to 4/15 1982	10.0
1981	66,354	4/19 to 4/21 1983	9.4
1982	42,659	5/2 to 5/3 1984	11.2
1983	12,282	5/2/85	9.2
1984	16,268	5/6 to 5/7 1986	11.3
1985	33,484	5/7 to 5/8 1987	10.4
1986	17,221	5/88	10.3
1987	9,282	4/89	11.5

<u>Fall chinook salmon</u> - Fall chinook salmon in the entire Coquille River system appear to be in a healthy state and are on an upward trend over the last 20 to 30 years (ODFW, 1992,), However the North Fork Coquille River does not show this upward trend over the past 20 to 30 years (Figure IV-1). Chinook peak counts have varied widely and there does not appear to be an obvious trend.

Chinook have different spawning and rearing habitat strategies (Croot; Marcolis, 1991) than coho and steelhead. Chinook rely heavily on the lower river system and the estuary for their early survival. The Coquille estuary is small when compared to the Coos River estuary and observations made by ODFW (ODFW, 1992) suggest that the Coquille estuary may have a limited carrying capacity.

In the North Fork Coquille River, chinook spawn in mainstem habitat more than either coho or steelhead. Chinook range upstream to approximately 2 miles above Steelhead Falls (Randy Smith, ODFW, personal communication). This may be a 2 mile range extension, since it is doubtful that chinook naturally made it above Steelhead Falls.

Chinook smolts have been released in the Coquille River Subbasin since 1984 and about 75,000 smolts have been released annually in upstream areas (ODFW, 1992). It is unknown what portion of these

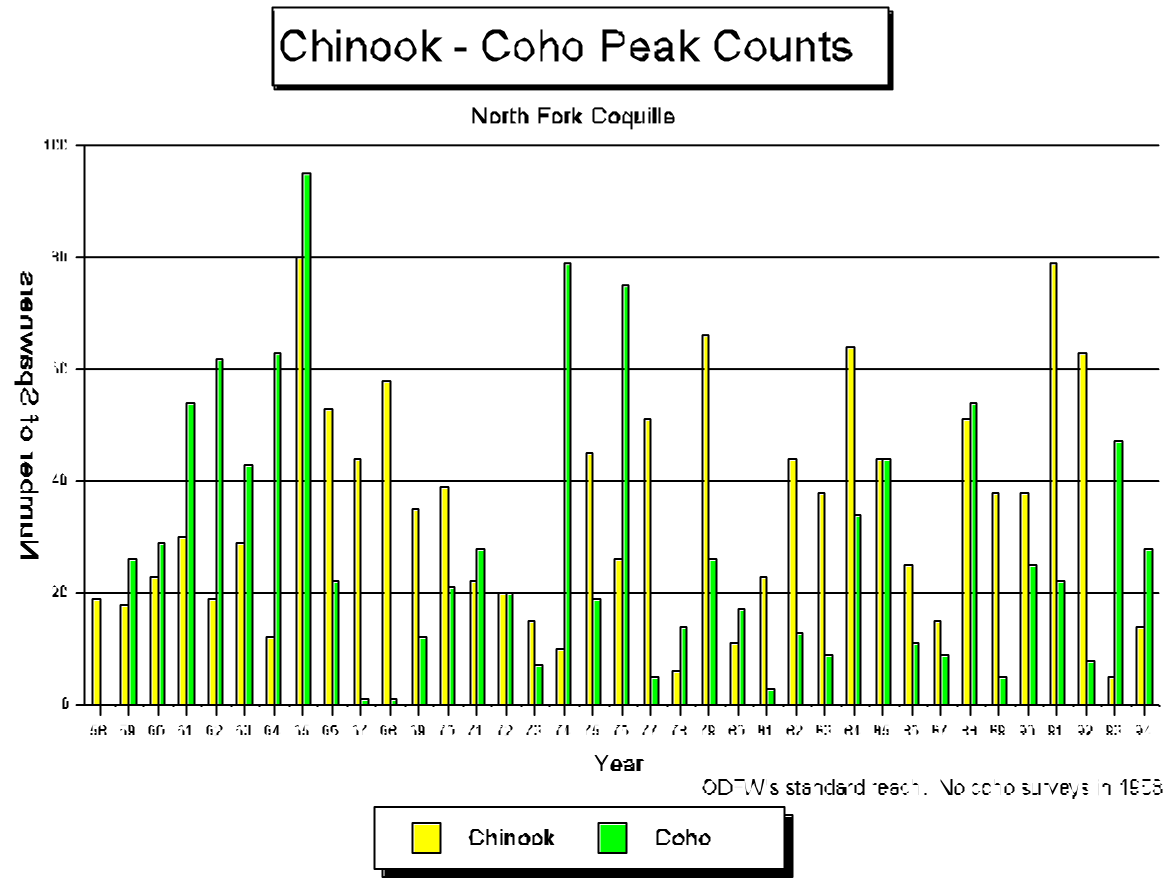


Figure IV-1

releases, if any, are located in the North Coquille and Fairview Subwatersheds. There have been hatchbox releases of chinook fry during the period of 1981 to 1990 within the North Coquille and Fairview Subwatersheds. Releases in the entire North Fork Coquille River system, for this period, totaled over 610,000, with over 300,000 chinook released into the mainstem from 1987 to 1990. These hatchbox releases have mainly occurred below Steelhead Falls downstream to the Laverne Falls area, in the mainstem near Fairview, Evans Creek, and Steinnon Creek. The specific source of origin of the eggs for the North Fork Coquille River releases is not known.

Winter Steelhead trout - The distribution of winter steelhead, and use of habitat for spawning is approximately the same as that of coho salmon in the North Coquille and Fairview Subwatersheds. It is presumed that the Steelhead Falls fishway improved access of steelhead to the upper North Fork Coquille River as it did for coho salmon, but it is unclear how many steelhead naturally made it above the falls. Since 1948 there has been an extensive hatchery steelhead supplement program in the Coquille River, including the North Fork Coquille River. Nearly all hatchery steelhead releases have occurred at Laverne Falls with the exception of an occasional release at the 608 bridge in the upper North Fork Coquille River. Alsea River stock have been used in the hatchery program from 1968 to 1986, with a conversion to wild Coquille River stock in 1987. The impacts of hatchery raised steelhead on the wild populations is not known but is not considered a beneficial impact.

Chum salmon - Chum salmon have never been very numerous in the Coquille River system and show up in the historical commercial catches as not much more than a trace[1]. Recent reported sightings in the North Fork Coquille River have amounted to just a fish or two per year.

Splash Dams and Stream Cleaning

Prior to the construction of a forest road system, logging companies had very few options in transporting logs to the mills and regional railroads. The river system was the method of choice to accomplish this by floating logs downstream. Improvements and maintenance were made to the river channels for ease of log transport. These improvements included eliminating vegetation along the river banks, blasting channel boulders, and removing large woody debris and snags from the river channel. This "improvement" resulted in the North Fork Coquille River being considered "navigable" to river mile 40. Stream "improvement and maintenance" was big business in association with splash damming. Sedell and Luchessa (1982) reports that by 1900 there were over 130 incorporated river and stream "improvement" companies operating in Washington and that through the years there were over 150 major splash dams in that state and over 160 major splash dams operating in Oregon.

Log drives were reported on the North Fork Coquille River from river mile 35 (1.0 miles below Whitley Creek) as early as 1902 and from river mile 42 (1 mile above Steelhead Falls) in 1903 (Farnell 1979). In 1903 over 8000 logs were put in the river with only a portion of them reaching their destination causing many log jams along the river. With thousands of more logs entering the river in 1904, the jams from the previous year caused even larger jams. In June 1905 G. A. Signalness built a "sizeable" splash dam at river mile 36 (just below Whitley Creek) to clear the stream. In October of 1905 another splash dam was built on the river at river mile 40 (about 1 mile below Steelhead Falls).

The extensive stream clearing that occurred downstream of splash dams to keep the logs from jamming up was not always successful. Farnell (1979) reports the Timberman describing the situation on the river in the spring of 1906 by estimating there to be 40,000 logs stalled along the river and about 8,000 logs in tributaries. Splash damming operations continued on the river at least to the late 20's and possibly into the mid-30's.

It appears that Glen Barker may have been the first to drive impounded logs from within the Fairview Subwatershed when he drove logs to Fairview that he stored in a deadhead dam below Laverne Falls . Other splash dams were constructed over the years from the Laverne Falls area down river to just above Fairview. A mill dam (Riverside Dam) belonging to the Riverside Lumber Company was situated on the North Fork Coquille River, just outside the subwatershed boundary, a third of a mile below Moon Creek. It had a working fish ladder that was often plugged with debris. It is not known how long it was in operation or the reason for it's termination. However, it is known from ODFW stream survey notes that it was in use as late as 1949. Oregon Fish Commission salmon spawning notes from the fall of 1949 indicate that coho were having considerable trouble using the ladder to get above the dam and that there was much evidence (crude gaffs and shell casings) of poaching below the dam.

Harmon and coauthors (1986) informs us that after 1936 fishery management agencies in the Pacific Northwest removed log jams from streams to increase fish access to spawning and nursery areas. Stream cleaning of debris and log jams, at times mistakenly performed to benefit fisheries, was initiated on a major scale in the late 1940's and the early 1950's in Oregon (Sedell; Luchessa 1982) and continued into the mid to late 1980's. Removal of log jams as barriers to fish migration was also supported by the view

---

[1] Between 1928 and 1949 only two years; 1928 (3,608 lbs), and 1931 (323 lbs), showed more than 51 pounds of commercially caught chum salmon taken from the Coquille River system. For those same years 272,170 and 143,000 pounds of coho were landed from the Coquille River. For 13 of those years no chum salmon were landed.

that woody debris accelerated streambank erosion and channel instability (Sedell et al., 1984). Debris from timber harvest that found it's way into the stream channel often exceeded natural levels. This debris was considered a potential cause of debris jams that could block fish migration or cause oxygen depletion in smaller streams. This period saw log and debris jams, and accumulations of small debris that had merely the potential to form jams cleaned from streams and riparian areas. It was also thought that if jams broke apart during winter flooding events, the stored sediments would cover downstream spawning habitat and impact private property.

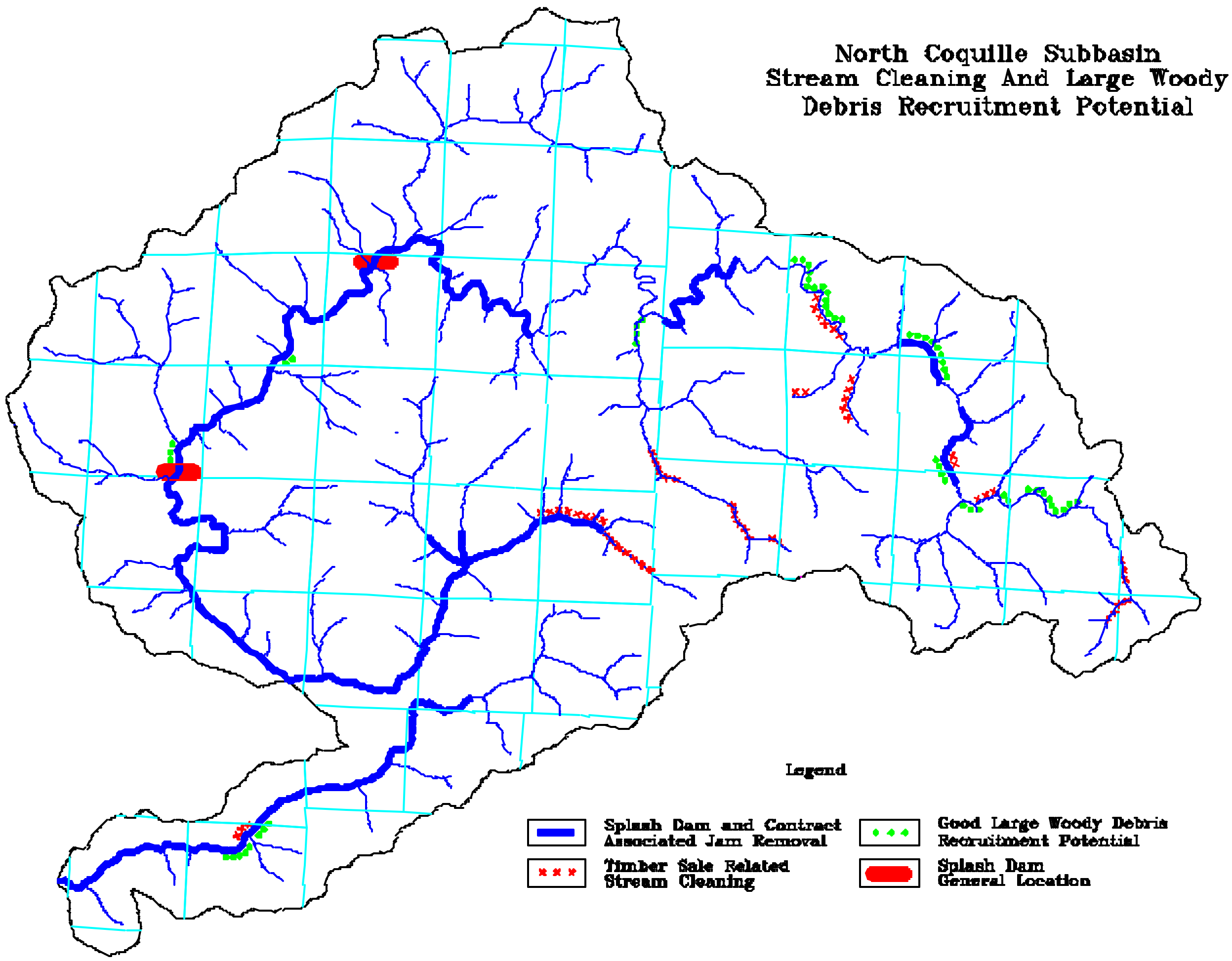
Around 1961 there was major effort by local government, private individuals, timber companies, federal agencies and State fish and game officials to remove log jams from the Coquille River. A total of ten miles of jams were cleared from locations throughout the entire Coquille River system in that year and the first part of the next. Map No. IV-2a&b shows just how extensive stream cleaning was in the stream reaches where documentation exists. This documentation is in the form of field notes, stream clearing contracts, and timber sale contracts, and State Water Resources Board hearing records (exhibit #9) from Coquille Oregon in 1961. It was acknowledged in Exhibit 22 of these hearing records that barriers resulting from accumulations of debris was a specific fishery problem. However during this period, instead of correcting the practices that introduce debris to the streams, jams were removed on the assumption that they were harmful and provided no benefits for fish. Map No. IV-2a&b also shows fish bearing streams and those stream reaches that are immediately adjacent to fish bearing streams that received extensive cleaning. It also shows those stream reaches that have been cleaned as part of timber sales.

