CHAPTER 3 - LIMITING FACTORS

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

APPENDICES REFERENCED

CHAPTER 3 - LIMITING FACTORS

A. INTRODUCTION

As discussed in Chapter 1, salmonid habitat is an issue which the CWA can control and/or restore. While the *Action Plan* focuses on the current needs of salmonids, it will conserve and restore crucial elements of natural systems that support other fish species, wildlife and people.

Fish habitat has declined over space and time in the Coquille watershed. Sustained salmonid productivity requires a network of complex and interconnected habitats, which are created, altered and maintained by natural physical processes in freshwater, estuaries, and the ocean. These diverse habitats are crucial for salmonid spawning, rearing, migration, maintenance of food webs, and predator avoidance.

High-quality fish habitats have common components which can be described and/or measured, i.e.: water quality, water quantity, habitat access, and a number of habitat elements. Habitat components are affected by both natural and man-caused events. When a habitat component falls below a certain benchmark level, it may become a limiting factor on fish production. For the anadromous fishery to increase, these limiting factors must be identified and addressed where they occur.

B. WATER QUALITY

The condition and availability of water in the Coquille basin is impacted by both natural and human causes. Inversely, water quality and quantity affect both the natural and human environments as the cycle goes full circle.

Abundant, clean, water is necessary for drinking, irrigation, and recreation (some water-contact recreation includes fishing, swimming, boating, scenic values, camping, and recreational mining). Good water quality is also necessary to sustain instream fisheries. Some of the human and natural factors limiting water quality are discussed below.

Water quality standards, as defined by the Clean Water Act, have two elements.

- the beneficial use being protected (listed in Table 3-1 below), and
- the specific "water quality criteria" or benchmark, which represents the quality of water that supports a particular use.

1. BENEFICIAL USES

Anadromous fish passage, salmonid spawning and rearing, and resident fish and aquatic life are often the most sensitive of the beneficial uses. For example, juvenile coho are extremely sensitive to elevated temperature regimes during their life cycles. Conversely, irrigation is not a temperature sensitive beneficial use. Water quality criteria for levels of fecal coliform, low dissolved oxygen, and sediment/turbidity are contained in Appendix D.

TABLE 3-1
SOUTH COAST BASIN BENEFICIAL WATER USES TO BE PROTECTED [1]

Beneficial Uses	Estuary & Adjacent Marine Waters	All Streams & Tributaries Thereto
Public Domestic Water Supply*		X
Private Domestic Water Supply*		X
Industrial Water Supply	X	X
Irrigation		X
Livestock Watering		X
Anadromous Fish Passage	X	X
Salmonid Fish Rearing	X	X
Salmonid Fish Spawning	X	X
Resident Fish and Aquatic Life	X	X
Wildlife and Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydro Power		X
Commercial Navigation & Transportation	X	

*With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards.

2. WATER QUALITY CRITERIA

Low Dissolved Oxygen Levels

Dissolved oxygen (DO) is important for maintaining a healthy and balanced distribution of aquatic life, and was one of the earliest measures chosen for protecting water quality. Salmonid species are the most sensitive beneficial use affected by DO concentration. In

[1] Table 4, Oregon Administrative Rules Chapter 340, Division 41, Section 322, DEQ

particular, the juvenile stage of salmonids is sensitive to even a slight reduction in oxygen during emergence from gravel spawning beds.[2]

Current data does not indicate that medium and high gradient areas of the Coquille River system have unacceptable DO levels. However, in the low gradient reaches the situation appears to be magnified as a result of elevated water temperatures and heavy organic loading in the head of tide area.

Organic material held in fine sediments results in an elevated sediment oxygen demand (ODEQ, 1992). Oxygen carried in the water is absorbed by this organic material and leaves water low in dissolved oxygen. As water temperatures increase, water holds even less oxygen. Point sources of organic materials include sewage treatment plants, other permitted National Pollution Discharge Elimination System Sites (NPDES), and Confined Animal Feeding Operations (CAFO). Refer to Appendix E for NPDES permitted sites and Appendix F for permitted CAFOs. Examples of non-point sources of organic material include in-channel stock watering and improperly maintained septic tanks and drainfields.

