Clackamas River Basin Action Plan

Appendix B: Summary of Fish Passage Barriers for the Clackamas River Basin

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Overview of Passage Barriers in the Clackamas Basin

The purpose of this appendix is to summarize what is currently known about barriers to fish passage within the Clackamas Basin, and to identify the highest priority artificial barriers that should be considered for replacement or retrofit. This summary uses information from the following sources:

- *Clear and Foster Creek Fish Passage Assessment and Prioritization Project* (Robison and Walsh, 2003)
- *Deep and Goose Creek Watershed Assessment*[1] (WPN, 2005)
- US Forest Service Culvert Inventory (USFS, 2005)
- Oregon Fish Passage Barriers database (ODFW, 2004)
- Clackamas County culvert inventory (Clackamas County, 2005)

For each artificial barrier[2] a prioritization was determined using the Replacement Index Score Ecological:

[RISE] = {B * S * [(H*Q) + C)]}

Where B = Degree of barrier with 1.0 = complete barrier, 0.5 = juvenile barrier, and 0 = not a barrier

S = Species downstream of crossing: 1.0 = steelhead or coho; 0.2 = resident fish only; 0 = exotics only (Streams with no fish or exotics not included in prioritization).

H = Habitat available upstream (ft).

Q = Habitat Quality index as defined by the proportion of different habitat types upstream of culvert. It a fraction of low gradient and low to moderate confinement habitat types divided by the total fish bearing length.

C = This is an index value of the closeness of the crossing to the mainstem of the Clackamas River. It is calculated by subtracting the distance between the crossing and the Clackamas River in feet from 150,000 feet and then dividing this distance by 50. In effect, this gives a stream immediately adjacent to the Clackamas River the equivalent of 1500 feet of high quality habitat upstream in comparison with the H and Q values above.

In the area covered by the *Clear and Foster Creek Fish Passage Assessment and Prioritization Project* (Robison , E. G. and J. Walsh, 2003) a Replacement Index Score Ecological with cost was also calculated as follows:

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[1] Also Includes fish passage information for Eagle Creek.

[2] Large dams on the mainstem Clackamas River and its principal tributaries were not included in the prioritization

[RISE-C] = RISE / Cost

Where Cost = The replacement cost in dollars based on estimated cost of replacement design

The following discussion is broken up into five geographic areas, each of which corresponds to the available fish barrier data sets (Figure 1).

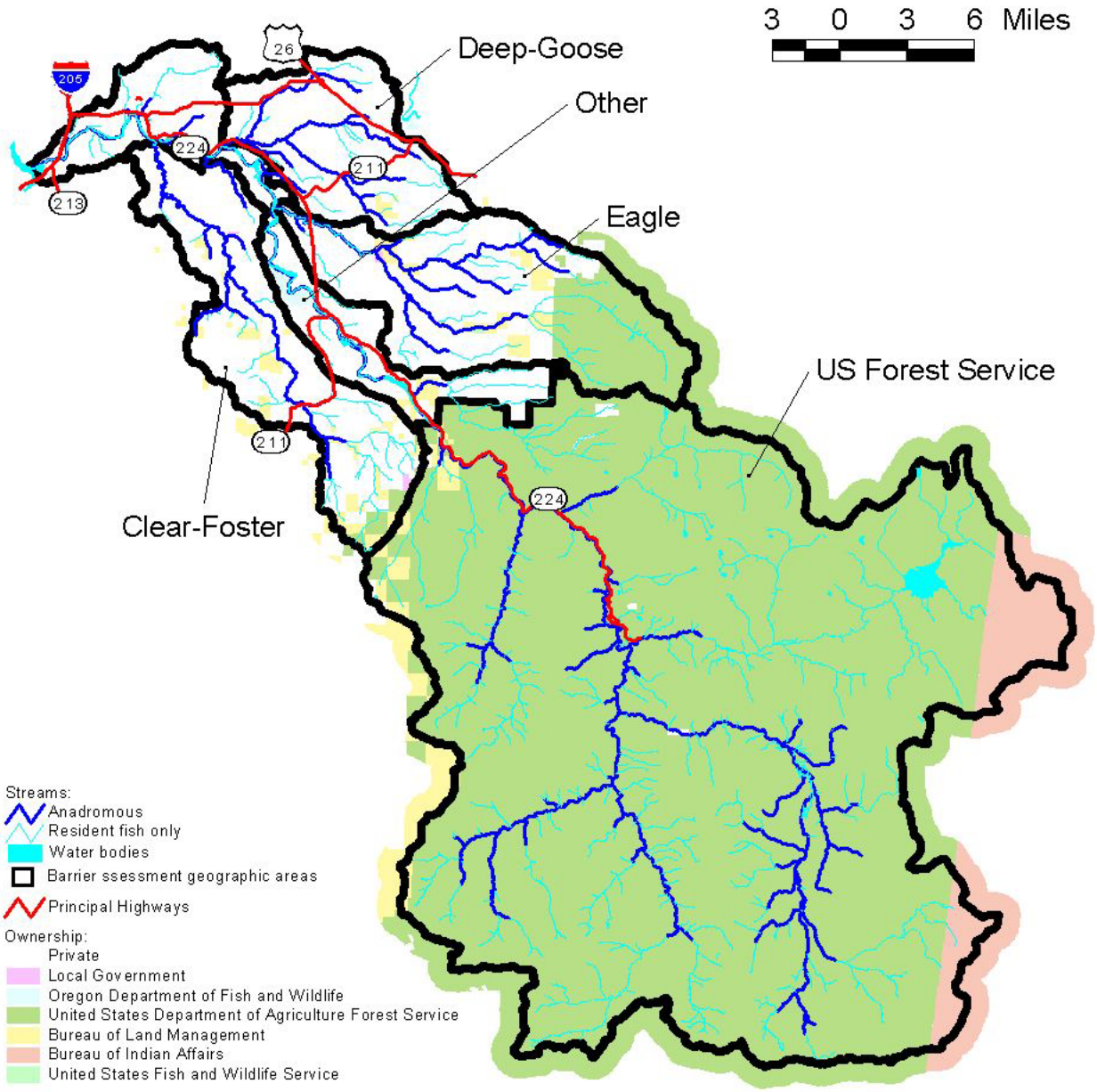

Figure 1. Geographic areas used to summarize fish passage barriers in the Clackamas Basin.

Clear-Foster Creeks

The following summary of fish passage barriers for Clear-Foster Creeks was taken from the *Clear and Foster Creek Fish Passage Assessment and Prioritization Project* report (Robison and Walsh, 2003). Key findings of this report include:

A total of 223 potential artificial barriers were evaluated in the Clear and Foster Creek watersheds. Of these there are a total of 159 barriers on fish bearing streams. Four of these crossings represented dams on tributary streams.

Of these 159 crossings 81 had verified fish passage blockage to some degree based on methods used in the assessment. Of these 81 crossings, 27 had complete blockages and 54 had partial blockages.

Of the 81 blockages, 34 are on streams that are thought to have anadromous fish species use. Anadromous fish use was determined by examining historical information regarding fish use in the Clear and Foster Creek basins and evaluating 16 key natural barriers that prevent anadromous travel. Many of these natural barriers were discovered and/or documented for the first time during summer 2002 fieldwork for this project.

Costs to fix the 81 potential blockages to fish passage were estimated as part of the assessment. The proposed fixes included bridges, open bottom culverts and slabs, and closed bottom culverts that are embedded to imitate natural streambed conditions. Pre-determined county cost estimates on county culverts were used when available. The total cost of repairing the 81 fish passage blockages is over 7.2 million dollars ($US), of which nearly 5.5 million dollars are accounted for by county fix proposals. The highest replacement estimate is $732,000 and the minimum estimate for a crossing correction is $5,460. Nearly 3.6 million dollars would be used to fix culvert blockages on anadromous streams. Of this 3.6 million dollars, nearly 3 million dollars is for county culverts.

Prioritization of the artificial barriers was conducted using the formulas described above. The highest priority crossings for repair are found on the main channel of Clear and Foster Creek and on key tributaries lower in the basin that do not have high gradient stretches and waterfalls. The ten[3] highest priority barriers for replacement are (ranked in descending order of priority; see Figure 2 for locations):

1. CL209 - Middle Clear Creek, Pipe in Clear Ck. The number one ranked crossing, CL209, is an irrigation pipe that creates a consistent drop represents a potential fish passage blockage to juvenile fish and probably can be mitigated at minimal cost.

2. CL069A - Middle Clear Creek, Private - A ford on Clear Creek (CL069A - not previously documented) was discovered during field work summer 2002. Could be mitigated by creating a roughened channel along part of the stream channel. If this fix is attempted, some further design work should be conducted as to the best way to fix this potential problem for juvenile fish and possibly weaker swimming adult fish. (Estimated cost about $7,500)

[3] A culvert that blocked fish passage near the mouth of Foster Creek (FO003) was the sixth-highest ranked barrier at the time that the report was published. This culvert has since been replaced with a bridge.