A review of BLM timber sale prospectuses on file (Table IV-2a&b) reveals stream cleaning was required on sales sold from 1965 through 1991 within the North Coquille and Fairview Subwatersheds. This period also saw contracts for the removal of log jams when it was thought removal would benefit anadromous fish. Most timber sale contracts stipulated that all debris and logs be removed from the stream channel and adjacent side slopes ranging from 2 to 10 feet each side. These contracts were generally for headwall, 1st and 2nd order streams. Most streams of this size are non-fish bearing. However, this cleaning action eliminates the material that is the composition of the hillslope and channel processes that contribute to the quality and quantity of fish habitat downstream.

Third order streams on public land had brush buffers and as of the early to mid-80's fish bearing streams had some extent of "no entry" buffers where timber harvest was concerned. This review showed that a total of approximately 81,000 linear feet (15 miles) of stream was cleaned of wood in the North Coquille Subwatershed, and 10,600 lineal feet (2 miles) of streams were clean in the Fairview Subwatershed. As the importance of woody material was realized, cleaning was limited to removing pieces associated with the logging activity, while leaving rootwads and embedded wood in place. We have no stream cleaning data on private lands.

Also shown on Map No. IV-2a&b are the areas where there is current good large woody debris recruitment potential based on streamside stand condition. In the North Fork Coquille, most of these reaches fall within the key watershed. These reaches should be considered candidates for projects that replace large, complex, woody aggregates in the stream channel. This could be accomplished by tree linings which would mimic the natural in- channel recruitment process.

Map No. IV-2a



Map No. IV-2b

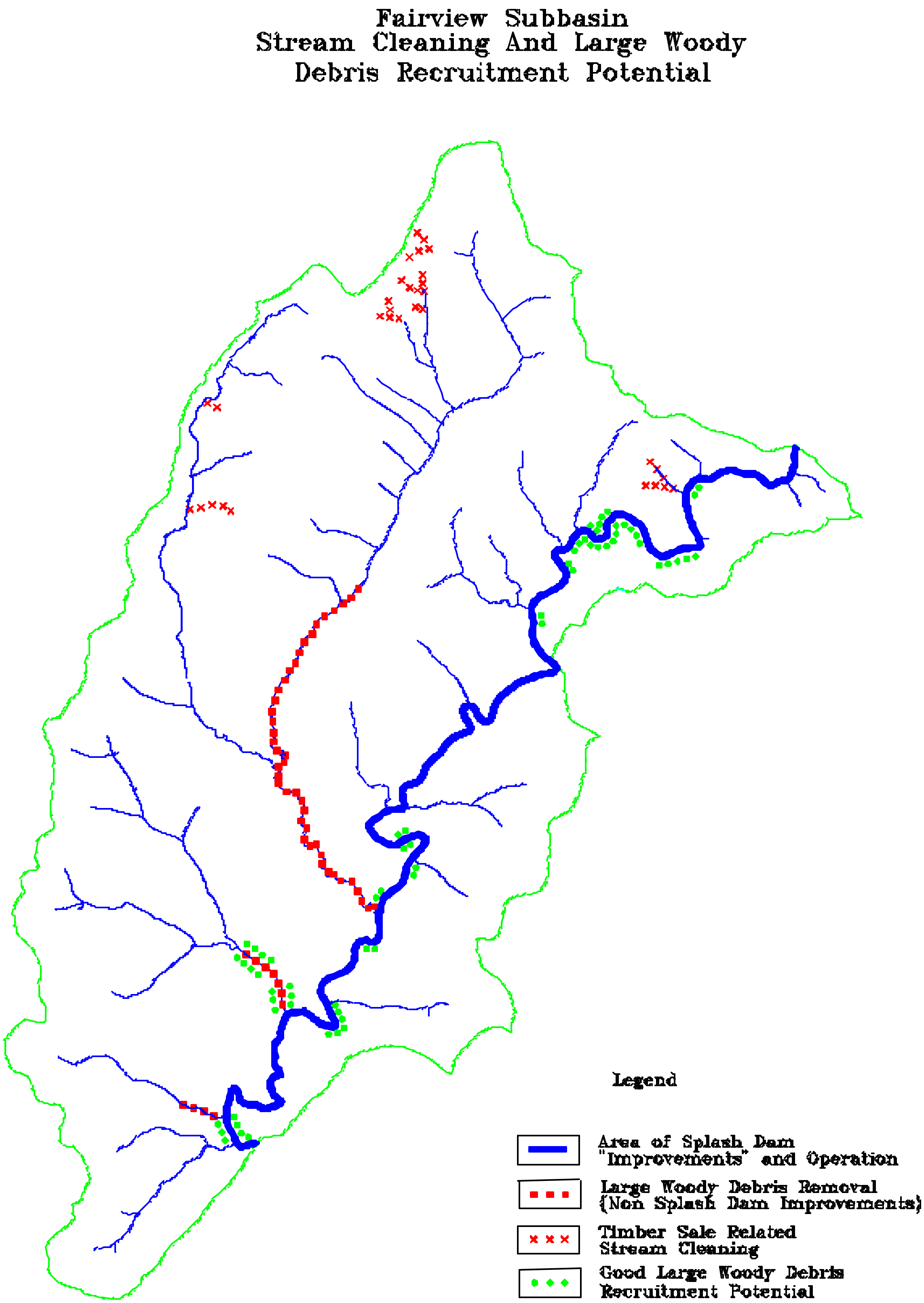

Fairview Subbasin
Stream Cleaning And Large Woody
Debris Recruitment Potential
Legend
Area of Splash Dam "Improvements" and Operation
Large Woody Debris Removal (Non Splash Dam Improvements)
Timber Sale Related Stream Cleaning
Good Large Woody Debris Recruitment Potential

Table IV-2a: Coquille Subwatershed Stream Cleaning

YEAR/ SALE NO.	SALE NAME	LINEAL FEET EST.	REMOVE ALL DEBRIS LEN. FEET DIA. INCH	WIDTH EACH SIDE OF CREEK IN FEET	10' X 10" GROSS YARD EACH SIDE IN FEET	6' X 6" GROSS YARD EACH SIDE IN FEET	COMMENTS
1965-24	NORTH FORK RIDGE	300	ALL DEBRIS				2600' CLEANED A 2ND TIME UNDER NORTH FRUIN RIDGE.
1932	WOODWARD CK.- MOOR CK.	6000	ALL DEBRIS				
1940	NORTH FORK MOON CREEK TIE	1700	>6' &> 6"				FROM BELOW HIGH WATER FLOW.
1932	608 EXTENSION	500	>6' &> 6"				FROM BELOW HIGH WATER FLOW.
1935	NORTH FRUIN RIDGE	2600	>4' &> 4"				TO A POINT ABOVE HIGH WATER MARK.
1944	BEAR TRACK	1500	>6' &> 6"				
1948	HOG RANCH SKIDOO RESERVE	2500	>6"				PILED CLEAR OF STREAM HIGH WATER LINE.
1945	BEAVER SLIDE EXTENSION	4000	>6"				PILED CLEAR OF STREAM HIGH WATER LINE.
1943	LITTLE NORTH FORK EXT.	1600	>6"				PILED CLEAR OF STREAM HIGH WATER LINE. (4)
1944	BEAR TRACK-COX CREEK	800	>6"	50			
1957	BIG FORK RIDGE	3150	>6"	50			HARDWOOD BUFFER 200' WIDE, 700' LONG.
1955	22 RIDGE REMAINS	2200	>6' &> 6"	ERR		25	PILED CLEAR OF STREAM HIGH WATER LINE. (6)
1954	GATEWOOD CREEK	3300	ALL DEBRIS	ERR		4'X4"X15'	PILED CLEAR OF STREAM HIGH WATER LINE. (2)
1976-106	MOON CREEK	1700	ALL DEBRIS	3		15	PILED CLEAR OF STREAM HIGH WATER LINE.
1977-16	COAL TRACK	600	ALL DEBRIS	2		15	PILED CLEAR OF STREAM HIGH WATER LINE. (5)
1977-18	MOON HUDSON DIVIDE	3600	ALL DEBRIS	1		UNIT	PILED CLEAR OF STREAM HIGH WATER LINE.
1977-44	ELK RUN PLANTATION	400	ALL DEBRIS	2		UNIT	PILED CLEAR OF STREAM HIGH WATER LINE.
1977-55	COOS RIVER SALVAGE	450	ALL DEBRIS	1		10	PILED CLEAR OF STREAM HIGH WATER LINE.
1978-15	COX CREEK-NORTH FORK COMBO.	1800	ALL DEBRIS	2			PILED CLEAR OF STREAM HIGH WATER LINE.
1978-20	FRUIN CREEK	2700	ALL DEBRIS	4			PILED CLEAR OF STREAM HIGH WATER LINE.
1978-22	COOS MOUNTAIN SPUR	6200	ALL DEBRIS	2			PILED CLEAR OF STREAM HIGH WATER LINE.
1978-24	MIDDLE HUDSON	3900	ALL DEBRIS	2	UNIT		PILED CLEAR OF STREAM HIGH WATER LINE. (3)
1978-45	BIG COAL MINK SALVAGE	400	ALL DEBRIS	3			PILED CLEAR OF STREAM HIGH WATER LINE.
1978-49	BUG RIDGE 608 SALVAGE	650	ALL DEBRIS	3			PILED CLEAR OF STREAM HIGH WATER LINE.
1979-21	UPPER MINK CREEK	1100	ALL DEBRIS	3			PILED CLEAR OF STREAM HIGH WATER LINE.
1980-22	HONCHO BEAVER SKYLINE	550	>6' &> 6"	15			END-HAULED & DECKED AT THE DEBRIS DISPOSAL.
1981-16	MIDDLE COOS MOUNTAIN	700	ALL DEBRIS	3			PLACED AT LEAST 10' FROM STREAM CENTER LINE.
1982-20	BUG ALDER AERIAL	3050	ALL DEBRIS	5		6'X4"X20'	PLACED AT LEAST 20' FROM STREAM CENTER LINE.
1983-17	ALDER MOON	1300	ALL DEBRIS	3			(1)
1985-13	MOON PIE	3950	ALL DEBRIS	3	25		PILED CLEAR OF STREAM HIGH WATER LINE.
1986-18	NORTH FORK COQUILLE	4900	ALL DEBRIS	3	25		PILED CLEAR OF STREAM HIGH WATER LINE.
1986-39	LITTLE NORTH FORK	2850	ALL DEBRIS	3	50		(1)
1988-47	FRUIN CREEK	1000	ALL DEBRIS	3	UNIT		(1)
1989-14	HARVEST MOON	2200	ALL DEBRIS	3	25		(1)
1990-41	BEAR ROCK	5800	ALL DEBRIS	3	25		(1)
1990-45	QUARTER MOON	900	ALL DEBRIS	3	25		(1)
	GRAND TOTAL LINEAL FEET	**80,850**					

(1) ALL DEBRIS, EXCEPT WELL- EMBEDDED OLD WOODY MATERIAL, PILED CLEAR OF STREAM HIGH WATER LINE
(2) HARDWOOD RESERVE 50' EACH SIDE STREAM CENTER (3300') GROSS YARD UNIT 6 X 6. REMOVE ALL DEBRIS 1' EACH SITE OF STREAM IN UNIT 1 (1800') & 5' IN UNIT 2 (1100'), GATEWOOD CK.
(3) REMOVE ALL DEBRIS 15' EACH SIDE OF STREAM CENTERLINE OF HUDSON CREEK (300').
(4) HARDWOOD BUFFER 150' EACH SIDE STREAM CENTERLINE.
(5) GROSS YARD UNIT 12 X 12.
(6) 5' EACH SIDE IN UNIT 1 (600') & 1' IN UNITS 2&3 (1600')