Coquille, Myrtle Point, and Powers are working to upgrade sewage treatment facilities to reduce the discharge of oxygen demanding substances. Bandon has completed upgrades necessary for their facility. The total maximum daily loading (TMDL) study conducted by ODEQ have resulted in the establishment of waste load allocations (WLA) for these facilities. Decreasing stream temperatures will improve DO saturations. Continuous monitoring will be required to determine if diurnal fluctuations in DO are problematic.

Oil and Toxins

[2] 1992-1994 Water Quality Standards Review - Final Issue Papers, June 1995, pg iv.

Toxic substance concentrations (or combinations) may be harmful, or may chemically change to harmful forms in the environment. They may also accumulate in sediments or bio-accumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare; aquatic life; wildlife; or other beneficial uses[3].

Toxic substances may have been introduced from a variety of point and non-point sources in the watershed such as: cumulative storm water discharges, spillage, and minor industrial sources. Little is known about their fate or transport in the system.[4]

Sediment/Turbidity

High sediment loads fill pool habitat, cover spawning gravels, and entrain organic material reducing intergravel dissolved oxygen. Sediment deposition can result in temporary barriers to upstream adult migration, aggradation of low-gradient reaches of streams, losses in deep water habitat, and elevated temperatures. Extreme turbidity events can result in gill abrasion and subsequent chronic effects on fish.

The Coquille River basin is naturally sediment productive due to the interplay of terrain, geology, and precipitation (ODEQ, 1992). Heavy seasonal rainfall combined with steep, thinly soiled slopes on unstable bedrock leave the drainage highly susceptible to earth-flows, debris slides, erosion, and flash flooding.

Excessive sedimentation from erosion in the watershed was identified as a potential cause for concern by the Soil and Water Conservation District (1983) and in the Preliminary Statewide Non-point Source Assessment (ODEQ, 1988). Elevated turbidity and sediment loads in all zones can be attributed to the effects soil disturbing activities such as road building, timber harvest, forest fires, and active bank erosion above the head of tide.

Temperature

Warm-season water temperatures appear to be one of the most critical, potential limiting factors in the Coquille drainage. In addition, warm water temperatures work in concert with other limiting factors to exacerbate their impacts.

Aquatic life is the beneficial use most sensitive to water temperature. Salmonid fishes, and some amphibians appear to be the most temperature-sensitive species. It is assumed that if

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[3] Oregon Administrative Rules Chapter 340, Division 41, Section 325 (2)(p), DEQ, 1996.

[4] (Draft) Near Coastal Waters Pilot Project "Action Plan for Oregon Estuary and Ocean Waters", 1990.

summertime temperatures are maintained within recommended limits, cooler temperatures will be maintained for spawning, egg incubation and development during late fall, winter, and spring as well.

Stream temperature is measured as the 7-day moving average of the daily maximum temperatures. If there is insufficient data to establish a 7-day average of maximum temperatures, the numeric criteria is applied as an instantaneous maximum. Appendix G contains stream temperature monitoring data for selected Coquille basin streams. These data sets will be a valuable asset in focusing future monitoring efforts, establishing restoration priorities, and for possible Water Quality Management Planning in the future. Delta-T values can assist in determining where excessive warming is occurring and is key information in determining how area streams might be cooled.

Many of Oregon's streams warm during the summer to temperatures above those optimal for native cold-water fish species. Human activities as well as natural factors, combined with low summer flows, contribute to this warming.

Human activities, particularly those that alter the stream channel; the riparian area; or stream-flow, influence stream temperature. These activities include grazing, logging, vegetation removal, stream channelization, water diversions, wetland drainage or filling, diking, reservoirs, and point-source discharges. Many of these activities were conducted using practices not currently approved. Over the years, channel widths have increased, while water depth has decreased.

Oregon is toward the warm (southern) end of the geographic range within which many native cold-water fish species occur. Thus, our natural, unaltered stream temperatures may be higher than those in Washington, British Columbia, or Alaska, where the same species occur.[5] Also, stream temperatures vary naturally in the short-term [daily, seasonally, following natural disturbances (e.g., floods)] and with long-term climatic changes. Stream temperatures also exhibit natural geographic variability, i.e., headwaters versus lower reaches or stream orientation (a result of elevation, gradient, time of exposure to air temperatures, amount of ground water inflow, and shade).

