

There are approximately 328 miles of road on all ownerships within the watershed. The average total road density across all ownerships in the LNS watershed is estimated at three miles per section. Road densities range from a low of less than one mile per section in the Battle Ax, Opal, Gold, and Henline SWBs, to a high of over five miles per section in the Evans and Sinker SWBs. Maps 11 & 12 (Transportation and Generalized Road Control) show the location of the roads by ownership and control.

There are several gates in the watershed which limit public access in the lower to middle portions of the watershed. Approximately two percent of the total road miles in the watershed are effectively closed. An additional 17 percent are at least seasonally closed with gates. Open (accessible) road densities across the watershed are presently estimated at 2.35 miles per section, which is considered to be moderate. However, open road densities vary widely across the watershed. Open road densities are high in the Kiel, Sinker, and Evans SWBs and low in the Battle Ax, Opal, Gold, Henline, and Elkhorn SWBs.

Inputs from the road density analysis were used to derive habitat effectiveness for open road densities (HER) indices using the Wisdom model. The HER index is a measure of the impact of roads on elk habitat quality. The average HER for the entire watershed is currently at or near 0.45, which is viable for elk. The HER is marginal to limiting in the Evans, Sinker, Kiel, and Canyon Creek SWBs.

Of the 328 total road miles in the watershed, 136 miles are on federal lands (41%). Average total road density on federal lands is estimated at 1.75 miles per section. Open (accessible) road densities on federal lands average 1.5 miles per section, which is considered to be low to moderate. The HER for federal lands is currently at or near .6, which is viable for elk. Open road densities on federal lands are highest in the Evans and Sinker SWBs.

## **Special Status/Special Attention Species**

*What SSSA are known or suspected to occur in the watershed? How will land use objectives and management guidelines in the ROD, Salem District RMP, Willamette NFP, Opal Creek legislation, and on privately managed lands influence future habitat for these species?*

### **Plants**

There are two known populations of BLM special status plant species in the LNS watershed. Based on a literature review of the habitat requirements of the SSS known to occur in the province, a list of potential species has been identified for the LNS Watershed and its special habitats (Appendix D). This list includes Federal Endangered, Federal Threatened, Federal Proposed Threatened, and Bureau Sensitive Species.

*Aster gormanii*, Gorman's aster, is a Bureau Species of Concern and a candidate for federal listing as a Category 2 species (USFWS 1993). It is also a candidate for listing by the Oregon State Department of Agriculture and is considered by the Oregon Natural Heritage Data Base (1993) to be threatened throughout its range. As of 1994, 63 populations have been reported in the region, all restricted to a narrow geographic range within the western Cascades and high Cascades physiographic provinces. This range is 50 miles north to south and 30 miles east to west. This known range is characterized by steep and rugged topography, and it is unlikely that

the range will be extended significantly. Many potential sites have not been inventoried due to this rugged habitat. A Salem BLM District/Willamette NF management plan was developed to maintain healthy, reproducing populations of the species at a variety of sites within its range.

### **NFP Survey and Manage Species**

The NFP lists fungi, lichens, bryophytes, and vascular plants to be given consideration through survey and management standards and guidelines (ROD pp. C4-C6, Table C-3 pp C49-C61).

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#### **Four strategy ratings apply to survey and manage species**

1. Manage known sites (beginning in 1995).
2. Survey prior to ground disturbing activities and manage newly discovered sites (for 1999 project implementation and beyond).
3. Conduct extensive surveys for the species to find high priority sites for species management.
4. Conduct general regional surveys to acquire additional information and to determine necessary levels of protection.

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Species with strategy ratings 1 or 3 demand the most immediate attention. Guidelines for survey and manage species with a strategy 1 rating are in draft form.

### **Fungi**

Out of the 234 fungi species listed in the NFP, one strategy 1 fungi is documented from Opal Creek area surveys while many others may potentially occur here based on potential distribution and habitat (Appendix D). Ten of the strategy 3 and 4 species have been documented.

***Polyozellus multiplex*, blue chanterelle:** is a deep blue to black cluster of compressed and fused caps. It is rare in the Pacific Northwest. The species is mycorrhizal with true fir and spruce. Distribution and specific locations in this region are not well known (ROD, Appendix J2, pp 161-162).

