A CHANGING LANDSCAPE

INTRODUCTION

In 1800, the basin remained largely a wilderness, untouched by human development. A heavy growth of coniferous trees and understory vegetation armored most stretches of the Clackamas and its tributaries. The river systems' cool streamflows, long shallow gravel beds and deep pools supported mighty populations of salmon, steelhead and resident fish. This ecosystem was not absolutely stable. Natural events caused regular and sporadic changes over time. For example, seasonal floods often caused the stream channel to move or create meanders. Still, the Clackamas maintained a long-term balance as its overall health allowed it to recover from naturally occurring disturbances.

Human activities, especially those after the early 1800s, changed this ecosystem. As more people moved into the area, the natural landscape and river system were developed and harnessed to provide for their growing needs. By harvesting riparian forests, removing instream logs and other wood, extracting sand and gravel from the stream channel, building dams, and diverting streamflows, they altered habitat conditions that had supported Clackamas River salmon and steelhead populations for centuries.

This section reviews settlement in the basin over time. It also discusses many human activities and developments that impacted the Clackamas River landscape and affected salmon and steelhead production. Thus, it provides a context for understanding how a combination of actions through the years contributed to the decline of wild salmon and steelhead runs in the Clackamas River Basin.

INDIAN USE

As early as 10,000 years ago, Indians roamed the Clackamas River drainage and other parts of the lower Columbia River. In these early years, the Indians developed settlements along the banks of the Columbia — including an important trade center near The Dalles (USFS 1993). They were often travelers, moving between river valleys and nearby forests with the changing seasons to fish, hunt, or gather other food and materials. Often, they would travel great distances as they moved between different harvest areas along the Columbia River and tributaries, and into the Cascade mountains. Evidence of their presence in the northern Oregon Cascades dates back at least 8,000-10,000 years (Burtchard et al. 1993). By 2,000-3,000 years ago, however, most settlement in the Clackamas River Basin had moved to the river's lower floodplain. Research suggests that Indians likely established large, permanent villages on the floodplain and traveled in small groups to upland harvest areas.

More than 100 cultural resource sites have been recorded in the upper Clackamas River corridor. Many of these sites display peeled cedar trees where bark was removed for manufacturing baskets. Researchers have also documented almost 50 lithic scatters (Burtchard et al 1993). Findings at a few of these archaeological sites date back about 4,000-6,000 years.

The lower basin was the home of the Clackamas Indians. They were Chinookan speakers, a group that once occupied the Columbia River Valley from Celilo Falls to the Pacific Ocean. Their lands included the lower Clackamas River valley and lower Willamette River from the falls to its confluence with the Columbia River (except Sauvie Island) and reached into the foothills of the Cascade Range.

When Lewis and Clark visited the area in 1806 they found that the Clackamas tribe numbered about 1,800 individuals and occupied 11 villages. Records suggest that the tribe had already been reduced by smallpox in the 1770s. The villages contained lodges or houses built with split-cedar planks. A principal Indian village existed at Oregon City near Willamette Falls (Seaman 1946).

A large Indian village also existed at the mouth of the Clackamas River. One settler, Elisha Applegate, wrote in 1843 of a moss-covered, dilapidated Indian house near the mouth of the Clackamas. She said the building, 300 feet long, was the headquarters for the Clackamas tribe when they were not in their mountain homes. The long house was partitioned into several rooms opening to a porch that ran along the building's south side. This gave each family a separate entrance. Several other buildings existed nearby (Lynch 1973). Other Indian villages stood near the Clackamas River at Estacada and Eagle Creek. John Wacheno, a Clackamas tribe elder, wrote in 1934 of a traditional Clackamas Indian village and summer fishing place near Estacada with 11 or 12 houses. He also mentioned a winter village on Eagle Creek (Ellis 1997).

Many Indian families lived in lower river permanent villages during the winter months and moved to seasonal camps in warmer weather. They knew the land intimately and developed an extensive trail system over the years. This trail network brought Indians from throughout the region to fish at Willamette Falls. During the early- and mid-1800s, early explorers followed the old Indian trails into unexplored country. They knew that the best paths would have been found over the years. One of these trails became the Barlow Road in 1845.

The Indians used several techniques to harvest fish in the Clackamas River. According to Wacheno, the Indians fished with elkhorn toggle head harpoons arming spears thrown from canoes, gill nets, dip nets dropped from platforms and fish traps. The abundance of the harvest, according to Wacheno, kept the Clackamas people busy all summer drying fish to sell (Burtchard et al. 1993).

Several epidemics of smallpox, malaria and measles hit the Clackamas tribe hard in the early 1800s. In 1851, an epidemic so depleted the tribe that only about 88 Clackamas survived (Lynch 1973). The relentless pressures of European influence, including disease and the drive for land, proved too much for the tribe. As a result, in 1855 the Clackamas tribe signed a treaty ceding their lands. Many tribal people moved to the Grand Ronde Reservation. Others settled on the Warm Springs Reservation or stayed on their homeland. Nevertheless, the Estacada area remained a center of settlement and resource use by the Clackamas and Warm Springs Indians for many years (Ellis 1997).

After the turn of the century, Indians from the Warm Springs Indian Reservation still returned to their homeland to visit friends, fish, or to gather berries and other plants. Much of this use was upriver of Estacada (Ellis 1997), but Indian fishing was also popular at River Mill Dam after its construction. Settlers recall that as late as the 1930s, Indians from Warm Springs would camp at Sandy and the men would travel to River Mill Dam to fish while the women gathered berries. Today, some Warm Springs elders still remember drying fish at Estacada and camping near River Mill Dam. Researchers believe the River Mill Dam area was important for fishing before the construction of the dam, but that much of the earlier use took place in the area flooded by Estacada Lake (Ellis 1997).