3. WATER QUALITY LIMITED STREAMS

Table 3-2 lists 22 streams or stream segments in the Coquille River system and the parameters which do not meet water quality standards under Section 303(d) of the Clean Water Act for fisheries (and other) beneficial uses. Fourmile Creek is also listed for temperature. More supporting data or information is needed for these same streams or stream segments to determine if there are other parameters which do not support beneficial uses.

Table 3-3 lists 15 streams or stream segments in the Coquille River system with a "Needs Data Status" included in the 1994/96 Oregon Section 303(d) List Decision Matrix. The table lists those parameters for which more supporting data or information is needed to determine if the streams do or do not meet Section 303(d) listing criteria. Twomile Creek is also included in this category for temperature. Figure 3-1 locates the streams listed in Tables 3-2 and 3-3.

[5] 1992-1994 Water Quality Standards Review - Temperature - Final Issue Papers, June 1995, pg 1-7.

Plus Twomile and Fourmile Creeks.

C. WATER QUANTITY

Low flows in the summer create water shortages for domestic use, livestock watering, irrigation and fish habitat. Many of the water quality problems in the Coquille River can be exacerbated by low flows, which fail to provide adequate dilution for nutrient rich, oxygen consuming pollutants discharged from sources year round. Low summer flows also result in greater diurnal temperature fluctuations, which can place an additional burden on some aquatic life already stressed by other factors. In addition, salt water intrusion may be greater during low flow periods, threatening the supply of groundwater and surface water for many users.[6]

1. NATURAL LIMITATIONS

In western Oregon, river flows are closely tied to rainfall, resulting in a seasonal pattern of winter floods and summer shortages. Annual precipitation within the watershed ranges from 50 inches in drier areas like Camas valley to 120 inches, with very little of the precipitation falling as snow. Rainfall from year to year is quite variable and appears to be a function of cyclical patterns occurring on 20- to 30-year intervals.

Fairly continuous rainfall between November and March rapidly causes the ground to become saturated. Runoff is very rapid because of poor water storage in the steep, thin soils of the upper watershed. Floods are likely to occur during this period, but may occur as early as September or as late as May. Very little rainfall occurs in the late summer and early

[6] Near Coastal Waters Pilot Project "Action Plan for Oregon Estuary and Ocean Waters:, 1990, pg 15-16.

TABLE 3-2
WATER QUALITY LIMITED STREAMS - 303(D) LIST[7]

Name	Description	Parameter				
		DO	FC	CA	HM	T
Bear Creek	Mouth to Headwaters	X	X			
Big Creek	Mouth to Headwaters					X
Catching Creek	Mouth to Headwaters					X
Cherry Creek	Mouth to Headwaters					X
Coquille Bay	Mouth to Prosper		X*			
Coquille River	Prosper to North/South Fork Confluence	X+	X	X		X
Cunningham Creek	Mouth to Headwaters	X++	X**			
Dement Creek	Mouth to Headwaters					X
East Fork Coquille River	Mouth to Headwaters					X
Johnson Creek	Mouth to Headwaters					X
Little North Fork Coquille River	Mouth to Headwaters		X			X
Middle Fork Coquille River	Mouth to Upper Rock Creek	X	X			X
North Fork Coquille River	Mouth to Middle Creek	X+	X			X
North Fork Coquille River	Middle Creek to Headwaters					X
Rock Creek (Middle Fork near Remote)	Mouth to Headwaters					X
Rock Creek (South Fork drainage)	Mouth to ~ RM 3				X	X
Rowland Creek	Mouth to Headwaters					X
Salmon Creek	Mouth to Headwaters					X
Sandy Creek	Mouth to ~ RM 5					X
South Fork Coquille River	Mouth to Yellow Creek		X			X
South Fork Coquille River	Yellow Creek to Johnson Creek					X
South Fork Coquille River	Johnson Creek to Headwaters					X

DO=Dissolved Oxygen - Salmonid Spawning: October - April.
+=Dissolved Oxygen - Cold Water Aquatic Life: May - September.
++=Dissolved Oxygen - Annual.

FC=Water Contact Recreation (Fecal Coliform) - Fall through Spring.
*=Fecal Coliform - Shellfish Growing Waters - Annual.
**=Water Contact Recreation (Fecal Coliform) - Fall through Spring and Summer.