### **Lichens**

Eighty-one lichens are listed in the NFP. Four with strategy 1 ratings are documented in the LNS Watershed. The Opal Creek area provides a unique habitat for a wide diversity of lichens. Fifteen lichens have been found that are strategy 3 and 4 species (Appendix D).

***Pseudocyphellaria rainierensis*, Rainier pseudocyphellaria lichen:** is an epiphytic species inhabiting moist old-growth coniferous forests in Oregon and Washington, primarily on the west slope of the Cascades. It has been found in the Opal Creek Area of the LNS Watershed which is centrally located within the species range. This population is within either the proposed Opal Creek SRA or the proposed OCW, so timber management will not be a disturbance factor, and mitigation measures will not be needed. Any older stands would be surveyed prior to project implementation for sites which would have a protection buffer (ROD, Appendix J2, pp 228-232).

For the next three lichen species, additional locations have been reported but not entered into the survey and manage database as of this time (John R. Davis, pers. comm.).

***Pilophorus nigricaulis*, nail lichen:** occurs on talus rock patches within old-growth stands with low fire frequencies. Only two other known sites are in Oregon and three in Washington. Species distribution and ecology are poorly known (ROD, Appendix J2, pp 237-238).

***Leptogium rivale*, skin lichen:** is a truly aquatic lichen and will die if desiccated. It is found on rocks in low to mid elevation streams where they provide habitat for aquatic invertebrate populations. This species is known from two mid-order streams in the HJA and one stream in Montana. Siltation is the primary disturbance factor for suitable habitat. The limited dispersal ability and rarity influenced the classification as strategy 1 (ROD, Appendix J2, 239-240). RRs and LSR designations in this watershed will provide habitat for this species.

***Hypogymnia oceanic*, seaside tube lichen:** is a rare oceanic influenced lichen which has been found widely from southeast Alaska and coastal British Columbia. It has been found in the HJA with the assumption that the maritime microclimates in old-growth mimic those in its primarily coastal distribution (ROD, Appendix J2, pp 243-246). LSRs and wilderness designations in this watershed provide suitable habitat for this species.

### **Exotic and Introduced Species of Concern**

Noxious weeds and exotic species may threaten native plant communities and wetlands, replace forage for wildlife, create fire hazards, reduce recreational enjoyment, compete with crops and poison livestock. Noxious weeds usually do not become established in native plant communities until there is disturbance. Some weed species become established after a disturbance and may become extremely tenacious.

Noxious weeds spread primarily along roads, through the spreading of infested gravel, and through other ground-disturbing activities such as the yarding of timber.

There are no known sites of Priority 1 (potential new invaders) noxious weed species in the LNS watershed. Four known populations of meadow knapweed, a Priority II noxious weed (eradication of new invaders), were found on BLM lands during a 1997 survey of 55 miles of roads in the watersheds. Priority species definitions are discussed in the *Salem District 1992-1997 Noxious Weed Control Program Environmental Assessment*.

There are several known occurrences of the Priority III noxious weeds such as Canadian thistle, St. Johnswort, tansy ragwort, and Scotch broom in the LNS Watershed. Established infestations are widespread throughout the landscape. The 1997 survey found that Scotch broom infestations were extensive throughout the watershed.

In addition to noxious weeds, there are several exotic species in the watershed. Although these species are not classified as noxious, they compete with the native vegetation and often have negative ecological impacts. In areas where the soil has been disturbed, such as road cuts, gravel pits, and clearcuts, exotic species have become common. Nonnative species are found in almost every type of habitat throughout western Oregon.

## **Animals**

### **Special Status Species**

As part of the LNS analysis, the occurrence of wildlife species in the watershed was analyzed. A list of vertebrate wildlife species was compiled using USFS and BLM wildlife databases, the Oregon Natural Heritage Program (ONHP) database, and various wildlife field guides and texts along with knowledge of the habitats present gained through air photo interpretation, GIS information, and field reconnaissance. The resulting list is included in Appendix D-1. This list of wildlife species was then cross referenced with ONHP's December 1995 publication, the Regional Forester's Sensitive Animal List for the Willamette NF and Salem District's sensitive species list to determine federal, state, USFS and BLM status of each species with status. The resulting list of special status species which are known or highly likely to occur in the LNS watershed and their habitat preferences is included in Appendix C-2. This list includes 1 federal endangered, 2 federal threatened, and 16 species which are USFS and/or BLM sensitive species. Species which are documented to occur in the watershed are denoted with a (D) in Appendix D2.

