APPENDIX G – ODFW FISH HABITAT IN THE CATHERINE CREEK GRANDE RONDE RIVER BASIN JANUARY 2011

FISH HABITAT ASSESSMENT IN CATHERINE CREEK, GRANDE RONDE RIVER BASIN

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Fish Habitat Assessment in Catherine Creek, Grande Ronde River Basin

Project Description and Introduction

A collaborative project between the Oregon Department of Fish and Wildlife (ODFW), Bureau of Reclamation (BOR), the Grande Ronde Model Watershed (GRMW), Union Soil and Water Conservation District (USWCD), and numerous other partners and landowners was initiated to examine the many factors which contribute to fish, specifically spring Chinook, survival in Catherine Creek. Potential outcomes include the development of operational management plans, stream habitat restoration projects, habitat conservation planning, and watershed analysis. The ODFW Aquatic Inventories Project conducted stream habitat surveys to document the status of stream conditions. These surveys in conjunction with fish distribution form the basis of the analyses. This paper summarizes the condition of stream habitat, the distribution and abundance of salmonid fishes, and the potential for restoration.

Catherine Creek is a tributary to the Grande Ronde River, which originates in the Blue Mountains in northeast Oregon. Catherine Creek flows 89 kilometers from the junction of South Fork and North Fork Catherine Creeks to its (current) confluence with the State Ditch (Figure 1). The creek flows out of the North and South Fork of Catherine Creek which is underlain by Grande Ronde and Imnaha basalt lithology. Most of the surveyed section flows through alluvial deposits that form the valley bottom. The lower reaches are deep, meandering sections of stream with little definition or structure, with remnant, cut-off oxbows. The surrounding landscape consists primarily of agriculture fields. The middle reaches of Catherine Creek have more distinct habitats, flow through an urban area (the town of Union), and has a mix of landscape influences. The upper reaches below North and South Fork Catherine creeks are mostly on state or federal land, have an increased gradient, and have more opportunities for off-channel habitat formation.

Viable anadromous salmonid populations in Catherine Creek and tributaries consist of Spring Chinook salmon (*Oncorhychus tshawytscha*) and summer steelhead (*O. mykiss*). The salmonids are designated as 'Threatened' under the federal Endangered Species Act. Additionally, bull trout (*Salvelinus confluentus)* and mountain whitefish (*Prosopium williamsoni*) are present. Non-salmonid species are present, but their distributions are either not well-documented or are not the subject of targeted studies. The list of observed fish includes Northern pike minnow *(Ptychocheilus oregonensis)*, carp (*Cyprinus carpio*), redside shiner (*Richardsonius balteatus)*, brown bullhead (*Ameiurus nebulosus*), smallmouth bass (*Micropterus dolomieu*), and catfish (*Ictalurus* species).

Spring Chinook salmon spawn and rear in the upper reaches, higher gradient portions of Catherine Creek. Naturally-produced age-0 fall migrants, account for 78% of the fish (Yanke et. al. 2009), and leave during the fall to overwinter downstream of Davis Dam. In the spring, they migrate out of Catherine Creek and the Grande Ronde watershed to migrate the sea as age-1 juveniles. Another group of juvenile Chinook overwinter in upper Catherine Creek and tributaries, and leave Catherine Creek at age-1 in the spring for the ocean. They return from the ocean to their natal streams two to three years later from June through August as 3 and 4 year old adults. Spawning occurs in the reaches above Davis Dam in August and September.

Summer steelhead trout spawn and rear upstream of the town of Union; they utilize the Creek downstream from Union for migration and rearing. Approximately one third overwinter in downstream areas and are considered early migrants. Steelhead may remain in Catherine Creek for up to 4 years before leaving the basin for their migration downstream to the ocean. The average ocean-going smolt age is 2 (Yanke et al. 2009). Steelhead remain in the ocean 1-2 years before returning to their natal stream to spawn.

Habitat Survey Approach and Methods

ODFW Aquatic habitat surveys were conducted on Catherine Creek in 1991, 1995, and 2010. All surveys described the channel morphology, riparian characteristics, and features and quality of instream habitat during summer flow, following methods described in Moore et al. (2010). Each habitat unit is an area of relatively homogeneous slope, depth, and flow pattern representing different channel forming processes. The units are classified into 22 hierarchically organized types of pools, glides, riffles, rapids, steps, and cascades, including slow water and off-channel pool habitat. Length, width, and depth was estimated or measured for each habitat unit. In addition, water surface slope, woody debris, shade, cover, and bank stability were recorded. Substrate characteristics were visually estimated at every habitat unit. Estimates of percent silt, sand, and gravel in low gradient (1-2%) riffles were used to describe potential spawning gravel quantity and quality. The surveys also provided an inventory of site-specific features such as potential barriers to fish passage (e.g., falls, culverts, and diversions) or oxbows.

Riparian transects described tree type and size, canopy closure, and ground cover associated with the floodplain, terraces, and hillslopes adjacent to the stream. Each transect was 5m wide and extended 30m perpendicular on each side of the stream.

Descriptions of channel and valley morphology followed methods developed at Oregon State University and described in detail in Moore et al. (2010). Valley and channel morphology defined the stream configuration and level of constraint that local landforms such as hillslopes or terraces imposed upon the stream channel (Grant 1988, Gregory et al. 1989, Moore and Gregory 1989). The channel was described as terrace-constrained or unconstrained. Channel dimensions included active (or bankfull) channel width and depth, floodprone width and height, and terrace widths and height. These descriptions of channel morphology have corresponding types within the OWEB and Rosgen channel typing system (Rosgen 1994).

The stream habitat surveys followed a basins, or census, survey design. The basin survey followed methodology proposed by Hankin (1984) and Hankin and Reeves (1988). The sampling design is based on a continuous walking survey from the mouth or confluence of a stream to the headwaters. The stream is stratified into a series of long sections called reaches and into short habitat units within each reach. The methodology provided flexibility of scale, allowing information to be summarized at the level of microhabitat, associations of habitat, portions or reaches of streams, watersheds, and subunits within regions. The continuous-survey approach provides field-based estimates of habitat conditions throughout a stream, described habitat and hydrologic relationships among streams or landscape features, and permitted stream-wide estimates of fish distribution and abundance.

The basin surveys were integrated into coverages on the 1:100,000 scale USGS digitized layer in a Geographical Information System (Jones et al 2001). The surveys were routed and displayed at the channel reach and habitat unit scales.

Analysis

Habitat data were summarized at the reach scale to describe channel morphology, habitat structure, sediment supply and quality, riparian forest connectivity and health, and in-stream habitat complexity. Individual attributes include:

Channel morphology	Channel dimensions
	Channel constraint features, if any
	Gradient
	Percent secondary channels
	Floodplain connectivity
Pool habitat	Percent pool
	Percent slow, backwater, and off-channel pools
	Deep Pools (>1m deep)
	Complex pools (contain > 3 pieces large wood)
Large Wood	Pieces of large wood (>0.15 diameter and >3m length)
	Volume of large wood (m3)
	Key pieces of wood (>0.6m diameter and >12m length)
Bank structure	Bank erosion
	Undercut bank
Substrate	Percent fines (silt, sand, organics), gravel, cobble, boulder, bedrock
	Percent fines and gravel in low gradient riffles
	Large course substrate – boulder count
Riparian	Shade
	Density of conifer trees, by size category
	Density of hardwood trees, by size category

Results

Catherine Creek 2010 habitat survey

The Catherine Creek 2010 habitat survey extended approximately 89 kilometers upstream from its confluence with the State Ditch to its terminus with the North Fork Catherine Creek and South Fork Catherine Creek. Twenty-two reaches were designated based on named tributary junctions, diversion or dam structures, bridge crossings, and geomorphic changes (Figure 2).

The upper reaches are forested below the confluence of North and South Catherine creeks, although the river flows through an agricultural and ranching landscape for most of its length. Catherine Creek flow through the town of Union from 63.7 river kilometer (rkm) to 66.4 rkm. Diversion dams are located at 64.5, 64.8, 65.0, and 66.3 rkm, and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) operate a weir at 69.2 rkm.

The survey was divided into three sections for this general discussion: a lower section (mouth to Davis Dam), middle section (Davis Dam to Brinkler Creek), and an upper section (Brinkler Creek to North Fork and South Fork Catherine Creeks) (Figure 3). More detail by reach can be found in the Catherine Creek 2010 Habitat Report (Appendix A).

The lower section of Catherine Creek (0 rkm to 56 rkm, Reaches 1 to 9) is a continuous homogenous channel, approximately 20 meters wide, which meanders through agriculture land use. The Creek, opaque with suspended sediment, is deep (average 0.9 meters) with little defined habitat. The gradient of the section is so slight that it averages 0.0 percent. Oxbows, remnant channels, have been cut off from the mainstem with only a control structure connecting the creek with the oxbow. The stream substrate and stream banks are primarily composed of fine sediment (hardpan clay, silt, some sand). Shrubs (hawthorn, willow, dogwood) and grasses line the stream bank providing little in the way of shade or woody (live or dead) structure. Elmer's Dam (20 rkm) is a seasonal dam for irrigation. Boards are placed/removed to control the water height and availability. When all the boards are in place, the water may pool for 21km (personal communication, L. Kuchenbecker). Tributaries entering the lower section of Catherine Creek include Warm Creek, Mill Creek, Old Grande Ronde River, McAlister Slough, and Ladd Creek.

The middle section (56 rkm to 76 rkm, Reaches 10-16) is shallower (average 0.5m) above the Davis Dam pool and characterized by more defined habitat, a mix of land use influences, and an increase in streamside trees. The channel is primarily a single channel, with little off-channel habitat. The stream habitat includes low gradient riffles as well as scour pools and glides. The substrate is a mix of fine sediments, gravel, and cobble. Large willows and other deciduous trees contribute to shading. Little Creek, Pyles Creek, and Brinkler Creek are named tributaries which enter the middle section. Land uses include agriculture, residential, and urban; the creek flows through the town of Union. There are at least five dams/fish ladders/diversions which fish encounter at river kilometer 64.5, 64.8, 65.0, 66.3, and 69.2. Lower Davis Dam marks the downstream margin of this section. Upper Davis Dam, located 1 km upstream from Lower Davis Dam, backs up water approximately 2.6 km. At present, both retain water from June through October through the use of boards.

The upper section of Catherine Creek extends from Brinkler Creek to the confluence of the North and South Fork Catherine Creeks (76 rkm – 89 rkm, Reaches 17-22). The upper section has long stretches of riffles with some rapids and pools; the average depth is 0.37m. The average gradient is 1.3 percent (Figure 5). Catherine Creek State Park and Whitman Nation Forest are within this section. The surrounding area is forested with deciduous and coniferous trees of all size classes. Trees in the riparian areas shade the creek, add stability to stream banks, and are a source of large wood for the channel. Named tributaries include Little Catherine Creek, Milk Creek, and Scout Creek. The stream habitat is complex with secondary channels, backwaters, and alcoves. Secondary channel habitat, nearly a third the distance of the primary channel, offers additional opportunity for fish to find slow water refuge.

Comparison of aquatic habitat in Catherine Creek 1991-1995 and 2010

The Aquatic Inventories Project conducted stream habitat surveys on Catherine Creek in the early 1990's and in 2010. Different portions of Catherine Creek were surveyed in 1991 and 1995; these were combined into one, continuous survey. The 2010 survey began at the confluence of Catherine Creek and State Ditch while the 1991-95 survey did not survey the lower 17km. In order to compare these surveys, Catherine Creek was split into three major sections, a lower (survey start to Davis Dam), middle (Davis Dam to Brinkler Creek), and an upper section (Brinkler Creek to North Fork and South Fork Catherine Creeks) (Figure 4).

Catherine Creek has changed little between the two surveys. The lower section of the creek continues to be a meandering stream constrained by terraces and agricultural activities with little undercut, riparian shading, or large wood. The substrate and bank material is fine sediment (Figure 6) and some of which is actively eroding. Percent active erosion may have decreased since 1995 simply due to increased shrub growth, which in turn better anchored the substrate. Water visibility is low. The middle section transitions from an agriculture landscape to a section with agriculture and urban land uses. The creek has five dams and diversions in this section. Streamside shade, coarse substrate, and stream gradient increases in the middle section. The upper reach maintains the riffle/pool habitat ratio of the middle section. However, the character of the upper section changes dramatically with a sharp increase in the number of multiple channels. The secondary and off-channel habitat increases from approximately 600 meters in the middle section to close to 5000 meters in the upper section (Figure 7). The primary channel to secondary channel area and length is similar between surveys (Table 1). The channel geomorphology and dimensions, habitat types, and substrate composition changed little between survey years (Table 2). Approximately half-as-much wood was observed during the 1991-95 survey in contrast to the 2010 survey, although the amount was still low (Table 3). The upper section had the most wood and the most opportunity for wood contribution.

There was a high water event in early June, prior to the 2010 survey start. The water flow reached more than 1200 cubic feet per second (cfs) in early June; a month later at the start of the survey the water flow had dropped to 140 cfs (Water Resources Department, http://apps2.wrd.state.or.us/apps/sw/hydro_report/data_Results.aspx?station_nbr=13320000&start_date=9/30/1980&end_date=9/30/2010&record_type=mdfMonthly_monthly_statistics_complete&tolerance=0&fdcCase=usgs&record_status=PUB&nbr_days=14&nbr_max=10). Normal flow at this time of year (June) ranges from 100-700 cfs. The high terraces on either side of Catherine Creek contained much of the high water, though many tributaries and oxbows flooded. Large wood data was higher in 2010 than the 1991-95 habitat survey. It is unclear as to how much wood was washed downstream or had been present prior to the high water event. The percent of pools was similar for both surveys, though there were more deep pools and more complex pools (deep pools with large wood) in 2010. Part of this may be attributed to the high water event and earlier time of survey; July – early September versus September and October for the 1991-95 survey. The total distance of secondary channels remained more or less the same. In the upper section, an unconstrained portion had been reworked by the Creek during the spring high water event. Gravel and wood were piled and channels had been formed, altering the available habitat.

Habitat quality relative to life stage requirements

We used a model (HabRate; Burke et al. 2010) to integrate habitat attributes as a method to assess overall habitat quality relative to freshwater life stages of Chinook and steelhead. We described the habitat quality for 1) spawning, egg survival, and emergence, 2) summer rearing, and 3) winter rearing. HabRate incorporates the habitat attributes collected in Catherine Creek during the summer of 2010. We collected information on stream substrate (fine sediment, gravel, and cobble), habitat unit type (scour, beaver, and off channel pools), cover (large wood, undercut banks), and channel morphology (secondary channels, gradient). The model combined attributes using logic equations, and provides a overall rating of habitat quality in a stepwise fashion. The ratings can be used as an additional tool to consider limiting factors for salmonid productivity in the system. Our assessment does not include water quality or quantity, although those factors can be added to the model for consideration. Model output ranks physical habitat quality from 1 to 3: poor, fair, and good.

We generated ratings from the 1991-95 and 2010 surveys. The conclusions concerning physical habitat were similar between survey years at the scale of the three long sections so we will focus on the output of the 2010 survey. The ratings are described here for the three sections, followed by a more detailed analysis for the 22 reaches.

Appendix B contains the habitat criteria for Chinook salmon and Steelhead trout life stages.

HabRate model results for Catherine Creek 2010: Spring Chinook Salmon

The availability and quality of spawning habitat did not change in the three sections (lower, middle, and upper) between 1991-95 and 2010. Appendix C illustrates the following summary for Chinook salmon. Spawning habitat is poor in the lower section and fair in the middle and upper sections. The abundance of fines and lack of coarse material lowers the quality of the few riffles that are present in the lower section. Riffles are prevalent in the middle and upper sections and the substrate has few fines and more gravel, but little cobble.

Overall, the lower section rated fair for 0+ Summer Rearing and Overwintering. Pools were scarce and cover was low. However the very few pools had good complexity which created an overly optimistic average rating for the reach. The middle section and upper sections also rated as fair on average (Figure 8). The sections lacked suitable pool area, undercut banks, large wood, and cobble substrate. Due to a decrease in fines and an increase in gravel, the substrate rating increased to good. The quantity of boulders also increased the cover rating.

HabRate model results for Catherine Creek 2010: Summer Steelhead Trout

HabRate comparisons for summer Steelhead generated the similar values for the 2010 surveys for each of the six categories (Appendix D). The lower section contains poor habitat for steelhead spawning, incubation and emergence. Substrate availability and quality precludes areas for spawning and survival to emergence were steelhead to successfully spawn. Spawning habitat quantity and quality is fair in the middle and upper sections.

Habitat quality for summer and winter rearing of age-0 and age-1 juvenile steelhead was poor in the lower section and fair in the middle and upper sections. Habitat was uniform with few pools and structurally-simple in the lower section. The middle and upper sections had few pools, although they had adequate depth and structure. The substrate complexity increase in the middle and upper sections, which provided better conditions for juvenile steelhead.

Reach detail of Catherine Creek 2010 survey data

Maintaining the original 22 reaches of the 2010 Catherine Creek survey allows for a finer scale of detail (Figure 2). Detailed examination of the 22 reaches shows the variety within the overall pattern in the middle and upper reaches (Appendices E and F). Selected reaches which met the good level of Chinook salmon and steelhead spawning, incubation, and emergence are 12, 13, 16, 20, and 21. The percent of pools achieved a good level in Reach 12 and fair in Reaches 18 and 20, and Reaches 20-22 had substantially higher amount of secondary channel as well. These attributes increase the quality of rearing habitat for juvenile steelhead and Chinook at all life stages. High quality Summer Rearing habitat for 1+ summer Steelhead is less widely available than overwintering habitat. No reach achieved a good rating. Generally, pool area, depth in fast water units, undercut, and large wood was low. Reaches 1-11 ranked poor; Reaches 12-22 ranked fair. Summer habitat water depth in fast water units ranged from 0.13-0.33m, which is lower than the preferred > 0.45m. Reaches 13, 14, 16, and 19-22 had better winter rearing conditions for steelhead because of a combination of cover factors – boulders, undercut, and/or wood availability.

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Tables

Table 1. Catherine Creek 1991-95 and Catherine Creek 2010 consolidated into three sections for comparison of reach features.

Survey	Reach	Primary channel length (m)	Secondary channel length (m)	Valley type*	Channel type**	Wetted width (m)	Active Channel width (m)	Terrace width (m)	Land use° dominant	Land use° subdominant	Vegetation type°° dominant	Vegetation type°° subdominant	Gradient (%)
Catherine Creek 9195	lower	34,752	20	WF	US	12.3	19.7	30.4	AG		G	D3	0
Catherine Creek 9195	middle	12,925	563	CT	CT	9	14.3	17	AG		D3	S	0.5
Catherine Creek 9195	upper	14,679	3,783	CT	CT	7.4	11.4	14.1	LG		M50		1.2
Catherine Creek 2010	lower	55,945	868	CT	CT	14.6	18.9	31.6	AG		S	G	0
Catherine Creek 2010	middle	20,169	582	CT	CT	9	16.2	26.4	LG	AG	G		0.6
Catherine Creek 2010	upper	13,296	4,864	CT	CT	7.5	17	30.4	LG	ST	G	D3	1.3
		89,410											

* Valley type codes: WF - wide floodplain; CT - constrained by high terraces

** Channel type codes: US - unconstrained single channel; CT - constrained by high terraces

° Land use codes: AG - agricultural crop or dairy land; LG - light grazing pressure; ST - second-growth timber (15-30cm dbh)

°° Vegetation type - G - annual grasses; S - shrubs; D3 - deciduous trees 3-15cm dbh; M50 - mixed conifer/deciduous trees 50-90cm dbh

Table 2. Catherine Creek 1991-95 and Catherine Creek 2010 consolidated into three sections for comparison of habitat unit-scale features.

Survey	Reach	Percent Substrate: organic	sand	gravel	cobble	boulder	bedrock	Percent wetted area (habitat): backwater	scour pool	glide	riffle	rapid	Pool summary: number of pools	number of pools >=1m deep	number of complex pools	pool frequency (channel widths/pool)
Catherine Creek 9195	lower	59	41	0	0	0	0	0	3.09	96.05	0	0	19	17	N/A *	93
Catherine Creek 9195	middle	8	21	40	35	5	2	15	15	10	57	12	125	19	N/A *	7
Catherine Creek 9195	upper	15	3	28	44	9	0	1.6	12	2	51	31	199	7	N/A *	8.2
Catherine Creek 2010	lower	42	27	2	0	0	28	1	0	98	1	0	7	0	2	428
Catherine Creek 2010	middle	5	5	45	35	7	3	2	11	9	51	1	90	44	19	14.2
Catherine Creek 2010	upper	8	9	31	42	8	2	0	12	0	73	11	110	30	28	9.7

N/A *: Complex pools were not calculated at the time of the survey.

Table 3. Catherine Creek 1991-95 and Catherine Creek 2010 consolidated into three sections for comparison of reach-scale features including bank condition and large woody debris (lwd).

Survey	Reach	Percent active erosion	Percent undercut banks	Number of pieces lwd	Pieces lwd/100m	Volume of lwd	Volume lwd/100m	Key pieces of lwd	Key pieces lwd/100m
Catherine Creek 9195	lower	16	0	94	0.3	14	0	N/A *	N/A *
Catherine Creek 9195	middle	29	1	387	3	118	0.9	N/A *	N/A *
Catherine Creek 9195	upper	16	1	516	3.5	306	2.1	N/A *	N/A *
Catherine Creek 2010	lower	6	1	340	0.6	84	0.2	1	0
Catherine Creek 2010	middle	9	3	639	3.2	347	1.7	7	0
Catherine Creek 2010	upper	17	7	1142	8.6	784	5.9	34	0.3

N/A *: Key pieces were not calculated at the time of the survey.

Table 4. Life history ratings for Chinook salmon and Steelhead trout for Catherine Creek based on 2010 habitat survey data.

		Chinook Salmon Habitat			**Steelhead trout Habitat**				
Stream	Reach	Spawning to Emergence	0+ Summer	0+ Winter	Spawning to Emergence	0+ Summer	0+ Winter	1+ Summer	1+ Winter
Catherine Creek	1	1	2	2	1	1	1	1	1
Catherine Creek	2	1	2	2	1	1	1	1	1
Catherine Creek	3	1	2	2	1	1	1	1	1
Catherine Creek	4	1	2	2	1	1	1	1	1
Catherine Creek	5	1	2	2	1	1	1	1	1
Catherine Creek	6	1	2	2	1	1	1	1	1
Catherine Creek	7	1	2	2	1	1	1	1	1
Catherine Creek	8	1	2	2	1	1	1	1	1
Catherine Creek	9	1	2	2	1	1	1	1	1
Catherine Creek	10		unsurveyed				unsurveyed		
Catherine Creek	11	1	2	2	1	2	1	1	1
Catherine Creek	12	3	3	2	3	3	2	2	2
Catherine Creek	13	3	2	2	3	2	3	2	3
Catherine Creek	14	2	2	2	2	2	3	2	3
Catherine Creek	15		unsurveyed				unsurveyed		
Catherine Creek	16	3	2	2	3	2	3	2	3
Catherine Creek	17	2	2	2	2	2	3	2	3
Catherine Creek	18	3	2	2	1	2	2	2	2
Catherine Creek	19	2	2	2	2	2	3	2	3
Catherine Creek	20	3	2	2	3	3	3	2	3
Catherine Creek	21	3	2	2	3	2	3	2	3
Catherine Creek	22	2	2	2	2	2	3	2	3

Figures

Figure 1. Catherine Creek Watershed within the Grande Ronde River Basin (HU 17060104)

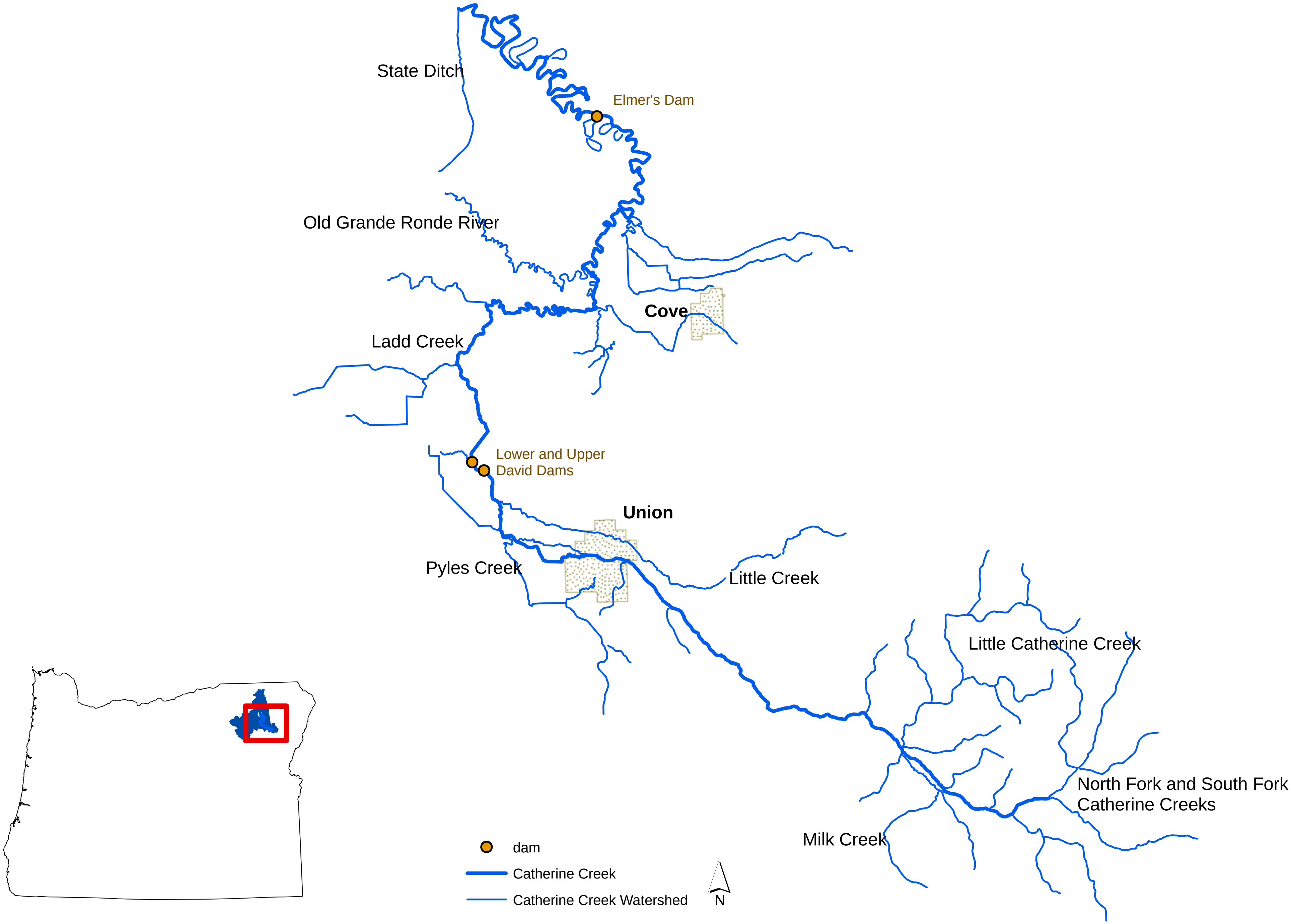


Figure 2. Catherine Creek reach breaks based on 2010 habitat survey data
Note that Reaches 10 and 15 were not surveyed

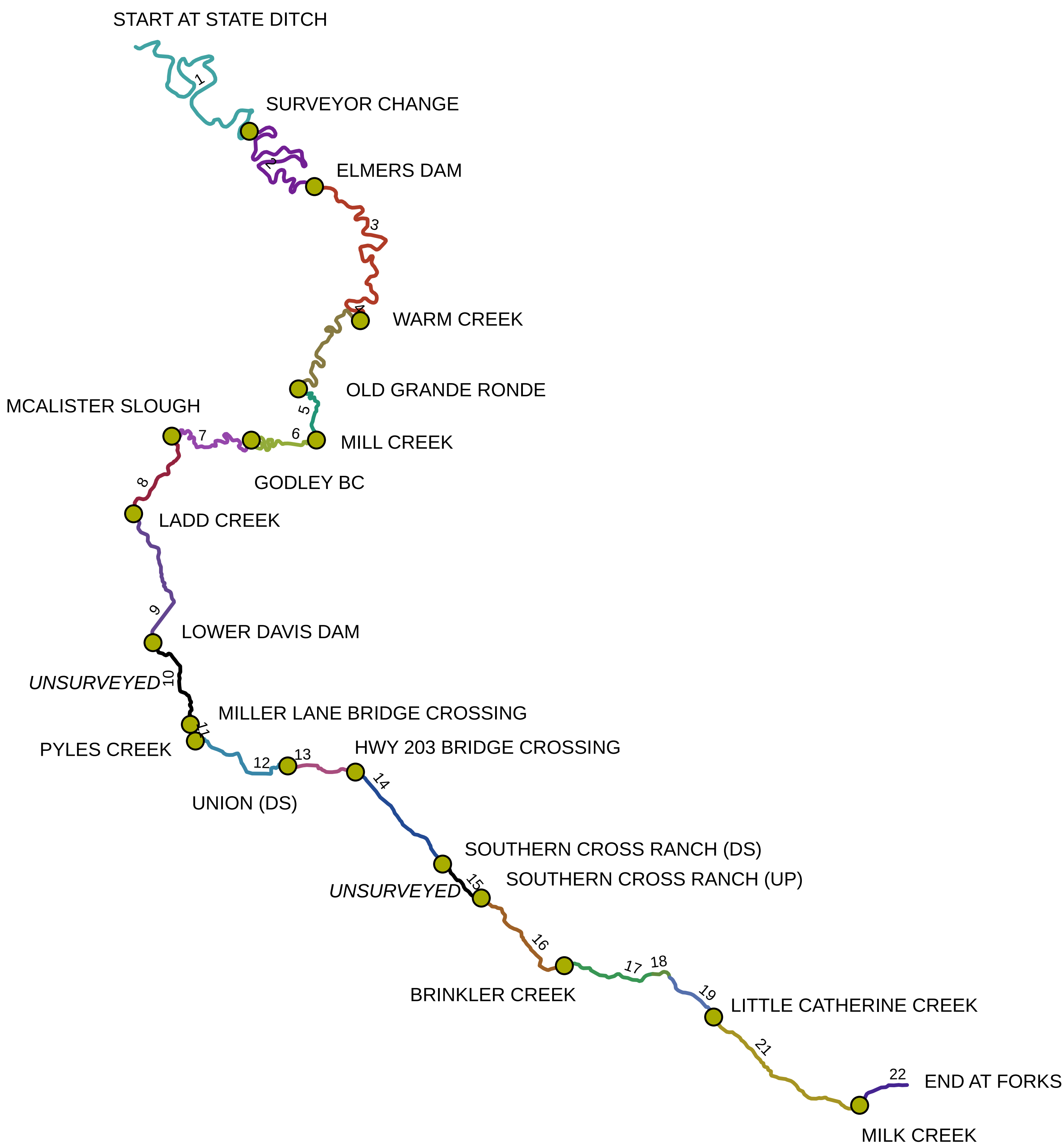


Figure 3. Catherine Creek 2010 habitat survey split into three sections: lower, middle, upper.

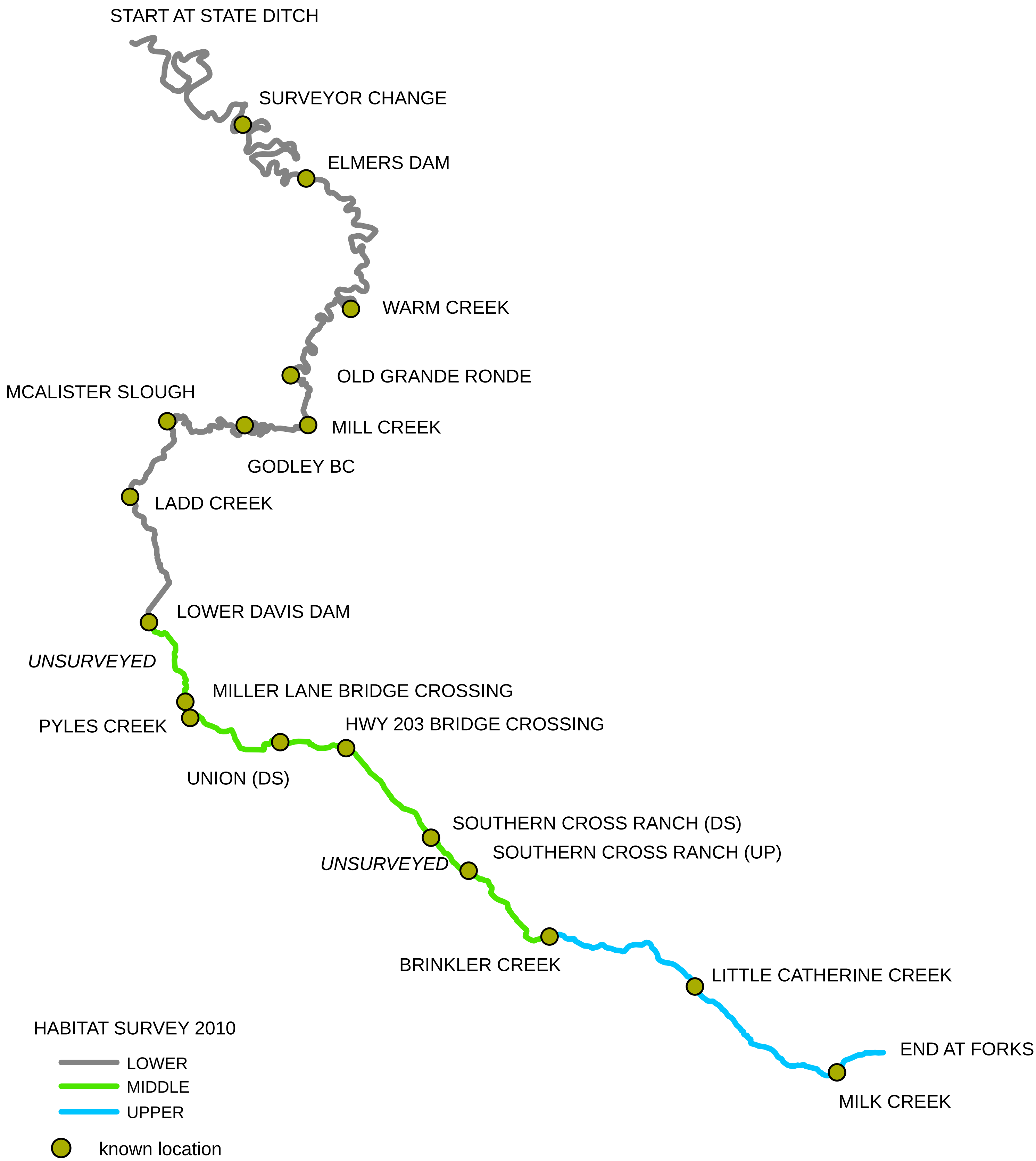


Figure 4. Catherine Creek divided into three sections (lower, middle, upper) for comparison of 1991-1995 and 2010 habitat survey data.

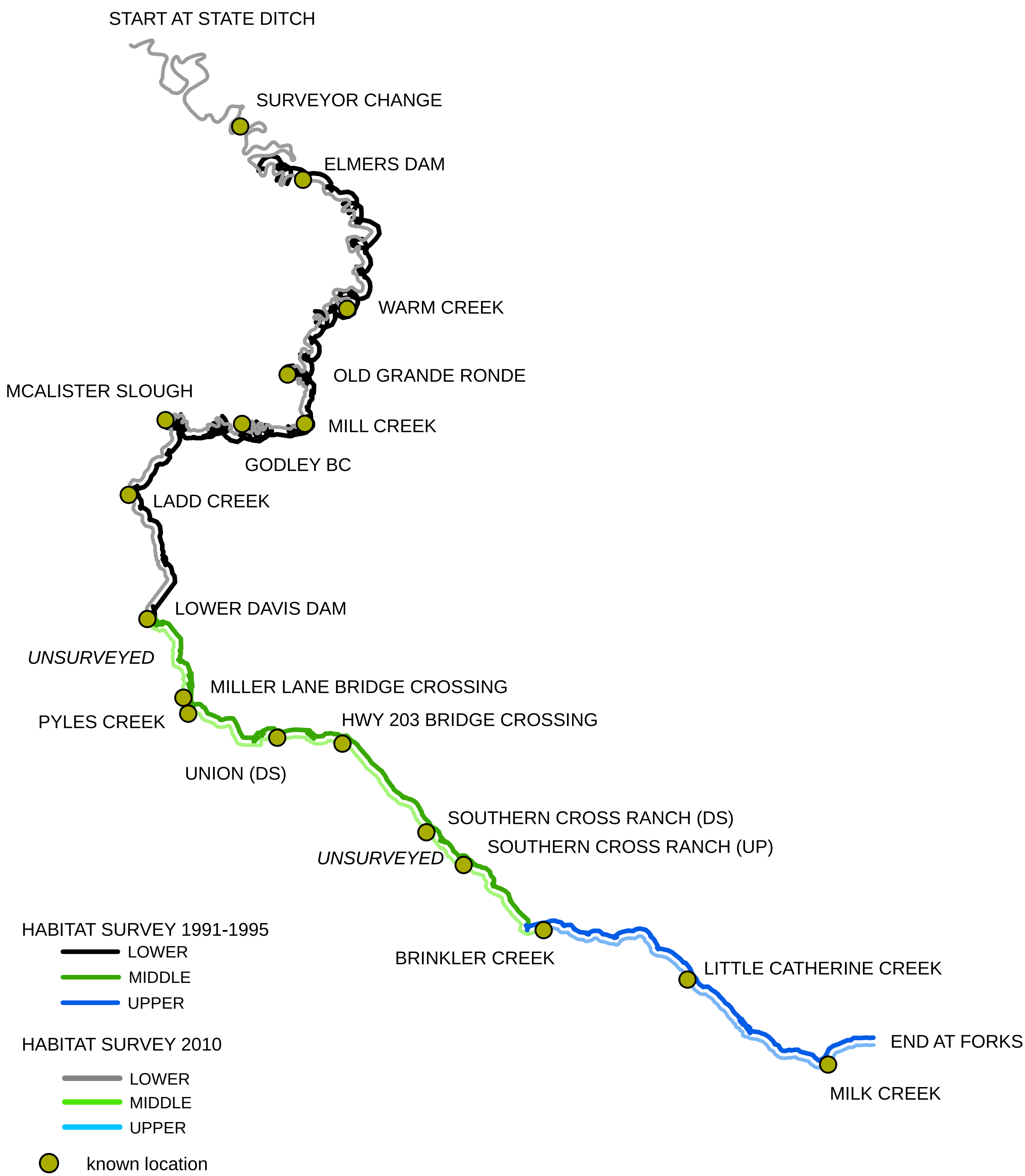


Figure 5. Catherine Creek gradient based on 2010 habitat survey data

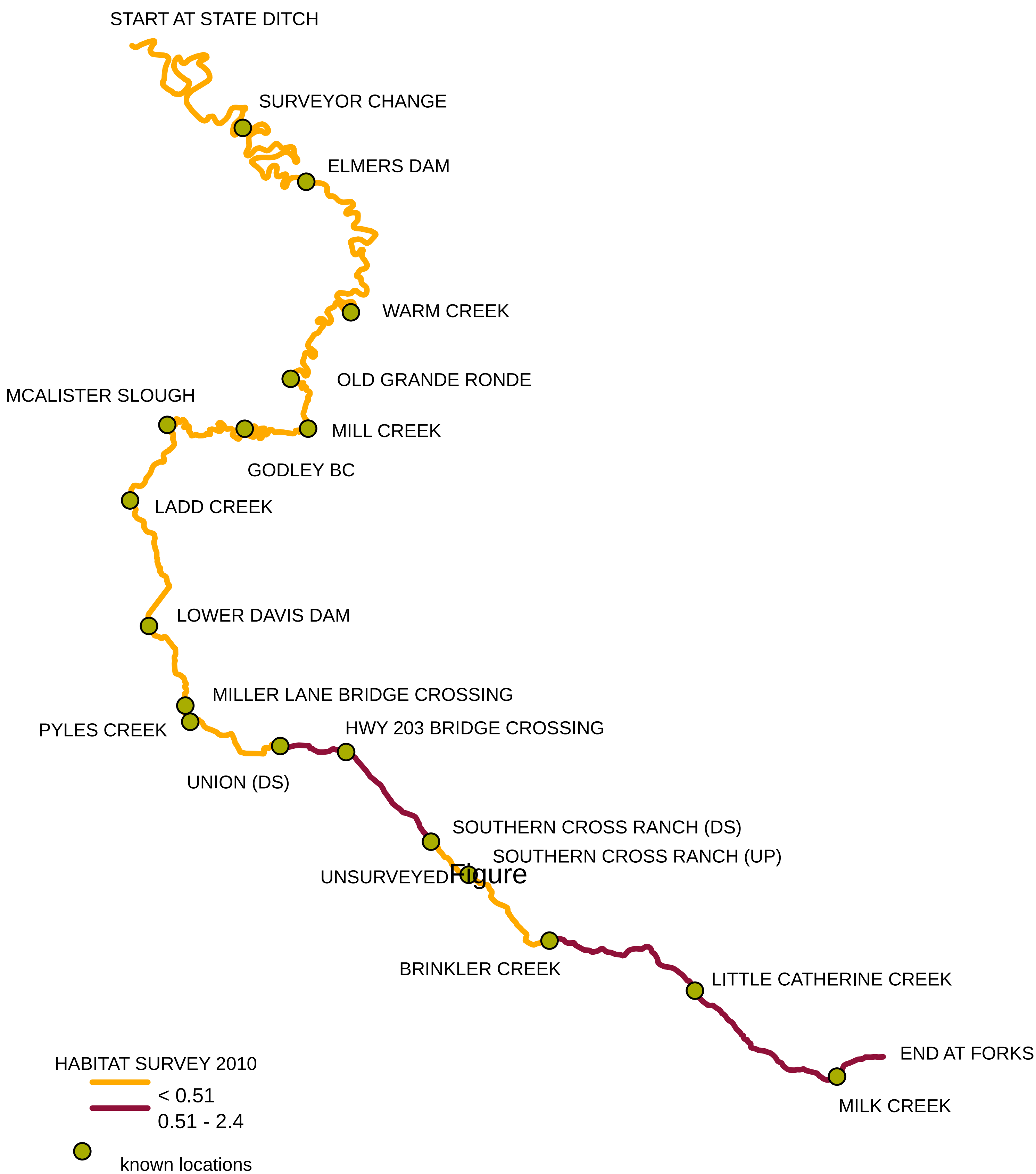


Figure 6. Catherine Creek divided into three sections for comparison of Percent Fine Sediment based on 1991-1995 and 2010 habitat survey data.

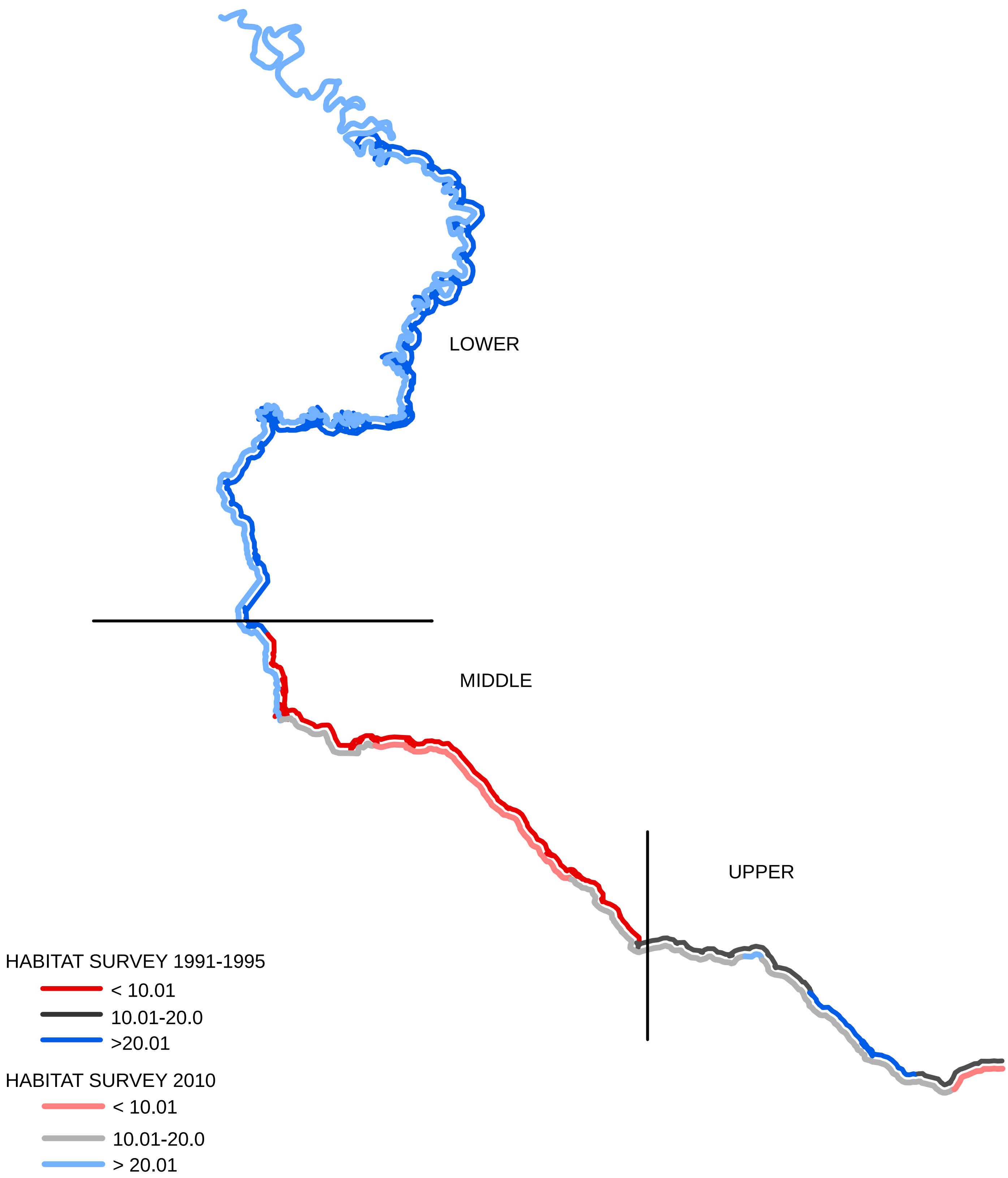


Figure 7. Catherine Creek divided into three sections for comparison of Percent Secondary Channel Length based on 1991-1995 and 2010 habitat survey data.

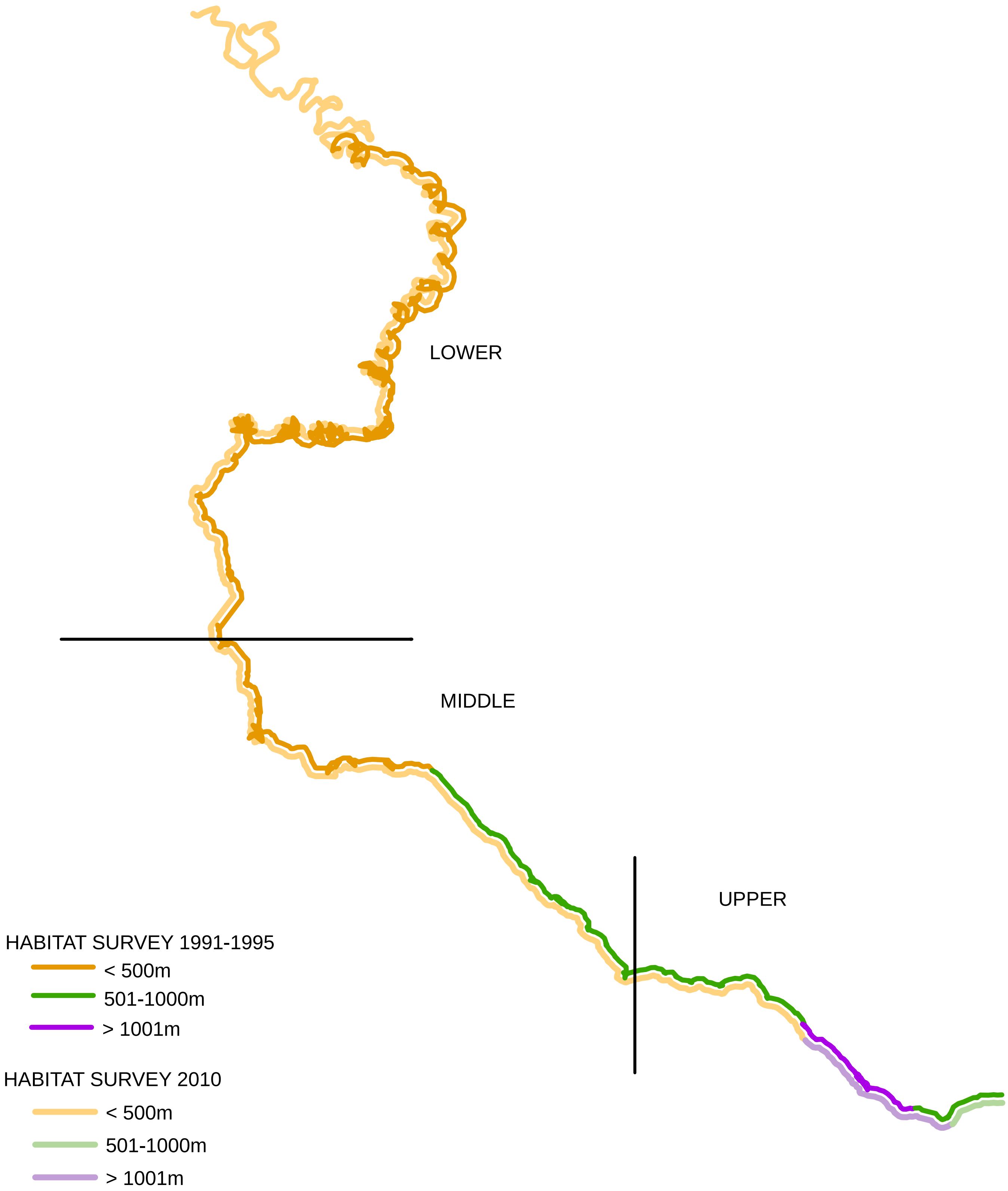


Figure 8. Catherine Creek 2010 habitat survey data applied to Chinook salmon HabRate life history ratings

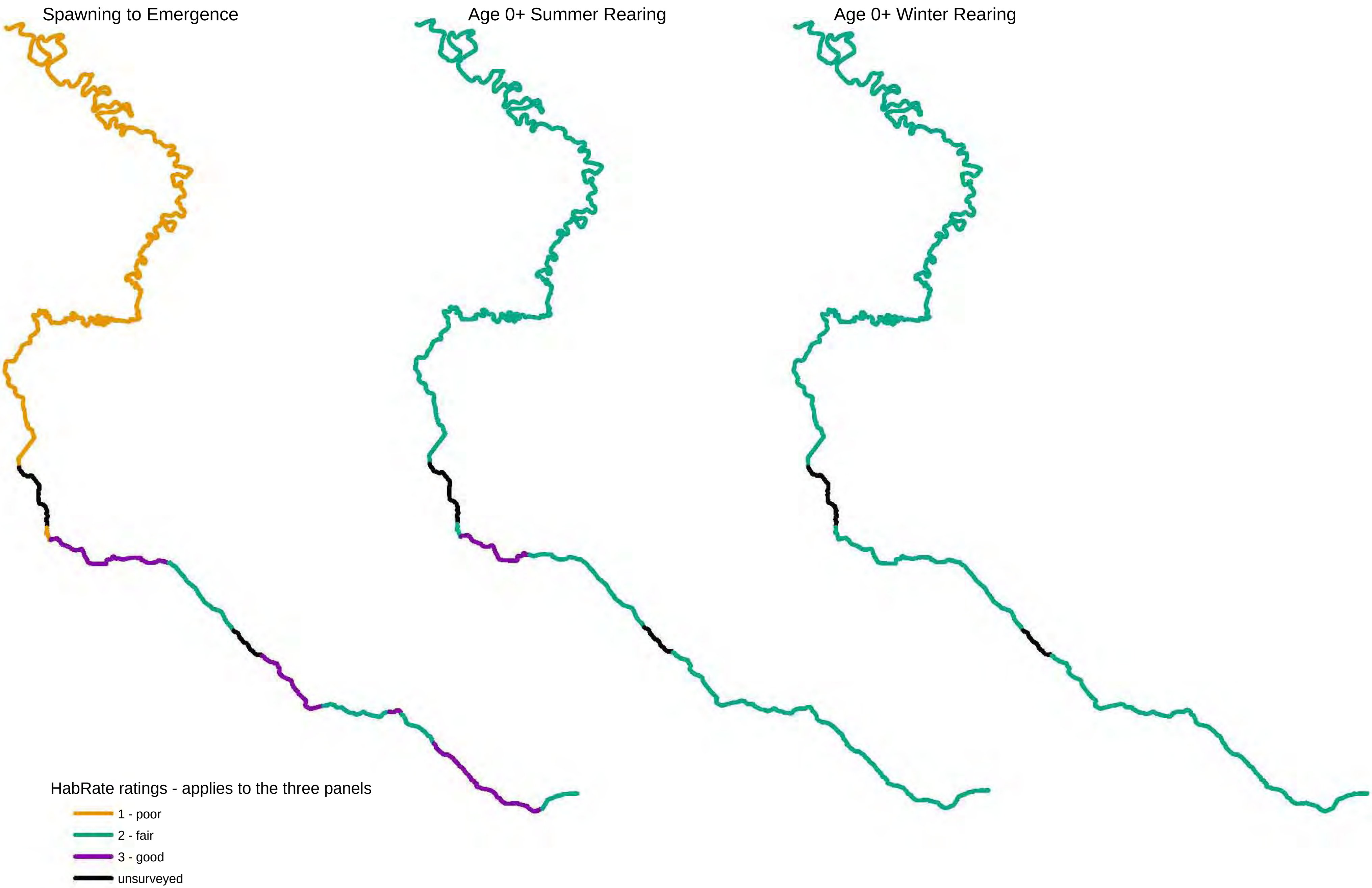
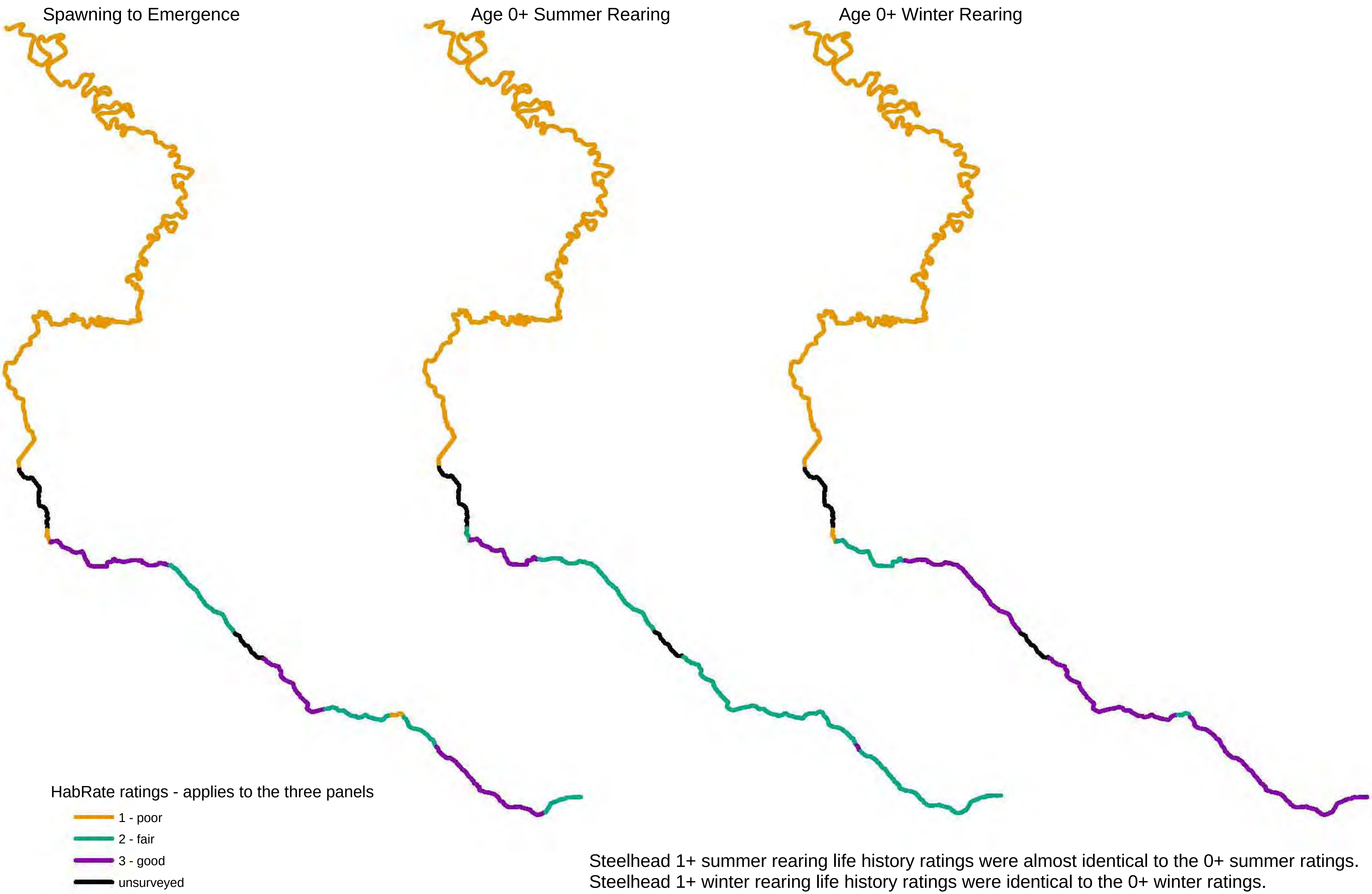


Figure 9. Catherine Creek 2010 habitat survey data applied to Steelhead trout HabRate life history ratings



Steelhead 1+ summer rearing life history ratings were almost identical to the 0+ summer ratings.
Steelhead 1+ winter rearing life history ratings were identical to the 0+ winter ratings.