CA=Chlorophyll a - Summer.
HM=Habitat Modification

7 1994/96 Oregon Section 303(d) List Decision Matrix, pgs 21-36.

T=Temperature - Summer

TABLE 3-3
STREAMS WITH A "NEEDS DATA STATUS"[8]

Name	Description	Parameter
Baker Creek	Mouth to Headwaters	Sediment
Beaver Creek	Mouth to Headwaters	Algae Dissolved Oxygen Nutrients Sediment
Bill Creek	Mouth to Headwaters	Temperature
Elk Creek	Mouth to Headwaters	Sediment
Fat Elk Creek	Mouth to Headwaters	Habitat and Flow Modification
Foggy Creek	Mouth to Headwaters	Habitat Modification Sediment Temperature
Hall Creek	Mouth to Headwaters	Habitat and Flow Modification Sediment
Middle Fork Coquille River	Upper Rock Creek to Headwaters	Sediment Temperature
Moon Creek	Mouth to Headwaters	Habitat Modification
Myrtle Creek	Mouth to Headwaters	Habitat Modification Sediment
Panther Creek	Mouth to Headwaters	Habitat Modification Temperature
Pulaski Creek (*B)	Mouth to Headwaters	Habitat and Flow Modification
Rock Creek (Myrtle Creek Drainage)	Mouth to Headwaters	Habitat Modification Sediment
Twelvemile Creek	Mouth to Headwaters	Sediment Temperature
Wooden Rock Creek (Middle Fk.)	Mouth to Headwaters	Habitat Modification

[8] 1994/96 Oregon Section 303(d) List Decision Matrix, pgs 21-36

FIGURE 3-1 303(d) LISTED AND "NEED DATA STATUS" STREAMS

fall. This, combined with a lack of snowpack and poor water storage in the upper watershed, results in late summer and early fall river flows that are a fraction of winter discharges.

The Coquille River has a mean annual discharge of 3288 cubic feet per second (cfs) (EPA, 1988), which is equivalent to 2,400,000 acre feet of water per year. Approximately 90% of the annual discharge is recorded in the months from November through April, and less than one percent during August and September. For example, in the 31 year period from 1930 to 1961, the average monthly discharge at the mouth of the Coquille River in September was 130 cfs, while in February it averaged 8,250 cfs (USGS, 1984).

2. HUMAN-CAUSED LIMITATIONS

Exacerbating the natural pattern of low summer flows are increased withdrawals for consumptive uses for drinking water and irrigation. There are many surface water intakes for both community and individual drinking water systems in the Coquille Basin. The cities of Bandon, Coquille, Myrtle Point, Powers, and a multitude of individual homes are served by surface water withdrawals.

The ODFW has recently applied for enhanced instream water rights to assure adequate flow to support the fishery. Many streams will not provide flows identified within these applications even with zero allocation for withdrawal.

D. HABITAT ACCESS

1. HUMAN-CAUSED LIMITATIONS

Several man-made fish migration barriers exist in the Coquille basin. Culverts, tide gates and dams are the best examples, they can prevent fish access due to steepness, velocity, or inaccessibility. The result is a loss of viable instream habitat.

Culverts

Some road culverts act as fish passage barriers and result in a direct loss of access to viable instream habitat. Some road culverts act as partial barriers that drain energy needed to spawn. The passage of both returning adults and rearing juveniles especially during winter flows are of concern.

Tide Gates

Tide gates can result in both degraded water quality and loss of off-channel and instream habitat. They have been widely placed at tributary/main stem confluences in low gradient reaches to control flooding and salt water infringement. These structures have the following effects on water quality and fish passage:

- A reduction of available salt marsh transition zones.
- A constriction and obstruction of flows draining from flooded wetlands.
- Historic tidal fluctuations are interrupted.

- Can present a physical passage barrier, which can result from poorly maintained gates (i.e. partially stuck closed) or properly maintained gates with heavy lids during low flows. The effects tide gate structures have on fish migration is poorly understood.
- Water quality often suffers behind tide gates as an artificial head of tide is formed. Waters behind closed tide gates can display elevated temperature and poor dissolved oxygen levels.