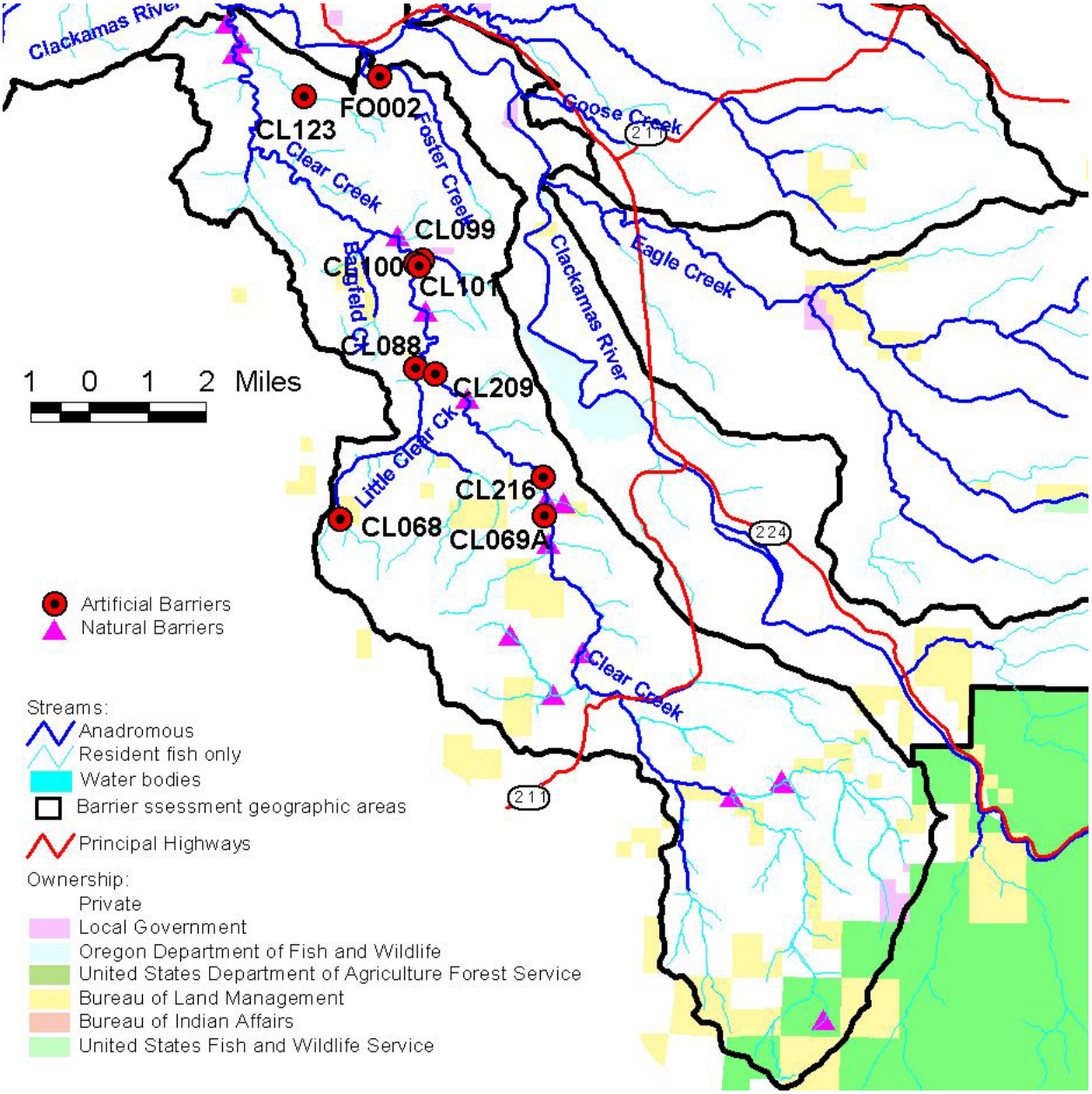

Figure 2. The ten highest-ranked artifical barriers to fish passage in the Clear and Foster Creek watersheds (from Robison and Walsh, 2003).

3. CL088 - Little Clear Creek, Redland - A box culvert on Little Clear Creek that has almost 15 miles of fish bearing stream habitat upstream that blocks fish passage for most or all fish.

4. CL216 - Middle Clear Creek, Private - A ford on Clear Creek that has a 2 foot drop that creates a possible barrier for juvenile and weak swimming fish.

5. CL123 - Lower Clear Creek, Springwater - A two barrel culvert crossing on an unnamed tributary to Creek that blocks fish passage for juvenile and weak swimming fish.

6. FO002 - Foster Creek, Gerber - A diversion dam on Foster Creek that may be mitigated by developing a fish ladder below it. (Estimated cost is about $15,000) This will be an extremely high priority if a culvert downstream (FO003) is replaced

7. CL068 - Little Clear Creek, BLM trail - A corrugated metal pipe culvert blocking fish passage on Mosier Creek. Potential to access 1.8 miles of upstream channel.

8. CL100 - Lower Clear Creek, Priv. Cedarhurst - Two concrete culverts on a very low use road that partially block fish passage on a large tributary to Clear creek that probably can be removed.

9. CL101 - Lower Clear Creek, Sylvan - Upstream of CL100, on a private paved road. Four round culvert pipes

10. CL099 - Lower Clear Creek, Mattoon - Upstream of CL100 and CL101, county crossing under Mattoon Road. Pipe arch.

These results provide information that can be used in applying for watershed or stream improvement grants. The proposed designs are for cost estimates only. Actual replacement of these culverts will require further design work. In some cases, several alternative designs can work at a crossing with extremely different costs involved. There may be opportunities in these instances to reduce costs by using alternative designs. In other cases, more expensive designs may be proposed for concerns beyond basic fish passage.

For more information see:

- The *Clear and Foster Creek Fish Passage Assessment and Prioritization Project* report available on-line at http://clackamasriver.org/projects.htm

- The Clear and Foster Creeks Fish Passage Assessment Interactive Tool, available on-line at http://clackamasriver.org/projects.htm

Deep-Goose Creeks

The following summary of fish passage barriers for Deep-Goose Creeks was taken from the *Deep and Goose Creek Watershed Assessment* (WPN, 2005). Key findings of this report include:

178 total potential barriers were examined in the Deep and Goose Creek watersheds. Of these, 105 potential instream barriers were surveyed in late summer and fall of 2003; potential barriers that were not surveyed were situated on non-fish bearing and/or headwater reaches.

Of the 105 barriers surveyed in Deep and Goose Creek watersheds, 21 were found to completely block and 28 to partially block passage to salmonids and resident fish species. One of these is a natural barrier near the mouth of Noyer Creek and 9 were on non-fish bearing reaches. The remaining 39 were prioritized in order of the severity their blockage has on limiting fish movement. 18 of the 39 barriers partially or completely block salmonid passage. Based on the

prioritization methods presented above, barriers to salmonid species will have a higher priority than barriers that affect only resident fish species.

None of the top priority barriers in the Deep and Goose Creek watersheds is a complete blockage to fish passage. All are partial barriers that block passage to at least juvenile and weak swimming salmonids at some point during the year. Of the top 10, only two are complete barriers. The ten barriers identified as the highest priority are (ranked in descending order of priority; see Figure 2 for locations):

1. Crossing DPD01 – This is a cement weir maintained by a Clackamas County wastewater treatment facility outside of Boring on the North Fork Deep Creek. The County uses the weir to test water quality for permitting purposes. The 27 foot wide weir spans the creek just downstream of the bridge on Ritchey Road. The weir is a partial barrier to juvenile fish because of the jump height and the width of the cement barrier. In addition, the weir's footing on each bank is eroding.

2. Crossing DP026A – This crossing is an unused bridge/culvert on the North Fork Deep Creek, not far upstream from the wastewater facility's weir. It is on privately-owned, industrial property. The bridge portion of the crossing is a log-spanner with approximately 15 feet of fill and vegetation growing on top. A 6-foot diameter metal culvert sits underneath the log spanners. The pipe has become a partial barrier because a beaver dam and other debris have blocked its inlet resulting in a 2.5-foot jump that fish have to clear to exit the pipe.

3. Crossing DPD02 – This barrier is a dam on private property on the North Fork Deep Creek upstream of DPD01 and DP026A. It is a partial barrier to fish passage from June to October when the landowner has the spillboards in place. The landowner manages the spillboards by removing them in early October and installing them after mid-June. When the spillboards are out this crossing does not represent a barrier to fish passage.

4. Crossing DPD05 – This is a 30-foot high dam with a fish ladder running up its face and four weirs downstream that raise the channel on Deep Creek. It is on private property. The weirs are partial barriers because each rises one to two feet above the water level and is 2-feet wide at the top. The fish ladder jump pools are 5-feet long, which can be short depending on the fish species and size. The fish ladder's jump heights are also tall at 1.2 feet. The landowner is interested in working with the council and the Oregon Department of Fish and Wildlife to improve the barrier as much as possible.