Appendix A

Catherine Creek 2010 Habitat Survey

ODFW AQUATIC INVENTORY PROJECT
STREAM REPORT

STREAM: Catherine Creek LLID: 1178722453139

BASIN: Grande Ronde River HUC NUMBER: 17060104

DATES: July 7 – September 22, 2010

SURVEY CREW: Ryan Lande and Ashley Davidson

REPORT PREPARED BY: Staci Stein and Peggy Kavanagh

USGS MAPS: Imbler, Gassett Bluff, Cove, Conley, Craig Mt., Union, Little Catherine Creek

ECOREGION: Blue Mountain Basin and Upland

GENERAL DESCRIPTION:

The Catherine Creek habitat survey began at the confluence with State Ditch and continued upstream 89.4 kilometers to end at the confluence of North Fork and South Fork Catherine Creek. Twenty-two reaches were designated based on major tributary junctions and change in land ownership. The river channel was primarily constrained by high terraces. There were 6,313 meters of secondary channel habitat. The land uses were agriculture and light grazing in the lower reaches and light grazing, large trees (30-50cm dbh), and second growth timber (15-30cm dbh) in the upper reaches. Fine sediments (36%), cobble (24%), and gravel (23%) were the primary stream substrates. The stream habitats were predominately glides (70%) and riffles (19%). Large wood volume ranged from 0-8.9m^3/100m per reach. Active bank erosion ranged from 0-28 percent of the stream reach length. The trees observed most frequently along the riparian zones were hardwoods ranging from 3-15cm dbh (based on 78 riparian transects). The crew walked or canoed to conduct the survey, as water level varied from low flow to high flow.

REACH DESCRIPTIONS:

Reach 1: (T02S-R39E-S10NW) Length 11,900 meters. Reach 1 began at the confluence with State Ditch. The channel was constrained by terraces in a broad valley floor. The valley width index was 20.0. There were 244 meters of secondary channel habitat. Land use was agriculture. The primary vegetation classes were shrub and grass. The average unit gradient was 0.0 percent. The stream habitat was 99% glides. Fine sediments (58%) and hardpan clay (35%) were the stream substrates. No active bank erosion was noted. There was no large wood debris present. The composition of the riparian zones were shrubs, grasses, and hardwood trees 3-15cm dbh (based on 12 riparian transects). Vegetation included willow, hawthorns, thistle, wild rose, grass, and wheat fields.

Reach 2: (T02S-R39E-S13SW) Length 8,315 meters. Reach 2 began after the confluence with Nye Creek. The channel was constrained by terraces in a broad valley floor. The valley width index was 20. There were 317 meters of secondary channel habitat. Land use was agriculture. The primary vegetation classes were shrub and grass. The average unit gradient was 0.0 percent. The stream habitat was 98% glides. Fine sediments (66%) and hardpan (32%) comprised the stream substrates. Active bank erosion was not noted. Large wood debris volume was 0.3m^3/100m. The trees found most frequently in the riparian zones were hardwoods 3-30cm dbh (based on 9 riparian transects). Alfalfa and agricultural grass fields were noted.

Reach 3: (T02S-R40E-S30NW) Length 9,855 meters. Reach 3 began at Elmer's Dam and continued upstream to Warm Creek confluence. The channel was constrained by high terraces in a broad valley floor. The valley width index (VWI) was 20. Land uses were agriculture and light grazing. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.0 percent. The stream habitat was composed of glides. Ninety-one percent of the stream substrate was silt and fine organic material. There was neither active bank erosion nor large wood noted. The vegetation found most frequently in the riparian zones were agricultural grass and wheat fields. Hardwood trees 3-15cm dbh were also noted (based on 11 riparian transects). Due to the water depth, the crew had difficulty determining and measuring active channel and flood prone dimensions; metric measurements were modified. Active channel and flood prone were not measured. Terrace height measurements were based on the height from the water surface to the terrace lip. The terrace width and VWI were collected per usual.

Reach 4: (T03S-R40E-S05NW) Length 5,762 meters. Reach 4 began after the confluence with Warm Creek and continued upstream to Old Grande Ronde channel junction. The channel was constrained by terraces within a broad valley floor. The valley width index (VWI) was 20. The land uses were agriculture and light grazing. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.0 percent. One hundred percent of the stream habitat was glide. Fine sediments (85%) and hardpan clay (15%) were the stream substrates. While there were countable pieces of large wood, wood volume was too low to be calculated. The trees found most frequently in the riparian zones were hardwoods 3-15cm dbh (based on four riparian transects). Shrubs and grasses were also noted which included corn, wheat, and agricultural fields. Due to the water depth, the crew had difficulty determining and measuring active channel and flood prone dimensions; metric measurements were modified. Active channel and flood prone were not measured. Terrace height measurements were based on the height from the water surface to the terrace lip. The terrace width and VWI were collected per usual.

Reach 5: (T03S-R40E-S18SW) Length 2,989 meters. Reach 5 began after the confluence with Old Grande Ronde channel and continued upstream to Mill Creek tributary. The channel was constrained by terraces in a broad valley floor. The valley width index was 20.0. The land uses were agriculture and light grazing. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.0 percent. One hundred percent of the stream habitats were glides. Stream substrates were fine sediments (57%) and hardpan (43%). Active bank erosion was 23% for the reach length. Wood volume was very low at less than $0.1m^3$/100 meters. The trees found most frequently in the riparian zones were hardwoods 3-15cm dbh (based on two riparian transects). Grasses were also noted.

Reach 6: (T03S-R39E-S13SW) Length 4,148 meters. Reach 6 began after the confluence with Mill Creek and continued upstream to Godly Lane bridge crossing. The channel was constrained by terraces in a broad valley floor. The valley width index was 20.0. The land uses were agriculture and light grazing. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.0 percent. Stream habitat was 99% glide. The stream substrates were hardpan (63%) and fine sediment (37%). Twenty-four percent of the reach length was actively eroding. Wood volume was very low at less than $0.1m^3$/100 meters. Agricultural grass fields and hardwood trees 3-15cm dbh were the dominant vegetation found in the riparian zones (based on four riparian transects).

Reach 7: (T03S-R39E-S15SW) Length 4,609 meters. Reach 7 began at the Godly Lane bridge crossing and continued upstream to McAlister Slough. The channel was an unconstrained channel in a wide floodplain. The valley width index was 20.0. Land uses were light grazing and agriculture. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.0 percent. The stream habitat was primarily glides (92%); either percent of the habitat was dry. Sand (64%) and hardpan (32%) were the stream substrates. Eighteen percent of the bank was actively eroding. Large wood debris volume was $0.1m^3/100m$. The trees found most frequently in the riparian zones were conifers 3-15cm dbh (based on four riparian transects). Agricultural grass fields were the predominant vegetation in the riparian.

Reach 8: (T03S-R39E-S28NE) Length 3,489 meters. Reach 8 began after the confluence with McAlister Slough and continued upstream to Ladd Creek tributary. The channel was unconstrained within a wide floodplain. The valley width index was 20.0. The land uses were light grazing and agriculture. The primary vegetation classes were grasses and deciduous trees 3-15cm dbh. The gradient was 0 percent. Ninety-seven percent of the stream habitat was glide. Sand (76%) and hardpan clay (21%) were the stream substrates. Active bank erosion was 12% of the reach length. Large wood volume was $0.8m^3/100m$. The trees found most frequently in the riparian zones were hardwoods 3-30cm dbh (based on three riparian transects). Agricultural grasses were the major vegetation in the riparian.

Reach 9: (T04S-R39E-S03NW) Length 4,878 meters. Reach 9 began at Ladd Creek tributary and ended at Lower Davis Dam. The channel was terrace-constrained in a broad valley floor. The valley width index was 20.0. Land use was heavy grazing. The primary vegetation classes were grasses and shrubs. The average unit gradient was 0.0 percent. The stream habitats were glides (86%) and riffles (13%). The stream substrate was predominately sand (66%) and hardpan (24%). Large wood debris volume was $0.4m^3/100m$. The riparian zones were predominately composed of agricultural grasses and pastures (based on five riparian transects). Hardwoods 3-15cm dbh were also noted.

Reach 10: (T04S-R39E-S03W) Length 3,389 meters. Reach 10 began at Lower Davis Dam and continued upstream to Miller Lane bridge crossing. This section was not surveyed and no data were collected due to difficult access and time constraints.

Reach 11: (T04S-R39E-S15NE) Length 514 meters. Reach 11 began at Miller Lane bridge crossing and ended at Pyles Creek tributary. There were 66 meters of secondary channel habitat. The channel was constrained by terraces in a broad valley floor. Land uses were light grazing and agriculture. The primary vegetation classes were grasses and deciduous trees 30-50cm dbh. The average unit gradient was 0.3 percent. The stream habitat was dominantly (99.5%) glides. The stream substrates were hardpan clay (43%), fine sediments (36%), and cobble (18%). Active bank erosion was 14% of the reach length. Large wood debris volume was $0.9m^3/100m$. No riparian zone transect was conducted.

Reach 12: (T04S-R39E-S15NE) Length 3,888 meters. Reach 12 began at the confluence with Pyles Creek and ended at the edge of Union. The channel was constrained by terraces in a broad valley floor. The valley width index was 20.0. Land uses were heavy grazing and agriculture. The primary vegetation classes were grass and deciduous trees 50-90cm dbh. The average unit gradient was 0.4 percent. Scour pools (43%), glides (34%), and riffles (20%) were the stream habitats. The stream substrate was composed of gravel (68%), cobble (16%), and fine sediments (12%). Active bank erosion was 20% of the reach length. Large wood debris volume was $1.7m^3/100m$. Agricultural grass fields were the dominant riparian vegetation. Few hardwood trees 3-15cm dbh were also noted (based on four riparian transects).

Reach 13: (T04S-R39E-S13SE) Length 2,713 meters. Reach 13 began at the edge of the town of Union and ended upstream from Swackhammer diversion. The channel was constrained by high terraces across a broad valley floor. The valley width index was 20.0. Land use was urban land. The primary vegetation classes were grass and deciduous trees 15-30cm dbh. The average unit gradient was 0.8 percent. Stream habitat was primarily riffles (75%). The stream substrate consisted of cobble (46%), gravel (35%), and boulder (15%). Large wood debris volume was $0.8m^3$/100m. The trees found in the riparian zones were hardwoods 3-30cm dbh (based on four riparian transects). Residential yard grass and horse pastures were also noted.

Reach 14: (T04S-R40E-S19NE) Length 3,788 meters. Reach 14 began upstream of Swackhammer diversion. The channel was constrained by terraces in a broad valley floor. The average valley width index was 17.6 (range: 11.0-20.0). The land use was light grazing. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.8 percent. Riffle (93%) was the dominant stream habitat. Stream substrate was composed of cobble (51%), gravel (30%), and boulder (11%). Large wood debris volume was $3.0m^3$/100m. The trees found most frequently in the riparian zones were hardwoods 3-15cm dbh (based on four riparian transects). Grasses and shrubs were also noted. A roadbed, private yard, and cow pasture were within the riparian transect zone.

Reach 15: (T04S-R40E-S28SW) Length 1,819 meters. Reach 15 was not surveyed. This was private property on Southern Cross Ranch. No data were collected.

Reach 16: (T04S-R40E-S33NE) Length 4,059 meters. Reach 16 began after Southern Cross private property boundary and ended at Brinkler Creek tributary junction. The channel was constrained by terraces in a broad valley floor. The average valley width index was 12.9 (range: 3.0-20.0). There were 364 meters of secondary channel habitat. Land uses were light grazing and second growth timber. The primary vegetation classes were grass and deciduous trees 3-15cm dbh. The average unit gradient was 0.5 percent. The stream habitat was predominately riffles (80%). The primary stream substrates were cobble (43%) and gravel (38%). Active bank erosion was 20% of the reach length. Large wood debris volume was $3.4m^3$/100m. The composition of the riparian zones were hardwoods 3-15cm dbh, shrubs, and grasses (based on two riparian transects). A cow pasture was noted.

Reach 17: (T05S-R40E-S06SW) Length 3,000 meters. Reach 17 began at the confluence with Brinkler Creek and ended at the Catherine Creek State Park boundary. The channel was constrained by terraces in a broad valley floor. The average valley width index was 5.9 (range: 1.0-14.5). There were 487 meters of secondary channel habitat. Land uses were light grazing and second growth timber. The primary vegetation classes were grasses and deciduous trees 3-15cm dbh. The average unit gradient was 0.8 percent. Riffles (85%) were the primary stream habitat. Stream substrate was composed mostly of cobble (47%) and gravel (27%). Large wood debris volume was $4.0m^3$/100m. The trees found most frequently in the riparian zones were hardwoods 3-30cm dbh (based on two riparian transects). Highway 213 and cow pastures were within the riparian transect zone.

Reach 18: (T05S-R41E-S07NW) Length 621 meters. Reach 18 spanned Catherine Creek State Park. The channel was constrained by alternating high terraces and hillslopes in a broad valley floor. The valley width index was 11.0. There were 288 meters of secondary channel habitat. Land uses were greenway and old growth forest. The primary vegetation classes were hardwoods 3-15cm and conifers 30-50cm dbh. The average unit gradient was 1.0 percent. The stream habitat was mostly riffle (73%). Gravel (33%), fine sediments (32%), and cobble (28%) were the predominant stream substrates. Large wood debris volume was $5.8m^3$/100m. The trees found most frequently in the riparian zones were hardwoods 3-15cm dbh (based on one riparian transect). Various sizes of conifers of were noted.

Reach 19: (T05S-R41E-S07NW) Length 1,920 meters. Reach 19 began at the Catherine Creek State Park east boundary and ended at the confluence with Little Catherine Creek. The channel was constrained by alternating high terraces and hillslopes in a broad valley floor. The average valley width index was 3.5 (range: 3.0-4.0). There were 119 meters of secondary channel habitat. Land uses were large trees and second growth timber. The primary vegetation classes were grasses and deciduous trees 3-15cm dbh. The average unit gradient was 1.2 percent. Riffles (89%) dominated the stream habitat. The stream substrate was a mix of cobble (48%), gravel (25%), fine sediments (16%), and boulder (11%). Seven percent of the reach length had actively eroding banks. Large wood debris volume was $1.5m^3$/100m. Hardwoods and conifers 3-15cm dbh were the trees found most frequently in the riparian zones (based on two riparian transects).

Reach 20: (T05S-R41E-S08SW) Length 339 meters. Reach 20 began at the confluence with Little Catherine Creek and ended at the Milk Creek tributary junction. The channel was constrained by terraces in a broad valley floor. The valley width index was 16.0. There were 368 meters of secondary channel habitat. Land uses were light grazing and large trees. The primary vegetation classes were grasses and deciduous trees 3-15cm dbh. The average unit gradient was 1.0 percent. The stream habitat was composed of riffles (45%), scour pools (35%), and rapids (11%). The stream substrate was primarily gravel (37%), cobble (35%), and fine sediments (18%). Active bank erosion was 28% of the reach length. Large wood debris volume was $3.5m^3$/100m. No riparian transects were conducted.

Reach 21: (T05S-R41E-S08SW) Length 5,725 meters. Reach 21 began at the confluence Milk Creek and ended at Scout Creek tributary. The channel was constrained by terraces in a broad valley floor. The average valley width index was 14.2 (range: 6.5-20.0). There were 3,071 meters of secondary channel habitat. Land uses were light grazing and second growth timber. The primary vegetation classes were grasses and deciduous trees 3-15cm dbh. The average unit gradient was 1.3 percent. The stream habitats were predominately riffles (70%) and scour pools (16%). The stream substrate was a combination of cobble (42%), gravel (34%), and fine sediments (18%). Active bank erosion was 24% of the reach length. Large wood debris volume was $8.9m^3$/100m. The trees found most frequently in the riparian zones were hardwoods 3-15cm dbh (based on four riparian transects). Conifers of various sizes were also recorded. The riparian had evidence of cattle presence.

Reach 22: (T05S-R41E-S22SE) Length 1,690 meters. Reach 22 began at the Scout Creek tributary junction and ended at the confluence of North and South Fork Catherine Creek. The channel was constrained by terraces in a broad valley floor. The average valley width index was 8.8 (range: 7.5-10.0). There were 530 meters of secondary channel habitat. Land uses were second growth timber and large trees. The primary vegetation classes were deciduous trees 3-15cm and conifers 15-30cm dbh. The average unit gradient was 2.4 percent. The stream habitats were riffles (48%) and rapids (43%). The stream substrate was a composition of cobble (47%), gravel (25%), boulder (17%), and fine sediments (10%). Active bank erosion was 15% of the reach length. Large wood debris volume was $4.5m^3$/100m. Conifers and hardwoods 3-15cm dbh were the trees found most frequently in the riparian zones (based on one riparian transect).

COMMENTS:

The crew surveyed upstream and downstream, by canoe and foot, and generally moved around as water levels and land owner availability dictated. Heavy spring rains, water retention due to in-stream construction, and water withdrawals impacted the ability to survey the creek. The crew surveyed Catherine Creek via canoe in Reaches 1 – 4 and part of Reach 5; the stream was too deep to survey by foot. In the remainder of the reaches, the crew conducted the survey by foot.

Water levels were considered high flow in Reaches 3 and 4, low flow in Reaches 7, 8, and 9, and moderate flow for the remaining stream reaches.

Fish were noted throughout the survey. The last fish was observed at unit 1084 (89,410m). A fish presence/absence survey was not conducted. While there are a number of diversion dams on the creek, none were thought to be passage barriers to adult fish. However, they could hinder upstream passage for juveniles. Most of the diversion ditches encountered were screened. The town of Union had four diversions, each a different configuration of fish ladder, pool–step-sequences, and by-pass to irrigation canal. Since the time of the survey, the Main Street diversion (unit 571, 65,032m) has been rebuilt.

In Reaches 1 – 3, oxbows were present and tended to be connected to the mainstem via a culvert. The crew didn't evaluate each oxbow and its connection to Catherine Creek, more often they noted the presence and gps reading of the oxbow entrance and/or exit. It was undetermined if the culverts were barriers to fish movement.

Much of the substrate from Reaches 1 through 12 was composed of hardpan clay. This is denoted as bedrock in the substrate composition. Refer to the Comment Summary for individual units with hardpan clay.

The crew identified numerous fish during the survey: salmonids included juvenile, adult, and jack Chinook salmon, redband trout, and bull trout; other fishes included Mountain whitefish, catfish, northern pike minnow, carp, redside shiner, brown bullhead, and small mouth bass.

Wildlife observations included the following: American bullfrog, western toad, Columbia spotted toad, green tree frog, tadpoles, turtle, nutria, beaver, river otter, muskrats, mule deer, adult and calf elk, and raccoon. There was a large diversity of birds observed during the survey: great blue herons, great horned owls, red-winged blackbirds, mallard ducks, cinnamon teal ducks, barn owls, cormorants, and hawk. Domestic livestock, mostly cows and horses, were also observed throughout the survey.

There was evidence of beaver throughout the survey in the form of chewed sticks and dens.

The named tributaries that entered the Catherine Creek stream survey included: Warm Creek (unit 221, 30,070m); Old Grande Ronde (unit 261, 35,832m); Mill Creek (unit 283, 38,822m); McAlister Slough (unit 361, 47,557m); Ladd Creek (unit 389, 51,067m); Pyles Creek (unit 448, 59,848m); Little Creek (unit 622, 69,104m); Brinker Creek (unit 713, 76,115m); Little Catherine Creek (unit 813, 81,656m); Milk Creek (unit 845, 81,995m); Scout Creek (unit 1044, 87,721m); North and South Fork Catherine Creek confluence (unit 1084, 89,410m).

The crew maintained a log book during the survey; the transcription of their survey observations are summarized in the following section. Efforts were made to present the notes as though the crew surveyed upstream. Since they surveyed as water conditions and landowner permission allowed, the dates of the notes reflect the actual survey date. The units had to be renumbered to be sequential.

Transcription of the Aquatic Inventories Project stream habitat survey crew's field notebooks from Catherine Creek July 7 – September 22, 2010

Note: Reaches and units mentioned in the following notes were updated to the final reach and unit calls, based on the survey being conducted continuously from the mouth to the headwaters, as the final report reads. While in the field, the crew surveyed as water levels and land owner access dictated. Miscellaneous notes (tally of work hours, notes to supervisor, etc.) were not included.

Reach 1
7/7/10 –- flow @ Union ~140cfs
Water is fairly swift making it somewhat difficult to maneuver in the canoe. Water is very turbid (impossible to see the bottom). Substrate seemed to be entirely mud. Had to estimate substrate by prodding depth staff and dragging it around. It would be helpful to be able to scoop up some substrate to help determine composition. Riparian transects and metrics are taking longer than they should because the mud is very deep. Also, we sink up to our knees in some places. The current is swift and carries the boat downstream when measuring the active channel.
Along the way we encountered a diversion pump along the stream bank which did not appear to be running at this time.
There were lots of carp swimming and rising around the boat. We saw a dead black bullhead catfish.
There was a 'pipe' hanging over the left bank that was made of steel drums welded together. Not sure of its purpose.

7/8/10 – flow ~139cfs
The creek seems to be dropping quickly. We took a temperature reading at 12:30pm, and it was 21°C.
We saw close to 20 adult bullfrogs in the afternoon and we heard several others calling.
There is little woody debris in the stream. Perhaps there is more, but due to the turbidity we can not see it.
In several places, large berms have been built on the terraces to constrain the stream. In most cases, there are agricultural fields on the other side. The terraces are sufficient to constrain the stream; hence, the stream is constrained by terraces not land use.

7/12/10 – flow ~69.24cfs
There is a huge diversity of birds, great blue herons, great horned owls, red-winged blackbirds, and several others. There has also been a lot of wildlife, including elk, deer, and either nutria or muskrat.

7/13/10 – flow ~85.9cfs – water 23°C
The riparian zone is starting to become wider and more densely vegetated.
Overall, lots of carp and bull frog activity.
Beyond riparian transcript at U36 on the right bank was another berm/raised parcel of land. These seem relatively common and are usually beyond the natural terraces.
We found a culvert draining. Water was coming out of the smashed culvert coming from what appeared to be an old channel or swamp. It's draining from the left bank. It is very marshy from where it's draining. The other end of the culvert could not be found. This is near U37 or 38.

While putting the coordinates on the map, we found they don't intersect the creek. We are marking the closet point on the map.
According to the map, a trib should have come in on the left bank between riparian transects 5 and 6 but one was never found.
There is little countable wood in the stream.

7/14/10
Where we ended the day there is a large alcove on the right bank ~10m from the creek. The oxbow is ~220m long with very high banks. At the upstream end, the AL is separated from another AL by a small berm. The second AL appears to come off of the creek upstream. These AL are connected to Catherine Creek by a man-made ditch. Just downstream of the AL there is an old oxbow cut off by a berm. The oxbow has a pump draining water from it on the upstream side. There is lots of irrigation piping lying around and one line travels several hundred meters to an irrigator that is currently not running.

22°C
WL = rodents
A lot of pipes – farmers are using water from it. Both an entrance and exit. CE/. Grasses and wheat and some shrubs on each side of oxbow 11T 0429534E, 5026426N
No pictures, as camera got wet and doesn't function.

U63 – downstream end of oxbow comes in forming an island. There is a berm separating the creek from the oxbow.
U69 – strange notch in terrace. On right bank, it looks almost like an alcove or old channel rather than a secondary channel. Calling this U70 AL dry. 20% silt and 80% matchhead veg. Still connected to main channel. Connection to mainstem is maintained. 244m long. It sits between the HT that the field is on and the HT along Catherine Creek.

7/15/10 - flow ~65.4cfs
U73 - has a bridge crossing. There are boulders under the bridge for stabilization. Lots of swallows nesting on bridge. Debris on bottom of bridge from high flow event. 11T 0430467E, 5026640N
U75 - CE/, culvert has 0.6m diameter. Spilling some water into creek. Water from culvert is 22°C. The width in this unit increases considerably. Culvert has a vertical drop of 0.7m. It has a cover that appears if pushed down would close off culvert. 11T 0430625E, 5026652N
Unidentified amphibian. Also, water seeping in through berm from oxbow on this unit.
U85 - There are cattle grazing up to the stream and the riparian is much thinner on right bank.

Reach 2

7/19/10 – flow ~33.6cfs
Called a reach changed because Ryan and I switched data sheets.
U89 – downstream end of oxbow enters on the left bank. The max width at the oxbow is 36m. We made this unit short to only encompass the area influenced by the oxbow. There are a lot of old culvert materials lying around near active channel. 11T 0431794E, 5025987N.
U91 – upstream end of oxbow. 11T 0430815E, 502587N
We were able to walk across the creek to do our metrics in U96. Also, we were able to walk almost the entire length of the unit.
Saw a small mouth bass.
Switched PDA to WSG 84 at Market Lane.

7/20/10
U104 - dead catfish
Saw a hatchery spring Chinook that looked like it might die soon.
U110 - riparian 11T 0432084E, 5025301E, 22.5°C
Saw a surveyor from GRMW who said that behind U110 the levy will be pushed back and the oxbow upstream may be opened back up again and riparian work will be done.
U111 – seep from an oxbow that appears someone tried to plug it up with a bunch of bricks.
U112 – in the middle is an oxbow which is blocked off on the upstream side. We called it an AL and surveyed 2 units. Downstream coordinates at U112 are 11T 0432040E, 5025159N; upstream coordinates at U116 are 11T 043998E, 5025130N
U116 – WL trail left bank and 2 great horned owls.

7/21/10
U120 - Estimated right bank due to dense vegetation
U126 – found dead hatchery Chinook female with 3 punches on left opercle
U127 – metrics and rip estimated due to dense shrubbery and steep bank on left. BC is middle of unit
Since start of the survey at Alicel bridge/State Ditch, the riparian has consisted mostly of willows and hawthorns. The riparian has started to be thicker/more dense.
In areas of high willow density, there appears to be a lot of beaver activity.

7/22/10 – flow ~32.7cfs
Starting a few units back from U141, there are intermittent sections of stream that have a different cross section than what we've seen. There is a width near the middle of the stream where substrate is built up and at which the depth is shallow and then it gets deeper on each side near the two banks. We are also starting to see the channel width become less uniform. There will be little peninsulas coming out of the bank that are obviously covered/submerged when the flows are at active channel height.
U142 – There are 2 CE on the right bank, Culvert 1 – 0.45m diameter, 1.0m drop – has a valve of sorts on the end of it. Culvert 2 – 0.45m diameter, 1.25m drop. Neither has water flowing through it and no indication on the map of an oxbow. There is a low spot beyond the terrace which is a field. Culvert 1 drains excess water, and Culvert 2 is attached to a pump that pumps water form the field into the creek. The low spot looked like a really old stream channel.
The terraces appear to be eroding on the right bank starting in U142. There is not active erosion at active or flood levels.
U149 – Reach 2 ends at Elmer's dam – 11T 0432394E, 5024236N – dam dimensions: spillway 5m wise, step height 2m, depth ~0.2m, made of concrete with wooden slats; fishway is 0.6m wide and 0.9m tall with 0.3m step to the water. Fishway is dewatered. 2 pumps built in on top of dam. Two rock jetties 20m downstream of dam. Fishway 1.5m wide and 0.55m step, stair-stepping up to damp pool.
Lots of juvenile fish – carp, small mouth bass, whitefish, redside shiners, few Chinook.

Reach 3

9/16/10
We spoke with Phil Hassinger and he said he usually lets the boards out of his dam by now but left them in because Anderson Perry is doing work downstream. Otherwise, Phil has no use for the water. The wood slats will be taken out in a few weeks.

We are going to continue to survey the Elmers pool but just collect modified metric data since the AC and FP are submerged.

9/20/10
We are still working our way downstream to Elmer's dam. There is a lot of erosion on the banks within the FP but above AC. There are large chunks of land with grass falling into the creek.

It appeared that an oxbow came in on the left bank but when we got to it, it appeared to be an old channel fed by Warm Creek and another trib/irrigation canal and they both feed this channel which then feeds into Catherine Creek. It contributes ~10% of the flow. The channel kind of looks like a smaller version of Catherine Creek and the point where Warm Creek and the other trib come together is quite away from the 1st unit of the trib. Reach 4 starts upstream of this tributary.

9/21/10
U201 – Oxbow has an outlet/downstream end with a /CE 11T 0433797E, 5021288N. CE diameter of 0.4m and has a flapper valve on it. No upstream entry could be found in the bank. There was another oxbow on the left bank near this one, but here wasn't an exit/entry apparent on the bank. We got on the terrace to look and it was a 2-3ft deep depression with an AG field on it. It appears that it rarely has water in it.

Through Reaches 3 and 4, there have been depressions in the bank that look kind of like oxbow entries but they appear to be well-used animal trails that have made depressions in the banks in several places. Water may be able to bypass the high terraces in these areas since it's lower than the terrace.

Difficult to feel substrate with depth staff, plus the water isn't clear enough to see through. We will estimate the data, but recall we are estimating. We're using both the depth staff and lead ball with string to get depths.

U182 – There is an irrigation canal with a culvert that is ~20m away from Catherine Creek but the culvert entry is blocked off by a bunch of rocks and concrete. It almost looks like the rocks and concrete caved in. Also, there is a cormorant acting disoriented and is perhaps blind in one eye.

Reach 4

9/16/10
U261 – Metric/Riparian was conducted where Rob's profile was done, according to the river mile map. No stakes or flagging could be found to know exactly where his profile was done. 11T 0431749E, 5018396N

We are going to continue to collect modified metric data since the AC and FP are submerged.

Reach 5

9/7/10
Started ~1000m above the Geckler Lane bridge and continuing to work downstream.

U277 – metric has same coordinates as the entry of a culvert on the left bank. The riparian transect on the 3rd zone hits an oxbow. The oxbow essentially has an entry and exit point at the same point so it circles around and enters and exits through the same spot which is a spot that looks almost like another channel because it is well scoured out.
U276 – oxbow enters
U263 – we stopped surveying at the end of this unit because we reached the influence of Elmer's dam pool. We thought this because the active channel feature was submerged. It had been getting progressively deeper. This is ~100m upstream of Old Grande Ronde River channel diversion – 11T 0431673E, 5018232N

Reach 5 starts after the Old Grande Ronde diversion. Here, the old channel is cut off from Catherine Creek via berm but there is a diversion w/ a headgate and a SD that pumps water into the old GR channel. The headgate is ~2m wide.

Reach 7

8/3/10
U362 - Culvert on McAlister Slough plugged with debris. Perhaps from all the beaver activity. Culvert 0.65m diameter. Doesn't contribute water, but instead takes water from Catherine Creek. This Slough ends Reach 7.

Mostly dry downstream of slough – both Catherine and McAlister are 23.5°C.

U330 – CE/ 0.4m diameter, corrugated steel with door. 6m step prior to CE then SS. Flow ~1%.
SD and juvenile carp in unit.
Just downstream of diversion of CE on the mainstem, there are plywood slats on 2X4s acting as homemade diversion or dam.

Reach 8

7/28/10
U388 – Ladd Creek enters on the right, ACW = 2.55m. End Reach 8 after Ladd enters.

Running along behind terrace on left bank is a marsh that runs parallel to Catherine Creek.

7/29/10
Working downstream from Ladd Creek
A lot of cattle along both banks. Right bank starting to become a large flood plain.

8/3/10
Water dropped significantly since last week.
Cows on left bank – heavy grazing
Morning water temp 20°C
Seen some dead fish (juvenile carp)
Very heavy cattle use and light to heavy grazing. More activity on left bank than right, but still use on both.

Reach 9

7/28/10
Started ~1/2mi upstream of Wilkinson Lane bridge. We are starting to see some very large willows along the riparian but otherwise there is heavy grazing in riparian and heavy cattle use on both sides of the creek.

On map, just upstream of Wilkinson Lane bridge showed there was a channel that stopped in a marshy area but appears to have been clocked off since it's not connected to Catherine Creek.

Start upstream of Ladd Creek

Reach 11

9/13/10
About halfway through the day we finished the section of Catherine creek from Miller Lane up to the downstream end of Union, where we had begun earlier in August. Just downstream from the wastewater treatment plant we found 1 adult female Chinook building a redd and 1 jack salmon.

Reach 13

8/4/10
Starting just downstream of the town of Union and surveying upstream.

Below first diversion there are three separate lines of boulders piled across the channel to slow the water going through the diversion. On the diversion there is a fish ladder that is 13.7m long with 4 steps. The downstream end of the ladder is closed off, presumably to keep water loss down, by a wooden slat. The fish ladder is 1.8m wide and there is a 0.4m step to the entrance. We broke the diversion into a series of steps (over structure) and plunge pools. On the upstream step is a dam created by putting planks in slots across the channel. The dam is ~0.65m high and diverts water into an irrigation canal. On the canal, there are 2 head gates – 1 partially open and 1 fully open. Culvert dimensions are 0.75m in diameter. The diversion comes off of the dam pool created by the dam on U559.

U548 and 549 have CE made of PVC and each contributes ~2% flow. They appear to be overflow pipes for the diversion upstream.

U554 – We came to a diversion = below and above were pools so we weren't able to do a metric. This is why there are 18units between metrics, though the distance is ~1000m. There were also bridge crossings and diversions keeping us from finding an uninfluenced spot.

A new diversion is built on U567. The stream has been somewhat channelized by retaining wall and sandbags to keep some water away from the construction area.

8/5/10 – flow ~5.95cfs
Today we started at the Main Street bridge diversion and worked upstream end of Reach 13 to the Swackhammer diversion.

Yesterday we talked with Rick Poe at the first diversion. The fishway was closed off so fish were unable to get by/over the boards. Rick told us that people were fishing in the fishway itself.
Throughout this reach, there have been numerous rock dams built by kids to pool the water.
U581 – The landowner was actively dumping concrete blocks in the creek to stabilize the stream bank.
U583+584 – Unit had logs embedded in the stream bank somewhat diagonally in relation of the stream that appeared to be put there to slow water flow and thus stabilize the stream bank.
Reach 13

The diversion below the Main Street bridge in Union is kind of odd; our habitat units don't exactly describe what is happening. We called a SS but the water doesn't flow over. The dam is made of wooden planks placed on a concrete spillway to back up the water so that the water is deep enough to push in to the diversion on the right bank. The diversion is open but is in very deep water. It appears to be the same size as the diversions downstream.

U584 – There are numerous logs buried in the bank with cut ends. Obviously placed to stabilize the bank and likely to slow the water coming out of the Swackhammer diversion dam, which is upstream of town.
/CE – has water flowing out of it. It is likely coming off one of the irrigation canals coming off of the diversion. The culvert is made of PVC pipe and has a 0.6m step to Catherine Creek. It is ~0.25m diameter.
Small water source coming in on the right. According to the map, it appears to be a small trib.

Just downstream of Swackhammer, there is another PVC culvert (0.25m diameter with a 0.4m drop to AC) on the left bank presumably coming off of the irrigation canal coming off above the diversion. The culvert contributes a fair amount of water and even has kind of created a channel itself within the active channel.

Just upstream of the PVC pipe is the Swackhammer diversion. The diversion is a series of concrete steps without plunge pools between. The steps act as the fish ladder itself. The canal comes off of the left side above the diversion. The total width of the diversion is 2.5m and each head gate has a width of 1.5m. The depth going into each head gate is 0.3m. The total draw of the diversion is very significant, drawing ~20% of the total volume of Catherine Creek. ~30m downstream on the irrigation canal it appears that there is a juvenile fish bypass with numerous water wheels operating.

Reach 14

8/11/10
We are starting at the Swackhammer diversion just outside of Union. There is one sections ~6 tenths of a mile that we won't be able to survey due to a lack of property access permission. This is tax lot 04540E05000 owner Short, Marcia M Trustee. Operator is Deborah Eyre. Owns both sides of the creek.

U589 – There are 2 culvert entries on the right bank coming off of an irrigation canal and an old head gate to the irrigation canal that does not appear to be functioning. All of this is happening within ~10m of the Hwy 203 bridge above town. The head gate entry is 1.25m wide and 1.35m tall. The entry to the head gate is 0.6m above the water surface (dry). The first culvert is made of PVC and has a diameter of 1.27m. The step from the culvert to the water surface is ~1.12m.

The excess water is coming from an irrigation canal. The outflow of the pipe flows onto rocks and would likely kill any juvenile fish that might pass through the pipe. This secondary culvert is 0.55m diameter and is made of corrugated galvanized steel. The step to the water surface is about 0.9m and also lands on rocks. It also leaves the irrigation canal.

There appears to be an artesian well along the left bank of the stream on U590. It is contributing a fair amount of water 0.5-1% of total volume. 17°C water from well.

Three spots appear to be old redds. The gravel is not freshly turned, so likely not a spring Chinook redd.

U593 – there is a culvert on left bank flowing out of an agriculture field w cows in it on the other side of Hwy 203. The water is dark brown and smell like bovine fecal matter.

U601 – Constrained by land use (road) on left side and hillslope on the right.

U614 – There are two PVC culvert entries on the left bank. The first culvert has a diameter of 0.18m with a 0.4m drop to the water surface. There is barely a trickle coming out of it. The second culvert has a 0.3m diameter and a 0.8m drop. The returning water is coming from a fish bypass downstream of a diversion. The culvert is returning a fair amount of water. The returning water is bouncing off of a concrete slab.

U615 – There is a diversion dam with an irrigation canal on the left side that has 2 head gates. There is a very nice new fishway on the right bank. The entry to the fishway is 0.3m wide and has a series of steps up to the dam pool. The SS appears to be permanent concrete structure with boards added to it to raise the water level. The head gates are both 1.25m wide. They have wooden slats closing them off but a decent amount of water is flowing down the canal.

8/12/10
Today we started surveying at a diversion on city of Union property. The Umatilla tribe also has a weir here where they separate hatchery and wild fish. Bob Judy owns the land directly upstream of the weir and has been contracted to dredge out the plunge pools on the diversion and the dam pool directly upstream. The plunge pools on the diversion have already been dredged and are too deep to wade. Due to the depth and active operations going on at the diversion, we decided to estimate the step heights, unit lengths, and plunge pool depths. We could see into the plunge pools on the weir and tell that they are at least 2.5m deep if not more. There are numerous large piles of gravel and sediment near the weir that had been removed prior to us surveying the plunge pools. There is a fish ladder on the left side of the diversion which has a trap on it so that fish can be sorted. It is currently closed off using wooden planks preventing any upstream migrations of fish. There is a weir on the bottom side of the diversion that is currently lifted, fish can therefore migrate upstream over the diversion dam itself.

Upstream of the diversion about 85m there is a headgate on the left bank opening into a canal. It is unscreened. The head gate is ~0.8m wide and the water flowing in is ~0.5m deep.

U640 – There is an irrigation canal that a farmer has dug. There is a head gate that is ~0.6m across; it is currently closed. It appears that it has been dredged. There is a point extending into the stream to divert water in the canal. It appears that there is a fish bypass on the canal. We surveyed upstream from the diversion to the Southern Cross Ranch, which denied us access.

Reach 16

8/12/10
We jumped out of the stream and went around their property and jumped back in on the Smith's property which is operated by Roger Huffman. Roger Huffman is their nephew. We started on Smith's property where there is a large wide gravel bar with an 02 channel to the right and an 03 channel to the left. On the 03 channel there is a diversion that appears to have been washed out by the high flows earlier this spring. The diversion is sitting in a deep pool sideways and is not operational. It appears that the landowners have been attempting to work on the washed out diversion. The pool in which the diversion sits in is created by a rock dam immediately downstream of the diversions. Upstream, the landowners are currently digging a new irrigation canal.

8/16/10
U672 – Deep pool with two large bull trout in it. One is ~75cm and the other is ~60cm.
U673 – Culvert entry left bank coming from a juvenile fish bypass. Culvert has a little bit of flow, 0.55m drop and 0.27m diameter PVC culvert.
There have been several 1+m deep lateral pools and each has contained at least one if not two adult bull trout in the 60-75cm class.
U679 – There is a small rock dam built up to divert water into an irrigation canal. There is a juvenile fish bypass downstream. The canal does not appear to be drawing much water. It is ~1.5m wide and ~0.4m deep.
U685 – Culvert entry right bank appears to be a return from a juvenile fish bypass on a canal. The diameter is 0.27m and flows directly into the stream. Above the fence crossing there is a small irrigation canal with a head gate that is 0.45m in diameter and is partially open. There is a juvenile fish bypass downstream.

8/17/10
U698 – The hillslopes come up to the stream on both sides. We decided not to break out a new reach because ~600-700m upstream Brinker Creek enters. We will break a new reach there. There is a culvert entry from a fish bypass. The culvert is 0.27m diameter and has a 0.4m drop to the water. No water is flowing out of the culvert.

Reach 17

8/19/10
U753 – Start of an 02 channel with an ACW of 3.8m.
U756 – Heading upstream, the unit starts to form several small channels that appear to be below ACH. These are part of one single channel upstream. It essentially functions like a big floodplain. The secondary channel has a large amount of shade; however, the water quality is not good. There is heavy use of the 02 by cattle and there are cow prints and patties all over. Lots of countable wood pieces. There is a presence of juvenile fish. The way the unit is braided is probably due to the fact that the left bank of the main channel is a wide floodplain.

Reach 18

8/19/10
U765 – A tributary enters the main channel on the left bank. We originally thought this was an 03 channel when we first walked its length. However, we discovered that this was the old

channel that got locked off by gravel on the upstream side (well above AC). Although this channel is blocked on the upstream side in U783, there is a tributary draining into the old channel as well as a spring seep. Both of these water sources are being backed up by beaver dams forming large pools and a somewhat floodplain like area. Both of these water sources essentially drain into the main creek channel through this old channel.

8/23/10
Over the weekend, temperatures at night dropped into the mid to upper 30s. The water temperature has dropped and the spring Chinook have started spawning in the area of Catherine Creek State Park.

Reach 19

8/24/10
U805 – The first metric was a broad valley floor, and there are road beds on both sides of the creek acting as the constraining features. The two roads are Hwy 203 and USFS Road 2036. We decided to use the channel form CL and valley form CT. Though CT is not very representative because the roads, not HT, are the constraining features.

Reach 20

8/24/10
U817 – There are 02 and 01 channels. The 02 channel comes off of the mainstem Catherine Creek and flows into Little Catherine Creek ~20m downstream. When we surveyed the 02 channel, we decided to add the section of Little Catherine to the 02 channel from their confluence downstream to mainstem Catherine.

Reach 21

8/25/10
U862 – We encountered a habitat type that we had difficulty calling. There is a ‘channel’ that comes in that eventually disappears into a field on the Hall Ranch. On the upstream end, there is a channel as well. In between, the water has jumped out of any sort of defined channel and deposited sand across the field ~30m wide. This spring, when the water was at its extreme high, it was pushed out of the main channel by a large log jam upstream and pushed into the fields outside of the AC. The length that the water would have flowed through the ‘channel’ and field is ~600m. The area in the field where the water flowed in the high water event is well above AC and FP. There are large pine trees in the area with wand deposited around them. If the creek were at active flow, this area would likely fill with water until it approaches where the channel just disappears ~400m upstream, then the water would have no where to go unless a major flood occurs. It also functions like a BW because it is not connected to the main channel upstream. The upstream side has a defined channel for ~300m and then it disappears downstream. We decided to survey this as a ~650m 02 that just disappears in the middle and comes back together up and downstream.

8/26/10
U888- Started here today

U891 – There is a series of DJ as you move upstream on the 05 channel. There is a very large DJ on U892. It appears that in the high flow even this year, these debris jams were formed and as a result, the flow of the main channel spread out over a very wide area and deposited large amounts of sand, gravel, and cobble. The DJ basically fills a ~55m wide FP area. It extends across almost the entire width and reaches the 01. These jams appear to have deposited a large amount of sand in the surrounding forest. Also, there are channels that appear to be formed recently everywhere. They are just mud and permanent vegetation that don't indicate previous impact from water.
U908 – There is a series of channels all less then ACH. There are several new channels that were likely formed during the year's high flow event, because these channels only have silt/organic substrate and run around several tree root systems and older (30-50dbh) conifers that wouldn't have grown had there had water been inundating the area. Only a few of the channels have gravel and cobble in addition to a scour line. Essentially, it appears that as the water came down, it hit a log jam and sent water out into the surrounding forest on the right bank, resulting in a new, very wide AC in this unit. It essentially blew through, widened out, and created new channels.
U915 – The right bank becomes almost level with water level and all the channels come back together.

8/30/10
Today there have been another series of DJ and multiple channels around U928. This is still in the Hall Ranch area. Also, we have found several Chinook adult mortalities as well as several spawning adults and redds.

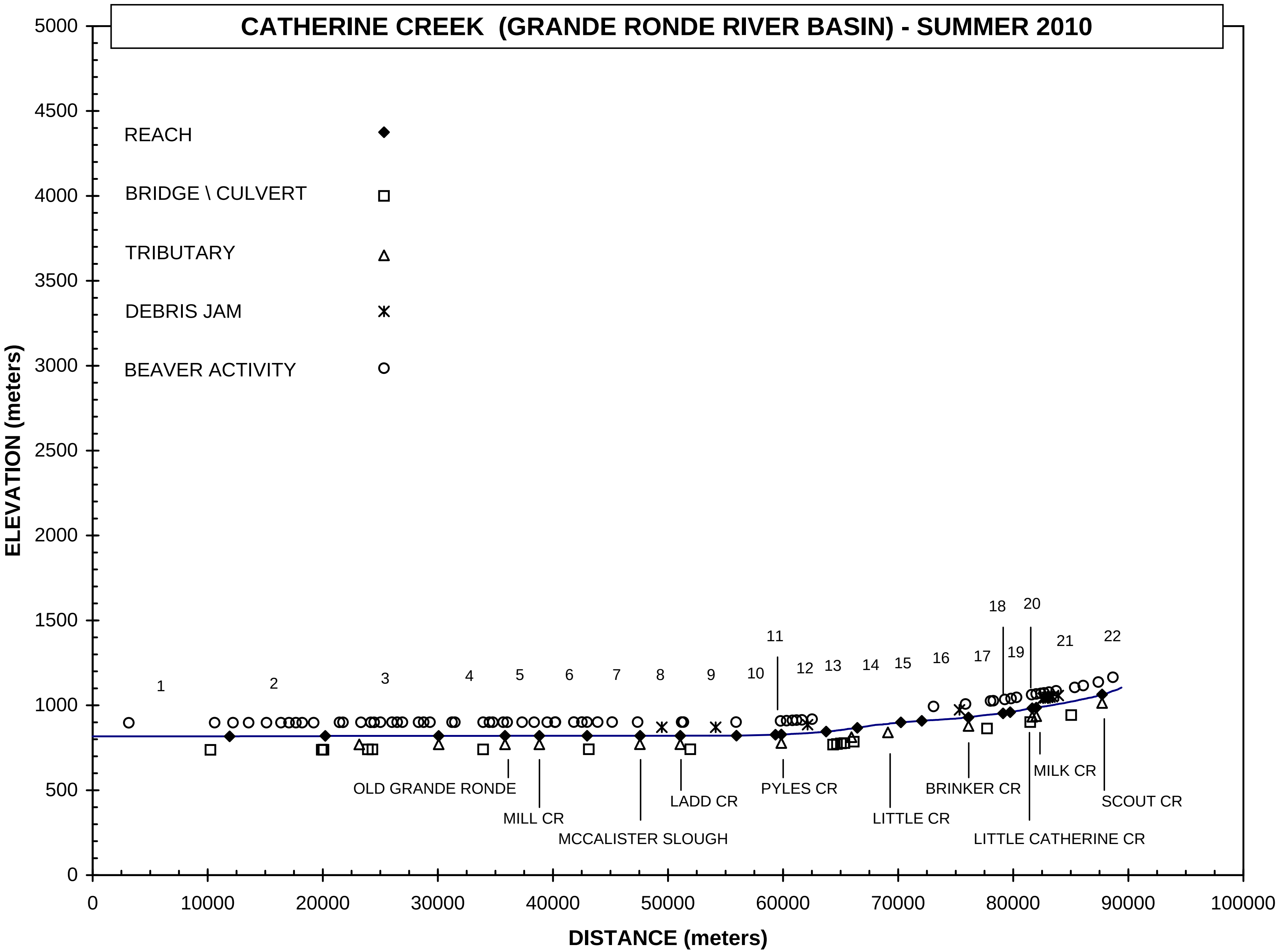
8/31/10
U1011-1015 – The channel has been dammed by a series of small rock dams created by kids at a church camp adjacent to the left bank. There are also several logs cabled to boulders along the stream to stabilize the bank so it won't destroy buildings near the stream.
In this area, there are lots of spawning spring Chinook at the tail of the man-made pools.

Reach 22

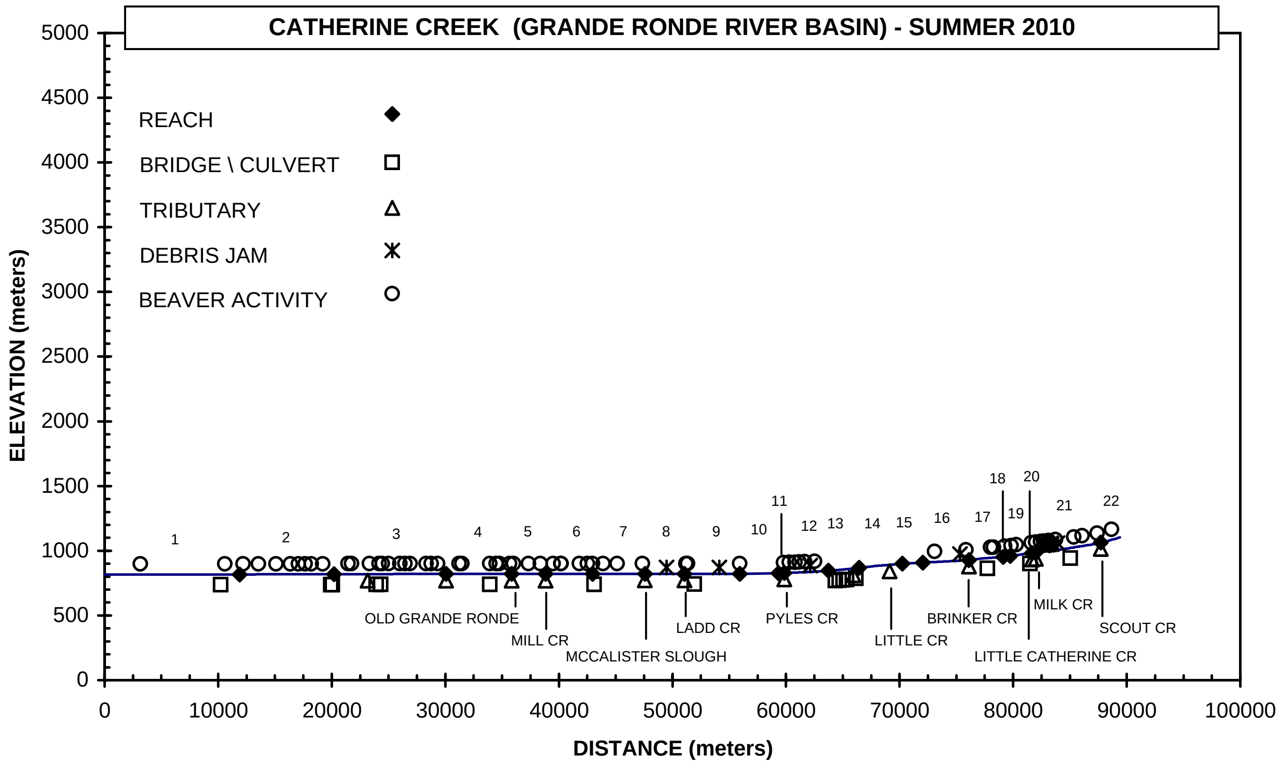
9/2/10
U1075 – There is a corrugated steel culvert entering on the left bank. There is only a tiny bit of water trickling through it. On the other side of Catherine Creek Lane there is a marsh which is where the other end of the culvert comes from. The culvert is oval and 1.45 X 0.45m diameter. All around the culvert is new rip rap placed to channelize the 03 channel. There is not a step, only a 0.7m cascade to the water surface.

9/2/10
Around 1mile from the forks (NF and SF Catherine Creeks), the road was built up on the left bank ~6ft above the water level. Likely, the road had been impacted by the spring flood.

9/6/10
We finished the upper reaches of Catherine Creek to the North and South Fork confluences. Today, we are starting at Godley Lane bridge since the water has dropped since we were there last. We plan to work downstream until the water level is too high to survey (above AC) due to the influence of Elmer's dam.



CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
REACH
BRIDGE \ CULVERT
TRIBUTARY
DEBRIS JAM
BEAVER ACTIVITY
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
OLD GRANDE RONDE
MILL CR
MCCALISTER SLOUGH
LADD CR
PYLES CR
LITTLE CR
BRINKER CR
MILK CR
SCOUT CR
LITTLE CATHERINE CR


CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
REACH
BRIDGE \ CULVERT
TRIBUTARY
DEBRIS JAM
BEAVER ACTIVITY
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
2
3
4
5
6
7
8
9
10
11
12
13
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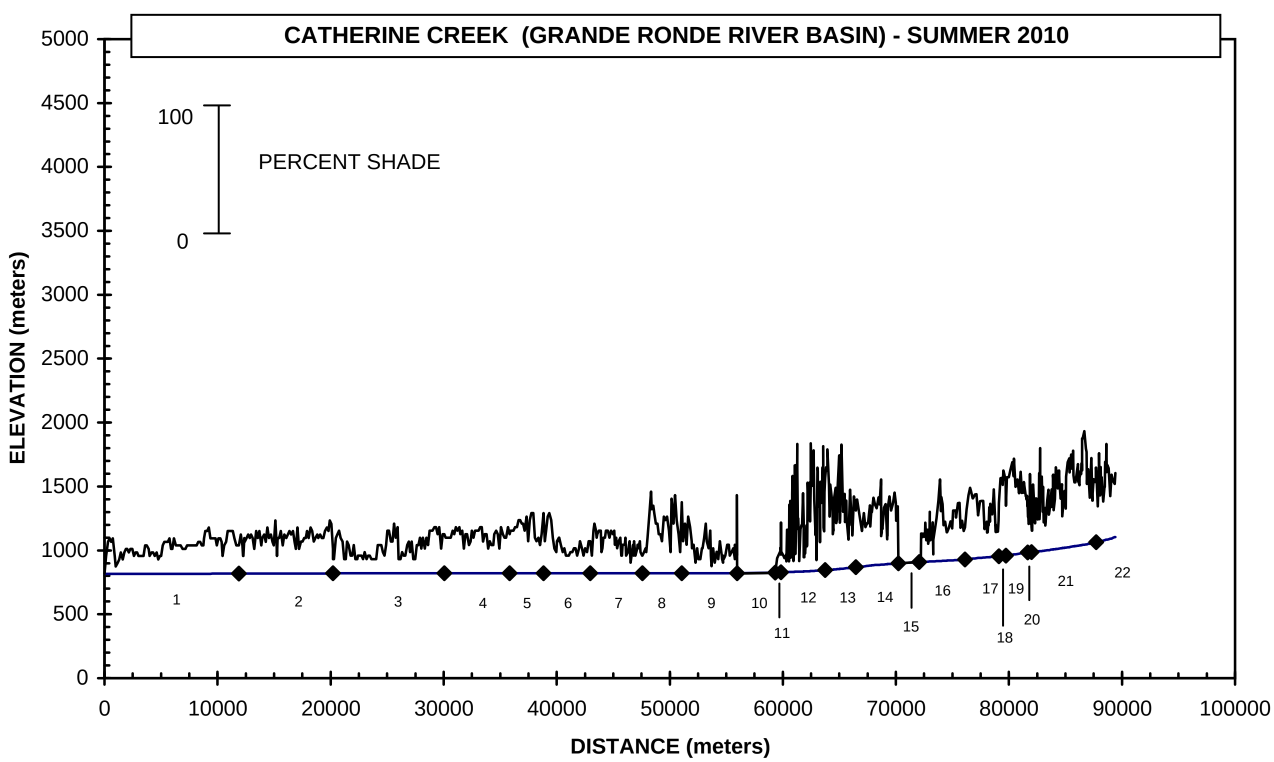
17
18
19
20
21
22
OLD GRANDE RONDE
MILL CR
MCCALISTER SLOUGH
LADD CR
PYLES CR
LITTLE CR
BRINKER CR
MILK CR
LITTLE CATHERINE CR
SCOUT CR


CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
100
0
PERCENT SHADE
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
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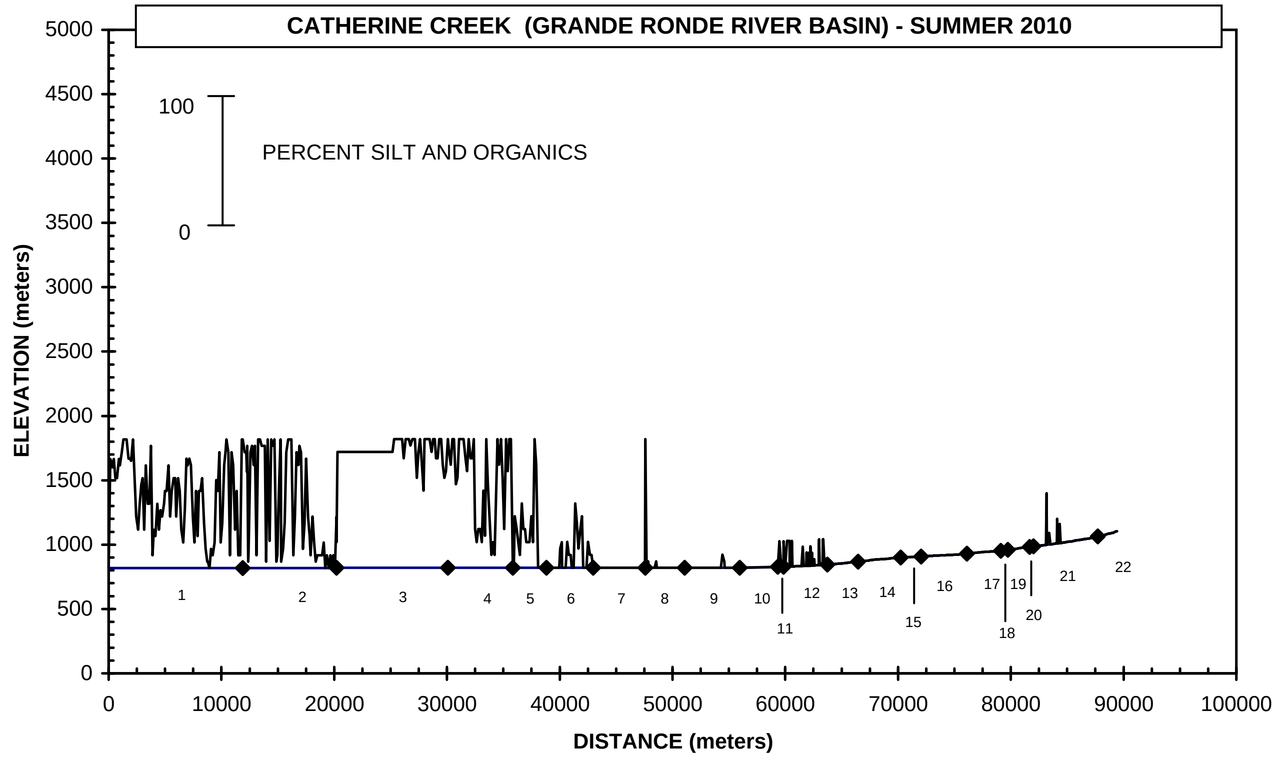
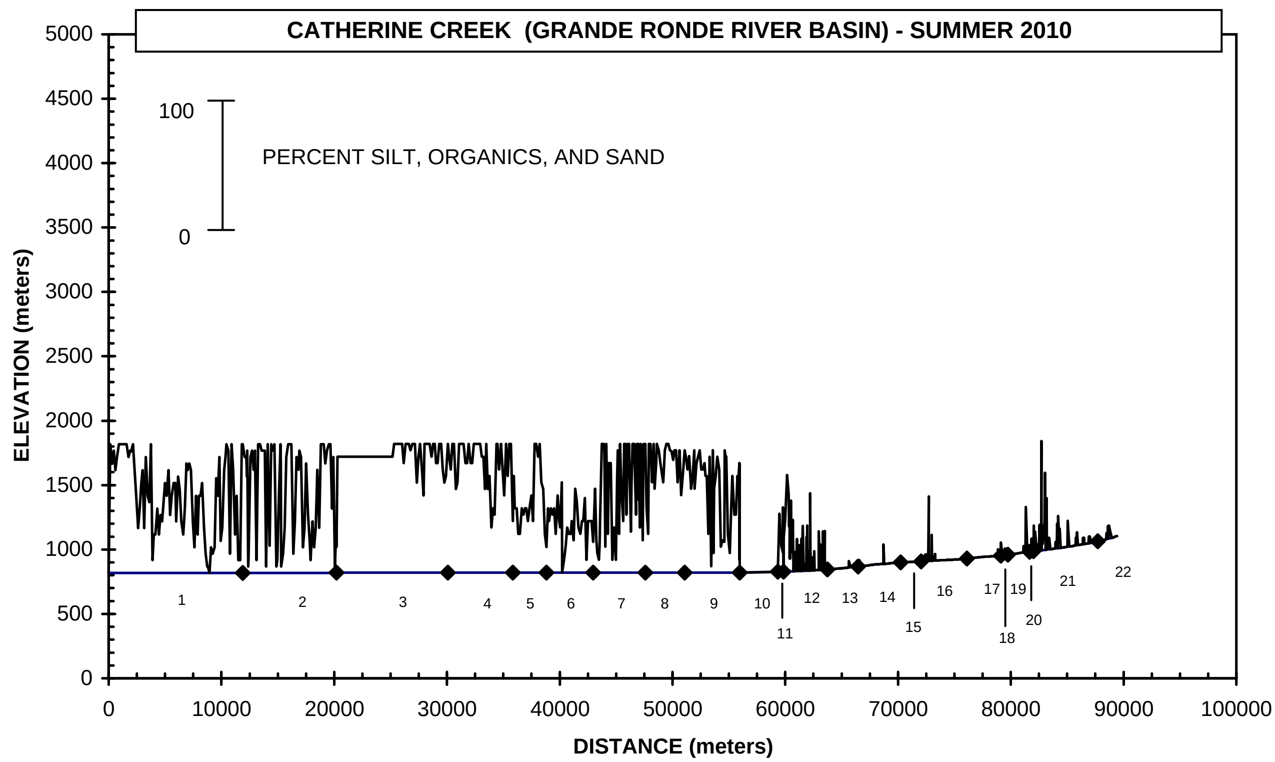
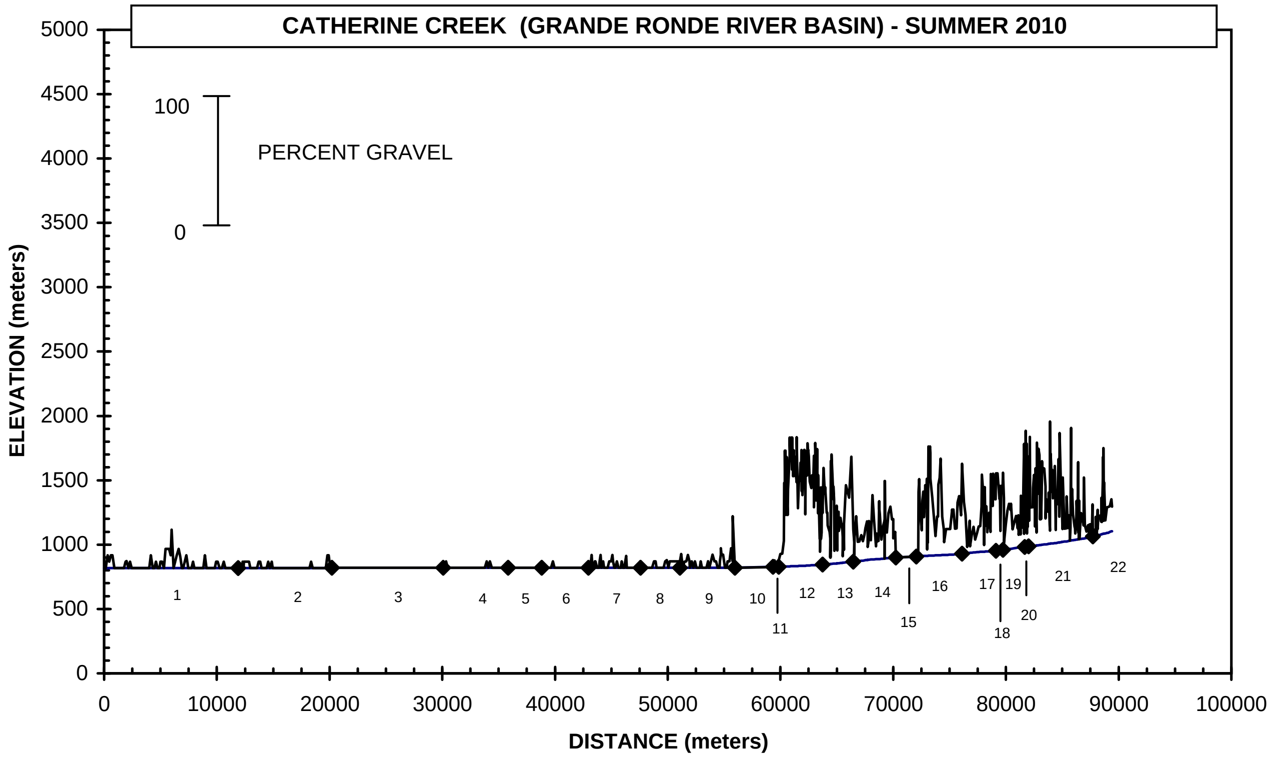

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
100
0
PERCENT SILT AND ORGANICS
ELEVATION (meters)
DISTANCE (meters)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22


CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
100
0
PERCENT SILT, ORGANICS, AND SAND
ELEVATION (meters)
DISTANCE (meters)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22


CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
100
0
PERCENT GRAVEL
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
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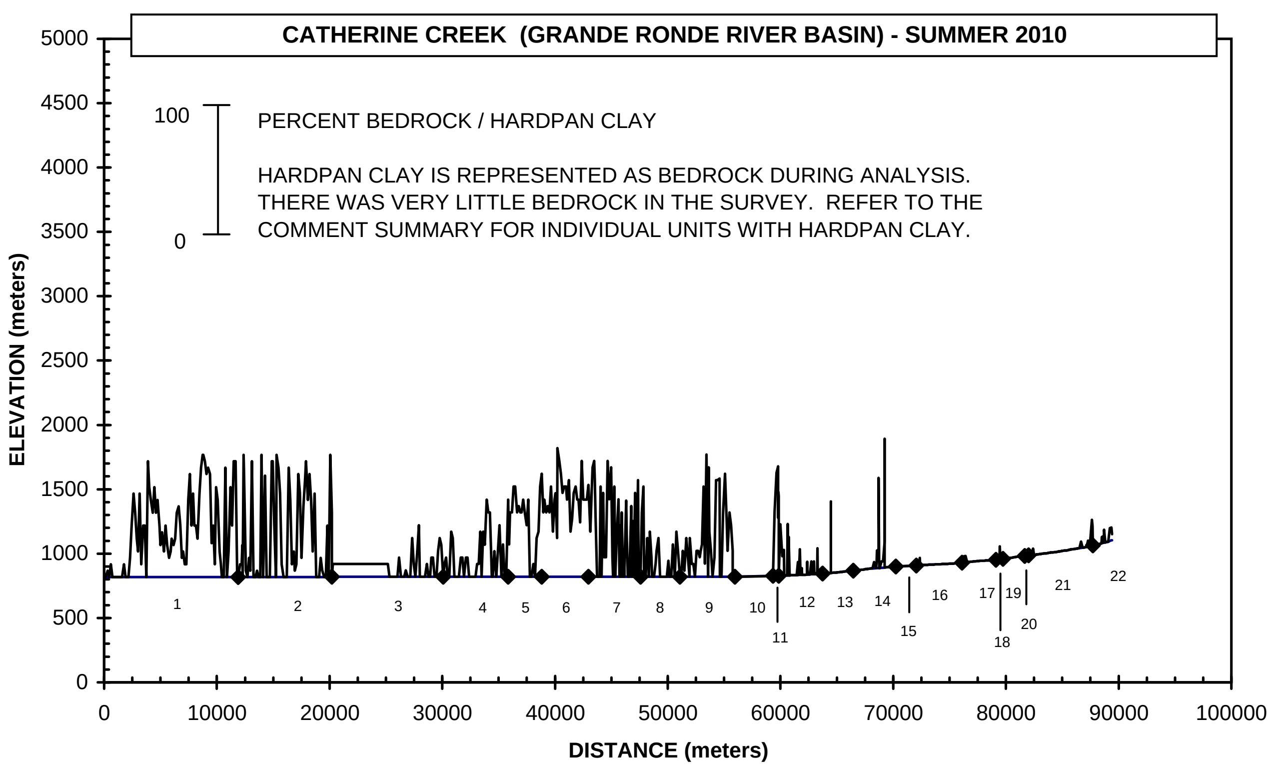
CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
100
0
PERCENT BEDROCK / HARDPAN CLAY
HARDPAN CLAY IS REPRESENTED AS BEDROCK DURING ANALYSIS.
THERE WAS VERY LITTLE BEDROCK IN THE SURVEY. REFER TO THE
COMMENT SUMMARY FOR INDIVIDUAL UNITS WITH HARDPAN CLAY.
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
2
3
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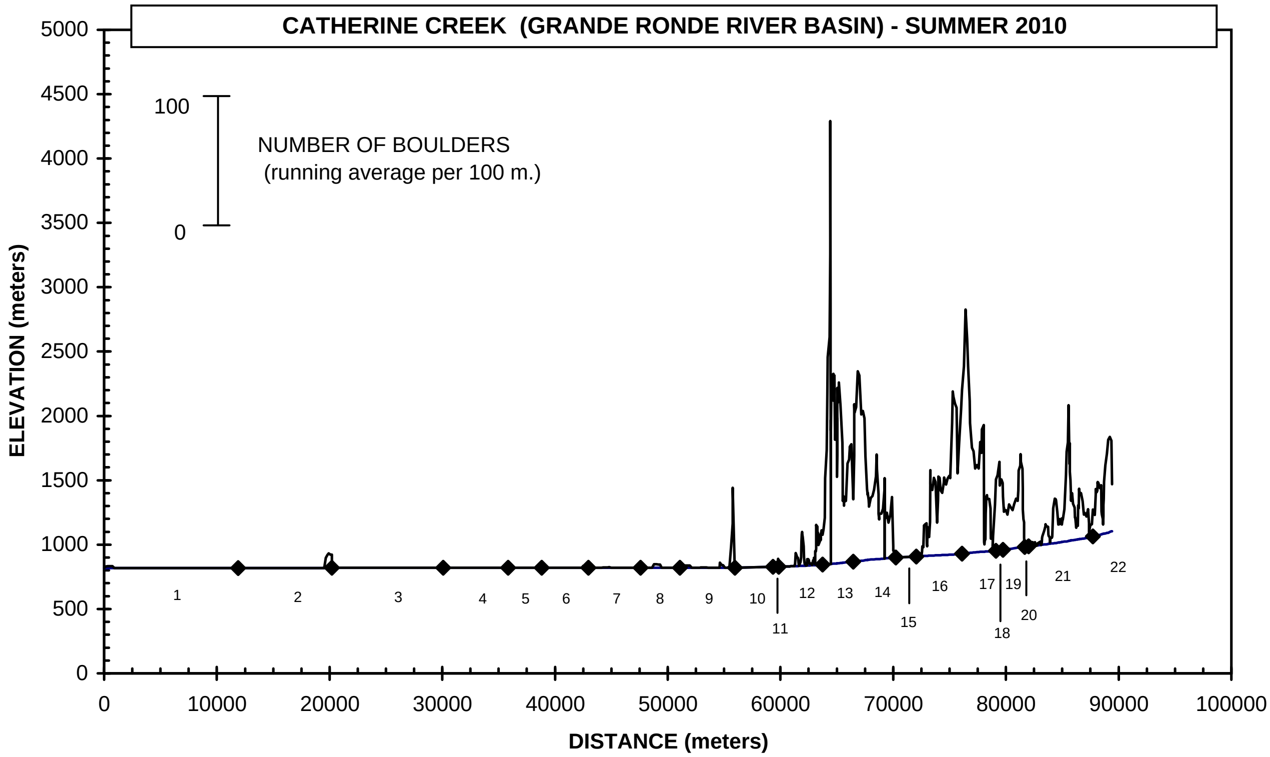
CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
NUMBER OF BOULDERS
(running average per 100 m.)
100
0
ELEVATION (meters)
DISTANCE (meters)
1
2
3
4
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6
7
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9
10
11
12
13
14
15
16
17
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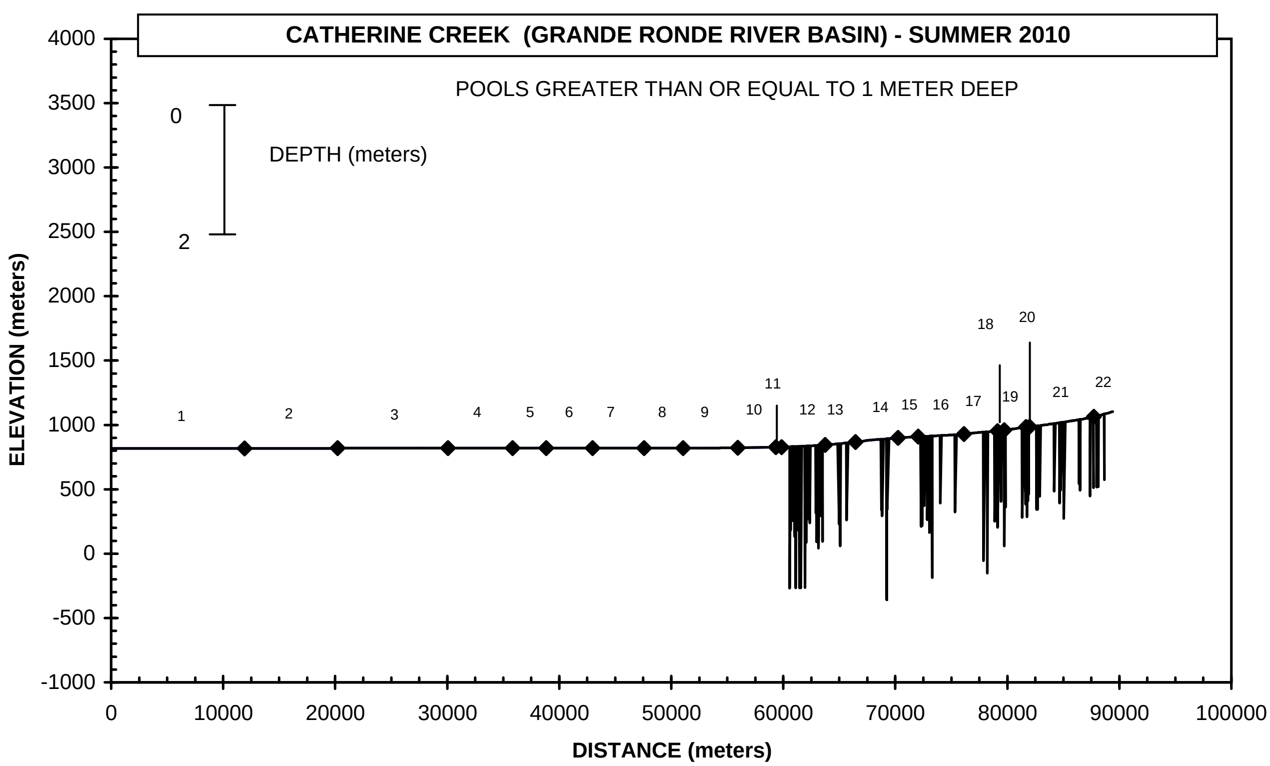
19
20
21
22


CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
POOLS GREATER THAN OR EQUAL TO 1 METER DEEP
DEPTH (meters)
0
2
ELEVATION (meters)
DISTANCE (meters)
1
2
3
4
5
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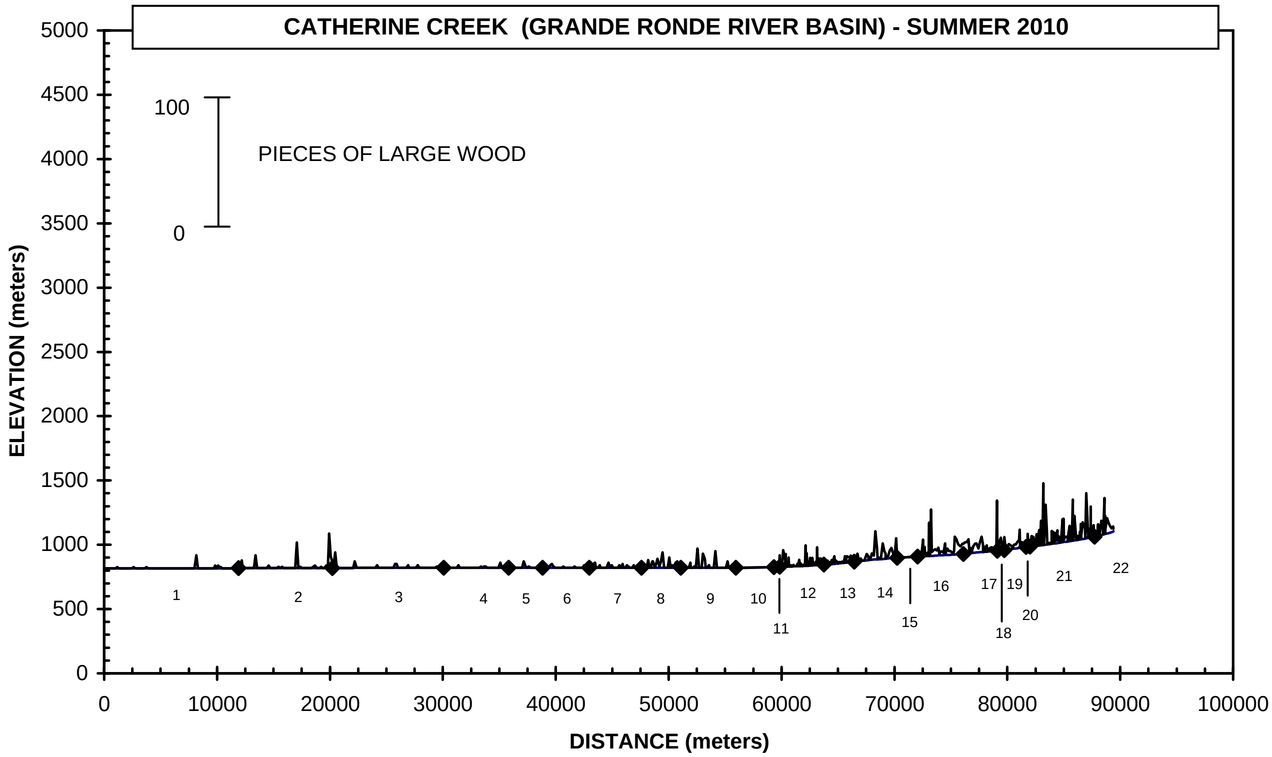
CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
PIECES OF LARGE WOOD
100
0
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10000
20000
30000
40000
50000
60000
70000
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100000
1
2
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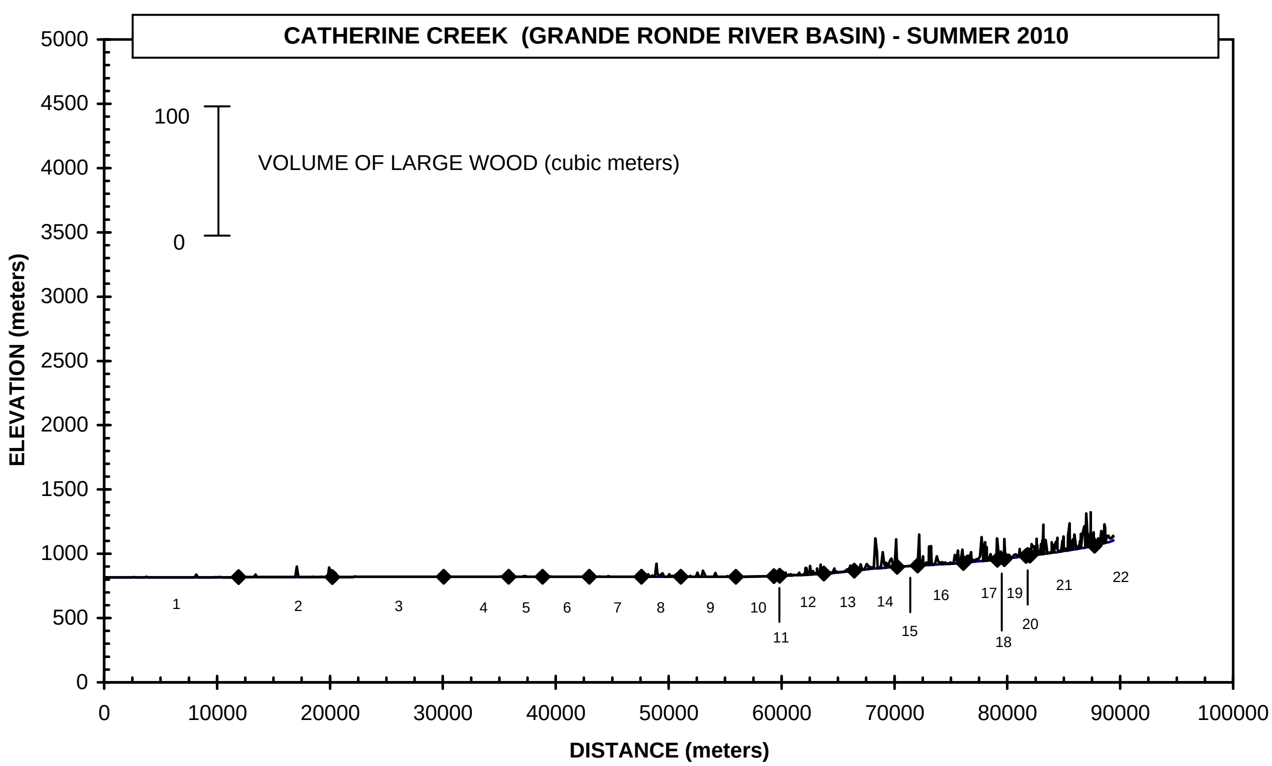
CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
VOLUME OF LARGE WOOD (cubic meters)
100
0
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
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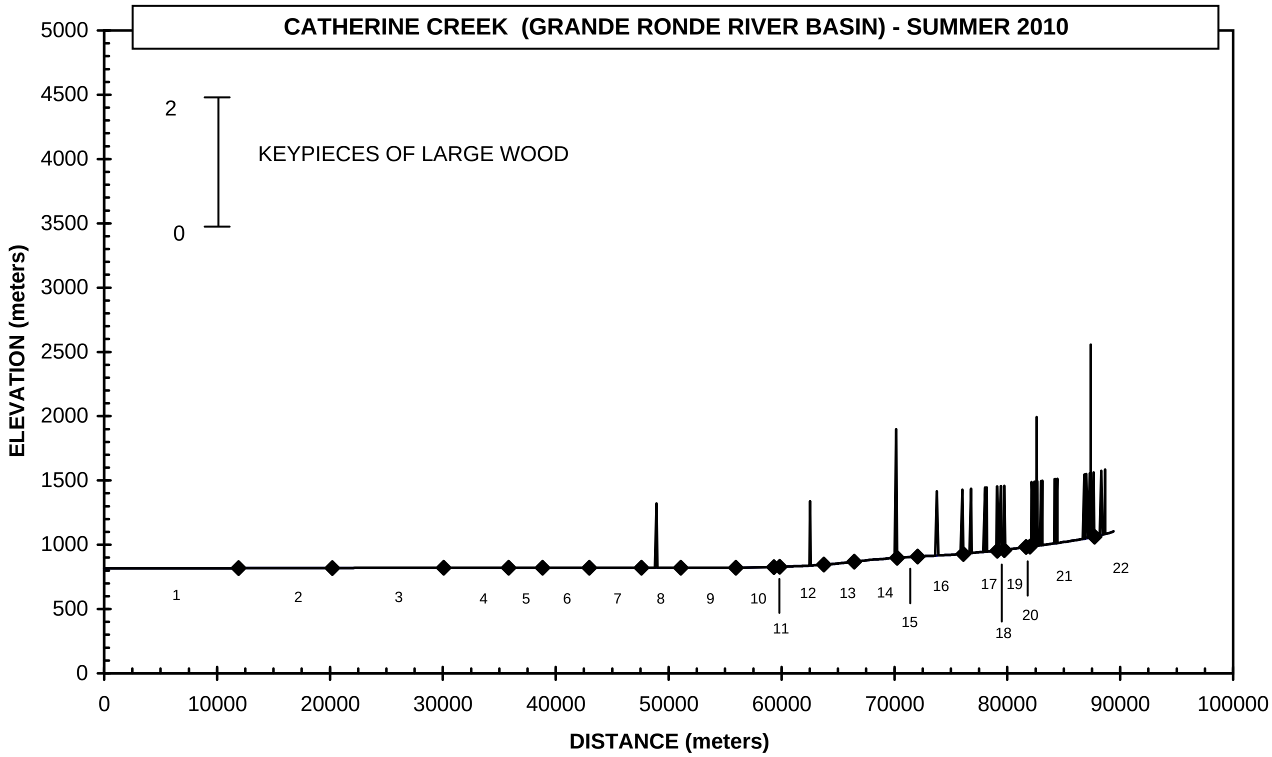
CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010
KEYPIECES OF LARGE WOOD
2
0
ELEVATION (meters)
DISTANCE (meters)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000
1
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3
4
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22

REACH 1 **T02S-R39E-S10NW** **REACH 1**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	11,900	277,109	0
Secondary	244	2,440	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 12		First Terrace *n* = 11	
Width:	23.2	Width:	27.3	47.9	(19.6 - 157.75)	43.5	(24.2 - 76.95)
Depth:	1.16	Height:	1.7	3.4	(2.8 - 3.9)	4.3	(3.35 - 7.5)

W:D ratio: 16.4
Stream Flow Type: MF
Average Unit Gradient: 0.0%
Water temperature (°C): 18.0 - 18.0

Entrenchment (ACW:FPW ratio): 1.7
Habitat Units/100m (total channel length): 0.7
Habitat Units/100m (primary channel length): 0.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	AG	
Riparian Vegetation:	S	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)	
Actively Eroding:	0%	Reach avg:	22%
Undercut Banks:	0%	Range:	6 - 36

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	23	0.2
Volume (m^3):	4	0.0
Key pieces (>=12m x 0.60m):	0	0.0

REACH 2 **T02S-R39E-S13SW** **REACH 2**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	8,315	142,625	0
Secondary	317	3,291	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 9		First Terrace *n* = 9	
Width:	16.9	Width:	19.2	31.2	(27.35 - 47.5)	37.4	(29.95 - 50.3)
Depth:	0.81	Height:	1.5	3.0	(2.8 - 3.28)	4.3	(3.16 - 6.96)

W:D ratio: 12.7
Stream Flow Type: MF
Average Unit Gradient: 0.0%
Water temperature (°C): 22.8 - 22.8

Entrenchment (ACW:FPW ratio): 1.7
Habitat Units/100m (total channel length): 0.8
Habitat Units/100m (primary channel length): 0.8

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	AG	
Riparian Vegetation:	S	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	0%	Reach avg: 29%
Undercut Banks:	0%	Range: 11 - 42

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	88	1.1
Volume (m^3):	25	0.3
Key pieces (>=12m x 0.60m):	0	0.0

REACH 3 **T02S-R40E-S30NW** **REACH 3**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	9,855	203,708	0
Secondary	150	1,025	0

Channel Dimensions (m)

	Wetted	Active	Floodprone *n* = 0	First Terrace *n* = 11
Width:	20.3	Due to deep water, active channel and flood prone dimensions were not measured. Terrace height was measured from water surface to terrace lip.		28.7 (1.25 - 41.6)
Depth:	1.63			3.3 (1.15 - 18.1)

W:D ratio:
Stream Flow Type: HF
Average Unit Gradient: 0.0%
Water temperature (°C): 16.6 - 16.6

Entrenchment (ACW:FPW ratio):
Habitat Units/100m (total channel length): 0.7
Habitat Units/100m (primary channel length): 0.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	AG	LG
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:		Reach avg: 22%
Undercut Banks:		Range: 11 - 39

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	30	0.3
Volume (m^3):	5	0.0
Key pieces (>=12m x 0.60m):	0	0.0

REACH 4 **T03S-R40E-S05NW** **REACH 4**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	5,762	84,508	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted	Active	Floodprone *n* = 0	First Terrace *n* = 5
Width: 14.6	Due to deep water, active channel and flood prone dimensions were not measured. Terrace height was measured from water surface to terrace lip.		17.7 (15.51 - 21.3)
Depth: 1.31			1.3 (1 - 1.5)

W:D ratio:
Stream Flow Type: HF
Average Unit Gradient: 0.0%
Water temperature (°C): 17.8 - 17.8

Entrenchment (ACW:FPW ratio):
Habitat Units/100m (total channel length): 0.7
Habitat Units/100m (primary channel length): 0.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	AG	LG
Riparian Vegetation:	D3	G

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	2%
Undercut Banks:	0%

Shade (% of 180)
Reach avg: 30%
Range: 19 - 36

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	9	0.2
Volume (m^3):	1	0.0
Key pieces (>=12m x 0.60m):	0	0.0

REACH 5 **T03S-R40E-S18SW** **REACH 5**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	2,989	35,611	0
Secondary	64	128	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 2		First Terrace *n* = 2	
Width:	11.5	Width:	12.9	20.6	(14.8 - 26.45)	23.1	(18.12 - 28.05)
Depth:	0.87	Height:	1.2	2.3	(2 - 2.62)	2.5	(2.2 - 2.72)

W:D ratio: 11.5
Stream Flow Type: MF
Average Unit Gradient: 0.0%
Water temperature (°C): 15.0 - 15.0

Entrenchment (ACW:FPW ratio): 1.6
Habitat Units/100m (total channel length): 0.7
Habitat Units/100m (primary channel length): 0.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	AG	LG
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	23%
Undercut Banks:	2%

Shade (% of 180)
Reach avg: 36%
Range: 22 - 47

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	8	0.3
Volume (m^3):	1	0.0
Key pieces (>=12m x 0.60m):	0	0.0

REACH 6 **T03S-R39E-S13SW** **REACH 6**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	4,148	38,529	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 4		First Terrace *n* = 4	
Width:	9.4	Width:	10.8	14.3	(12.25 - 16.49)	16.2	(12.85 - 18.64)
Depth:	0.74	Height:	1.2	2.5	(2.4 - 2.5)	2.8	(2.48 - 3.11)

W:D ratio: 8.8
Stream Flow Type: MF
Average Unit Gradient: 0.0%
Water temperature (°C): 15.5 - 15.5

Entrenchment (ACW:FPW ratio): 1.3
Habitat Units/100m (total channel length): 0.7
Habitat Units/100m (primary channel length): 0.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	AG	LG
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	24%	Reach avg: 23%
Undercut Banks:	2%	Range: 14 - 47

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	10	0.2
Volume (m^3):	1	0.0
Key pieces (>=12m x 0.60m):	0	0.0

REACH 7 **T03S-R39E-S15SW** **REACH 7**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	4,609	23,161	15
Secondary	32	130	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 5		First Terrace *n* = 2	
Width:	4.5	Width:	14.9	70.0	(14.15 - 118.2)	32.9	(16.35 - 49.52)
Depth:	0.24	Height:	1.3	2.6	(2 - 3.32)	2.8	(2.5 - 3.05)

W:D ratio: 11.7
Stream Flow Type: LF
Average Unit Gradient: 0.0%
Water temperature (°C): 34.5 - 34.5

Entrenchment (ACW:FPW ratio): 4.6
Habitat Units/100m (total channel length): 1.0
Habitat Units/100m (primary channel length): 1.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	AG
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	18%	Reach avg: 25%
Undercut Banks:	0%	Range: 8 - 39

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	32	0.7
Volume (m^3):	3	0.1
Key pieces (>=12m x 0.60m):	0	0.0

REACH 8 **T03S-R39E-S28NE** **REACH 8**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	100%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	100%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	3,489	27,110	0
Secondary	16	21	0

Channel Dimensions (m)

Wetted		Active		Floodprone n = 3	First Terrace n = 0
Width:	6.9	Width:	13.7	137.6 (62.85 - 190)	(-)
Depth:	0.28	Height:	1.6	3.1 (2.96 - 3.4)	(-)

W:D ratio: 8.8
Stream Flow Type: LF
Average Unit Gradient: 0.0%
Water temperature (°C): 26.8 - 26.8

Entrenchment (ACW:FPW ratio): 9.8
Habitat Units/100m (total channel length): 0.8
Habitat Units/100m (primary channel length): 0.8

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	AG
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	12%
Undercut Banks:	1%

Shade (% of 180)
Reach avg: 38%
Range: 17 - 64

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	67	1.9
Volume (m^3):	27	0.8
Key pieces (>=12m x 0.60m):	1	0.0

REACH 9 **T04S-R39E-S03NW** **REACH 9**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	4,878	37,184	0
Secondary	44	86	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 5		First Terrace *n* = 4	
Width:	7.1	Width:	14.5	44.6	(18.7 - 120)	30.4	(24.5 - 42.6)
Depth:	0.31	Height:	1.3	2.5	(2.2 - 2.74)	3.4	(2.75 - 4.09)

W:D ratio: 11.6
Stream Flow Type: LF
Average Unit Gradient: 0.0%
Water temperature (°C): 21.8 - 21.8

Entrenchment (ACW:FPW ratio): 3.3
Habitat Units/100m (total channel length): 1.0
Habitat Units/100m (primary channel length): 1.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	HG	
Riparian Vegetation:	G	S

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	6%	Reach avg: 21%
Undercut Banks:	4%	Range: 6 - 89

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	73	1.5
Volume (m^3):	18	0.4
Key pieces (>=12m x 0.60m):	0	0.0

REACH 10 **T04S-R39E-S03NW** **REACH 10**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index VWI Range: -

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	3,389	33,890	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 0	First Terrace *n* = 0
Width:	10.0	Width:		(-)	(-)
Depth:		Height:		(-)	(-)

W:D ratio:
Stream Flow Type:
Average Unit Gradient: 0.2%
Water temperature (°C): -

Entrenchment (ACW:FPW ratio):
Habitat Units/100m (total channel length): 0.0
Habitat Units/100m (primary channel length): 0.0

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:		
Riparian Vegetation:		

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	0%
Undercut Banks:	0%

Shade (% of 180)
Reach avg: 22%
Range: 22 - 22

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	0	
Volume (m^3):	0	
Key pieces (>=12m x 0.60m):	0	

REACH 11 **T04S-R39E-S15NE** **REACH 11**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index VWI Range: -

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	514	5,763	0
Secondary	66	79	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 0	First Terrace *n* = 0
Width:	7.3	Width:		(-)	(-)
Depth:	0.51	Height:		(-)	(-)

W:D ratio:
Stream Flow Type: MF
Average Unit Gradient: 0.3%
Water temperature (°C): 12.0 - 12.0

Entrenchment (ACW:FPW ratio):
Habitat Units/100m (total channel length): 1.6
Habitat Units/100m (primary channel length): 1.8

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	AG
Riparian Vegetation:	G	D30

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	14%
Undercut Banks:	1%

Shade (% of 180)
Reach avg: 16%
Range: 11 - 39

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	11	2.1
Volume (m^3):	5	0.9
Key pieces (>=12m x 0.60m):	0	0.0

REACH 12 **T04S-R39E-S15NE** **REACH 12**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	3,888	33,707	0
Secondary	36	78	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 9		First Terrace *n* = 7	
Width:	7.6	Width:	17.6	47.4	(12.45 - 120.2)	33.9	(13.65 - 70.05)
Depth:	0.58	Height:	0.9	1.7	(1.48 - 1.94)	2.1	(1.86 - 2.32)

W:D ratio: 20.4
Stream Flow Type: MF
Average Unit Gradient: 0.4%
Water temperature (°C): 13.0 - 13.0

Entrenchment (ACW:FPW ratio): 2.6
Habitat Units/100m (total channel length): 2.4
Habitat Units/100m (primary channel length): 2.4

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	HG	AG
Riparian Vegetation:	G	D50

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	20%
Undercut Banks:	4%

Shade (% of 180)
Reach avg: 41%
Range: 8 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	147	3.8
Volume (m^3):	65	1.7
Key pieces (>=12m x 0.60m):	1	0.0

REACH 13 **T04S-R39E-S13SE** **REACH 13**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 20.0 VWI Range: 20 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	2,713	25,385	0
Secondary	77	430	1

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 4		First Terrace *n* = 3	
Width:	8.7	Width:	14.3	64.6	(12.8 - 209.55)	19.5	(16 - 22.61)
Depth:	0.34	Height:	0.6	1.1	(0.96 - 1.3)	1.7	(1.52 - 1.8)

W:D ratio: 25.7
Stream Flow Type: MF
Average Unit Gradient: 0.8%
Water temperature (°C): 22.9 - 22.9

Entrenchment (ACW:FPW ratio): 3.7
Habitat Units/100m (total channel length): 1.8
Habitat Units/100m (primary channel length): 1.8

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	UR	
Riparian Vegetation:	D15	G

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	1%
Undercut Banks:	4%

Shade (% of 180)
Reach avg: 55%
Range: 22 - 97

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	61	2.2
Volume (m^3):	23	0.8
Key pieces (>=12m x 0.60m):	0	0.0

REACH 14 **T04S-R40E-S19NE** **REACH 14**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 17.6 VWI Range: 11 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	3,788	44,081	0
Secondary	40	71	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 6		First Terrace *n* = 5	
Width:	11.2	Width:	14.5	51.1	(14.3 - 214)	19.9	(16.5 - 24.98)
Depth:	0.57	Height:	0.7	1.3	(1 - 1.66)	1.7	(1.42 - 1.9)

W:D ratio: 22.4
Stream Flow Type: MF
Average Unit Gradient: 0.8%
Water temperature (°C): 16.4 - 16.4

Entrenchment (ACW:FPW ratio): 3.4
Habitat Units/100m (total channel length): 1.4
Habitat Units/100m (primary channel length): 1.5

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	
Riparian Vegetation:	D3	G

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	3%	Reach avg: 44%
Undercut Banks:	6%	Range: 19 - 69

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	129	3.4
Volume (m^3):	114	3.0
Key pieces (>=12m x 0.60m):	2	0.1

REACH 15 **T04S-R40E-S28SW** **REACH 15**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	0%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index VWI Range: -

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	1,819	18,190	0
Secondary	0	0	0

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 0	First Terrace *n* = 0
Width:	10.0	Width:		(-)	(-)
Depth:	0.20	Height:		(-)	(-)

W:D ratio:
Stream Flow Type:
Average Unit Gradient: 0.5%
Water temperature (°C): -

Entrenchment (ACW:FPW ratio):
Habitat Units/100m (total channel length): 0.1
Habitat Units/100m (primary channel length): 0.1

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:		
Riparian Vegetation:		

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	0%	Reach avg: 53%
Undercut Banks:	0%	Range: 53 - 53

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	0	
Volume (m^3):	0	
Key pieces (>=12m x 0.60m):	0	

REACH 16 **T04S-R40E-S33NE** **REACH 16**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 12.9 VWI Range: 3 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	4,059	49,937	0
Secondary	364	1,136	5

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 5		First Terrace *n* = 4	
Width:	9.3	Width:	17.3	45.2	(17.08 - 129.29)	26.6	(19.75 - 35.15)
Depth:	0.49	Height:	0.6	1.2	(1.12 - 1.3)	1.3	(1.22 - 1.45)

W:D ratio: 29.0
Stream Flow Type: MF
Average Unit Gradient: 0.5%
Water temperature (°C): 16.0 - 16.0

Entrenchment (ACW:FPW ratio): 2.5
Habitat Units/100m (total channel length): 1.5
Habitat Units/100m (primary channel length): 1.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	ST
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	20%
Undercut Banks:	3%

Shade (% of 180)	
Reach avg:	32%
Range:	6 - 92

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	291	7.2
Volume (m^3):	140	3.4
Key pieces (>=12m x 0.60m):	4	0.1

REACH 17 **T05S-R40E-S06SW** **REACH 17**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 5.9 VWI Range: 1 - 14.5

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	3,000	35,540	0
Secondary	487	1,545	2

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 4		First Terrace *n* = 3	
Width:	8.9	Width:	20.2	36.8	(15.85 - 63.16)	46.2	(31.92 - 67.6)
Depth:	0.42	Height:	0.6	1.1	(1 - 1.16)	3.1	(1.1 - 6.76)

W:D ratio: 36.2
Stream Flow Type: MF
Average Unit Gradient: 0.8%
Water temperature (°C): 15.9 - 15.9

Entrenchment (ACW:FPW ratio): 1.8
Habitat Units/100m (total channel length): 1.3
Habitat Units/100m (primary channel length): 1.5

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	ST
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	8%
Undercut Banks:	5%

Shade (% of 180)
Reach avg: 40%
Range: 19 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	159	5.3
Volume (m^3):	121	4.0
Key pieces (>=12m x 0.60m):	5	0.2

REACH 18 **T05S-R41E-S07NW** **REACH 18**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 11.0 VWI Range: 11 - 11

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	100%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	621	8,080	0
Secondary	288	1,013	2

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 1		First Terrace *n* = 1	
Width:	6.2	Width:	14.8	16.3	(16.33 - 16.33)	16.7	(16.73 - 16.73)
Depth:	0.38	Height:	0.7	1.3	(1.3 - 1.3)	1.3	(1.32 - 1.32)

W:D ratio: 22.8
Stream Flow Type: MF
Average Unit Gradient: 1.0%
Water temperature (°C): 18.0 - 18.0

Entrenchment (ACW:FPW ratio): 1.1
Habitat Units/100m (total channel length): 2.5
Habitat Units/100m (primary channel length): 3.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	GN	OG
Riparian Vegetation:	D3	C30

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	4%
Undercut Banks:	4%

Shade (% of 180)
Reach avg: 62%
Range: 19 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	47	7.6
Volume (m^3):	36	5.8
Key pieces (>=12m x 0.60m):	3	0.5

REACH 19 **T05S-R41E-S07NW** **REACH 19**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 3.5 VWI Range: 3 - 4

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	0%	Braided Channel	0%
Alt. Terrace/Hill	100%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	1,920	22,683	0
Secondary	119	244	5

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 2		First Terrace *n* = 2	
Width:	9.7	Width:	16.8	24.0	(21.65 - 26.3)	29.2	(23 - 35.3)
Depth:	0.35	Height:	0.6	1.2	(1.22 - 1.22)	2.1	(1.52 - 2.72)

W:D ratio: 27.5
Stream Flow Type: MF
Average Unit Gradient: 1.2%
Water temperature (°C): 10.5 - 10.5

Entrenchment (ACW:FPW ratio): 1.5
Habitat Units/100m (total channel length): 1.6
Habitat Units/100m (primary channel length): 1.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LT	ST
Riparian Vegetation:	D3	S

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	7%
Undercut Banks:	2%

Shade (% of 180)
Reach avg: 56%
Range: 36 - 89

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	58	3.0
Volume (m^3):	29	1.5
Key pieces (>=12m x 0.60m):	0	0.0

REACH 20 **T05S-R41E-S08SW** **REACH 20**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 16.0 VWI Range: 16 - 16

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	339	3,179	0
Secondary	368	1,343	5

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 1	First Terrace *n* = 1
Width:	5.4	Width:	21.3	38.3 (38.27 - 38.27)	49.5 (49.52 - 49.52)
Depth:	0.35	Height:	0.4	0.9 (0.86 - 0.86)	1.2 (1.16 - 1.16)

W:D ratio: 49.4
Stream Flow Type: MF
Average Unit Gradient: 1.0%
Water temperature (°C): 12.0 - 12.0

Entrenchment (ACW:FPW ratio): 1.8
Habitat Units/100m (total channel length): 4.7
Habitat Units/100m (primary channel length): 9.7

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	LT
Riparian Vegetation:	G	D3

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	28%
Undercut Banks:	8%

Shade (% of 180)
Reach avg: 36%
Range: 17 - 94

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	26	7.7
Volume (m^3):	12	3.5
Key pieces (>=12m x 0.60m):	0	0.0

REACH 21 **T05S-R41E-S08SW** **REACH 21**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 14.2 VWI Range: 6.5 - 20

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	5,725	65,612	0
Secondary	3,071	8,034	33

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 10		First Terrace *n* = 8	
Width:	7.2	Width:	16.5	39.9	(12.22 - 165)	24.3	(14.15 - 46)
Depth:	0.36	Height:	0.6	1.1	(0.98 - 1.3)	1.5	(1.22 - 1.96)

W:D ratio: 29.2
Stream Flow Type: MF
Average Unit Gradient: 1.3%
Water temperature (°C): 11.0 - 11.0

Entrenchment (ACW:FPW ratio): 2.5
Habitat Units/100m (total channel length): 2.2
Habitat Units/100m (primary channel length): 3.4

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	LG	ST
Riparian Vegetation:	D3	S

Bank Condition and Shade

Bank Status	Percent Reach Length	Shade (% of 180)
Actively Eroding:	24%	Reach avg: 49%
Undercut Banks:	9%	Range: 11 - 94

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	705	12.3
Volume (m^3):	509	8.9
Key pieces (>=12m x 0.60m):	24	0.4

REACH 22 **T05S-R41E-S22SE** **REACH 22**

Valley and Channel Summary

Valley Characteristics (Percent Reach Length)

Narrow Valley Floor		Broad Valley Floor	
Steep V-shape	0%	Constraining Terraces	100%
Moderate V-shape	0%	Multiple Terraces	0%
Open V-shape	0%	Wide Floodplain	0%

Valley Width Index 8.8 VWI Range: 7.5 - 10

Channel Morphology (Percent Reach Length)

Constrained		Unconstrained	
Hillslope	0%	Single Channel	0%
Bedrock	0%	Multiple Channel	0%
Terrace	100%	Braided Channel	0%
Alt. Terrace/Hill	0%		
Landuse	0%		

Channel Characteristics

Type	Length (m)	Area (m2)	Dry Units
Primary	1,690	16,641	0
Secondary	530	2,839	1

Channel Dimensions (m)

Wetted		Active		Floodprone *n* = 2		First Terrace *n* = 2	
Width:	7.7	Width:	11.7	24.0	(23.1 - 24.95)	29.3	(24.45 - 34.15)
Depth:	0.37	Height:	0.6	1.3	(1.28 - 1.3)	1.6	(1.5 - 1.68)

W:D ratio: 18.2
Stream Flow Type: MF
Average Unit Gradient: 2.4%
Water temperature (°C): 9.5 - 9.5

Entrenchment (ACW:FPW ratio): 2.1
Habitat Units/100m (total channel length): 1.8
Habitat Units/100m (primary channel length): 2.4

Riparian, Bank, and Wood Summary

	Primary	Secondary
Land Use:	ST	LT
Riparian Vegetation:	D3	C15

Bank Condition and Shade

Bank Status	Percent Reach Length
Actively Eroding:	15%
Undercut Banks:	4%

Shade (% of 180)
Reach avg: 48%
Range: 28 - 100

Large Wood Debris

	Total	Total / 100m primary channel
All pieces (>=3m x 0.15m):	147	8.7
Volume (m^3):	76	4.5
Key pieces (>=12m x 0.60m):	2	0.1

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 7/7/2010

REACH 1 **T02S-R39E-S10NW** **REACH 1**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	84	11,900	23.3	1.18	277,109	11		57	4	3	0	0	36
POOL-ALCOVE	1	244	10.0	0.00	2,440	0		100	0	0	0	0	0
Total:	85	12,144	23.2	1.16	279,549	11	**Avg:**	58	4	3	0	0	35

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	1	244	10.0	0.00	2,440	0.87%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	84	11,900	23.3	1.18	277,109	99.13%	11	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	1	0.1	0.1
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	444.6		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 7/14/2010

REACH 2 **T02S-R39E-S13SW** **REACH 2**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	62	8,315	17.4	0.84	142,624	56		51	14	1	0	0	33
POOL-ALCOVE	2	317	6.4	0.15	3,291	0		100	0	0	0	0	0
STEP/STRUCTURE	1	0	5.0	0.20	1	0		20	0	0	40	40	0
Total:	65	8,633	16.9	0.81	145,915	56	**Avg:**	52	14	1	1	1	32

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	2	317	6.4	0.15	3,291	2.26%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	62	8,315	17.4	0.84	142,624	97.74%	56	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	0	5.0	0.20	1	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	2	0.2	0.2
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	225.1		
Residual pool depth (avg):			

REACH 3 **T02S-R40E-S30NW** **REACH 3**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	71	10,005	20.3	1.63	204,733	0		91	0	0	0	0	9
Total:	71	10,005	20.3	1.63	204,733	0	**Avg:**	91	0	0	0	0	9

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	71	10,005	20.3	1.63	204,733	100.00%		
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/16/2010

REACH 4 **T03S-R40E-S05NW** **REACH 4**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	40	5,762	14.6	1.31	84,508	0		68	17	0	0	0	15
Total:	40	5,762	14.6	1.31	84,508	0	**Avg:**	68	17	0	0	0	15

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	40	5,762	14.6	1.31	84,508	100.00%		
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/17/2010

REACH 5 **T03S-R40E-S18SW** **REACH 5**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	22	3,053	11.5	0.87	35,739	0		23	34	0	0	0	43
Total:	22	3,053	11.5	0.87	35,739	0	**Avg:**	23	34	0	0	0	43

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	22	3,053	11.5	0.87	35,739	100.00%		
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/17/2010

REACH 6 **T03S-R39E-S13SW** **REACH 6**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	29	4,118	9.3	0.78	38,186	0		10	29	0	0	0	60
RIFFLE	1	28	11.5	0.21	325	0		0	15	0	0	0	85
STEP/BEAVER DAM	1	2	11.5	0.15	17	0		0	0	0	0	0	100
Total:	31	4,148	9.4	0.74	38,529	0	**Avg:**	9	28	0	0	0	63

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	29	4,118	9.3	0.78	38,186	99.11%	0	0.0
Riffles	1	28	11.5	0.21	325	0.84%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	2	11.5	0.15	17	0.04%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

REACH 7 **T03S-R39E-S15SW** **REACH 7**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
DRY UNIT	1	48	9.0	0.00	428	0		0	100	0	0	0	0
GLIDE	33	3,574	5.6	0.31	21,349	13		3	53	2	0	0	42
PUDDLED UNIT	14	1,020	1.6	0.08	1,514	0		0	88	2	0	0	10
Total:	48	4,641	4.5	0.24	23,291	13	**Avg:**	2	64	2	0	0	32

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	33	3,574	5.6	0.31	21,349	91.66%	13	0.1
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	15	1,067	2.1	0.07	1,942	8.34%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/3/2010

REACH 8 **T03S-R39E-S28NE** **REACH 8**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	24	3,242	7.8	0.32	26,289	19		0	79	2	0	0	18
RIFFLE	4	262	2.4	0.14	841	0		8	75	0	0	0	18
STEP/BEAVER DAM	1	0	2.3	0.11	1	0		5	0	0	0	0	95
Total:	29	3,505	6.9	0.28	27,131	19	**Avg:**	2	76	2	0	0	21

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	24	3,242	7.8	0.32	26,289	96.90%	19	0.1
Riffles	4	262	2.4	0.14	841	3.10%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	0	2.3	0.11	1	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 7/28/2010

REACH 9 **T04S-R39E-S03NW** **REACH 9**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	31	4,200	7.6	0.37	32,077	20		0	65	4	0	0	30
POOL-BACKWATER	3	44	2.0	0.32	86	0		10	90	0	0	0	0
POOL-PLUNGE	1	8	13.0	0.85	104	34		0	85	5	5	5	0
RIFFLE	7	633	7.1	0.13	4,771	10		0	82	3	1	0	14
STEP/BEDROCK	1	5	5.8	0.12	29	0		0	15	0	0	0	85
STEP/COBBLE	3	26	4.9	0.04	137	70		0	52	20	18	10	0
STEP/STRUCTURE	1	6	10.9	0.01	65	0		19	0	27	0	54	0
Total:	47	4,922	7.1	0.31	37,270	134	**Avg:**	1	66	5	2	2	24

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	3	44	2.0	0.32	86	0.23%	0	0.0
Scour Pools	1	8	13.0	0.85	104	0.28%	34	32.7
Glides	31	4,200	7.6	0.37	32,077	86.07%	20	0.1
Riffles	7	633	7.1	0.13	4,771	12.80%	10	0.2
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	5	37	6.3	0.05	232	0.62%	70	30.2
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	4	0.8	0.8
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	2	0.4	0.4
Pool frequency (channel widths/pool):	85.0		
Residual pool depth (avg):	0.75		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/21/2010 Survey Date: 9/8/2010

REACH 10 **T04S-R39E-S03NW** **REACH 10**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
MIX OF HABITATS	1	3,389	10.0		33,890	0		17	17	17	17	17	17
Total:	1	3,389	10.0		33,890	0	**Avg:**	17	17	17	17	17	17

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

REACH 11 **T04S-R39E-S15NE** **REACH 11**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	8	576	7.3	0.58	5,813	4		18	22	2	9	1	48
STEP/COBBLE	1	4	7.3	0.01	29	0		0	0	5	95	0	0
Total:	9	580	7.3	0.51	5,842	4	**Avg:**	16	20	3	18	1	43

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	8	576	7.3	0.58	5,813	99.50%	4	0.1
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	4	7.3	0.01	29	0.50%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/8/2010

REACH 12 **T04S-R39E-S15NE** **REACH 12**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area: S/O	Snd	Grvl	Cbl	Bldr	Bdrk
GLIDE	13	1,136	9.8	0.24	11,532	14		6	18	57	13	0	7
POOL-BACKWATER	1	12	2.0	0.35	24	0		0	15	85	0	0	0
POOL-ISOLATED	2	24	1.9	0.52	55	0		0	25	73	3	0	0
POOL-LATERAL SCOUR	24	1,275	8.5	1.19	11,234	104		5	8	66	17	2	3
POOL-STRAIGHT SCOUR	12	424	7.5	1.28	3,272	14		5	15	65	12	1	2
RAPID/BOULDERS	2	35	4.8	0.08	152	25		0	0	63	15	23	0
RIFFLE	22	915	7.8	0.14	6,868	61		1	3	70	21	2	3
STEP/COBBLE	17	104	6.1	0.11	649	4		0	5	79	14	2	0
Total:	93	3,924	7.6	0.58	33,786	222	**Avg:**	3	9	68	16	2	3

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	3	36	1.9	0.46	78	0.23%	0	0.0
Scour Pools	36	1,699	8.2	1.22	14,505	42.93%	118	0.8
Glides	13	1,136	9.8	0.24	11,532	34.13%	14	0.1
Riffles	22	915	7.8	0.14	6,868	20.33%	61	0.9
Rapids	2	35	4.8	0.08	152	0.45%	25	16.4
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	17	104	6.1	0.11	649	1.92%	4	0.6
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	39	9.9	10.0
Pools >=1m deep:	23	5.9	5.9
Complex pools (LWD pieces>=3):	9	2.3	2.3
Pool frequency (channel widths/pool):	5.7		
Residual pool depth (avg):	1.03		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/1/2010