Both physical and water quality impacts need to be better defined, but through a modified management of ditching and tide gate activities, benefits are likely to be realized. The CWA is currently developing pilot activities directed towards achieving a better understanding of tide gates and related issues. These projects seek to find which installations are problematic and which are not. Examples of pilot projects include retrofitting, block and tackle, and pet door installations in the Ferry Creek and Geiger Creek areas.

Dams and Diversions

Small dams and diversions exist in the watershed. The CWA will work with the Water Resources Department and use stream habitat surveys to identify these and take appropriate action.

2. NATURAL LIMITATIONS

Log jams and falls are naturally occurring features of high gradient stream reaches, and develop and dissipate often as a result of flood events.

E. HABITAT ELEMENTS

Table 3-4 displays the habitat benchmarks currently being used by ODFW for the habitat elements discussed below. The habitat element discussion gives an ecological basis and historical context of conditions in the Coquille basin.

1. SUBSTRATE

Gravel can be available in a stream, but have relatively low amounts located appropriately for spawning. Streams deficient in wood or boulder structure often experience gravel transport to non-spawning areas.

2. LARGE WOODY DEBRIS

Removal of large woody debris and boulders entrained in the riparian and river system began soon after the arrival of early European settlers. Where these actions took place, the removal of structure has resulted in significant losses of instream habitat during elevated flow events, loss of sediment and gravel deposition areas, and the loss of channel diversity and deep water pool habitat. Lack of large wood recruitment potential is problematic in all forks of the Coquille River.

3. OFF-CHANNEL HABITAT

Wetlands and floodplains provide calm water refuge areas for juvenile fish during high water flow events. Wetland losses include, in particular, a network of backwater and off-channel ponds that once functioned as over-wintering habitat for anadromous fishes.

TABLE 3-4
HABITAT BENCHMARKS - ODFW AQUATIC INVENTORY & ANALYSIS PROJECT

		Habitat Component	Undesirable	Desirable
POOLS		Pool Area (%Total Stream Area)	<10	>35
POOLS		Pool Frequency (Channel Widths Between Pools)	>20	5-8
POOLS	Depth	Small Streams (<7m width)	<0.2	>0.5
POOLS	Depth	Med. Streams (7m<S<15m width) - Low Gradient (<3%)	<0.3	>0.6
POOLS	Depth	Med. Streams (7m<S<15m width) - High Gradient (>3%)	<0.5	>1.0
POOLS	Depth	Large Streams (>15m width)	<0.8	>1.5
POOLS		Complex Pools (wood complexity >3)km	<1.0	>2.5
RIFFLES		Width/Depth Ratio	>30	<15
RIFFLES		Gravel (%Area)	<15	>35
RIFFLES		Silt-Sand-Organics (% Area)		
RIFFLES		Volcanic Parent Material	>15	<8
RIFFLES		Sedimentary Parent Material	>20	<10
RIFFLES		Channel Gradient <1.5%	>25	<12
SHADE		Stream Width <12 meters	<60	>70
SHADE		Stream Width >12 meters	<50	>60
WOOD		Pieces / 100m Stream Length	<10	>20
WOOD		Volume / 100m Stream Length	<20	>30
WOOD		Key Pieces (>60cm dia. & > 10m long)/100m	<1	>3
Riparian Conifers* # > 20in dbh/1000ft Stream Length			<150	>300
Riparian Conifers* # > 35in dbh/1000ft Stream Length			<75	>200

* 30m From Both Sides of Channel

4. RIPARIAN PROTECTION

The Oregon Forest Practices Act specifies current riparian buffer requirements on private timberland. The state also has a Riparian Property Tax Incentives Program administered by the Oregon Department of Fish and Wildlife. Coos County has ordinances which provide for a 50' riparian setback (92-05-009PL) and also a 50' riparian vegetation protection zone.

The Bureau of Land Management and US Forest Service maintain Riparian Reserves along all intermittent and perennial streams, as well as wetlands and other aquatic areas on public lands within the Coquille watershed. Fish-bearing streams are provided with reserves averaging approximately 400 feet on each side of the stream.

5. STREAMBANK CONDITION

Early historical accounts identified portions of the Coquille River as a meandering river. Although streambank erosion is often observed in meandering systems, currently stream channels are severely eroding in mid and low gradient portions of the Coquille. Long-term land uses have changed the composition and amount of riparian vegetation, resulting in the degradation of stream corridors and channel banks.