SETTLEMENT AND USE BY EUROAMERICANS

In the early 1800s, settlers of European background joined Indians in the lower basin. Attracted to the basin's rich resources, many of these new settlers came up the Willamette River from the growing Portland and Oregon City areas. They settled along the lower river valleys and tributaries near the present communities of Gladstone, Carver, and Barton. Improved transportation on the Willamette River in the mid-1800s lured more settlers to the lower basin. Steamboat operations began on the Willamette River with service from Portland to Eugene starting in 1856-1857.

Few early explorers and travelers ventured into the rugged upper Clackamas River basin during the 19th century. Except for a few trails, nonnative travel and exploration routes usually skirted the high rugged mountains in favor of river and valley floors with more gentle terrain and readily available

food. Maps from as late as 1921 show no roads above Cazadero Dam near Estacada (Burtchard et al. 1993).

Two routes were generally used by early explorers and settlers. One of these routes, worn by years of Indian use, was the South Pass trail. It was discovered in November 1812 by Robert Stuart, an Astorian. Two fur trappers, Joseph Meek and Robert Newell, drove their wagons over the trail to Oregon a few years later. It was used again in 1830 when several members of the Rocky Mountain Fur Company brought their wagons, heavy with furs, over the mountains (Lynch 1973). Another old Indian trail, the Barlow Road, became a popular route for emigrants crossing the Cascades and traveling through the Clackamas drainage. It crossed Eagle Creek near the present location of Bonnie Lure Park, turned southward for two miles and crossed the Clackamas River at the old Feldheimer Ferry location (about four river miles downstream from River Mill Dam).

Settlement came slowly to the Clackamas River Valley until the late 1800s and early 1900s. The settlers were first drawn to lands along the lower reaches, which were close to activities in the Willamette Valley. The area saw more growth in the late 1800s after rails replaced the river as the transportation choice for travel from Portland to Oregon City. The Willamette Bridge Railway Company, a predecessor of Portland General Electric, began operating a trolley line in Portland in 1889. This was the first electric trolley on the Pacific Coast. Then in 1893, the company started running a 14-mile interurban electric railroad between Portland and Oregon City, the first in the United States. The electric railway had an enormous impact on the social and economic development of the Oregon City area. Business boomed in Oregon City when the trolley from Portland began service every half hour. The electric railway brought businesses same-day delivery of merchandise and supplies from Portland wholesalers. It also opened new weekend recreation destinations. Canemah Park, at the southern end of the line, became a popular recreation site (Portland General Electric 1982).

Through the 1800s, the area around the present town of Estacada remained at the edge of the settled lands. The area was sparsely populated and surrounded by dense forests. In 1859, settlers built a bridge across the Clackamas River near the mouth of Eagle Creek. The bridge was replaced and improved regularly after suffering flood damages, but remained an important point for crossing the Clackamas through the 19th century (Lynch 1973).

After the turn of the century, the Estacada area became the nucleus of hydro development. Power site investigations, and plant and railroad construction and operation all contributed to the stable economy and growth of Estacada. In 1903, the Oregon Water Power and Railway Company, also a predecessor company of Portland General Electric, built a rail line to the area. The railway ran from Portland through Gresham and Boring to Estacada and served primarily to haul workers, equipment and supplies to the Cazadero site, just east of Estacada. The original plat for the "Town of Estacada" was filed in Oregon City on January 9, 1904 and the city was incorporated in 1905.

Development of the railroad also brought more pleasure seekers to the area — particularly after the company built a hotel and picnic park, and started running excursion trains on weekends. The electrified railroad brought crowds of Portlanders to Estacada and to recreation sites along the Clackamas River. The visitors would board the train in Portland and spend their day picnicking, fishing and swimming. The excellent, affordable meals offered by a local hotel drew other visitors.

The situation was well described in the *Street Railway Journal*, October 29, 1904:

> *"Estacada is a town of 300 or 400 people . . . where six months ago there was nothing but a small farm and standing timber . . . The Hotel Estacada is owned by the Oregon Water Power and Railway Company and has been constructed with a view of providing accommodations for those desiring short and inexpensive outings. ...As a special inducement for Sunday traffic, a rate of 50 cents is given for a round trip from Portland to Estacada, instead of the weekday fare of $1.35. A rate of $1.50 is offered for the round-trip including dinner at the hotel."*

The completion of River Mill Dam in 1911 brought more visitors and residents to the area. The dam formed Estacada Lake and created slack water up to the Cazadero powerhouse. Railway services were expanded, with as many as seven extra trains scheduled on Sundays for pleasure seekers. The interurban lines were advertised as "The Trout Route" in anglers' guides.

The basin's population expanded rapidly through the early 1900s. New settlers and entrepreneurs moved in, using the basin's rich resources to meet increasing demands for goods and services in local communities, and in Portland and Oregon City. For many years poor access limited development to the lower basin. At the time only a few roads existed and they were usually muddy or dusty. Consequently, settlers cut timber and cultivated lands along the lower Clackamas and tributaries.