REACH 13 **T04S-R39E-S13SE** **REACH 13**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
DRY CHANNEL	1	45	8.0	0.00	360	6		50	5	15	30	0	0
GLIDE	3	107	10.3	0.18	1,087	112		0	0	38	57	5	0
POOL-BACKWATER	2	22	3.0	0.36	65	12		50	0	8	40	3	0
POOL-DAMMED	4	263	9.7	1.12	2,364	193		0	1	50	46	3	0
POOL-LATERAL SCOUR	3	173	8.9	0.58	1,624	54		0	0	55	42	3	0
POOL-PLUNGE	4	27	12.4	0.70	329	9		0	0	31	59	11	0
POOL-STRAIGHT SCOUR	1	26	8.0	0.70	205	59		0	0	20	35	45	0
RIFFLE	21	2,096	8.4	0.21	19,452	1,999		0	0	41	49	10	0
STEP/BOULDERS	4	5	8.7	0.16	47	86		0	0	6	21	73	0
STEP/COBBLE	1	10	6.5	0.13	62	15		0	0	15	75	10	0
STEP/STRUCTURE	5	16	8.3	0.13	221	0		0	0	29	42	17	11
Total:	49	2,789	8.7	0.34	25,816	2,545	**Avg:**	3	0	35	46	15	1

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	6	285	7.4	0.87	2,429	9.41%	205	8.4
Scour Pools	8	226	10.5	0.65	2,158	8.36%	122	5.7
Glides	3	107	10.3	0.18	1,087	4.21%	112	10.3
Riffles	21	2,096	8.4	0.21	19,452	75.35%	1,999	10.3
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	10	31	8.3	0.14	329	1.28%	101	30.7
Dry	1	45	8.0	0.00	360	1.39%	6	1.7
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	14	5.0	5.2
Pools >=1m deep:	3	1.1	1.1
Complex pools (LWD pieces>=3):	2	0.7	0.7
Pool frequency (channel widths/pool):	13.9		
Residual pool depth (avg):	0.60		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/5/2010

REACH 14 **T04S-R40E-S19NE** **REACH 14**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
POOL-BACKWATER	2	15	1.6	0.45	23	5		5	0	30	55	3	8
POOL-DAMMED	1	45	15.0	1.10	669	30		0	5	45	50	0	0
POOL-ISOLATED	2	17	1.2	0.35	20	0		0	90	8	3	0	0
POOL-LATERAL SCOUR	2	58	8.5	0.95	483	23		0	2	27	66	5	0
POOL-PLUNGE	6	58	14.5	2.27	822	16		0	0	55	45	0	0
POOL-STRAIGHT SCOUR	2	65	7.3	0.81	468	61		0	0	22	39	33	7
RAPID/BOULDERS	1	19	15.0	0.40	288	9		0	0	20	75	5	0
RIFFLE	28	3,519	11.2	0.29	41,028	2,366		0	0	24	60	13	2
STEP/BOULDERS	1	0	12.4	0.33	5	14		0	0	5	5	90	0
STEP/COBBLE	3	30	9.9	0.24	317	12		0	0	22	68	10	0
STEP/STRUCTURE	7	2	15.0	0.26	30	0		0	2	45	29	0	24
Total:	55	3,828	11.2	0.57	44,153	2,536	**Avg:**	0	4	30	51	11	5

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	5	77	4.1	0.54	712	1.61%	35	4.9
Scour Pools	10	180	11.9	1.71	1,772	4.01%	100	5.6
Glides	0	0			0	0.00%	0	0.0
Riffles	28	3,519	11.2	0.29	41,028	92.92%	2,366	5.8
Rapids	1	19	15.0	0.40	288	0.65%	9	3.1
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	11	32	13.4	0.26	352	0.80%	26	7.4
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	15	3.9	4.0
Pools >=1m deep:	8	2.1	2.1
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	17.6		
Residual pool depth (avg):	1.29		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/21/2010 Survey Date: 8/12/2010

REACH 15 **T04S-R40E-S28SW** **REACH 15**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
MIX OF HABITATS	1	1,819	10.0	0.20	18,190	0		17	17	17	17	17	17
Total:	1	1,819	10.0	0.20	18,190	0	**Avg:**	17	17	17	17	17	17

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	0	0			0	0.00%	0	0.0
Scour Pools	0	0			0	0.00%	0	0.0
Glides	0	0			0	0.00%	0	0.0
Riffles	0	0			0	0.00%	0	0.0
Rapids	0	0			0	0.00%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	0	0			0	0.00%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	0	0.0	0.0
Pools >=1m deep:	0	0.0	0.0
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	0.0		
Residual pool depth (avg):			

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/21/2010 Survey Date: 8/16/2010

REACH 16 **T04S-R40E-S33NE** **REACH 16**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
CASCADE/BOULDERS	1	10	0.6	0.01	6	4		0	0	5	65	25	5
DRY CHANNEL	2	55	1.7	0.00	102	5		0	20	55	25	0	0
DRY UNIT	1	38	3.6	0.00	138	0		0	0	50	50	0	0
GLIDE	1	81	9.0	0.21	732	85		0	0	40	60	0	0
POOL-ALCOVE	1	4	0.7	0.30	3	0		95	0	0	5	0	0
POOL-BACKWATER	2	26	5.0	0.63	139	0		90	0	8	3	0	0
POOL-DAMMED	1	34	8.0	1.23	272	0		30	5	35	30	0	0
POOL-ISOLATED	4	56	1.2	0.40	61	4		65	8	11	16	0	0
POOL-LATERAL SCOUR	12	460	10.3	1.20	5,323	87		1	3	58	36	2	0
POOL-STRAIGHT SCOUR	2	85	7.0	0.88	647	1		0	45	43	13	0	0
PUDDLED UNIT	2	27	1.5	0.09	44	1		40	8	30	23	0	0
RAPID/BOULDERS	2	243	8.0	0.26	1,946	523		0	0	20	48	33	0
RIFFLE	31	3,274	11.9	0.33	41,281	1,313		0	0	38	54	7	0
STEP/BEAVER DAM	1	2	5.5	0.41	11	0		0	0	10	5	85	0
STEP/COBBLE	4	27	13.5	0.17	370	7		0	0	36	61	3	0
Total:	67	4,422	9.3	0.49	51,073	2,030	**Avg:**	10	3	38	43	6	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	8	120	2.9	0.55	474	0.93%	4	0.8
Scour Pools	14	545	9.8	1.15	5,970	11.69%	88	1.5
Glides	1	81	9.0	0.21	732	1.43%	85	11.6
Riffles	31	3,274	11.9	0.33	41,281	80.83%	1,313	3.2
Rapids	2	243	8.0	0.26	1,946	3.81%	523	26.9
Cascades	1	10	0.6	0.01	6	0.01%	4	66.7
Step/Falls	5	29	11.9	0.22	381	0.75%	7	1.8
Dry	5	120	2.0	0.03	284	0.56%	6	2.1
Culverts	0	0			0	0.00%	0	0.0

REACH 16 **T04S-R40E-S33NE** **REACH 16**

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	22	5.0	5.4
Pools >=1m deep:	10	2.3	2.5
Complex pools (LWD pieces>=3):	8	1.8	2.0
Pool frequency (channel widths/pool):	11.6		
Residual pool depth (avg):	0.82		

REACH 17 **T05S-R40E-S06SW** **REACH 17**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area: S/O	Snd	Grvl	Cbl	Bldr	Bdrk
CASCADE/BOULDERS	1	10	0.4	0.01	4	0	0	0	0	0	0	100
POOL-BACKWATER	3	54	2.3	0.44	119	1	33	58	8	0	0	0
POOL-ISOLATED	1	9	2.0	0.21	17	0	0	0	85	15	0	0
POOL-LATERAL SCOUR	8	255	6.8	1.04	1,848	1	6	8	45	41	0	0
POOL-STRAIGHT SCOUR	1	20	5.0	1.50	101	4	0	10	60	20	10	0
PUDDLED UNIT	2	231	2.0	0.11	462	0	10	10	5	70	5	0
RAPID/BOULDERS	6	331	8.9	0.22	3,189	577	0	2	9	40	49	0
RIFFLE	24	2,579	11.8	0.26	31,346	1,796	2	2	27	59	10	0
Total:	46	3,487	8.9	0.42	37,085	2,379	**Avg:** 5	7	27	47	12	2

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	4	62	2.3	0.39	136	0.37%	1	0.7
Scour Pools	9	275	6.6	1.09	1,949	5.25%	5	0.3
Glides	0	0			0	0.00%	0	0.0
Riffles	24	2,579	11.8	0.26	31,346	84.52%	1,796	5.7
Rapids	6	331	8.9	0.22	3,189	8.60%	577	18.1
Cascades	1	10	0.4	0.01	4	0.01%	0	0.0
Step/Falls	0	0			0	0.00%	0	0.0
Dry	2	231	2.0	0.11	462	1.24%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	13	3.7	4.3
Pools >=1m deep:	4	1.1	1.3
Complex pools (LWD pieces>=3):	1	0.3	0.3
Pool frequency (channel widths/pool):	13.3		
Residual pool depth (avg):	0.83		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/18/2010

REACH 18 **T05S-R41E-S07NW** **REACH 18**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	S/O	Snd	Grvl	Cbl	Bldr	Bdrk
							Substrate Percent Wetted Area					
DRY CHANNEL	1	65	1.0	0.00	65	0	0	50	30	20	0	0
POOL-ISOLATED	1	2	1.5	0.20	3	0	0	50	5	45	0	0
POOL-LATERAL SCOUR	6	153	7.0	0.59	1,419	55	33	17	24	23	3	0
POOL-STRAIGHT SCOUR	3	73	11.2	1.12	997	23	20	7	47	15	8	3
PUDDLED UNIT	1	10	0.7	0.05	7	0	95	0	5	0	0	0
RAPID/BOULDERS	1	6	1.5	0.05	8	0	5	0	70	25	0	0
RIFFLE	9	600	6.8	0.17	6,594	273	11	6	40	41	3	0
STEP/BEDROCK	1	0	0.8	0.09	0	0	0	0	0	0	0	100
Total:	23	909	6.2	0.38	9,093	351 **Avg:**	20	12	33	28	3	5

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	1	2	1.5	0.20	3	0.03%	0	0.0
Scour Pools	9	226	8.4	0.77	2,416	26.57%	78	3.2
Glides	0	0			0	0.00%	0	0.0
Riffles	9	600	6.8	0.17	6,594	72.52%	273	4.1
Rapids	1	6	1.5	0.05	8	0.09%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	1	0	0.8	0.09	0	0.00%	0	0.0
Dry	2	75	0.9	0.03	72	0.79%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	10	11.0	16.1
Pools >=1m deep:	3	3.3	4.8
Complex pools (LWD pieces>=3):	3	3.3	4.8
Pool frequency (channel widths/pool):	6.1		
Residual pool depth (avg):	0.53		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/19/2010

REACH 19 **T05S-R41E-S07NW** **REACH 19**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
DRY CHANNEL	1	10	1.7	0.00	17	0		0	50	5	45	0	0
DRY UNIT	2	53	1.2	0.00	64	1		50	42	0	5	3	0
GLIDE	1	33	12.0	0.30	396	15		0	0	35	65	0	0
POOL-BACKWATER	1	5	5.0	0.32	26	4		0	40	5	30	25	0
POOL-LATERAL SCOUR	2	89	9.5	1.10	861	22		0	3	78	13	8	0
POOL-STRAIGHT SCOUR	3	77	10.4	1.13	811	35		0	13	23	52	12	0
PUDDLED UNIT	2	24	1.2	0.23	29	1		98	0	0	0	3	0
RAPID/BOULDERS	1	16	10.0	0.25	164	5		0	0	10	60	30	0
RIFFLE	17	1,721	11.4	0.24	20,376	643		0	0	29	64	8	0
STEP/BEAVER DAM	1	1	15.5	0.15	16	2		0	0	5	5	90	0
STEP/COBBLE	1	11	15.5	0.06	169	12		0	0	15	65	20	0
Total:	32	2,040	9.7	0.35	22,927	740	**Avg:**	9	7	25	48	11	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	1	5	5.0	0.32	26	0.11%	4	15.4
Scour Pools	5	166	10.0	1.12	1,672	7.29%	57	3.4
Glides	1	33	12.0	0.30	396	1.73%	15	3.8
Riffles	17	1,721	11.4	0.24	20,376	88.87%	643	3.2
Rapids	1	16	10.0	0.25	164	0.72%	5	3.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	2	12	15.5	0.11	184	0.80%	14	7.6
Dry	5	87	1.3	0.09	109	0.48%	2	1.8
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	6	2.9	3.1
Pools >=1m deep:	4	2.0	2.1
Complex pools (LWD pieces>=3):	0	0.0	0.0
Pool frequency (channel widths/pool):	20.3		
Residual pool depth (avg):	0.78		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/24/2010

REACH 20 **T05S-R41E-S08SW** **REACH 20**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
DRY CHANNEL	1	20	5.8	0.00	115	0		95	0	5	0	0	0
DRY UNIT	1	30	1.0	0.00	30	0		0	0	50	50	0	0
POOL-BACKWATER	1	3	1.3	0.43	3	0		95	0	5	0	0	0
POOL-LATERAL SCOUR	9	204	7.0	0.80	1,516	5		1	7	62	21	0	10
POOL-STRAIGHT SCOUR	2	26	3.5	0.36	88	0		85	0	3	13	0	0
PUDDLED UNIT	3	54	0.6	0.11	43	0		30	0	48	22	0	0
RAPID/BOULDERS	1	31	16.4	0.09	508	0		0	0	25	75	0	0
RIFFLE	11	312	5.5	0.19	2,042	8		7	1	29	53	1	9
STEP/BEDROCK	1	0	2.0	0.10	0	0		0	0	0	0	0	100
STEP/COBBLE	3	28	6.2	0.19	176	7		0	0	40	53	7	0
Total:	33	707	5.4	0.35	4,522	20	**Avg:**	16	2	37	35	1	9

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	1	3	1.3	0.43	3	0.07%	0	0.0
Scour Pools	11	230	6.4	0.72	1,604	35.47%	5	0.3
Glides	0	0			0	0.00%	0	0.0
Riffles	11	312	5.5	0.19	2,042	45.15%	8	0.4
Rapids	1	31	16.4	0.09	508	11.24%	0	0.0
Cascades	0	0			0	0.00%	0	0.0
Step/Falls	4	28	5.1	0.17	176	3.90%	7	4.0
Dry	5	104	1.7	0.06	188	4.17%	0	0.0
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	12	17.0	35.4
Pools >=1m deep:	3	4.2	8.8
Complex pools (LWD pieces>=3):	1	1.4	2.9
Pool frequency (channel widths/pool):	2.8		
Residual pool depth (avg):	0.42		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/21/2010 Survey Date: 9/1/2010

REACH 21 **T05S-R41E-S08SW** **REACH 21**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
CASCADE/BOULDERS	4	46	5.7	0.15	297	22	0	0	13	49	33	6
DRY CHANNEL	2	97	3.6	0.00	349	0	0	38	38	25	0	0
DRY UNIT	12	546	4.1	0.00	1,700	2	0	25	48	27	0	0
POOL-BACKWATER	8	120	2.4	0.38	269	5	23	56	7	11	3	2
POOL-BEAVER DAM	1	3	2.0	0.47	5	0	95	0	5	0	0	0
POOL-DAMMED	1	12	9.0	1.10	108	15	0	5	30	55	10	0
POOL-ISOLATED	2	9	1.5	0.30	13	0	50	18	28	5	0	0
POOL-LATERAL SCOUR	38	1,115	7.5	0.82	9,286	86	7	14	47	30	2	1
POOL-STRAIGHT SCOUR	11	294	7.9	0.73	2,424	25	3	9	42	42	4	0
PUDDLED UNIT	19	1,087	1.4	0.18	1,200	14	17	29	28	25	0	0
RAPID/BOULDERS	14	722	6.9	0.26	5,333	195	3	1	20	60	15	1
RIFFLE	63	4,563	9.5	0.23	50,754	738	1	4	34	53	8	0
RIFFLE W/ POCKETS	2	69	11.0	0.34	755	120	0	0	19	58	23	0
STEP/BEAVER DAM	3	3	10.3	0.12	31	0	32	0	2	67	0	0
STEP/BOULDERS	1	0	11.0	0.50	4	8	0	0	0	10	90	0
STEP/COBBLE	16	113	9.9	0.15	1,120	4	0	1	33	64	2	0
Total:	197	8,796	7.2	0.36	73,647	1,234	**Avg:** 6	12	34	42	6	0

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / $100m^2$)
Dammed & BW Pools	12	144	2.8	0.44	395	0.54%	20	5.1
Scour Pools	49	1,408	7.6	0.80	11,710	15.90%	111	0.9
Glides	0	0			0	0.00%	0	0.0
Riffles	65	4,632	9.6	0.23	51,509	69.94%	858	1.7
Rapids	14	722	6.9	0.26	5,333	7.24%	195	3.7
Cascades	4	46	5.7	0.15	297	0.40%	22	7.4
Step/Falls	20	116	10.0	0.16	1,155	1.57%	12	1.0
Dry	33	1,729	2.5	0.10	3,248	4.41%	16	0.5
Culverts	0	0			0	0.00%	0	0.0

REACH 21 **T05S-R41E-S08SW** **REACH 21**

POOL SUMMARY

	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	61	6.9	10.7
Pools >=1m deep:	13	1.5	2.3
Complex pools (LWD pieces>=3):	20	2.3	3.5
Pool frequency (channel widths/pool):	8.7		
Residual pool depth (avg):	0.52		

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/1/2010

REACH 22 **T05S-R41E-S22SE** **REACH 22**

HABITAT DETAIL

Habitat Type	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Large Boulders (#>0.5m)		Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk
CASCADE/BOULDERS	2	37	13.5	0.24	506	10		0	0	5	90	5	0
POOL-BACKWATER	2	17	1.8	0.36	29	0		88	0	10	3	0	0
POOL-LATERAL SCOUR	3	51	8.0	1.01	478	13		0	10	28	50	12	0
POOL-STRAIGHT SCOUR	3	63	8.0	0.92	497	5		0	8	56	31	2	3
PUDDLED UNIT	1	35	2.3	0.16	81	3		19	0	75	6	0	0
RAPID/BOULDERS	14	1,006	7.9	0.25	8,401	597		0	1	18	48	31	2
RIFFLE	14	1,001	7.8	0.28	9,388	299		0	9	27	51	14	0
STEP/COBBLE	1	10	10.0	0.21	100	0		0	0	10	85	5	0
Total:	40	2,220	7.7	0.37	19,480	927	**Avg:**	5	5	25	47	17	1

HABITAT SUMMARY

Habitat Group	Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Wetted Area (m^2)	Wetted Area Percent	Large Boulders Number	Large Boulders (# / 100m^2)
Dammed & BW Pools	2	17	1.8	0.36	29	0.15%	0	0.0
Scour Pools	6	114	8.0	0.97	975	5.01%	18	1.8
Glides	0	0			0	0.00%	0	0.0
Riffles	14	1,001	7.8	0.28	9,388	48.19%	299	3.2
Rapids	14	1,006	7.9	0.25	8,401	43.12%	597	7.1
Cascades	2	37	13.5	0.24	506	2.60%	10	2.0
Step/Falls	1	10	10.0	0.21	100	0.51%	0	0.0
Dry	1	35	2.3	0.16	81	0.41%	3	3.7
Culverts	0	0			0	0.00%	0	0.0

POOL SUMMARY

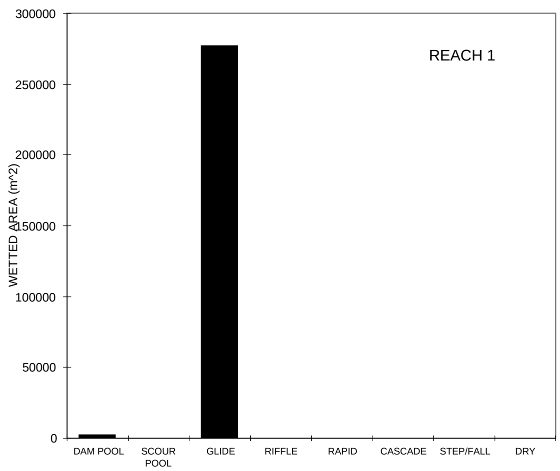
	Total	Total of all Channel Lengths # / Km	Primary Channel Length # / Km
All Pools:	8	3.6	4.7
Pools >=1m deep:	3	1.4	1.8
Complex pools (LWD pieces>=3):	3	1.4	1.8
Pool frequency (channel widths/pool):	23.7		
Residual pool depth (avg):	0.56		

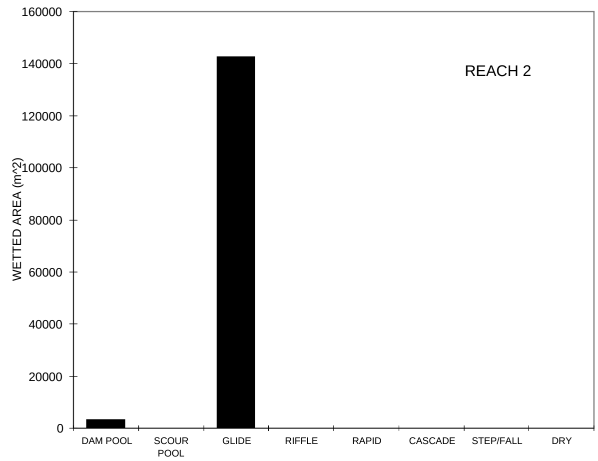
STREAM SUMMARY **CATHERINE CREEK**

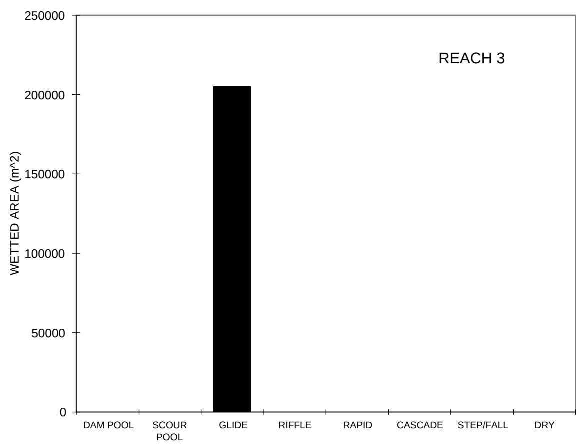
Number Units	Total Length (m)	Avg Width (m)	Avg Depth (m)	Total Area (m^2)	Substrate Percent Wetted Area S/O	Snd	Grvl	Cbl	Bldr	Bdrk	Large Boulders (#>0.5m)
1084	95,724	10.7	0.62	1,256,167	21	15	23	23	5	13	13,221

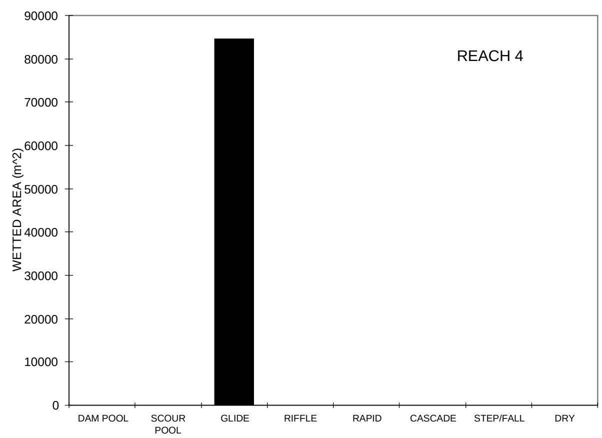
Habitat Group	Wetted Area (m^2)	Percent
Dammed & BW Pools	10,103	0.80%
Scour Pools	44,835	3.57%
Glides	882,173	70.23%
Riffles	235,820	18.77%
Rapids	19,989	1.59%
Cascades	813	0.06%
Step/Falls	3,609	0.29%
Dry	6,746	0.54%
Culverts	0	0.00%
Unsurveyed	52,080	4.15%

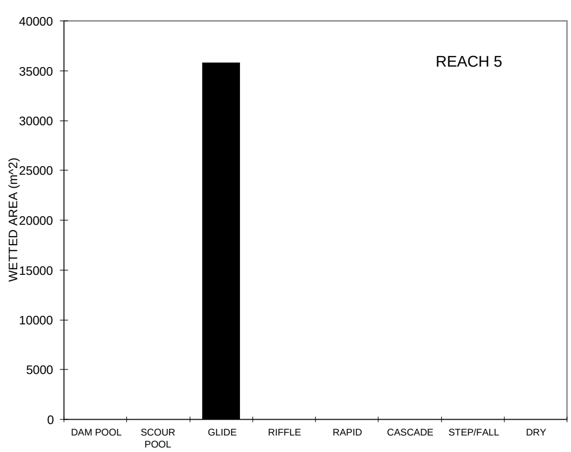
CATHERINE CREEK: HABITAT DISTRIBUTION

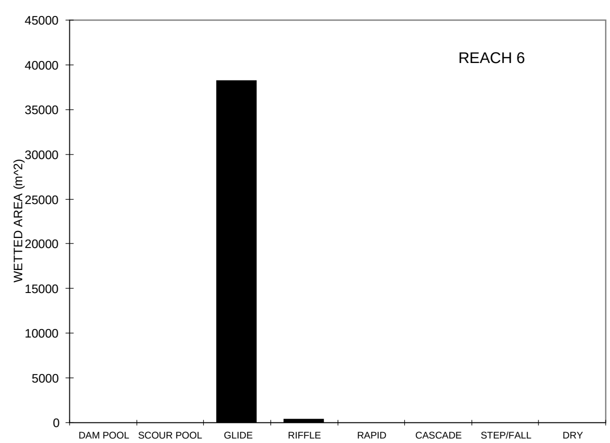












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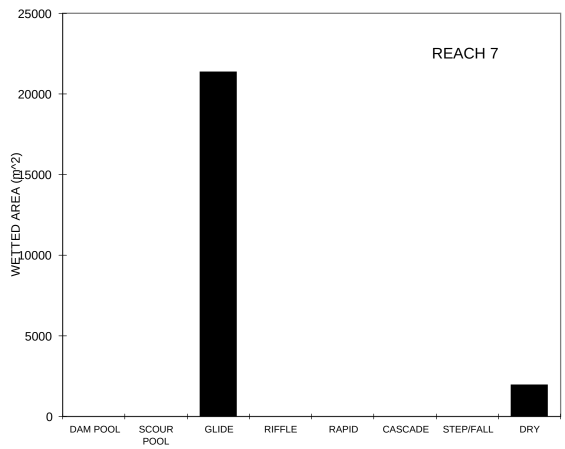

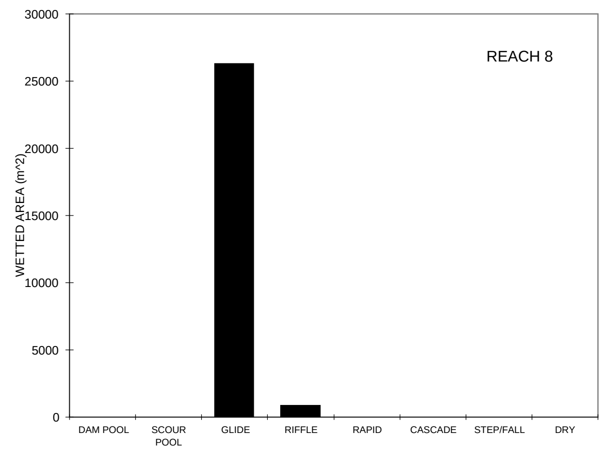

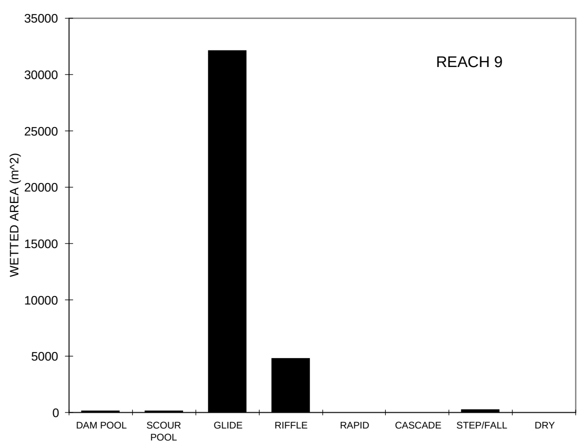

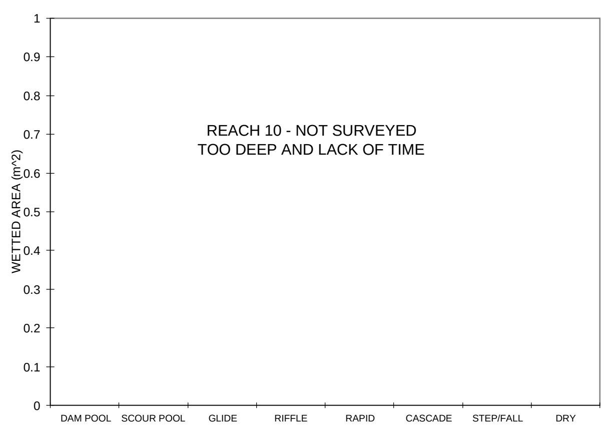

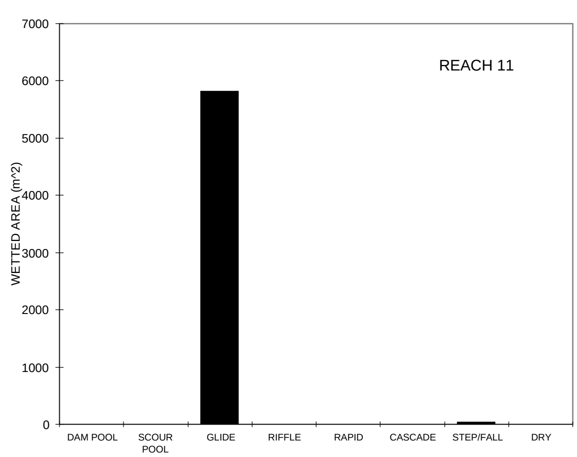

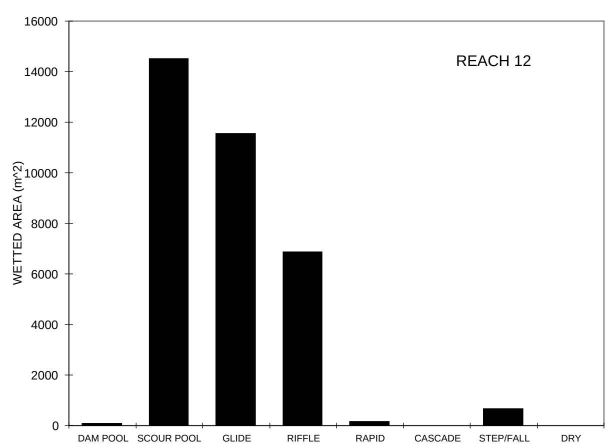

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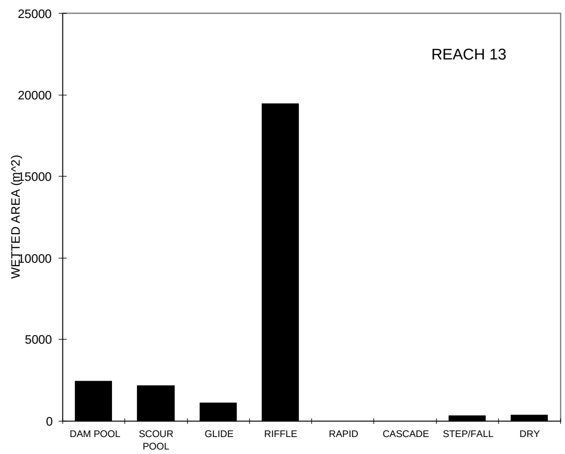

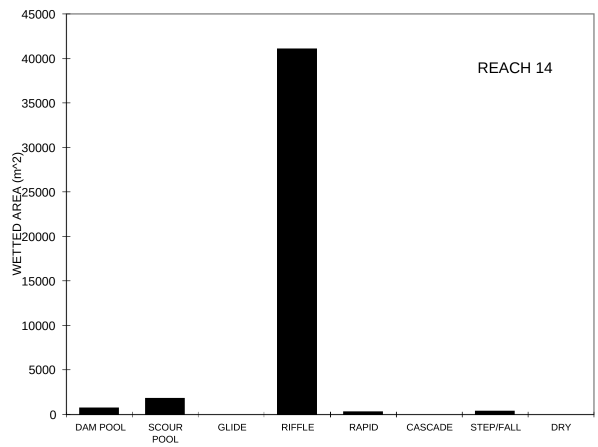

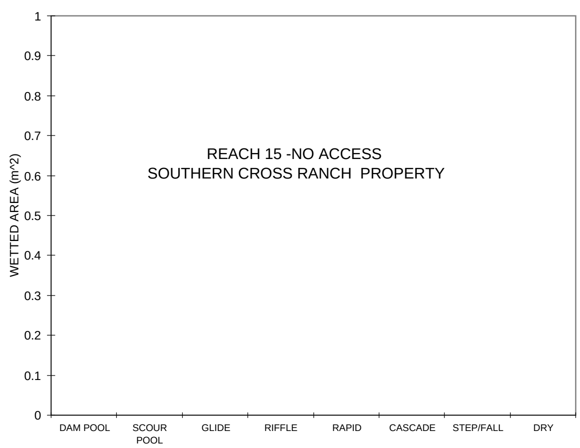

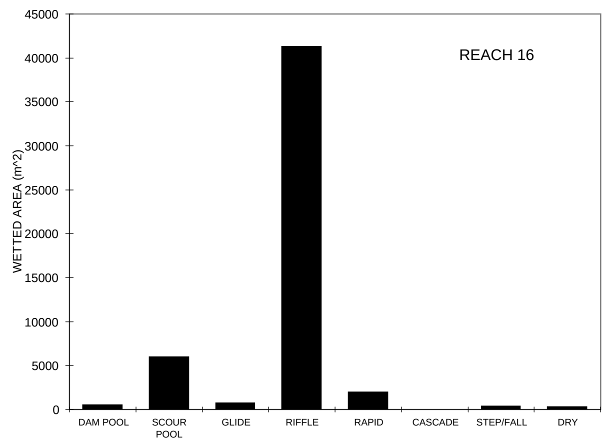

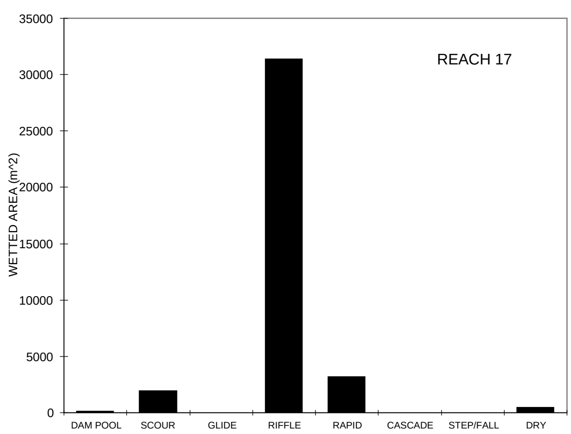

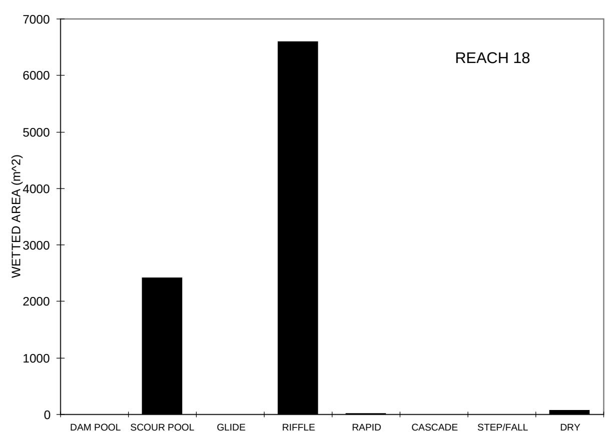

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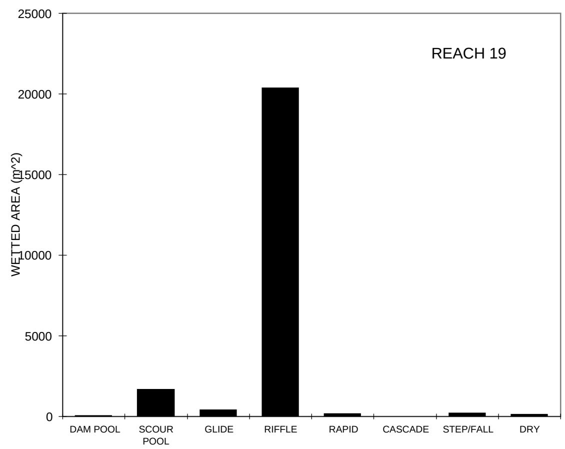

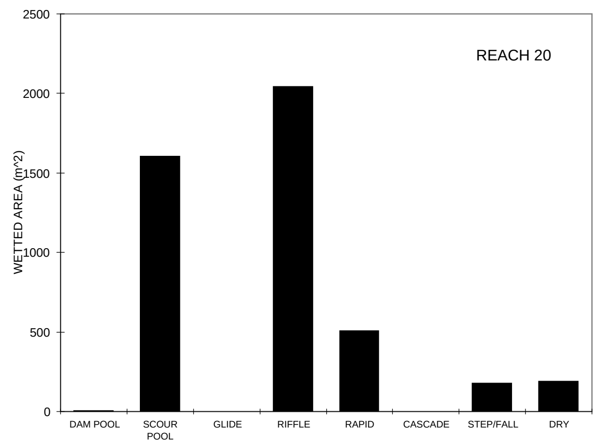

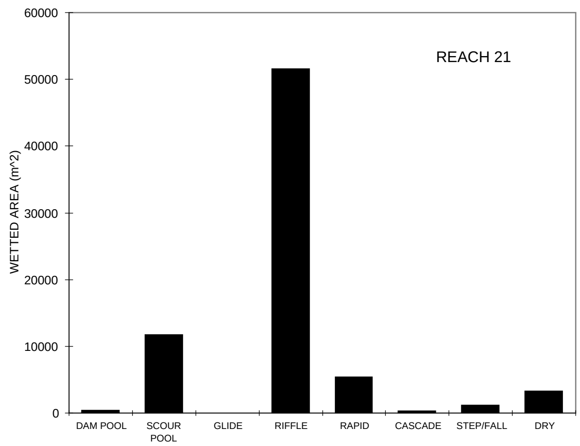

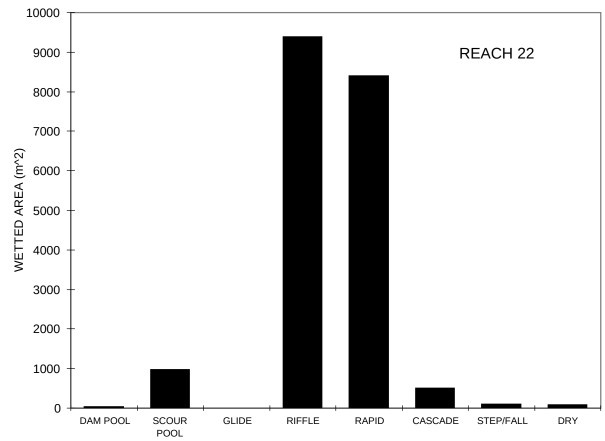

RIPARIAN ZONE VEGETATION

Reach 1 Reach 1

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
1	LF	1	HT	55	0	20	40	**Conifer**						40% BARE MUD
								Hardwood						
1	LF	2	HT	0	0	10	50	**Conifer**						40% BARE DIRT; AG FIELD-GRASS
								Hardwood						
1	LF	3	HT	0	0	0	100	**Conifer**						GRASS FIELD
								Hardwood						
1	RT	1	HT	70	0	20	40	**Conifer**						40% BARE MUD; HAWTHORN
								Hardwood	3					
1	RT	2	HT	0	0	70	30	**Conifer**						THISTLE
								Hardwood						
1	RT	3	HT	0	0	0	100	**Conifer**						WILD GRASSES
								Hardwood						
7	LF	1	FP	7	0	30	5	**Conifer**						65% BARE MUD
								Hardwood						
7	LF	2	FP	1	0	0	30	**Conifer**						70% MUD
								Hardwood						
7	LF	3	FP	-2	0	5	0	**Conifer**						95% MUD FROM HIGH WATER
								Hardwood	3					
7	RT	1	HT	35	10	5	75	**Conifer**						5% BARE MUD
								Hardwood	2	1				
7	RT	2	HT	12	0	0	100	**Conifer**						GRASS
								Hardwood						
7	RT	3	HT	-18	0	0	100	**Conifer**						GRASS
								Hardwood						
15	LF	1	HT	25	0	10	30	**Conifer**						60% BARE MUD; SM WILLOWS
								Hardwood	6					
15	LF	2	HT	-2	0	0	100	**Conifer**						GRASS
								Hardwood						
15	LF	3	HT	-4	0	0	100	**Conifer**						GRASS
								Hardwood						
15	RT	1	HT	14	0	20	5	**Conifer**						75% BARE MUD; HAWTHORN
								Hardwood						
15	RT	2	HT	0	95	30	0	**Conifer**						HAWTHORN, BARE MUD
								Hardwood	15					
15	RT	3	HT	0	95	40	0	**Conifer**						THICK BRUSH; EST
								Hardwood	5					
22	LF	1	FP	0	30	40	0	**Conifer**						60% BARE MUD; WILLOWS
								Hardwood						

22	LF	2	HT	0	80	95	5	**Conifer**			EST-TOO BRUSHY; WILLOWS
								Hardwood	1		
22	LF	3	HT	0	90	95	0	**Conifer**			BRUSHY; WILLOWS
								Hardwood			
22	RT	1	HT	15	0	15	65	**Conifer**			20% BARE MUD; WILLOWS
								Hardwood			
22	RT	2	HT	21	0	0	30	**Conifer**			70% BARE DIRT
								Hardwood			
22	RT	3	HT	-10	0	0	30	**Conifer**			70% BARE DIRT
								Hardwood			
29	LF	1	HT	15	70	80	0	**Conifer**			20% BARE MUD
								Hardwood	1		
29	LF	2	HT	0	10	20	80	**Conifer**			WILD ROSE, HAWTHORN-BRUSHY
								Hardwood			
29	LF	3	HT	0	0	0	100	**Conifer**			EST-BRUSHY
								Hardwood			
29	RT	1	FP	8	0	0	50	**Conifer**			50% BARE MUD
								Hardwood			
29	RT	2	HT	1	0	0	100	**Conifer**			GRASS
								Hardwood			
29	RT	3	HT	4	0	0	100	**Conifer**			GRASS
								Hardwood			
36	LF	1	HT	15	95	0	5	**Conifer**			95% BARE MUD
								Hardwood	19	3	
36	LF	2	HT	0	90	15	5	**Conifer**			HAWTHORN
								Hardwood	8	2	
36	LF	3	HT	0	60	40	10	**Conifer**			HAWTHORN
								Hardwood	8	1	
36	RT	1	FP	8	0	10	60	**Conifer**			30% MUD; WILLOW
								Hardwood			
36	RT	2	HT	2	0	0	95	**Conifer**			5% BARE GROUND
								Hardwood			
36	RT	3	HT	2	0	0	100	**Conifer**			NATURAL GRASS
								Hardwood			
43	LF	1	HT	40	65	60	0	**Conifer**			
								Hardwood	7		
43	LF	2	HT	5	85	80	0	**Conifer**			EST-BRUSHY
								Hardwood	3		
43	LF	3	HT	0	75	80	0	**Conifer**			BRUSHY
								Hardwood			
43	RT	1	HT	50	75	30	0	**Conifer**			EST-BRUSHY AND STEEP
								Hardwood	9		
43	RT	2	HT	5	0	0	100	**Conifer**			GRASS
								Hardwood			
43	RT	3	HT	0	0	0	100	**Conifer**			GRASS
								Hardwood			

50	LF	1	HT	10	15	40	5	**Conifer**		55% BARE DIRT
								Hardwood		
50	LF	2	HT	5	40	50	60	**Conifer**		SMALL WILLOWS; GRASS
								Hardwood		
50	LF	3	HT	27	20	10	90	**Conifer**		GRASS
								Hardwood	1	
50	RT	1	HT	45	95	90	0	**Conifer**		10% BARE MUD
								Hardwood	7	
50	RT	2	HT	5	10	10	90	**Conifer**		
								Hardwood		
50	RT	3	HT	0	0	0	100	**Conifer**		
								Hardwood		
57	LF	1	LT	0	30	60	10	**Conifer**		40% BARE
								Hardwood		
57	LF	2	HT	15	0	10	90	**Conifer**		TRANSITION BTWN FP AND TERR
								Hardwood		
57	LF	3	HT	0	0	10	90	**Conifer**		GRASS
								Hardwood		
57	RT	1	LT	14	45	0	15	**Conifer**		WILLOWS; 85% BARE DIRT
								Hardwood	30	
57	RT	2	LT	12	85	40	60	**Conifer**		HAWTHORNS
								Hardwood	25	
57	RT	3	HT	5	5	0	30	**Conifer**		70% WHEAT FIELD
								Hardwood		
64	LF	1	FP	12	95	0	50	**Conifer**		WILLOW THICKET; 50% BARE
								Hardwood	50	
64	LF	2	LT	4	0	0	100	**Conifer**		GRASS
								Hardwood		
64	LF	3	HT	0	0	0	100	**Conifer**		TRANSITION
								Hardwood		
64	RT	1	HT	0	65	75	0	**Conifer**	3	25% BARE MUD
								Hardwood		
64	RT	2	HT	0	0	0	100	**Conifer**		WILD GRASSES
								Hardwood		
64	RT	3	HT	0	0	0	0	**Conifer**		100% WHEAT FIELD
								Hardwood		
72	LF	1	HT	15	70	60	0	**Conifer**		40% MUD; TRANSITION; BRUSHY-EST
								Hardwood	10	
72	LF	2	HT	0	10	10	90	**Conifer**		EST-BRUSHY
								Hardwood		
72	LF	3	HT	0	0	0	100	**Conifer**		GRASS-NATURAL
								Hardwood		
72	RT	1	HT	2	30	50	5	**Conifer**		45% BARE MUD, WILLOWS
								Hardwood	10	
72	RT	2	HT	7	0	0	100	**Conifer**		
								Hardwood		

72	RT	3	HT	-25	0	0	100	**Conifer**			TERR TRANSITION
								Hardwood			
79	LF	1	HT	29	5	15	70	**Conifer**			15% MUD; TRANSITION
								Hardwood			
79	LF	2	HT	0	70	0	90	**Conifer**			10% BARE
								Hardwood	2	4	
79	LF	3	HT	0	0	0	100	**Conifer**			GRASS
								Hardwood			
79	RT	1	HT	40	0	20	30	**Conifer**			50% BARE MUD; TRANSITION
								Hardwood			
79	RT	2	HT	0	0	0	0	**Conifer**			PLOWED FIELD
								Hardwood			
79	RT	3	HT	0	0	0	0	**Conifer**			PLOWED FIELD
								Hardwood			

RIPARIAN ZONE VEGETATION

Reach 2 Reach 2

Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
					Cover (percent)				Diameter class (cm)					
86	LF	1	HT	28	95	75	0	**Conifer**						5%BARE DIRT; TRANSITION
								Hardwood						
86	LF	2	HT	2	50	60	35	**Conifer**						5% BARE DIRT
								Hardwood	5	3				
86	LF	3	HT	0	0	0	100	**Conifer**						GRASS
								Hardwood	10	6				
86	RT	1	HT	32	55	30	40	**Conifer**						30% BARE DIRT; TRANSITION
								Hardwood	5	9				
86	RT	2	HT	0	0	0	100	**Conifer**						GRASS FIELD
								Hardwood						
86	RT	3	HT	0	0	0	100	**Conifer**						GRASS AG FIELD
								Hardwood						
96	LF	1	LT	10	5	10	10	**Conifer**						75% BARE DIRT
								Hardwood						
96	LF	2	HT	0	100	95	0	**Conifer**						EST
								Hardwood						
96	LF	3	HT	0	100	95	0	**Conifer**						
								Hardwood						
96	RT	1	HT	70	50	40	5	**Conifer**						5% BARE DIRT; TRANSITION
								Hardwood						
96	RT	2	HT	0	0	0	100	**Conifer**						GRASS AG FIELD
								Hardwood						
96	RT	3	HT	0	0	0	100	**Conifer**						GRASS AG FIELD
								Hardwood						
103	LF	1	HT	30	90	60	0	**Conifer**						40% BARE DIRT-TRANSITION
								Hardwood	6					
103	LF	2	HT	0	60	50	20	**Conifer**						30% BARE DIRT
								Hardwood	13	2				
103	LF	3	HT	0	0	0	100	**Conifer**						ALFALFA FIELD
								Hardwood						
103	RT	1	HT	45	0	25	70	**Conifer**						5% BARE DIRT; GRASS, WHEAT
								Hardwood						
103	RT	2	HT	6	0	0	95	**Conifer**						5% BARE DIRT
								Hardwood						
103	RT	3	HT	0	0	0	100	**Conifer**						GRASS-WHEAT
								Hardwood						
110	LF	1	HT	33	0	5	90	**Conifer**						5% BARE DIRT; TRANSITION
								Hardwood						

110	LF	2	RB	0	0	0	95	**Conifer**				FARM ACCESS RD; 5% BARE
								Hardwood				
110	LF	3	HT	0	0	0	100	**Conifer**				GRASS-AG FIELD
								Hardwood				
110	RT	1	HT	27	80	80	0	**Conifer**	3	6		20% BARE DIRT, TRANSITION
								Hardwood				
110	RT	2	HT	6	95	60	0	**Conifer**				
								Hardwood	20	10	2	
110	RT	3	HT	0	5	5	85	**Conifer**				5% BARE DIRT, GRASS-WHEAT
								Hardwood				
120	LF	1	HT	50	55	75	20	**Conifer**				5% BARE DIRT; TRANSITION
								Hardwood	2			
120	LF	2	HT	23	5	0	85	**Conifer**				10% BARE DIRT; GRASS-AG
								Hardwood				
120	LF	3	HT	0	0	0	95	**Conifer**				5% BARE DIRT
								Hardwood				
120	RT	1	HT	30	50	90	10	**Conifer**				TRANSITION
								Hardwood				
120	RT	2	HT	0	0	10	90	**Conifer**				GRASS-AG FIELD; EST
								Hardwood				
120	RT	3	HT	0	0	0	100	**Conifer**				GRASS-AG FIELD
								Hardwood				
127	LF	1	HT	40	100	75	0	**Conifer**				25% BARE DIRT; TRANSITION
								Hardwood	10			
127	LF	2	HT	0	0	10	90	**Conifer**				GRASS-AG
								Hardwood				
127	LF	3	HT	0	0	0	100	**Conifer**				GRASS-AG
								Hardwood				
127	RT	1	HT	53	0	95	0	**Conifer**				5% BARE DIRT; TRANSITION
								Hardwood				
127	RT	2	HT	0	0	0	100	**Conifer**				GRASS-AG
								Hardwood				
127	RT	3	HT	0	0	0	100	**Conifer**				GRASS-AG FIELD
								Hardwood				
134	LF	1	HT	88	0	5	70	**Conifer**				30% BARE DIRT; TRANSITION
								Hardwood				
134	LF	2	HT	0	0	0	95	**Conifer**				5% BARE DIRT
								Hardwood				
134	LF	3	HT	0	0	0	95	**Conifer**				5% BARE DIRT
								Hardwood				
134	RT	1	FP	3	5	95	0	**Conifer**				5% BARE DIRT
								Hardwood				
134	RT	2	HT	28	0	40	55	**Conifer**				5% BARE DIRT; TRANSITION
								Hardwood				
134	RT	3	HT	-5	0	0	100	**Conifer**				GRASS-WHEAT FIELD
								Hardwood				

141	LF	1	FP	10	50	30	60	**Conifer**		10% BARE DIRT; GRASS
								Hardwood		
141	LF	2	HT	2	5	5	90	**Conifer**		HAWTHORN; 5% BARE DIRT
								Hardwood		
141	LF	3	HT	0	50	50	50	**Conifer**		
								Hardwood		
141	RT	1	HT	78	5	10	80	**Conifer**		10% BARE DIRT; TRANSITION GRASS-AG
								Hardwood		
141	RT	2	HT	0	0	0	100	**Conifer**		
								Hardwood		
141	RT	3	HT	0	0	0	100	**Conifer**		GRASS-AG FIELD
								Hardwood		
148	LF	1	HT	40	90	90	0	**Conifer**		BRUSHY, STEEP TRANSITION; 5% BARE
								Hardwood	2	
148	LF	2	HT	0	100	95	0	**Conifer**		
								Hardwood		
148	LF	3	HT	0	0	10	90	**Conifer**		GRASS-LAWN, YARD
								Hardwood		
148	RT	1	FP	0	85	85	5	**Conifer**		10% BARE DIRT; GRASS-NATURAL EST-DENSE SHRUBRY
								Hardwood		
148	RT	2	FP	0	100	100	0	**Conifer**		
								Hardwood		
148	RT	3	FP	0	100	100	0	**Conifer**		
								Hardwood		

RIPARIAN ZONE VEGETATION

Reach 3 Reach 3

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
152	LF	1	HT	0	0	0	100	**Conifer**						
								Hardwood						
152	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
152	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
152	RT	1	HT	0	0	0	100	**Conifer**						
								Hardwood						
152	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
152	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
159	LF	1	HT	0	5	0	100	**Conifer**						
								Hardwood						
159	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
159	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
159	RT	1	FP	3	0	0	100	**Conifer**						FP MAY BE HT
								Hardwood						
159	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
159	RT	3	HT	0	0	0	20	**Conifer**						AG FIELD; 80% BARE DIRT
								Hardwood						
166	LF	1	FP	5	0	0	100	**Conifer**						
								Hardwood						
166	LF	2	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
166	LF	3	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
166	RT	1	HT	0	0	0	100	**Conifer**						
								Hardwood						
166	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
166	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
170	LF	1	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						

170	LF	2	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
170	LF	3	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
170	RT	1	HT	0	0	10	90	**Conifer**			
								Hardwood			
170	RT	2	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
170	RT	3	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
178	LF	1	HT	0	0	0	100	**Conifer**			
								Hardwood			
178	LF	2	HT	0	0	0	20	**Conifer**			60% PAVEMENT; 20% BARE-RB
								Hardwood			
178	LF	3	HT	0	0	0	30	**Conifer**			70% BARE
								Hardwood			
178	RT	1	FP	46	10	0	100	**Conifer**		1	
								Hardwood			
178	RT	2	HT	0	0	0	20	**Conifer**			80% DIRT
								Hardwood			
178	RT	3	HT	0	0	0	0	**Conifer**			00% DIRT
								Hardwood			
184	LF	1	FP	27	0	0	100	**Conifer**			
								Hardwood			
184	LF	2	HT	-2	0	0	100	**Conifer**			AG FIELD
								Hardwood			
184	LF	3	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
184	RT	1	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
184	RT	2	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
184	RT	3	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
192	LF	1	HT	0	40	80	20	**Conifer**			
								Hardwood	2		
192	LF	2	HT	0	0	0	100	**Conifer**			
								Hardwood			
192	LF	3	HT	0	0	0	100	**Conifer**			
								Hardwood			
192	RT	1	FP	20	0	0	100	**Conifer**			
								Hardwood			
192	RT	2	HT	-3	0	0	60	**Conifer**			40% BARE
								Hardwood			
192	RT	3	HT	0	0	0	0	**Conifer**			100% BARE DIRT
								Hardwood			

199	LF	1	FP	14	0	0	100	**Conifer**			
								Hardwood			
199	LF	2	HT	-2	0	0	100	**Conifer**			AG FIELD
								Hardwood			
199	LF	3	HT	0	0	0	100	**Conifer**			AG FIELD
								Hardwood			
199	RT	1	HT	0	5	0	100	**Conifer**			
								Hardwood	6		
199	RT	2	HT	0	0	0	100	**Conifer**			
								Hardwood			
199	RT	3	HT	0	0	0	100	**Conifer**			
								Hardwood			
206	LF	1	HT	0	5	0	100	**Conifer**			TRANSITION
								Hardwood			
206	LF	2	HT	0	0	0	100	**Conifer**			
								Hardwood			
206	LF	3	HT	0	0	0	100	**Conifer**			
								Hardwood			
206	RT	1	HT	10	0	0	100	**Conifer**			2 DEER IN RIP
								Hardwood			
206	RT	2	HT	10	5	0	100	**Conifer**			
								Hardwood	2		
206	RT	3	HT	0	0	0	100	**Conifer**			GRASS WHEAT
								Hardwood			
213	LF	1	HT	0	30	45	55	**Conifer**			BV
								Hardwood			
213	LF	2	HT	0	40	60	40	**Conifer**			
								Hardwood			
213	LF	3	HT	0	70	0	100	**Conifer**			
								Hardwood	5		
213	RT	1	HT	0	0	5	95	**Conifer**			TRANSITION
								Hardwood			
213	RT	2	HT	0	0	0	100	**Conifer**			
								Hardwood			
213	RT	3	HT	0	0	0	100	**Conifer**			
								Hardwood			
220	LF	1	HT	30	0	0	100	**Conifer**			
								Hardwood			
220	LF	2	HT	0	0	0	100	**Conifer**			
								Hardwood			
220	LF	3	HT	0	0	0	100	**Conifer**			
								Hardwood			
220	RT	1	HT	5	0	0	100	**Conifer**			ANIMAL TRAIL
								Hardwood			
220	RT	2	HT	0	75	0	40	**Conifer**			60% BARE DIRT
								Hardwood	9	3	