The historic use of splash dams and the removal of channel wood and boulders has resulted in severe disturbance and down cutting of some existing channels (ODEQ, 1992). Modification of waterways, including channelization and dredging, increased peak flows and sedimentation.

6. FLOODPLAIN CONNECTIVITY

Three factors were prominent in the loss of functioning wetlands:

- The severing of tributary floodplain connectivity.
- Human disturbances that have impacted the meandering of tributary streams of the lower Coquille (channelization).
- Flood control measures implemented in recent decades.

The main stem of the Coquille remains connected to historic floodplains and actively floods yearly, although the connectivity is somewhat affected by diking as a result of roads, power lines, and, less frequently, agricultural activities. However, many tributary floodplains have been disconnected and are no longer functioning in flood events (e.g., 10, 25, 50, 100 year storm events). This loss of connectivity to floodplains and wetland areas has resulted in accelerated sedimentation into tributary stream channels, decreasing the natural application of upland sediments to wetland areas through flood events. As a result, the agricultural community continues to invest heavily in the removal and disposal of accumulated sediments.

Many systems have been channelized in order to remove meanders and maximize agricultural production. Dikes and drainage ditches are other alterations that were employed for flood control, and typically run parallel to the streams. Flood control dikes, tide gates and channel maintenance practices that promote rapid drainage have decoupled side channel tributaries from the main stems of the low gradient portions of the Coquille River and its tributaries. These changes have resulted in corresponding fish habitat losses in the mid-slope and tidal portions of the system. However, if managed to maximize benefits, drainage ditches can provide off-channel habitat that was not present in historical times.

There are no federally constructed flood control projects in the Coquille River Basin. The Army Corps of Engineers (COE) conducted emergency flood control measures mostly in the Beaver Slough Drainage District for repair, restoration and straightening of levees and other flood control works. Local Drainage Districts conducted most of the flood control activities, which included the protection of several tracts in the lower Coquille by levee construction. In 1942, for example, a district drained 5,100 acres by constructing canals and outlet conduits with tide gates. Private land owners have installed and maintained drainage conduits (COE et al, 1972).

F. COMPARISON OF LIMITING FACTORS

TABLE 3-5
COMPARISON OF LIMITING FACTORS BY SUB-WATERSHED

Forks	Temp	Turbidity/ Sediment Loading	Dissolved Oxygen	Wetland Losses	Channel Complexity	Gravel Availability	Barriers	Summer Stream-flow
North (East)	1	2	3	2	1	1	1	2
Middle	1	1	3	2	1	1	1	2
South	1	1	3	2	1	2	1	2
Main Stem	1	1	1	1	1	3	1	1

1=High Concern 2=Moderate Concern 3=Low Concern
References: NPS Assessment, ODEQ, 1988. Coquille River TMDL, 1994.
Personal Communication Jim Muck, ODFW, 1994. Pam Blake, ODEQ, 1994.

G. HISTORICAL IMPACTS ON HABITAT COMPONENTS[9]

Salmonids evolved in freshwater ecosystems that were historically characterized by flood

[9] This entire section is abridged from the Historical Reconstruction of the Coquille River and Surrounding Landscape, ODEQ. 1992

plains, braided channels, and off-channel areas; all of which contained considerable structural complexity, such as large woody debris and debris jams.[10]

The cumulative impacts of natural events and human activities have changed salmonid habitat resulting in the decline of salmonid populations in the Coquille watershed. Natural events can have short- and long-term effects on freshwater, estuarine, and oceanic habitats. Examples of natural events include: short-term droughts, freezing, and floods; as well as long-term trends of cooling, warming, low rainfall, high rainfall, high or low oceanic productivity, etc.. Human activities such as fishing, artificial propagation, alteration of spawning and rearing habitats, and introduction of exotic species have also impacted the fishery.

Contemporary habitats in the Coquille are often characterized by a combination of the following conditions which have altered flows, tidal movement, and flushing action; affecting wetlands and other wildlife and aquatic habitat:

- Stream channels generally lack complexity.
- Insufficient large wood is present in stream channels.
- Off-channel, wetland and slough habitat is uncommon.
- Water temperatures are higher in some areas because riparian vegetation has been reduced and channel depth has decreased due to sedimentation (increased W:D ratio).
- Summer flows are lower in some areas because less water is retained in upriver areas and water is withdrawn from streams.