Table IV-2b: Fairview Subbasin Stream Cleaning

YEAR/ SALE NO.	SALE NAME	LINEAL FEET EST.	REMOVED	WIDTH EACH SIDE OF CREEK	10' X 10" GROSS YARD EACH SIDE IN FEET	COMMENTS
1978-21	FAIRVIEW	2700	ALL DEBRIS	4		PILED CLEAR OF STREAM HIGH WATER LINE.
1981-20	BLUE WOODWARD THINNING	800	ALL DEBRIS	3		PLACED AT LEAST 5 FT. FROM THE STREAM CHANNEL CENTERLINE.
1985-19	YOUNG BLUE	2600	ALL DEBRIS	3		PILED CLEAR OF STREAM HIGH WATER LINE.
1991-10	SKY BLUE	4500	ALL DEBRIS	3	50	ALL DEBRIS, EXCEPT WELL EMBEDDED OLD WOODY MATERIAL PILED CLEAR OF STREAM WATERLINE.
	TOTAL	10,600				

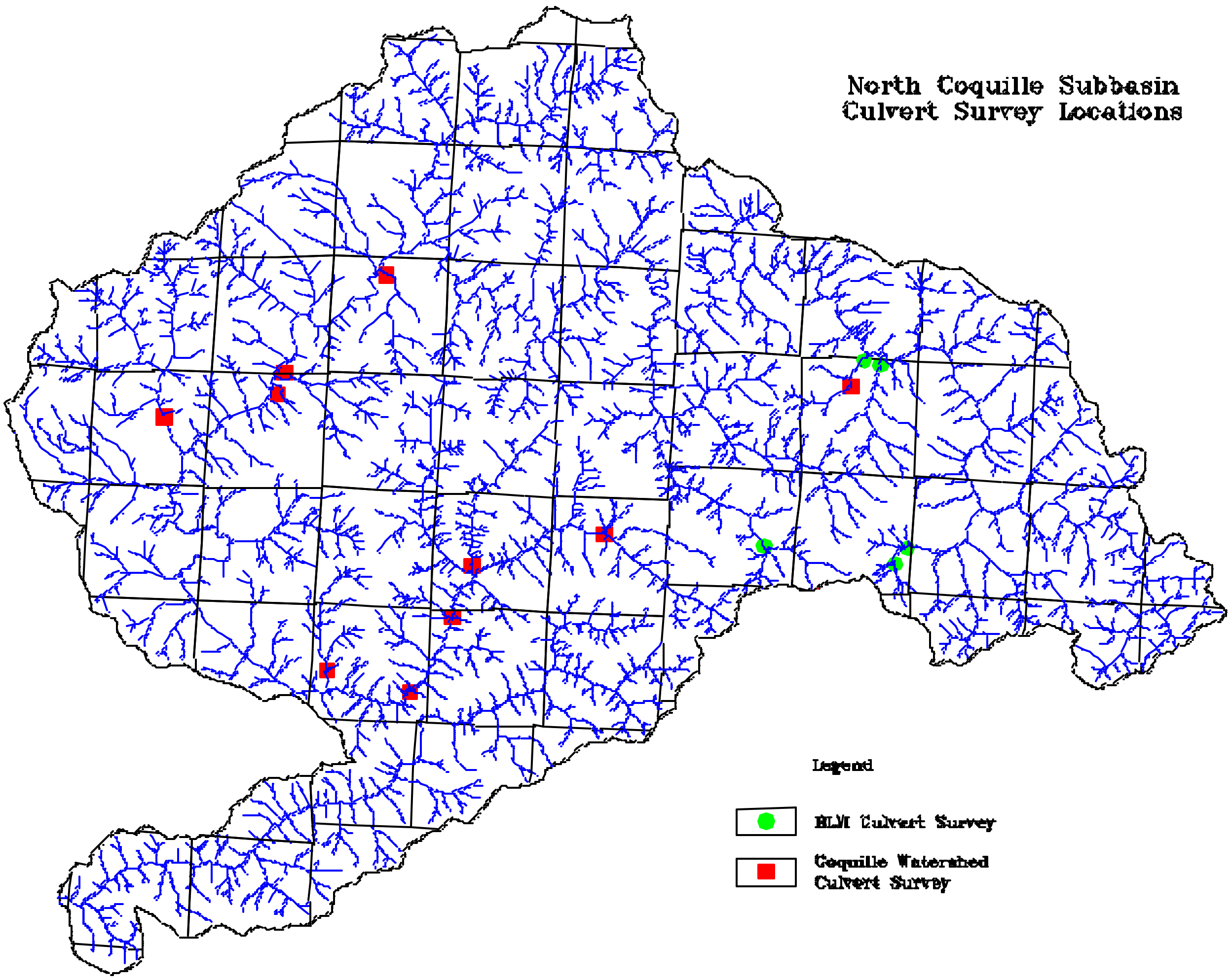
Culverts and Road Crossings

[In 1995 when the initial watershed analyses were completed for the North coquille and Fairview Watersheds the] culvert designs used by BLM on public land and required for private lands by the State Forest Practices laws are mostly inadequate to pass run-off from major storm events and allow fish passage. The requirement for fish passage considerations in the design of culverts and other types of stream/drainage crossings has been only a recent development. As a result, anadromous fish have been eliminated from some former suitable habitat by blockages created by impassable culverts. The amount of this habitat lost to anadromous fish access is unknown, however, it is thought to extend at least several stream miles. Impassable culverts also isolate populations of resident game and non-game fish.

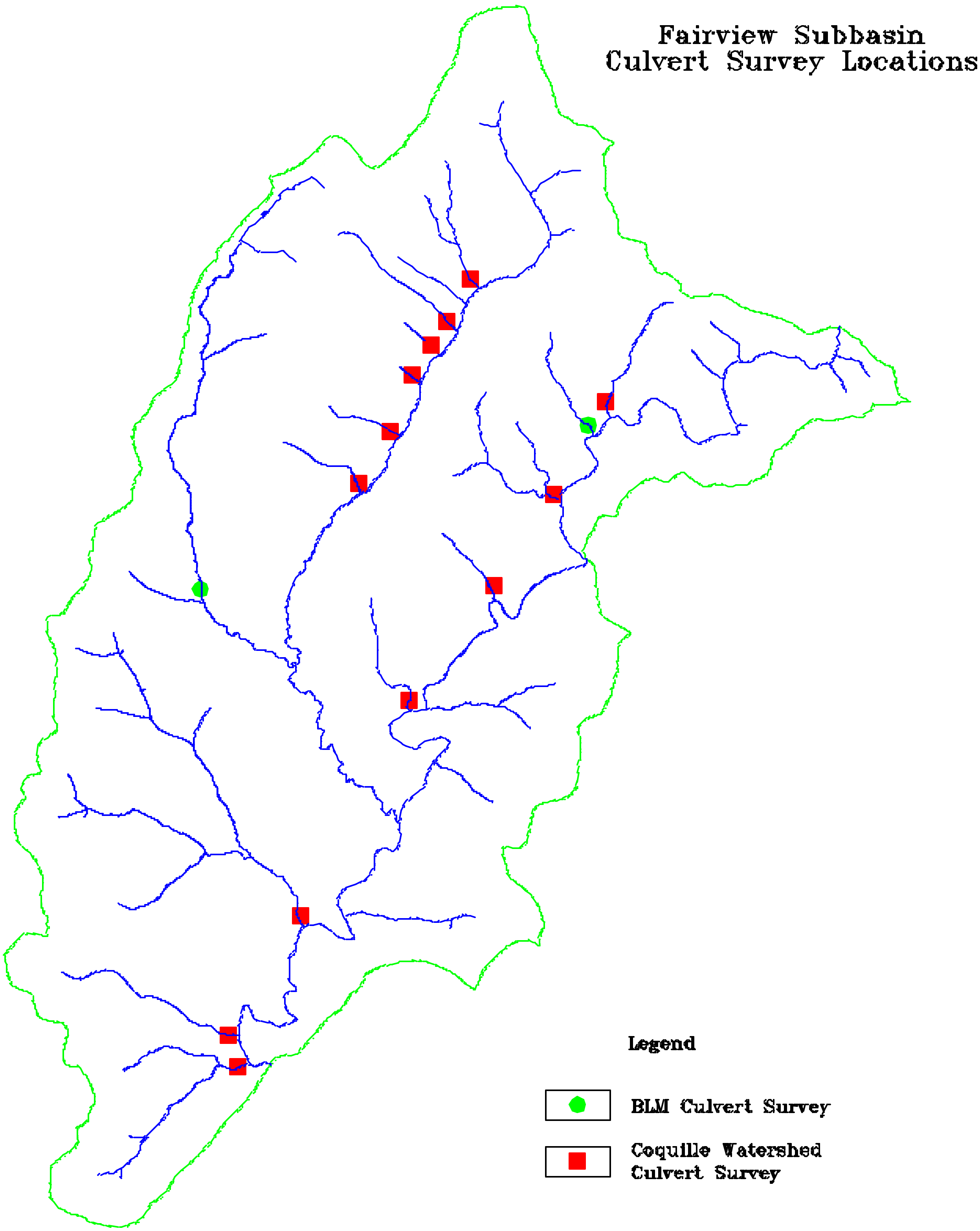
With a federal listing of coho salmon pending and several other species of fish being considered for petitioning as T&E, local organizations such as the Coquille Watershed Association (CWA) are looking for ways to improve population numbers of anadromous fish. One way of boosting fish numbers is to make former habitat blocked by culverts accessible for spawning and rearing. A culvert inventory has been initiated in the Coquille River basin by the CWA and BLM. [In 1995 this] inventory includes portions of the North Coquille and Fairview Subwatersheds. The CWA has concentrated it's inventory efforts on State, county, and private lands while leaving the Forest Service and BLM to inventory associated public lands. [In 1995 a] combined total of 30 culverts have been inspected in the North Coquille and Fairview Subwatersheds, and with 20 of these showing fish passage or structural problems (Map No. IV-3a&b). The CWA can assist private land owners with the costs associated with the repairs or replacement of the culverts and BLM will utilize the "Jobs in the Woods" or other funding sources to correct culvert problems on public lands.

Although both CWA and BLM resources (man power and dollars) are in short supply, a coordinated, systematic inventory and follow-up repair/replacement program should be initiated and would have positive results for the fishery in the near future. To avoid a duplication of effort, the CWA and BLM should work closely to ensure that culverts are not inspected more than once.

Map No. IV-3a


North Coquille Subbasin
Culvert Survey Locations
Legend
BLM Culvert Survey
Coquille Watershed
Culvert Survey

Map No. IV-3b



Fairview Subbasin
Culvert Survey Locations
Legend
BLM Culvert Survey
Coquille Watershed
Culvert Survey

Fishery/Aquatic Habitat

Rosgen Stream Type Associations **-** The Rosgen Stream Classification system was used to distinguish differences and similarities in stream types and provide a common language, when necessary, for discussions of stream state (Rosgen, 1994).

In the North Coquille Subwatershed, Rosgen Type A streams are headwall zero to first and possibly some second order streams. The headwalls of the North Fork Coquille River, Little North Fork and Fruin Creek originate on the Tyee and Flournoy Formations and contain waterfalls or steep cascade slide reaches. Although the Tyee and the Flournoy formations are no different structurally, the overlaying Tyee Formation is capable of providing a more competent stream gravel than the Flournoy Formation. There is a downstream progression of "most" to "least" competency in the formations. The Tyee Formation of the upper North Fork Coquille River will pulse competent rock into the streams and river during high precipitation events. These Type A streams have little suitable fish habitat and are subject to frequent channel because of their steep gradients. Isolated populations of resident cutthroat trout may exist in short protected reaches of some of these streams. A thorough inventory of these habitats has not been accomplished. Hillslope processes, (landslides and debris flows,) that contribute boulders, gravels, and large woody material to downstream fish bearing stream segments are important in the these stream types.

In the Fairview Subwatershed, Rosgen Type A streams are headwall zero to first and possibly second order streams. Because of the relatively low gradient nature of the subbasin, few of the type A streams exist in the Fairview Subwatershed. They are generally concentrated in the Blue Ridge and originate on the pillow and brecciated submarine basalt of the Roseburg Formation. They are deeply incised and retain little substrate. The gravel provided by hillslope processes, (landslides and debris flows,), is easily weathered and poorly suited as spawning gravel.

Step/pool streams (Rosgen Type B), 3rd to 5th order in size contain the most suitable salmonid habitat available in the North Fork Coquille Subwatershed. These types are the main resident and anadromous salmonid spawning and rearing habitats. Although most Type B streams in the North Coquille Subwatershed have been heavily impacted by past forest management, they maintain portions of their pre-disturbance functions. Because of the gentle topography and the predominance of sandstone/siltstone and alluvial deposits in the subbasin, there are very few examples of step/pool (Rosgen Type B) stream types in the Fairview Subwatershed. The upper reaches of Steinnon Creek and Swayne Creek might be the only good examples of a Rosgen type B stream in the Fairview Subwatershed. Steinnon Creek also originates on the pillow and brecciated submarine basalt of the Roseburg Formation which produces brittle gravels. Dense riparian vegetative cover provides a thermal buffer to keep stream water temperatures suitable for salmonids and other aquatic life. This vegetation, throughout much of the North Coquille and Fairview Subwatersheds, is mainly hardwoods and provides little long term in-stream cover or structure. Road construction has infringed on the floodplain of many of these streams and has contributed to accelerated sedimentation. Most of the streams of this type are controlled by terraces that have streambank boulder and riparian vegetative constraints.