220	RT	3	HT	5	60	0	70	**Conifer**			30% BARE DIRT
								Hardwood	6	3	

RIPARIAN ZONE VEGETATION

Reach 4 Reach 4

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
231	LF	1	HT	0	20	100	0	**Conifer**						EST-STEEP BANK; HAWTHORN
								Hardwood	10	5				
231	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
231	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
231	RT	1	HT	5	35	50	50	**Conifer**						ANIMAL TRAIL
								Hardwood	13	3				
231	RT	2	HT	3	75	40	60	**Conifer**						
								Hardwood	16	4				
231	RT	3	HT	-2	80	30	70	**Conifer**						
								Hardwood	16	3				
238	LF	1	HT	0	0	0	100	**Conifer**						60% CORN; TRANSITION
								Hardwood						
238	LF	2	HT	0	0	0	100	**Conifer**						100% CORN
								Hardwood						
238	LF	3	HT	0	0	0	100	**Conifer**						100% CORN
								Hardwood						
238	RT	1	HT	5	80	50	50	**Conifer**						
								Hardwood						
238	RT	2	HT	10	0	100	0	**Conifer**						
								Hardwood	10					
238	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
252	LF	1	HT	0	0	10	90	**Conifer**						
								Hardwood						
252	LF	2	HT	30	30	90	10	**Conifer**						
								Hardwood						
252	LF	3	HT	0	0	0	100	**Conifer**						20 HARVESTED WHEAT TRANSITION
								Hardwood						
252	RT	1	HT	60	0	0	100	**Conifer**						
								Hardwood						
252	RT	2	HT	0	0	0	95	**Conifer**						5% BARE; GRASS=HARVEST WHEAT
								Hardwood						
252	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
259	LF	1	HT	0	0	85	15	**Conifer**						
								Hardwood						

259	LF	2	HT	0	0	100	0	**Conifer**	
								Hardwood	
259	LF	3	HT	0	0	100	0	**Conifer**	
								Hardwood	
259	RT	1	FP	24	0	90	10	**Conifer**	
								Hardwood	
259	RT	2	HT	0	0	0	100	**Conifer**	AG FIELD
								Hardwood	
259	RT	3	HT	0	0	0	100	**Conifer**	AG FIELD
								Hardwood	

RIPARIAN ZONE VEGETATION

Reach 5 Reach 5

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
270	LF	1	HT	0	10	20	80	**Conifer**						
								Hardwood	5					
270	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
270	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
270	RT	1	HT	22	40	0	100	**Conifer**						
								Hardwood						
270	RT	2	HT	1	85	0	100	**Conifer**						
								Hardwood	22					
270	RT	3	HT	1	35	0	70	**Conifer**						30% BARE
								Hardwood	9					
277	LF	1	FP	0.5	0	90	10	**Conifer**						
								Hardwood						
277	LF	2	HT	5	0	50	50	**Conifer**						
								Hardwood						
277	LF	3	SC	0	0	30	70	**Conifer**						ZONE 3=OXBOW
								Hardwood						
277	RT	1	HT	0	0	0	100	**Conifer**						
								Hardwood						
277	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
277	RT	3	HT	0	5	0	100	**Conifer**						
								Hardwood	3					

RIPARIAN ZONE VEGETATION

Reach 6 Reach 6

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
285	LF	1	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
285	LF	2	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
285	LF	3	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
285	RT	1	HT	57	0	0	100	**Conifer**						BV
								Hardwood						
285	RT	2	HT	0	0	10	90	**Conifer**						
								Hardwood	4					
285	RT	3	HT	0	65	10	90	**Conifer**						
								Hardwood	21					
292	LF	1	HT	55	0	10	90	**Conifer**						
								Hardwood						
292	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
292	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
292	RT	1	HT	38	5	5	95	**Conifer**						
								Hardwood						
292	RT	2	HT	2	0	0	100	**Conifer**						
								Hardwood						
292	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
301	LF	1	FP	19	15	50	50	**Conifer**						
								Hardwood	25					
301	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
301	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
301	RT	1	HT	0	0	0	95	**Conifer**						5% BARE; AG FIELD
								Hardwood						
301	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
301	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
308	LF	1	HT	33	0	5	95	**Conifer**						AG FIELD
								Hardwood						

308	LF	2	HT	0	0	5	95	**Conifer**	
								Hardwood	
308	LF	3	HT	0	0	0	100	**Conifer**	
								Hardwood	
308	RT	1	HT	0	5	10	0	**Conifer**	5% BARE; TRANSITION
								Hardwood	
308	RT	2	HT	0	0	0	100	**Conifer**	AG FIELD
								Hardwood	
308	RT	3	HT	0	0	0	100	**Conifer**	AG FIELD
								Hardwood	

OREGON DEPARTMENT OF FISH AND WILDLIFE CATHERINE CREEK

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/3/2010

RIPARIAN ZONE VEGETATION

Reach 7 Reach 7

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
316	LF	1	HT	4	0	10	90	**Conifer**						
								Hardwood						
316	LF	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
316	LF	3	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
316	RT	1	HT	0	5	0	95	**Conifer**	10					
								Hardwood						
316	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
316	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
326	LF	1	FP	2	10	40	60	**Conifer**						
								Hardwood						
326	LF	2	FP	0	0	10	90	**Conifer**						
								Hardwood						
326	LF	3	FP	0	0	0	100	**Conifer**						
								Hardwood						
326	RT	1	HT	0	0	0	100	**Conifer**						
								Hardwood						
326	RT	2	HT	0	0	0	100	**Conifer**						
								Hardwood						
326	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
345	LF	1	FP	2	0	85	10	**Conifer**						COW TRAMPLED; 5% BARE
								Hardwood						
345	LF	2	FP	0	0	0	95	**Conifer**						5% BARE
								Hardwood						
345	LF	3	HT	17	0	0	95	**Conifer**						TRANSITION, 5% BARE
								Hardwood						
345	RT	1	FP	0	0	0	100	**Conifer**						
								Hardwood						
345	RT	2	FP	0	0	0	100	**Conifer**						
								Hardwood						
345	RT	3	FP	0	0	0	100	**Conifer**						
								Hardwood						
355	LF	1	FP	5	0	10	70	**Conifer**						COW TRAMPLED; 20% BARE
								Hardwood						

355	LF	2	FP	0	0	5	70	**Conifer**	25% BARE
								Hardwood	
355	LF	3	FP	0	0	0	100	**Conifer**	
								Hardwood	
355	RT	1	FP	0	0	0	100	**Conifer**	COW PATH AND PRINTS
								Hardwood	
355	RT	2	HT	0	0	2	98	**Conifer**	
								Hardwood	
355	RT	3	HT	0	0	0	100	**Conifer**	
								Hardwood	

RIPARIAN ZONE VEGETATION

Reach 8 Reach 8

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
365	LF	1	HT	0	0	0	100	**Conifer**						GRASS-AG
								Hardwood						
365	LF	2	HT	0	0	0	100	**Conifer**						GRASS-AG
								Hardwood						
365	LF	3	HT	0	0	0	100	**Conifer**						GRASS-AG
								Hardwood						
365	RT	1	FP	9	85	0	80	**Conifer**						GRASS, 20% BARE DIRT
								Hardwood	2	4	1			
365	RT	2	FP	-8	65	0	65	**Conifer**						GRASS, 35% BARE DIRT
								Hardwood						
365	RT	3	FP	5	80	0	65	**Conifer**						35% BARE DIRT, GRASS
								Hardwood			1	2	1	
373	LF	1	FP	0	85	0	5	**Conifer**						95% BARE DIRT
								Hardwood	6	2	2	2	2	
373	LF	2	FP	0	100	0	15	**Conifer**						85% BARE DIRT
								Hardwood						
373	LF	3	FP	0	0	0	100	**Conifer**						NATURAL GRASSES
								Hardwood						
373	RT	1	FP	-6	10	0	100	**Conifer**						
								Hardwood				1		
373	RT	2	HT	12	0	0	100	**Conifer**						TRANSITION, GRASSES
								Hardwood						
373	RT	3	HT	-23	0	0	100	**Conifer**						NATURAL GRASSES
								Hardwood						
382	LF	1	FP	0	45	0	100	**Conifer**						NATURAL GRASSES
								Hardwood						
382	LF	2	FP	0	90	0	100	**Conifer**						NATURAL GRASSES
								Hardwood						
382	LF	3	HT	-20	0	0	100	**Conifer**						NATURAL GRASSES
								Hardwood						
382	RT	1	FP	-2	80	0	95	**Conifer**						5% BARE DIRT; GRASSES
								Hardwood	3					
382	RT	2	FP	-5	40	0	100	**Conifer**						MARSHY AREA, GRASSES
								Hardwood						
382	RT	3	FP	0	60	0	100	**Conifer**						MARSHY AREA, GRASSES
								Hardwood	5					

RIPARIAN ZONE VEGETATION

Reach 9 Reach 9

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
392	LF	1	FP	0	0	0	100	**Conifer**						NATURAL GRASS
								Hardwood						
392	LF	2	HT	4	0	0	100	**Conifer**						GRASS
								Hardwood						
392	LF	3	HT	-20	0	0	100	**Conifer**						GRASS
								Hardwood						
392	RT	1	FP	0	0	0	100	**Conifer**						
								Hardwood						
392	RT	2	FP	0	0	0	100	**Conifer**						
								Hardwood						
392	RT	3	FP	0	80	70	30	**Conifer**						
								Hardwood	10					
400	LF	1	FP	-1	0	0	90	**Conifer**						10% BARE DIRT, WILLOWS
								Hardwood						
400	LF	2	HT	12	0	0	50	**Conifer**						50% PLACED CBL; GRASS
								Hardwood						
400	LF	3	HT	-40	95	0	90	**Conifer**						10% BARE DIRT, GRASS
								Hardwood	1		2	1	1	
400	RT	1	FP	5	0	5	95	**Conifer**						GRASS-NATURAL
								Hardwood						
400	RT	2	HT	2	0	0	100	**Conifer**						NATURAL GRASS
								Hardwood						
400	RT	3	HT	-20	0	0	100	**Conifer**						NATURAL GRASS
								Hardwood						
409	LF	1	HT	8	90	0	70	**Conifer**						30% BARE DIRT, TRANSITION
								Hardwood						
409	LF	2	HT	-15	30	0	100	**Conifer**						GRASS-AG; COW PASTURE
								Hardwood						
409	LF	3	HT	0	0	0	100	**Conifer**						GRASS-AG FIELD, COW PASTURE
								Hardwood						
409	RT	1	HT	-2	0	5	95	**Conifer**						GRASS-NATURAL
								Hardwood						
409	RT	2	HT	-5	0	0	100	**Conifer**						GRASS-NATURAL
								Hardwood						
409	RT	3	HT	-10	0	0	100	**Conifer**						GRASS-NATURAL
								Hardwood						
419	LF	1	FP	1	0	0	100	**Conifer**						
								Hardwood						

419	LF	2	FP	1	0	0	100	**Conifer**			
								Hardwood			
419	LF	3	FP	14	0	0	100	**Conifer**			
								Hardwood			
419	RT	1	FP	7	15	0	100	**Conifer**			
								Hardwood	1		
419	RT	2	FP	-1	15	0	100	**Conifer**			
								Hardwood		1	
419	RT	3	FP	40	0	0	80	**Conifer**			20% BARE DIRT
								Hardwood			
429	LF	1	HT	65	0	5	95	**Conifer**			TRANSITION
								Hardwood			
429	LF	2	HT	28	0	0	100	**Conifer**			
								Hardwood			
429	LF	3	HT	0	0	0	100	**Conifer**			
								Hardwood			
429	RT	1	HT	28	0	0	95	**Conifer**			CATTLE USE; 5% BARE DIRT
								Hardwood			
429	RT	2	HT	-22	0	0	100	**Conifer**			
								Hardwood			
429	RT	3	HT	0	0	0	100	**Conifer**			
								Hardwood			

RIPARIAN ZONE VEGETATION

Reach 12 Reach 12

					Cover (percent)				Diameter class (cm)					
Unit	**Side**	**Zone**	**Surface**	**Slope**	**Canopy**	**Shrub**	**Grass**		**3-15**	**15-30**	**30-50**	**50-90**	**>90**	**Notes**
449	LF	1	HT	9	0	0	100	**Conifer**						BV ACTIVITY
								Hardwood						
449	LF	2	HT	2	0	0	100	**Conifer**						AG FIELD
								Hardwood						
449	LF	3	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
449	RT	1	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
449	RT	2	HT	0	0	0	100	**Conifer**						AG FIELD
								Hardwood						
449	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
472	LF	1	FP	0	0	0	100	**Conifer**						EST DUE TO NO ACCESS
								Hardwood						
472	LF	2	FP	0	0	0	100	**Conifer**						PVT PROP-HEFNER
								Hardwood						
472	LF	3	FP	0	0	0	100	**Conifer**						
								Hardwood						
472	RT	1	FP	0	35	0	100	**Conifer**						
								Hardwood						
472	RT	2	FP	2	0	0	100	**Conifer**						
								Hardwood				2		
472	RT	3	FP	7	0	0	100	**Conifer**						
								Hardwood						
504	LF	1	FP	0	90	5	95	**Conifer**						EST DUE TO NO ACCESS
								Hardwood	2		3			
504	LF	2	FP	0	0	0	100	**Conifer**						HEFNER PVT PROP
								Hardwood						
504	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
504	RT	1	FP	0	35	10	90	**Conifer**						GOATS GRAZING IN RIPARIAN
								Hardwood						
504	RT	2	FP	0	0	0	100	**Conifer**						
								Hardwood						
504	RT	3	FP	0	0	0	100	**Conifer**						
								Hardwood						
525	LF	1	HT	0	20	0	100	**Conifer**						DIANE HEFNER PROP-EST.
								Hardwood						

525	LF	2	HT	0	10	0	100	**Conifer**				
								Hardwood				
525	LF	3	HT	0	0	0	100	**Conifer**				
								Hardwood				
525	RT	1	FP	10	95	20	20	**Conifer**				60% BARE SAND
								Hardwood	7	3	2	
525	RT	2	HT	0	0	0	100	**Conifer**				COW PASTURE
								Hardwood				
525	RT	3	HT	0	0	0	100	**Conifer**				COW PASTURE
								Hardwood				

RIPARIAN ZONE VEGETATION

Reach 13 Reach 13

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
542	LF	1	FP	0	50	5	95	**Conifer**						
								Hardwood	2	6				
542	LF	2	FP	0	45	5	95	**Conifer**						
								Hardwood	4					
542	LF	3	FP	0	85	30	70	**Conifer**						
								Hardwood	4					
542	RT	1	FP	4	5	10	90	**Conifer**						
								Hardwood	2					
542	RT	2	FP	0	0	0	100	**Conifer**						HORSE PASTURE
								Hardwood						
542	RT	3	FP	0	0	0	100	**Conifer**						HORSE PASTURE
								Hardwood						
560	LF	1	HT	20	40	0	10	**Conifer**						TRANSITION, 90% GRV, CBL, BLDR
								Hardwood	5	3	1			
560	LF	2	HT	0	0	0	100	**Conifer**						YARD GRASS
								Hardwood						
560	LF	3	HT	0	0	0	100	**Conifer**						YARD GRASS
								Hardwood						
560	RT	1	HT	20	25	0	70	**Conifer**						TRANSITION, PARTIALLY YARD
								Hardwood						
560	RT	2	HT	0	0	0	0	**Conifer**						HOUSE
								Hardwood						
560	RT	3	HT	0	0	0	0	**Conifer**						HOUSE
								Hardwood						
573	LF	1	HT	0	85	0	40	**Conifer**						60% CBL,, YARD; TRANSITON
								Hardwood	1	1			1	
573	LF	2	HT	0	50	0	60	**Conifer**						YARD, HOUSE, PARKING
								Hardwood						
573	LF	3	HT	0	40	0	45	**Conifer**						55% YARD, HOUSE
								Hardwood						
573	RT	1	HT	0	90	5	0	**Conifer**						TRANSITION, WILD ROSE, 95% GRAV
								Hardwood						
573	RT	2	HT	0	0	0	5	**Conifer**						STREET, PARKING LOT
								Hardwood						
573	RT	3	HT	0	0	0	5	**Conifer**						STREET, PARKING LOT
								Hardwood						
582	LF	1	HT	0	5	5	0	**Conifer**						BOTH BANKS RESIDENTIAL
								Hardwood						

582	LF	2	HT	0	0	0	0	**Conifer**		
								Hardwood		
582	LF	3	HT	0	0	0	0	**Conifer**		
								Hardwood		
582	RT	1	FP	10	60	5	5	**Conifer**		
								Hardwood	9	
582	RT	2	HT	0	0	0	0	**Conifer**		100% BARE
								Hardwood		
582	RT	3	HT	0	0	0	0	**Conifer**		100% GRV
								Hardwood		

RIPARIAN ZONE VEGETATION

Reach 14 Reach 14

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
591	LF	1	HT	5	90	90	0	**Conifer**						10% ROADBED
								Hardwood	2	3				
591	LF	2	RB	0	0	0	15	**Conifer**						
								Hardwood						
591	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
591	RT	1	HT	1	5	20	75	**Conifer**						5% GRV
								Hardwood	6	1				
591	RT	2	HS	65	5	80	20	**Conifer**						
								Hardwood						
591	RT	3	HS	90	0	5	95	**Conifer**						
								Hardwood						
601	LF	1	RB	0	0	0	0	**Conifer**						100% GRV-PAVEMENT
								Hardwood						
601	LF	2	HT	0	0	0	100	**Conifer**						COW PASTURE
								Hardwood						
601	LF	3	HT	0	0	0	100	**Conifer**						COW PASTURE
								Hardwood						
601	RT	1	HS	45	85	75	5	**Conifer**					1	20% BARE
								Hardwood	6	3				
601	RT	2	HS	85	5	5	95	**Conifer**						
								Hardwood						
601	RT	3	HS	85	5	5	95	**Conifer**						
								Hardwood						
620	LF	1	HT	0	95	10	90	**Conifer**					6	
								Hardwood	1		3			
620	LF	2	HT	0	95	5	95	**Conifer**						YARD ZONE 2+3
								Hardwood						
620	LF	3	HT	0	40	0	100	**Conifer**						YARD
								Hardwood						
620	RT	1	HS	80	80	60	0	**Conifer**					3	40% BARE AND DIRT
								Hardwood	7					
620	RT	2	HS	90	0	100	0	**Conifer**						
								Hardwood						
620	RT	3	HS	90	0	100	0	**Conifer**						
								Hardwood						
645	LF	1	RB	0	45	10	75	**Conifer**						BEYOND FENCE INTO PVT
								Hardwood	5					

645	LF	2	HT	0	0	0	100	**Conifer**			PASTURE
								Hardwood			
645	LF	3	HT	0	0	0	100	**Conifer**			PASTURE
								Hardwood			
645	RT	1	HS	100	5	65	30	**Conifer**			5% BARE
								Hardwood			
645	RT	2	HS	80	15	90	10	**Conifer**		1	
								Hardwood			
645	RT	3	HS	80	0	90	10	**Conifer**	3		
								Hardwood			

OREGON DEPARTMENT OF FISH AND WILDLIFE — CATHERINE CREEK

HABITAT INVENTORY — Report Date: 12/7/2010 — Survey Date: 8/12/2010

RIPARIAN ZONE VEGETATION

Reach 16 Reach 16

					Cover (percent)				Diameter class (cm)					
Unit	**Side**	**Zone**	**Surface**	**Slope**	**Canopy**	**Shrub**	**Grass**		**3-15**	**15-30**	**30-50**	**50-90**	**>90**	**Notes**
661	LF	1	FP	9	5	5	75	**Conifer**						20% BARE, CBL, GRV
								Hardwood						
661	LF	2	HT	0	0	5	95	**Conifer**						COW PASTURE
								Hardwood						
661	LF	3	HT	0	0	0	100	**Conifer**						COW PASTURE
								Hardwood						
661	RT	1	FP	5	45	75	20	**Conifer**						5% SAND
								Hardwood			4			
661	RT	2	HT	0	5	50	50	**Conifer**						
								Hardwood			2			
661	RT	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
695	LF	1	FP	0	0	0	100	**Conifer**						LEFT BANK HEAVILY GRAZED
								Hardwood						
695	LF	2	FP	0	0	0	100	**Conifer**						CATTLE USE
								Hardwood						
695	LF	3	FP	0	0	0	100	**Conifer**						
								Hardwood						
695	RT	1	HS	57	90	90	100	**Conifer**						CATTLE USE
								Hardwood	45	2				
695	RT	2	HS	40	0	0	100	**Conifer**						CATTLE USE
								Hardwood						
695	RT	3	HS	40	0	0	100	**Conifer**						CATTLE USE
								Hardwood						

RIPARIAN ZONE VEGETATION

Reach 17 Reach 17

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
717	LF	1	RB	0	0	0	10	**Conifer**						HWY 203, 90% BARE
								Hardwood						
717	LF	2	HS	50	5	0	100	**Conifer**				1		
								Hardwood						
717	LF	3	HS	50	0	0	100	**Conifer**						
								Hardwood						
717	RT	1	HS	85	50	90	10	**Conifer**						
								Hardwood	5					
717	RT	2	HS	40	35	90	10	**Conifer**		1		1		
								Hardwood						
717	RT	3	HS	40	35	90	10	**Conifer**			2			
								Hardwood						
743	LF	1	HT	-4	10	5	95	**Conifer**						
								Hardwood	1	6	3			
743	LF	2	RB	0	0	0	0	**Conifer**						100% GRV, HWY 203, PAVEMENT
								Hardwood						
743	LF	3	HT	0	0	50	50	**Conifer**						
								Hardwood						
743	RT	1	HS	11	65	80	10	**Conifer**						HEAVY CATTLE USE ALL ZONES
								Hardwood	3					
743	RT	2	HS	25	95	100	0	**Conifer**						
								Hardwood	3					
743	RT	3	HS	25	95	100	0	**Conifer**						
								Hardwood						

RIPARIAN ZONE VEGETATION

Reach 18 Reach 18

					Cover (percent)				Diameter class (cm)					
Unit	**Side**	**Zone**	**Surface**	**Slope**	**Canopy**	**Shrub**	**Grass**		**3-15**	**15-30**	**30-50**	**50-90**	**>90**	**Notes**
767	LF	1	HT	0	35	70	30	**Conifer**	1					
								Hardwood	2					
767	LF	2	HT	0	70	70	30	**Conifer**						
								Hardwood	4					
767	LF	3	HT	0	65	80	20	**Conifer**				1		
								Hardwood						
767	RT	1	HS	90	40	60	0	**Conifer**						40% MOSS
								Hardwood						
767	RT	2	HS	90	85	100	0	**Conifer**			1			
								Hardwood						
767	RT	3	HS	90	85	100	0	**Conifer**		2				
								Hardwood						

RIPARIAN ZONE VEGETATION

Reach 19 Reach 19

Unit	Side	Zone	Surface	Slope	Cover (percent) Canopy	Shrub	Grass		Diameter class (cm) 3-15	15-30	30-50	50-90	>90	Notes
790	LF	1	HT	0	25	20	20	**Conifer**			1			YARD, 60% PINE NEEDLES
								Hardwood						
790	LF	2	HT	0	50	0	50	**Conifer**						YARD; 50% PINE NEEDLES
								Hardwood	5					
790	LF	3	HT	0	45	0	50	**Conifer**						YARD, 50% PINE NEEDLES
								Hardwood						
790	RT	1	HS	50	40	70	0	**Conifer**	6					30% MOSS
								Hardwood						
790	RT	2	HS	50	95	45	5	**Conifer**	8	1				50% MOSS
								Hardwood						
790	RT	3	HS	50	95	90	0	**Conifer**	10				1	10% PINE NEEDLES
								Hardwood						
805	LF	1	FP	-3	80	20	80	**Conifer**						BV
								Hardwood	17	1				
805	LF	2	FP	3	40	30	40	**Conifer**		1				FS RD 2036; 30% BLDR, CONCRETE
								Hardwood	24					
805	LF	3	RB	0	0	0	0	**Conifer**						100% BLDR, CONCRETE
								Hardwood						
805	RT	1	RB	0	0	0	5	**Conifer**						HWY 203
								Hardwood						
805	RT	2	RB	0	0	0	0	**Conifer**						100% GRV, CONCRETE
								Hardwood						
805	RT	3	HS	-26	10	5	95	**Conifer**						
								Hardwood						

RIPARIAN ZONE VEGETATION

Reach 21 Reach 21

					Cover (percent)				Diameter class (cm)					
Unit	**Side**	**Zone**	**Surface**	**Slope**	**Canopy**	**Shrub**	**Grass**		**3-15**	**15-30**	**30-50**	**50-90**	**>90**	**Notes**
880	LF	1	HT	0	10	0	100	**Conifer**	1		1			
								Hardwood						
880	LF	2	HT	0	0	5	95	**Conifer**						
								Hardwood						
880	LF	3	HT	0	0	0	100	**Conifer**						
								Hardwood						
880	RT	1	FP	3	75	0	100	**Conifer**	1	3				BV, CATTLE TRAMPLING
								Hardwood	12	1				
880	RT	2	FP	-2	80	0	100	**Conifer**		1	2			BV, CATTLE TRAMPLED
								Hardwood	6					
880	RT	3	FP	0	70	20	70	**Conifer**			2			BV, CATTLE TRAMPLED
								Hardwood	17					
926	LF	1	FP	0	5	30	70	**Conifer**						
								Hardwood	7					
926	LF	2	HS	55	5	60	40	**Conifer**	1					
								Hardwood	5					
926	LF	3	HS	55	15	55	45	**Conifer**						
								Hardwood						
926	RT	1	HT	0	0	50	50	**Conifer**						
								Hardwood						
926	RT	2	HT	0	0	50	50	**Conifer**						
								Hardwood						
926	RT	3	HT	0	0	50	50	**Conifer**						
								Hardwood						
985	LF	1	SC	0	0	0	0	**Conifer**						EST DUE TO DENSE VEG
								Hardwood	3					
985	LF	2	HT	0	60	100	0	**Conifer**						
								Hardwood						
985	LF	3	HT	0	60	100	0	**Conifer**						
								Hardwood						
985	RT	1	FP	2	65	60	0	**Conifer**						40% BARE DIRT
								Hardwood	1	3				
985	RT	2	FP	0	80	90	0	**Conifer**			2			BV, 10% BARE
								Hardwood	4		4			
985	RT	3	FP	0	55	90	0	**Conifer**						10% BARE
								Hardwood						
1017	LF	1	FP	0	60	60	5	**Conifer**		1				35% BARE
								Hardwood	9					

1017	LF	2	HT	0	90	80	0	**Conifer**	2				20% BARE
								Hardwood	10	2	1		
1017	LF	3	HT	0	100	100	0	**Conifer**					
								Hardwood					
1017	RT	1	HS	100	35	100	0	**Conifer**	1				
								Hardwood	1				
1017	RT	2	HS	100	55	100	0	**Conifer**	4		1	1	
								Hardwood					
1017	RT	3	HS	100	70	100	0	**Conifer**	4	3	2		
								Hardwood					

RIPARIAN ZONE VEGETATION

Reach 22 Reach 22

					Cover (percent)				Diameter class (cm)					
Unit	Side	Zone	Surface	Slope	Canopy	Shrub	Grass		3-15	15-30	30-50	50-90	>90	Notes
1054	LF	1	HT	-2	90	60	5	**Conifer**	2		2			35% BARE
								Hardwood	7					
1054	LF	2	RB	0	0	10	5	**Conifer**						85% PAVEMENT
								Hardwood						
1054	LF	3	HS	95	20	20	20	**Conifer**	2					60% BARE DIRT
								Hardwood						
1054	RT	1	FP	6	55	90	10	**Conifer**	2					
								Hardwood	7					
1054	RT	2	HT	1	5	5	90	**Conifer**						5% BARE, CBL
								Hardwood			2			
1054	RT	3	RB	0	0	0	80	**Conifer**						OLS RD, 20% BARE, CBL
								Hardwood						

RIPARIAN ZONE VEGETATION SUMMARY

REACH 1 **REACH 1**

Summary of Riparian Zone (0-30m) **12 transects**

Total hardwoods/1000	1199
Total conifers/1000 ft	15
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.3	12.8	0.0	4.5	0.0	1.4	0.3	18.8
15-30cm	0.0	0.3	0.0	0.5	0.0	0.1	0.0	0.9
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.3	13.2	0.0	5.0	0.0	1.5	0.1	6.6

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	33	24	14
Shrub cover	31	18	12
Grass/forb cover	23	63	65

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	71	88	96
Low terrace	8	8	0
Floodplain	21	4	4
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	22	4	-1

RIPARIAN ZONE VEGETATION SUMMARY

REACH 2 **REACH 2**

Summary of Riparian Zone (0-30m) 9 transects

Total hardwoods/1000	711
Total conifers/1000 ft	61
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.3	2.8	0.0	4.2	0.0	1.1	0.3	8.1
15-30cm	0.7	1.0	0.0	1.7	0.0	0.7	0.7	3.3
30-50cm	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	1.0	3.8	0.0	6.1	0.0	1.8	0.3	3.9

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	45	29	14
Shrub cover	54	29	14
Grass/forb cover	26	64	84

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	78	89	94
Low terrace	6	0	0
Floodplain	17	6	6
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	6	0
Riprap	0	0	0
Surface slope (%)	37	4	0

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/16/2010

RIPARIAN ZONE VEGETATION SUMMARY

REACH 3 **REACH 3**

Summary of Riparian Zone (0-30m) **11 transects**

Total hardwoods/1000	200
Total conifers/1000 ft	6
Total conifers >20" dbh/1000 ft	6
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	0.7	0.0	1.0	0.0	1.0	0.0	2.7
15-30cm	0.0	0.0	0.0	0.3	0.0	0.3	0.0	0.5
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.1	0.7	0.0	1.3	0.0	1.3	0.0	1.1

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	4	5	6
Shrub cover	6	3	0
Grass/forb cover	94	85	83

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	73	100	100
Low terrace	0	0	0
Floodplain	27	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	7	0	0

RIPARIAN ZONE VEGETATION SUMMARY

REACH 4 **REACH 4**

Summary of Riparian Zone (0-30m) 4 transects

Total hardwoods/1000	1219
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	5.8	0.0	6.5	0.0	4.0	0.0	16.3
15-30cm	0.0	2.0	0.0	1.0	0.0	0.8	0.0	3.8
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	7.8	0.0	7.5	0.0	4.8	0.0	6.7

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	17	13	10
Shrub cover	48	41	16
Grass/forb cover	52	58	84

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	88	100	100
Low terrace	0	0	0
Floodplain	13	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	12	5	0

RIPARIAN ZONE VEGETATION SUMMARY

REACH 5 — **REACH 5**

Summary of Riparian Zone (0-30m) **2 transects**

Total hardwoods/1000	1189
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	2.5	0.0	11.0	0.0	6.0	0.0	19.5
15-30cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	2.5	0.0	11.0	0.0	6.0	0.0	6.5

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	13	21	10
Shrub cover	28	13	8
Grass/forb cover	73	88	85

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	75	100	75
Low terrace	0	0	0
Floodplain	25	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	25
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	6	2	0

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

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RIPARIAN ZONE VEGETATION SUMMARY

REACH 6 **REACH 6**

Summary of Riparian Zone (0-30m) **4 transects**

Total hardwoods/1000	762
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	6.3	0.0	1.0	0.0	5.3	0.0	12.5
15-30cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	6.3	0.0	1.0	0.0	5.3	0.0	4.2

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	3	0	8
Shrub cover	10	2	1
Grass/forb cover	78	98	99

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	88	100	100
Low terrace	0	0	0
Floodplain	13	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	25	0	0

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 8/3/2010

RIPARIAN ZONE VEGETATION SUMMARY

REACH 7 **REACH 7**

	Summary of Riparian Zone (0-30m)	**4 transects**
Total hardwoods/1000	0	
Total conifers/1000 ft	152	
Total conifers >20" dbh/1000 ft	0	
Total conifers >35" dbh/1000 ft	0	

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	2.5	0.0	0.0	0.0	0.0	0.0	2.5	0.0
15-30cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-50cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	2.5	0.0	0.0	0.0	0.0	0.0	0.8	0.0

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	2	0	0
Shrub cover	18	2	0
Grass/forb cover	78	94	99

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	38	50	63
Low terrace	0	0	0
Floodplain	63	50	38
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	2	0	2

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RIPARIAN ZONE VEGETATION SUMMARY

REACH 8 **REACH 8**

Summary of Riparian Zone (0-30m) 3 transects

Total hardwoods/1000	691
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	3.7	0.0	0.0	0.0	1.7	0.0	5.3
15-30cm	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
30-50cm	0.0	1.0	0.0	0.0	0.0	0.3	0.0	1.3
50-90cm	0.0	1.0	0.0	0.0	0.0	0.7	0.0	1.7
>90cm	0.0	0.7	0.0	0.0	0.0	0.3	0.0	1.0
Total/100m2	0.0	8.3	0.0	0.0	0.0	3.0	0.0	3.8

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	51	49	23
Shrub cover	0	0	0
Grass/forb cover	80	80	94

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	17	33	50
Low terrace	0	0	0
Floodplain	83	67	50
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	0	0	-6

RIPARIAN ZONE VEGETATION SUMMARY

REACH 9 **REACH 9**

Summary of Riparian Zone (0-30m) 5 transects

Total hardwoods/1000	207
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	0.2	0.0	0.0	0.0	2.2	0.0	2.4
15-30cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-50cm	0.0	0.0	0.0	0.2	0.0	0.4	0.0	0.6
50-90cm	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
>90cm	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2
Total/100m2	0.0	0.2	0.0	0.2	0.0	3.0	0.0	1.1

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	11	5	18
Shrub cover	2	0	7
Grass/forb cover	94	95	90

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	40	70	70
Low terrace	0	0	0
Floodplain	60	30	30
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	11	0	-4

RIPARIAN ZONE VEGETATION SUMMARY

REACH 12 **REACH 12**

Summary of Riparian Zone (0-30m) 4 transects

Total hardwoods/1000	290
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	2.3	0.0	0.0	0.0	0.0	0.0	2.3
15-30cm	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.8
30-50cm	0.0	1.3	0.0	0.0	0.0	0.0	0.0	1.3
50-90cm	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.5
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	4.3	0.0	0.5	0.0	0.0	0.0	1.6

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	34	1	0
Shrub cover	4	0	0
Grass/forb cover	88	100	100

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	38	50	63
Low terrace	0	0	0
Floodplain	63	50	38
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	2	1	1

RIPARIAN ZONE VEGETATION SUMMARY

REACH 13 **REACH 13**

Summary of Riparian Zone (0-30m) 4 transects

Total hardwoods/1000	594
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	4.8	0.0	1.0	0.0	1.0	0.0	6.8
15-30cm	0.0	2.5	0.0	0.0	0.0	0.0	0.0	2.5
30-50cm	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.3
Total/100m2	0.0	7.8	0.0	1.0	0.0	1.0	0.0	3.3

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	45	12	16
Shrub cover	4	1	4
Grass/forb cover	39	45	40

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	0
High terrace	63	75	75
Low terrace	0	0	0
Floodplain	38	25	25
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	7	0	0

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RIPARIAN ZONE VEGETATION SUMMARY

REACH 14 **REACH 14**

Summary of Riparian Zone (0-30m) 4 transects

Total hardwoods/1000	564
Total conifers/1000 ft	213
Total conifers >20" dbh/1000 ft	168
Total conifers >35" dbh/1000 ft	152

Average number of trees in a 5-meter wide band

	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	6.8	0.0	0.0	0.8	0.0	0.8	6.8
15-30cm	0.0	1.8	0.0	0.0	0.0	0.0	0.0	1.8
30-50cm	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.8
50-90cm	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
>90cm	2.5	0.0	0.0	0.0	0.0	0.0	2.5	0.0
Total/100m2	2.5	9.3	0.3	0.0	0.8	0.0	1.2	3.1

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	51	15	6
Shrub cover	41	35	25
Grass/forb cover	34	54	75

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	38	50	50
High terrace	38	38	50
Low terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	25	13	0
Riprap	0	0	0
Surface slope (%)	29	40	43

RIPARIAN ZONE VEGETATION SUMMARY

REACH 16 **REACH 16**

Summary of Riparian Zone (0-30m) 2 transects

Total hardwoods/1000	1615
Total conifers/1000 ft	0
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	22.5	0.0	0.0	0.0	0.0	0.0	22.5
15-30cm	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
30-50cm	0.0	2.0	0.0	1.0	0.0	0.0	0.0	3.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	25.5	0.0	1.0	0.0	0.0	0.0	8.8

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	35	1	0
Shrub cover	43	14	0
Grass/forb cover	74	86	100

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	25	25	25
High terrace	0	50	50
Low terrace	0	0	0
Floodplain	75	25	25
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	18	10	10

RIPARIAN ZONE VEGETATION SUMMARY

REACH 17 **REACH 17**

Summary of Riparian Zone (0-30m) 2 transects

Total hardwoods/1000	640
Total conifers/1000 ft	152
Total conifers >20" dbh/1000 ft	61
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
Diameter class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	0.0	4.5	0.0	1.5	0.0	0.0	0.0	6.0
15-30cm	0.0	3.0	0.5	0.0	0.0	0.0	0.5	3.0
30-50cm	0.0	1.5	0.0	0.0	1.0	0.0	1.0	1.5
50-90cm	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	0.0	9.0	1.5	1.5	1.0	0.0	0.8	3.5

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	31	34	33
Shrub cover	44	48	60
Grass/forb cover	31	28	40

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	50	75	75
High terrace	25	0	25
Low terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	25	25	0
Riprap	0	0	0
Surface slope (%)	23	29	29

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RIPARIAN ZONE VEGETATION SUMMARY

REACH 18 **REACH 18**

Summary of Riparian Zone (0-30m) 1 transects

Total hardwoods/1000	366
Total conifers/1000 ft	305
Total conifers >20" dbh/1000 ft	61
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	1.0	2.0	0.0	4.0	0.0	0.0	1.0	6.0
15-30cm	0.0	0.0	0.0	0.0	2.0	0.0	2.0	0.0
30-50cm	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0
50-90cm	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	1.0	2.0	1.0	4.0	3.0	0.0	1.7	2.0

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	38	78	75
Shrub cover	65	85	90
Grass/forb cover	15	15	10

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	50	50	50
High terrace	50	50	50
Low terrace	0	0	0
Floodplain	0	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	45	45	45

RIPARIAN ZONE VEGETATION SUMMARY

REACH 19 | **REACH 19**

Summary of Riparian Zone (0-30m) 2 transects

Total hardwoods/1000	1433
Total conifers/1000 ft	853
Total conifers >20" dbh/1000 ft	30
Total conifers >35" dbh/1000 ft	30

Average number of trees in a 5-meter wide band

Diameter	Zone 1 0-10 meters		Zone 2 10 - 20 meters		Zone 3 20 - 30 meters		Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood	Conifer	Hardwood
3-15cm	3.0	8.5	4.0	14.5	5.0	0.0	12.0	23.0
15-30cm	0.0	0.5	1.0	0.0	0.0	0.0	1.0	0.5
30-50cm	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.0
Total/100m2	3.5	9.0	5.0	14.5	5.5	0.0	4.7	7.8

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	36	46	38
Shrub cover	28	19	24
Grass/forb cover	26	24	36

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	25	25	50
High terrace	25	25	25
Low terrace	0	0	0
Floodplain	25	25	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	25	25	25
Riprap	0	0	0
Surface slope (%)	12	13	6

RIPARIAN ZONE VEGETATION SUMMARY

REACH 21 **REACH 21**

	Summary of Riparian Zone (0-30m) 4 transects
Total hardwoods/1000	1311
Total conifers/1000 ft	503
Total conifers >20" dbh/1000 ft	15
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters Conifer	Zone 1 0-10 meters Hardwood	Zone 2 10 - 20 meters Conifer	Zone 2 10 - 20 meters Hardwood	Zone 3 20 - 30 meters Conifer	Zone 3 20 - 30 meters Hardwood	Zones 1-3 0-30 meters Conifer	Zones 1-3 0-30 meters Hardwood
3-15cm	0.8	8.3	1.8	6.3	1.0	4.3	3.5	18.8
15-30cm	1.0	1.0	0.3	0.5	0.8	0.0	2.0	1.5
30-50cm	0.3	0.0	1.3	1.3	1.0	0.0	2.5	1.3
50-90cm	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	2.0	9.3	3.5	8.0	2.8	4.3	2.8	7.2

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	31	46	46
Shrub cover	38	61	64
Grass/forb cover	41	36	33

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	13	25	25
High terrace	25	50	50
Low terrace	0	0	0
Floodplain	50	25	25
Wetland/meadow	0	0	0
Stream channel	13	0	0
Roadbed/Railroad	0	0	0
Riprap	0	0	0
Surface slope (%)	13	19	19

OREGON DEPARTMENT OF FISH AND WILDLIFE **CATHERINE CREEK**

HABITAT INVENTORY Report Date: 12/7/2010 Survey Date: 9/1/2010

RIPARIAN ZONE VEGETATION SUMMARY

REACH 22 **REACH 22**

Summary of Riparian Zone (0-30m) 1 transects

Total hardwoods/1000	975
Total conifers/1000 ft	488
Total conifers >20" dbh/1000 ft	0
Total conifers >35" dbh/1000 ft	0

Average number of trees in a 5-meter wide band

Diameter class (cm)	Zone 1 0-10 meters Conifer	Zone 1 0-10 meters Hardwood	Zone 2 10 - 20 meters Conifer	Zone 2 10 - 20 meters Hardwood	Zone 3 20 - 30 meters Conifer	Zone 3 20 - 30 meters Hardwood	Zones 1-3 0-30 meters Conifer	Zones 1-3 0-30 meters Hardwood
3-15cm	4.0	14.0	0.0	0.0	2.0	0.0	6.0	14.0
15-30cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30-50cm	2.0	0.0	0.0	2.0	0.0	0.0	2.0	2.0
50-90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>90cm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total/100m2	6.0	14.0	0.0	2.0	2.0	0.0	2.7	5.3

Canopy closure and ground cover

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Canopy closure	73	3	10
Shrub cover	75	8	10
Grass/forb cover	8	48	50

Predominant landform in each zone

	Zone 1 0-10 meters (%)	Zone 2 10 - 20 meters (%)	Zone 3 20 - 30 meters (%)
Hillslope	0	0	50
High terrace	50	50	0
Low terrace	0	0	0
Floodplain	50	0	0
Wetland/meadow	0	0	0
Stream channel	0	0	0
Roadbed/Railroad	0	50	50
Riprap	0	0	0
Surface slope (%)	2	1	48

Summary of Riparian Zone (0-30m) for all reaches **78 transects**

Summary of riparian zone (0-100 feet) extrapolated to 1,000 feet along stream

Total hardwoods/1000	720
Total conifers/1000 ft	91
Total conifers >20" dbh/1000 ft	13
Total conifers >35" dbh/1000 ft	9

Average number of trees in a 5-m wide band

Diameter	Zones 1-3 0-30 meters	
class (cm)	Conifer	Hardwood
3-15cm	0.8	9.9
15-30cm	0.2	1.3
30-50cm	0.2	0.4
50-90cm	0.1	0.1
>90cm	0.1	0.1

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
1	1	GL	00	150	FC	427154E/5028752N; RIP 1	START 427154/5028752
1	2	GL	00	300		T=18C	BEDROCK=HARDPAN
1	4	GL	00	600			HARDPAN
1	5	GL	00	750	CS/, SD/	CS/-BLDRS, SD/-PUMP	PLACED BOULDERS
1	8	GL	00	1150	AM	AM=W.TOAD; RIP 2; 427737/5028610	WESTERN TOAD
1	10	GL	00	1450	WL	WL-NUTRIA/OTTER?	NUTRIA
1	11	GL	00	1600	AM	BULLFROG	NUTRIA HOLE IN BANK
1	12	GL	00	1750			HARDPAN
1	15	GL	00	2150		428223E/5028118N; RIP 3	
1	16	GL	00	2300			HARDPAN
1	17	GL	00	2450	AM	AM-BULLFROG	FROG; HARDPAN
1	18	GL	00	2600			HARDPAN
1	19	GL	00	2750			HARDPAN
1	20	GL	00	2900			HARDPAN
1	21	GL	00	3000			HARDPAN
1	22	GL	00	3150	BV	BV-CHEWS; 428462E/5027148N; RIP 4	HARDPAN
1	23	GL	00	3300	AM	BULLFROG (BF)	BF, W.TOAD; HARDPAN
1	24	GL	00	3450	AM, WL	MUSKRAT	BF; MUSKRAT; HARDPAN
1	25	GL	00	3600	AM, WL	BULLFROG CALL	BF; GREAT HORNED OWL; HARDPAN
1	27	GL	00	3900			HARDPAN
1	28	GL	00	4000			HARDPAN
1	29	GL	00	4150	AM	11T 428590E/5027772N; RIP 5	HARDPAN, BULLFROGS
1	30	GL	00	4300			HARDPAN
1	31	GL	00	4450	WL	HORSE IN RIP, HARDPAN	MALLARD, CINNAMON TEAL
1	32	GL	00	4600		WILLOWS ALONG BANK	HORSES NEAR STREAM; HARDPAN
1	33	GL	00	4750		SOME MARSHY AREAS	HP=HARDPAN
1	34	GL	00	4900			HP
1	35	GL	00	5000			HP
1	36	GL	00	5150		11T 428837E/5028133N; RIP 6	HP
1	37	GL	00	5300	CE/		HP
1	38	GL	00	5450			HP
1	39	GL	00	5600	WL		CALF ELK, HP
1	40	GL	00	5750	AM	BF	HP
1	41	GL	00	5900			HP
1	42	GL	00	6000			HP
1	43	GL	00	6150	WL	11T 429208E/5028066N; RIP 7	BARN OWL; HP
1	44	GL	00	6300			HP
1	45	GL	00	6450			HP
1	46	GL	00	6600			HP
1	47	GL	00	6750			HP
1	48	GL	00	6900			HP
1	49	GL	00	7000			HP
1	50	GL	00	7150	AM	11T 429275E/5027386N; RIP 8; BF	HP'; INVASIVE LILLY IN RIP ZONE
1	51	GL	00	7300		WATER TEMP 23°C	HP
1	52	GL	00	7450			HP
1	53	GL	00	7600			HP
1	54	GL	00	7750			HP
1	55	GL	00	7900			HP
1	56	GL	00	8000		DEAD CARP	HP
1	57	GL	00	8150		11T 0428908E/5026636N; RIP 9	
1	59	GL	00	8450	BV		CHEWED STICKS
1	61	GL	00	8750			HP
1	62	GL	00	8800			HP
1	63	GL	00	8930	CE/	DWNSTRM END OF OXBOW	HEADGATE ON OXBOW; HP
1	64	GL	00	9080	WL	1T 429607E/5026329N; RIP 10	HP, RACCOON

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
1	65	GL	00	9230			HP
1	66	GL	00	9380			HP
1	67	GL	00	9530			HP
1	68	GL	00	9680			HP
1	69	GL	01	9830			HP
1	70	AL	10			DRY, 80% GRASS; SEASONALLY WET	
1	71	GL	00	9930			HP
1	72	GL	00	10080	WL	WL TRAIL; 11T 430177E/5026638N	HP, MULE DEER DOE, RIP 11
1	73	GL	00	10240	BC, /CS	MARKET LANE; HP; PLACED BOULDERS	
1	75	GL	00	10450	CE/, SS	CE/-SPILLING FLOW	.7M DROP FROM CULVERT
1	76	GL	00	10600	BV, WL	BEDDED DOE; BV	CHEWED STICKS
1	77	GL	00	10750	WL	WL TRAIL/	GAME TRAIL; HP
1	79	GL	00	11050		11T 430388E/5026278N; RIP 12	HP
1	80	GL	00	11200			HP
1	81	GL	00	11350			HP
1	82	GL	00	11500	WL		GAME TRAIL; HP
1	83	GL	00	11650	FC		OPERATING WELL ON RT BANK
1	84	GL	00	11800		CATTLE USE ON BANK; DEAD NORTHERN PIKE MINNOW; RIP 19	
1	85	GL	00	11900		CATTLE IN STREAM	END REACH
2	86	GL	00	12050		11T 430408E/5026048N; RIP 13	SIGN OF CATTLE IN RIP; HP
2	87	GL	00	12200	BV,WL		OLD BRIDGE XING
2	88	GL	00	12260			HP
2	89	GL	00	12290		OXBOW LF BANK ENTRY	OLD CULVERT MATERIAL DWNSTRM
2	90	GL	00	12380			HP
2	91	GL	00	12410		OXBOW EXIT	OXBOW; HP
2	92	GL	00	12560			HP
2	93	GL	00	12710			SIGN OF CATTLE IN RIPARIAN
2	94	GL	00	12860	FC		CATTLE IN RIPARIAN
2	95	GL	00	12960			HP
2	96	GL	00	13110		11T 430598E/5025357N; RIP 14	HP
2	97	GL	00	13260	AM		BF
2	98	GL	00	13410	WL		DEER ON BANK
2	99	GL	00	13560	BV		CHEWED STICKS
2	100	GL	00	13710	SS/,WL		NUTRIA HOLES IN BANK
2	102	GL	00	13960		T=24°C	HP
2	103	GL	00	14110	WL	11T 431290E/5025310N; RIP 15	GAME TRAIL; 3 BARN OWLS
2	104	GL	00	14260			HP
2	105	GL	00	14410		CATTLE USE NEXT TO STREAM	
2	107	GL	00	14710	WL		GAME TRAIL
2	110	GL	00	15110	BV, FC	RIP 16	HP
2	111	GL	00	15225		11T 432084E/5025301N-RIP	
2	112	GL	01	15260			HP
2	113	AL	10			11T 432040E/5025159N; OXBOW BLOCKED UPSTRM	
2	114	AL	10		AM		MANY BF TADPOLES
2	115	GL	00	15305	WL		GAME TRAIL; HP
2	116	GL	00	15455	WL	OXBOW UPSTRM; 431998/5025130	MUSKRAT BURROW; HP
2	117	GL	00	15605	WL		3 GREAT HORNED OWL; HP
2	118	GL	00	15755	WL		GREAT HORNED OWL; HP
2	120	GL	00	16065		11T 431371E/5025087N; RIP 17	
2	121	GL	00	16215	WL		MUSKRAT
2	122	GL	00	16365	BV		HP
2	123	GL	00	16515	BV, /SS		HP
2	124	GL	00	16665	WL		MUSKRAT; HP
2	125	GL	00	16815			HP
2	126	GL	00	16915	AM		W.TOAD; HP

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
2	127	GL	00	17065	BV, AM	11T 430909E/5024744N; RIP 18	FROG; HP
2	128	GL	00	17215	BV, BC	BC 11T 430947/5024701	HP
2	129	GL	00	17365			HP
2	130	GL	00	17515	WL	DEAD ELK IN RIP	DEAD ELK LF BANK; HP
2	131	GL	00	17665	WL, BV		ANIMAL TRAIL; HP
2	132	GL	00	17815	AM		BULLFROG; HP
2	133	GL	00	17915	WL		GAME TRAIL; HP
2	134	GL	00	18065	WL	T=22.5°C; RIP 19	GAME TRAIL; HP
2	135	GL	00	18215	BV	11T 431512E/5024629N-NAD 27	HP
2	136	GL	00	18365			HP
2	137	GL	00	18515	WL		GAME TRAIL; HP
2	138	GL	00	18665			HP
2	140	GL	00	18915	FC		
2	141	GL	00	19065		11T 431676E/5024339N; RIP 20	
2	142	GL	00	19215	/CE,BV,/SS	HIGH TERRACE ERODING	HP
2	143	GL	00	19365			HP
2	146	GL	00	19815	SS/		HP
2	147	GL	00	19915	BC	HOUSE/ WITH TREES NEAR	
2	148	GL	00	20065	BC	RIP 21	HP; WATCH TOWER
2	149	GL	00	20215	CS	T=22.5°C	
2	150	SS	00	20215	CS	H=2.0M; 432206E/5024368N	END REACH
3	151	GL	00	20303	CS/	START AT ELMER'S DAM	CONCRETE AT ELMER'S DAM
3	152	GL	00	20453	CS/		CONCRETE FROM OLD BC
3	153	GL	00	20603		T=17°C	
3	154	GL	00	20753	WL		BARN OWL
3	155	GL	00	20903	AM		BULLFROG
3	156	GL	00	21053	AM		BULLFROGS
3	157	GL	00	21203	AM		DOWNSTREAM END OF OXBOW
3	158	GL	00	21353	/CE		.5 DIAM
3	159	GL	00	21453	BV		
3	160	GL	00	21603		T=17°C	
3	161	GL	00	21753	BV,AM,CE/		.5M DIAM, 1.5M DROP; BFROGS
3	162	GL	00	21903	BV		OXBOW ON RT OF BANK
3	163	GL	00	22053	AM	11T 433715E/5023377N	BULLFROGS
3	164	GL	00	22203			DIVERSION
3	165	GL	00	22353	WL		RIVER OTTER
3	166	GL	00	22420		ROB'S TRANSECT	
3	167	GL	00	22570	AM		BULLFROG
3	168	GL	00	22720	AM		BULLFROG
3	171	GL	11			TRIB T=16°C	TRIB, OXBOW
3	172	GL	01	23170	TJ/		
3	173	GL	00	23320	AM, BV	T=15°C	BULLFROG
3	174	GL	00	23470	AM		BULLFROGS
3	175	GL	00	23620	AM		BULLFROGS
3	176	GL	00	23770	AM		MANY BULLFROGS
3	177	GL	00	23920	BC, AM		BOOTHLANE, BULLFROGS
3	178	GL	00	24020	AM	MANY BULLFROGS; SCHOOL CATFISH	
3	179	GL	00	24170	BV		
3	180	GL	00	24320	BC,WL,CE/	0.4M DIAM WITH FLAP VALVE; WOOD DUCK	
3	181	GL	00	24470	BV,CE/		0.3M DIAM WITH FLAP VALVE
3	182	GL	00	24620	BV,WL		IRRIGATION CANAL ON LEFT
3	184	GL	00	24920	AM		BIG BULLFROG
3	185	GL	00	25020	BV		SUBSTRATE ESTIMATED
3	186	GL	00	25170	BV		
3	189	GL	00	25620	AM		BULLFROGS AND TADPOLES

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
3	190	GL	00	25770	/CE		UPDTREAM END OF OXBOW-.4M DIAM
3	191	GL	00	25920	AM		LG BULLFROG
3	192	GL	00	26020	BV		
3	193	GL	00	26170			HARDPAN
3	195	GL	00	26470	BV		EST-COULD NOT FEEL BOTTOM
3	196	GL	00	26620	CE/		.4M DIAM; UPSTREAM END OXBOW
3	197	GL	00	26770	WL	GREAT BLUE HERON, HARDPAN CLAY	
3	198	GL	00	26920	BV		
3	199	GL	00	27020	BV		
3	201	GL	00	27320	AM,/CE	BULLFROG; OXBOW HAS FLAP VALVE	
3	202	GL	00	27470			HARDPAN
3	204	GL	00	27770			HARDPAN
3	205	GL	00	27920			HARDPAN
3	206	GL	00	28020	WL		2 DEER
3	208	GL	00	28320	BV		
3	209	GL	00	28470	BV		
3	210	GL	00	28620	WL,AM		DEAD FAWN; BULLFROG
3	211	GL	00	28770	BV		
3	212	GL	00	28920	BV		
3	213	GL	00	29020	BV,WL	T=17°C	HARDPAN
3	214	GL	00	29170	BV	11T 433670E/5020320N	HARDPAN
3	215	GL	00	29320	BV		
3	217	GL	00	29620			HARDPAN
3	218	GL	00	29770			HARDPAN
3	219	GL	00	29920			HARDPAN
3	220	GL	01	30070	TJ/	END REACH	TRIB
3	221	GL	11			TRIB T=15°C	TRIB, UNNAMED FROM WARM CR
4	222	GL	00	30182			HARDPAN
4	223	GL	00	30332		T=17°C	HARDPAN
4	224	GL	00	30482	WL		2 BARN OWLS
4	226	GL	00	30782			HARDPAN
4	227	GL	00	30932			HARDPAN
4	228	GL	00	31082	WL		BARN OWL
4	229	GL	00	31232	BV		
4	230	GL	00	31382	BV,WL		3 BARN OWLS
4	231	GL	00	31482	BV		
4	232	GL	00	31632			HARDPAN
4	234	GL	00	31932	WL	T=18°C	BARN OWL
4	235	GL	00	32082			HARDPAN
4	236	GL	00	32232			HARDPAN
4	237	GL	00	32382		11T 432707E/5019858N	
4	238	GL	00	32482		11T 432217E/5019173N	
4	242	GL	00	33082	AM		BULLFROGS, HARDPAN
4	243	GL	00	33232			HARDPAN
4	244	GL	00	33382			HARDPAN
4	245	GL	00	33482		T=18°C	
4	246	GL	00	33632	WL		WOODDUCK, HARDPAN
4	247	GL	00	33782			HARDPAN
4	248	GL	00	33932	/BV,BC,CS/CS		COVE HWY, CS/CS-CONCRETE
4	249	GL	00	34082	BV,AM		BULLFROG, HARDPAN
4	250	GL	00	34232			HARDPAN
4	251	GL	00	34382		11T 432014E/5018728N	
4	252	GL	00	34482	BV		
4	253	GL	00	34632		T=17°C	HARDPAN
4	254	GL	00	34782	BV		