### **NFP Survey and Manage Species**

The red tree vole, a Survey and Manage strategy one species, is suspected to occur in the LNS watershed. The red tree vole is considered to be a late-successional associate, and there is suitable habitat present in all SWBs, primarily below 3500 feet elevation. The LNS watershed was screened according to the *Interim Guidance for Red Tree Voles*. The LNS was found to be viable with 68 percent of the watershed in federal ownership of which 75 percent is suitable habitat for the red tree vole. The great gray owl, a protection buffer species, is known to occur in the watershed. There is one sighting in each of the Elkhorn and Kiel SWBs. Sightings are more frequent in the east side of the watershed toward the crest of the Cascades. A nesting pair has been identified to the north of the watershed. The silver-haired bat and Pacific western big-eared bat, which are identified as needing of additional protection in the NFP, occur in the watershed. Also, the long-eared myotis and long-legged myotis, which were also identified as needing of additional protection, are suspected to occur in the watershed.

Little is known about the occurrence of SSSA invertebrate species in the LNS watershed. A list of suspected or possible SSSA invertebrate species that could occur in the watershed is in Appendix D3. There are three Survey and Manage Strategy mollusk species that could reasonably occur in the LNS watershed. The Oregon megomphix is found in moist conifer/hardwood forests in association with big-leaf maple logs and litter. Two tail-droppers (slugs), *Prophysaon coeruleum* and *Prophysaon dubium*, are associated with hardwood logs and litter in moist conifer/hardwood

forests. The Siskiyou caddisfly, a Bureau sensitive species, has been documented to occur in the LNS.

### **Threatened and Endangered Species**

Threatened and endangered species habitat was analyzed separately in the watershed analysis process. There are two federally threatened and one endangered species which are documented to occur in the LNS. The peregrine falcon and bald eagle have been documented in the upper end of the watershed. The northern spotted owl has been documented throughout the watershed, especially in the upper half.

#### **Bald Eagle**

There have been a number of sightings of bald eagles in the upper end of the watershed. The closest known nest site is located in the vicinity of Detroit Reservoir, five miles to the south and east of the watershed. Bald eagles have been observed along the NSR corridor to the south, from Detroit Reservoir downstream to Mill City and Stayton; especially in the vicinity of Big Cliff Dam. Most of the sightings from the LNS are in the vicinity of Opal Creek and the Henline area. It is unknown if these birds are different from the birds observed along the North Santiam or the nesting birds at Detroit Reservoir. Bald eagles have large home ranges and are known to move long distances, so are likely to be present as migrants and non-residents in the LNS. There are no known nest sites. However, there is a lack of concentrated survey effort to establish the status of the bald eagle in the watershed. There are sightings during the nesting season which are suggestive of a potential nest site in the vicinity. Suitable nest sites are abundant in the LNS. The most promising locations are along the ridge that separates the LNS from the North Santiam from the confluence to the upper end of Opal Creek (Isaacs, pers. comm.).

#### **Peregrine Falcon**

The peregrine falcon has been documented in the watershed with scattered sightings in the vicinity of Rocky Top, Battle Ax, and Elkhorn Ridge. The closest known nest site is seven miles to the east of the watershed. The peregrine falcon is likely to occur as a migrant and has been documented late in the nesting season and through fall migration. There are numerous cliffs that qualify as suitable habitat in terms of cliff height and structure in the upper half of the watershed, especially in the Henline, Dry, Elkhorn, Opal, Gold, and Battle Ax SWBs. There are fewer numbers of suitable cliffs in the Cedar and Evans SWBs. There is little suitable habitat for peregrine falcons in the lower portions of the watershed, with House Mountain being the best possibility. There are no large bodies of water in the LNS; however, there is significant riparian habitat along the LNS and its tributaries. Prey is available such as the band-tailed pigeon and passerine birds. There are no known nest sites in the watershed. However, there is a lack of survey information from this portion of the Cascades Range of Oregon. The upper half of the watershed is suitable habitat due to the presence of suitable cliffs and riparian habitat (Pagel, pers. comm.).

## Northern Spotted Owl

The overall habitat conditions for northern spotted owls were analyzed across the entire watershed. Age classes and forest types were classified as suitable for nesting, foraging, dispersal, or non-suitable habitat for the spotted owl. Non-suitable habitat was further classified as either capable or non-capable of becoming suitable habitat over time. The results are displayed on Map 13, Spotted Owl Habitat Map, and Table 9, Spotted Owl Habitat by Ownership.