1. ESTUARY, RIVER AND WETLANDS

Early settlers were attracted to lower sections of coastal rivers in Oregon because these estuaries offered the physical characteristics of natural ports. This was especially true of the Coquille River basin where European settlement began in the early 1850's. The Coquille River not only provided a navigable harbor, but also initially offered over 40 miles of tidally influenced river, exceeded in length in Oregon only by the Columbia River. The Coquille initially lacked a consistently safe river entrance, but beginning in 1881, the U.S. Army Corps of Engineers (Corps) dredged the bar and constructed jetties which narrowed, deepened and stabilized the river mouth entrance.

Although there is only limited information about the Coquille River in the early years when the basin was first settled, it is apparent from the information that is available that major changes have occurred to the system and habitat over the past 100 years. An early record describes the river area being 350 feet in width for twenty-five miles and navigable for that distance by vessels drawing fourteen to fifteen feet of water. Steamers of lesser draft were able to reach up to Myrtle Point. Another early report from the book, Pioneer History of Coos and Curry Counties, Oregon, by Orvil Dodge, describes a ferry service operated by Abraham Hoffman at

[10] The 1997 Oregon Plan, Chapter 3, pg 3-4.

the confluence of the Middle and South forks of the Coquille River. According to Dodge, this area was deep and influenced by the tide until the settlers cleared the timber from the banks of the river. That confluence is now shallow and the upper limit of significant tidal influence is several miles downstream.

At the time of Euro-American settlement in the mid-1800s, the valley's landscape features included vegetational communities associated with lands annually inundated with water from periodic river flooding, persistent coastal rainfall, and surface and sub-surface runoff from the uplands.

Original notes from surveys of the Coquille Valley between 1857 and 1872 give detailed information on historical features of the valley. The tidal section of the Coquille River at that time was linked with over 20,500 acres of bottomlands, 70% of which were marshy in character. Of these 14,350 acres of marshland, 87% were densely covered with trees and shrubs, and the balance was grassy marsh. Over-story species included myrtle, alder, maple, ash, and spruce, with an under-story of salmonberry, willow, crab-apple, and coarse grass. In some instances, swampland was covered with a dense thicket of willow and alder brush, rather than trees. The current estuary of the Coquille river is one of the smaller in the state containing 380 acres of tidelands, and 383 acres of permanently submerged land.

The influences of the historical marshland features on the landscape and its resources are broad in scope. The marshlands served as a source and regulator of nutrients, including regular inputs of leaves and other organic materials that were consumed by aquatic insects and other invertebrates. The trees and brush trapped and deposited sediment on the bottomlands, and standing trees trapped woody debris in the floodplains as it was transported from upriver during floods. The complex habitat structure created by the vegetation and downed wood enhanced tidal creek habitat and provided cover for fish during flood periods.

Substantial alterations to the woodlands, such as filling and diking, were necessary to make the valley habitable and allow agricultural development. According to English and Skibinski (1973), most of the marshes had been converted to farm land by 1870. Beaver dams that created pond habitat for anadromous fishes were also removed.

Although some river bank failure is inevitable along alluvial valley streams, tree and brush communities (now scarce) once protected the banks by providing many layers of protection.

Removal of Channel Wood

Removal of large wood from the tidal and upriver sections of the Coquille River to clear the channel of obstructions began soon after settlement. This material, also referred to as snags, was removed because it created problems for commercial boat traffic as well as the gill net fishery that operated on the river. Gill netting was outlawed by the State in 1925.

The Corps became involved in channel maintenance in the tidal section of the Coquille River in the late 1880s, but discontinued channel maintenance projects on the river above Bandon in 1924.

The Port of Coquille was formed in 1911 to assume the responsibilities of maintaining the Coquille River above the city of Coquille that was no longer regularly maintained for navigation by the federal government. The Port worked intensively to maintain a navigable channel up to Myrtle Point between 1915 and 1923.

The combined activities of the Port and Corps resulted in an average of roughly 8 snags per mile per year being removed from the channel below Myrtle Point. The Port of Bandon, the lower river port agency, was formed at about the same time as the Port of Coquille, and has periodically dredged and cleared the channel of large wood over the years.