Above Estacada, the Clackamas River Basin remained a 650-square-mile area of timbered wilderness until the 1920s. The country was too steep and rugged for roads, and contained few trails. In many places, sheer cliffs flanked the river, forcing trails to climb up and down the side of the canyon, and making a trip to the upper country a strenuous task. Fast flows and numerous boulders in the Clackamas restricted travel by boat. For many years, a Forest Service ranger station at Oak Grove, built about 1908, was manned only in the summer fire season because of its isolated location. All supplies were transported into the area by pack train.

Several major wildfires devastated forests in the upper basin between 1868 and 1912, sometimes blanketing the forest and adjacent lowlands so heavily with smoke that darkness fell at midday (Burtchard et al. 1993). Generally, the fires were left alone to complete their natural burn cycle.

Access to the upper basin improved after 1921 when Portland General Electric cut a road through the heavily forested area to reach the Oak Grove project site. About 30 miles of road were built — much of it along the narrow steep-walled Clackamas River canyon — to transport workers, equipment and supplies from the end of the railroad line at Cazadero into the project area. Once the road was in, the company immediately extended the railroad line to the site. The railroad was completed in 1923, bringing a rapid and convenient means of access to the upper Clackamas River Basin upstream from the North Fork.

Settlement in the Clackamas River Basin continued, and by the early 1950s about 86,000 people lived in the Clackamas County area. As the road network improved, the lower basin became a bedroom community to the city of Portland. People moved to the scenic river valleys of the Clackamas and commuted to work in the Portland area. The new residents primarily settled in or near the communities of Gladstone, Estacada and Oregon City. Many service-oriented businesses also sprouted in the lower basin to meet the needs of the growing number of residents and visitors.

Today, the basin is still experiencing rapid growth, particularly near the communities of Gladstone, Estacada and Oregon City. It also draws many visitors. With the development of good roads, people quickly discovered the scenic beauty of the Clackamas River and opportunities for good fishing and white-water boating. Consequently it has become a popular recreation area luring many people from the Portland area, less than two hours away, and from the nearby communities of Estacada, Molalla, Gresham and Sandy. Recreational activities include camping, fishing, scenic driving and hunting. Angling is particularly popular on the lower river below River Mill Dam. Most angling occurs from fall through spring when coho, winter steelhead and spring chinook can be caught. Other visits to the

basin continue to be primarily seasonal, heaviest in the summer months and active during spring and fall weekends.

TIMBER HARVEST

Timber harvest in the lower basin started in the early 1800s. The lack of good roads above the Estacada area and easy access to trees in the lower basin tied most logging activities to lower basin forests until the 1940s.

The first sawmill in Clackamas County was built in 1825 or 1826 on Sawmill Creek, probably the same stream on which Dr. McLoughlin had his flour mill (Lynch 1973). Timber harvest and sawing lumber developed into an important industry and soon sawmills existed all along the Clackamas and tributaries. Many of these sawmills were apparently washed away by flood waters in December 1849. According to notes by one early settler, Lot Whitcomb, "all (sawmills) but one on the Clackamas" washed away during the 1849 flood (Farnell 1979). Other mills were built in the 1850s, including one on Eagle Creek in 1850 and another on Deep Creek in 1856 (Lynch 1973). By the late 1800s, small sawmills, called "gyppo" mills were everywhere in the lower basin.

When possible, loggers used the Clackamas and tributaries to transport the timber to mill sites. The 1880 census records show that logs were floated to mills on Rock Creek, Clear Creek and the Clackamas River. Use of the river as a transportation corridor for timber continued for several years, with at least one early mill owner taking legal action to protect his right to drive timber downstream. Harvey Cross, owner of a sawmill at Gladstone on the Clackamas River (RM 0.8), moved to protect his right to float logs down the river after the 1891 state legislature passed "An Act to Protect the Title of Owners of Floating Logs, Timber and Lumber". In 1893 he registered the sign of a cross "as a mark and destination of all said logs owned by me and cut adjacent to and driven down said stream (the Clackamas)." Records suggest that in November 1895 Cross drove about 3,800 logs down the Clackamas River from about two miles above the mouth of Deep Creek. The following March, he drove 500,000 board feet of saw logs about ½ mile down Clear Creek and then down the Clackamas River to the mill (Farnell 1979).

Another company, the Clarkson and McIrvin Boom Company, also used the river to transport logs. In 1896, the company received permission from the Clackamas County Commissioners to use the Clackamas as "a public highway for the floating and transporting of logs, pilings and poles" and to lease the river to collect tolls for such use. The company proposed to charge tolls on the river below Eagle Creek, below the mouth of Deep Creek and portions of Deep Creek. An article in *The Oregonian* in 1896 discusses the company's actions. According to a newspaper article, the company removed 200,000 feet of piling from the Clackamas River and then gathered timber to transport. When the article was written, the company was waiting for a rise of water to move about 250,000

feet of timber down the river. It expected to have another 250,000 feet of wood before the higher flows came (Farnell 1979).

Log drives continued into the 1900s. In 1912, two log drivers, the Himler brothers, claimed to have run 40,337 railroad ties down the river between May and November, enough to load 55 railroad cars (Farnell 1979). Another early resident of the area, Mr. Mumpower, also drove railroad ties down the Clackamas. In a conversation with James Farnell, a historian, he recalled driving logs from as high as the present site of McIver Park (RM 20.5) to a mill at Barton. He said that they only floated logs in summer and that the drives were often helped by a flash release from the dam (Farnell 1979).