**Table 9. Spotted Owl Habitat by Ownership**

Spotted Owl Habitat Class	BLM/FS		PRIVATE/STATE		TOTAL	
	Acres	%	Acres	%	Acres	%
<b>Nesting</b>	23,244	47	781	4	24,025	33
<b>Foraging</b>	10,725	22	1,861	8	12,586	17
<b>Dispersal</b>	6,943	14	10,310	45	17,253	24
<b>Capable</b>	5,720	12	7,606	33	13,326	19
<b>Non-capable</b>	2,734	5	2,233	10	4,967	7
<b>TOTALS</b>	49,366		22,791		72,157	

Approximately 50 percent of the watershed is considered to be suitable habitat for nesting and/or foraging (suitable), 24 percent is dispersal, and 26 percent is non-habitat. Of the non-suitable habitat, 73 percent is capable of becoming suitable habitat over time.

The eastern half of the watershed was found to be highly viable for nesting spotted owls, especially the Opal and Gold SWBs. Suitable habitat was found to be marginal to limiting in the Sinker, Evans, and Canyon Creek SWBs. The Kiel SWB has the least amount of suitable habitat of any SWB in the watershed at six percent.

Spotted owl habitat on federal lands was further analyzed and categorized by LUA.

**Table 10. Spotted Owl Habitat on Federal Lands by LUA.**

<b>Spotted Owl Habitat Class</b>	<b>GFMA</b>	<b>%</b>	<b>CONN</b>	<b>%</b>	<b>SRMA</b>	<b>%</b>	<b>WILD</b>	<b>%</b>
<b>Nesting</b>	<b>1,153</b>	<b>17%</b>	<b>1,970</b>	<b>42%</b>	<b>5,574</b>	<b>54%</b>	<b>10,398</b>	<b>51%</b>
<b>Foraging</b>	<b>404</b>	<b>6%</b>	<b>543</b>	<b>11%</b>	<b>3,222</b>	<b>31%</b>	<b>5,271</b>	<b>26%</b>
<b>Dispersal</b>	<b>3,165</b>	<b>47%</b>	<b>858</b>	<b>18%</b>	<b>436</b>	<b>4%</b>	<b>1,950</b>	<b>10%</b>
<b>Capable</b>	<b>1,746</b>	<b>27%</b>	<b>988</b>	<b>21%</b>	<b>767</b>	<b>8%</b>	<b>1,378</b>	<b>7%</b>
<b>Non-Capable</b>	<b>212</b>	<b>3%</b>	<b>357</b>	<b>8%</b>	<b>353</b>	<b>3%</b>	<b>1,221</b>	<b>6%</b>
<b>Total</b>	<b>6,680</b>		<b>4,716</b>		<b>10,352</b>		<b>20,218</b>	

<b>Spotted Owl Habitat Class</b>	<b>LSR</b>	<b>%</b>	<b>DDR</b>	<b>%</b>	<b>WSR</b>	<b>%</b>	<b>Total</b>	<b>%</b>
<b>Nesting</b>	<b>1,680</b>	<b>53%</b>	<b>315</b>	<b>44%</b>	<b>2,154</b>	<b>62%</b>	<b>23,244</b>	<b>47%</b>
<b>Foraging</b>	<b>415</b>	<b>13%</b>	<b>24</b>	<b>3%</b>	<b>846</b>	<b>24%</b>	<b>10,725</b>	<b>22%</b>
<b>Dispersal</b>	<b>408</b>	<b>13%</b>	<b>80</b>	<b>11%</b>	<b>46</b>	<b>1%</b>	<b>6,943</b>	<b>14%</b>
<b>Capable</b>	<b>645</b>	<b>20%</b>	<b>136</b>	<b>19%</b>	<b>60</b>	<b>2%</b>	<b>5,720</b>	<b>12%</b>
<b>Non-Capable</b>	<b>49</b>	<b>2%</b>	<b>160</b>	<b>22%</b>	<b>382</b>	<b>11%</b>	<b>2,734</b>	<b>5%</b>
<b>Total</b>	<b>3,197</b>		<b>715</b>		<b>3,488</b>		<b>49,366</b>	

Approximately 69 percent of federal lands in the watershed is considered to be suitable habitat, 14 percent is dispersal, and 17 percent is non-suitable habitat. Of the non-suitable habitat present on federal lands, 68 percent is capable of becoming suitable habitat over time.