The pool/riffle (Rosgen Type C & E) stream characteristics show up on tributary and mainstem river reaches that flow through the Quaternary Alluvium, and on some reaches of tributary streams above this alluvium deposit. Differences in stream types here are subtle and are found in the width/depth ratio and sinuosity measurements. These reaches are the most heavily impacted of the subwatershed and reflect little of their pre-settlement conditions. Most reaches have been down cut to bedrock (39% below Steelhead Falls) from stream cleaning, log drives, and splash dam operations, and provide only marginal suitable salmonid spawning (19% below Steelhead Falls) or winter rearing habitat. This down cutting has restricted juvenile salmonid migration into mainstem tributaries because of the loss of tributary connectivity and floodplain interactions. Pool/riffle stream types normally provide excellent rearing and wintering habitat for salmonids. However, the in-channel features that provide this habitat component in the subwatershed were lost when the log jams and channel obstructions were cleared. The stream channel vegetative canopy of the main stem is very open and elevated summer water temperatures occur. Other streams such as Woodward Creek, lower reaches of Steinnon and Steele Creeks, although impacted from past land management practices, currently have a relatively closed hardwood canopy and maintain a cooler water temperature. These pool/riffle stream types have streambanks that consist mainly of alluvial deposits that consist of sands and clay, with little to no bank rock. These streams are vegetatively controlled by grass, shrub, and tree roots. Large wood, when it does reach the stream channel, is important as cover structure for fish, reducing stream energy, and maintaining a high sinuosity. Large woody debris gets exposed and buried as the stream channel moves across the floodplain. Wood in the channel deflects streamflow and creates meanders. This wood gets incorporated in meander pools and scour pools. Salmonids seek refuge in the slow current of side-channels, backwater areas, and undercut shelter provided by large wood during high winter flows. Although important as fish cover, large wood in the channel is not the driving force in shaping these stream systems. These types occur in reaches of the mainstem as well as it's tributaries of Lost, Blair, Steele, Evans, Woodward, and lower Steinnon Creeks.

Large Woody Debris **-** Large woody debris plays an important role in the hydrologic process as well as creating and maintaining fish habitat throughout entire river systems. Large wood can enter the stream in several ways. Debris flows that carry large trees, boulders, gravel, and sediments enter streams and create areas of high structural diversity and collection points for storing organic material and spawning gravels. Individual large trees can fall across the stream forming spanners that also collect and store wood and spawning gravel. Wood eventually breaks down and decays and is processed by micro-organisms and enters the food cycle of the aquatic ecosystem. It's main function, however, is it's structural characteristics and how they influence channel hydraulics and provide habitat for the spawning and rearing of a variety of aquatic organisms.

Large wood pieces in the stream channel add to bank stability, forms complex pool habitats, stabilizes sediment wedges, stores organic matter, and forms velocity breaks that slow water and maintain water tables during periods of drought. Large woody debris is important to the biological assembledges of streams and rivers. Wood provides overhead and undercut fish cover, energy breaks from high flows, organic debris supply for the benthic community, and the nutrient cycling process. It governs the storage and release of sediments and detritus that facilitates the biological processing of organic inputs from the surrounding forest (Bisson et al. 1987).

ODFW, PACFISH and others have developed guidelines for the numbers of pieces of naturally occurring large woody material in streams based on values from surveys of reference conditions. These standards should not be universally applied to all streams. Streamside vegetation controls and influences the stability of stream types C and E, which are found throughout the Fairview Subbasin. Reaches of stream types A and B are generally controlled by the large wood component and appropriate standards would likely apply to these types where they are found.

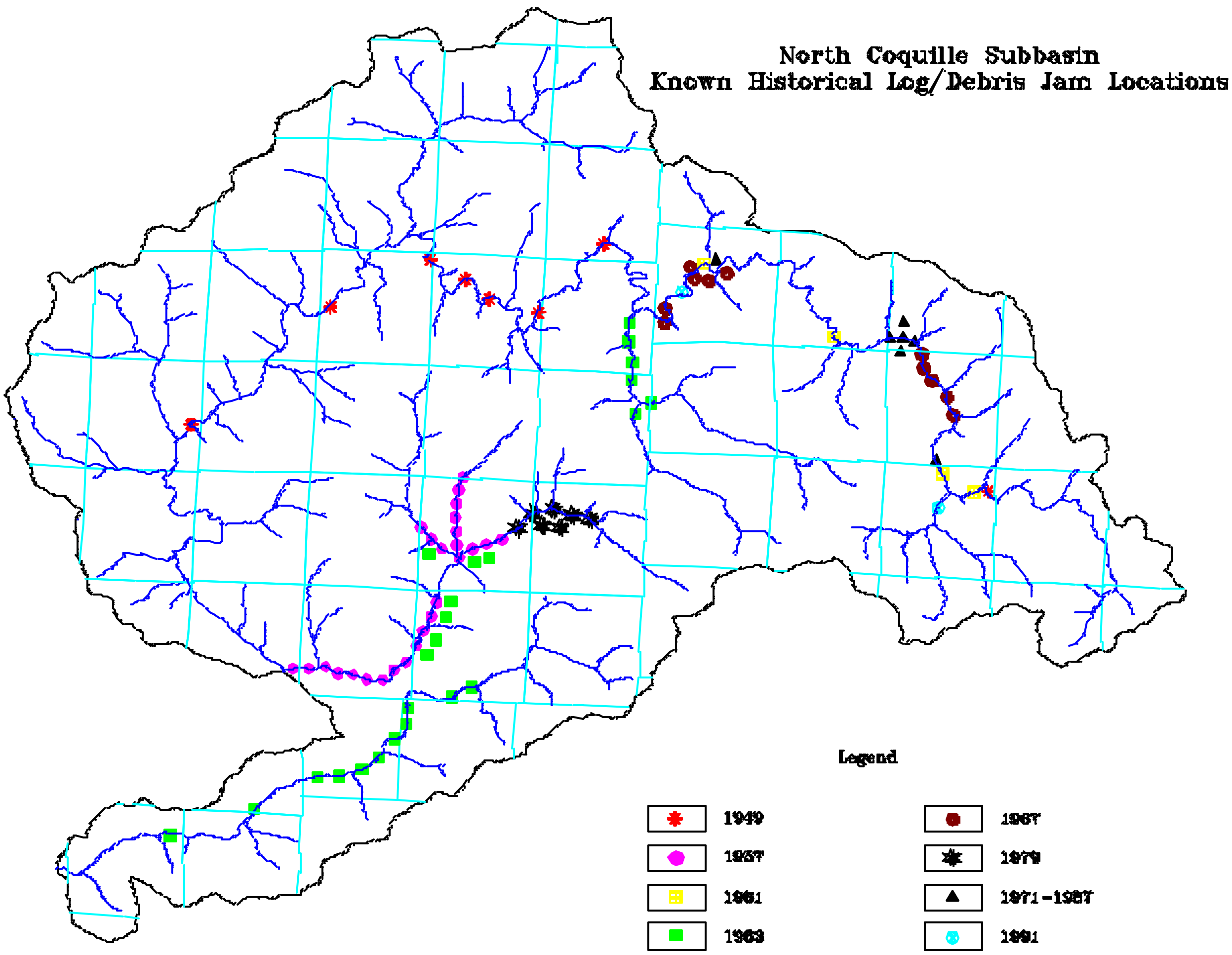
Several habitat inventories have been conducted on the North Fork Coquille River over the years by both the BLM and the ODFW. These inventories have looked at different parameters of fish habitat at different levels of detail. Stream inventories dated 1949, 1951, 1953 and 1961-1964 (on file at the ODFW office in Charleston) conducted by the Oregon Fish Commission, and in 1980 by BLM. The Oregon Fish Commission concentrated on general habitat descriptions with an emphasis on log jams that might block fish passage. The 1961 survey took an extensive look at the general stream channel substrate composition from Laverne Falls to the upper forks in the headwaters. BLM followed this with a survey of log jams, general substrate composition, and anadromous fish distribution in approximately the upper 5 miles of the mainstem. This was followed in 1991 by an extensive habitat survey of the upper 5 miles of the mainstem North Fork Coquille River.

Stream survey's from 1949 through 1991 have documented the locations of large wood in the mainstem North Fork Coquille River and major tributaries in the form of log jams (Map No. IV-4a&b). The earlier surveys described these jams in little detail. Most surveyors included the presence or absence of logging debris in their notes describing the jams. All identified jams through the 1971 survey had logging debris as part of their descriptions.

All of the benefits that large woody debris provided to stream hydrology and aquatic ecology were over-shadowed by the wholesale desire by biologists and others to provide obstruction free access for anadromous fish to upstream portions of streams and river. What stream cleaning accomplished in making downstream log drives easier, it was thought to do likewise for the upstream movement of salmon, steelhead, and trout. The era of cleaning streams of log/debris jams that block fish passage, whether real or perceived, peaked in the late 1950's to early 1960's and continued on into the early 1980's. By 1961 over $45,000 was spent to remove log jams on the North Fork Coquille River from the mouth to the headwaters (OSWRB, 1961). This also was shortly after a period of peak logging activity in the subwatershed. Stream bottoms were easily accessed and were the first areas to be logged. Hillslopes adjacent to the streams were logged as upstream progress was made. Downhill logging of these hillslopes was the preferred method. This method promoted the downhill movement of sediments and slash debris. Trees seemed an endless commodity and mills were limited to using only the choicest logs. This resulted in large amounts of unusable bits and pieces of wood being discarded in the forest and left in streams. Most of the jams described in the stream surveys were not originally jams but the remnants of debris flows, spanner logs or log accumulations and most likely did not block fish passage, especially at higher bypass flows. As the discarded pieces of wood and slash floated downstream they were collected by spanner logs or log accumulations tightly sealing them and creating true jams. A 1957 survey of Moon Creek located 26 separate log/debris jams in about 4 miles of stream. These jams were earmarked for removal, and, although described as having logging debris in them, these "jams" probably were naturally occurring spanners or log accumulations that got smothered and plugged by logging debris and were labeled as problems to fish passage. It should be noted that the apparent 6.5 log/debris jams per mile should not be interpreted as a naturally occurring number of LWD pieces per mile. This stream cleaning action initiated the down-cutting and lowered water table conditions currently found in most perennial tributaries to the North Fork Coquille River. Log jam removal and the resulting loss of fish habitat was not confined to Moon Creek (Map No. IV-2a), but was practiced throughout the subwatershed.

A follow-up survey of Moon Creek in 1963 showed only 7 jams remaining. It is not known if these jams are part of the 26, or if all 26 were removed and these 7 were jams that had been reformed. The removal of debris jams was very efficient and it is likely that the original log spanners or log accumulations that provided habitat and spawning areas were removed as well. Moon Creek and a part of one tributary were again surveyed in 1994 by the ODFW. This survey, which nearly duplicates the entire 1957 survey, is divided into 6 reaches. In all 6 reaches the riparian vegetation canopy is dominated by young red alder less than 30 centimeters in diameter. It has been composed of red alder since logging entry up the drainage in the 1950's. Based on the ODFW standard for number of pieces and volume of wood per 100 meters, 3 of the 6 reaches exceed the good category. Two of these reaches are in the tributary and were the terminus of downhill logging and may have accumulated large debris. The other reach is in the main creek channel and may be debris related or natural pieces exposed through scour. All other reaches for both numbers and volume are in the poor category except for the number of pieces in reach 2 which is in the fair category. These reaches have an average shade component of just more than 94%.

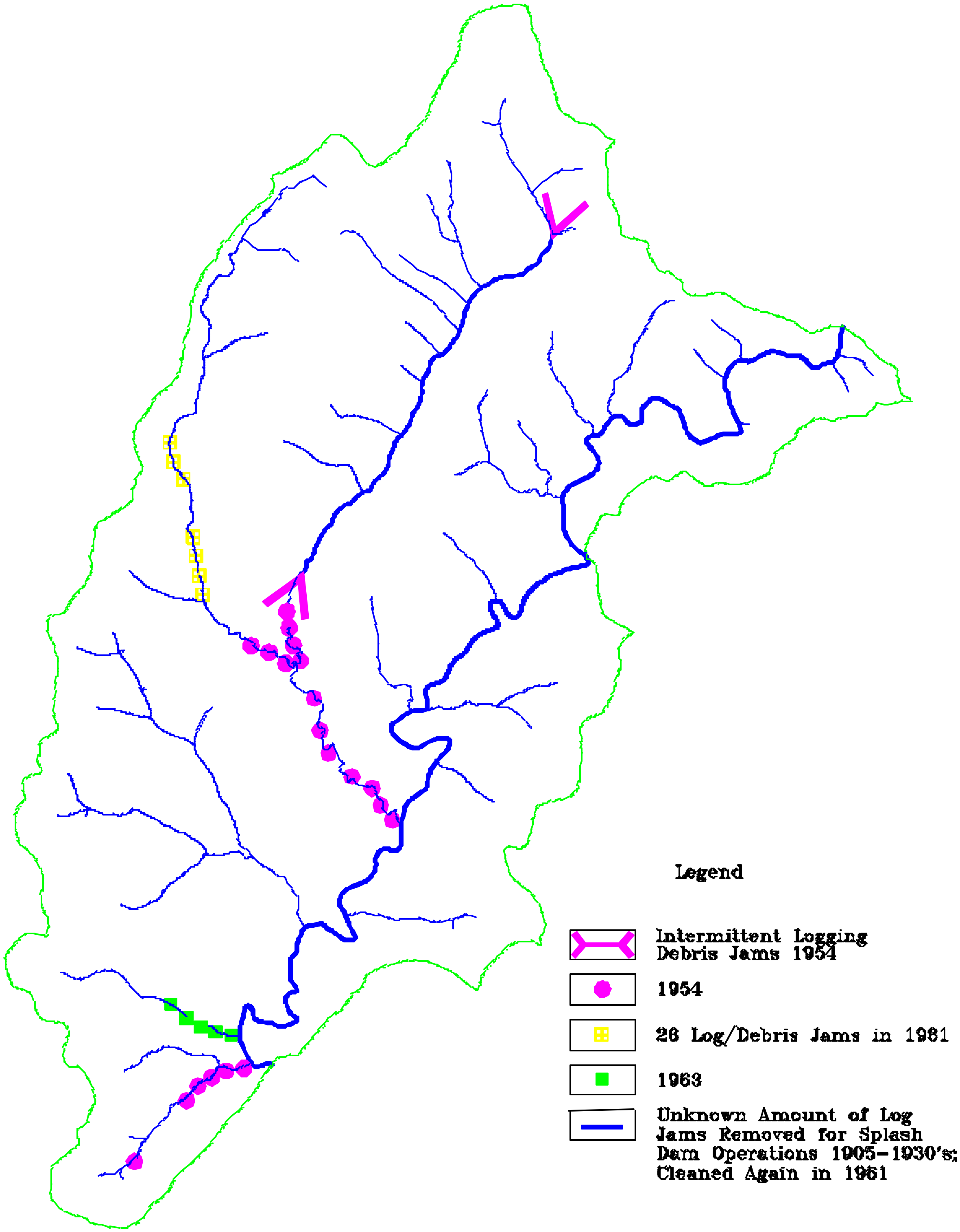
Map No. IV-4a



North Coquille Subbasin
Known Historical Log/Debris Jam Locations
Legend
1949
1957
1961
1963
1967
1979
1971-1987
1991