Early logging practices often left scars on the landscape. Since timber harvest was generally unrestricted, loggers cut timber that could be easily reached and moved to markets. They removed timber from riparian areas, unstable slopes and other lands that would be protected today. Such disturbances affected habitat conditions along the lower river and tributaries. They reduced soil stability, leaving the exposed soils more susceptible to erosion during storms and high flows. Other habitat damage resulted from the driving of logs down streams. Log drives scoured stream channels, removed riparian vegetation, and created barriers to fish passage. The log drives also hindered hatchery efforts. In 1902, J. Wisner, a manager of the Clackamas hatchery, reported that about 2,000 cords of wood were being floated down the river. Hatchery personnel had to construct a boom above their egg-taking rack to guide the wood through a gate in the structure (Wisner 1902). Water quality was also affected by sawmill production and logging activities during this time. By 1890, sawdust and other mill waste were common pollutants in any stream in the state (Oregon Fish Commission 1889-1890).

Use of the river to transport logs declined after 1903 when developers brought railway services to the area. In 1904, more than 100,000 cords of wood were hauled by the Estacada line to Portland, which still burned wood almost exclusively for fuel. The rail also provided access to previously unreachable territory, thus supporting the growing logging industry.

Access to the basin's vast forests improved further in the 1920s when Portland General Electric built a road to the Oak Grove drainage, and the Forest Service started developing truck trails. These corridors established the primary network for the forest's road system in many areas. The Forest Service built Skyline Road (Road 4220) into the Ollalie Lake area in the later 1920s and extended roads into the Oak Grove Fork drainage in the 1930s. Road construction in the upper drainage continued with the addition of 23.4 miles in the 1940s and 61 miles in the 1950s. Many secondary roads were also developed. Road development took off in the 1960s when about 210.7 miles of road were constructed in the upper basin. By 1969, about 60 percent of the upper watershed's existing system was in place. During the 1970s, 90 miles of road were added to this system and many existing roads were converted to asphalt. Another 97.4 miles and 10 miles of new road were

constructed in the 1980s and 1990s, respectively. In addition, many existing roads were improved with asphalt. oday, the upper Clackamas watershed alone contains about 490 miles of roads (USFS 1995).

The new road system opened the upper basin to timber harvest. Vast quantities of timber were harvested after 1950, nearly all on national forest land. By 1960, approximately 880 acres in the upper basin had been clear-cut harvested using mainly tractor skidding techniques. Harvest increased during the 1960s, occurring throughout the upper watershed. By the end of the 1960s, an additional 7,393 acres had been clear-cut. Harvest escalated during the next 25 years. About 21,000 acres were cut between 1970 and 1994 using all types of harvesting techniques. Several other areas were also harvested during this time, primarily to salvage timber in areas hit by bark beetle or windstorm damage. Overall, between 1950 and 1994 timber harvests occurred on more than 29 percent of the upper Clackamas watershed (USFS 1995).

Road construction and timber harvest critically affected conditions in the upper basin. Logging road construction and timber harvest increased the risk of landslides in the drainage. Generally, logging roads are considered one of the biggest triggers of landslides because they compact soil and reduce its ability to absorb precipitation. Research outside the Mt. Hood National Forest has shown that 80-90 percent of the sedimentation associated with timber harvest can be attributed to road building (ODFW 1992). Studies in the Clackamas drainage support this finding. In 1988, the Mt. Hood National Forest identified active slide areas in the Collawash, Oak Grove Fork, Hot Springs Fork, Fish Creek and upper mainstem Clackamas drainages (ODFW 1992).

Road-building along the Clackamas River and tributaries also affected stream stability and habitat conditions. Loggers and road builders were often attracted to the floodplains because they were easier to reach and develop than the surrounding rugged territory. Consequently, road building along streams, including the development of several main access roads, caused stream realigning and straightening and the removal of large amounts of riparian vegetation. In the 1950s, for example, Forest Road 46 was extended by realigning the Clackamas River between RM 57 and RM 65. The realigned channel is about 20 percent shorter than the natural channel and contains significantly less fish habitat.

The logging of streamside trees, such as in the Fish Creek and upper Collawash systems, affected habitat diversity and channel stability and reduced stream shading. Loss of shade contributed to increases in water temperatures during late summer and fall. Water temperatures exceeding 65°F — a level affecting salmon and trout production — have been recorded in Fish Creek and the lower Clackamas, Hot Springs Fork, and Collawash rivers.

Studies conducted on Fish Creek in the middle Clackamas drainage illustrate some impacts

associated with logging and road construction. The Fish Creek watershed has been the focus of intensive multi-year investigations. The results of these investigations are discussed below.

Fish Creek — A Case Study

Conditions in Fish Creek are believed to typify many middle and lower watersheds on the forest. Studies conducted in the Fish Creek drainage since 1982 show that more than 40 percent of the old growth trees have been logged and more than 140 miles of roads have been carved throughout the 30,000-acre drainage. When biologists evaluated aquatic habitat conditions and fish production capability as part of a major stream rehabilitation effort, they found that "present habitat conditions varied significantly from historical conditions" (USFS 1988).

Studies show that "between the middle and late 1950s and the early 1960s substantial changes in channel condition/stability, summer water temperature regimes and watershed conditions occurred." Changes in channel condition and stability include a 34 percent loss of low flow pool habitat (Everest et al. 1986), a 90 percent decline in large wood structure, and active channel widening and downcutting over at least 60 percent of the lower 11 miles of stream. In addition, maximum summer water temperatures at the stream mouth rose to between 68° and 75°F — eight to ten degrees above the estimated temperature regime in the late 1950s. Because of these changes, investigators found that the quality of accessible anadromous habitat has declined by an estimated 20-25 percent over the last 20 to 30 years (USFS 1988). Influencing factors include blocked access at tributary road crossings and reduced channel length due to downcutting and straightening.