The amount of suitable habitat is 23 percent in GFMA, 54 percent in CONN, and 66 percent in LSR. The amount of suitable habitat approaches 80 percent in SRMA and wilderness areas.

The watershed is viable for dispersal of spotted owls. The LNS watershed provides dispersal to/from the Molalla River watershed to the north, the Clackamas River to the east and north, and the upper North Santiam to the southeast. USFS lands in the Battle Ax, Gold, Opal, and Henline SWBs are directly connected. They are a part of the large wilderness/LSR complex in the western Oregon Cascades, where the majority of dispersal between known spotted owl sites takes place. The SWBs in the lower portion of the watershed are located to the west of the major wilderness/LSR complex and are comprised of mostly BLM and private lands.

Dispersal of spotted owls is severely limited by the Willamette Valley to the west and the NSR corridor and the cities of Lyons, Mehama, Gates, and Mill City to the south. To the south, nine miles across the NSR corridor is the Quartzville LSR (RO213). The lower half of the LNS has minor importance for dispersal to/from Silver Falls State Park and Abiqua Creek to the north and west.

Immediately to the north, there is a large LSR in the Molalla River drainage, which surrounds the Table Rock Wilderness. This is actually a part of the same wilderness/LSR network as the LNS LSR and the Bull of the Woods wilderness (RO209). There is an LSR surrounding the Jefferson Wilderness (RO214) near the crest of the Cascades which is 18 miles to the east. This LSR extends from the Jefferson Wilderness to the south, east of Detroit Reservoir. Another LSR extends along the Clackamas River and connects the Jefferson Wilderness with the Roaring River LSR (RO207) and Salmon-Huckleberry LSR/ Wilderness complex to the north (see North Willamette LSR Assessment for more connectivity).

There are 9,200 acres of USFS lands in the watershed which were designated as Critical Habitat for the spotted owl (CHU-12). These areas are located mostly in the Opal SWB, with some in the Battle Ax, Gold, and Cedar SWBs. Most of these lands are located in wilderness and SRMA designated under the Oregon Resources Conservation Act of 1996.

Once the overall habitat conditions were analyzed across the watershed, each individual known spotted owl site (KOS) was analyzed. The KOS is established by buffering the site center with the provincial home range radius for the spotted owl. The provincial home range radius for the western Oregon Cascades province is 1.2 miles. Once the KOSs were established, the habitat within each was classified as either suitable, dispersal, or non-suitable habitat for the spotted owl. The results were used to estimate viability of each site. A known owl site (KOS) which has an intact 70 to 100-acre core area and the equivalent of over 40 percent suitable habitat within its provincial home range radius is considered to be viable.

There are 10 spotted owl site centers located in the watershed. Of the 10 KOSs with site centers in the watershed, eight were found to be viable. These eight sites are all located in the upper half of the watershed in wilderness, SRMA, LSR, and WSR. The two sites in the lower half of the watershed were found to be limiting or possibly non-viable, due to a lack of suitable habitat. Neither of these two sites have an unmapped LSR (core area) associated with them. Both of these sites were discovered within the last five years. Surveys indicate that they are not consistently occupied.

There are seven spotted owl site centers located just outside of the upper end of the watershed. Due to their location, surrounding topography, and past harvest patterns, the LNS contributes significant habitat to one of these seven sites. Four of the seven sites are located to the north and east toward the Molalla and Clackamas rivers, where connectivity between the major wilderness/LSR complex is important. The other three are located to the south and east toward Detroit Reservoir and the North Santiam River (NSR) corridor.

Barred owls have not been documented nesting in the LNS, but pairs have been observed in Kiel SWB and the lower end of Elkhorn SWB. There are no known sightings in the upper end of the watershed.

Current acres of capable habitat, suitable habitat, and number/condition of KOSs in the LNS was calculated, and the results are shown in Table 11.