Map No. IV-4b

Fairview Subbasin
Known Historical Log/Debris Jam Locations



While important as an in-stream habitat feature, large wood in [the type C and E] alluvial stream systems plays a lesser role in streambank stabilization. Much of the streambank stability in type C and E streams come from root systems which bind the fine alluvial deposits. These Rosgen C and E type streams have a high sinuosity and travel across the floodplain as streambanks erode and build. Large wood enters the stream channel mainly by undercutting actions or, in the mainstem by flood flows. This wood is buried in deposits and re-exposed as the channel moves across the floodplain. It acts to deflect stream energy and redirect the current forming scour pool habitat. Under natural conditions these stream types have a tendency to move laterally with little down cutting action.

The recruitment of large conifer to the stream channel will occur at a very slow rate and in the distant future because of the dominance of young red alder in the riparian area. This slow rate of large conifer recruitment magnifies the importance of complex red alder accumulations in the channel of Moon Creek. These red alder pieces will provide fish habitat structure and is the primary allochthonous energy source for the aquatic food chain until conifer become re-established.

With the cleaning of log jams from streams came the loss of complex channel structures and the over-wintering habitat preferred by juvenile salmon, steelhead, and trout. The extensive removal of jams that create and maintain large, stable, pool and calm water habitat has lead ODFW to suggest that the amount of over-wintering habitat is limiting in the North Fork Coquille River (Jim Muck, ODFW, personal communication).

Many sites had documentation of repeated removals of log/debris jams and may be natural collection sites. For geomorphological and hydrological reasons these sites will always be locations of natural complex log accumulations if the wood of appropriate size enters the channel and is transported to these sites. These sites represent opportunities to develop complex log accumulation projects and set in place long term monitoring of the effectiveness of log placement and it's benefits as fish habitat.

A recent survey of the upper mainstem North Fork Coquille River was conducted in 1991 by BLM and started from just above the Little North Fork Coquille River mouth in 26-11-13 to the upper forks in 26-10-21. This encompasses approximately 5 miles of stream and most of the mainstem in the key watershed. Part of this survey looked at the numbers and distribution of large wood as it contributes to fish habitat. Wood was categorized by conifer or hardwood and by size of piece (Table IV-3) and was totaled for each of the 6 stream reaches. Most of this length of the North Fork Coquille River has been cleaned of wood and log jams in the past, so it was not too surprising to find so little large wood in this section. Notes were taken along with habitat measurements and only 2 multiple log accumulations were noted along the entire length. One complex log accumulation was noted near the start of the survey and one near the end, a separation of nearly 4.5 miles.

When compared to standards set by the ODFW and PACFISH for large woody debris in streams, only one of the reaches surveyed was in the ODFW fair category (10 to 20 pieces per 100 meters of stream), with the remaining 5 reaches in the ODFW poor range (less than 10 pieces per 100 m of stream, ranging from 2-9 pieces) when looking at conifer alone (Table IV-3). When combining hardwoods and conifer 3 reaches are in the ODFW fair category, while the other 3 remain in the ODFW poor category. Only one of the poor reaches (reach 4) is in an area of good condition for the potential recruitment of large woody debris to the stream channel. All three of the fair reaches encompass areas of good condition for the potential recruitment of large woody debris to the stream channel. All reaches fall far short of being in compliance with PACFISH recommendations for large wood for streams.

Table IV-3: North Fork Coquille River, BLM Stream Survey - 1991				
Reach ID	Woody Structure			
	No. Of Pieces			Pieces/100 Meters
	5-11" Conifer	11-21" Conifer	21+" Conifer	Total Conifer
5NFCO002	22	44	52	5
5NFCO003	12	26	12	3
5NFCO004	10	15	19	2
5NFCO005	19	52	32	9
5NFCO006	18	56	28	7
5NFCO007	41	100	68	11

While stream cleaning and salvaging from streams and riparian areas has been stopped, the legacy of the cleaning process remains. It will be many years before the in-stream habitat improvement options of the State water protection rules will be applied to sections of the North Fork Coquille River if they ever will be. Climatic conditions have not recently been favorable for natural processes to provide large wood to the streams. Even if they were favorable, there are only limited locations in the subwatershed (Map No. IV-2a) where there are standing trees large enough that when recruited to streams actually provide the complex large wood accumulations needed to stabilize hydrologic processes and provide good fish habitat.

Beaver dams were also perceived as barriers to fish migration and should be removed. Beaver dams however furnish a habitat type that is highly diversified and provide the accumulated sediments necessary for retaining a high water table for riparian vegetative maintenance, especially during periods of drought. In streams that have been cleared of their large wood, beaver ponds provide important retention time for the processing of stored organic matter. Organic matter accumulates and becomes the food base and energy supply of the stream. This organic matter is subject to microbial colonization which feeds much of the macro-invertebrate community which then serves as food for fish and other aquatic predators. As summer habitat, these ponds provide highly productive pool habitat for rearing salmonid fingerlings. As wintering habitat, they dissipate stream energy and provide slack water and side channel areas for many aquatic organisms . On larger streams and rivers beaver dams are seasonal structures that are generally washed away with high winter flows.

<u>Stream Substrate</u> - The mainstem North Fork Coquille River below Steelhead Falls has had extensive clearing to accommodate log drives and splash dam operations from as early as 1902. Because of the gentle gradient of the river in this reach, it is likely that before log drives a large proportion of the channel bottom was covered with gravel suitable for salmonid spawning. Much of the substrate stored in the river channel was transported downstream by the elimination of channel constraints and the scouring action of the water and log volume released from splash dam operations. The act of cleaning log jams from the mainstem North Fork Coquille River above Steelhead Falls and the other major tributary streams not only eliminated complex structure, pool habitat and in-stream nutrient production, it also eliminated the large velocity break structures and channel constraints that cause gravels and sediment to settle and store them in place. These wedges of stored gravel, sediment, and organic material are the places that fish use for spawning and macro-invertebrates use for processing food items.

A review of the air photos back to 1950 of the upper North Fork Coquille River in the key watershed shows that periodic flooding scour of the streambanks is an important process in the redistribution of available spawning gravels. The broadened portions of the floodplain store river washed gravels that are periodically exposed and re-buried as flooding events occur and the river moves across the floodplain. Sediments are processed downstream and gravels are re-exposed as bed substrates. These events occur in reaches of low gradient, however the replenishment of this gravel still depends on periodic inputs from hillslope processes. Wood is a key component in retaining the low gradient of the floodplain and preventing downcutting. Large wood accumulations increase the capacity of the floodplain to store gravel and allows for important floodplain interactions to occur on a more frequent basis.

The stream channel substrate composition component of a stream survey, conducted in 1963-4 on the upper North Fork Coquille River, was compared to a similar habitat component from a stream habitat survey conducted on the key watershed portion of the North Fork Coquille River in 1991. Although terminologies and methods were different in the surveys, the substrate components (bedrock, gravel, and silt and sand), as measured, were the same. This portion of the North Fork Coquille River currently acts as a Rosgen B3/B4 type. This is a cobble/gravel dominated system with periodic high flows that process silt and sand downstream. This substrate comparison showed that for both the 1963-4 and 1991 surveys, the percent of stream channel with exposed bedrock was 19%. This amount of exposed bedrock may be excessive since by 1964 much of the natural and debris caused jams that store gravels were removed and this part of the river was periodically cleaned through the 1970's. The percent of stream channel covered by the combination of small and large gravel was 45% and 44% respectively. These numbers are similar though probably low for the very reason, periodic river cleaning, that the bedrock component was high. The percent of stream channel covered by sand and silt was 3% in 1963-4 and showed an increase to 10% in 1991. This Rosgen type typically stores small amounts of silt and sands in the channel and floodplain and processes the majority downstream. Land management, particularly road building, has increased in the upper subwatershed since 1964. Road associated failures may reflect this 7% increase in sand and silts. This level of increase may continue since there are active road related slope failures occurring from Section 21 in Township 26 South, Range 10 West. The condition of the road system in this upper key watershed should be inspected to determine sediment risks to the stream channel and aquatic habitat.

The reach of the North Fork Coquille River below Steelhead Falls currently acts as a Rosgen C1/C2 type because of the dominant bedrock substrate, but may historically have been more similar to a C3/C4 or E3/E4 because of the storage of cobble/gravels. The 1963-4 data shows that the river reach below Steelhead Falls has a 40% bedrock composition with 19% gravel, not all of which was suitable for salmonid spawning, and 14% sand and silts. This may be gravel deposited or redistributed since splash dam operations ceased. If channel constraints, such as large wood accumulations were to become re-established in the channel this section of river has the capacity to store large quantities of cobbles and gravels suitable for salmonid spawning. Gravel composition of the North Fork Coquille River through the Fairview Subbasin is unknown, but is thought to be well below the estimate from the upstream reach.

The bedrock dominated channel below Steelhead Falls has lost the cobble/gravel substrate because of the log drives and splash dam operations. While there is some areas of gravel deposits (about 19% of the reach has gravel and ODFW has a one mile long fish spawning monitoring site located just below Giles Creek) this reach is about 40% bedrock substrate. There are very few local sources of gravel within this reach of river and much of the gravel originally in this reach probably came from upstream sources. The headwaters of the mainstem are in the Tyee formation, and this is the source for competent gravel for the main stem. This gravel is supplied from landslides and debris flows and take many years to be transported down the channel to replenish reaches cleared for log drives and splash dam operation. Many years of land management practices (road building, timber harvest, agriculture) have altered the way the river functions and subsequently reduced the rate of gravel recruitment. With a poor to fair LWD recruitment potential along much of main stem in the North Coquille Subwatershed below Steelhead falls, large scale habitat improvement projects, such as boulder weir placement, will be needed to maintain the existing gravel base in place. It may also be necessary to bring in spawnable gravels from off-site sources.

Due to the predominance of bedrock substrate, those aquatic species, including macro-invertebrates, that require clean gravel with many interstitial spaces for survival, have been relegated to small pockets of gravel when it is available.

There are very few local sources of gravel within the Fairview Subwatershed reach of the main stem and much of the gravel originally in this reach probably came from upstream sources. The locally produced gravel from the sandstone and siltstone of the Roseburg Formation is unsuitable as long term spawning gravel and quickly erodes to sand and silts. The broadened portions of the floodplain store river washed gravels that are periodically exposed and re-buried as flooding events occur and the river moves across the floodplain. Sediments are processed downstream and gravels are re-exposed for spawning and macro-invertebrate production. These events occur in reaches of low gradient, however the replenishment of this gravel still depends on periodic inputs from hillslope processes. Wood is a key component in retaining the low gradient of the floodplain and preventing down cutting. Large wood accumulations increase the capacity of the floodplain to store gravel and allows for important floodplain interactions to occur on a more frequent basis.

Gravel from the Steinnon and Woodward Creek drainages originate from the brecciated submarine basalt on Blue Ridge. This gravel breaks down rapidly once it enters the stream and probably does not enter the mainstem North Fork as valuable spawning gravel. In addition, it is the source of turbidity in Woodward Creek. The headwaters of Woodward Creek are down cutting through a clay deposit which enters into suspension and imparts a milky turbidity to the creek. A high turbidity can impact fish and aquatic life. Bisson and Bilby (1982) reported that juvenile coho salmon avoided water with turbidities that exceeded 70 Nephelometric Turbidity Units (NTU), which may occur in certain types of watersheds and with severe erosions. The turbidity measurement of Woodward Creek is unknown.