Many disturbed areas in the Fish Creek drainage collapsed under the pressure of peak flows during the flood of 1996. After the flood, approximately 236 landslides resulted in the drainage. Approximately 36 percent of these slides were related to logging roads and another 42 percent were tied to timber work, particularly in young tree stands. The slides caused piles of logs and rock debris to clog roads and destroyed a 110-foot cement bridge (Bulletin 1997). They also increased sediment loading throughout the lower drainage.

Today, timber harvest continues to be one of the most important industries in the area. However, harvest practices have improved. Current harvest and regeneration techniques are designed to reduce impacts on the watershed. For example, the treatment of harvest areas improved in the mid-1980s when forest personnel began applying new methods to increase new tree growth and survival. These methods included using fertilizers and planting higher-quality trees in harvested areas. As a result, new tree growth has improved by 30 percent over the "normal yields" expected in the 1950s (USFS 1995).

AGRICULTURE

During the early and middle 1800s, suitable lands along the lower river valleys and plateaus were cultivated for agricultural production. However, many potential farmers were discouraged by the basin's narrow floodplain, rugged terrain, and dense forests. Settlers who chose to farm in the basin often had to remove a thick blanket of trees and brush from their land before preparing it for planting. Other times, emigrants settled on bare lands that had previously been harvested by loggers. Once the land was cleared, the rich soils were cultivated and planted to produce grains, berries, vegetable gardens and orchards. Truck farmers often took their fresh produce to markets or wholesalers in the Portland area. Crop selection changed in the 1890s after farmers began using the railroad to transport their goods to market. Some farmers started raising potatoes and other crops and shipping them to markets. This replaced a practice of growing hay and grain to fatten hogs and cattle, and then driving the beasts "on the hoof" the long distance to Portland (Lynch 1973).

Agricultural use in the lower Clackamas River Basin continued to grow through the early and middle 1900s. Farms in the area produced grass seed, dairy, berries and truck farm crops. Christmas tree production also became important in later years. Today, approximately 1/8 of the drainage is used to produce berries, tree fruit, field crops, Christmas trees and livestock.

These activities impacted habitat conditions in the lower river basin in several ways. Development of lands for agricultural use resulted in removal of streamside vegetation and caused streambank erosion. Removing streamflows for irrigation also reduced instream flows in some drainages. Generally, however, low flows caused by water withdrawals are not a problem in the drainage.

MINING

Small mining operations have occurred periodically in the drainage since the mid-1800s. A rock quarry existed on the south bank of the Clackamas (RM 8) near the present town of Carver by the late 1860s. Stone from the quarry was floated down the Clackamas to building sites in Portland (Farnell 1979). Other mining operations began in the early 1900s. Prospectors mined for gold, silver and copper during the 1910s in the Pansy Basin and along the North Fork and Oak Grove Fork rivers. A mine on the headwaters of Eagle Creek was also worked for a short period. In the late 1930s, several cinnabar mines were operated on Oak Grove Fork. These mines produced significant amounts of mercury until 1943 when the operations ended (Burtchard et al. 1993).

Gravel was also mined. Dredging has occurred at several locations on the main Clackamas River including near the river's mouth. Several upland gravel operations have also existed in the lower subbasin. One operation worked until recently had a major impact on the Clackamas River. Sand and gravel mining on the Clackamas near RM 14 began in the 1960s. Operators removed material from instream gravel bars and then moved into adjacent floodplain areas. They built a dike at the 100-year floodplain to keep water in its settling ponds from breaching into the river. Several pits ranging from 8 feet to 30 feet in depth were mined above the 200-year floodplain in the 1970s and 1980s. In 1996, floodwaters broke through the river channel above the dike and spilled into the gravel pits. As a result, about ½ mile of stream was lost when an oxbow was cut off. Further, pools have been lost upstream as the river system moved gravel downriver to fill the pits. Today, the river continues to seek a new equilibrium.

Such operations within or adjacent to the stream corridor have impacted natural stream characteristics. Disturbance of the stream channel through the removal of gravel, riparian vegetation and other material reduced spawning and rearing habitat and — as seen on the Clackamas during the 1996 flood — left the system more susceptible to erosion during high flows. Gravel removal also affected water quality in and immediately below the mined areas when washing operations were not properly contained in settling ponds.

INDUSTRIAL DEVELOPMENT — Including Associated Dams

Settlers in the 1800s started several industrial enterprises. In 1842, Philip Foster settled land on Eagle Creek[1] and built a grist mill (Lynch 1973). A larger operation began in 1867 when W.W. Buck and Henry Pittock established a paper mill at Park Place near Gladstone on the Clackamas River at the site of Buck's sawmill, which was to be torn down. Four waterwheels were installed to operate the mill and it started producing paper in 1868. The mill operated for 17 years. It closed after the increasing demand for paper in the early 1880s prompted its owners to develop a new site at Camas on the Columbia River where cottonwood trees were abundant (PGE 1982).

The dam associated with the paper mill near Gladstone is reported to have blocked upstream fish passage except during high flows. It, or another dam in the same vicinity, continued to hinder fish

1 The creek was named Eagle Creek after Indians told early settlers that in the days of their fathers the salmon came to the creek by the thousands. When the salmon reached the shallows the eagles would swoop down and pick them out (Lynch 1975).

passage through the late 1800s. Records refer only to "the dam" and it is unclear whether they are referring to the dam built on the Clackamas in 1869 or 1870, or to another dam built later. Some later reports refer to a sawmill dam near Gladstone. The impact of this early dam on the lower Clackamas River is described in a report by the State Fish Commission in 1890. The report says the commission was informed in late September that the dam across the Clackamas River at Gladstone was preventing salmon from ascending the river. The commissioner describes the dam as made of rock and brush, about 3 feet high, blocking fish passage during low flows.