**Table 11. Current Status of the Spotted Owl and Its Habitat within the LNS Watershed.**

	<b>Total WA</b>	<b>Total Protected (%)</b>	<b>Total Unprotected (%)</b>
<b>Acreage within Boundary</b>	<b>72,157</b>	<b>37,910 (53%)</b>	<b>34,250 (47%)</b>
<b>Acreage of Federal</b>	<b>49,366</b>	<b>37,910 (77%)</b>	<b>11,365 (23%)</b>
<b>Federal Spotted Owl Habitat Capable Acres</b>	<b>46,623</b>	<b>35,750 (77%)</b>	<b>10,800 (23%)</b>
<b>Total Suitable Spotted Owl Habitat</b>	<b>36,611</b>	<b>29,850 (82%)</b>	<b>6,700 (18%)</b>
<b>Federal Suitable Spotted Owl Habitat</b>	<b>33,969</b>	<b>29,850 (88%)</b>	<b>4,060 (12%)</b>
<b>Total Spotted Owl Sites</b>	<b>10</b>	<b>8</b>	<b>2</b>
<b>Spotted owl sites (&gt;40%)</b>	<b>8</b>	<b>8</b>	<b>0</b>
<b>Spotted owl sites (30-40%)</b>	<b>1</b>	<b>0</b>	<b>1</b>
<b>Spotted owl sites (20-30%)</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Spotted owl sites (&lt;20%)</b>	<b>1</b>	<b>0</b>	<b>1</b>

## **Fish**

- 1. What is the distribution of anadromous fish?*
- 2. What stocks of anadromous fish are recognized as "at risk"?*
- 3. What resident fish exist in the watershed, and what is their distribution?*

### **Salmonid Species Assessment and Distribution**

Much of the most productive habitat in the Santiam sub-basin has been blocked by dams on the North and Middle Santiam rivers. Detroit Dam and the downstream Big Cliff Dam, constructed in 1953 on the North Santiam, and Foster and Green Peter dams, constructed in 1968 on the South and Middle Santiam rivers, have blocked anadromous fish passage to historic upstream spawning and rearing areas. As a result of these dams, wild anadromous fish production is now restricted to lower mainstem and tributary streams, such as the LNS (see Map 14).

Hatchery production of spring chinook (*Oncorhynchus tshawytscha*) was increased as mitigation for the dams on the North Santiam. Hatchery stocks are derived primarily from native Willamette stock. Spring chinook fry and fingerlings were released in the LNS in 1958, 1959, 1983, and 1984. STEP releases of spring chinook fry were made in the LNS from 1984-1987. Because released fish were fry and fingerlings, with very low expected adult returns, it is doubtful that they made a significant genetic contribution to the existing stock (J. Haxton, personal communication). No releases of winter steelhead (*O. mykiss*) have been made in the LNS basin. Skamania stock summer steelhead (*O. mykiss*) was first introduced into the LNS in 1966. Releases were made below river mile (RM) 17 to minimize potential impacts on naturally produced winter steelhead, which are found primarily above RM 17. Summer steelhead releases were discontinued in 1994 due to concerns about competition with wild stocks. STEP releases of native Willamette stock winter steelhead fry were made in the LNS in 1984 and 1987 but probably made very little, if any, genetic contribution for the same reasons described for spring chinook.

Historically, upstream migration of anadromous fish was blocked by Salmon Falls at RM 15.9. A fish ladder was installed at the falls in 1958. Steelhead are now suspected to migrate as far as a barrier falls at RM 23.9 near Jawbone Flats. In the years following the opening of the fish ladder at Salmon Falls, chinook were commonly seen upstream of the falls. Currently, chinook are rarely found upstream of Salmon Falls, although they are capable of ascending the fish ladder.

## Winter Steelhead Trout

Status: Depressed (Proposed for federal listing as threatened, February 1998)

The Santiam River sub-basin provides the majority of the winter steelhead production in the Willamette Basin. Runs of Willamette Basin early-run and late-run winter steelhead have been declining since the late 1980s and are at or near record low numbers. In 1996, a record low number of 1,322 late-run winter steelhead were counted at Willamette Falls. The 1997 Willamette Falls count of late-run winter steelhead showed considerable improvement at 3,925 fish. Early-run fish are primarily of hatchery origin, while native fish make up the late-run. In February 1994, the National Marine Fisheries Service (NMFS) received a petition to list Willamette River winter steelhead under the Endangered Species Act. In August 1996, the NMFS determined that Upper Willamette River steelhead did not warrant listing (Federal Register, 1996). Early-run winter steelhead are not suspected to exist in the LNS.