In the recent past, the Oregon Department of Fish and Wildlife (ODFW), federal agencies, and the private industry actively removed logs, jams, and other wood structures from hundreds of miles of coastal streams. The belief at that time was that these materials impacted the upstream and downstream passage of salmonids. Although many of the large jams did impair fish passage, we now know that eliminating this structure greatly reduced winter rearing habitat for juvenile salmonids, greatly reduced habitat diversity, and degraded a substantial amount of aquatic and riparian habitats.

Dredging

The history for the tidal Coquille is one of progressive shoaling, beginning upriver at Myrtle Point, and gradually moving down to the lower river. Channel depth can be influenced by a variety of factors, including the volume of down-river flow, channel width, channel filling, and the ability of flood waters to scour and transport material. Land use activities, including near-stream logging, land and riparian vegetation removal for farming, and the removal of channel wood from tributaries, were probable sources of early inputs of sediment to the tidal channel.

By 1886, the river steamers were experiencing difficulty in traveling the last mile to Myrtle Point during lower flows. A river survey in 1891 reported that six shoals had formed above the city of Coquille. By 1897, another shoal formed a mile down-river of the others. Because the results of dredging were only temporary, pile-dike construction and dredging attempts in the 1890s failed to restore a navigable channel. In 1902, the Corps abandoned their efforts to maintain the river between Coquille and Myrtle Point. The Port of Coquille's attempts to restore the last 5 miles of channel to a 4 foot controlling depth between 1915 and 1923 were also temporary.

During the fifteen years that the Corps had repeatedly dredged upriver, the tidal river from Coquille to Bandon was free of shoals. By 1903, however, two shoals had formed in this stretch, and by 1920 the number of shoals had increased to six. Over the next sixteen years, the Corps repeatedly dredged these channel areas to restore and maintain a channel 9 to 10 feet deep and about 100 feet wide, until the project ended in 1924.

2. UPLANDS

The uplands were heavily forested with fir, cedar, hemlock, spruce, and some pine. Approximately 2,200 acres burned in a fire prior to 1870.

Historical Logging

Like other coastal river basins in Oregon, past logging practices had major negative impacts on fish and riparian habitats. Standard logging practices prior to 1972 included splash dams, downhill logging, decking of logs in streams, building of roads, and train tracks along stream courses, and the elimination of hundreds of miles of valuable riparian vegetation along the streams.

Prior to forest road construction, the Forks of the Coquille and their tributaries were the only attractive options to logging companies for the transportation of logs down-river to mills, regional railroads, or main transportation routes. However, early transport of logs down the tributaries could only occur in the winter season during high flow events. A more convenient method of stream log transport was to augment the stream flow through the construction of wooden splash dams. These dams stored water that was released when needed to float the logs downstream.

At least twenty-five splash dams were operated in the Coquille system, which included 8 on the North Fork, 4 on the East Fork, and 3 on the Middle Fork. Single splash dams were built on Middle, Elk, Big, Sandy, and Cherry Creeks. Myrtle and Rock Creek had 2 dams each and 1 on Dement Creek off the South Fork.

The Port of Coquille Commission was created in 1911, about the time that the first splash dams were being built. The Commissions' upriver responsibilities included the improvement and maintenance of channels for navigational purposes, as well as log transportation.

Because many of the tributaries were narrow, the Port trimmed trees and brush along sections of the banks to open and widen the channels, blasted channel boulders, and removed channel snags. The effectiveness of the bank vegetation trimming was significant, and can be best portrayed as follows; the Port reported that on three miles of the East Fork "it formerly took about three days to work a drive of a thousand logs" through the segment, but after the channel work it took "about one and one half hours for an equal amount of logs to pass through." River transportation of logs continued in some tributaries until 1946 (Beckman, 1974).

3. FLOODS AND RELATED EVENTS

Floods are natural, cyclical events. They are an important means of channel formation. Several large floods in the late 1800s caused the loss of homes and livestock, and definitely made an impression on the early settlers. The first flood was in 1861, the second in 1881, and the last in 1890. The 1861 flood was responsible for relocating the mouth of the Coquille River. The 1890 storm and the persistent rainfall during that period probably triggered a large landslide that dammed Salmon Creek and persisted for several days.