A fishway was constructed at the dam in 1892 to provide fish passage (Oregon Fish Commission 1892). However, reports suggest the dam continued to hinder fish passage except during periods of high flow. A 1892 report notes that salmon did not appear at the Clear Creek station in late August as they could not pass the sawmill dam (U.S. Commission of Fish and Fisheries 1892). Another report during this time mentions a sawmill dam found 1 mile above the mouth of the Clackamas and 4 miles below the hatchery that stood about 7 feet high with no fish passage. The dam is also mentioned in fish harvest reports. According to records by a Mr. Seaburg, of Ilwaco, Washington — noted as one of the most extensive salmon packers at the time — in April and May 1893 about 140 tons of chinook salmon were caught below the dam in the Clackamas River with gillnets and seines. He explained that most of the fish were taken at the dam where the fish congregated in their attempts at passage. More than 100 tons were caught in 1894 at the same location (U.S. Fish Commission 1894). In 1894 the U.S. Commission of Fish and Fisheries recognized the Gladstone Dam as "one of the greatest evils now affecting the fisheries of the Columbia River Basin" (U.S. Fish Commission 1894). The problem was resolved in 1895 when the Columbia River Packers Propagation Company put a ladder over the dam providing adequate passage for anadromous fish.

A report by L.T. Barin in 1885 suggests that other small dams also existed in the basin during the middle and late 1800s. Barin (1885) mentions three dams on the Clear Creek — one built in 1852 at Hardings Mill three miles above the hatchery, another built in 1848 or 1850 at Viola, and a third built in 1865 at Springwater. Other settlers probably also built small dams on the Clackamas and tributaries during this period to support their mill operations.

HYDROELECTRIC DEVELOPMENT

Incredible population and industrial growth in the Portland metropolitan area during the early 1900s created a hunger for a large electric power supply. Power was needed to fuel the extensive system of interurban railroads and trolleys that would eventually spread from the Columbia River to Salem in the middle Willamette Valley. It was also needed to bolster the region's growing industrial and residential developments. As electric requirements increased at a rapid rate, low-cost hydroelectric generation became more attractive for bulk power supply. Hydro developers recognized the potential for power development on the Clackamas River at the turn of the century. They began site investigations in 1901 and acquired several potential power sites in 1902.

In 1948, the region again faced a shortage of energy to meet its growing needs. This propelled Portland General Electric Company to study developments that would increase its generation capability. Again, the company looked to the Clackamas River system to help meet these needs. They initiated several actions in the basin to improve the existing systems' capability. The various hydroelectric projects in the basin are discussed briefly.

Cazadero/Faraday Dam

In 1902, the Oregon Water Power and Railway Company, a predecessor of Portland General Electric, started work on Cazadero Dam in the Clackamas River about 1.25 miles upstream from the town of Estacada. Workers completed the timber-crib, rock-filled dam in 1907. A wooden fish ladder was included as part of the dam's original construction.

When the dam was completed, fish propagators began operating an egg-taking station just below it. These activities prevented full use of the ladder. The fish ladder also suffered repeated damage by floodwaters in the early years and was repaired frequently. Records show the ladder being repaired following a flood the winter of 1909-1910. The ladder was damaged badly by floods in 1917 and was not repaired because egg-taking activities downstream at River Mill Dam prevented fish from reaching Cazadero. In 1939, the company rebuilt the ladder at a cost of about $22,000.

During the 1950s, the company modified the project to handle the water discharged by two units operating on peaking loads at North Fork. A new intake was constructed above the original Cazadero Dam, and a ½-mile-long concrete-lined tunnel was built. The company also built a new turbine generator beside the original powerhouse. A new fish ladder, constructed as part of the North

Fork Project, provided passage around both the Cazadero and North Fork dams. The projects were completed in 1958.

In December 1964, a major flood on the Clackamas River severely damaged Cazadero Dam. The dam ``collapsed when another flood hit five weeks later in January 1965. It was replaced with a new concrete dam, named Faraday, in 1966.

River Mill Dam

The Oregon Water Power and Railway Company began building a second plant on the Clackamas River in 1909. The River Mill project, below the Cazadero plant and less than one mile northeast of Estacada, started generating power in 1911.

Upon completion, River Mill contained a concrete fish ladder that had received approval from Oregon's Master Fish Warden. The ladder was considered a model design for its day. Fish propagators immediately placed a fish rack below the ladder entrance to collect brood stock. The rack prevented full use of the fish ladder for migration over the dam until 1940. Eggs were taken below the ladder from 1913 through 1939, when the hatchery was abandoned.

In 1926, Portland General Electric improved the ladder at River Mill, although salmon migration was stopped most of the time by egg-taking operations. They constructed additional pools at the lower end of the ladder, widened turning and resting pools, and moved apertures between the pools to meet new state requirements. The ladder was improved again in late 1939. This time the company improved the fish ladder entrance and installed an attraction water pump and diffusion chamber as recommended by the U.S. Bureau of Fisheries.

Passage improvements made at Cazadero and River Mill dams in 1939 restored fish passage to the upper Clackamas basin. When the new North Fork ladder became operable in 1958, the ladder over Cazadero Dam was removed.