The LNS, managed as a wild steelhead fishery by the Oregon Department of Fish & Wildlife (ODFW), is considered a key area for late-run, wild fish production. ODFW spawner surveys in two LNS tributaries (Sinker and Elkhorn creeks) indicate wild steelhead spawner escapement has been declining since the late 1980s (Table 12), with an increase in 1997. Sport catch data for the LNS (Table 13) also indicate a declining trend starting in 1988.

**Table 12. Winter Steelhead Redds Per Mile and Miles Surveyed in Sinker and Elkhorn Creeks, 1987-1996.**

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
SINKER CR.	38.6	*	8.6	*	*	15.7	12.9	19.5	1.4	1.4	7.1
MILES SURVEYED	0.7	*	0.7	*	*	0.7	0.7	0.7	0.7	0.7	0.7
ELKHORN CR.	31	*	13.8	*	10	11	12	11	7	0	10
MILES SURVEYED	1.0	*	0.8	*	1.0	1.0	0.5	1.0	1.0	1.0	1.0

\* Not surveyed

**Table 13. Estimated Winter Steelhead Sport Catch in the LNS, Run Years 1982-83 through 1993-94.**

RUN YEAR	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94
SPORT CATCH	48	35	157	236	161	187	130	77	66	18	48	28

Steelhead are found in approximately 26.8 miles of streams in the watershed. Most of the habitat is in the mainstem, although three tributaries (Sinker, Elkhorn, and Evans creeks) are known or suspected to support steelhead populations in the lower reaches.

Spring Chinook Salmon

Status: Depressed (Proposed for federal listing as threatened, February 1998)

Spring chinook escapement in the LNS is declining as indicated by spawner survey data (Table 14) and snorkel survey data (Table 15).

**Table 14 . LN S Spring Chinook Redds Per Mile and Miles Surveyed, 1991-1996.**

YEAR	1991	1992	1993	1994	1995	1996
REDDS PER MILE	3.0	0	5.0	2.7	3.0	0
MILES SURVEYED	3.0	3.0	3.0	3.0	3.0	19.6

**Table 15. LNS Spring Chinook Snorkel Survey Counts, 1971 and 1992-1996.**

YEAR	1971	1992	1993	1994	1995	1996
LIVE ADULTS	236	15	10	0	0	1
DEAD ADULTS	6	1	0	0	0	0
JUVENILES	100	52	21	1044	5	11
MILES SURVEYED	7.5	4.5	4.5	4.5	5.6	4.5

## Resident Trout

Status: Unknown

Resident cutthroat trout (*O. clarki*) are found throughout the watershed, particularly upstream of anadromous barriers. Presence of rainbow trout (*O. mykiss*), probably introduced, has been reported in some tributaries, generally above barrier falls. Opal Creek and Opal Lake are known to contain introduced populations of brook trout (*Salvelinus fontinalis*).

## AQUATIC

### Hydrology and Water Quality

- \* *What is the current water quality condition on the river? What is the trend in water quality?*
- \* *Is the current level of water quality supporting beneficial uses?*
- \* *How has human development and uses affected water quality on the river?*
- \* *What opportunities exist for improving water quality through changes in management and site specific projects?*
- \* *Where are the major sources of sediment from erosion, landsliding, road runoff, or other management activity located? What areas have the greatest potential for landslides or erosion?*
- \* *How have riparian and stream channel conditions affected water quality?*

### Introduction

The LNS watershed (5th field watershed) drains approximately 113 square miles or 72,157 acres of the west slope of the Oregon Cascade Mountains and is contained within the larger North Santiam watershed which covers 1,800 square miles (4th field watershed). In turn, the North Santiam watershed is located in the WRB (2nd field watershed), which is the largest river basin in Oregon, draining 11,100 square miles. A large percentage of the state's population and major cities are located in the WRB including Portland, Salem, and Eugene. The USGS has divided the WRB into hydrologic units and assigned each a hydrologic unit code. The LNS drainage is contained in the 1709000505 Hydrologic Unit. The LNS watershed has been divided into 11 sub-watersheds (SWB): Kiel Creek Frontal, Canyon Creek Frontal, Sinker Creek Frontal, Evans Creek Frontal, Dry Creek Frontal, Elkhorn Creek, Henline Mountain., Cedar Creek, Gold Creek Frontal, Battle Axe Creek, and Opal Creek (Map 7). SWB acreages are listed in Table 16.