5. Crossing DP037 – This crossing is a box culvert on the North Fork Deep Creek that runs underneath Highway 26. It is a partial barrier to passage because of a high outlet drop, borderline box slope, and long length. In addition, because of a cement wall through its center, it could be a velocity barrier at high flows.

6. Crossing DP069 – This is a crossing on Tickle Creek near the Sandy wastewater treatment facility on private property, though the waster water treatment facility likely has an easement to use or full ownership of the road. The crossing has three culverts. All three are partial to complete barriers to fish passage. The two culverts that receive the most flow have slopes at or over 4%. The third culvert is less steep at 2%, but is also above the water level from summer through late fall. It and the middle culvert are rusted through their bottoms.

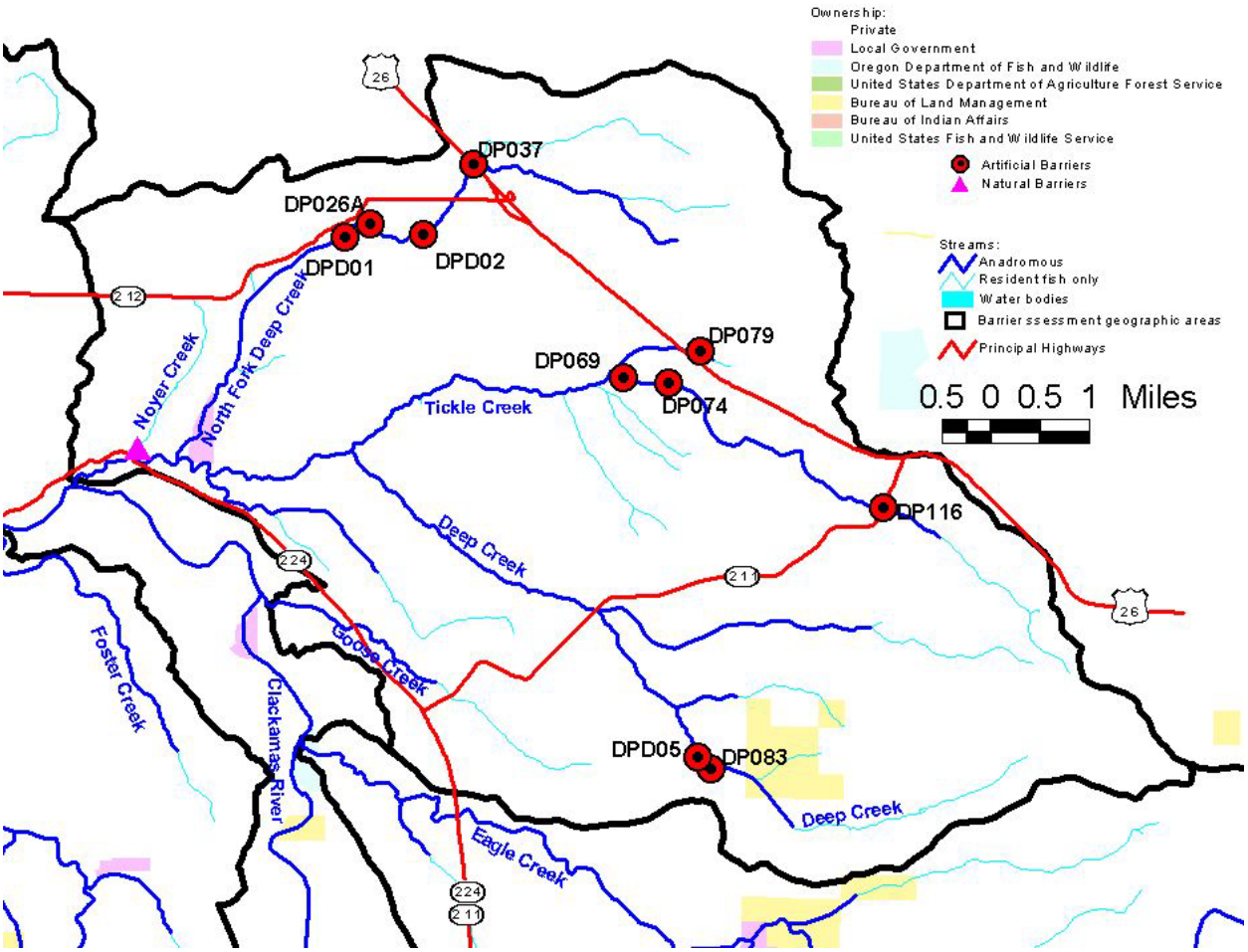

Figure 3. The ten highest-ranked artificial barriers to fish passage in the Deep and Goose Creek watersheds (from WPN, 2005).

7. Crossing DP074 – This crossing on Tickle Creek is a combination dam and pipe culvert on private property. The crossing is a partial barrier because the culvert has a steep slope combined with a hydraulically challenging inlet created by the dam.

8. Crossing DP083 – This crossing is a double culvert crossing immediately upstream of DPD05 on Deep Creek. Though the road is marked on the GIS road layer as a Clackamas County easement, local residents and the County have treated it as a private road. It is a barrier for juvenile and/or weaker swimming fish because of the pipe slope and flow constriction.

9. Crossing DP079 – This crossing is a box culvert underneath SE Orient Road on a tributary of Tickle Creek. It is a complete barrier to fish passage because of its steep gradient, length, and potential high velocities caused by constricted flow.

10. Crossing DP116 – This crossing is a cement box culvert on Tickle Creek that has been identified by the ODFW as a barrier. It runs under State Highway 211. The fish passage survey found this crossing to be a complete barrier. It has a high outlet jump, steep slope, long length, and narrow width which could cause velocity issues.

For more information see:

- The Fisheries section, the Fish Passage Appendices, and the Fish Passage Barrier Map included in the *Deep and Goose Creek Watershed Assessment* report (WPN, 2005), available on-line at http://clackamasriver.org/projects.htm

- The Deep-Goose-Eagle Creeks Fish Passage Assessment Interactive Tool, available on-line at http://clackamasriver.org/projects.htm

Eagle Creek

The following summary of fish passage barriers for Eagle Creek was taken from the *Deep and Goose Creek Watershed Assessment* (WPN, 2005). Key findings of this report include:

Unlike Deep and Goose Creek watersheds, Eagle Creek watershed's geology and topography result in more natural barriers to salmonids and resident fish migration, particularly in the upper reaches of Eagle Creek. However, residents and land managers have introduced numerous additional barriers to the watershed through road construction, channel alteration, and instream water impoundment.

Of the 54 barriers surveyed in Eagle Creek watershed, 11 were found to partially and 15 to completely block passage to salmonids and resident fish species. Of these 26, 3 are natural barriers. The 23 artificial barriers have been prioritized in order of the severe effect their blockage has on limiting available salmonid habitat. 10 of the 23 partially or completely block salmonid passage.

As in Deep and Goose Creek watersheds, barriers occur on all ownerships. Though the US Forest Service and Bureau of Land Management own more acreage in the Eagle Creek watershed, only 2% of the crossings were surveyed on this ownership. Most of the federal land holdings sit in the upper portion of Eagle Creek and contain few crossings. Four significant and successive waterfall barriers sit downstream of these crossings. Therefore, the majority of the federal crossings were identified as low priority and were not surveyed. County ownership accounts for 55% of the stream crossings, 39% exist on private ownership, and 3.7% are found on state-owned land.

Prioritization was conducted using the methodology described above. The ten barriers identified as the highest priority are (ranked in descending order of priority; see Figure 4 for locations):

1. Crossing EG084 – This crossing is the highest priority crossing in Deep, Goose, and Eagle Creeks. It is a large cement dam on private ownership that stretches across the North Fork Eagle Creek. When the spillboards are not managed, it is a complete barrier. It is not certain if the landowner removes the spillboards during salmonids migration. They were present and installed to a height of approximately 6-8 feet on October 1, 2004. In high flows, even with spillboard management, this crossing may be a velocity barrier.