Oak Grove Project

In 1907, the Southern Pacific Company began looking to the Clackamas River Basin to secure power for its contemplated 340-mile Oregon electrification railroad system. The company took steps to secure this power source by filing notices of water appropriation on the Oak Grove Fork of the

Clackamas in 1907 and on Three Lynx Creek in 1908. In 1911, the Portland Railway Light and Power Company (a predecessor to Portland General Electric) assumed all legal liabilities and assets of the Oak Grove project.

After a lapse of 10 years, the company again started work on the project. They completed construction of a concrete diversion dam on the Oak Grove Fork in 1923, creating Lake Harriet. No fish passage facilities were required at the dam as two natural 24-foot falls about one mile downstream of the dam blocked fish migration. The plant began generating power in 1924.

In 1952, Portland General Electric began investigating sites for new facilities on the Oak Grove Fork of the Clackamas River to supply additional peak capacity for the two existing Oak Grove generating units. The company decided to create a 430-acre-feet capacity forebay at Frog Lake. They began excavation in 1953. The Frog Lake forebay was placed in service that year. In 1997, Frog Lake was reduced in capacity to 266 acre-feet to control movement associated with ancient landslide terrain.

The company also started investigations in the subbasin for another dam site in 1952. This dam would regulate flows to support increased energy generation at the Clackamas River hydro plants during the low flow period, September to April. The company selected a site at Timothy Meadows, about 1,000 feet downstream from a site investigated in 1910. In 1953-1954, they constructed a road up Oak Grove Fork Canyon from Lake Harriet to the selected dam site near the headwaters of the Oak Grove Fork under an agreement with the Forest Service. The company completed construction of a compacted-earth dam in 1956. The dam formed Timothy Lake, a 1,440-acre impoundment, which soon became a popular recreation site.

North Fork Dam

Investigations for a power site above the backwater of Cazadero Dam began in 1907. The project would ultimately become North Fork Dam. The company surveyed and mapped the site in 1907, and began extensive core drilling of the dam foundation in 1908. When the site was deemed suitable for development, the railroad was extended upriver from Cazadero Dam. Ultimate development of the project, however, did not occur until the power shortage period of the 1950s.

In 1954, nearly half a century after initial investigations, Portland General Electric began new studies for the North Fork hydroelectric development. The company received pre-license consent from the Federal Power Commission for the project in September 1956. This consent came after Portland

General Electric and the Oregon Department of Fish and Game reached agreement on the scope of the facilities for handling migratory fish. The project was completed in 1958.

Upon completion, the North Fork project included extensive fish passage facilities bypassing both Cazadero (later named Faraday) and North Fork dams. The project's 1.9-mile fish ladder transported fish from the river below Faraday and deposited them above North Fork Dam after climbing 196 feet. The ladder, 10 feet wide and 6 feet deep, included a fish trap that has normally been operated from June to October.

The company also built facilities to help downstream migrants. These included a collection device above North Fork Dam to attract the migrants and convey them to the North Fork fishway. Near the lower end of the fishway, they assembled a "separator" to pass fish from the fishway into a pipeline to carry them to the river below River Mill Dam. Today, downstream migrants are counted at the separator. Downstream migrants can also leave North Fork Reservoir over the spillway during high water.

Construction of the North Fork project significantly improved fish passage upstream from River Mill Dam and Estacada Lake. Studies have shown that the North Fork screen and diversion facility effectively attracts and passes salmon and steelhead smolts because they typically migrate downstream near the water surface. The downstream migrant bypass is less effective at attracting chinook smolts away from the turbines as chinook often migrate at greater depths.

After discussions with the State of Oregon regarding fish losses and enhancements, Portland General Electric proposed to pay up to one million dollars for building a fish hatchery to be operated by the State of Oregon. The company and State reached formal agreement in 1975. The company committed to paying up to one million dollars for a fish hatchery capable of producing 50,000 pounds of salmonids annually. The state agreed to pay for any expenses to enlarge the hatchery or to produce more fish. All costs of operating and maintaining the hatchery are to be shared equally by the company and State. In signing the agreement, Portland General Electric did not admit past or present liability for abundance of fish on the Clackamas River, but entered the agreement with the purpose of cooperatively increasing salmon production of the river. In addition, the agreement stipulated that the company was not required to construct additional fish passage facilities, protection devices or modify power operations to improve fish passage. Construction of the hatchery began in 1977 on land that the company deeded to the State. The 17.5-acre site, which now supports the Clackamas Hatchery, lies next to McIver State Park on the Clackamas River.

SALMON AND STEELHEAD HARVEST

Clackamas River salmon and steelhead runs dropped steadily in the mid- to late-1800s as the fishing industry expanded through the region. Fishing parties on the Columbia River, and on the lower Willamette and Clackamas rivers, caught scores of fish bound for spawning grounds in the Clackamas basin.

Harvest in these early years focused on spring chinook. Commercial harvest for spring chinook began on the Columbia River in the mid-1800s and grew quickly until it peaked around 1873 with a take of 43 million pounds (Oregon Game Commission 1951). Spring chinook harvest on the Columbia then declined significantly, suggesting that the river's spring chinook run had been weakened by overharvest. Records from 1877 show use of more than 1,000 drift nets in the Columbia, each about 1,200 feet long (U.S. Commission of Fish and Fisheries 1877). Commercial gear regulations were first adopted on the Columbia in 1878.