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
4	255	GL	00	34932			HARDPAN
4	256	GL	00	35082			HARDPAN
4	258	GL	00	35382			HARDPAN
4	260	GL	00	35682	BV		
4	261	GL	00	35832	TJ	END REACH, OLD GRANDE RONDE	HARDPAN
5	262	GL	00	35922	SD/	11T 432067E/5017936N	HARDPAN
5	263	GL	00	36022	BV		HARDPAN
5	264	GL	00	36172	BV		HARDPAN
5	265	GL	00	36322	BV		HARDPAN
5	266	GL	00	36472	BV		HARDPAN
5	267	GL	00	36622	BV		HARDPAN
5	268	GL	00	36772	BV		HARDPAN
5	269	GL	00	36922	BV,WL		GREAT HORNED OWL
5	270	GL	00	37022	BV.WL	T=15°C; 11T 432021E/5017253N	GREAT HORNED OWL
5	271	GL	00	37172	BV		OXBOW/
5	272	GL	00	37322	BV		HARDPAN
5	273	GL	00	37472	BV		HARDPAN
5	274	GL	00	37622	WL,BV		TRAILS, CORMORANT, HARDPAN
5	275	GL	00	37772	BV		
5	276	GL	00	37922	BV	GPS OXBOW	OXBOW ENTERS ON RT
5	277	GL	00	38072	WL	T=14.5	DEER IN RIP; HARDPAN
5	278	GL	00	38222	BV	11T 432995E/5016594N	GEKELER LANE
5	279	GL	00	38372	BV		
5	280	GL	00	38522	BV		HARDPAN
5	281	GL	00	38672	BV		HARDPAN
5	282	GL	01	38822	TJ	HAWTHORN, MILL CR, END REACH	MILL CR, HARDPAN
5	283	GL	11		TJ/	11T 432086E/5016661N; T=14.5°C-MILL °CR	
6	284	GL	00	38955	BV,WL		TURTLE, HARDPAN
6	285	GL	00	39055	BV		HARDPAN
6	286	GL	00	39205	BV,WL	11T 431472E/5016513N	TURTLE-ORANGE ON BACK
6	287	GL	00	39355	BV		HARDPAN
6	288	GL	00	39505	BV		HARDPAN
6	289	GL	00	39655	BV,AM		BULLFROG, TADPOLES
6	290	GL	00	39805	BV		HARDPAN
6	291	GL	00	39955	BV		GARBAGE IN CR; HARDPAN
6	292	GL	00	40035	BV		HARDPAN
6	293	GL	00	40185	BV		DEAD JUV CARP, BV DEN; HARDPAN
6	294	RI	00	40213	BV		HARDPAN
6	295	SD	00	40215	BV		BV DAM
6	296	GL	00	40370	BV		BV DAM, HARDPAN
6	297	GL	00	40520	BV		HARDPAN
6	298	GL	00	40670	WL,BV		GREAT HORNED OWL; HARDPAN
6	299	GL	00	40820			HARDPAN
6	300	GL	00	40970	BV	T=17.5; 11T 430797E/5016607N	HARDPAN
6	301	GL	00	41070	WL		HAWK AND OWL; HARDPAN
6	302	GL	00	41220	WL		DEER IN RIP
6	303	GL	00	41370			HARDPAN
6	304	GL	00	41520	BV		HARDPAN
6	305	GL	00	41670	BV		HARDPAN
6	306	GL	00	41820	WL,BV	T=14°C	BV DEN, OWL, HARDPAN
6	307	GL	00	41970	WL	GREAT HORNED OWL,CINNAMON TEAL, 11T 430520E/5016666N	
6	308	GL	00	42070			HARDPAN
6	309	GL	00	42220	WL		GREAT HORNED OWL, HARDPAN
6	310	GL	00	42370			HARDPAN
6	311	GL	00	42520	WL,BV		GREAT HORNED OWL

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
6	312	GL	00	42670	SD,BV		HARDPAN
6	313	GL	00	42820			HARDPAN
6	314	GL	00	42970	WL,BV	END REACH	MUSKRAT, HARDPAN
7	315	GL	00	43120	/CS,BC	GODLEY LANE BRIDGE	HARDPAN, BOULDERS
7	316	PD	00	43236			ACW=10; .1 AT DEEPEST
7	317	GL	00	43335		T=28°C	HARDPAN
7	318	GL	00	43485			DEAD MUSKRAT, DEAD JUV CARP
7	319	PD	00	43536			HARDPAN
7	320	GL	00	43592			HARDPAN
7	321	GL	00	43742	BV		HARDPAN
7	322	GL	00	43892	BV,AM	MANY LARGE FEMALE BULLFROGS	8-10 BULLFROGS
7	323	PD	00	43957			ACW=10.5; LARGE CATTLE AREA
7	324	GL	00	44052			HARDPAN
7	325	PD	00	44115		11T 0430022E/50164994N	ACW=9.3M
7	326	GL	00	44265	BV		DEAD JUV, CARP, HARDPAN
7	327	GL	00	44365			HARDPAN
7	328	GL	00	44515			HARDPAN
7	330	GL	00	44815	/SD,CE/,CS		HARDPAN, CATTLE PATH
7	331	GL	00	44965	BV		HARDPAN
7	332	GL	00	45085			HARDPAN
7	333	PD	00	45149	BV		ACW=9.5M
7	334	GL	00	45266	BV	11T 429447E/5016910N	T=27°C
7	335	GL	00	45343	AM		ACW=9; BULLFROGS
7	336	GL	00	45489	WL, BV	T=34°C	GREAT HORNED OWL, HARDPAN
7	337	GL	00	45639	BV		HARDPAN
7	338	PD	00	45707			ACW=9M
7	339	GL	00	45768	/WL		MUSKRAT HOLES, HARDPAN
7	340	PD	00	45816			ACW=8; .1 DEEPEST
7	341	GL	00	45915	WL		TRAIL, HARDPAN
7	342	PD	00	46015			HARDPAN
7	343	GL	00	46080			HARDPAN
7	344	PD	00	46132		11T 429028E/5016572N	
7	345	GL	00	46316	BV	BULLHEAD CATFISH	BROWN BULLHEAD; DEAD CARP
7	346	GL	00	46380		T=35C; 11T 0428423E/5016755N	CATTLE/
7	347	GL	00	46460			DEEP POCKET; 1.1 DEEP
7	348	PD	00	46542		11T 428427E/5016751N-PDA	
7	350	GL	00	46757			DEAD CARP; HARDPAN
7	351	PD	00	46823			MAX D=0.28; ACW=9.5
7	352	GL	00	46856			HARDPAN
7	353	GL	00	46920			HARDPAN
7	355	GL	00	47115	BV		OVERFLOW PIPE INTO CR
7	356	PD	00	47163		T=33°C	ACW=8.5; MAX D=.4
7	358	GL	00	47359	BV	BV DEN ON RT BANK	BV DEN; HARDPAN
7	359	DU	00	47407			ACW=9M
7	360	PD	00	47557	TJ	MCALISTER SLOUGH	ACW=9M
7	361	GL	11		/TJ	MCALISTER SLOUGH TAKES WATER	MCCALISTER SLOUGH; HARDPAN
7	362	GL	01	47579	BV	FROM CATHERINE, END REACH, LOTS OF BV ACTIVITY	
8	363	GL	00	47708			HARDPAN
8	364	GL	00	47858		11T 428097E/5017030N	HARDPAN
8	365	RI	00	47907			METRIC
8	366	GL	00	48042		N. PIKEMINNOW; T=24°C	N. PIKEMINNOW
8	367	GL	00	48192	WL	GREAT BLUE HERON, DEAD CARP, HARDPAN	
8	368	RI	00	48333	BV,WL		GREAT HORNED OWL; 3 DEAD CARP
8	369	GL	00	48402			HARDPAN
8	370	GL	00	48552	DJ		HARDPAN

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
8	371	RI	00	48617		COWS IN STREAM	DEAD JUV °CARP; T=20°C
8	372	GL	00	48767	FC	11T 427860E/5016683N	
8	373	GL	00	48917	/CS	FLOOD EST-VERY WIDE	HARDPAN, CONCRETE SLABS
8	374	GL	00	49017		T=23.5°C; 11T 427657E/5015770N	HARDPAN
8	375	GL	00	49167		CORMORANTS, EGRETS, ROOKERY HERONS, HARDPAN CLAY	
8	376	GL	00	49317	/CS		HERON, CORMORANT; BLDRS
8	377	GL	00	49467	DJ,FC	CORMORANTS, HERONS	CORMORANT, ROOKERY
8	378	GL	00	49617	BV		
8	380	GL	00	49917	BV	SEVERAL DEAD JUV CARP	DEAD CARP, HARDPAN
8	381	GL	00	50067	BV	FPW EST- VERY WIDE	DEAD CARP, HARDPAN
8	382	GL	00	50167	WL,AM		TREE FROG, BARN OWL
8	383	GL	00	50317		2 BARN OWLS	
8	384	GL	00	50467			CATTLE TRAIL/
8	386	GL	00	50767	BV		HARDPAN
8	387	GL	00	50917	BV,AM	DEAD CATFISH; TRASH	BULLFROG, HARDPAN
8	388	GL	01	51067	/TJ	END REACH	LADD CREEK
8	389	GL	11			ACW=2.55M	LADD CREEK
8	390	RI	11			T=24°C	HARDPAN
8	391	SD	11		BV	STEP H=.4M	HARDPAN
9	392	GL	00	51187	BV	FPW EST-VERY WIDE	BEAVER DEN
9	393	GL	00	51337	BV	BV DEN/	3 BV DENS
9	394	GL	00	51487			DEAD CARP, HARDPAN
9	395	GL	00	51637			HARDPAN
9	396	GL	00	51787			HARDPAN
9	397	GL	00	51937		BC=WILKINSON LANE	
9	398	RI	00	51966	BC,CS/	426578E/5014429N	BOULDERS, HARDPAN
9	400	RI	01	52116			HARDPAN
9	401	RI	00	52266	AM	NAD 27-11T 426973E/5013574N; COWS IN CR, TREE FROG, HARDPAN	
9	403	GL	00	52544	DJ,/BV		HARDPAN
9	404	GL	00	52694	AM		TREE FROG
9	405	GL	00	52844		GREAT HORNED OWL	HARDPAN
9	406	RI	00	52909			HARDPAN
9	407	GL	00	53041			HARDPAN
9	408	GL	00	53191		T=22.5°C	HARDPAN=BEDROCK
9	410	GL	00	53431		11T 427312E/5012690N-NAD 27	HARDPAN
9	412	RI	00	53630		T=21°C; COWS IN CREEK	HARDPAN
9	413	SR	00	53635		HARDPAN	STEP OVER HARDPAN
9	415	GL	00	53836			HARDPAN
9	416	GL	00	53986			DEAD REDSIDE SHINER
9	417	GL	00	54136	DJ		HARDPAN
9	418	GL	00	54286	/SS,AM		CATTLE, TREE FROG
9	419	GL	00	54436			HARDPAN, METRIC
9	420	GL	00	54586			CATTLE TRAIL/
9	421	RI	00	54627		T=21.5°C	
9	422	BW	10		WL		GREAT HORNED OWL
9	425	GL	00	54768	BV	11T 427573E/5012010N; POSSIBLY BLUEGILL	
9	426	GL	00	54918	CS/		HARDPAN
9	427	GL	00	55068	BC,CE/,CS/	DEAD ADULT CHINOOK	BLDRS
9	428	GL	00	55218	/SS		HARDPAN
9	429	GL	00	55318			HARDPAN, T=22°C METRICS
9	430	GL	00	55468		11T 427108E/5011321N	HARDPAN
9	431	GL	00	55618		DEAD JUV. MALLARD	DEAD JUV MALLARD, HARDPAN
9	432	GL	00	55768			HARDPAN, SMALL MOUTH BASS
9	435	GL	01	55921	BV		HARDPAN, CLAMS, MUSSELLS
9	436	SC	00	55931		T=22°C	

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
9	437	PP	00	55939			MANY JUV FISH
9	438	SS	00	55945	SS,CS/CS	LOWER DAVIS DAM	END REACH
10	439	MX	00	59334		DAVIS DAM-MILLER LANE	NOT SURVEYED
11	440	GL	00	59484	FC		BRK=HARDPAN
11	441	GL	00	59634	/CS		CONCRETE SLAB, HARDPAN
11	442	GL	00	59784	BV		HARDPAN
11	443	GL	00	59793			HARDPAN
11	444	GL	00	59806	BV,WL		MUSKRAT HOLE, HARDPAN
11	445	GL	00	59836	BV		HARDPAN
11	446	SC	00	59840	BV		
11	447	GL	01	59848	/TJ,CS/CS	11T 428197E/5007735N	PYLES CR, RIPRAP, END REACH
11	448	GL	11		BV	T=18°C	PYLES CREEK
12	449	GL	00	59998	BV		BV DEN, HARDPAN
12	450	GL	00	60148			HARDPAN
12	451	GL	00	60308	BV		DEBRIS PILE W/JUV FISH
12	452	RI	00	60327	BV		
12	453	GL	00	60387	BV		
12	455	GL	00	60425		T=13.5C	
12	457	GL	00	60513	CS/		CONCRETE
12	458	RI	00	60555		11T 428508E/5007564N	
12	459	SP	00	60576	/CS		CARS AND RIPRAP; DEPTH EST.
12	460	RI	00	60637	BV		HARDPAN
12	461	SP	00	60660	AM	GREEN TREE FROG	TREE FROG, IRRIGATION DITCH/
12	462	RI	00	60714			HARDPAN
12	463	LP	00	60818	BV		
12	465	SP	00	60850	AM		TREE FROG
12	466	RI	01	60887	CS/		CONCRETE
12	468	BW	10		CS/,AM	COLUMBIA SPOTTED FROG	COLUMBIA SPOTTED FROG
12	469	GL	00	60946			HARDPAN
12	470	SC	00	60950	FC		
12	471	LP	00	61034	UD/,CS/		CONCRETE
12	473	LP	00	61114	CS/	EST-LEFT BANK HEFFNER PROP	CONCRETE; DEPTH EST.
12	474	RI	00	61129		NO ACCESS	
12	475	LP	00	61170	CS/BV		RIPRAP
12	476	SC	00	61175	BV		
12	477	LP	00	61227	BC,CS/CS	11T 428903E/5007349N	PRIVATE BC; RIPRAP
12	478	RI	00	61246	BV	T=14°C; FLOW-MF	
12	479	LP	00	61278	BV		
12	480	SC	00	61288	BV	AGRICULTURE (AG)/HEAVY GRAZING (HG) ,GRASS/HARDWOOD 50-90CM DBH	
12	481	LP	00	61347	/CS		OIL DRUMS AND COBBLE
12	482	RI	00	61368		FLOOD EST	
12	483	LP	00	61437		LF BANK HEFFNER	DEPTH EST.
12	484	SC	00	61441	BV	ALFALFA RT BANK	
12	485	LP	00	61563	CS/	FIELD	CABLED LOGS, BLDRS, CONCRETE
12	486	RI	00	61643	BV		
12	487	LP	00	61715			HARDPAN
12	488	GL	00	61786	SD/	11T 429185E/5007232N; T=14°C, FLOW=MF	
12	489	SP	00	61846		SALMON BUILDING REDD	REDD AND ADULT SALMON
12	490	SC	00	61857	/CS	HG/AG; GRASS/DECIDUOUS 3-15CM DBH, BOULDERS	
12	491	SP	00	61904	/CS		HARDPAN, BOULDERS
12	492	SC	00	61912		T=14°C; FLOW-MF; 11T 429507E/5006927N	
12	493	SP	00	61950			DEPTH EST
12	494	RI	00	61983	CS/		BLDRS
12	495	LP	00	62056	CS/CS		BLDRS
12	497	SP	00	62125	DJ		MANY JUV FISH

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
12	500	SC	00	62193		HG/AG; US/WF	
12	501	LP	00	62226	/CS		BLDRS
12	502	RI	00	62274	/CS	G/S	LOGS AND CONCRETE
12	503	LP	00	62336	AM	LG FEMALE BULLFROG	LG BULL FROG
12	504	SC	00	62342		FLOODPRONE ESTIMATED LEFT-NO ACCESS	
12	505	LP	00	62373			HARDPAN
12	506	RI	00	62413	/CS		CONCRETE
12	507	GL	00	62460		RIGHT BANK ESTIMATED - BARBED WIRE FENCE	
12	508	SC	00	62463	BV	11T 429694E/5006677N; T=12°C	
12	509	GL	00	62522	BV,CS/	BOULDERS, GOATS AND SHEEP IN RIPARIAN	
12	510	SP	00	62574		HG/AG; G/D30-50	IRRIGATION DITCH ON RT
12	511	RI	00	62598		IRRIGATION DITCH ENTERS ON RIGHT	
12	512	GL	00	62736			HARDPAN
12	513	RI	00	62786		TERRACE-CONSTRAINED; DEAD SALMON	
12	514	GL	00	62881			DEAD ADULT CHINOOK
12	517	SP	00	62978	/CS		HARDPAN, CONCRETE
12	518	LP	00	63009	/CS	T=12°C; 11T 430222E/5006626N	CONCRETE, BOULDERS (BLDRS)
12	523	SP	00	63127		CT/CT	
12	524	LP	00	63162	CS/		4-6" TROUT, BLDRS
12	526	LP	00	63244	CS/	HG/AG, D30-50/G	REDD, JACK AND ADULT SALMON
12	528	LP	00	63275		13°C, LOW FLOW, 11T 430349E/5006792N, JUVENILE WHITEFISH	
12	529	RB	00	63296	/SS,/CS		RIPRAP
12	530	LP	00	63331		RT BANK WASTE WATER TREATMENT PLANT	
12	533	RI	00	63465	CS/CS		BLDRS, RIPRAP
12	534	LP	00	63510	CS/		BLDRS, CONCRETE
12	535	SC	00	63519	CS/		BLDRS, CONCRETE
12	536	SP	00	63559	CS/	RR/HG, D15-30/G	CONCRETE BLDRS
12	537	RB	00	63572	CS/		CONCRETE
12	538	LP	00	63601	/CS	14°C, LOW FLOW; 11T 430612E/5006925N, LOGS AND BOULDERS	
12	539	RI	00	63658	/CS	END REACH	CONCRETE, BLDRS
13	542	LP	00	63820	CS/CS	11T 0430781E/5006830N; FP EST	BOULDERS
13	543	RI	00	63928	/CS	LIGHT GRAZING/URBAN, GRASS/DECIDOUS 30-50CM, BOULDERS	
13	545	RI	00	64090	/CS		BLDR, CONCRETE SLABS
13	546	LP	00	64149	SD/,CS/		CONCRETE SLABS
13	547	GL	00	64197	CS/		CONCRETE SLABS
13	548	RI	00	64347	BC,CS,GS,CE	BC=10TH STREET	CE, BLDRS
13	549	RI	00	64422	CS/,CE/		OVERFLOW FROM CULVERT, BLDRS
13	550	SB	00	64425	CS/CS	T=22.5°C	BLDRS
13	551	SP	00	64451	CS/CS		BLDRS
13	552	SB	00	64453	CS/CS	T=22°C	BLDRS
13	553	PP	00	64462	CS/CS	DIVERSION #1-SEE NOTEBOOK	BLDRS
13	554	SS	00	64462	CS/CS	H=.15M	CONCRETE WALL
13	555	PP	00	64468	CS/CS		CONCRETE WALL
13	556	SS	00	64468	CS/CS	H=.3; 11T 431705E/5006841N	CONCRETE WALL
13	557	PP	00	64474	CS/CS		CONCRETE WALL
13	558	SS	00	64477	CS/CS	H=.37M	CONCRETE WALL
13	559	DP	00	64536	/CS		BLDRS
13	560	RI	00	64686	BC,/CS	BC=5TH STREET	CONCRETE SLABS, BLDRS
13	561	RI	00	64711	CS/		BLDRS
13	563	RI	01	64793	CS/CS		BLDRS, CONCRETE WALL
13	564	BW	10			RETAINING WALL CREATES BW	MADE BY DIVERSION CONSTRUCTION
13	565	RI	01	64850		DIVERSION CONSTRUCTION	DIVERSION CONSTRUCTION
13	566	DC	02				02 CHNL
13	567	DP	00	64990	/CE,/CS	CREATED BY RETAINING WALL	PTC CAUSED BY SANDBAGS
13	570	PP	00	65031	UD	PP CAUSED BY DIVERSION DAM	CONCRETE

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
13	571	SS	00	65032	PA	H=.85; MAIN STREET DIVERSION	CONCRETE
13	572	DP	00	65071	/CS		CONCRETE, BLDRS
13	573	RI	00	65144	CS/CS		
13	574	GL	00	65181	CS/CS	URBAN LAND USE	BLDRS
13	575	RI	00	65331	CS/CS,BC	11T 432094E/5006609N; BC=BELLWOOD	
13	576	RI	00	65481	CS/CS		CONCRETE SLABS
13	577	RI	00	65509	CS/		CONCRETE
13	578	SB	00	65509	CS/	H 0.25M	CONCRETE SLABS
13	579	RI	00	65621	CS/,BV	LANDOWNER STABILIZED BANK	BLDRS, CONCRETE
13	580	SB	00	65622	/CS,BV	T=16°C, H=0.3M	BOULDERS
13	581	DP	00	65646	/CS	CREATED BY ROCK DAM	BOULDERS
13	582	RI	00	65796	/CS		CONCRETE
13	583	RI	01	65946	/TJ.CS/,CE		PLACED LOGS
13	584	RI	11			T=17°C	ACW=1.1
13	585	RI	01	66096	CS/CS		BOULDERS, CONCRETE
13	587	RI	00	66136	CS, CE/		PVC, BLDRS, CONCRETE
13	588	SS	00	66149	CS/CS	SWACKHAMMER, HWY 203 BC	CONCRETE WALLS
13	589	RI	00	66299	SD,UD,CE,BC		BC, CS,
13	590	RI	00	66449	CS/CS	11T 432530E/506670N; T=17°C	BOULDERS, END REACH
14	591	RI	00	66545	CS/		BOULDERS
14	592	SB	00	66545		11T 433165E/5006366N; H=.15M	
14	593	LP	00	66561	/UD,/CS		BOULDERS
14	594	RI	00	66711	/CS		BOULDERS
14	595	RI	00	66861	CS,CE		AG FIELD DUMPING IN CR
14	596	RI	00	67011	CS/CS		BOULDERS
14	597	RI	00	67161	CS/CS		BOULDERS
14	598	RI	00	67311	CS/CS,WL		DEER, BLDRS
14	599	RI	00	67461	CS/CS,WL		BLDRS, DEER
14	600	RI	00	67541	CS/CS,WL		BLDRS, DEER
14	601	RI	01	67691	CS/CS		
14	602	BW	10		CS/	11T 433806E/5005632N, 2D, FRY IN BACKWATER, BOULDERS	
14	603	RI	00	67724	CS/	T=17°C	BOULDERS
14	604	SC	00	67730		LIGHT GRAZING	
14	605	RI	00	67811	CE/		SEEPING AG FIELD
14	607	RB	00	67862	CS/		BOULDERS
14	608	RI	00	68012	CS/		BOULDERS
14	609	RI	00	68162	/WL		CATTLE IN RIP
14	610	RI	00	68312	CS/		BOULDERS
14	611	RI	00	68462		FLOOD PRONE EST.	
14	612	RI	00	68522		11T 434204E/5004956N, 3D	
14	613	SP	00	68555		T=19°C	
14	614	RI	00	68705	CE/*2	UNCONSTRAINED	.3M DIAM, .18 DIAM
14	615	SS	00	68705		H=1.0M	H=1.0M; DAM DIVERSION, WD SLAT
14	616	DP	00	68749	UD,CS/CS		BLDRS, CONCRETE
14	618	LP	00	68804	CS/CS		CARS, BLDRS
14	619	RI	00	68954	BC,CS/CS		BLDRS, CONCRETE, SLABS
14	620	RI	01	69104	TJ/	TJ/	LITTLE CREEK
14	622	RI	11		FC	T=18°C	ACW=3.5M
14	623	RI	00	69227	WL	BIRD	
14	624	SS	00	69228	CS/CS	H=.35M	CONCRETE WALLS
14	625	PP	00	69233	CS		
14	626	SS	00	69233	CS	H=.25M	
14	627	PP	00	69239	CS	S/D15-30	
14	628	SS	00	69239	CS	H=.3M	
14	629	PP	00	69245	CS	T=18.5°C	

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
14	630	SS	00	69245	CS	11T 434804E/5004571N; H=.3M	
14	631	PP	00	69250	CS		
14	632	SS	00	69251	CS/CS	11T 434979E/5004347N, H=.3M-WEIR	CONCRETE WALLS
14	633	PP	00	69256	CS		
14	634	SS	00	69257		H=.3M	
14	635	PP	00	69287			FISH BYPASS,TRAP
14	636	RI	00	69437	UD/		
14	637	RI	00	69587			
14	638	RI	01	69737		T=13°C; DRY IRRIGATION CANAL/	
14	639	IP	10			FRY IN ISOLATED POOL	FISH
14	640	RI	00	69887	CS/	DIVERSION	BOULDERS
14	641	RI	01	70004	CS/CS,FC		CONCRETE, BLDRS
14	642	IP	10			FISH IN IP, LG/RR, D30-50/S	JUV FISH
14	643	SC	00	70016	WL		TRAIL, GRAZING
14	644	RI	00	70166	CE/	11T 435320E/5003727N	POND DRAINING INTO CREEK
14	645	RI	00	70237	CS/	END REACH	BOULDERS
15	646	MX	00	72056		SHORT/SOUTHERN CROSS RANCH PR(	11T 435320E/5003727N-NO ACCESS
16	647	RI	01	72206		T=16°C, CA/CT	11T 436463E/5002628N
16	648	BW	10		BV		
16	650	SC	03				SET UP MANMADE ROCK PILE
16	651	DP	03				WASHED OUT DIVERSION
16	655	PD	02				ACW=3.1M
16	656	DU	02			FLOWING THROUGH ROCKS	ACW=3.6
16	662	LP	00	72394		11T 436673E/5002455N	IRRIGATION CANAL/
16	663	RI	00	72544	CS/, /SS	HEAVY GRAZING	
16	667	RI	01	72674	CS/		CONCRETE SLABS
16	668	AL	10			T=16°C, HARDWOODS 30-50CM DBH AND GRASS	
16	669	SP	00	72725		MULTIPLE TERRACES	
16	671	RI	00	72812		DECIDUOUS TREES 30-50CM DBH/GRASS, T=18C	
16	672	LP	00	72842		2 LG BULLTROUT	30+ TROUT/SALMONID
16	673	RI	00	72958	BV,CE/CS		REDD, BLDR
16	674	LP	00	72996		LIGHT GRAZING, EXCLOSURE	BULLTROUT
16	676	IP	10				MANY JUV FISH
16	677	LP	00	73040		LARGE BULLTROUT	~25" BULLTROUT
16	678	RI	00	73078	CS/		CONCRETE
16	679	SD	00	73080	BV	11T 437085E/5002195N	BLDR, CONCRETE STEP
16	680	RI	00	73120	BV,UD		FISH BYPASS-OVERFLOW CULVERT
16	681	LP	00	73188	CS/	SPRING CHINOOK	BOULDER, WHITEFISH
16	682	RI	00	73255		11T 437211E/5001816N	
16	683	LP	00	73301	BV	2 CHINOOK SALMON	OTTER, CHINOOK
16	684	SC	00	73305		S/D30-50	
16	685	RI	00	73455	FC./CE,/UD		
16	686	RI	00	73605			COWS IN CR
16	687	RI	00	73755	BV,SD/		
16	688	RI	00	73905		DEEP POCKETS LEFT BANK	
16	689	RI	00	73975		T=20°C, CA/CT	
16	690	LP	00	74006	CS/	REDD ON TAILOUT	BOULDERS
16	691	RI	00	74134	CS/		BOULDERS
16	692	LP	00	74202		HG/RR, G/D3-15	BOULDERS
16	693	RI	00	74352	CS/,BV		BOULDERS
16	694	RI	00	74491	CS/CS,BC	11T 437857E/5001073N	KIRBY'S PROP
16	695	RI	01	74526			COWS IN CREEK
16	696	IP	10			UNCONSTRAINED	
16	697	RI	00	74676		DECAYED SALMON CARCASS	
16	698	RI	00	74826	SD/,CE/		0.3M DIAM

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
16	699	RI	00	74976	CS/		
16	700	RB	00	75069	BV,CS/	T=15°C	BOULDERS
16	701	RI	01	75219	SS/		UNDER HWY 203
16	702	DC	02			11T 438406E/5000394N	ACW=1.4
16	703	RI	00	75287	WL	BIRD	
16	704	LP	00	75328	DJ	SALMON IN POOL	REDBAND
16	705	RI	00	75478	/SS,BV	T=18.5°C	30" BULLTROUT
16	706	RB	00	75628	/CS		
16	707	GL	00	75710	BV	3 SALMON IN GLIDE	3 CHINOOK
16	708	RI	01	75860	AM,BV		FROG
16	709	PD	02		AM		ACW=1.6M, FROG
16	710	RI	01	76010	BV,BC,CS/CS	BC	ACW=2.0
16	711	DC	02			2 SM PUDDLES	
16	712	RI	01	76115	WL,BV,/TJ	T=14.5°C, END REACH	BRINKER CR
16	713	CB	11			T=18°C, BRINKER CR	ACW=0.8M, HARDPAN
17	714	RI	00	76265	GS,WL	T=20°C	
17	716	RB	00	76565	CS/		BLDRS
17	717	RB	00	76646	CS/	NO TERRACES, HILLSLOPE	BLDRS
17	718	RI	00	76778	CS/	REDD, CH/MV	REDD, BLDRS
17	719	RB	00	76828	SS/,CS/	6 SALMON; G/D30-50	CH
17	720	RI	00	76978	CS/	11T 439408E/5000513N, SALMON	CH
17	721	RI	00	77128	BC,CS/CS	BC PRIVATE	BLDRS, CONCRETE
17	722	RI	01	77278	/TJ		TREEFROG
17	723	CB	11			T=15°C	ACW=1.2M
17	724	RI	00	77428		CHINOOK	
17	725	RI	00	77578	WL, SS/		DOE
17	726	RI	00	77728	CS,BC,WL	6 CHINOOK	SNAKE, 11T 440180E/5000085N
17	727	RI	01	77833	/TJ		UNNAMED TRIBUTARY
17	728	RI	11			T=17°C	ACW=1.0M
17	729	BW	10		WL, CS/	CT/CT	BLDRS, PRINTS
17	730	LP	00	77875		11T 440287E/500009N; CHINOOK IN POOL	
17	731	RI	00	78025	BV,CS/	CHINOOK	BLDRS, CONCRETE
17	732	RI	00	78036			
17	735	LP	00	78113		T=18°C	
17	736	RI	01	78188	BV		
17	737	IP	10				JUV FISH
17	738	LP	00	78213			DEPTH ESTIMATED
17	739	RI	00	78273	BV		
17	740	RI	01	78333	/CS	11T 440781E/5000024N	BLDRS
17	743	RI	00	78506	/CE	OLD BROKEN CONCRETE CULVERT, OLD IRRIGATION	
17	744	RI	01	78626		CHINOOK PAIR IN SIDE CHANNEL	CHINOOK
17	747	RI	01	78820			ADULT CHINOOK
17	748	RI	01	78840			CATTLE IN CR
17	749	BW	10				JUVENILE CHINOOK
17	750	LP	01	78867	DJ	2 ADULT CHINOOK	ADULT CHINOOK
17	751	RI	01	79017		DEAD CHINOOK PAIR	JUVENILE CHINOOK - DEAD
17	752	RI	01	79094	AM		TREE FROG, SNAKE
17	753	LP	02			11T 441363E/5000090N	
17	754	RB	02			HG/ST; 30/G	
17	756	PD	02			DENSE HAWTHORN; T=14°C	JUVENILE FISH
17	758	PD	02		BV	FISH IN PUDDLES	JUVENILE FISH
17	759	RI	0	79265		END REACH	
18	760	RI	00	79265	BV	REACH BREAK=STATE PARK	
18	761	RI	00	79419	BV	11T 0441470E/5000172	STACKED ROCKS BY PARK POOLING
18	762	SP	00	79443	DJ	GREENWAY/OLD GROWTH; 11T 441853E/5000084N	

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
18	763	RI	01	79505	BV		
18	764	LP	01	79590	BV	T=18C, TWO SALMON REDDS	2 REDDS
18	765	RI	02		TJ/	D3-15/C30-50	(5) SALMON
18	766	LP	11		BV		JUV FISH, ACW=18M
18	768	SP	01	79736		2 SALMON, REDD	SALMON, REDD
18	770	LP	04				JUVENILE CHINNOK, SNAKE
18	775	LP	04		BV		
18	776	RI	04		BV		
18	777	SR	03			H=.15M	HARDPAN
18	778	RI	03		BV, DJ		ACW=1.8M, JUVENILE FISH
18	779	PD	05		DJ		ACW=2.0M
18	780	LP	03		BV		
18	781	DC	06				ACW=1.0M
18	782	SP	03		BV,DJ	END CATHERINE CREEK STATE PARK	END REACH
19	783	RI	00	79812	BV	11T 0442212E/4999702N	REDD
19	784	BW	10		BV		
19	785	SP	00	79836			SM ROCK DAM BUILT BY SWIMMERS
19	786	SD	00	79837	BV	H=.5M	STEP FORMED BY CAMPERS
19	787	RI	00	79987	BV,BC	11T 442374E/4999556N	FOOTBRIDGE
19	788	RI	00	80137		OG/UR	REDD
19	789	RI	00	80287	BV,SD	T=11°C	
19	790	RI	00	80410	SD		
19	793	PD	02				ACW=1.2M
19	797	RI	00	80743	BV		
19	799	RI	00	81043	BV		
19	800	RI	00	81100	BV, AM	TREE FROG	LARGE TREES CHEWED, TREE FROG
19	801	SP	00	81130	/SS	JUV CHINOOK	
19	802	RI	00	81280	CS/,BV	ARTISAN WELL LF BANK	
19	803	RI	00	81305		LT/ST; T=10°C	
19	804	SP	00	81327		11T 443200E/4998985N; 3 ADULT CHINOOK	
19	805	RI	00	81477	BC,CS/CS		HWY 203, BLDRS
19	807	SC	00	81508		CL/CT	
19	809	LP	00	81604	BV	3 SALMON IN POOL	ADULT CHINOOK
19	810	RB	00	81620		2 REDDS	REDDS, SALMON
19	811	LP	00	81648		5 SALMON	REDD, ADULT CHINOOK
19	812	RI	01	81656	/TJ	T=12°C, END REACH	LITTLE CATHERINE CR
19	813	DC	11			11T 443278E/4998798N	UNNAMED JUNCTION ON TOPO
19	814	RI	11			T=10.5°C, LITTLE CATHERINE CR	LITTLE CATHERINE; ACW=7.6M
20	815	RI	01	81689	BV	T=11°C	
20	817	RB	01	81734	BV		
20	818	LP	01	81767		11T 443340E/4998695N; 1 REDD	
20	819	RI	01	81809	BV	LIGHT GRAZING / LARGE TIMBER	
20	820	RI	02				ACW=8.0M
20	822	SC	02		BV		
20	823	LP	02			LITTLE CATHERINE CONFLUENCE	
20	824	RI	02		TJ/		LITTLE CATHERINE
20	826	RI	02		BV,TJ/	UNNAMED TRIB	
20	827	DC	11				ACW=0.75M
20	828	SR	03			H=.25M	HARDPAN
20	829	RI	03				HARDPAN
20	831	LP	04				ACW=2.0M, CLAY
20	833	LP	01	81850			2 ADULT CHINOOK
20	834	SC	01	81860			2 ADULT CHINOOK, REDD
20	835	LP	01	81900		2 SALMON, LARGE REDD	REDD
20	837	PD	02		BV		02 CHNL, ACW=8.0

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
20	838	DU	02		BV		02 CHNL
20	839	PD	03				03 CHNL, ACW=1.7
20	840	PD	04				04 CHNL, ACW=1.1
20	841	LP	01	81947			JUVENILE CHINOOK
20	842	RI	01	81995	BV	MILK CREEK OFF SIDE CHANNEL, BUT HERE FOR DISTANCE-SAKE	
20	843	SC	05		BV		05 CHNL
20	844	LP	05		BV		05 CHNL
20	845	RI	05		/CS,BV./TJ		
20	846	SP	11		BV	END REACH; T=15°C, ACW=3.3M	MILK CREEK, ACW=3.3
20	847	RI	05		BV	T=17°C	
21	848	LP	01	82025	BV	REDD	
21	849	RI	01	82053	BV		
21	850	LP	06				JUVENILE FISH
21	851	RI	06				ACW=13.0
21	854	PD	06				ACW=1.5
21	855	LP	01	82109		SALMON	LARGE REDDS, 2 ADULTS
21	856	RI	01	82153	BV,DJ	SALMON	ADULT CHINOOK
21	857	DU	06		BV		ACW=2.6
21	858	PD	06		BV		ACW=2.2
21	859	RI	05		BV	REDD	REDDS
21	860	SP	05		BV		
21	861	RI	00	82303	BV/FC	DEEP POCKETS W/ 5 SALMON	MAIN CHNL
21	862	RI	01	82386		11T 443677E/4998266N; T=10°C, SALMOI	MANY CATTLE IN RIP
21	863	LP	01	82404	BV	LIGHT GRAZING, SECOND GROWTH TIMBER	
21	864	RI	01	82496	BV		
21	865	LP	01	82541	BV		
21	867	RI	03		BV		03 CHNL
21	868	LP	03			CT/CT	
21	869	SC	03		BV	D3-15/G	
21	870	LP	03		AM		COLUMBIA SPOTTED FROG
21	871	RI	03		BV		
21	872	LP	01	82600	DJ		
21	873	RI	01	82633	FC		
21	874	DU	04		WL	T=17°C	ACW=5.2, GROUSE
21	875	PD	04		DJ	US/WF	PTC GOES TO DRY UNIT
21	878	LP	01	82685		11T 443995E/4998187N	REDD, ADULT CH
21	879	SC	01	82690	BV		ADULT CH
21	880	LP	01	82713	BV	TAKEN ON PTC	REDD
21	881	SC	01	82721	BV		
21	882	LP	01	82753	BV	REDD, 2 SALMON	REDD, 2 ADULT CH
21	884	SP	01	82769	BV		
21	885	RI	01	82822	BV		
21	886	BW	10		BV		
21	887	PD	06		BV		ACW=2.3M
21	888	PD	05		BV,AM	COLUMBIA SPOTTED FROG	CATTLE TRAFFIC
21	889	DU	05		BV		HEAVY CATTLE TRAFFIC
21	890	PD	05		DJ,BV		ACW=2.7M
21	891	LP	05		DJ		
21	892	PD	05		DJ,BV		ACW=4.0M
21	895	LP	01	82891			REDDS, 4 ADULT CHINOOK
21	896	RI	01	82986	BV,DJ	4 REDDS, 2 SALMON	WILD CHINOOK ON REDD
21	897	DU	06		BV		ACW=1.5M
21	898	PD	06				ACW=3.8M
21	902	LP	01	83017		2 SALMON, 1 REDD	BULL TROUT
21	903	RI	01	83074		REDD	REDD

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

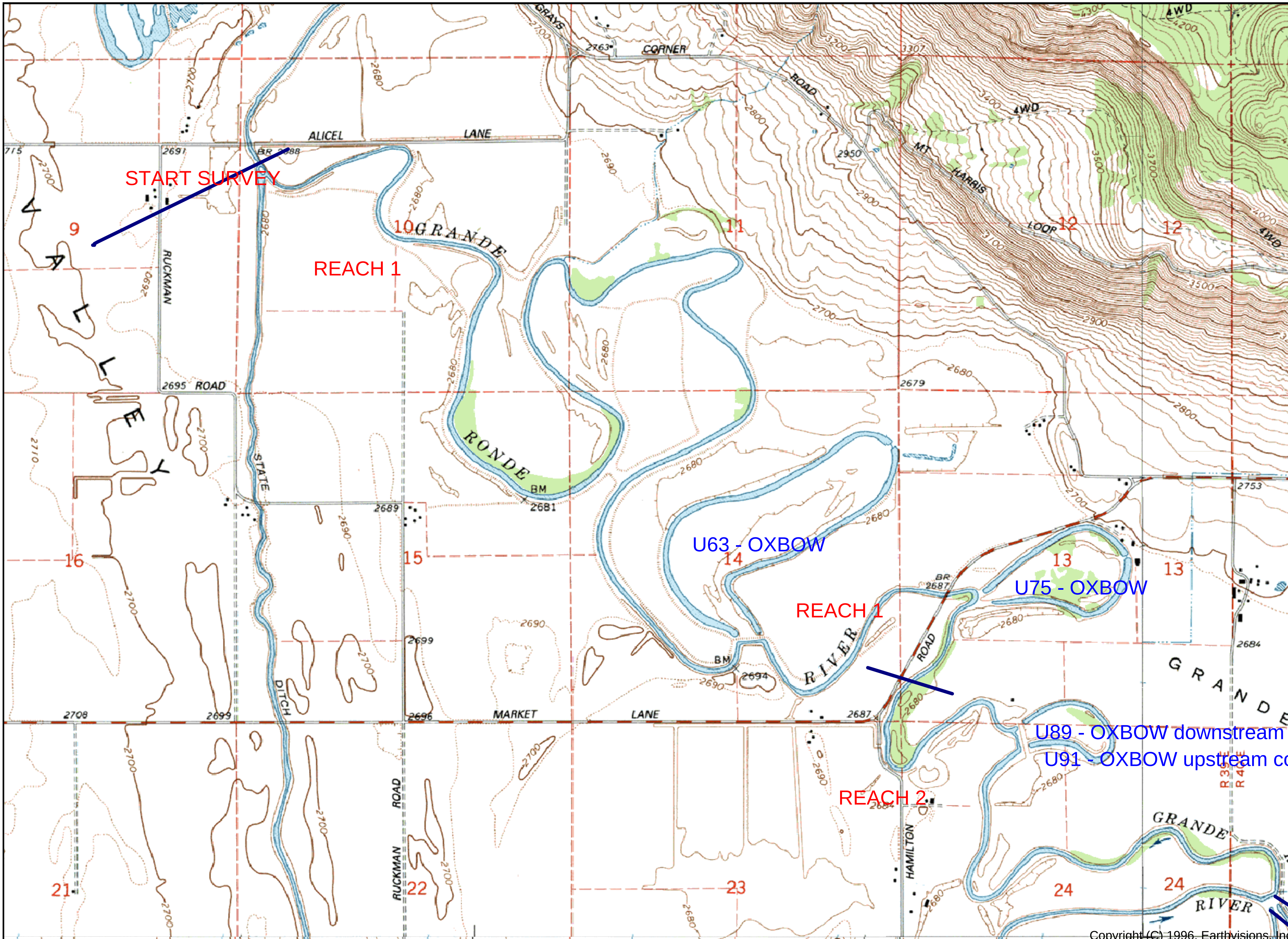
REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
21	906	SP	01	83108			REDD, SEVERAL TROUT
21	907	SC	01	83109	BV	LIGHT GRAZING, LARGE TIMBER	
21	908	RI	01	83184	BV,DJ	4 SALMON, 2 REDDS	MULTIPLE CHANNELS
21	909	LP	01	83207		11T 444281E/4997811N	POST SPAWN HATCHERY MORTALITY
21	910	SC	01	83215			
21	911	LP	01	83243		REDD	REDD AT PTC; SALMON
21	912	PD	02		BV		ACW=1.7M
21	914	PD	02				CATTLE TRAFFIC
21	915	RI	00	83393	DJ,BV		2 REDDS, 4 SALMON, 1 JACK
21	916	RI	00	83503	BV	3 ADULT CHINOOK, JACK, REDD	REDDS
21	917	RB	00	83526		REDD, SALMON	ADULT SALMON
21	919	BW	10				HATCHERY MALE CHINOOK
21	920	RI	01	83730	BV	3 SALMON, 2 REDDS	
21	921	IP	10				HEAVY CATTLE TRAFFIC
21	922	BW	10			LG/ST; T=8C; CT/CT	ADULT CHINOOK
21	923	RI	01	83772		ST, CT/CT, REDD, SALMON	
21	924	IP	10			S/G	MANY JUV FISH
21	925	LP	00	83786		11T 444659E/4997401N; SALMON	REDD, SALMON
21	928	LP	01	83919	DJ	3 SALMON BUILDING REDDS	REDD, ADULT CHINOOK
21	931	RI	01	84068	BV,/SS		
21	934	LP	02			5 REDDS, MANY SALMON	REDD ON PTC
21	935	SC	02				ACW=9.0M
21	938	PD	03		BV		
21	939	DC	04			2 SALMON, 2 REDDS	ACW=4.0M
21	940	RI	03				ADULT HATCHERY CHINOOK
21	941	LP	03		BV	REDD	
21	942	SP	01	84114		2 SALMON, 2 REDDS	ADULT CHINOOK
21	943	PD	05		DJ	DEAD SALMON	ACW=4.0M, CHINOOK
21	944	RI	01	84163	FC		MALE ADULT CHINOOK CARCASS
21	945	LP	01	84180		2 REDDS, 1 SALMON	REDDS
21	946	RI	01	84298	BV		4 REDDS, SALMON
21	947	BW	10		WL		TRACKS
21	948	BW	10		BV, DJ	6 REDDS, MANY SALMON	
21	949	PD	06				ACW=7.0M
21	951	LP	06		ACW=2.9M		
21	952	DU	06		ACW=5.5M	LARGE AND SECOND-GROWTH TIMBER	
21	953	LP	01	84326		1 REDD, 2 SALMON	REDD
21	954	RI	01	84429	FC,/CS		BOULDERS
21	955	PD	05			11T 444980E/4996923N	
21	956	DU	05		FC	T=9.5°C	
21	957	LP	00	84453	BV,/CS	2 SALMON, 1 REDD	REDD, BOULDERS
21	958	RI	01	84561	CS/	1 REDD	REDD, BOULDERS
21	959	RB	02			TERRACES	
21	960	RI	00	84648		5 SALMON, 3 REDDS	MULTIPLE REDDS, ADULTS
21	961	LP	00	84679		3 SALMON, 2 REDDS	
21	962	RB	01	84721	/CS		REDD, ADULT CH
21	963	LP	01	84750		DEAD SALMON-SPAWNED	MORTALITY - POST SPAWN FEMALE
21	964	SC	02		BV		
21	965	LP	02		BV		
21	967	RI	01	84900			2 JACKS, 2 ADULT CH
21	968	DC	03		BV	2 JACKS, 5 ADULTS, 2 REDDS	ACW=3.2M
21	970	RB	01	84969		1 SALMON	
21	971	RB	02		CE/,CS/	BOULDERS, UMATILLA ACCLIMATION POND	
21	972	SP	00	85004		2 SALMON, 1 REDD	JACK
21	973	RB	00	85022		LARGE AND SECOND-GROWTH TIMBER	

CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
21	974	SP	00	85043	BC,CS/CS	T=7.5°C; 3 SALMON, 2 REDDS	REDDS, 3 ADULT CHINOOK
21	976	RI	00	85343	BV	T=7.5°C	
21	977	RI	00	85359			2 REDDS
21	978	SP	00	85384		2 SALMON, 1 REDD	ADULT CHINOOK
21	979	RI	00	85505		SPAWNED HEN CHINOOK	SALMON CARCASS
21	980	RP	00	85548		445476E/4996747N	
21	981	RI	00	85651		REDD, SPAWNED MALE	CHINOOK CARCASS
21	982	RP	00	85676	CS/	2 REDDS	REDDS, CARCASS
21	983	SB	00	85677	CS/	ST/LT; S/D3-15; H=.32	BOULDERS
21	984	RI	00	85716	CS/	11T 445985E/4996372N	BOULDERS
21	985	RI	01	85787	WL	3 REDDS, 2 SALMON	PILEATED WOODPECKER
21	987	LP	01	85871	BV	2 REDDS, 4 SALMON, 1 JACK	CHINOOK CARCASS
21	988	RI	02		TJ/	T=10.5°C; 7 SALMON, 3 REDDS	5 CH SALMON
21	989	RI	11		BV	T=15°C;11T 445982E/4996376N	ACW=1.3M
21	990	RB	01	85944		1 SALMON, 1 REDD	
21	991	LP	03		BV,WL		
21	992	RI	04		DJ,BV		
21	993	SD	04		BV	H=.15M	WATER RUNS UNDER BV DAM
21	994	BP	04		BV		DRY BV DAM
21	995	RI	03		BV		
21	1000	RI	00	86091	BV	4 SALMON, 3 REDDS	JACK MORT
21	1002	RB	00	86166		RR/LT; D3-15/S	
21	1005	RI	00	86343		3 REDDS, 2 SALMON	
21	1006	RI	01	86385			REDD, SALMON
21	1008	LP	00	86421		2 REDDS, 2 DEAD SALMON	REDD, SALMON
21	1010	RI	00	86468		1 REDD, 3 SALMON, 11T 446429E/4996201N	
21	1011	SD	00	86468		H=.25M	DAM BUILT BY ROCK PILES
21	1012	DP	00	86480	CS/CS,BC	SPRUCE, GRAND FIR	FOOTBRIDGE, REDD
21	1013	RI	00	86516	CS/CS	6 SALMON, 3 REDDS	CABLED LOGS
21	1014	SD	00	86518	CS/CS	H=.37M	CABLED LOGS, BLDRS
21	1015	RI	00	86668	CS/CS	3 REDDS	REDDS, 2 ADULT CH
21	1017	RI	01	86879	TJ/	T=9C	UNNAMED TRIB
21	1018	RB	11			11T 446926E/4996094N; T=12C	ACW=3.5M
21	1020	SP	01	86906		ST/LT; D3-15/C30-50	
21	1021	RB	01	86999			2 CH CARCASSES
21	1023	LP	02		BV		
21	1025	RI	00	87149	/SS	REDD	JACK MORT
21	1027	BW	10		AM	2 SALMON, 1 REDD, 2 C.SPOTTED FRO(	COLUMBIA SPOTTED FROG
21	1028	RI	01	87372	AM		TREE FROG, HATCHERY CH
21	1030	LP	01	87392	BV		
21	1032	SC	00	87397		11T 447415E/4995823N	
21	1033	RI	00	87491	BV	2 REDDS, 2 SALMON	2 REDDS, SALMON
21	1034	RB	01	87630	/TJ,/SS	D3-15/S; LT/ST	
21	1035	CB	11		WL	447509E/4995854N	
21	1036	BW	10			T=11C	
21	1038	RI	02		CS/		BLDRS
21	1039	RB	02		CS/		BLDRS
21	1040	RI	02		CS/	REDD, T=9.5°C	BLDRS
21	1041	LP	00	87684			CH SALMON, CARCASS
21	1043	RI	01	87721	/TJ		SCOUT CREEK
21	1044	CB	11			SCOUT CR, T=10.5°C	END REACH
22	1045	RI	00	87871	BC,CS/CS	BC,11T 447667E/4995925N	CARCASS
22	1051	RI	00	88099	CS/		BLDRS
22	1052	LP	00	88126		REDD; D3-15/C15-30; ST/LT	
22	1054	RI	00	88192			CH CARCASS

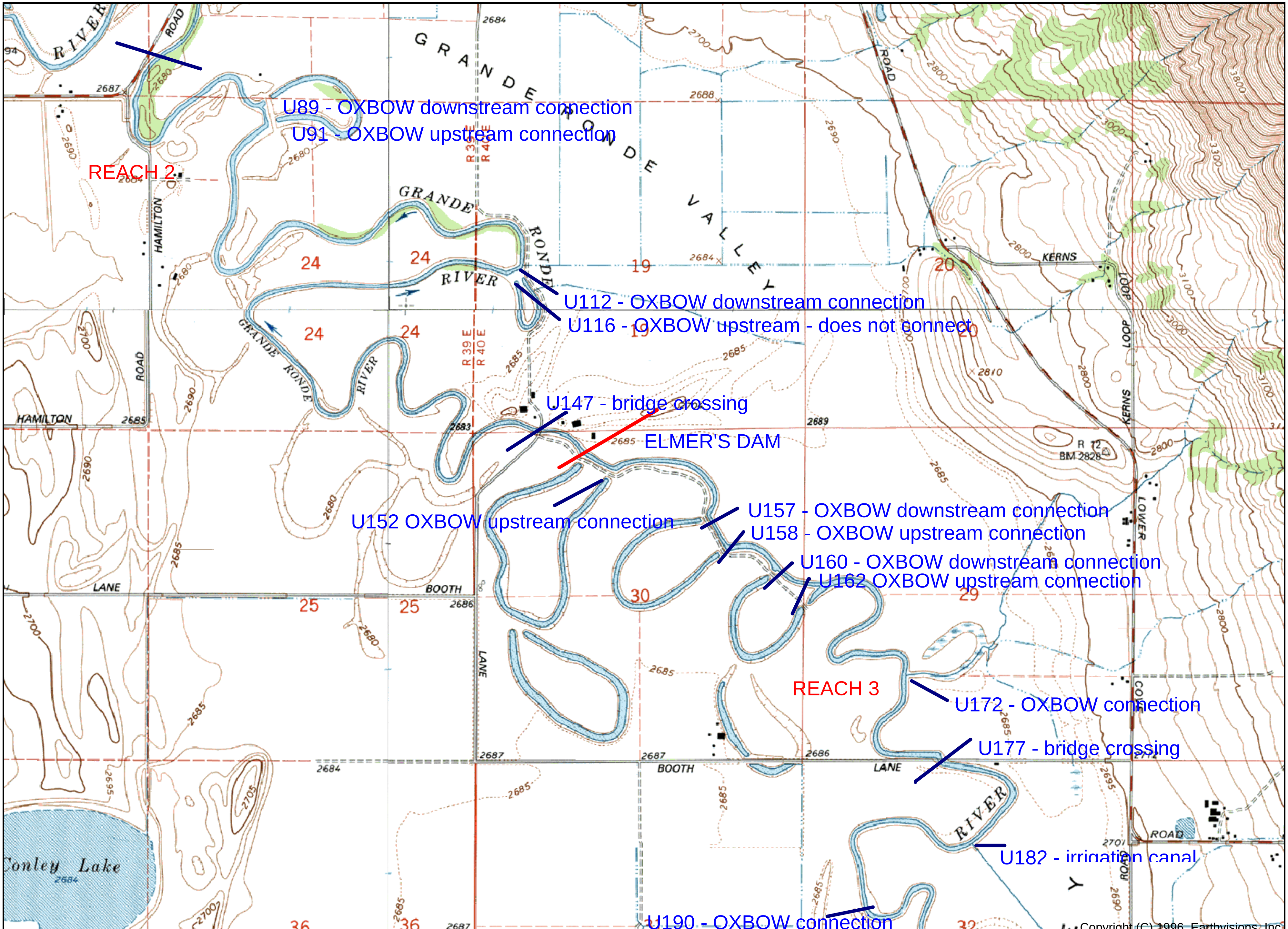
CATHERINE CREEK (GRANDE RONDE RIVER BASIN) - SUMMER 2010

REACH	UNIT#	TYPE	CHAN	DIST.(m)	COMMENTS	NOTE_ESTIMATOR	NOTE_NUMERATOR
22	1055	RB	00	88326	WL	REDD	CH CARCASS
22	1056	RB	01	88438		REDDS	
22	1057	RI	02			11T 447909E/4996265N	
22	1058	LP	02			REDD	REDD
22	1060	RB	02			T=11°C	
22	1063	RB	01	88502	BV	DEEP POCKET-10M LONG	
22	1064	RB	01	88603	DJ		HEN CH CARCASS
22	1065	RI	04		DJ		
22	1067	SP	01	88617			REDD, SALMON
22	1068	RB	01	88641			MALE CH CARCASS
22	1069	SP	01	88661	BV		CHINOOK CARCASS
22	1072	SP	01	88699		11T 448491E/4996438N; T=8°C	REDDS
22	1073	RI	01	88820	/SS	2 REDDS	
22	1074	RI	03		CS/,CE/	BOUDERS, CORRUGATED CULVERT	
22	1075	RB	03		CS,,CE/,SS		
22	1077	RB	03		BV		
22	1078	PD	05		BV		
22	1079	RI	00	88970	CE/	ST/LG; D3-15	TWO CULVERT ENTRIES
22	1080	RI	00	89066		REDD	REDD
22	1081	RB	00	89216	CE/		MALE CH CARCASS, 3 REDDS
22	1082	RB	01	89366	CE/		CHINOOK CARCASS
22	1084	RB	00	89410		END SURVEY, 11T 449053E/4996458N; CONF SF AND NK CATHERINE	



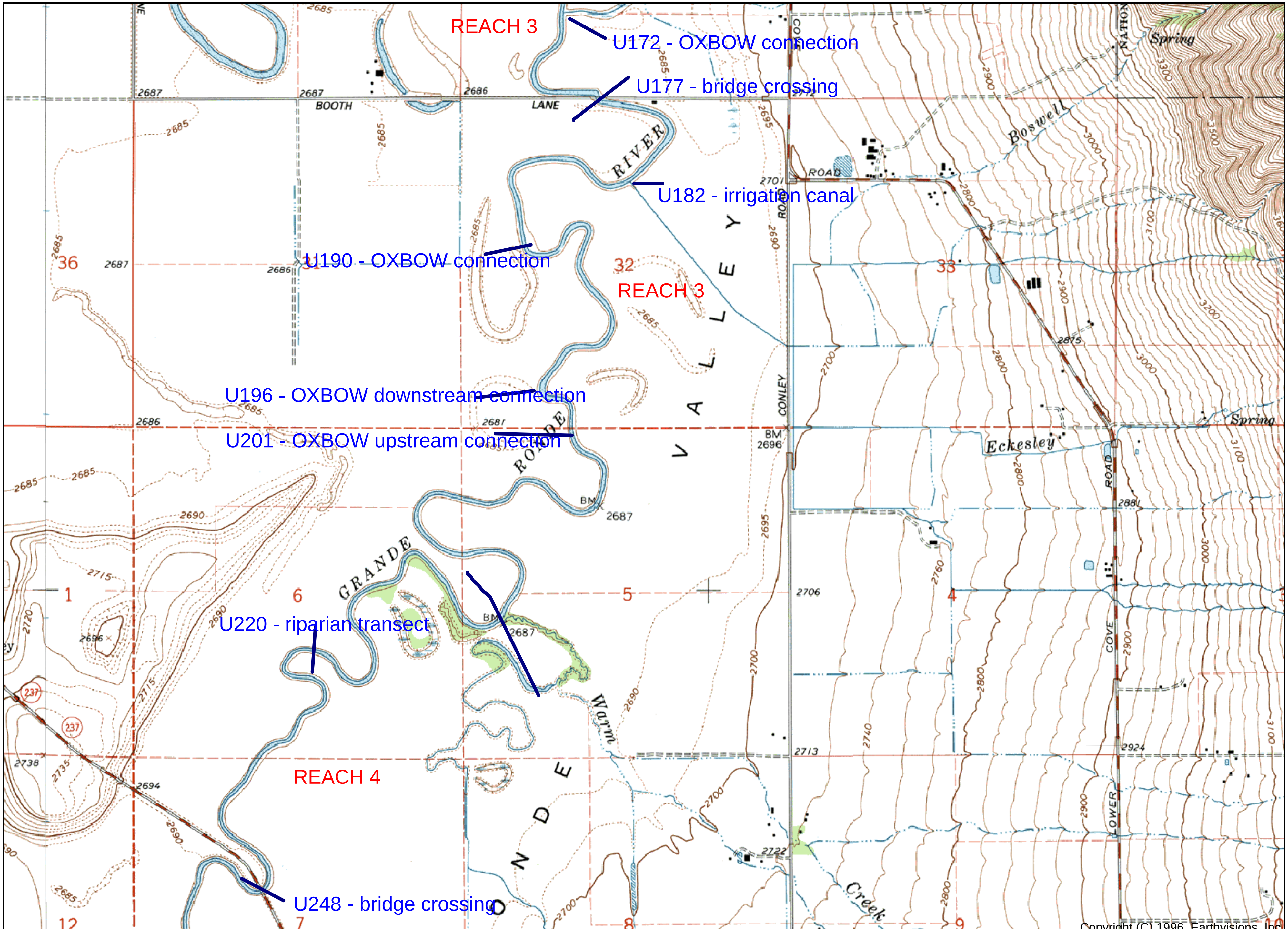
Name: IMBLER (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
2010 SUMMER