<u>Habitat Improvement Projects</u> **-** In recent years there has been a cooperative effort by ODFW, the Coquille Watershed Association, BLM, and private individuals and timber companies to improve and restore various components of in-stream and riparian habitats missing from the North Fork Coquille River.
In addition, the BLM's "Bring Back The Natives" initiative has focused these and other public and private agencies and entities in cooperative restoration efforts throughout the entire Coquille River drainage.

These efforts have concentrated on providing in-stream structural placement for overwintering salmonids, and the riparian revegetation measures of planting conifers and willows and fencing to restrict livestock from streambanks. In-stream boulder and log weirs have been designed to collect and store gravels that enter the mainstem or that get redistributed by flooding events. These gravels are then held in place as spawning habitat for anadromous and resident fish species. These weirs are then available for the placement of a combination of brush bundles, root wad clusters, or boulder clusters, which provide habitat for juvenile fish. Map IV-1a&b shows the locations of in-stream fisheries projects in the subwatershed.

Riparian revegetative efforts have focused on the release of existing conifer and conifer or willow plantings within existing riparian habitats. Where necessary, private land owners are encouraged to fence livestock away from the immediate streamside to protect plantings and eroding streambanks. Fences can be designed to allow livestock access to drinking water while maximizing bank protection.

These projects have been placed in reaches of the river that have received some of the most intensive stream cleaning activities in the North Coquille and Fairview Subwatersheds. BLM's habitat enhancement opportunities in Fairview and on lower end of the North Coquille Subwatersheds are limited to public lands on Moon Creek and Hudson Creek. Any projects proposed for these creeks will complement projects currently existing or planned for adjacent private lands. Projects to add complex large woody debris accumulations to the stream channel would be the most appropriate design for Moon and Hudson Creeks. The river corridor and adjacent floodplain, on the main stem reach in the Fairview Subwatershed, is managed for livestock pasture, crop irrigation, and channel stability. The rural residential and agricultural nature of private land in the valley prevents the taking of measures needed to return the river to a fully functional state that provides balance between the hydrologic functions and in-channel fishery habitat. There is a level of in-channel habitat improvement that can benefit the mainstem fishery and at the same time be compatible with the residential and agricultural land use pattern. However, this is something that BLM management alone cannot achieve. BLM ownership on the North Fork Coquille River in the Fairview Subwatershed, is limited (2.7 miles) and extremely scattered. In-channel habitat improvements on the stream reaches on BLM land would have limited cumulative benefits to the fishery of the mainstem because these parcels are so dispersed. The benefits of BLM fisheries habitat improvements is also limited by the type of in-channel habitat manipulation compatible with hydrologic function and floodplain interaction.

In order to obtain more meaningful fishery habitat improvement across the Watershed, private land owners must take an active role in changing in-channel and river corridor management. The degree of river restoration depends on the degree of coordination and cooperation across all land owners. There needs to be a desire by all land owners to restore riparian and in-stream habitat for a common goal of fishery restoration. Mainstem North Fork Coquille River restoration needs to be temporally and spatially linked to provide maximum function to the biologic and hydrologic components of the river. The Coquille Watershed Association and the Oregon Department of Fish and Wildlife should take the lead in coordinating private land restoration to appropriately blend it with BLM projects.

All cooperation by private property owners is strictly voluntary. Project funding is shared across several agencies and individuals. This habitat enhancement program currently has momentum and every effort to maintain or increase the level of cooperation should be pursued by BLM.

References

Bisson, P.A.; Bilby, R.E. 1982. Avoidance of suspended sediment by juvenile coho salmon. North American Jour. Of Fisheries Manag. 2:371-374.

Bisson, P.A.; Bilby, R.E.; Bryant, M.D.; Dolloff, C.A.; Grette, G.B.; House, R.A.; Murphy, M.L.; Koski, K.V.; Sedell, J.R. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. In: Salo, E.O.; Cundy, T.W., eds. *Streamside management: forestry and fisheries interactions. Contribution Number. 57.* Seatle, Washington: University of Washington, Institute of Forest Resources. 143-190.

Croot C. and L. Marcolis, Eds. 1991. Pacific Salmon Life Histories. **UBC** Press, Vancouver, British Columbia, Canada. 564p

Farnell, J.E. 1979. *Coos and Coquille Rivers navigability studies*. State of Oregon, Division of State Lands. 107 p.

Harmon, M.E.; Franklin, J.F.; Swanson, F,J.; Sollins, P.; Gregory, S.V.; Lattin, J.D.; Anderson, N.H.; Cline, S.P.; AumenN.G.; Sedell, J.R.; Lienkaemper, G.W.; Cromack, K.,Jr.; Cummins, K.W. 1986. Ecology of course woody debris in temperate ecosystems. Advances in Ecological Research. 15:133-302. New York, NY: Academic Press.

Nickelson, T.E., Nicholas, J. W., Mcgie, A.M., Lindsay, R.B., Bottom, D.L., Kaiser, R,J., and Jacobs, S.E.1992. Status of anadromous salmonids in Oregon coastal basins. Ocean Salmon Management, Oregon Department of Fish and Wildlife, Portland. 83p

Oregon Department of Fish and Wildlife (ODFW). 1992. *DRAFT: Coquille Basin Fish Management Plan*. June 1992.

Oregon Department of Fish and Wildlife (ODFW). *DRAFT: Oregon Coho Salmon Biological Status Assessment*. December 21,1994.

OSWRB, 1961. Hearing Record, November 16, 1961, State Water Resources Board of the State of Oregon,

Coquille, Oregon
Rosgen D.L., 1994. A classification of natural rivers. Catena. 22: 169-199
Sedell, J.R.and Luchessa, K.J. 1982. Using the historical record as an aid to salmonid habitat enhancement. In: Armantrout, N.B., ed. Acqiuisition and utilization of aquatic inventory information: Proceedings of the symposium; Bethesda, Md. American Fisheries Society, Western Division. 210-223.
Sedell, J. R., Frederick J. Swanson, and Stanley V. Gregory. 1984. Evaluating fish response to woody debris. In: Hassler T.J. ed. *Proceedings: Pacific northwest stream habitat management workshop. October 10-12, 1984, Humboldt State University, Arcata, California*., American Fisheries Society, Western Division. 222-245.

Middle Creek Subwatershed

III. DESCRIPTION OF THE WATERSHED, INCLUDING ITS NATURAL AND CULTURAL FEATURES

Aquatic - Discussion of Aquatic systems is covered in the Stream Morphology /Hydrology portion of Section III.

Stream Morphology/Hydrology - The predominant freshwater habitat of the Middle Creek subwatershed is Middle Creek proper, which terminates as a 6th order stream in Lee Valley where it empties into the North Fork Coquille River. The Middle Creek subwatershed, along with it's associated 4th and 5th order tributary watersheds and frontal streams contain 339 miles of streams of which 74 miles are known to be inhabited by anadromous and resident fish species. Because of steep slopes, thin soils and lack of water storage as snow in the higher elevations of the subwatershed, runoff follows the precipitation pattern with winter excess and summer drought. Mean two year 24 hour high flow for the watershed is about 2300 cfs two year 24 hour instantaneous flow (bankfull discharge) is about 3800 cfs. Additional return intervals of 24 hour duration are: 5 year instantaneous peak flow 5300 cfs, 10 year instantaneous peak flow 6179 cfs, 25 year instantaneous peak flow 7100 cfs and the 100 year flood flow is about 9000 cfs. (USGS Wellman et al. 1993 and USGS Harris et al. 1979). There have been no runoff events greater than the 5 year storm since the mid 1980's. Middle Creek has a mean annual discharge of 193 cubic feet per second, 90 percent occurring from November to April, and less than one percent occurring during August and September. There is very little surface water storage in the watershed to augment low late summer flows. Low flows in late summer are often limiting for fish habitat and cause water shortages for domestic and agricultural use. Average two year recurrence interval seven day low flows seldom exceeds 3 cfs for the watershed or about 0.06 cfs/square mile. High flows in channelized streams during winter contribute to accelerated channel scouring, sedimentation, and bank failure.

The subwatershed has a high drainage density, generally arranged in a dendritic pattern. Drainage densities average 6.7 mi./sq.mi. overall, with stream densities approaching 9 mi./sq.mi. in the Tyee Formation. The Rosgen Stream Classification system was used to distinguish differences and similarities in stream types and provide a common language for discussions of stream state (Rosgen 1994). Three primary stream types are found in Middle Creek watershed; headwater (types A1a+, A2a+, A1 and A2), step/pool (types B1-B4, and B1c-B4c) and pool/riffle (types C4b and C5b). Type A streams are headwall, first, second, and sometimes third order streams and are characterized as relatively straight, steep gradients of 10 percent or greater; with reaches of waterfalls, cascades, and frequently spaced vertical drop/scour-pool bed features. These streams have a flash discharge regime and store very little fine or coarse sediment. As hillslope soils become saturated, during prolonged winter rainfall events, the variable source stream network begins to expand headward including these low order channels. Water reaching the channels by direct interception, or by gravitational forces through the soils pore pathways is not stored, but exported quickly. Type A streams are entrenched and confined by narrow valley walls, and are sources of cool water, woody debris, nutrients, and sediments to downslope streams. These streams have a high susceptibility to shallow rapid debris flows.

Debris avalanches and shallow rapid debris torrents are primary in shaping and influencing these first - third order headwater V erosional stream channels. Debris torrents are masses of water, mud. rock and large woody debris (LWD) that may move in excess 40 mph down the channel and scour the channel to bedrock. Depending on channel constrictions and amount of debris, torrents can also scour high bank areas. During debris torrents, materials sorting occurs where large rocks and LWD rise to the top. LWD in or suspended over the stream channel can slow and in some cases stop the advance of a debris torrent. Debris torrents occur as natural events in these streamtypes, but the rate and runout distance has been accelerated in the 1950's through the 1970's by road building and harvest practices in the subwatershed. These occurrences are linked to prolonged storms when daily precipitation exceeds 4 inches and soils are already saturated. (The return period for this type of condition and succeeding precipitation event, triggering stream torrents has not yet been fully evaluated for the subwatershed). These stream segments transport rock weathering materials, sediment, LWD and nutrients through them chiefly by this episodic torrenting mechanism the material is deposited at channel constrictions or just above high angle (>70 degrees) tributary junctions (Benda 1985). These torrent deposits are reworked by the stream over a period of years and supply gravel and other particle sizes to downstream reaches. Debris torrents can temporarily dam higher order channels, creating dam break floods.

Most of the waterfalls are migration blocks to anadromous fish, although resident cutthroat trout may be found in suitable habitat above many of these falls. The fishery component of these streams is limited to cutthroat trout and sculpin due to these steep gradients and the susceptibility to debris torrents or severe drought conditions. Anadromous species, with the exception of lamprey, are generally not found in these streams.

Lower down the system are Type B, step/pool streams. These third through fifth order streams receive water, gravels and sediment, nutrients and some LWD inputs from the headwater streamtypes. They are either tributary streams or mainstem segments. These streamtypes are at or near the water table and are mostly perennial. The time from on set of precipitation to the point of peak run-off is rapid for tributary step/pool streams. This is because the distances and travel time from the first through third order headwater streams are uniform due to the dendritic stream pattern. The rapid rise and fall pattern does not allow for lengthy transport of LWD. In contrast, the peak flow for the mainstem step/pool stream types is delayed and the duration may be extended depending on how synchronized the run-off is from the tributary streams. The extent of tributary stream run-off synchronization is influenced by management activities in the tributary watershed. These streams are the transitional streams between the headwater streams and the pool/riffle dominated streams, and due to past land management in this subwatershed, they are generally bedrock controlled.. They are of steep to moderate gradient, ranging from 2-10 percent, with low sinuosity. Under undisturbed conditions they are moderately entrenched, riffle dominated types, with stepping features of infrequently spaced large pools at bends or areas of constrictions, and interspersed with cascades. Substrate is dominated by boulder/cobble with frequent inputs of sediment. These streams have little transport capability beyond catastrophic landslide or flooding events. Anadromous fish species start to show up in these streams where access is available. The smaller streams are used for spawning by coho, cutthroat, and steelhead; and the larger streams additionally being used for spawning by chinook salmon. Some resident fish use occurs as well as rearing (over-wintering) for anadromous species.

Middle Creek from Moore Creek to the BLM boundary just above Middle Creek falls alternates between Rosgen B and C streamtypes. LWD is still very important in maintaining stream function, and is currently deficient. A narrow older floodplain is along this length of mainstem, but the stream has become entrenched, and the base level downcut to bedrock. The Middle Creek falls provides a base level control for the current upstream section. This area has lost connectivity with a fairly distinct narrow floodplain. The stream is not accessible to this inactive floodplain, even at the one hundred year storm depth (Carpenter and Lauer, Resource files). This portion of stream is moderately sensitive to coarse and fine sediment inputs. Sediment has been observed to fill rock diagonal fish structures within one season after construction (Carpenter 1994, personal observation). The Middle Creek road parallels the stream in this section and has additionally impinged on the stream, narrowing the cross section in places. This has increased winter high flow water velocities and prevented somewhat higher sinuousities that should be characteristic of these streamtypes. The road limits a progression of stream states and upward trend this reach.