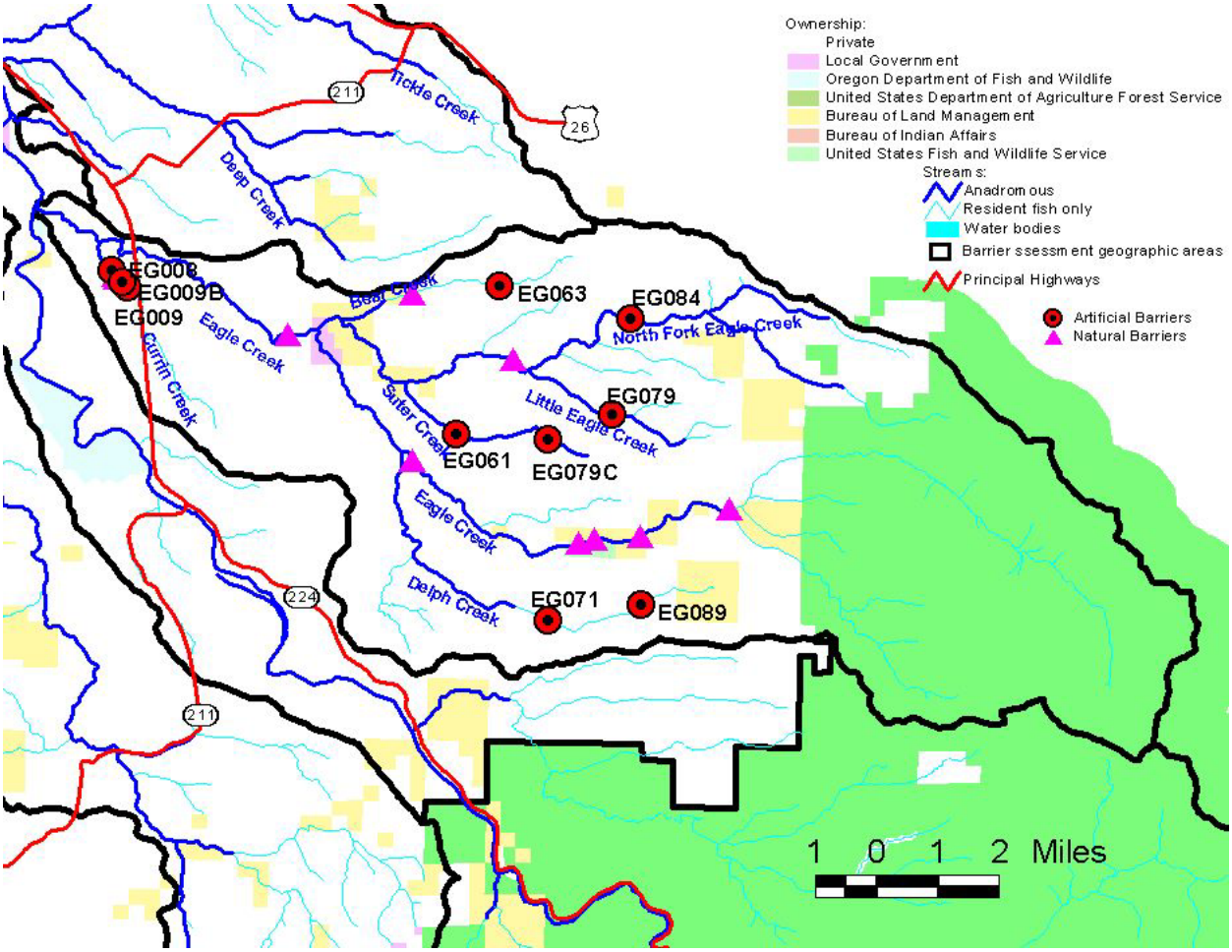

Figure 4. The ten highest-ranked artificial barriers to fish passage in the Eagle Creek watershed (from WPN, 2005).

2. Crossing EG009B – This crossing is a waterfall structure constructed on private ownership low on Currin Creek. It is a complete barrier to fish passage.

3. Crossing EG008 – This crossing on a privately maintained road is a partial barrier on lower Currin Creek with three culverts. One of the three culverts is a complete barrier and the other two are partial barriers because of a high outlet jump height and steep culvert slope.

4. Crossing EG071 – This County crossing is a complete barrier on Delph Creek under Porter Road. The crossing has two culverts that have high outlet jumps, a shallow outlet pool, and steep slopes.

5. Crossing EG079 – This crossing is a complete barrier on Little Eagle Creek on private ownership. The landowner has created a backwatering solution that might improve passage and has plans to monitor it. The owners are aware of the fish passage problem.

6. Crossing EG009 – This crossing is a partial barrier on Talons Road over Currin Creek. It is a double culvert crossing with a high outlet jump and borderline culvert slopes. The crossing is not of adequate size to handle the seasonal flows and routinely backs up over the road.

7. Crossing EG089 – This crossing is a complete barrier on Delph Creek on private ownership. It is a double culvert crossing with steep slopes and flow constriction that could create velocity barriers.

8. Crossing EG061 – This crossing is a partial barrier on a tributary to North Fork Eagle Creek under Clausen Road. Both culverts have fairly high outlet jumps and steep slopes.

9. Crossing EG063 – This crossing is a complete barrier to passage on Bear Creek under Kleinsmith Road. Though it has a fairly long length and is undersized compared to the average bankfull channel width, the primary cause of blockage to passage is a boulder strengthened wood barrier at the inlet that creates a ponding feature for the neighbor's landscaping. Removal of this barricade would facilitate fish passage, dropping this crossings priority ranking considerably.

10. Crossing EG079C – This culvert on a tributary of the North Fork Eagle Creek is a complete barrier. However, it is ranked 10th because it has no low-moderate channel habitat type reaches upstream of it. It is a barrier because it has a steep culvert slope and a moderate outlet jump that empties out onto a 35 foot bedrock chute.

For more information see:

- The Fish Passage Appendices, and the Fish Passage Barrier Map included in the *Deep and Goose Creek Watershed Assessment* report (WPN, 2005), available on-line at http://clackamasriver.org/projects.htm

- The Deep-Goose-Eagle Creeks Fish Passage Assessment Interactive Tool, available on-line at http://clackamasriver.org/projects.htm

US Forest Service Lands

Unpublished information on 78 fish barriers on National Forest lands was provided for this assessment by the US Forest Service (USFS, 2005). Forest Service data was provided in spreadsheet format, which was subsequently plotted within GIS as part of this assessment. Information on natural barriers within the area was available from ODF&W (2004). The geology and topography of the upper Clackamas Basin results in many more natural barriers to salmonids and resident fish migration than are found in the lower basin.

Of the 78 barriers identified in the upper basin, 12 are identified as partially blocking passage, and 66 completely block passage to fish species. All barriers but one are located on US Forest Service roads; the exception being located on State Route 224.

Prioritization was conducted using the methodology described above. Information on all 78 barriers found on USFS lands is presented in Table 1, found at the end of this document. The ten barriers identified as the highest priority are (ranked in descending order of priority; see Figure 5 for locations):

1. USFS crossing # 35 - This culvert is located on Forest Service Road 46 at Cabin Creek. The culvert is approximately 62' in length at a 1.1% gradient, with less then a foot of jump height at the downstream invert. The crossing is a partial barrier to the anadromous and resident species that use this creek.

2. USFS crossing #57 – Located on Forest Service Raod 4671at Rhododendron Creek. The culvert is set at a gradient of almost 8%, and with a jump height at the downstream invert of approximately 8 feet it is a complete barrier to anadromous and resident fish species found in this creek.

3. USFS crossing #16 – Located on Forest Service Road 46 on Mag Creek. The culvert is 37' in length, with an invert gradient of 2.3%, and a downstream invert height of approximately 3 feet. This is a complete barrier to the anadromous and resident fish species found in this creek.

4. USFS crossing #64 – Located on Forest Service Road 4671170 on Fawn Creek. This culvert is approximately 60' in length, with a gradient of 7.5%, and an invert height of approximately 8 feet. The culvert is a complete barrier to the resident (and probable anadromous) fish that use the creek.

5. USFS crossing #63 – Located on Forest Service Road 4671 on Fawn Creek. This culvert is approximately 80' in length, with a gradient of 1.9%, and a downstream invert elevation of 2.2 feet. This culvert is a complete barrier to the resident (and probable anadromous) fish that use the creek.

6. USFS crossing #2 – Located on Forest Service Road 4620 on Whale Creek. This culvert is approximately 48' in length, with a gradient of 3.9%, and a downstream invert elevation of 1.5'. The culvert is a complete block to the anadromous and resident species that use this creek.

7. USFS crossing #67 – Located on Forest Service Road 4200370 on Last Creek. This culvert is approximately 40' in length, with a gradient of 5.9%, and a downstream invert elevation of 1.1'. The culvert is a complete block to the resident fish species that use this creek.

8. USFS crossing #19 – Located on Forest Service Road 4645120 on Mag Creek. This culvert is approximately 41' in length, with a gradient of 3.0%, and a downstream invert elevation of 0.6'. This culvert is a complete block to the anadromous and resident species that use this creek.

9. USFS crossing #21 – Located on Forest Service Road 46 on Tar Creek. This culvert is approximately 75' in length, with a gradient of 6.2%, and a downstream invert elevation of 0.6 feet. This culvert is a partial block to the anadromous and resident species that use this creek.

10. USFS crossing #17 – Located on Forest Service Road 46 on Tag Creek. This culvert is set at a gradient of is approximately 5.4%, with a downstream invert elevation of 0.1 feet. This culvert is a partial block to the anadromous and resident species that use this creek.