The Clackamas River also experienced heavy commercial fishing during this period, probably because of easy access from Oregon City and Portland. As on the Columbia, fishing parties on the Clackamas caught as many spring chinook as possible and then turned to silver salmon and fall chinook. Drift nets were the most common fishing gear, but traps and set-nets were also used. A report written in 1876 describes a trap at the mouth of the Clackamas River that almost completely closed the river to upriver fish passage. Records from 1877 show drift nets and two traps being used to catch fish on the lower Clackamas River. In September, a trap reached nearly across the mouth of the Clackamas to trap "silversides" (U.S. Commission of Fish and Fisheries 1877). In 1886, a commercial fisher, A.S. Abernethy, reported fishing by several parties on the Clackamas River near the mouth of Clear Creek. The various parties fished with drift nets and short set-nets, and one party used a trap. He estimated that approximately 3,500 chinook salmon were caught before July 10. Fishing pressure probably then dropped off as late-season fish became soft and unfit for markets (Abernethy 1886).

Heavy fishing continued through 1894. Gillnetters caught approximately 12,000 adult spring chinook in the lower Clackamas in 1893 (Smith 1974). Many more salmon were caught in 1894. According to reports by Hugh Smith, who was touring the Pacific Northwest, gillnetters on the lower Clackamas below the Gladstone Dam caught more than 100 tons of chinook in 1894. If these fish weighed an average of 22.76 pounds — the average weight for 104,831 chinook caught in the Columbia River in 1893 — about 8,000 chinook were caught in the lower Clackamas in 1984 (Smith 1974).

By 1895, about 82 commercial parties fished for salmon on the Clackamas and lower Willamette rivers, an area of about 30 miles. They harvested one run of large chinook from April 10 to May 10, and a second run of smaller salmon through June. The fishing parties used drift gillnets to catch the larger fish and set nets with a smaller-sized mesh to catch the second run. Fishing resumed in late summer with silver salmon harvest from late-September to mid-November, and steelhead harvest from November until March 1. The fish were usually sold in Portland. Reports estimate that the total catch averaged 5/10 chinook, 1/10 silver, and 4/10 steelhead (U.S. Commission of Fish and Fisheries 1895).

Fishing pressure remained high on the Columbia River in the early 1900s, but an important change took place. While commercial fisheries maintained an average annual harvest of about 25 million pounds until 1922, spring chinook made up less of the catch. Around 1880, spring and summer chinook runs started declining and harvest shifted to fall chinook salmon. As a result, by 1920, the catch was estimated to be half fall chinook. Harvest emphasis also moved to steelhead (1890 to 1900) and then to coho (1920s) during this period. Peak commercial catches of chinook and coho occurred in 1883 and 1925, respectively (Lichatowich and Mobrand 1995). Commercial landings for all species declined steadily after 1923, with an average annual harvest of 15 million pounds from 1923 to 1958 (Lichatowich and Mobrand 1995).

In 1912, the ocean troll fishery (towing a hook and line behind a boat) began competing with the Columbia River fishery. The troll fishery initially began off the mouth of the Columbia River, the number of boats doubling from about 500 in 1915 to about 1,000 in 1919 (Northwest Power Planning Council 1987). There were few restrictions on the ocean fisheries until 1948.

Commercial fishing on the Clackamas River declined after the turn of the century. By 1908, only about five or six commercial operators were still fishing on the river. Seasons were designated for commercial fishing on the Clackamas around 1910. The seasons were eliminated for a short time in 1918 because of a discrepancy in the laws regulating commercial fishing, and the river became open to indiscriminate fishing again until the problem was rectified. Once regulations were reestablished, poaching became evident. The state received many complaints regarding heavy illegal fishing in the lower Clackamas basin. Illegal gillnetting below River Mill Dam remained heavy through the Depression years. In 1950 commercial fishing was banned on the Clackamas and Willamette rivers. Fish from the Clackamas continued to contribute to fisheries on the ocean and Columbia River. Spring chinook remained the most important commercial fish.

As access to the Clackamas River and tributaries improved, the basin saw an increase in sport fishing.

Over the years, basin sport fisheries have continued to grow in popularity. Today, winter and summer steelhead and coho salmon are pursued in both the mainstem and tributaries, such as Eagle Creek. The basin also supports a strong resident trout fishery.

Clackamas spring chinook still attract a considerable number of sport anglers to the Clackamas and Willamette rivers. The run supports a highly popular sport fishery in the Portland metro area and contributes substantially to a large sport fishery in the Willamette River below the falls. In the Clackamas basin, annual sport harvest has increased from about 700 fish before 1977 to more than 3,000 fish in recent years. Most fishing occurs on the lower river below River Mill Dam.

SUMMARY

The Clackamas River Basin has seen significant changes since the early 1800s. Over the last 150 years human efforts to extract and harness resources have altered natural stream hydrology, streamflow patterns, channel structure and water quality within the Clackamas River system. Human impacts include timber harvest, road building, driving logs downstream, dam building and operations, extraction of instream and floodplain gravels and downed wood, removal of riparian vegetation, and the destruction of side channels and wetlands. These changes contributed to dramatic losses of salmon and steelhead habitat and productivity. The runs have also been greatly affected by hatchery egg-take operations and by overfishing in the Columbia River, ocean and Clackamas River.

The following sections discuss salmon and steelhead production in the Clackamas basin through the years. Human activities and developments discussed in this section directly influenced these runs and actions taken to improve them. Consequently, key events that shaped conditions in the Clackamas drainage during each period are often mentioned in the discussions and are summarized at the end of each section.