The pool/riffle, type C streams, (5th and 6th order) are the next in the system. These stream types are characterized by a low gradient (0.1% to 4%) in broad valleys with terraces in association with flood plains and alluvial soils. These reaches of Middle Creek are slightly entrenched with a well defined meandering channel and established point bars. They have a riffle/pool dominated bed morphology, with a substrate dominated by fines and gravel with some cobble. The discharge regime exhibits a long rise with sustained high flows. Large woody debris originates from flood plain trees, blowdown from adjacent slopes, or from catastrophic landslide or flooding events and helps to maintain streambank integrity. Streambanks are vegetatively controlled, with root systems holding in place the fine material deposited in the flood plain alluvium that comprise the streambanks. Because of the low gradient, this stream segment is subject to deposition or aggradition and is very sensitive to coarse and fine sediment inputs. Moderate storm flows and receding flows from larger winter storms will deposit sediment on point and lateral bars, forcing lateral stream movement and bankcutting. Lack of bank riparian forest has caused increased instability. Under undisturbed conditions, large woody debris will be constantly exposed and buried as the stream moves across the flood plain. Currently, most of this stream class in the subwatershed is privately owned. Measures are taken by land owners to reduce the affects flooding and stabilize stream reaches to prevent the stream from moving laterally across the flood plain. This has contributed to the down cutting of the stream channel which limits the streams ability to interact with the flood plain, reducing off-channel habitats, water storage and soil deposition on the flood plain. In these stream types, LWD that comes to rest in the stream channel and flood plain provides excellent habitat for resident and anadromous fish. A continuous supply of LWD, adequate pool hiding cover, and productive riffles make this class of stream prime wintering habitat as higher flood flows push fish out of the upper stream reaches. Management practices on this class of stream severely altered the habitat characteristics that combine to provide good fish habitat and functional wetlands.

Middle Creek falls is a 26 foot waterfall at the interface between the Lookingglass and the Flournoy formations, and was the first blockage to anadromous fish passage on Middle Creek prior to laddering in 1962. This laddering has given coho and chinook salmon and winter steelhead access to approximately 15 miles of habitat once inhabited only by cutthroat trout and other native non-game species. Cherry Creek has a series of step falls which block anadromous fish passage except for winter steelhead. This series of step falls is situated at the interface of the Lookingglass and the Flournoy formations and runs on or parallel to a known geologic fault.

There are no lakes in the subwatershed. However, there are various small, natural and manmade ponds. These perennial and ephemeral ponds are habitat for a variety of aquatic life such as amphibians and macro-invertebrates that are not adapted to flowing water, or species that seek refuge from high winter water velocities in streams. One constructed pond in upper Alder Creek is concrete lined and used as a water source for fire suppression. Other important standing water habitats are sag ponds, roadside ditches, and seasonal wetlands. There is very little true wetland habitat available in the watershed. Most available wetland is associated with sag ponds, seeps, and on flood plains. Those associated with flood plains are generally small and found in alluvial deposits or oxbow formations in the lower reaches of Middle Creek dominated by private agricultural lands.

The watershed presently supports populations of coho salmon, fall chinook salmon, winter steelhead, resident and sea-run cutthroat trout, rainbow trout, and numerous non-salmonid fish species. Historically, this list also included chum salmon, which inhabited the East and North Forks of the Coquille River, and have been recorded in Cherry Creek. Spring chinook have historically been found in the lower reaches of Cherry and Middle Creeks, now dominated by agriculture. Nehlsen and coauthors (1991), reported Coquille River (which includes Middle Creek) stocks of spring chinook salmon, coho salmon, and sea-run cutthroat trout to be "at risk" of extinction as a result of habitat degradation, over-fishing, and other factors. Pacific coast coho salmon (including Middle Creek stocks) were petitioned for listing under the federal Endangered Species Act twice in 1993 (first by Oregon Trout, and later by Pacific Rivers Council). Spring chinook salmon, in all forks of the Coquille River, are threatened by high pre-spawning mortality (brought on by high summertime water temperatures and poaching) and genetic impacts (due to hatchery manipulation of their very small population) (ODFW 1993). Winter steelhead runs in the Coquille river were below their 20-year average during seven out of ten years from 1981-90 (Nickelson et al. 1992), and this is probably true for the Middle Creek subwatershed as well. Winter steelhead returns are comprised largely of hatchery stocks on all but the Middle Fork of the Coquille River. Cutthroat trout exhibit great genetic diversity between isolated populations throughout the Coquille River basin. Their populations have been adversely impacted by hatchery releases, diminished availability of complex pool habitat, and most likely by competition for scarce habitats in Middle Creek above the fishladder).

Although stream riparian areas may occupy only a small percentage of a watershed, they represent an extremely important component of the overall landscape and cannot be overlooked when addressing fish habitats. Under natural conditions in the subwatershed, conifers (western redcedar, hemlock and Douglas-fir) dominate overstories in small V-shaped drainages. As stream size increase, hardwoods (red alder, big-leaf maple, myrtle and Oregon ash) become a more important component of the riparian forest. Conifer maintained a presence on the floodplains prior to land clearing for agriculture and the early timber harvests (Dodge 1898, pp. 169, 407).

Logging and land clearing has simplified streamside riparian forests and aquatic habitat by replacing the older mixed conifer/hardwood stands with young hardwood-dominated stands and agricultural fields. Removal of large conifer that could reach the streams has diminished the contribution of large woody material into the streams. Large wood is important because it shapes the channel morphology and contributes to aquatic diversity. Conifer logs provide long-term structures to trap sediment, maintain water quality, reduce peak flood flows, control erosion and provide fish habitat. Hardwoods provide only a relatively short-lived source of woody debris.

VII. THE WATERSHED'S PAST AND PRESENT CONDITION

AQUATIC RELATIONSHIPS

Fish Habitat - At the time of settlement, Middle Creek and it's tributaries functioned with an equilibrium that assimilated the extreme natural events. Flood, fire, wind, and drought patterns not only shaped upland landscapes, they also played a major role in the formation of riparian habitat and structure, channel morphology, and instream habitat. Impacts were quickly moderated in time, and although individual parts may be severely altered, the landscape and species components as a whole remained intact.

The Rosgen Stream Classification system was used to distinguish differences and similarities in stream types and provide a common language for discussions of stream state (Rosgen 1994). Aquatic and fishery habitat components are discussed in a similar manner along Rosgen stream types.

In the subwatershed, Rosgen Type A streams are headwall to first and possibly second order streams with many of them originating on the Tyee Formation and contain waterfalls or steep cascade slide reaches. These streams have little suitable fish habitat and are subject to frequent channel scouring because of their steep gradients. Isolated populations of resident cutthroat trout may exist in short protected reaches of some of these streams, but a thorough inventory has not been accomplished as yet.

Step/pool streams (Rosgen Type B), 3rd to 5th order in size contain the most suitable salmonid habitat available. These types are the main resident and anadromous salmonid spawning and rearing habitats. Although most Type B streams in the subwatershed have been heavily impacted by past forest management, they maintain much of their pre-disturbance functions. Dense riparian vegetative cover provides an adequate thermal buffer to keep stream water temperatures suitable for salmonids and other aquatic life, however this vegetation is mainly hardwood and provides little long term instream cover or structure. Road construction has infringed on the floodplain of many of these streams, particularly Middle Creek itself, and has contributed to accelerated sedimentation. Most of the streams of this type are controlled by terraces that have streambank vegetative constraints.

The pool/riffle (Rosgen Type C) portion of the subwatershed is primarily lower Cherry Creek and Middle Creek below the falls. These reaches are mainly private residential and agricultural lands and have been settled since the mid to late 1800's. Type C reaches have been the most heavily impacted streams in the subwatershed and reflect nothing of their pre-settlement conditions. Most reaches have been downcut to bedrock from stream cleaning, log drives, and splash dams, and provide little suitable salmonid spawning and rearing habitat. The stream channel vegetative canopy is very open and elevated summer water temperatures are common. Streambanks consist mainly of alluvial deposits and are vegetatively controlled. Pool/riffle stream types provide excellent rearing and wintering habitat for salmonids, however, these features on this stream type severely impacted. Large wood found in the stream channel is important as cover structure to fish. Salmonids seek refuge in backwater and undercut shelter provided by large wood during high winter flows.

Log Drives and Splash Dams - Prior to the construction of a forest road system, logging companies had very few options in transporting logs to the mills and regional railroads. The river system was the method of choice to accomplish this by floating logs downstream. Improvements and maintenance was made to the river channels for ease of log transport. These improvements included eliminating vegetation along the river banks, blasting channel boulders, and removing large woody debris and snags from the channel. This practice eliminated many miles of productive spawning and rearing habitat for salmon, trout, and other fishes. Splash dams functioned as a water storage dam to augment stream flows for driving logs down river. Logs were hauled to the dam, placed in the impoundment and allowed to flush downstream when the dam was opened. As timber supplies were exhausted in the lower reaches, the companies moved further up-stream to new sources of timber. Log drives were described by Farnell (1979) as taking place on Middle Creek from the Lawhorne Creek area, but it is not known if they were assisted by a splash dam.

The legacy left by the splash dams on Middle Creek is one of disrupted hydrologic functions and lost fisheries habitat. The operation of splash dams included the clearing of brush and trees from the streambanks, and boulders, large wood, and any other perceived obstructions to log passage from the waterway below splash dams. By removing natural channel constraints, substrate was transported downstream by the scouring action of the logs and the flushing action of the sudden release of a large volume of water. Log drives were conducted at winter high flows and resulted in the similar impacts to the channel.

The Middle Creek channel below the falls consists primarily of alluvial deposits. It has been downcut to the bedrock level by erosion caused by many years of log drives. Floodplain connectivity, channel function, and water table levels and water storage capacity of the riparian zone is lost or severely reduced. In some areas Middle Creek is downcut as much as 15-20 feet from the top of the streambank. Many tributary channels are no longer at the same elevation as the bed of Middle Creek due to this downcutting. This elevational difference makes fish migration to spawning and rearing habitat possible only at infrequent flood events in Middle Creek. During periods of extreme drought, these streams may be totally inaccessible to anadromous, as well as migrating resident fish.

The bedrock channel has lost the cobble/gravel substrate. The upstream source of competent gravel is the Tyee Formation. This gravel is supplied from landslides and debris flows that occur in this formation and take many years to be transported down the channel to replenish these splash dam reaches. Due to the predominance of bedrock substrate, those aquatic species, including macro-invertebrates, that require clean gravel with many interstitial spaces for survival, have been relegated to small pockets of gravel when it is available.

At high flows this stream type (Rosgen C) has the ability to float and flush downstrean any large pieces of wood that might enter the channel and provide hydrologic benefits. Without large wood or other type of in-channel constraint, the streambed building process will not occur in sufficient amounts to reconnect the stream with the floodplain or its tributaries, except for infrequent major catastrophic events. Without a building up of substrate, salmonids and other gravel spawning fish will have limited reproduction capacity within this reach. Aquatic habitat surveys show that this reach has a substrate composition of 30 percent gravel. The quality of this gravel for salmonid spawning is unknown because gravel 6" to 18" in depth that is needed for spawning and this depth may not be present. Other fish habitat components such as streambank and in-stream habitat cover, water quantity, and water quality have been affected in this reach. These areas are very slow to recover from the loss of structural and habitat components. In the 60 years or so since splash dam operations ended, much of Middle Creek is still composed of a bedrock channel. Middle Creek, encompassing the area of impact by splash dams, had an average of 32 percent exposed bedrock substrate with some areas as high as 95 percent exposed bedrock. In addition to altered substrate composition, reaches of splash dam impact had reduced LWD (number of pieces, volume, and key pieces), and low macroinvertebrate richness. In contrast, the reach of Middle Creek above the falls has not been subjected to splash dams. It has, in the past, been cleared of obstructions and is constricted by the adjacent road. The habitat survey conducted through this reach recorded an average of 9 percent exposed bedrock. Exposed bedrock in a portion of this reach has been covered by the redistribution of gravel bars caused by the placement of fish habitat improvement structures on the Bureau of Land Management land. Boulder weirs have been placed to hold gravels for fish spawning.

<u>Stream cleaning -</u> Many streams were cleaned for what were thought to be appropriate biological purposes. Harmon and coauthors (1986) informs us that after 1936 fishery management agencies in the Pacific Northwest removed log jams from streams to increase fish access to spawning and nursery areas. Removal of log jams as barriers to fish migration was also supported by the view that woody debris accelerated streambank erosion and channel instability (Sedell et al. 1984). Debris from timber harvest that found it's way into the stream channel often exceeded natural levels. This debris was considered as a potential cause of debris jams that could block fish migration or cause oxygen depletion in streams.

Large wood, as existing or potential in-stream fish habitat, has been eliminated from the landscape by bits and pieces for many years. A review of BLM timber sale prospectuses on reveals that stream cleaning was required on sales sold from 1970 through 1991 in the Middle Creek subwatershed. This period also saw contracts for the removal of log jams when it was thought removal would benefit anadromous fish. Most contracts stipulated that all debris an logs be removed from the stream channel and adjacent side slopes ranging from 2 to 10 feet each side. These contracts were generally for headwall, 1st and 2nd order streams. Most streams of this size are non-fish bearing, however, this cleaning action eliminates hillslope and channel processes that contribute to the quality and quantity of fish habitat downstream. Third order streams on public land had brush buffers and as of the early to mid-80's fish bearing streams had some extent of "no entry" buffers where timber harvest was concerned. This review showed that a total of 125,550 linear feet (23.8 miles) of stream was cleaned of wood in the Middle Creek subwatershed. The streams were completely cleaned of wood in the early years. As the importance of woody material was realized, cleaning was limited to removing pieces associated with the logging, leaving rootwads and embedded material in place. We have no stream cleaning data on private lands.