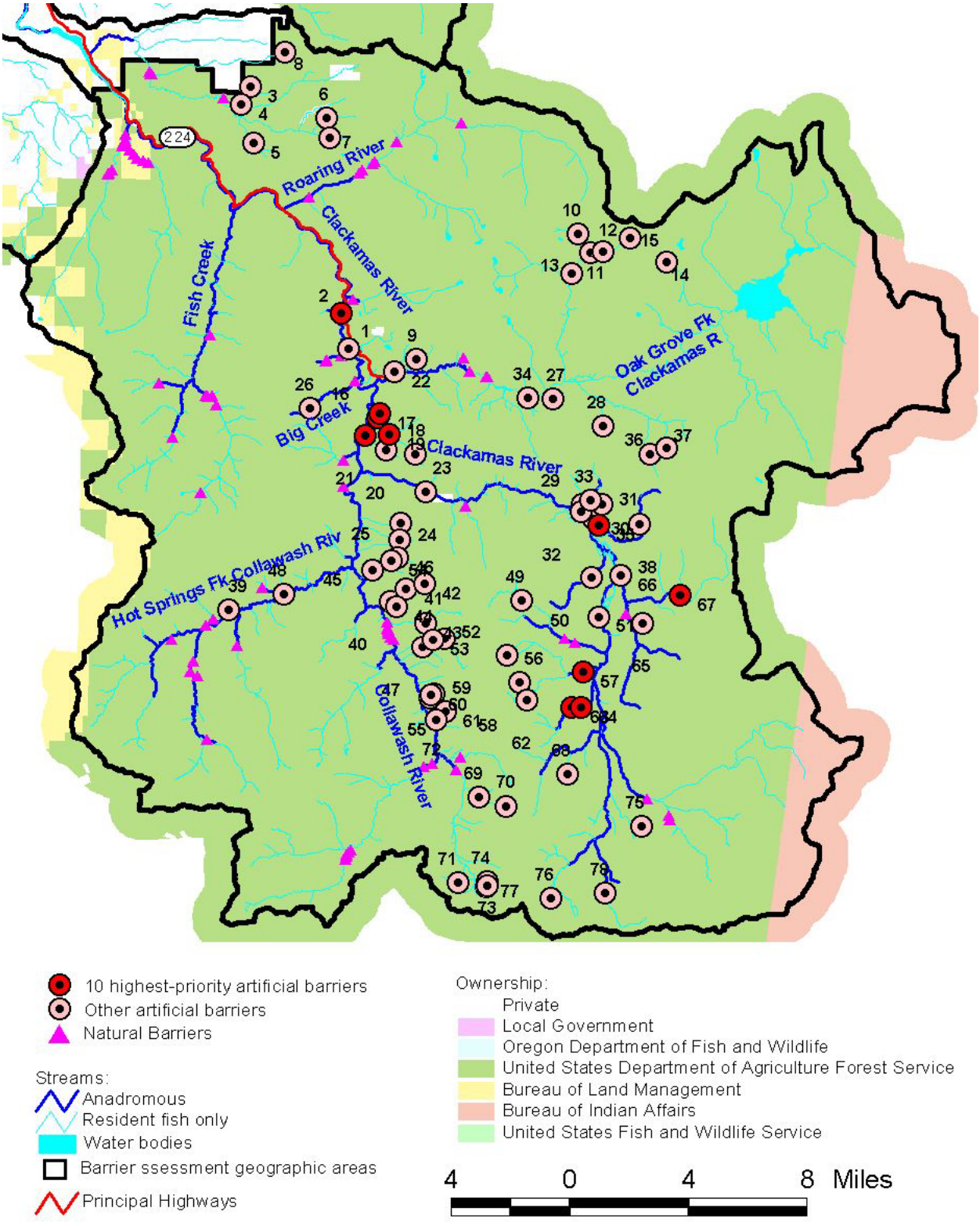

Figure 5. Artificial barriers to fish passage on USFS lands (derived from USFS, 2005).

Remaining Areas

The previous assessments and unpublished information cover the majority of the Clackamas Basin. However, there is a portion of the lower Clackamas River mainstem and Lower Basin tributaries (Rock, Richardson, Sieben, Wade and Dubois Creeks being the primary tributaries) that are not covered in prior studies (area labeled "other" in Figure 1). Information from the ODF&W (2004) was used to summarize barriers to fish passage in these areas.

21 potential fish barriers are identified by the ODF&W (2004) in these unsurveyed areas. on National Forest lands was provided for this assessment by the US Forest Service (USFS, 2005). In addition, 10 natural barriers were identified by ODF&W (2004). Barriers in the vicinity of Sieben, Rock, and Richardson Creeks are shown in Figure 6; barriers in the vicinity of Wade and Dubois Creeks are shown in Figure 7.

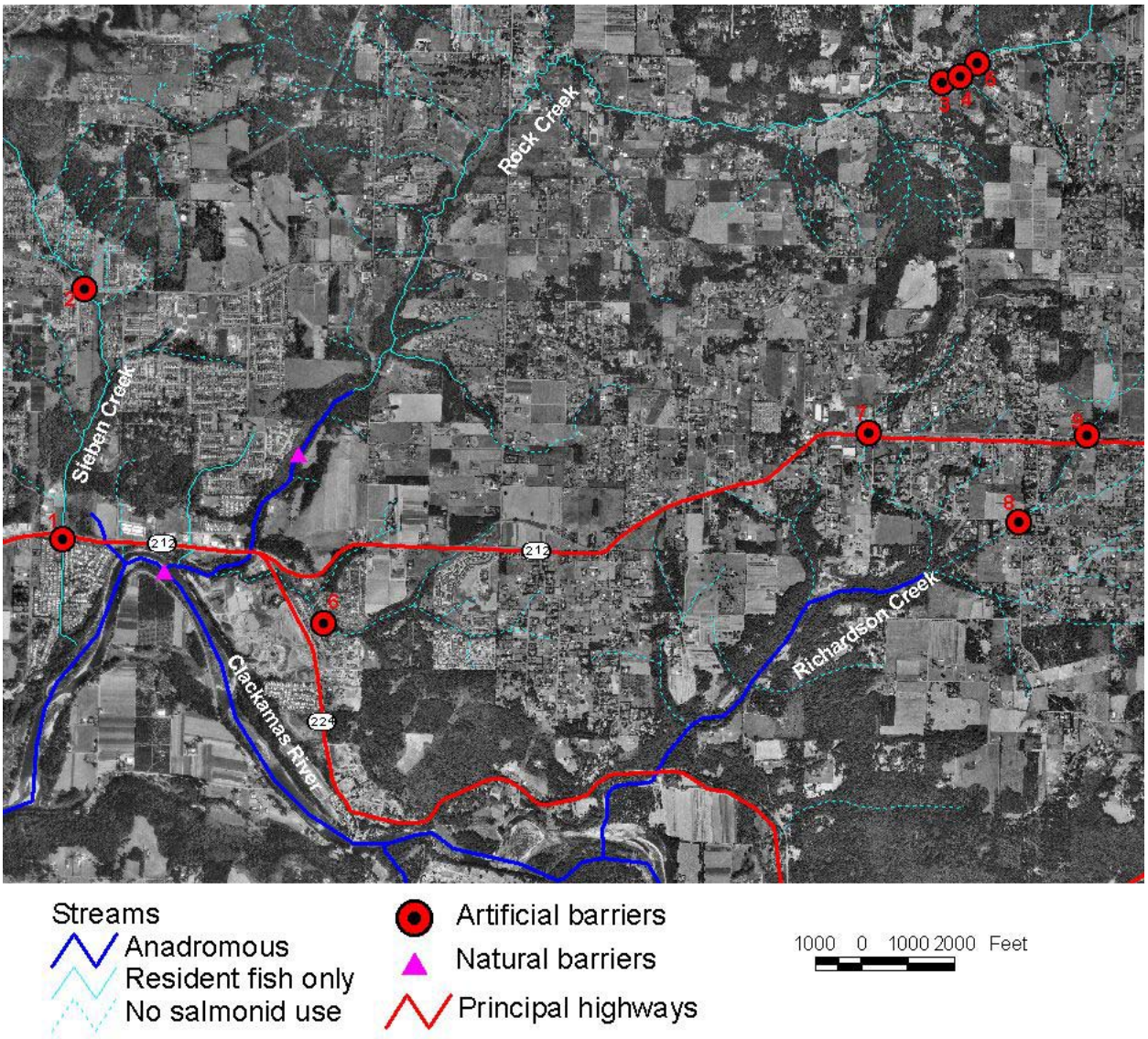

Figure 6. Artificial barriers to fish passage in the Sieben, Rock, and Richardson Creek watersheds (derived from ODFW, 2004).