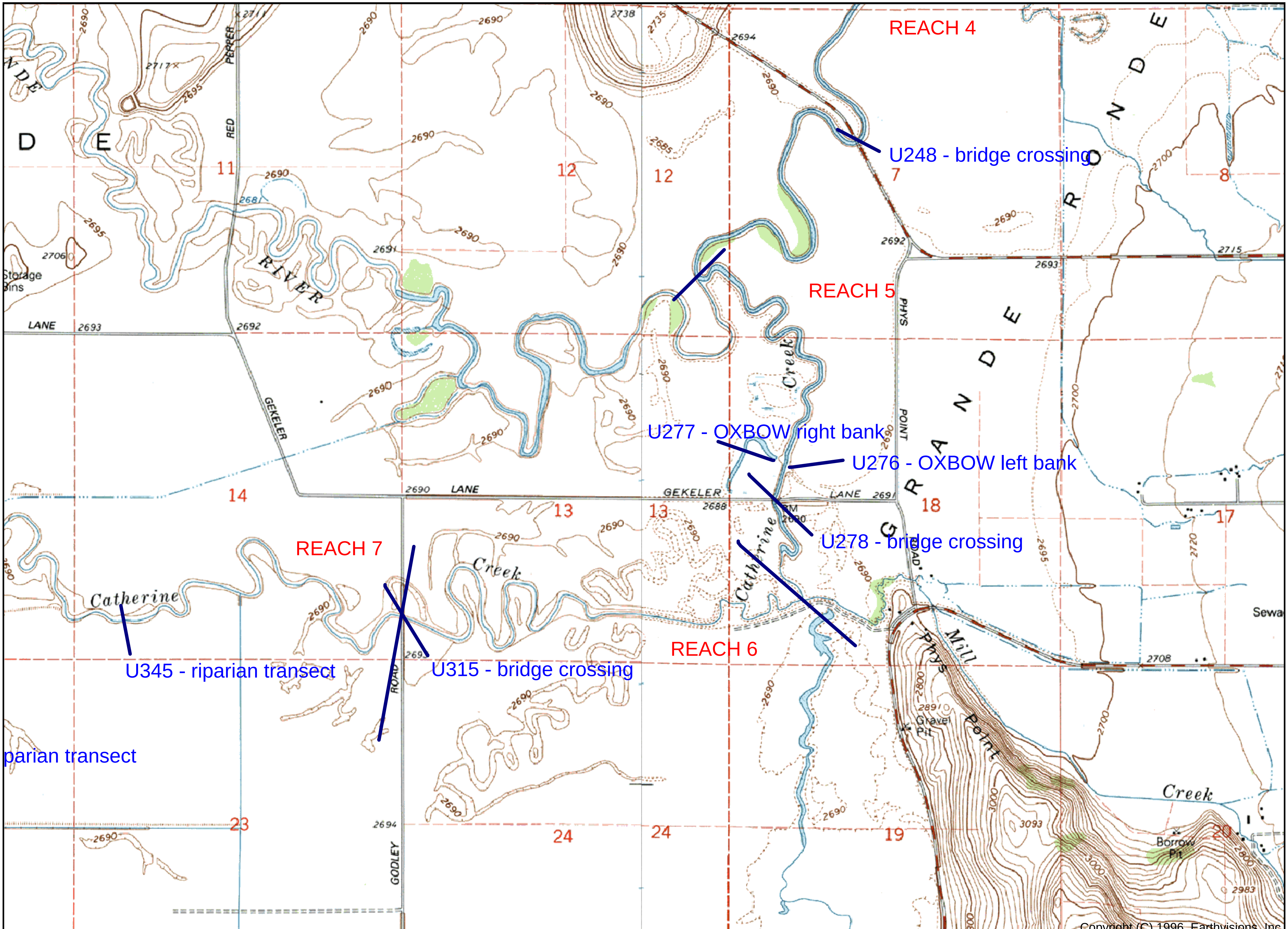
Name: COVE (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010



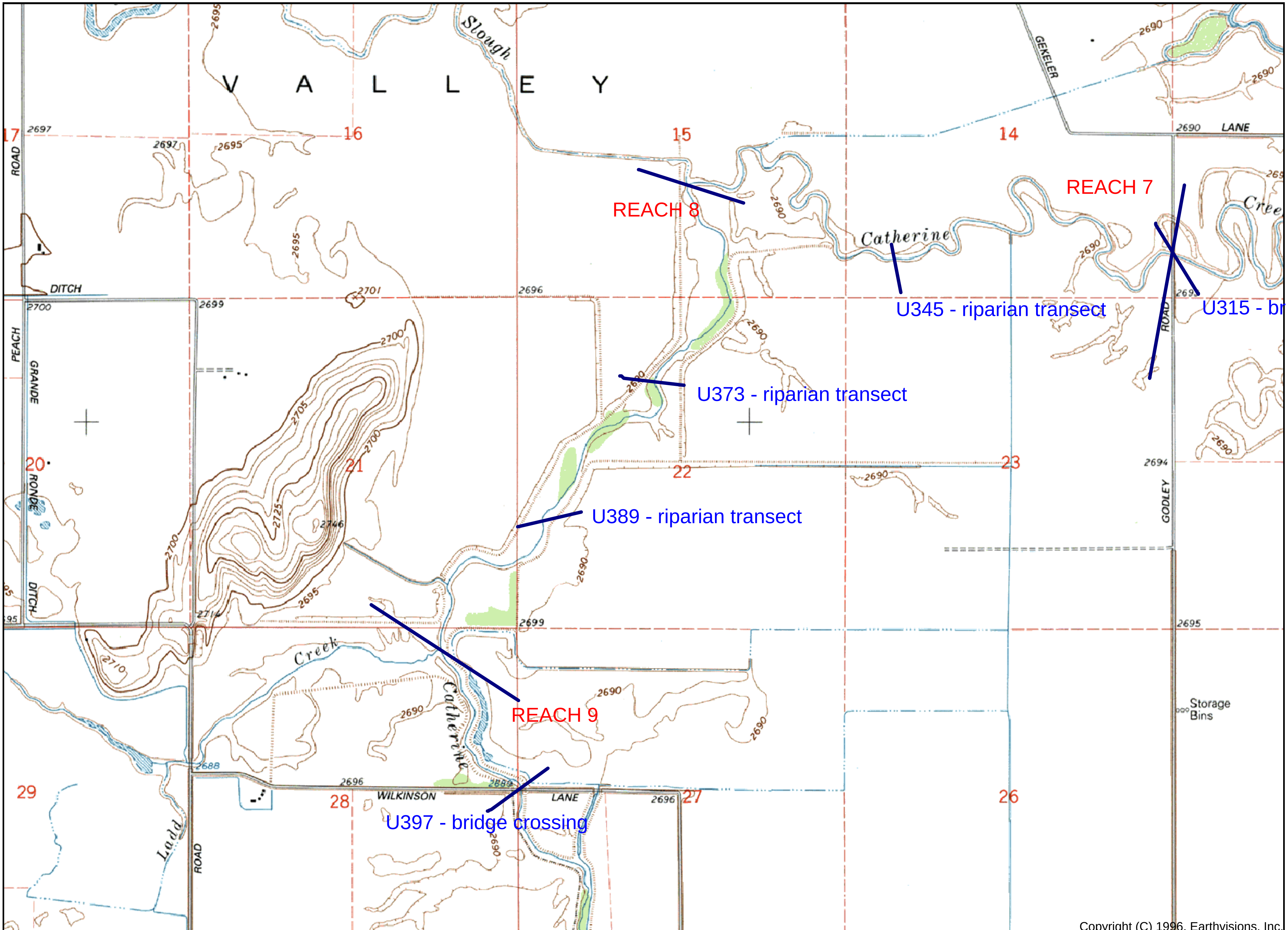
Name: COVE (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010



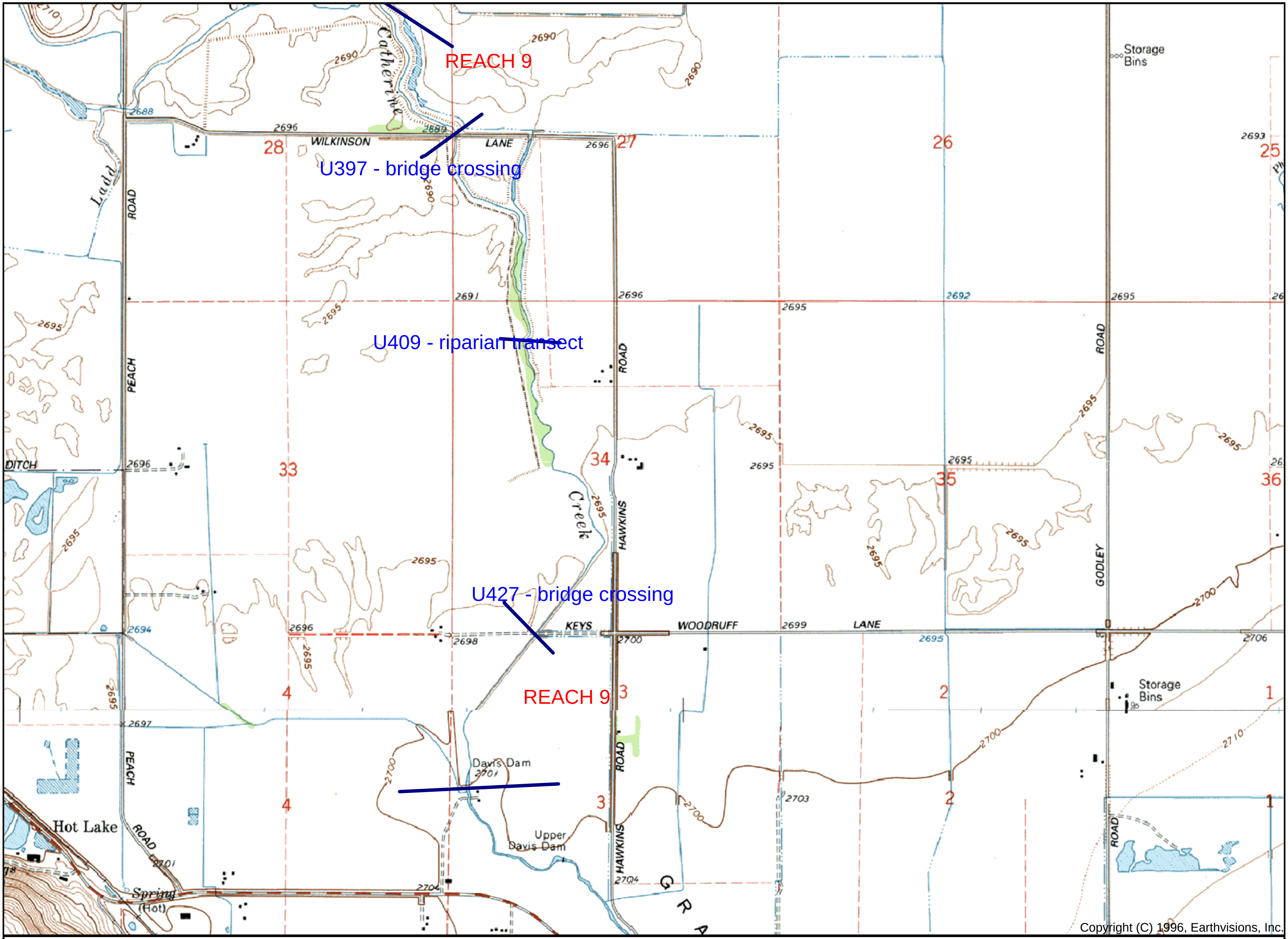
Name: CONLEY (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010



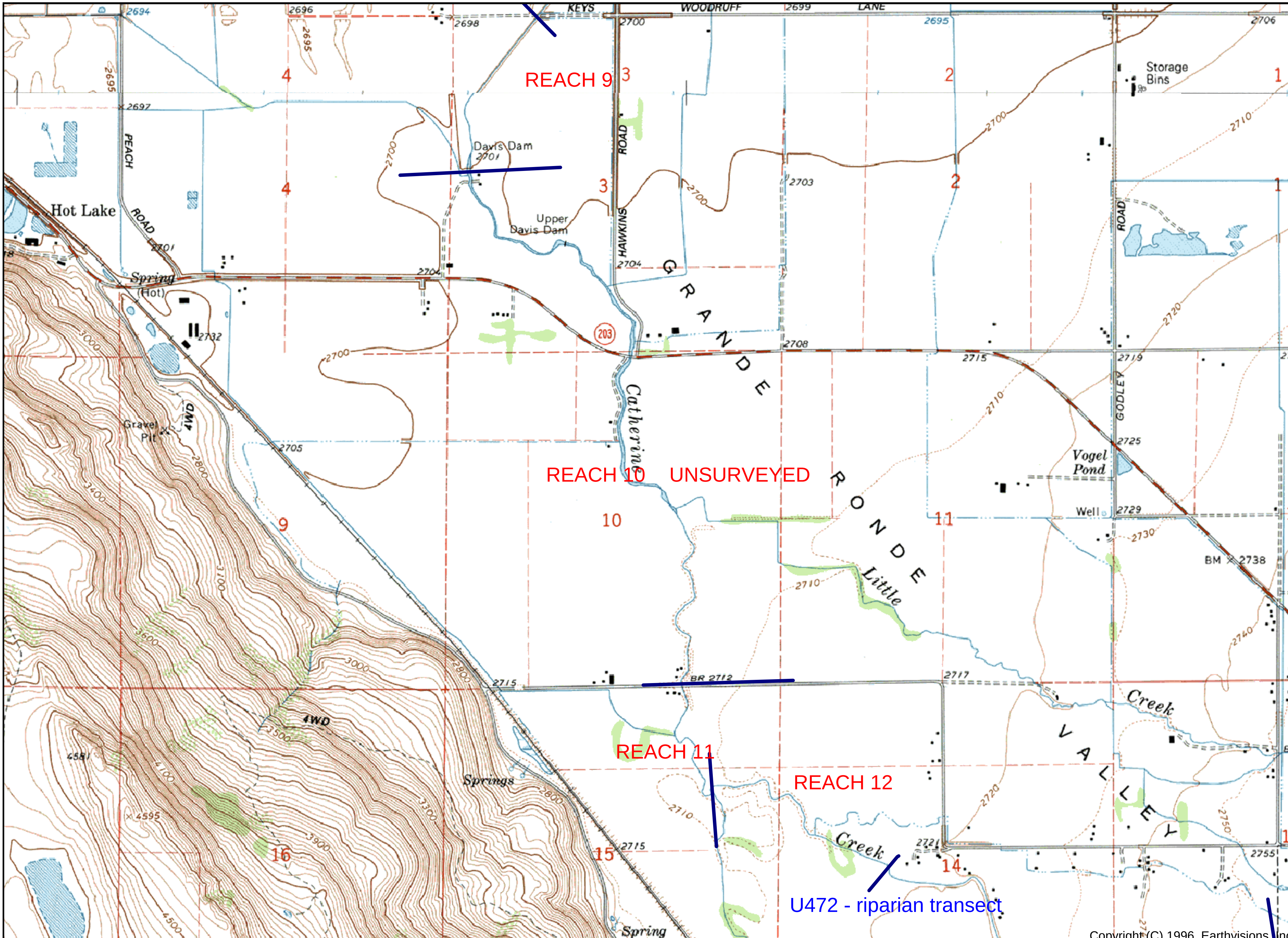
Name: CONLEY (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010



Name: CONLEY (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010



Name: CRAIG MT (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010

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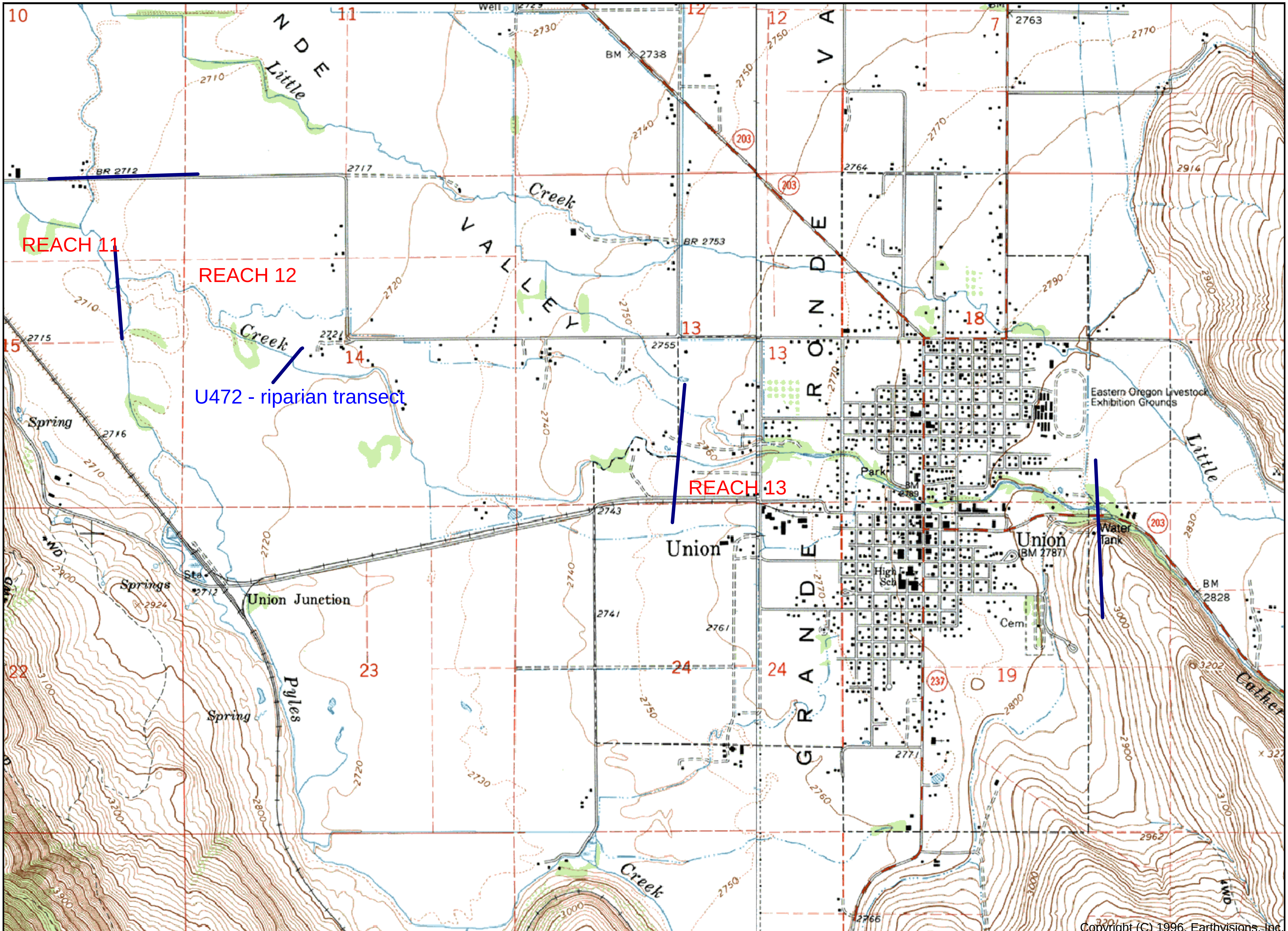
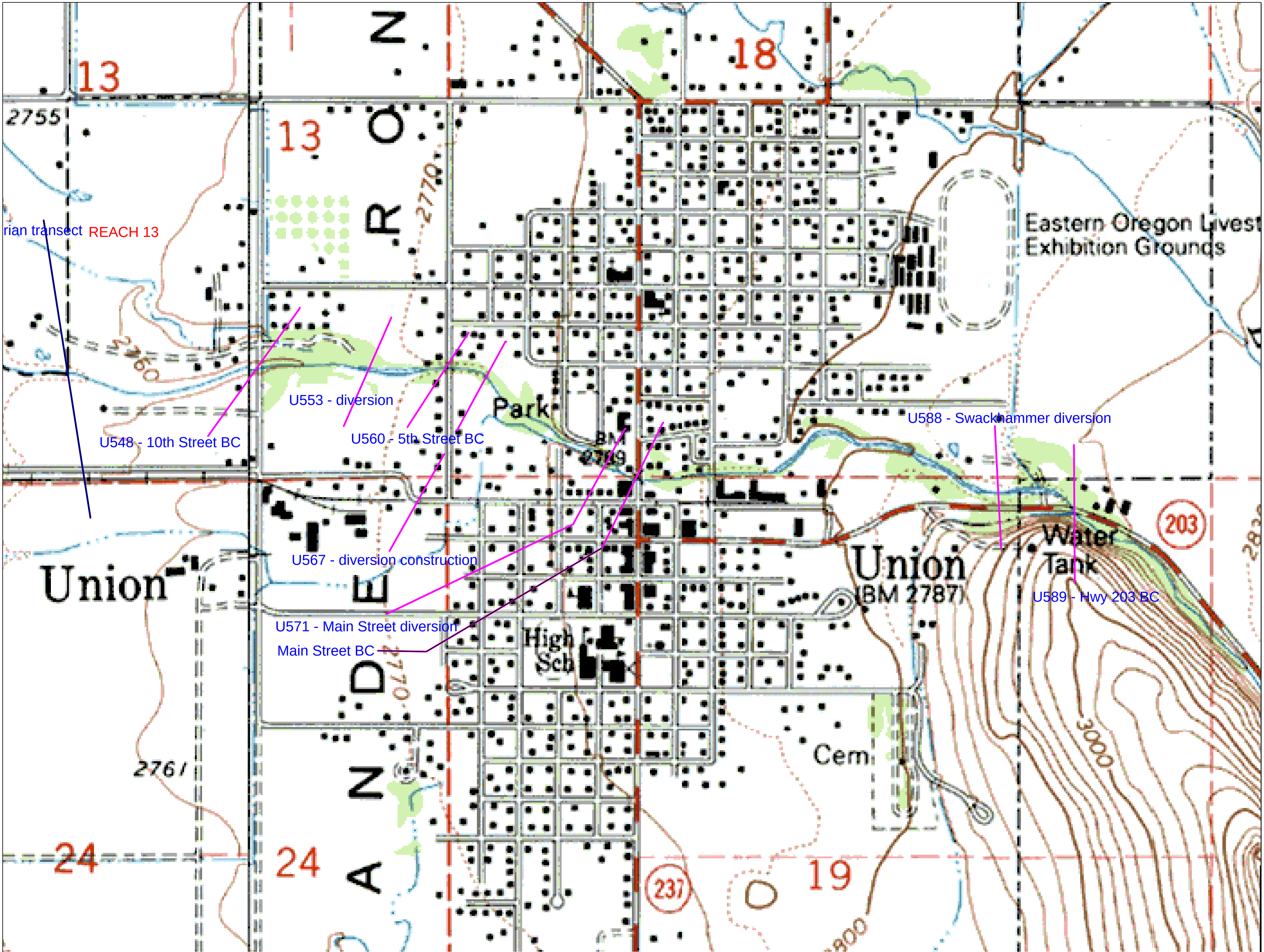
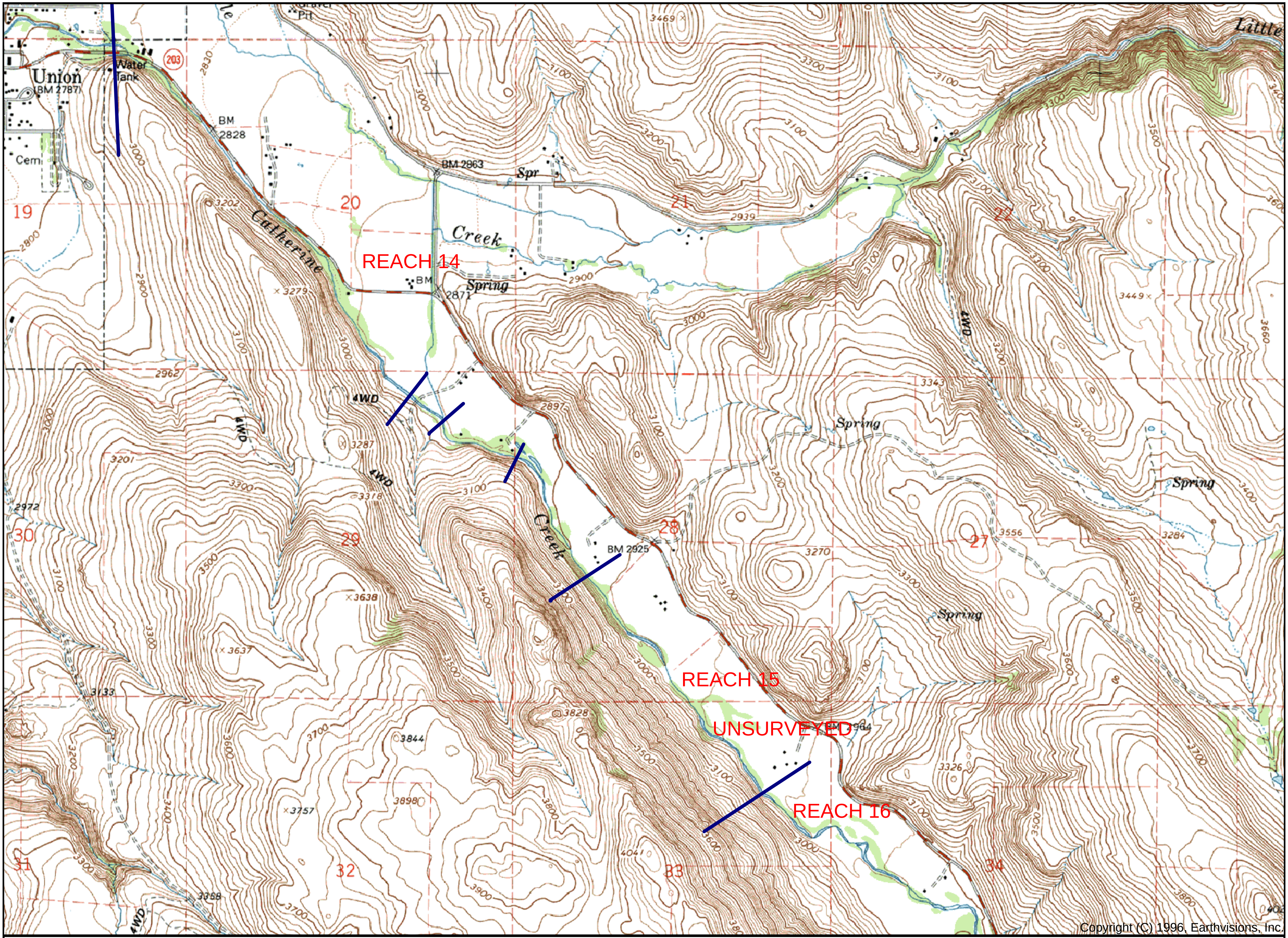


Name: CRAIG MT (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
SUMMER 2010

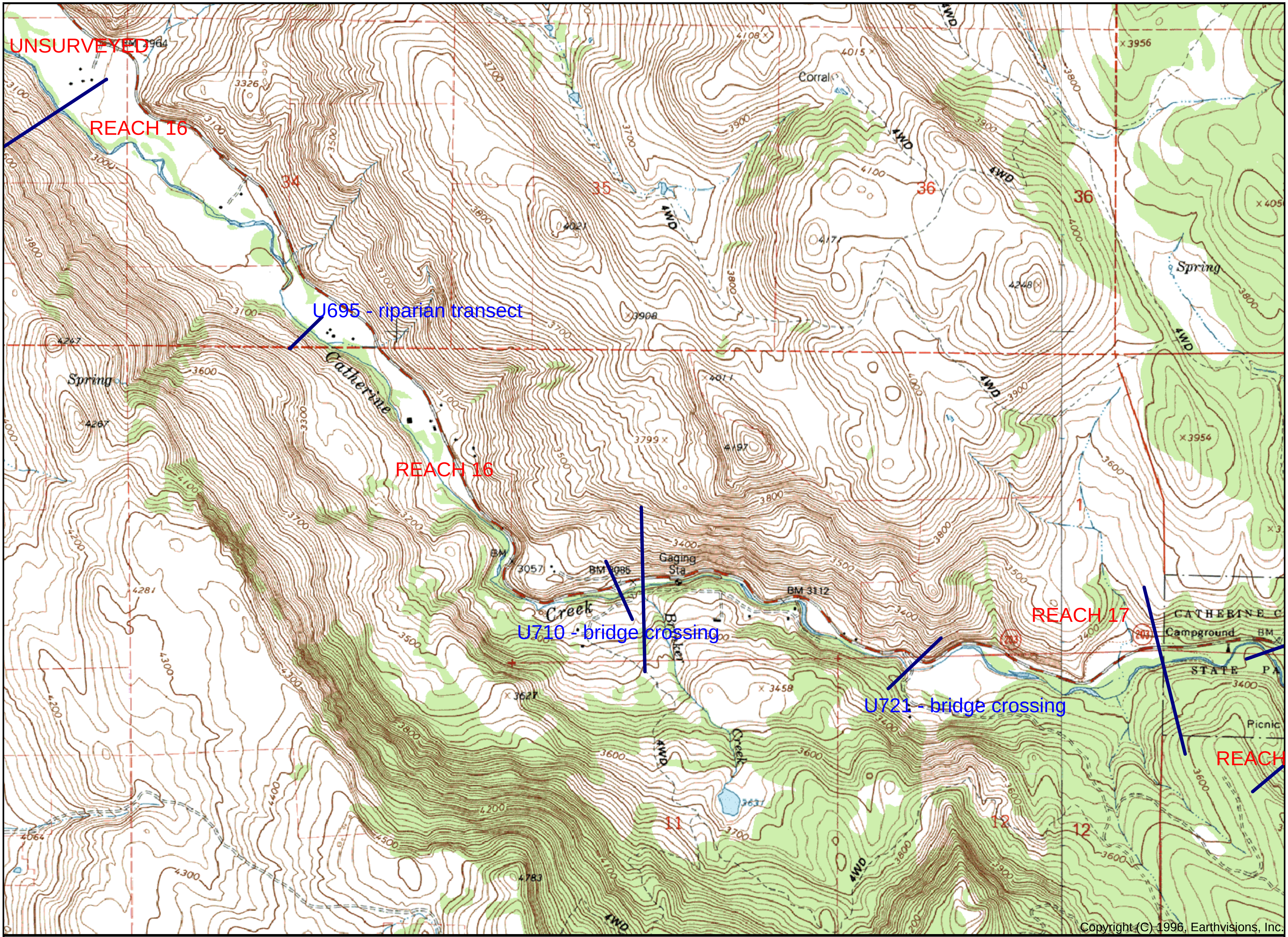


rian transect
REACH 13
U548 - 10th Street BC
U553 - diversion
U560 - 5th Street BC
U567 - diversion construction
U571 - Main Street diversion
Main Street BC
U588 - Swackhammer diversion
U589 - Hwy 203 BC
Eastern Oregon Livest
Exhibition Grounds
Park
Union
Union
(BM 2787)
High
Sch
Water
Tank
Cem
2755
2761
2770
3000
13
13
18
24
24
19
203
237



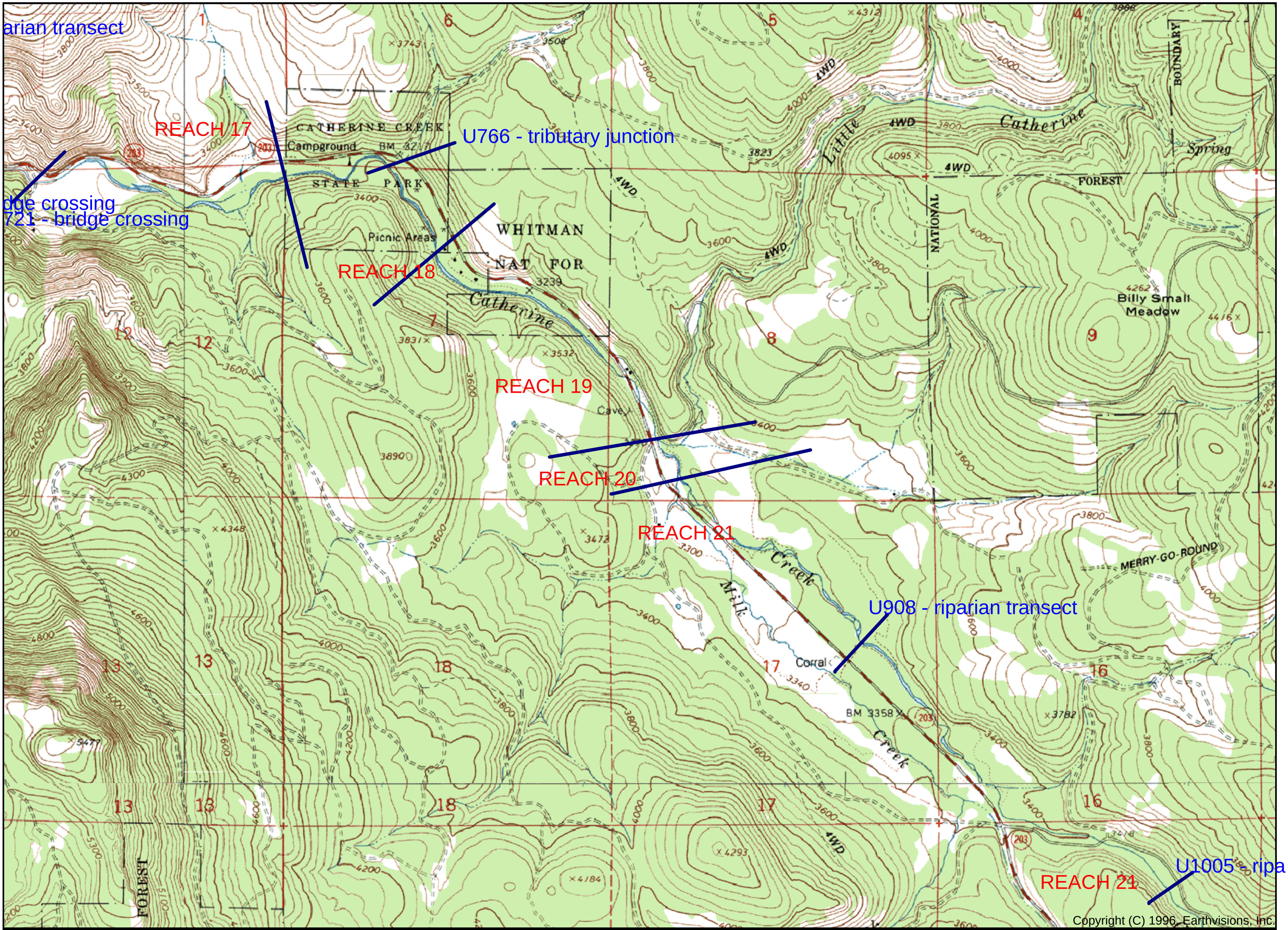
Name: UNION (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
2010 SUMMER



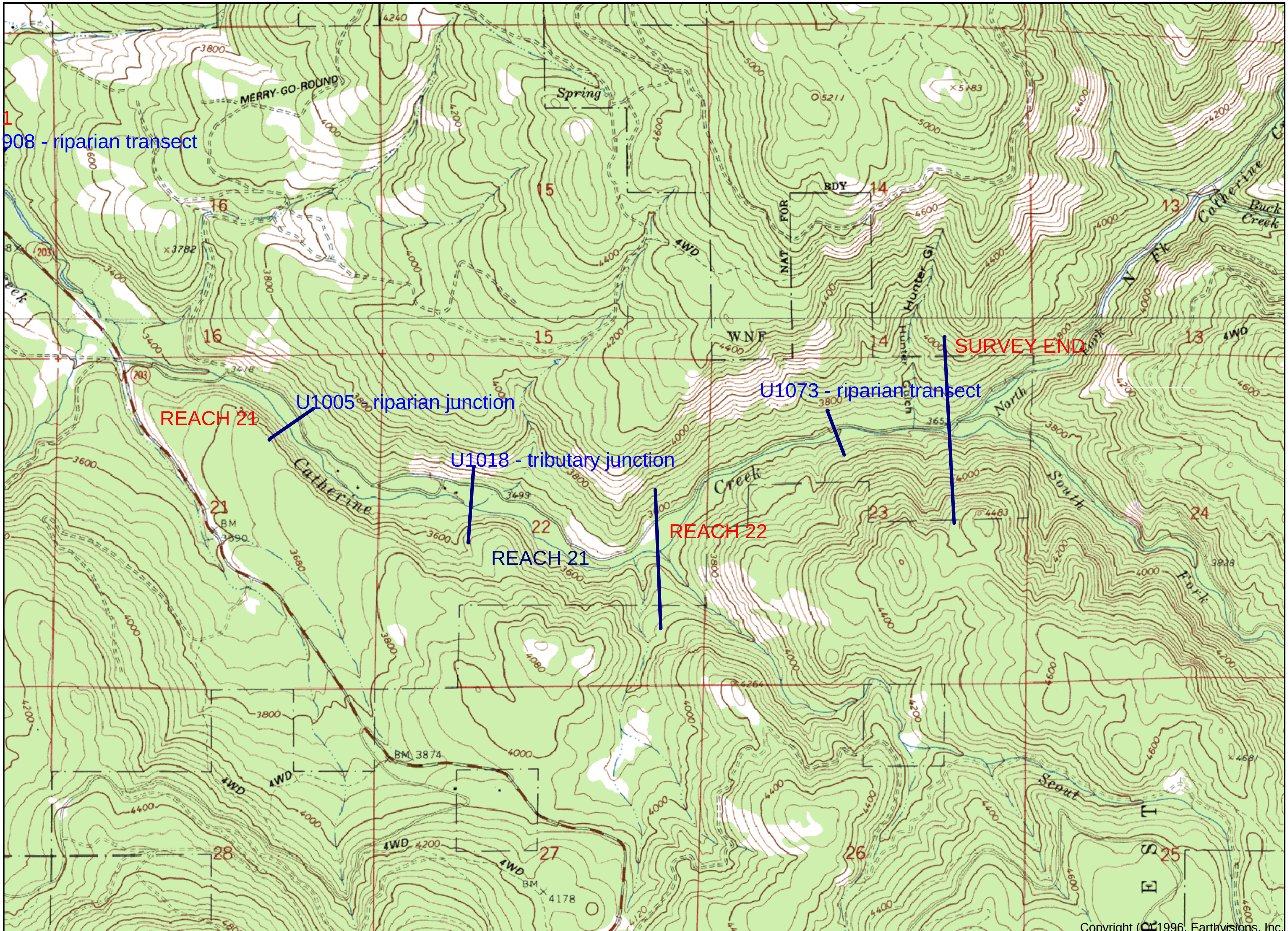
Name: UNION (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
2010 SUMMER



Name: LITTLE CATHERINE CREEK (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
2010 SUMMER



Name: MEDICAL SPRINGS (OR)
Date: 12/21/10
Scale: 1 inch = 2,000 ft.

CATHERINE CREEK HABITAT SURVEY
GRANDE RONDE RIVER BASIN
2010 SUMMER

CATHERINE CREEK
2010 STREAM HABITAT PHOTOS

Catherine Creek- Reach 1 unit 1 - Glide - Looking Upstream

Catherine Creek- Reach 1 unit 8 - Glide – Left Riparian

Catherine Creek- Reach 3 unit 159 - Glide – Right Riparian

Catherine Creek- Reach 3 unit 178 - Glide – Left Riparian

Catherine Creek- Reach 3 unit 178 - Glide – Right Riparian

Catherine Creek- Reach 3 unit 182 – Irrigation Material

CATHERINE CREEK
2010 STREAM HABITAT PHOTOS

Catherine Creek- Reach 3 unit 206 - Glide –
Right Riparian

Catherine Creek- Reach 3 unit 220 - Glide –
Right Riparian

Catherine Creek- Reach 3 unit 220 - Glide –
Looking Upstream

Catherine Creek- Reach 4 unit 245 - Glide –
Right Riparian

Catherine Creek- Reach 4 unit 259 - Glide – Left
Riparian

Catherine Creek- Reach 5 unit 262 - Glide –
Looking Upstream

CATHERINE CREEK
2010 STREAM HABITAT PHOTOS

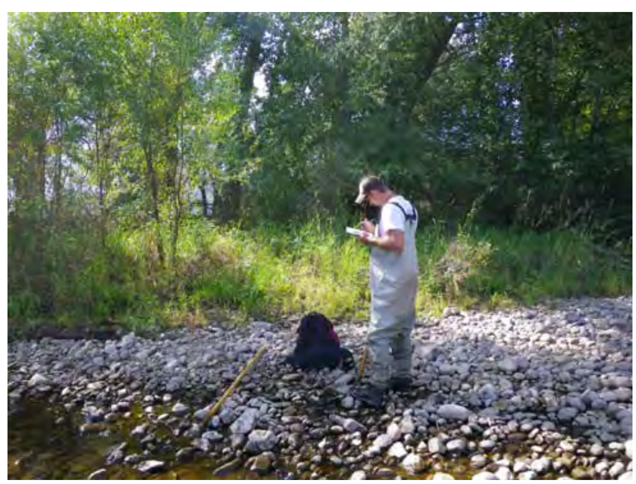
Catherine Creek- Reach 6 unit 292 - Glide – Left Riparian

Catherine Creek- Reach 6 unit 295 – Beaver Dam and Ryan

Catherine Creek- Reach 6 unit 301 - Glide – Looking Upstream

Catherine Creek- Reach 7 unit 326 - Glide – Right Riparian

Catherine Creek- Reach 12 unit 449 - Glide – Looking Upstream



Catherine Creek- Reach 12 unit 514 - Right Riparian

CATHERINE CREEK
2010 STREAM HABITAT PHOTOS

Catherine Creek- Reach 13 unit 551 – Scour Pool - Looking Downstream

Catherine Creek- Reach 13 unit 553 – Looking Upstream at Diversion

Catherine Creek- Reach 13 unit 559 – Culverts Diverting Water

Catherine Creek- Reach 13 unit 590 – Riffle - Looking Upstream

Catherine Creek- Reach 14 unit 624 – Umatilla Fish Trap Weir

Catherine Creek- Reach 14 unit 645 – Right Riparian

CATHERINE CREEK
2010 STREAM HABITAT PHOTOS

Catherine Creek- Reach 16 unit 661 – Riffle - Right Riparian

Catherine Creek- Reach 17 unit 717 – Rapid - Looking Upstream

Catherine Creek- Reach 17 unit 743 – Riffle - Right Riparian

Catherine Creek- Reach 19 unit 817 – Rapid - Left Riparian

Catherine Creek- Reach 21 unit 861 – Riffle - Right Riparian

Catherine Creek- Reach 21 unit 908 – Riffle - Left Riparian

CATHERINE CREEK
2010 STREAM HABITAT PHOTOS

Catherine Creek- Reach 21 unit 975 – Riffle - Right Riparian

Catherine Creek- Reach 22 unit 1045 – Riffle - Looking Upstream

Catherine Creek- Reach 22 unit 1054 – Riffle - Right Riparian

Catherine Creek- Reach 22 unit 1073 – Riffle - Right Riparian

Appendix B

HabRate Life History Criteria

Chinook Salmon Input Values

1 Spawning, egg survival, emergence

Attribute	Criteria and Rating: 3	2	1
Fines (%)	≤ **10**	> 10 and ≤ 20	> **20**
Gravel (%)	≥ **30**	< 30 and > 15	≤ **15**
Cobble (%)	≥ **20** and ≤ **40**	< 20 and ≥ 10 > 40 and ≤ 70	< **10** or > **70**
Pool Area (% pools)	≥ **40** and ≤ **60**	< 40 and ≥ 20	< 20 or > 60
Residual Pool depth (m)	≥ **0.2**		< 0.2
Gradient (%)	< **4**		≥ 4

2 Summer Rearing 0+

	3	2	1
Fines (%)	≤ **10**	> 10 and ≤ 30	> **30**
Gravel (%)	≥ **15**	15 and ≥ 5	< **5**
Cobble and boulders (%)	≥ **15**	< 15 and ≥ 8	< **8**
Pool Area (% pools)	≥ **40** and ≤ **60**	< 40 and ≥ 20	< **20** or > 60
Pool complexity (*see below*)	3	2	1
Cover Undercut (%)	≥ **15**	15 and ≥ 10	< **10**
Pieces of large woody debris / 100m	≥ **20**	20 and ≥ 10	< **10**
Number of boulders / 100m	≥ **20**	< 20 and ≥ 5	< **5**
Gradient (%)	≤ **4**		> 4

3 Overwintering 0+

	3	2	1
Fines (%)	≤ **10**	> 10 and ≤ 30	> **30**
Cobble and boulders (%)	≥ **15**	< 15 and ≥ 8	< **8**
Pool Area (% pools)	≥ **40** and ≤ **60**	< 40 and ≥ 20	< **20** or > 60
Pool complexity		See below	
Cover Undercut (%)	≥ **15**	< 15 and ≥ 10	< **10**
Pieces of large woody debris / 100m	≥ **20**	< 20 and ≥ 10	< **10**
Number of boulders / 100m	≥ **20**	< 20 and ≥ 5	< **5**
Gradient (%)	< **4**		≥ 4

4 Pool Complexity

	3	2	1
Scour Pool Depth (m) (*min. at summer flow*) Wetted width ≤ 10m	> **0.6**	≤ 0.6 and ≥ 0.6	< **0.6**
Wetted width > 10m	> **1**	≤ 1 and ≥ 0.6	< **0.6**
Large woody debris (LWD) combined Keypieces of LWD per pool	≥ **0.6**	< 0.6 and > 0	= **0**
	or	*or*	*and*
pieces of LWD per pool	≥ **2**	< 2 and > 0	= **0**

Steelhead Trout Input Values

1 Spawning, egg survival, emergence

	Criteria and Rating		
Attribute	**3**	**2**	**1**
Fines (%)	≤ 10	> 10 and ≤ 20	> 20
Gravel (%)	≥ 30	< 30 and ≥ 15	< 15
Cobble (%)	≥ 10 and ≤ 30	> 30 and ≤ 60	< 10 or > 60
Pool area (% pools)	≥ 40 and ≤ 60	≥ 20 and < 40	< 20 or > 60
Residual Pool Depth (m)	≥ 0.2		< 0.2

2 Summer Rearing 0+

	3	2	1
Fines (%)	≤ 10	> 10 and ≤ 30	> 30
Cobble and boulders (%)	≥ 20	< 20 and ≥ 10	< 10
Pool Area (% pools)	≥ 40 and ≤ 60	< 40 and ≥ 20	< 20 or > 60
Cover Undercut (%)	≥ 15	< 15 and ≥ 10	< 10
Pieces of large woody debris / 100m	≥ 20	< 20 and ≥ 10	< 10
Number of boulders / 100m	≥ 20	< 20 and ≥ 5	< 5

3 Overwintering 0+

	3	2	1
Fines (%)	≤ 10	> 10 and ≤ 30	> 30
Cobble and boulders (%)	≥ 20	< 20 and ≥ 10	< 10
Pool Area (% pools)	≥ 40 and ≤ 60	< 40 and ≥ 20	< 20 or > 60
Pool complexity		See below	
Cover Undercut (%)	≥ 15	< 15 and ≥ 10	< 10
Pieces of large woody debris / 100m	≥ 20	< 20 and ≥ 10	< 10
Number of boulders / 100m	≥ 20	20 and ≥ 5	< 5
Gradient (%)	< 4	≥ 4	

4 Summer Rearing 1+

	3	2	1
Fines (%)	≤ 10	> 10 and ≤ 30	> 30
Cobble and boulders (%)	≥ 20	> 20 and ≥ 10	< 10
Pool Area (% pools)	≥ 40 and ≤ 60	< 40 and ≥ 20	< 20 or > 60
Depth in fast water units (m)	≥ 0.5		< 0.5
Additional Cover Undercut (%)	≥ 15	< 15 and ≥ 10	< 10
Pieces of large woody debris / 100m	≥ 20	< 20 and ≥ 10	< 10
Number of boulders / 100m	≥ 20	< 20 and ≥ 5	< 5

5 Overwintering 1+ life history

	3	2	1
Fines (%)	≤ 10	> 10 and ≤ 30	> 30
Cobble and boulder (%)	≥ 25	< 25 and ≥ 10	< 10
Pool Area (% pools)	≥ 40 and ≤ 60	< 40 and ≥ 20	< 20 or > 60
Pool complexity		See Below	
Cover Undercut (%)	≥ 20	< 20 and ≥ 10	< 10
Pieces large woody debris / 100m	≥ 20	< 20 and ≥ 10	< 10
Number of boulders / 100m	≥ 20	< 20 and ≥ 5	< 5

6 Pool Complexity

	3	2	1
Scour Pool Depth (m) (*min. at summer flow*) Wetted width ≤ 10m	> 0.6	≤ 0.6 and ≥ 0.6	< 0.6
Wetted width > 10m	> 1	≤ 1 and ≥ 0.6	< 0.6
Large woody debris (LWD) Keypieces of LWD / 100m	≥ 0.6	< 0.6 and > 0	= 0
	or	*or*	*and*
Pieces of LWD / 100m	≥ 2	< 2 and > 0	= 0

Appendix C

HabRate models for Catherine Creek Chinook salmon based on 2010 data split into three sections: lower, middle, upper.

HabRate model for Catherine Creek 2010 habitat survey data for Chinook salmon habitat availability at Spawning, Incubation, and Emergence.

Stream	Reach	Fines	Gravel	Cobble	**Substrate**	Pool Area	Residual Pool Depth	Gradient	**Morphology**	**Rating**
CATHERINE CREEK 2010	1	1	1	1	1	1	3	3	3	1
CATHERINE CREEK 2010	2	3	3	1	2	1	3	3	3	2
CATHERINE CREEK 2010	3	2	3	1	2	1	3	3	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Chinook salmon habitat availability for 0+ Summer Rearing.

								Cover					
Stream	**Reach**	Fines	Gravel	Cobble and boulders	**Substrate**	**Pool Area**	**Pool Complexity**	Undercut	Large woody debris/100m	Large Boulders/100m	**Cover**	**Gradient**	**Rating**
CATHERINE CREEK 2010	1	1	1	1	1	1	3	1	1	1	1	3	2
CATHERINE CREEK 2010	2	3	3	1	2	1	3	1	1	3	2	3	2
CATHERINE CREEK 2010	3	2	3	1	2	1	3	1	1	3	2	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Chinook salmon habitat availability for 0+ Winter Rearing.

							Cover					
Stream	**Reach**	Fines	Cobble and boulders	**Interstices**	**Pool Area**	**Pool Complexity**	Undercut	Large woody debris/100m	Large Boulders/100m	**Cover**	**Gradient**	**Rating**
CATHERINE CREEK 2010	1	1	1	1	1	3	1	1	1	1	3	2
CATHERINE CREEK 2010	2	3	1	1	1	3	1	1	3	2	3	2
CATHERINE CREEK 2010	3	2	1	1	1	3	1	1	3	2	3	2

Appendix D

HabRate models for Catherine Creek Steelhead trout based on 2010 data split into three sections: lower, middle, upper.

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout habitat availability at Spawning, Incubation, and Emergence.

Stream	Reach	Fines	Gravel	Cobble	Substrate	Pool Area	Residual Pool Depth	Rating
CATHERINE CREEK 2010	1	1	1	1	1	1	3	1
CATHERINE CREEK 2010	2	3	3	1	2	1	3	2
CATHERINE CREEK 2010	3	2	3	1	2	1	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout habitat availability at 0+ Summer Rearing.

Stream	Reach	Fines	Cobble and boulders	Substrate	Pool Area	Cover: Undercut	Cover: Large woody debris/100m	Cover: Boulders/ 100m	Cover	Rating
CATHERINE CREEK 2010	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK 2010	2	3	1	2	1	1	1	3	2	2
CATHERINE CREEK 2010	3	2	1	2	1	1	1	3	2	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout habitat availability at 0+ Winter Rearing.

Stream	Reach	Fines	Cobble and boulders	Interstices	Pool Area	Cover: Undercut	Cover: Large woody debris/100m	Cover: Boulders/ 100m	Cover	Pool Complexity	Pool Habitat	Gradient	Rating
CATHERINE CREEK 2010	1	1	1	1	1	1	1	1	1	2	2	3	1
CATHERINE CREEK 2010	2	3	1	1	1	1	1	3	2	3	2	3	2
CATHERINE CREEK 2010	3	2	1	1	1	1	1	3	2	3	2	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout habitat availability at 1+ Summer Rearing. .

Stream	Reach	Fines	Cobble and boulders	Interstices	Pool Area	Depth in fast water units	Cover: Undercut	Cover: Large woody debris/100m	Cover: Boulders/ 100m	Cover	Rating
CATHERINE CREEK 2010	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK 2010	2	3	1	2	1	1	1	1	3	2	2
CATHERINE CREEK 2010	3	2	1	2	1	1	1	1	3	2	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout habitat availability at 1+ Winter Rearing.

Stream	Reach	Fines	Cobble and boulders	**Interstices**	Pool Area	Pool Complexity	**Pool Habitat**	Cover: Undercut	Cover: Large woody debris per 100m	Cover: Boulders per 100m	**Cover**	**Rating**
CATHERINE CREEK 2010	1	1	1	1	1	2	2	1	1	1	1	1
CATHERINE CREEK 2010	2	3	1	1	1	3	2	1	1	3	2	2
CATHERINE CREEK 2010	3	2	1	1	1	3	2	1	1	3	2	2

Appendix E

HabRate models for Catherine Creek Chinook salmon based on 2010 data

HabRate model for Catherine Creek 2010 habitat survey data for Chinook salmon habitat availability at Spawning, Incubation, and Emergence. Rating is the final rating for the reach based on the attributes in the table.

Stream	Reach	Fines	Gravel	Cobble	**Substrate**	Pool Area	Residual Pool Depth	Gradient	**Morphology**	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	2	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	3	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	4	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	5	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	6	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	7	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	8	1	1	1	1	1	1	3	1	1
CATHERINE CREEK	9	1	1	1	1	1	3	3	3	1
CATHERINE CREEK	10					unsurveyed				
CATHERINE CREEK	11	1	1	2	1	1	1	3	1	1
CATHERINE CREEK	12	2	3	2	3	3	3	3	3	3
CATHERINE CREEK	13	3	3	2	3	1	3	3	3	3
CATHERINE CREEK	14	3	2	2	2	1	3	3	3	2
CATHERINE CREEK	15					unsurveyed				
CATHERINE CREEK	16	2	3	2	3	1	3	3	3	3
CATHERINE CREEK	17	2	2	2	2	1	3	3	3	2
CATHERINE CREEK	18	1	3	3	3	2	3	3	3	3
CATHERINE CREEK	19	2	2	2	2	1	3	3	3	2
CATHERINE CREEK	20	2	3	3	3	2	3	3	3	3
CATHERINE CREEK	21	2	3	2	3	1	3	3	3	3
CATHERINE CREEK	22	3	2	2	2	1	3	3	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Chinook salmon 0+ Summer Rearing habitat availability.

								Reach Cover					
Stream	**Reach**	Fines	Gravel	Cobble and boulders	**Substrate**	**Pool Area**	Pool Complexity	Undercut	Large woody debris/100m	Large Boulders/100m	**Cover**	**Gradient**	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	2	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	3	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	4	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	5	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	6	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	7	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	8	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	9	1	2	1	2	1	3	1	1	1	1	3	2
CATHERINE CREEK	10							unsurveyed					
CATHERINE CREEK	11	1	1	3	2	1	1	1	1	1	1	3	2
CATHERINE CREEK	12	2	3	3	2	3	3	1	1	2	2	3	3
CATHERINE CREEK	13	3	3	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	14	3	3	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	15							unsurveyed					
CATHERINE CREEK	16	2	3	3	2	1	3	1	1	3	2	3	2
CATHERINE CREEK	17	2	3	3	2	1	3	1	1	3	2	3	2
CATHERINE CREEK	18	1	3	3	2	2	3	1	1	3	2	3	2
CATHERINE CREEK	19	2	3	3	2	1	3	1	1	3	2	3	2
CATHERINE CREEK	20	2	3	3	2	2	3	1	1	2	2	3	2
CATHERINE CREEK	21	2	3	3	2	1	3	1	2	3	2	3	2
CATHERINE CREEK	22	3	3	3	3	1	3	1	1	3	2	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Chinook salmon 0+ Overwintering habitat availability.

Stream	Reach	Fines	Cobble and boulders	Interstices	Pool Area	Pool Complexity	Reach Cover: Undercut	Reach Cover: Large woody debris/100m	Reach Cover: Large Boulders/100m	Reach Cover: Cover	Gradient	Rating
CATHERINE CREEK	1	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	2	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	3	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	4	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	5	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	6	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	7	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	8	1	1	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	9	1	1	1	1	3	1	1	1	1	3	2
CATHERINE CREEK	10						unsurveyed					
CATHERINE CREEK	11	1	3	1	1	1	1	1	1	1	3	2
CATHERINE CREEK	12	2	3	3	3	3	1	1	2	2	3	2
CATHERINE CREEK	13	3	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	14	3	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	15						unsurveyed					
CATHERINE CREEK	16	2	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	17	2	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	18	1	3	1	2	3	1	1	3	2	3	2
CATHERINE CREEK	19	2	3	3	1	3	1	1	3	2	3	2
CATHERINE CREEK	20	2	3	3	2	3	1	1	2	2	3	2
CATHERINE CREEK	21	2	3	3	1	3	1	2	3	2	3	2
CATHERINE CREEK	22	3	3	3	1	3	1	1	3	2	3	2

Appendix F

HabRate models for Catherine Creek Steelhead trout based on 2010 data

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout Spawning, Incubation, and Emergence habitat availability.