Most drainage size, fish bearing streams (4th-6th orders) had roads built along them within their floodplain. Construction activities included the clearing of downed wood and cutting of live trees from the stream channel and riparian zones. Road maintenance on a regular basis will keep at least half of the riparian zone from contributing wood to the streamside and channel. Future recruitment of LWD to fish bearing streams will be hindered by the area lost to roads. The ODFW survey shows that of the streams surveyed only two stream reaches met or exceeded the habitat benchmark level of >20 pieces per 100 meters. A reach of the North Fork Cherry Creek and a reach of the South Fork Cherry Creek averaged 45 and 26 pieces per 100m respectively, with Moore Creek approaching this habitat benchmark with 17 pieces per 100 meters. The volume of LWD in the stream and the number of key pieces (>0.6 m diameter and >10 m long) is very important for creating and maintaining stable fish habitat. Large key pieces of wood are generally stable, often partially buried pieces, with the root wad attached and are not easily transported downstream. They are the anchor pieces that collect other woody debris to form complex habitat preferred by fish. Both the North Fork (141 m^3 and 10 key pieces/100m) and South Fork (80 m^3 and 5 key pieces/100m) of Cherry Creek had exceeded the habitat benchmark values of 30 m^3 and 3 key pieces per 100 meters for good habitat conditions. No other creeks exceeded the key piece benchmark. The only other creek to exceed the volume benchmark value was Moore Creek, which had 38 m^3 LWD per 100 meters. These LWD values for the North and South Fork of Cherry Creek reflect the general limited timber harvest activities that have occurred in this area. Compared with other creeks in the subwatershed, North and South Fork Cherry Creeks have a relatively intact old growth forest along most of their lengths that contribute LWD to the streams.

Fish Passage - The occurrence of a debris jam or dam that blocks the passage of anadromous fish in non-navigable rivers and streams should be recognized as a natural component of properly functioning hillslope and stream channel processes. A debris jam that appears to be a complete migration block during summer low flows, may in fact pass fish at higher flow stages. Although log jams may block fish passage in some streams they rarely eliminate a major fraction of spawning or rearing habitat in a drainage basin. Sedell and Luchessa (1982) estimate that log jams prevented fish migration to 12% of the length of potential fish producing streams in the Coquille River basin in the 1940's and the early 1950's. Whether blocking fish passage or not, jams may also be providing channel maintenance functions (sediment storage, raise water tables, etc.) that, due to past management practices such as splash damming and stream cleaning, are very scarce across the landscape. It is entirely possible, however, that if a debris jam or dam were to occur, an identified "at risk" species may be blocked from a part of it's spawning and rearing habitat. Such a situation, while considering the needs of the species, must also take into account the physical habitat needs of the stream channel and it's maintenance processes.

Large Woody Debris (LWD) - Large woody debris plays an important role in the hydrologic process as well as creating and maintaining fish habitat throughout entire river systems. Wood eventually breaks down and decays and is processed by micro-organisms and enters the food cycle of the aquatic ecosystem. It's main function, however, is it's structural characteristics and how they influence channel hydraulics. Debris in the stream channel adds to bank stability, forms pool habitats, stabilizes sediment wedges, stores organic matter, and forms velocity breaks that slow water and maintain water tables during periods of drought. Large woody debris is important to the biological assembledges of streams and rivers. Wood provides overhead and undercut fish cover, energy breaks from high flows, organic debris supply for the benthic community, and the nutrient cycling process. It governs the storage and release of sediments and detritus that facilitates the biological processing of organic inputs from the surrounding forest (Bisson et al. 1987).

There are no drainages within the subwatershed that are entirely free from man's impacts. There only a few stream reaches that can be used as a reference to see what fully functioning streams and riparian zones are like. Therefore, most entire stream reaches are not in proper functioning condition or are functioning at risk.

One relic stream that has had relatively little human impact is the North Fork Cherry Creek. This fourth order stream runs through the Cherry Creek Research Natural Area and has many intact components. The headwall is a Rosgen Type Aa+ stream in a narrow, moderately V-shaped valley with a channel gradients averaging about 19 percent and is constrained by hillslopes. Uplands consist of a mix of mature and old growth conifer and the riparian zone vegetation is a mix of large conifer and hardwoods, and an understory shrub layer with an estimated average canopy closure of 90-95 percent. Hardwoods are present, primarily at the immediate streamside where active disturbances are caused by high flows and allow red alder to regenerate. The steep gradient accounts for landslide scars within the stream channel and little evidence of terracing is noticeable except for a one large debris jam that buries the stream channel. Large woody debris is a major component of the riparian habitat, although the steep gradient makes it prone to periodic slides. A 1994 survey recorded an average of 12 pieces of large woody debris (>3m X 0.15m) and a wood volume of 25 cubic meters per 100 meters of stream in this Rosgen type. The amount of LWD recorded in this reach is in the fair category as classified according to ODFW habitat benchmarks. One of the functions of headwater streams is to feed LWD to downstream reaches where it collects in the stream channel and contributes to channel morphology and habitat stability. Considering the nature of downstream channel conditions this headwall is fully functional.

The step/pool section of the North Fork Cherry Creek is a Rosgen Type B2 stream that is in a narrow to open, moderate V-shape valley form, which is constrained by hillslopes and high terraces. The stream channel has an average gradient of 3% and has numerous log jams. Uplands consist of a mix of mature and old growth conifer and the riparian zone vegetation is a mix of large conifer and hardwoods, and an understory shrub layer with an estimated average canopy closure of 80-85 percent. Hardwoods are present, primarily at the immediate streamside. The terraces formed in this reach result from old landslides that have reached the channel. There is an adequate supply of LWD from the upstream headwall and adjacent riparian habitat. The supply of LWD from the riparian zone enters the stream through blowdown or streambank undercuts. The 1994 survey recorded an average of 16 pieces of large woody debris (>3m X 0.15m) and a wood volume of 60 cubic meters per 100 meters of stream over this entire step/pool section. The lower one quarter of this reach, which had a more gentle gradient, has an average of 45 pieces and volume of 141 cubic meters per 100 meters of stream. This reach has the greatest number of key pieces (larger than10m X0.6m) of LWD surveyed in the subwatershed. The length of a piece of wood relative to channel width is an important factor in maintaining channel stability. Short pieces can stabilize narrow channels, but longer pieces are needed to stabilize wider channels. The piece diameter is important because larger pieces require greater hydrologic force to be moved, withstand greater load forces, and resist decay longer than smaller pieces (Swanston 1991). Key pieces are large, structurally sound, partially buried conifer or hardwood logs that form hydrological channel constraints and are major contributors to channel morphology and stable fish structure. There are more than 10 key pieces of wood per 100 meters of stream in this reach. The amount of LWD recorded in this reach is in the good category as classified according to ODFW habitat benchmarks.

The pool/riffle Rosgen Type C and E streams in the Middle Creek subwatershed are not represented by an extensive block of intact old growth forested riparian habitat. What remains of intact reaches are short pieces of Rosgen Types C3b and C4b streams that exist as mature/old growth riparian buffers surrounded by young re-forested stands. These reaches have historically been cleaned of wood and are impacted by adjacent management actions. The Rosgen Type C reach extends from the fish ladder upstream to approximately Moore Creek. This reach averaged 7 pieces and 7 cubic meters of large woody debris per 100 meters of stream, and less than one key piece of wood per 100 meters of stream. The amount of LWD recorded in this reach is in the poor category as classified by ODFW habitat benchmarks.

Middle Creek from the fish ladder to it's mouth varies between type C and probably type E streams. This section was the first settled and developed and impacts have been extensive enough that no relic areas remain. Land in agricultural use for many years will have poor LWD recruitment, but likely would exhibit residual large hydrologic constraints that may have been buried in the streambanks for many years. A 1994 survey showed an average of 6 pieces of large woody debris (>3m X 0.15m) and a wood volume of 4.5 cubic meters per 100 meters of stream over the pool/riffle section of Middle Creek. The lower one quarter of this reach, which had a more gentle gradient, had an average of 45 pieces and an average volume of 141 cubic meters per 100 meters of stream. There was less than one key piece of wood per 100 meters of stream which would indicate that although the number and volume per 100 meters is fairly high it is made up of small, less durable wood. The amount of LWD recorded in this entire reach is in the poor category as classified by ODFW according to habitat benchmarks.

Large woody debris is also the primary source of ocean driftwood. This large organic debris floats downhill from the forest to the sea. This material is processed by organisms as it makes it's way downstream. Major storm events accelerate the rate which LWD is moved to the sea. In the tidal segment of coastal streams and rivers, driftwood provides shelter from predators for fish, such as stickleback, sturgeon, starry flounder,and juvenile and adult trout and salmon (Maser and Sedell 1994.). This large organic material also provides habitat for many marine organisms and stability to ocean beaches. Historical records of efforts to remove large wood, known as "snags," from the estuary and lower section of the Coquille River are good indicators of the pre-settlement conditions of the basin. Between 1899 and 1923, more than 8,000 snags were removed from the river to improve navigation. The volume of large wood at the mouth of the Coquille River declined by 60 percent between 1970 and 1985 (USDI, BLM 1993b).

Special Status Aquatic Species **-** [Current status for coho, steelhead, cutthroat, and chinook at beginning of this chapter.] There are two federal candidate invertebrate species, Burnell's false water penny beetle, *Acneus burnelli* and Denning's agapetus caddisfly, *Agapetus denningi* are thought to be present in the subwatershed. Chum salmon *Oncorhynchus keta* are on the State of Oregon sensitive species list, however, their presence in the subwatershed is thought to be individuals that have strayed from other coastal runs. In addition, Pacific lamprey *Lampetra tridentata* is included on the State of Oregon vulnerable species list.

Currently, approximately 350 species of mollusks are known to occur in forests within the range of the northern spotted owl (FEMAT 1993). Over 100 species have been identified as being associated with late-successional forests. These include aquatic and land snails and slugs. The range of many of these species is unknown, although only a few are thought to occur in the region of the province that includes Middle Creek. Many of the aquatic species are associated with small springs and seeps that have not been included in past inventories. Future aquatic inventories should be undertaken to determine if any of these species occur in the subwatershed.

References

Benda, L.E. 1985. Behavior and effect of debris flows on streams in the Oregon Coast Range. In: Bowles D.S., ed. Delineation of landslides, flash floods, and debris flow hazards in Utah. Utah Water Research laboratory General Series UWRL/G-85?03, Logan, Utah. 153-163.

Bisson, P.A.; Bilby, R.E.; Bryant, M.D.; Dolloff, C.A.; Grette, G.B.; House, R.A.; Murphy, M.L.; Koski, K.V.; Sedell, J.R. 1987. Large woody debris in forested streams in the Pacific Northwest: past, present, and future. In: Salo, E.O.; Cundy, T.W., eds. Streamside management: forestry and fisheries interactions. Contribution Number. 57. Seatle, Washington: University of Washington, Institute of Forest Resources. 143-190.

Dodge, O. 1898. *Pioneer History of Coos and Curry Counties, Or. 2nd ed*. 1969. Bandon, Or. 468 pages.

Farnell, J.E. 1979. Coos and Coquille Rivers navigability studies. State of Oregon, Division of State Lands. 107 p.

Forest Ecosystem Management Assessment Team (FEMAT). 1993. *Forest Ecosystem Management: An Ecological, Economic, and Social Assessment.*

Harmon, M.E.; Franklin, J.F.; Swanson, F,J.; Sollins, P.; Gregory, S.V.; Lattin, J.D.; Anderson, N.H.; Cline, S.P.;

AumenN.G.; Sedell, J.R.; Lienkaemper, G.W.; Cromack, K.,Jr.; Cummins, K.W. 1986. Ecology of course woody debris in temperate ecosystems. Advances in Ecological Research. 15:133-302. New York, NY: Academic Press.

Maser, C.; Sedell,J.R. 1994. From the forest to the sea: the ecology of wood in streams, rivers, estuaries, and oceans. St. Lucie Press, Delray Beach, Fl. 200 p.

Nehlsen, W., Williams, J.E., and Lichatowich, J.A. 1991. *Pacific Salmon At The Crossroads: Stocks At Risk From California, Oregon, Idaho, and Washington*. Fisheries. 16(2):4-21.

Nickelson, T.E., Nicholas, J.W., Mcgie, A.M., Lindsay, R.B., Bottom, D.L., Kaiser, R.J., and Jacobs, S.E. 1992. Status of anadromous salmonids in Oregon coastal basins. Ocean Salmon Management, Oregon Department of Fish and Wildlife, Portland. 83 p..

Rosgen D.L., 1994. A classification of natural rivers. Catena. 22: 169-199

Sedell, J.R.; Luchessa, K.J. 1982. Using the historical record as an aid to salmonid habitat enhancement. In: Armantrout, N.B., ed. Acquisition and utilization of aquatic inventory informatiom: Proceedingd of the symposium; Bethesda, MD. American Fisheries Society, Western Division. 210-223.

Sedell, J.R.; Swanson, F.J.; Gregory, S.V. 1984. Evaluating fish response to woody debris. In: Hassler T.J., ed. Pacific northwest stream habitat management workshop. Proceedings of the workshop. Arcata, CA. American Fisheries Society, Western Division. 222-245.

Swanston, D.N. 1991. Natural processes. American Fisheries Society Special Publication 19. 139-179.

USDI, BLM. 1993b. Coos Bay District Draft RMP