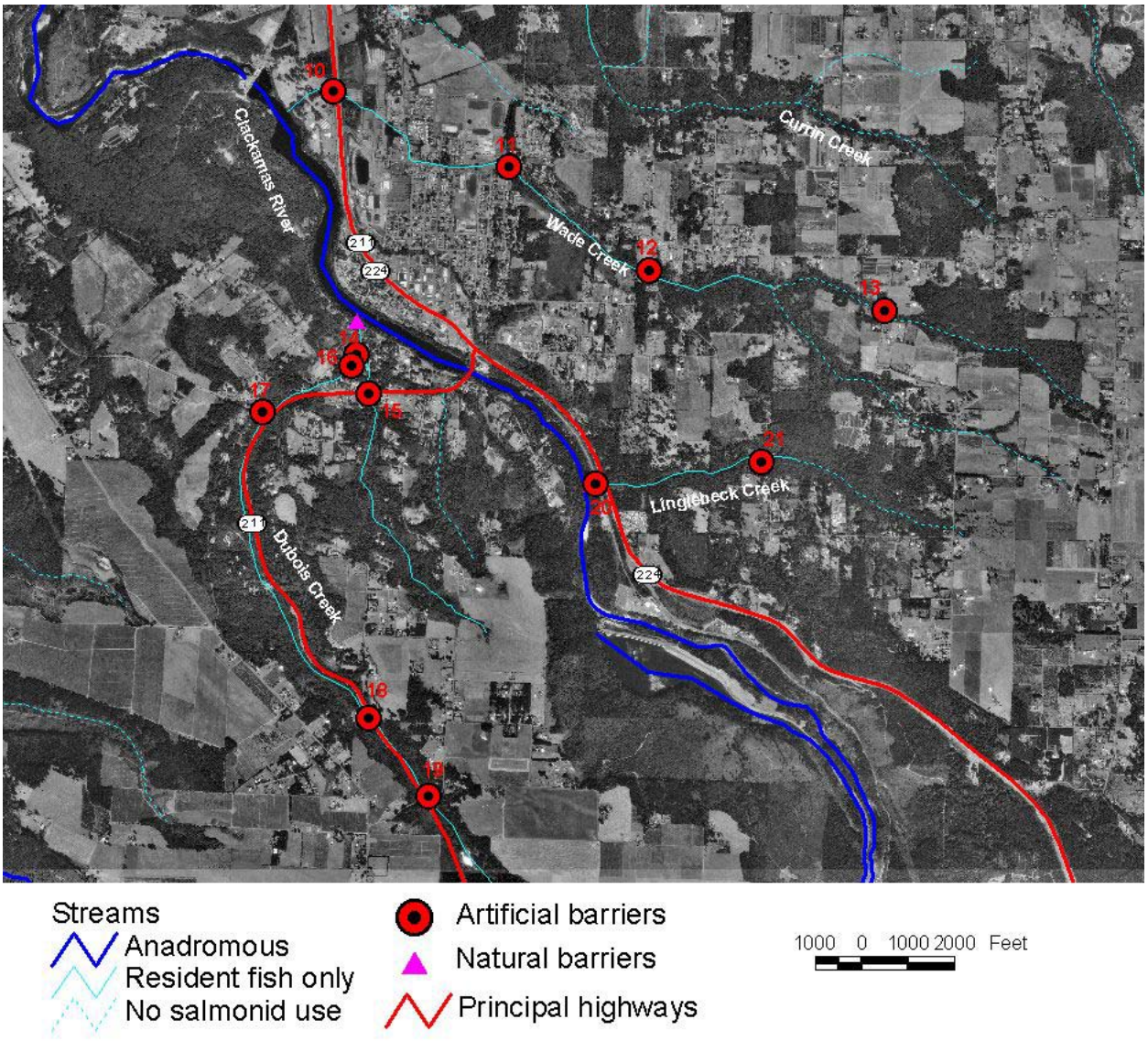

Figure 7. Artificial barriers to fish passage in the Wade, Dubois, and Linglebeck Creek watersheds (derived from ODFW, 2004).

Of the 21 potential barriers identified in these unsurveyed areas, only one is identified as a complete blockage (#20; Figure 7), six are identified as partial barriers, 2 are identified as not being barriers, and passage status is unknown at the remaining 12 sites. For the purposes of prioritization it was assumed that the barriers having unknown passage status are partial barriers. Five of the barriers are on streams that are identified as not currently supporting salmonid species.

Prioritization was conducted using the methodology described above. Information on all 21 barriers found in the unsurveyed areas is presented in Table 2, found at the end of this document.

The ten barriers identified as the highest priority are (ranked in descending order of priority; see Figure 6 and Figure 7 for locations):

1. #10 - Park Pond Dam: This is a partial barrier to resident salmonids, located near the mouth of Wade Creek. The Alaskan fishway barrier at highway crossing may allow some limited passage.

2. #14 – Culvert across Dubois Creek on S Poplar Road. Degree of blockage is unknown (assumed partial blockage). Consists of 2 culverts that create a velocity barrier, and provides a limited entrance pool that inhibits fish passage.

3. #16 - Culvert across Dubois Creek on S Poplar Road, upstream of previous. This is a partial barrier created by 2 pipes (60'x60") plus a 24" overflow pipe. Juvenile step barrier.

4. #3 – Culvert on Rock Creek at SE Wiese Road. This is a partial barrier (juvenile step barrier) with an inadequate jump pool.

5. #4 – Culvert on Rock Creek at SE Bohna Park Road, immediately upstream of previous site. Degree of blockage is unknown (assumed partial blockage). Step falls 4' over rock, pool is 4' horizontal distance below culvert.

6. #5 – Culvert on Rock Creek at SE Tillstrom Road, immediately upstream of previous site. This is a partial barrier. Velocity impedes fish passage.

7. #17 – Culvert on Dubois Creek at S Hayden Road. This is a partial barrier. Velocity impedes fish passage.

8. #11 – Culvert on Wade Creek at NE 6th Avenue. Degree of blockage is unknown (assumed partial blockage). Concrete extends 20' below culvert with 15" drop at lower end.

9. #18 – Culvert on Dubois Creek at State Highway 211. Degree of blockage is unknown (assumed partial blockage). Velocity, drop and lack of pool prohibit fish at most, if not all flows.

10. #20 – Culvert on Linglebeck Creek at State Highway 224. This is a complete blockage. Culvert is too steep and small to allow for fish passage.

References

Clackamas County. Unpublished culvert inventory for County Roads within the Clackamas River Basin. Department of Transportation and Development, Clackamas, OR

Oregon Department of Fish and Wildlife. 2004. Oregon Fish Passage Barriers database, version 9/15/04. Available at http://rainbow.dfw.state.or.us/nrimp/information/fishbarrierdata.htm

Robison , E. G. and J. Walsh. 2003. Clear and Foster Creek Fish Passage Assessment and Prioritization Project. Watersheds Northwest Inc., Mckinleyville CA and Upstream Connection, LLC, Portland OR

US Forest Service (USFS). 2005. Unpublished culvert inventory data for Forest Service lands within the Clackamas Basin. Clackamas River Ranger District, Mt. Hood National Forest, Estacada, OR

Watershed Professionals Network (WPN). 2005. Deep and Goose Creek Watershed Assessment. Watershed Professionals Network, Boise, ID; and Upstream Connection, LLC, Portland OR

Tables

Table 1. Characteristics of artificial barriers on USFS lands. Passing status gray = partial barrier; red = full barrier.

Map Id	Rd. #	Milepost	Stream Name	Legal	Culvert characteristics					Species	Dist. to Clack. R. (ft)	Upstr. Low-grad. Hab. (ft)	Values for RISE calculation					RISE
					Length (ft)	Slope (%)	Invert Ht (ft)	Pass status	Problem				B	S	H	Q	C	
1	St. Rte. 224	7.9	Bull Creek	T5S R6E S34	62	-1.3%	0.0	Grey		CT- RB	1220	3150	0.5	0.2	11300	0.28	2,976	613
2	4620000	0.6	Whale Creek	T5S R6E S28	48	-3.9%	1.5	Red	Gradient	Co- CT	1480	0	1	1	1470	0.00	2,970	2,970
3	4613130	0.4	Whisky Creek	T4S R5E S13	85	-5.1%	2.3	Red	Gradient	CT- RB	44125	0	1	0.2	0	0.00	2,118	424
4	4613000	0.5	Dry Creek	T4S R5E S23	74	-6.9%	2.3	Red	Gradient	RB	43450	0	1	0.2	6750	0.00	2,131	426
5	4611000	1.7	Winslow Creek	T4S R5E S25	35	-2.6%	0.5	Red	Gradient	RB	50080	2000	1	0.2	6015	0.33	1,998	800
6	4612140	0.1	Trib. To Boyer Creek	T4S R6E S20	37	-12.3%	2.4	Red	Gradient	RB	62240	0	1	0.2	5256	0.00	1,755	351
7	4612000	2.7	Boyer Creek	T4S R6E S28	46	-3.2%	0.5	Red	Gradient	RB	61870	1300	1	0.2	2820	0.46	1,763	613
8	4613000	3.5	Bedford Creek	T4S R6E S7	49	-2.2%	0.1	Red	Gradient	RB	45740	0	1	0.2	0	0.00	2,085	417
9	4631000	2.0	Station Creek	T5S R6E S36	55	-1.7%	0.3	Red	Gradient	CT- BT	10940	0	1	0.2	4600	0.00	2,781	556
10	5800150	0.1	High Creek	T5S R7E S11	63	-9.4%	3.4	Red	Gradient	CT	72180	1500	1	0.2	5250	0.29	1,556	611
11	5800138	0.3	Black Meadow Wolf Ck	T5S R7E S13	44	-4.8%	0.5	Red	Gradient	CT	68465	0	1	0.2	9750	0.00	1,631	326
12	5800140	0.1	Black Meadow Wolf Ck	T5S R7E S13	65	-6.3%	2.2	Red	Gradient	CT	70885	0	1	0.2	7330	0.00	1,582	316
13	5830000	0.8	High Creek	T5S R7E S14	48	-3.0%	2.9	Grey		CT	63500	1500	0.5	0.2	25500	0.06	1,730	323
14	5820000	2.1	Anvil Creek	T5S R8E S17	53	-8.9%	2.4	Red	Gradient	CT	98690	250	1	0.2	1350	0.19	1,026	255
15	5800000	5.7	Black Meadow Wolf Ck	T5S R8E S7	37	-7.6%	1.4	Red	Gradient	CT	76685	0	1	0.2	850	0.00	1,466	293
16	4600000	8.5	Mag Creek	T6S R6E S11	37	-2.3%	3.1	Red	Gradient	Co-SH- CT	1450	750	1	1	12225	0.06	2,971	3,721
17	4600000	8.6	Tag Creek	T6S R6E S12	0	-5.4%	0.1	Grey		Co-SH- CT	1540	0	0.5	1	9300	0.00	2,969	1,485
18	4640150	0.4	Mag Creek	T6S R6E S13	49	-2.6%	4.2	Red	Gradient- Perch	CT	11350	0	1	0.2	2325	0.00	2,773	555
19	4645120	0.4	Mag Creek	T6S R6E S14	41	-3.0%	0.6	Red	Gradient	Co- SH- CT	5200	0	1	1	8475	0.00	2,896	2,896
20	4645130	0.2	Tar Creek	T6S R6E S14	47	-2.1%	1.2	Red	Gradient	CT	4900	0	1	0.2	2580	0.00	2,902	580
21	4600000	7.7	Tar Creek	T6S R6E S15	75	-6.2%	0.6	Grey		Co-SH- CT	100	1280	0.5	1	7380	0.17	2,998	2,139
22	4600250	0.1	Pint Creek	T6S R6E S2	50	-2.7%	2.3	Red	Gradient	CT- RB	5400	1250	1	0.2	9130	0.14	2,892	828
23	4600000	4.0	Switch Creek	T6S R6E S25	60	-9.9%	6.5	Red	Gradient- Perch	No fish	100	0	1	0	3900	0.00	2,998	0
24	6311000	1.0	Cap Creek	T6S R6E S35	36	-2.4%	1.1	Red	Gradient	none	19265	0	1	0	2200	0.00	2,615	0
25	6311000	2.0	Sluice Creek	T6S R6E S35	81	-14.0%	4.5	Red	Gradient- Perch	CT	20475	0	1	0.2	2500	0.00	2,591	518
26	4620000	4.9	Big Creek	T6S R6E S8	70	-7.8%	0.6	Red	Gradient	RB	11450	0	1	0.2	4050	0.00	2,771	554
27	5730130	1.3	Trib. Of Oak Grove Fk.	T6S R7E S11	64	-7.9%	1.0	Red	Gradient	cT	39850	0	1	0.2	1500	0.00	2,203	441
28	5730000	4.4	Devil's Spring	T6S R7E S12	37	-2.2%	1.5	Red	Gradient	CT	56855	0	1	0.2	1150	0.00	1,863	373
29	4660000	0.4	Lost Creek	T6S R7E S25	51	-12.6%	3.3	Red	Span:BF	CT	2300	2800	1	0.2	9640	0.29	2,954	1,151
30	4600000	7.6	Pan Creek	T6S R7E S25	86	-2.1%	4.5	Red	Gradient- Perch	CT	2030	0	1	0.2	3400	0.00	2,959	592
31	4660000	1.2	Pan Creek	T6S R7E S25	63	-12.6%	1.4	Red	Gradient	CT	5430	0	1	0.2	0	0.00	2,891	578
32	4600000	8.1	Pot Creek	T6S R7E S25	71	-2.4%	0.4	Grey		CT	1140	2800	0.5	0.2	21990	0.13	2,977	578
33	4660000	0.7	Pot Creek	T6S R7E S25	85	-8.9%	0.9	Red	Gradient- Perch	CT	3900	0	1	0.2	8805	0.00	2,922	584

Map Id	Rd. #	Milepost	Stream Name	Legal	Culvert characteristics					Species	Dist. to Clack. R. (ft)	Upstr. Low-grad. Hab. (ft)	Values for RISE calculation					RISE
					Length (ft)	Slope (%)	Invert Ht (ft)	Pass status	Problem				B	S	H	Q	C	
34	5700000	5.8	Trib. Of Oak Grove Fk.	T6S R7E S3	55	-8.2%	0.5	Red	Gradient	CT- RB	35000	0	1	0.2	4675	0.00	2,300	460
35	4600000	6.8	Cabin Creek	T6S R7E S36	62	-1.1%	0.3	Grey		Co- SH- CT	2950	9000	0.5	1	21875	0.41	2,941	5,971
36	5730000	7.1	Chief Creek	T6S R8E S17	35	-3.6%	0.4	Red	Gradient	CT	68000	4300	1	0.2	4300	1.00	1,640	1,188
37	5730000	8.1	Snive Creek	T6S R8E S17	41	-6.4%	1.0	Red	Gradient	unknown	68915	0	1	0.2	0	0.00	1,622	324
38	4660000	3.5	Cabin Creek	T6S R8E S31	42	-0.7%	0.4	Grey		CT	14200	3500	0.5	0.2	9400	0.37	2,716	622
39	7000000	4.7	Ferry Creek	T7S R5E S13	52	-6.9%	2.9	Red	Gradient	RB	50505	0	1	0.2	0	0.00	1,990	398
40	6300170	0.2	Peat Creek	T7S R6E S11	63	-6.6%	3.7	Red	Gradient	CT	36240	0	1	0.2	10235	0.00	2,275	455
41	6311000	4.7	Peat Creek	T7S R6E S12	50	-3.0%	0.8	Red	Gradient	CT	40130	0	1	0.2	1550	0.00	2,197	439
42	6310000	8.2	So. Fork Peat Creek	T7S R6E S12	61	-12.4%	1.0	Red	Gradient	CT	43730	0	1	0.2	0	0.00	2,125	425
43	6300000	8.5	Buckeye Creek	T7S R6E S13	12	-8.6%	0.2	Grey		CT	43745	0	0.5	0.2	8000	0.00	2,125	213
44	6300000	7.0	Trib. Of Collawash N. of Buckeye Creek	T7S R6E S14	57	-6.3%	2.0	Red	Gradient	CT	36780	0	1	0.2	0	0.00	2,264	453
45	6300170	2.3	Paste Creek	T7S R6E S2	85	-5.5%	6.2	Red	Gradient- Perch	CT	26525	0	1	0.2	12260	0.00	2,470	494
46	6311000	3.0	Paste Creek	T7S R6E S2	41	-9.1%	0.3	Red	Gradient	CT	31835	0	1	0.2	3045	0.00	2,363	473
47	6300000	0.0	Happy Creek	T7S R6E S24	68	-7.0%	3.6	Red	Gradient	RB	49525	0	1	0.2	0	0.00	2,010	402
48	7000000	2.8	Dutch Creek	T7S R6E S7	71	-8.9%	2.0	Red	Gradient	CT- RB	39125	0	1	0.2	4440	0.00	2,218	444
49	4672000	0.3	N. Trib. Lowe Creek	T7S R7E S10	82	-2.9%	0.1	Grey		CT	19970	6950	0.5	0.2	13015	0.53	2,601	955
50	4651000	3.0	Kansas Creek	T7S R7E S12	62	-13.7%	0.5	Red	Gradient	CT	7200	1780	1	0.2	10800	0.16	2,856	927
51	4670000	0.5	Unamed Trib. Of Clackamas River	T7S R7E S13	5	-4.2%	4.2	Red	Gradient- Perch	CT	300	0	1	0.2	0	0.00	2,994	599
52	6350000	2.1	Happy Creek	T7S R7E S19	32	-7.7%	1.1	Red	Gradient	RB	54175	500	1	0.2	4525	0.11	1,917	483
53	6360000	0.6	Happy Creek	T7S R7E S19	16	-5.7%	7.6	Red	Gradient- Perch	RB	51675	4500	1	0.2	14445	0.31	1,967	1,293
54	6311160	0.3	Paste Creek	T7S R7E S2	42	-6.1%	6.7	Red	Gradient- Perch	CT	30595	0	1	0.2	4290	0.00	2,388	478
55	6380000	0.3	Russ Creek	T7S R7E S2	95	-11.0%	2.2	Red	Gradient	RB	56475	0	1	0.2	0	0.00	1,871	374
56	4672000	3.3	Tumble Creek	T7S R7E S21	60	-4.3%	0.1	Red	Gradient	CT	21200	0	1	0.2	540	0.00	2,576	515
57	4671000	1.2	Rhododendron Creek	T7S R7E S25	0	-7.6%	7.9	Red	Gradient- Perch	SH-Co-CT	3350	2575	1	1	40625	0.06	2,933	5,508
58	4672000	4.7	N. Trib. Rhododenron	T7S R7E S27	63	-7.5%	1.1	Red	Gradient	CT	17300	0	1	0.2	0	0.00	2,654	531
59	6370000	0.3	Blitzen Creek	T7S R7E S31	0	-14.7%	4.0	Red	Gradient- Perch	RB	55486	0	1	0.2	1275	0.00	1,890	378
60	6380000	0.2	Blitzen Creek	T7S R7E S31	60	-6.0%	0.4	Red	Gradient- Perch	RB	56181	0	1	0.2	1970	0.00	1,876	375
61	6370000	1.4	Jazz Creek	T7S R7E S31	5	-16.2%	3.6	Red	Gradient	No Fish	63950	0	1	0	0	0.00	1,721	0
62	4672000	5.5	Rhododendron Creek	T7S R7E S34	65	-7.5%	2.0	Red	Gradient	CT	16300	2575	1	0.2	4770	0.54	2,674	1,050
63	4671000	2.7	Fawn Creek	T7S R7E S35	83	-1.9%	2.2	Red	Gradient- Span:BF	CT (SH-Co-CT??)	7800	550	1	1	18430	0.03	2,844	3,394
64	4671160	2.1	Fawn Creek	T7S R7E S36	60	-7.5%	8.0	Red	Gradient- Perch	CT (SH-Co-CT??)	6200	550	1	1	20030	0.03	2,876	3,426
65	4200000	1.9	Trib. Of Last Creek	T7S R8E S17	57	-6.5%	1.3	Red	Gradient	CT	10900	0	1	0.2	0	0.00	2,782	556
66	4600000	0.1	Bonner Creek	T7S R8E S7	40	-0.9%	0.3	Grey		unknown	475	0	0.5	0.2	1150	0.00	2,991	299

Map Id	Rd. #	Milepost	Stream Name	Legal	Culvert characteristics					Species	Dist. to Clack. R. (ft)	Upstr. Low-grad. Hab. (ft)	Values for RISE calculation					RISE
					Length (ft)	Slope (%)	Invert Ht (ft)	Pass status	Problem				B	S	H	Q	C	
67	4210370	0.9	Last Creek	T7S R8E S9	40	-5.9%	1.1	Red	Gradient	CT	16200	12100	1	0.2	23000	0.53	2,676	2,955
68	4672000	0.0	Trib. Of Hunter Creek	T8S R7E S14	50	-1.3%	0.5	Grey		CT	14370	0	0.5	0.2	0	0.00	2,713	271
69	6370000	3.3	Round Creek	T8S R7E S17	36	-8.0%	3.0	Red	Gradient	BT	81040	400	1	0.2	3200	0.13	1,379	356
70	4671000	1.1	Round Creek	T8S R7E S27	54	-10.9%	2.2	Red	Gradient	BT	86210	0	1	0.2	0	0.00	1,276	255
71	6370000	1.9	Tributary of East. Fk. Collawash River	T8S R7E S31	88	-8.7%	0.7	Red	Gradient	RB	100337	1360	1	0.2	1915	0.71	993	471
72	6380000	1.2	Jazz Creek	T8S R7E S33	51	-6.0%	8.0	Red	Gradient- Perch	No Fish	61658	0	1	0	220	0.00	1,767	0
73	6370000	0.6	Maryanne Creek	T8S R7E S33	82	-4.5%	4.7	Red	Gradient- Perch	RB	100002	0	1	0.2	1640	0.00	1,000	200
74	6370000	1.3	Tributary of East. Fk. Collawash River	T8S R7E S33	72	-4.2%	2.0	Red	Gradient	RB	100218	0	1	0.2	0	0.00	996	199
75	4600000	4.2	Cub Spring	T8S R8E S20	73	-4.9%	0.0	Red	Gradient	CT	21650	0	1	0.2	1450	0.00	2,567	513
76	4672260	1.7	S. Fork Berry Creek	T9S R7E S2	79	-6.5%	2.9	Red	Gradient	CT	35802	0	1	0.2	630	0.00	2,284	457
77	6370000	1.1	E. Fk. Collawash River	T9S R7E S5	80	-4.7%	0.6	Red	Gradient	RB	100380	0	1	0.2	0	0.00	992	198
78	4600000	6.6	Cub Creek	T9S R8E S6	80	-1.6%	0.7	Grey		CT	32170	7350	0.5	0.2	12300	0.60	2,357	971

Table 2. Characteristics of artificial barriers within unsurveyed areas.

Map ID	Road	Description	Passage status	Comments	Ownername	Dist. to Clack. R. (ft)	Upstr. Low-grad. Hab. (ft)	Values for RISE calculations					RISE
								B	S	H (ft of upstream hab)	Q	C	
1	State Hwy 212	Unnamed culvert	None		ODOT	2600	0	0	0.2	11050	0	2948	0
2	SE Sunnyside Road	Unnamed culvert	Unknown	@ SE 140th (Rd 22491)	Clackamas Co.	8400	0	0.5	0.2	5250	0	2832	283
3	SE Wiese Road	Unnamed culvert	Partial	Juvenile step barrier. Inadequate pool.	Clackamas Co.	25775	5600	0.5	0.2	8000	0.7	2484.5	808
4	SE Bohna Park Rd	Unnamed culvert	Unknown	Step falls 4' over rock, pool is 4' horizontal distance below culvert.	Clackamas Co.	26200	5600	0.5	0.2	7575	0.74	2476	808
5	SE Tillstrom Rd	Unnamed culvert	Partial	0.15 miles from Bohna Rd. intersection. Velocity impedes fish passage.	Clackamas Co.	26700	5600	0.5	0.2	7075	0.79	2466	807
6	n/a	Haberlach Dam	Unknown		Private	4200	0	0.5	0	0	0	2916	0
7	State Hwy 212	Unnamed culvert	Unknown	Double Culvert meets standards; upper end is blocked with a board, debris.	ODOT	14500	0	0.5	0	0	0	2710	0
8	SE Royer Road	Unnamed culvert	Unknown		Clackamas Co.	12950	0	0.5	0	0	0	2741	0
9	State Hwy 212	Unnamed culvert	Unknown	Not on straight-line chart. Velocity barrier.	ODOT	15350	0	0.5	0	0	0	2693	0
10	n/a	Park Pond Dam	Partial	Documented in 1949. Owner source: Ref. 50088. Alaskan fishway barrier at highway crossing--may allow some limited passage.	Private	1300	8550	0.5	0.2	11200	0.76	2974	1152
11	NE 6th Ave	Unnamed culvert	Unknown	Concrete extends 20' below culvert with 15" drop at lower end. Co Rd log lists as Bridge (18' x 26')	Clackamas Co.	5650	4235	0.5	0.2	6850	0.62	2887	712
12	SE Moss Hill Road	Unnamed culvert	None		Clackamas Co.	9450	1050	0	0.2	3050	0.34	2811	0
13	SE Squaw Mtn Rd	Unnamed culvert	Unknown	Velocity barrier.	Clackamas Co.	14830	0	0.5	0	0	0	2703	0

Map ID	Road	Description	Passage status	Comments	Ownername	Dist. to Clack. R. (ft)	Upstr. Low-grad. Hab. (ft)	Values for RISE calculations					RISE
								B	S	H (ft of upstream hab)	Q	C	
14	S Poplar Rd	Unnamed culvert	Unknown	2 culverts. Velocity and lack of pool inhibit fish passage.	Clackamas Co.	750	5530	0.5	0.2	23360	0.24	2985	852
15	State Hwy 211	Unnamed culvert	Unknown	Velocity barrier.	ODOT	1660	0	0.5	0.2	6500	0	2967	297
16	S Poplar Rd	Unnamed culvert	Partial	2 pipes (60'x60") + 1 24" overflow pipe. Co Rd log lists as concrete. Juvenile step barrier.	Clackamas Co.	1400	5530	0.5	0.2	15790	0.35	2972	850
17	S Hayden Rd	Unnamed culvert	Partial	Velocity impedes fish passage.	Clackamas Co.	3500	4860	0.5	0.2	13690	0.36	2930	779
18	State Hwy 211	Unnamed culvert	Unknown	Velocity, drop and lack of pool prohibit fish at most, if not all flows.	ODOT	11200	3360	0.5	0.2	5990	0.56	2776	614
19	S Day Hill Rd	Unnamed culvert	Partial	Velocity impedes fish passage.	Clackamas Co.	13250	2160	0.5	0.2	3940	0.55	2735	490
20	State Hwy 224	Unnamed culvert	Complete	Checked upstream end only. Culvert is too steep and small to allow for fish passage.	ODOT	150	0	1	0.2	4640	0	2997	599
21	SE Moss Hill Road	Unnamed culvert	Unknown	Slope varies.	Clackamas Co.	3890	0	0.5	0.2	900	0	2922	292