Stream	**Reach**	Fines	Gravel	Cobble	**Substrate**	**Pool Area**	Residual Pool Depth	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	1
CATHERINE CREEK	2	1	1	1	1	1	1	1
CATHERINE CREEK	3	1	1	1	1	1	1	1
CATHERINE CREEK	4	1	1	1	1	1	1	1
CATHERINE CREEK	5	1	1	1	1	1	1	1
CATHERINE CREEK	6	1	1	1	1	1	1	1
CATHERINE CREEK	7	1	1	1	1	1	1	1
CATHERINE CREEK	8	1	1	1	1	1	1	1
CATHERINE CREEK	9	1	1	1	1	1	3	1
CATHERINE CREEK	10				unsurveyed			
CATHERINE CREEK	11	1	1	3	1	1	1	1
CATHERINE CREEK	12	2	3	3	3	3	3	3
CATHERINE CREEK	13	3	3	2	3	1	3	3
CATHERINE CREEK	14	3	2	2	2	1	3	2
CATHERINE CREEK	15				unsurveyed			
CATHERINE CREEK	16	2	3	2	3	1	3	3
CATHERINE CREEK	17	2	2	2	2	1	3	2
CATHERINE CREEK	18	1	3	3	1	2	3	1
CATHERINE CREEK	19	2	2	2	2	1	3	2
CATHERINE CREEK	20	2	3	2	3	2	3	3
CATHERINE CREEK	21	2	3	2	3	1	3	3
CATHERINE CREEK	22	3	2	2	2	1	3	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout 0+ Summer Rearing habitat availability.

						Cover				
Stream	**Reach**	Fines	Cobble and boulders	**Substrate**	Pool Area	Undercut	Large woody debris/100m	Boulders/ 100m	**Cover**	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	2	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	3	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	4	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	5	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	6	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	7	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	8	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	9	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	10					unsurveyed				
CATHERINE CREEK	11	1	2	2	1	1	1	1	1	2
CATHERINE CREEK	12	2	2	2	3	1	1	2	2	3
CATHERINE CREEK	13	3	3	3	1	1	1	3	2	2
CATHERINE CREEK	14	3	3	3	1	1	1	3	2	2
CATHERINE CREEK	15					unsurveyed				
CATHERINE CREEK	16	2	3	3	1	1	1	3	2	2
CATHERINE CREEK	17	2	3	3	1	1	1	3	2	2
CATHERINE CREEK	18	1	3	2	2	1	1	3	2	2
CATHERINE CREEK	19	2	3	3	1	1	1	3	2	2
CATHERINE CREEK	20	2	3	3	2	1	1	2	2	3
CATHERINE CREEK	21	2	3	3	1	1	2	3	2	2
CATHERINE CREEK	22	3	3	3	1	1	1	3	2	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout 0+ Overwintering habitat availability.

						Cover							
Stream	**Reach**	Fines	Cobble and boulders	**Interstices**	**Pool Area**	Undercut	Large woody debris/100m	Boulders/ 100m	**Cover**	Pool Complexity	**Pool Habitat**	**Gradient**	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	2	1	1	1	1	1	1	1	1	2	2	3	1
CATHERINE CREEK	3	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	4	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	5	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	6	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	7	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	8	1	1	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	9	1	1	1	1	1	1	1	1	3	2	3	1
CATHERINE CREEK	10						unsurveyed						
CATHERINE CREEK	11	1	2	1	1	1	1	1	1	1	1	3	1
CATHERINE CREEK	12	2	2	2	3	1	1	2	2	3	3	3	2
CATHERINE CREEK	13	3	3	3	1	1	1	3	2	3	2	3	3
CATHERINE CREEK	14	3	3	3	1	1	1	3	2	3	2	3	3
CATHERINE CREEK	15						unsurveyed						
CATHERINE CREEK	16	2	3	3	1	1	1	3	2	3	2	3	3
CATHERINE CREEK	17	2	3	3	1	1	1	3	2	3	2	3	3
CATHERINE CREEK	18	1	3	1	2	1	1	3	2	3	3	3	2
CATHERINE CREEK	19	2	3	3	1	1	1	3	2	3	2	3	3
CATHERINE CREEK	20	2	3	3	2	1	1	2	2	3	3	3	3
CATHERINE CREEK	21	2	3	3	1	1	2	3	2	3	2	3	3
CATHERINE CREEK	22	3	3	3	1	1	1	3	2	3	2	3	3

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout 1+ Summer Rearing habitat availability.

							Cover				
Stream	**Reach**	Fines	Cobble and boulders	**Interstices**	**Pool Area**	Depth in fast water units	Undercut	Large woody debris/100m	Boulders /100m	**Cover**	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	2	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	3	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	4	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	5	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	6	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	7	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	8	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	9	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	10					unsurveyed					
CATHERINE CREEK	11	1	2	2	1	1	1	1	1	1	1
CATHERINE CREEK	12	2	2	2	3	1	1	1	2	2	2
CATHERINE CREEK	13	3	3	3	1	1	1	1	3	2	2
CATHERINE CREEK	14	3	3	3	1	1	1	1	3	2	2
CATHERINE CREEK	15					unsurveyed					
CATHERINE CREEK	16	2	3	3	1	1	1	1	3	2	2
CATHERINE CREEK	17	2	3	3	1	1	1	1	3	2	2
CATHERINE CREEK	18	1	3	2	2	1	1	1	3	2	2
CATHERINE CREEK	19	2	3	3	1	1	1	1	3	2	2
CATHERINE CREEK	20	2	3	3	2	1	1	1	2	2	2
CATHERINE CREEK	21	2	3	3	1	1	1	2	3	2	2
CATHERINE CREEK	22	3	3	3	1	1	1	1	3	2	2

HabRate model for Catherine Creek 2010 habitat survey data for Steelhead trout 1+ Overwintering habitat availability.

								Cover				
Stream	**Reach**	Fines	Cobble and boulders	**Interstices**	**Pool Area**	Pool Complexity	Pool Habitat	Undercut	Large woody debris/100m	Boulders/ 100m	**Cover**	**Rating**
CATHERINE CREEK	1	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	2	1	1	1	1	2	2	1	1	1	1	1
CATHERINE CREEK	3	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	4	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	5	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	6	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	7	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	8	1	1	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	9	1	1	1	1	3	2	1	1	1	1	1
CATHERINE CREEK	10						unsurveyed					
CATHERINE CREEK	11	1	2	1	1	1	1	1	1	1	1	1
CATHERINE CREEK	12	2	2	2	3	3	3	1	1	2	2	2
CATHERINE CREEK	13	3	3	3	1	3	2	1	1	3	2	3
CATHERINE CREEK	14	3	3	3	1	3	2	1	1	3	2	3
CATHERINE CREEK	15						unsurveyed					
CATHERINE CREEK	16	2	3	3	1	3	2	1	1	3	2	3
CATHERINE CREEK	17	2	3	3	1	3	2	1	1	3	2	3
CATHERINE CREEK	18	1	3	1	2	3	3	1	1	3	2	2
CATHERINE CREEK	19	2	3	3	1	3	2	1	1	3	2	3
CATHERINE CREEK	20	2	3	3	2	3	3	1	1	2	2	3
CATHERINE CREEK	21	2	3	3	1	3	2	1	2	3	2	3
CATHERINE CREEK	22	3	3	3	1	3	2	1	1	3	2	3

IDENTIFICATION AND CHARACTERIZATION OF JUVENILE SPRING CHINOOK SALMON OVERWINTER REARING HABITAT IN UPPER GRANDE RONDE VALLEY

ANNUAL REPORT 2010

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ABSTRACT

This study was designed to document and describe overwinter rearing reaches of Catherine Creek early migrant spring Chinook salmon in the Grande Ronde Valley. Early migrants occupied a reach of Catherine Creek residing between Union, OR and the mouth of Mill Creek for overwinter rearing from October 2009 through March 2010. Median weekly linear range was high during fall migration however, decreased toward zero (i.e., no movement) during winter. A considerable increase in movement occurred during mid-January and coincided with elevated water temperatures. A gradient shift occurs within this reach near the mouth of Pyles Creek, where Catherine Creek transitions from complex habitat comprised of riffles and pools to homogenized deep run habitat. Juvenile spring Chinook salmon preferred deep water and slow currents near cover and the bank throughout their distribution; however, coarse substrates were optimal within the high gradient reach; silt was most suitable in the low gradient reach. Survival of radio-tagged juvenile Chinook appeared relatively high through winter.

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Introduction

Successful recovery strategies for Chinook salmon *Oncorhynchus tshawytscha* listed under the Endangered Species Act (ESA) require knowledge of factors limiting seasonal carrying capacity of their stream habitats (Van Dyke et al. 2009). Given the large geographic extent of their life history, critical habitat for anadromous Chinook salmon varies on a temporal and spatial scale. For Chinook salmon populations exhibiting a 'stream-type' life history, whereby juveniles remain in freshwater for one year prior to seaward migration (Wydoski and Whitney 2003), the quality and quantity of rearing habitat within natal subbasins governs the quantity and size of fish produced (Bjornn and Reiser 1991).

Catherine Creek, a tributary of the Grande Ronde River, supports a depressed population of ESA-listed Snake River spring/summer Chinook salmon. Available habitat varies widely from headwater tributaries in the Wallowa Mountains to the mouth. Most Chinook salmon spawning occurs from Union, OR to the confluence of North Fork Catherine and Middle Fork Catherine creeks (Figure 1). Icing conditions are present within the tributaries and main stem of Catherine Creek from November to April (Van Dyke et al. 2009).

The carrying capacity and survival of anadromous fish have been reduced within the Grande Ronde River Subbasin by land management activities which have contributed to riparian and instream habitat degradation (Nowak et al. 2004). Stream conditions in Catherine Creek, below the city of Union, consist of highly modified meandering and channeled sections of stream flowing through agricultural land. Following construction of the Grande Ronde Ditch for flood-control in the late 1800's, Catherine Creek flowed through the historic Grande Ronde River channel and currently meets the Grande Ronde Ditch near Alicel, OR (Nowak et al. 2004, Figure 1).

Catherine Creek is on the 303(d) Stream List based on concerns of high temperatures, habitat and flow modifications, and low dissolved oxygen (Nowak et al 2004). Riparian vegetation is sparse and provides little shade or instream cover in lower Catherine Creek. The river is heavily silted due to extensive erosion associated with agricultural, forest management practices and mining activities (Yanke et al. 2008). This reach of Catherine Creek is currently listed as an Oregon Water Resources Department (OWRD) flow restoration priority, as irrigation withdrawals in the Grande Ronde Valley generally reduce Catherine Creek flows by 90-95% until November 1 (end of irrigation season).

Winter rearing habitat quantity and quality in Grande Ronde River Valley may be important factors limiting spring Chinook salmon smolt production for Catherine Creek. Anthropogenic alterations to lower Catherine Creek (e.g., isolated oxbows, irrigation diversions, artificial levees) may degrade the ability of spring Chinook salmon to successfully emigrate into the Grande Ronde River. Naturally-produced spring Chinook salmon exhibit two migrational life history strategies corresponding to different river reach selection during freshwater rearing (Jonasson et al. 1997). Early migrants redistribute downstream from upper rearing areas to overwinter in the Grande Ronde Valley between Union and Elgin, OR (Figure 1), whereas late migrants overwinter in upper rearing areas before both groups migrate seaward in the spring. On average, approximately 80% of Catherine Creek Chinook salmon juveniles select the early migrant life history and overwinter in the Grande Ronde Valley downstream of Union, OR (Yanke et al. 2008).

Early migrant survival to Lower Granite Dam (fish overwintering in the Grande Ronde Valley) is typically lower for the Catherine Creek population than other Chinook salmon populations in the Grande Ronde Subbasin. From migration years (MY) 2004-08, early migrant survival to Lower Granite Dam (LGD), for Catherine Creek, averaged 0.13±0.06 (SD), compared to an aggregate mean of 0.24±0.05 for other Grande Ronde River populations (Yanke et al. 2008). Previous research estimated that travel times through the Grande Ronde Valley reach were considerably greater than any other reach, and accounted for 42% of the mortality incurred in freshwater for naturally-produced Chinook salmon (Monzyk et al. 2009).

A recent Biological Opinion by the National Marine Fisheries Service calls for efforts to increase survival for these threatened populations in areas outside the hydrosystem (NMFS 2008). It has been identified that a better understanding of the survival and migration dynamics of smolts on a reach specific scale will provide greater focus for fisheries managers to apply limited resources to improve survival of these populations (Monzyk et al. 2009). The reaches meandering through the Grande Ronde Valley were identified as the highest priority for restoration for Catherine Creek spring Chinook salmon (Nowak et. al 2004); however, little is known regarding the timing, location, and source of mortality for this depressed population. This research was designed to identify and describe spring Chinook salmon overwinter rearing reaches within the Grande Ronde Valley.

Methods

Site Description

This study was conducted within Grande Ronde Valley located in upper Grande Ronde Basin of the Blue Mountains Province in northeast Oregon (Figure 1). Catherine Creek, a highly regulated and known spring Chinook salmon spawning tributary of the Grande Ronde River, was chosen for this study due to juvenile spring Chinook salmon emigrants having comparatively low survival rates to the Snake and Columbia river hydrosystem. Catherine Creek is a seventh-order river where it converges with the Grande Ronde River, at the downstream section of the Grande Ronde Ditch, and drains approximately 1,045 km^2. Catherine Creek, which is approximately 109.3 km long, originates in the southern slopes of the Eagle Cap Mountains at a maximum headwater elevation of 2679 m and converges with the Grand Ronde River at an elevation of 816 m. Catherine Creek has a diverse flow and habitat regime being comprised of an upstream high gradient reach and downstream low gradient reach; the gradient transition occurs in close proximity to the mouth of Pyles Creek. The high gradient watershed that encompasses Catherine Creek is composed of mixed-coniferous forest, while lower Catherine Creek is primarily dedicated to agriculture sustained by irrigation. Catherine Creek is partially impounded by three irrigation dams (i.e., upper and lower Davis dams and Elmer Dam) from late-summer to mid-winter.

Radiotelemetry and PIT Tagging

Ninety-eight wild Catherine Creek juvenile spring Chinook salmon early migrants were implanted with Lotek Wireless radio transmitters (Model NTQ-1) with a 12 h/d duty cycle from 20 October 2009 to 1 December 2009 (Table 1). In addition, a 134.2 kHz 12 mm passive integrated transponder (PIT) tag (Destron Fearing; Model TX1411SST) was implanted into the periodontal cavity of 826 wild early migrants from 14 September 2009 to 30 November 2009. Tagged fish were captured using a 5 ft rotary screw trap (Figure 2).

Fish were randomly selected for PIT tagging per 24 h sample. Initially, fish were placed into a 6.0 L container and anesthetized in an aerated solution containing 50 mg/L of tricaine methanesulfonate (MS-222). Random fish were selected and PIT-tags were inserted intraperitoneally, using a modified hypodermic syringe, posterior of the longest ray of the pectoral fin and offset left of the ventral midline (Prentice et al. 1986, 1990; Matthews et al. 1990, 1992). Syringes and PIT-tags were disinfected for 10 min in 70% isopropyl alcohol and allowed to dry prior to use. Length (FL, mm), weight (0.1 g) and unique tag code was recorded for each fish processed. Tagged fish were then transferred to a covered recovery tank containing aerated freshwater until recovered. Recovered fish were immediately released downstream of the screw trap into habitat exhibiting reduced flow.

Fish weighing greater than or equal to 8.5 g were selected for coded radio tag implantation to ensure the transmitter to fish weight ratio remained ≤3.0%; well below the tag burden of 6.7%, which is the level Brown et al. (2010) documented juvenile hatchery Chinook salmon begin to experience negative effects on survival (Figure 2). Radio transmitters utilized had an 18 mm trailing antenna and a mean weight of 0.27 g (SD 0.004); mean tag burden for implanted transmitters was 2.9% (SD 0.002). Implanted radio transmitters operated between 164.0 and 168.0 MHz and transmitted a signal at a varied burst rate of 6 pluses per minute. This radio tag operating configuration yielded a typical battery life of 41 days and a guaranteed battery life of approximately 33 days. All coded radio tags were divided among three frequencies to minimize receiver scan time while reducing the probability for tag collision.

Radio tag implantation occurred at the sampling location following the conclusion of a 24 h sampling period. Following removal from the screw trap live box, fish were placed into an aerated 19 L covered container. Immediately prior to surgery, fish were placed into a 6 L container containing 70 mg tricaine methanesulfonate (MS 222)/L buffered with sodium bicarbonate. Following anesthetized fish exhibiting loss of equilibrium and reduced opercular rate (i.e., stage 4 anesthesia; Summerfelt and Smith 1990) (mean 5.9 minutes, SD 1.4), a fine foam pad coated with synthetic mucus restoring agent (PolyAqua; Kordon LLC, Hayward, CA) was used to stabilize the fish ventral side up. A plastic tube was used to continuously administer diluted anesthetic (MS 222, 35 mg/L) through the mouth and over the gills to initiate partial recovery and prevent contamination of the incision during surgery. Following surgery, implanted fish were transferred to a covered 19 L aerated freshwater container until equilibrium and opercular rate had restored (mean 6.9 minutes, SD 2.8). Upon complete recovery, fish were immediately returned to a portion of Catherine Creek, near the capture location, which exhibited reduced flow (Moore et al. 1990). Measurements collected for all PIT tagged fish were also collect for radio-tagged fish.

Surgical protocol used was similar to that of Adams et al. (1998). A 5 mm incision was made anterior to the pelvic gridle and offset 2 mm left of and parallel to the ventral midline. The incision was initiated with a 16-gauge needle to a depth adequate enough to merely penetrate the peritoneum (Summerfelt and Smith 1990) and finished with suture scissors to prevent internal injury. A trailing antenna outlet was created in the body wall using the shielded-needle technique (Ross and Kleiner 1982; Adams et al. 1998). Following placement of the antenna through the body wall, a sterilized radio tag coated with oxytetracycline (200 mg/mL) was inserted into the body cavity to minimize infection and positioned directly underneath the incision. Following transmitter implantation, sterile, synthetic absorbable, monofilament surgical suture (Maxon 5–0) with a 17 mm 1/2 circle, reverse cutting needle was used to close the incision with three interrupted sutures (Wagner and Cooke 2005). To reduce infection, completed sutures were coated with antibacterial ophthalmic ointment (Vetropolycin). Mean total surgery time for all radio-tagged juvenile Chinook was 5.7 minutes (SD 1.7).

Stationary radio receivers (Lotek SRX-400 W7AS) were positioned throughout the Grande Ronde Valley to assist mobile tracking efforts (Figure 3). Four receivers were installed on lower Catherine Creek, while one receiver was installed on the Grande Ronde River downstream of the mouth of Catherine Creek. Specifically, stationary receivers were installed near lower Davis Dam, Gekeler Lane, Booth Lane, Alicel Lane and Rhinehart Lane. Stationary receivers were powered by a single 12-V battery that was replaced biweekly during site visits to download detection data.

Effort was made to obtain a weekly relocation, from 21 October 2009 to 22 March 2010, for each radio-tagged fish following a 5-day recovery period (Martinelli et al. 1998). Typically, the portion of Catherine Creek between the screw trap and Gekeler Lane was tracked weekly; however, tracking extended to the mouth of Catherine Creek at least once monthly to ensure that possible radio-tagged emigrants occupying these areas were relocated. In addition, on 22 December 2009, aerial tracking was conducted of Catherine Creek tributaries Mill and Little Creek and the Grande Ronde River from Elgin, OR to the upstream margin of the Grande Ronde Ditch in an effort to relocate stray emigrants. Lower reaches of Pyles Creek and Little Creek were tracked weekly. Periodically, the lower reaches of Ladd Creek and Mill Creek were radio-tracked in attempt to relocate missing fish.

Mobile tracking was typically accomplished by foot or boat using a Lotek SRX-400 W5XG receiver and a three-element Yagi antenna (Lotek). Upon receiving a signal from a radio-tagged fish, geographic coordinates were obtained using a hand-held global positioning system unit (Garmin GPS II Plus) for all relocations. During free flowing periods (i.e., minimal surface ice), 30 codes were randomly selected weekly and identified as fish to determine an exact location for using triangulation techniques. For all triangulated fish, microhabitat use data was collected; however, considerable surface ice (~ 0.5 m thick) during mid to late-December hindered weekly tracking efforts and prohibited the collection of microhabitat use data. Microhabitat variables measured included water temperature (C°), dissolved oxygen (mg/L), depth (m), bottom velocity (m/s), mean column velocity (m/s), dominant substrate, subdominant substrate, cover type, distance to cover (m) and distance to bank (m).

Significant effort (1,130 person hours, 14 hours/day) was required to accomplish the necessary field work needed to address our research objectives. A total of 81 tracking sessions were completed resulting in 1,053 relocations and 854.8 river km were tracked. An average of 0.81 river km was tracked to obtain a single radio-tagged fish relocation.

Microhabitat Use and Availability

Microhabitat use data were collected at each exact location occupied by a relocated radio-tagged juvenile Chinook salmon (Table 2). Microhabitat availability data were collected using line-transect survey techniques. Both the high and low gradient reaches of Catherine Creek used by radio-tagged early migrants were divided into lower, middle and upper sections (Table 2; Figure 4).

Microhabitat availability data was obtained, within these sections, from reaches occupied by tagged fish during flow conditions synonymous to those associated with microhabitat use (Figure 4). Microhabitat variables measured at each transect point included depth (m), bottom velocity (m/s), mean column velocity (m/s), dominant substrate, subdominant substrate, cover type, distance to cover (m) and distance to bank (m). Morphological stream characteristics obtained during habitat availability surveys included bank angle (°), undercut bank distance (m), and 30-m riparian land use (%). Microhabitat availability data and morphological stream characteristics for Catherine Creek were collected during late-January and early-February 2010 (Table 3). Evenly spaced transects positioned two mean stream widths (2MSWs) apart were divided into evenly-spaced points from which microhabitat variables were measured (Simonson et al. 1994). A total of 57 transects were surveyed yielding 698 survey points, resulting in approximately 12 points per transect. A total of 1.3 km of the 29.9 km (~ 4.3%) regularly radio-tracked was included in these microhabitat availability surveys (Table 4).

For microhabitat use and availability, a top-set wading rod was used to measure depth to the nearest centimeter. A Marsh-McBirney flow meter (Model 2000) was used to measure bottom and mean current velocity (m/s). Mean current velocity was measured in the water column at a depth 60% from the surface in water depths of 0.75 m or less. For depths greater than 0.75 m, current velocity was measured at depths 20% and 80% from the surface, which were averaged to produce mean column velocity (McMahon et al. 1996). Dominant and subdominant substrates were visually determined using a modified Wentworth particle size classification (Bovee 1986; Table 5). Nearest dominant cover type was visually determined by establishing the presence or absence of cover and then determining the distance to the fish location. Cover types used were no cover, coarse woody debris, fine woody debris, root wad, emersed aquatic vegetation, submersed aquatic vegetation, terrestrial vegetation, undercut bank, and boulder (Table 6). Cover types were considered associated with fish occurrence when the cover was 2 m or less from the fish location.

In addition to collecting an instantaneous temperature measurement at each fish location, continuous hourly water temperature data were collected using HOBO Pendant Temperature Loggers (Onset Computer Corporation) from mid-July 2009 to early-May 2010 at strategic locations along Catherine Creek (Figure 5). Flow in cubic feet per second (cfs), for Catherine Creek, was acquired from the Oregon Department of Water Resources gauging station 13320000 (available online at http://apps2.wrd.state.or.us/apps/sw/hydro_near_real _time/display_hydro_graph.aspx?station_nbr=13320000) and converted to m^3/s.

Night-time Snorkeling

Larger juvenile Chinook salmon have been documented to use significantly different habitats compared to smaller individuals of the same cohort (Everest and Chapman 1972; Holecek et al. 2009). Since we were restricted by tag burden to only radio-tagging the upper echelon of sampled early migrants, we conducted post-surgery night-time snorkeling to recapture radio-tagged and PIT tagged individuals to conduct size and growth comparisons. A three-man crew would initially relocate a radio-tagged fish and determine specific location using triangulation techniques. Subsequent sampling of that location would be conducted by one snorkeler, outfitted with a dive light, slowly moving downstream and attempting to guide all observed juvenile Chinook salmon into a downstream seine operated by a two-person crew. All recaptured tagged fish and a subsample of co-occupants were measured to obtain FL (mm) and weight (g). This technique was conducted at upper, middle and lower reaches of the identified overwintering area to avoid introducing spatial bias; however, excessive depth and limited visibility prohibited effective snorkeling of the lower reach. Night-time snorkeling was conducted on 9 November, 20 November, 12 January and 26 January. Extensive icing conditions precluded night-time snorkeling during December and prohibitive high water events were present during February and March.

Statistical Analysis

Growth.—Growth of recaptured radio-tagged and PIT tagged fish were compared using the Mann-Whitney rank sum test to ascertain if growth of radio-tagged fish significantly differed from that of PIT tagged fish, which are reported to sustain positive growth following PIT tagging (Prentice et al. 1990). To ascertain if overwintering reaches occupied by radio-tagged fish represented that of the entire early emigrant size distribution, size at tagging for recaptured seined PIT tagged fish occupying the same habitat as relocated radio-tagged fish was compared to size at tagging for all temporally similar PIT tagged fish. The Mann-Whitney rank sum test was employed to compare size of emigrants during redistribution to that of recaptured co-occupants during overwinter rearing.

Spatial Analysis.—Median linear range was calculated for all radio-tagged early migrant spring Chinook salmon. Linear ranges were estimated using similar techniques as those described by (Vokoun 2003). Relocation coordinates were imported into ArcView 9.3. A National Hydrology Dataset flow line data layer, obtained from the United States Geological Survey (available online at http://nhdgeo.usgs. gov/viewer.htm), was then used to delineate the Catherine Creek thalweg. Shareware arcscripts Add Points Evenly Along a Line (Lead 2002) and Nearest Neighbor 3.1 (Weigel 2002) were subsequently used to manipulate data layers and estimate overwinter weekly linear range. Fall and winter relocations were compared using the Kolmogorov-Smirnov two-sample test (K-S test). To determine if size of radio-tagged fish influenced migration distance or reach occupancy, simple linear regression was used to compare weight to total linear range for all radio-tagged fish.

Microhabitat.—Microhabitat use and availability data were spatially (i.e., high and low gradient) and temporally (i.e., fall and winter) stratified. High and low gradient microhabitat use data were compared to analogous microhabitat availability data. In addition, high gradient microhabitat use data were compared to low gradient use data. A spatial (i.e., seasonal) difference in microhabitat use was examined by comparing (K-S test) high and low gradient microhabitat use. A K-S test was used to compare microhabitat use to available microhabitat to assess for non-random microhabitat use for all continuous variables (i.e., depth, bottom velocity, mean column velocity, dominant substrate, distance to cover and distance to bank). Substrate was included as a continuous variable due to the continuity of substrate particle size spectrum. An analogous likelihood-ratio chi-square test was performed on the categorical variable cover to test for nonrandom microhabitat use.

Microhabitat suitability was estimated by comparing microhabitat use and availability data. Suitability was calculated by dividing microhabitat use (%) by microhabitat available (%) for each variable. Microhabitat suitability ranges from 0 to 1, with 0 indicating least suitable microhabitat and 1 representing preferred or optimal microhabitat (Waters 1976; Bovee 1986). In an attempt to increase transferability of suitability indexes, influence of uncommon available microhabitat data were eliminated from suitability analyses by omitting rare available microhabitat producing Category III criteria (Bovee 1986). The purpose of this data manipulation was to enhance suitability index transferability to overwinter rearing reaches that may differ from those of Catherine Creek.

Principal component analysis (PCA) was conducted on all continuous microhabitat variables (depth, bottom velocity, mean column velocity, dominant substrate, distance to cover, and distance to bank) to determine selected fall and winter macrohabitat. PCA allows the collective interaction among multiple microhabitat variables to be investigated and ranked by importance by creating sequential uncorrelated linear combinations (i.e., principle components) that maximize variation explanation. Components with eigenvalues greater than 1.0 were retained as recommended by Kaiser (1960), Stevens (1996), and Kwak and Peterson (2007). Habitat availability scoring coefficients were subsequently used to calculate microhabitat use principle component scores. A K-S test was conducted on retained principal component scores to investigate for statistically significantly differences between microhabitat use and availability for both fall and winter.

Results and Discussion

PIT-tags were inserted into 826 Catherine Creek juvenile spring Chinook salmon early migrants between 14 September and 30 November 2009. Water temperatures during tagging ranged from 0.5 °C on 29 November to 15 °C on 26 September. PIT tagged fish had a mean length of 78.4 mm (SD, min–max; 7.9, 56–100) and mean weight of 5.5 g (SD, min–max; 1.6, 2.0–11.0). Radio tags were implanted into 98 juvenile spring Chinook salmon early migrants between 20 October and 1 December 2009. Water temperatures during tagging ranged from 8.0 °C on 22 October to 0.5 °C on 29 November 2009. Radio-tagged fish had a mean length (FL) of 94.6 mm (SD, min–max; 2.8, 89–105) and mean weight of 9.4 g (SD, min–max; 0.9, 8.1–13.3). An essential assumption associated with the integrity of tagging studies is that the employed technique results in unaltered or has a negligible affect on growth, mortality and behavior (Guy et al. 1996). Prentice et al. (1990) reported that 55–120 mm (FL) PIT tagged juvenile Chinook salmon experience negative growth during a 20 d period post-tagging; however, compensatory growth is present following this recovery period. As a general rule of thumb, Winter (1996) recommends that radio transmitters should not weigh more than 2% of body mass out of water; however, this is often difficult to achieve for small fish (e.g., juvenile life stage). Recent research advocates development and implementation of a more scientific based index to assist researchers in selecting the appropriate tag to address established objectives (Brown et al. 1999). Brown et al. (2010) found that acoustic transmitters negatively affected juvenile Chinook salmon (FL, 90–110 mm) when tag burdens exceeded 6.7%. Research by Adams et al. (1998) found that surgically implanted radio transmitters (2.2–5.6% tag burden) did not cause significant long-term decreased swimming performance for juvenile Chinook salmon >120 mm (FL); however, those <120 mm (FL), exposed to a tag burden ≥4.6%, exhibited significantly inhibited swimming performance. Considerable effort was made to conform to the 2% recommendation by Winter (1996), while attempting to tag as representative a size proportion of the early migrant population as possible. During our study, radio tag implanted juvenile Chinook salmon experienced an average tag burden of 2.9% (SD, min–max; 0.002, 2.0–3.3%).

Twelve (12 %) radio-tagged fish were confirmed mortalities or cases of tag expulsion owing to recovered radio tags; four of the recovered tags were reinserted. One recovered tag was triangulated to and recovered from within avian scat, while two tags were recovered from mink dens. Several other recovered tags were triangulated to and recovered from the bank however, could not be associated with a specific source of mortality. Two mortalities were triangulated to an irrigation ditch located immediately upstream of the Swackhammer Fish Ladder. Three (3%) radio-tagged fish were never relocated. Data collected for confirmed mortalities or shed tags were excluded from all analyses.

Of the remaining 83 fish regularly relocated, all fish remained within the Catherine Creek drainage throughout the study. Six (7 %) fish were relocated within tributaries of Catherine Creek; 3 were relocated within Pyles Creek and 3 were relocated within Little Creek. Fish relocated to Pyles Creek were restricted to occupying only the lower 75 m due to a migration barrier (i.e., culvert).

During fall (22 September–20 December), 5 (6 %) fish were relocated below lower Davis Dam, while the majority (92 %) remained upstream of lower Davis Dam (Figure 6). One (1 %) consistently relocated fish was tagged after 20 December and thus did not contribute to the fall sample. During winter (21 December–19 March), 6 (7%) of the remaining 83 fish were not relocated likely due to radio tags exceeding their typical battery life capacity. Of the remaining 77 fish, 50 (65 %) fish limited their occupancy to reaches upstream of lower Davis Dam. A considerably larger proportion (i.e., 35 % or 27 fish) occupied reaches downstream of lower Davis Dam during winter compared to fall.

During early-spring (i.e., March), the majority (i.e., 88 % or 73 tags) of the remaining radio tags implanted had exceeded their warranty life, while 10 (12 %) continued to transmit a signal. Distribution of these fish was considerable, ranging from Union, OR to lower Catherine Creek. On 10 March 2010, one fish was relocated approximately 11.6 rkm upstream from the mouth of Catherine Creek, likely conducting spring emigration.

Stationary receivers detected 8 radio-tagged juvenile Chinook salmon from 31 October 2009 to 8 March 2010 (Table 7). Detections occurred at lower Davis Dam, Gekeler Lane and Booth Lane; no fish were detected at receivers positioned at Alicel Lane and Rhinehart Lane. The majority (63%) of the detections occurred during mid-January and coincided with an increase in water temperature. All detections occurred during early morning or late evening periods (i.e., before 0800 and after 1700), except for one detection that occurred during mid-March, indicating obligatory nocturnal movement.

Size and Growth

Significantly different microhabitat use and reach occupancy has been reported for juvenile Chinook salmon (Everest and Chapman 1972; Hillman et al. 1987; Holecek et al. 2009). In addition to significantly different summer microhabitat use, Holecek et al. (2009) reported a size associated spatial difference in reach occupancy; where by, smaller juvenile Chinook salmon occupied upper Big Creek, and larger fish occupied lower Big Creek in central Idaho. During our study, fish (n = 290) collected during night-time snorkeling had a mean length and weight of 82.9 mm (SD, min–max; 7.0, 63–100) and 6.3 g (SD, min–max; 1.6, 2.6–10.8), respectively. No statistically significant size difference was found between PIT tagged early migrants and those recaptured PIT tagged fish (n = 14) co-occurring with radio-tagged fish (length, $P = 0.3280$; weight, $P = 0.4950$; Figures 7–8), indicating that occupied stream reaches and microhabitat use of radio-tagged early migrants are representative of that of the entire size distribution of the early migrant population sampled at the screw trap. In addition, simple linear regression revealed that total linear range was not statistically significantly related to size ($P = 0.6954$; Figure 9). Holecek et al. (2009) suggested that spatial differences in water temperature, life history (i.e., summer-run vs. spring-run), fish density and microhabitat availability could possibly explain size associated variation in microhabitat and reach occupancy.

Recaptured PIT tagged early migrants (n = 13) had a mean absolute growth of 0.021 g/d (SE, min–max; 0.017, -0.040–0.200), while recaptured radio-tagged fish (n = 5) had a mean absolute growth of -0.010 g/d (SE, min–max, 0.006, -0.030–0.003; Table 8). No statistically significant growth difference was found between radio-tagged early migrants and PIT tagged fish ($T = 34$, $P = 0.20$). However, these results should be interpreted skeptically due low sample size.

Linear Range and Reach Occupancy

Monthly median linear range was considerably greater during fall than winter (Table 9). Higher monthly median ranges during fall were associated with early migrants redistributing from spawning reaches to downstream winter rearing reaches. Depressed monthly median linear ranges during winter coincided with early migrants demonstrating sedentary behavior while occupying overwintering reaches. During January, monthly median linear range increased significantly despite remaining low compared to fall (Table 9). Elevated January movement was attributed to numerous fish briefly reinitiating emigration. The majority of these mobile fish abandoned high gradient reaches upstream from the mouth of Pyles Creek and occupied low gradient reaches between the mouth of Pyles Creek and Mill Creek. Movement during this study was predominantly directed downstream, however during December one radio-tagged fish returned 1.34 km upstream and remained in this reach the remainder of the winter occasionally demonstrating wandering behavior.

Water temperatures throughout the study area, during the study period, were relatively homogeneous (Figure 10). Water temperature appeared to be a proximate migration stimulus associated with movement during fall migration and overwinter rearing. Weekly median linear range decreased and was associated with decreasing water temperatures during late-October and early-November when sedentary behavior became prevalent (Figure 11). Sedentary behavior persisted and coincided with water temperatures near 0 °C until mid-January when a peak in weekly median linear range occurred and was associated with increasing water temperatures (4–5 °C). Discharge did not appear to have any noticeable affect on movement from mid-October to late-March (Figure 11).

Distribution of radio-tagged early migrant relocations during fall and winter were statistically significantly different ($P < 0.0001$; Figure 12), indicating that a seasonal spatiotemporal shift occurs resulting in considerably different habitat occupancy (i.e., low/high gradient). During fall, the majority of relocations (n = 448, 89 %) occurred in high gradient reaches upstream of the mouth of Pyles Creek, while only 54 relocations occurred in low gradient reaches downstream of the mouth of Pyles Creek. During winter, nearly half (n = 236, 43 %) of the relocations occurred in low gradient reaches downstream of the mouth of Pyles Creek; 315 (57 %) of the relocations occurred in high gradient reaches upstream of the mouth of Pyles Creek (Figure 12).

Microhabitat

<u>Microhabitat Use Comparisons</u>.—Microhabitat use variables depth, dominant substrate and cover type were statistically significantly different ($P < 0.0001$) between low and high gradient reaches; microhabitat use variables bottom velocity, mean column velocity, distance to bank and distance to cover were not statistically significantly different ($P > 0.05$) between low and high gradient reaches (Table 10; Figure 13). Early migrants occupied deeper water in low gradient reaches compared to high gradient reaches. Bottom and mean column velocity currents used were similar between low and high gradient reaches; however, on average, mean column velocity currents used were swifter. Cobble was the modal dominant substrate used in the high gradient reach, while silt was the modal dominant substrate used in the low gradient reach. Mean distance to bank for fish detections were between 2–3 m for both the low and high gradient reach. Boulders were most frequently used as cover within the high gradient reach, while fine woody debris was the modal cover type used in the low gradient reach. Most fish relocations occurred in close proximity to cover for

both low and high gradient reaches, with mean distance to cover for both reaches being less than or equal to 0.50 m (Figure 13).

Microhabitat Use and Availability Comparisons.—Microhabitat use and availability univariate frequency distributions were statistically significantly different for all variables (depth, bottom velocity, mean column velocity, dominant substrate, cover, distance to cover and distance to bank) for both the high and low gradient reach ($P < 0.05$; Figures 14–15). Such significant divergence between microhabitat use and availability indicates that early migrant juvenile Chinook salmon nonrandomly select specific microhabitats during fall migration and overwinter rearing irrespective of stream reach occupied.

Catherine Creek juvenile spring Chinook salmon early migrant microhabitat use was uniformly different than that available (Figures 14–15). Average depth used was considerably greater than that available for both the high and low gradient reach, indicating that early migrants select depths greater than those available during fall migration and overwinter rearing. Bottom velocity mean use, corresponding to the high gradient reach, was greater than that of the low gradient reach, indicating that subsequent early migrants select swifter bottom velocities than those available; to a lesser extent, a similar trend was present for the low gradient reach. The same divergent relationship of greater velocities being used than available was documented of mean column velocity for both the low and high gradient reach. High gradient modal available dominant substrate was gravel, while utilized modal dominant substrate was cobble, indicating that coarser substrates are selected than those available; silt was most commonly available and used by early migrants in the low gradient reach. Distance to bank mean use was shorter than the corresponding availability mean for the high gradient reach, indicating that subsequent early migrants tended to select habitat near the bank; low gradient distance to bank mean use was nearly equal to the corresponding availability mean. Early migrants occupying the high gradient reach most frequently used boulders as cover; fine woody debris was most commonly used in the low gradient reach as cover, despite cover not being readily available in either reach (Figures 14–15). Clusters of tumbleweed *Sisymbrium altissimum* and American waterweed *Elodea canadensis* were commonly available and heavily used in the low gradient reach, while not available in the high gradient reach. For both the high and low gradient reach, use and availability distance to cover means demonstrate minimal variation; however, high gradient reach mean use distance to cover was slightly less than the corresponding availability mean, indicating that subsequent early migrants generally select habitat that is in close proximity to cover.

Suitable and Optimal Microhabitat.—Univariate microhabitat suitability indices revealed most suitable or optimal microhabitat during the fall migration and overwintering periods for Catherine Creek early migrant juvenile spring Chinook salmon (Figures 16–17). Deep depths were optimal or preferred for both high and low gradient reaches. Slow bottom and mean column velocity currents were optimal for all reaches occupied. Silt, cobble and boulder substrates were most suitable within the high gradient reach, while silt and sand were optimal substrates within the low gradient reach. Root wad was the preferred cover type for the high gradient reach, while coarse woody debris was most suitable for the low gradient reach (Figures 16–17). Moderate to small distances to cover (i.e., 0.0 – 2.0 m) were optimal for both the high and low gradient reaches. A variety of distances from bank (i.e., 0 – 6.0 m) were highly suitable for the low gradient reach, while distances from bank ≥6.0 m were optimal within the high gradient reach (Figures 16–17).

Catherine Creek juvenile spring Chinook salmon univariate microhabitat suitability indices generally agree with those previously reported. During summer juvenile Chinook salmon occupy shallow to moderate depths sustaining slow to moderate velocities flowing over fine to medium substrates near cover positioned close to the bank (Hillman et al. 1987; Holecek et al. 2009). Juvenile Chinook microhabitat use tends to shift toward deeper depths and slower current velocities, with an elevated use of fine (e.g., silt) and coarse (e.g., boulder) substrates near large cover types (e.g., boulder, coarse woody debris) near the bank (Hillman et al. 1987; Allen et al. 2000). However, previously reported microhabitat use data and subsequent univariate suitability indices were derived based on data obtained from snorkel survey techniques, which have been reported to introduce fright bias (i.e., reactive displacement) and possibly yield erroneous results when only "undisturbed" fish are included in analyses that likely do not represent the entire population (Brignon 2009). Advances in radiotelemetry (i.e., NanoTag transmitters; Lotek Wireless, Inc.) have permitted application of this technology to small fishes; historically tag size was prohibitive. Pertaining to microhabitat use identification, radiotelemetry techniques minimize fright, temporal, spatial, ice cover, turbidity, and depth biases compared to snorkeling techniques (Larimore and Garrels 1985; Winter 1996). Excessive depths and turbidity levels present in the low gradient reach of Catherine Creek (i.e., downstream of Pyles Creek) would have certainly prohibited the application of snorkeling techniques consequentially producing reach occupancy, temporal and spatial biases.

High and Low Gradient Reach Comparisons.—Microhabitats occupied by early migrant juvenile spring Chinook salmon revealed similarities and differences between high and low gradient reaches during the fall migration and overwintering periods (Table 11). Microhabitat variables depth, dominant substrate and cover occupied were statistically significantly different ($P < 0.0001$) between high and low gradient reaches, while variables bottom velocity, mean column velocity, distance to cover and distance to bank were not ($P > 0.05$; Table 11). Shallower depths were used within the high gradient reach, while deeper depths were more frequently used in the low gradient reach. Bottom and mean column velocities ranging 0.0–0.1 were most frequently used within both high and low gradient reaches. Coarse substrates (i.e., cobble) were occupied within the high gradient reach compared to fine substrates (i.e., silt) within the low gradient reach. Fine and coarse woody debris, in addition to boulders, were predominately used as cover within the high gradient reach, while fine woody debris and terrestrial vegetation were used heavily within the low gradient reach. Distances to cover ranging 0.0 – 0.5 m were prevalent for both high and low gradient reaches. Distances to bank ranging 0.0 – 4.0 m were most frequent for both high and low gradient reaches.

Multivariate Analyses.—Within the high gradient reach, Catherine Creek early migrant juvenile spring Chinook salmon occupied macrohabitat nonrandomly for components 1, 2 and 3 ($P < 0.0001$; Table 12). Similarly, in the low gradient reach, early migrants selected macrohabitat nonrandomly for components 1 and 2 ($P < 0.05$; Table 12). Principal component analysis (PCA) indicated that combinations of all continuous variables measured (depth, bottom velocity, mean column velocity, dominant substrate, distance to cover, distance to bank) were important in determining macrohabitat selection. Retained components 1, 2 and 3 explained a cumulative variance of 81% for the high gradient reach (Table 13); components 1 and 2 explained a cumulative variance of 64% for the low gradient reach (Table 14). For both reaches, bottom and mean column velocity loadings were large enough to indicate a significant influence on PC1. Dominant substrate was never large enough to contribute to PC1, however contributed to PC2 for both reaches. Loadings for depth were not large enough to contribute to PC1 or PC2 for the high gradient reach, however were large enough to contribute to both PC1 and PC2 for the low gradient reach. Loading for distance to cover and distance to bank were large enough to indicate influence on PC1 and PC2 for the high gradient reach, however were less consistently influential for the low gradient reach. Loadings for depth, bottom velocity and dominant substrate were significantly large enough to indicate considerable influence on PC3.

During the fall migration and overwintering period, within the high gradient reach, early migrants were typically occupying marginal habitat with slow currents near cover, and were rarely located near the thalweg when no cover and fast velocities were prevalent (low PC1 scores; Figure 18). Fish were encountered near the thalweg when coarse substrates (e.g., cobble and boulder) and cover were co-occurring (high PC2 scores); fish were rarely encountered near the bank when cover was absent and substrates were predominately fines (i.e.., clay and silt) (low PC2 scores). Relocations were associated with moderate bottom velocities when coarse substrates (i.e., cobble and boulder) and deep water were present (low PC3 scores), while were less associated with slow bottom velocities co-occurring with fine substrates and shallow depths (high PC3 scores; Figure 19). Within the low gradient reach, early migrants generally selected moderate depths when slow currents and cover were present (low PC1 scores), and tended to avoid deep water when fast currents were present with the absence of cover (high PC1 scores; Figure 20). In addition, low gradient relocations were near the bank when moderate depths and silt were present (moderate PC2 scores; Figure 20).

Microhabitat Availability.—Microhabitat availability surveys of Catherine Creek revealed that the high gradient reach, upstream of the mouth of Pyles Creek, is considerably different from the low gradient reach designated as downstream from the mouth of Pyles Creek (Table 2). The high gradient reach exhibited shallower depths with considerably swifter currents flowing over coarser substrates compared to the low gradient reach. Substrates available in the high gradient reach ranged from clay to boulder, while available substrates ranged from clay to sand in the low gradient reach (Table 2). The dominant cover type for both reaches was “no cover”; cover was absent from 32% and 43% of the high gradient and low gradient reaches, respectively. More than half of all microhabitat availability survey points were within 2.0 m of cover (57%, high gradient; 68%, low gradient; Table 2).

Stream and riparian morphology characteristics, obtained from microhabitat availability surveys, indicate that the high and low gradient reaches are primarily similar (Table 3). The low gradient reach was considerably wider than the high gradient reach; however, both reaches exhibited generally small bank angles. Undercut bank distance was minimal for both reaches suggesting that base flow conditions produces negligible erosion or spring freshets obscure such erosion. Land use conditions, within a 50 m buffer of surveyed reaches, were similar between high and low gradient reaches. The majority of land use was dedicated to agriculture with forested and developed categories constituted ≤25% each (Table 3).

Management Implications and Recommendations

Catherine Creek is a highly altered and degraded system (e.g., berms, channelization, irrigation diversions, dams). Efforts directed toward increasing survival of early migrants during fall migration and overwintering periods would likely be most efficiently directed toward portions bounded by Union, OR and the mouth of Mill Creek. Moreover, the high gradient reach located between Union, OR and the mouth of Pyles Creek was most intensely utilized; holistic rehabilitation efforts would likely be most productive if concentrated within this reach.

Several reaches within the high gradient overwintering reach were not occupied consistently by the early migrant population, indicating that these reaches do not contain habitat conditions conducive to successful overwintering. Specifically, the reach extending approximately 1.7 km upstream of Swackhammer Fish Ladder appeared to only be utilized as a migration corridor, suggesting that this high gradient channelized reach exhibiting homogenized riffle habitat is being avoided as overwintering habitat. In addition, several smaller reaches positioned between Union, OR and the mouth of Pyles Creek appeared channelized and lacked habitat complexity (e.g., pools and cover). Employing habitat restoration techniques, within these degraded reaches, that facilitate habitat complexity and increase occupancy potential will likely increase overwintering carrying capacity. In addition to rehabilitation of existing stream reaches, stream restoration that reclaims historic stream channels within the high gradient reach would considerably increase habitat availability by increasing stream length. Increasing habitat availability, habitat complexity, stream length and subsequently overwinter carrying capacity of the high gradient reach could potentially decrease linear range (i.e., movement) and the associated elevated mortality risk associate with migration.

The majority of radio-tagged early migrant relocations were associated with cover (e.g., log, root wad, terrestrial vegetation). The riparian zone of both the high and low gradient reaches used by early migrants was primarily devoted to agriculture, indicating that riparian vegetation which ultimately is the source of numerous types of cover may be a limiting factor. In addition, reaches associated with agriculture and minimal riparian vegetation exhibited extensive stream entrenchment, bank erosion and reduced habitat complexity. Establishment and protection of riparian vegetation would likely elevate the contribution of terrestrial vegetation into the stream, thereby elevating habitat complexity and cover availability. In addition, riparian vegetation is associated with bank stability and reduced erosion. Holistic management practices that enhance the riparian corridor vegetation of Catherine Creek could improve overwinter carrying capacity of early migrants by increasing habitat complexity (i.e., cover) and bank stability.

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Table 1. Characteristics of radio-tagged juvenile spring Chinook salmon from Catherine Creek, Oregon. Mortalities during the study period were not used for analyses.

Tag Code	Transmitter frequency (MHz)	Date tagged	Tag mass (g)	Fork Length (mm)	Weight (g)	Number of relocations
11	166.300	10/28/2009	0.279	91	8.5	13
12	166.300	10/28/2009	0.273	94	9.1	11
13	166.300	10/28/2009	0.267	93	8.5	3
14	166.300	10/28/2009	0.270	91	8.6	11
15	166.300	10/30/2009	0.272	91	8.7	14
16	166.300	10/30/2009	0.269	94	8.8	17
17	166.300	10/31/2009	0.275	92	9.1	15
18	166.300	10/31/2009	0.264	93	8.8	14
19	166.340	10/31/2009	0.269	94	8.7	15
20	166.300	10/31/2009	0.277	93	8.6	16
21	166.340	10/31/2009	0.271	96	9.5	16
22	166.300	10/31/2009	0.272	92	8.6	8
23	166.300	10/31/2009	0.271	93	8.7	14
24	166.300	10/31/2009	0.272	94	8.8	13
25	166.300	10/30/2009	0.268	93	8.7	10
26	166.300	10/30/2009	0.269	93	8.5	Mort
27[a]	166.300	11/23/2009	0.275	98	9.6	7
27	166.300	10/30/2009	0.275	94	9.5	Mort
28	166.300	10/30/2009	0.270	95	9.4	1
29	166.300	10/30/2009	0.267	93	8.6	Mort
30	166.300	10/29/2009	0.269	99	11.1	10
31	166.300	10/29/2009	0.274	96	9.8	14
32	166.300	10/30/2009	0.272	91	8.5	Mort
33	166.300	10/30/2009	0.265	100	13.3	0
34	166.300	10/29/2009	0.274	102	11.3	10
35	166.300	10/28/2009	0.276	92	9.2	14
36	166.300	10/29/2009	0.273	95	9.2	12
37	166.300	10/30/2009	0.267	96	9.8	7
38	166.320	10/27/2009	0.265	99	10.7	11
39	166.320	10/27/2009	0.268	93	9.2	11
40	166.320	10/27/2009	0.267	94	8.8	9
41	166.320	10/26/2009	0.267	96	9.6	Mort
42	166.320	10/26/2009	0.268	98	10.2	0
43	166.320	10/21/2009	0.265	89	8.1	18
44	166.320	10/21/2009	0.271	90	10.1	Mort
45	166.320	10/26/2009	0.271	91	8.9	15

Table 1.—(Continued).

Tag Code	Transmitter frequency (MHz)	Date tagged	Tag mass (g)	Fork Length (mm)	Weight (g)	Number of relocations
46	166.320	10/26/2009	0.274	93	9.3	17
47	166.320	10/26/2009	0.278	93	9.4	17
48[a]	166.320	11/23/2009	0.269	95	9.2	7
48	166.320	10/24/2009	0.269	98	11.6	Mort
49	166.320	10/26/2009	0.272	96	10.6	14
50	166.320	10/26/2009	0.270	95	9.7	15
51	166.320	10/26/2009	0.271	94	9.7	15
52	166.320	10/22/2009	0.267	93	9.4	1
53	166.320	10/23/2009	0.270	91	9.2	11
54	166.320	10/26/2009	0.265	94	9.4	9
55	166.320	10/28/2009	0.274	91	8.9	15
56	166.320	10/24/2009	0.263	98	10.6	18
57	166.320	10/26/2009	0.266	91	8.9	13
58	166.320	10/20/2009		94	9.4	17
59	166.320	10/20/2009		95	9.2	15
60[a]	166.320	11/23/2009	0.285	100	10.8	2
60	166.320	10/20/2009	0.285	97	9.9	Mort
61	166.320	10/20/2009		93	8.9	11
62	166.320	10/20/2009		93	8.5	18
63	166.320	10/20/2009		93	9.3	24
64	166.320	10/20/2009		91	8.6	18
65	166.340	10/31/2009	0.270	94	9.1	15
66	166.340	10/31/2009	0.274	94	8.9	16
67	166.340	10/31/2009	0.265	96	9.2	14
68	166.340	10/31/2009	0.268	92	8.8	16
69	166.340	10/31/2009	0.273	96	9.6	13
70	166.340	10/31/2009	0.269	105	12.2	12
71	166.340	10/31/2009	0.265	94	8.7	13
72	166.340	10/31/2009	0.268	95	9.5	10
73	166.340	10/31/2009		102	10.6	14
74	166.340	10/31/2009	0.277	93	8.8	17
75	166.340	10/31/2009		92	8.5	6
76	166.340	10/31/2009		95	8.8	7
77	166.340	10/31/2009	0.269	95	9.4	8
78	166.340	10/31/2009	0.270	92	9.1	17
79	166.340	10/31/2009	0.266	94	8.8	13
80	166.340	10/31/2009	0.270	94	9.5	16
81	166.340	10/31/2009	0.267	96	10.0	19
82[a]	166.340	11/24/2009	0.268	95	10.3	12
82	166.340	10/31/2009	0.268	94	9.1	Mort

Table 1.—(Continued).

Tag Code	Transmitter frequency (MHz)	Date tagged	Tag mass (g)	Fork Length (mm)	Weight (g)	Number of relocations
83	166.340	10/31/2009	0.269	95	9.5	16
84	166.340	10/31/2009	0.268	95	9.2	16
85	166.340	10/31/2009	0.263	95	9.8	17
86	166.340	10/31/2009	0.272	97	10.3	Mort
87	166.340	10/31/2009	0.272	91	9.0	20
88	166.340	11/16/2009	0.265	96	9.7	11
89	166.340	11/16/2009	0.269	95	9.4	14
90	166.340	11/16/2009	0.274	103	11.9	14
91	166.300	11/26/2009	0.268	96	9.3	12
92	166.300	11/26/2009	0.268	95	8.9	10
93	166.300	11/26/2009	0.264	93	8.8	15
94	166.300	11/28/2009	0.266	95	9.2	Mort
95	166.300	11/30/2009	0.261	95	8.5	14
96	166.320	11/30/2009	0.268	93	8.5	0
97	166.320	11/30/2009	0.267	93	8.5	15
99	166.320	11/26/2009	0.269	94	8.7	7
100	166.320	12/01/2009	0.264	98	10.5	3
101	166.340	11/30/2009	0.265	94	8.5	15
102	166.340	11/30/2009	0.271	98	10.4	4
103	166.340	11/25/2009	0.269	95	9.3	12
104	166.340	11/26/2009	0.272	96	9.2	Mort
105	166.340	11/29/2009	0.269	97	9.4	14
Mean			0.269	94.6	9.4	12.2
SD			0.004	2.8	0.9	5.0

[a] Tags were deployed a second time after recovery from mortalities.

Table 2.—Summarized microhabitat use and availability for high and low gradient reaches of Catherine Creek where radio-tagged early migrant spring Chinook salmon were located.

	High gradient		Low gradient	
Variable and statistic	Use	Available	Use	Available
Temperature (C°)				
n	268		108	
Mean	3.28		2.78	
SE	0.14		0.19	
Min – max	0.00 – 10.00		0.00 – 8.00	
Dissolved oxygen (mg/L)				
n	205		61	
Mean	14.39		14.06	
SE	0.07		0.14	
Min – max	12.10 – 16.81		12.13 – 16.68	
Depth (m)				
n	255	395	108	300
Mean	0.61	0.24	0.83	0.52
SE	0.02	0.01	0.04	0.02
Min – max	0.04 – 2.20	0.00 – 1.02	0.20 – 2.0	0.00 – 2.00
Bottom velocity (m/s)				
n	243	395	102	300
Mean	0.07	0.20	0.06	0.08
SE	0.01	0.01	0.01	0.01
Min – max	0.00 – 0.74	0.00 – 1.50	0.00 – 0.41	0.00 – 0.45
Mean velocity (m/s)				
n	243	395	104	300
Mean	0.16	0.34	0.12	0.20
SE	0.01	0.02	0.01	0.01
Min – max	0.00 – 0.70	0.00 – 1.65	0.00 – 0.52	0.00 – 0.76
Dominant substrate				
n	267	395	105	300
Mode	Cobble	Gravel	Silt	Silt
SE	0.07	0.06	0.07	0.04
Min – max	CL – BR	CL – B	CL – B	CL – SD
Distance to bank (m)				
n	262	395	107	301
Mean	2.19	1.87	2.64	2.63
SE	0.09	0.07	0.20	0.13
Min – max	0.00 – 8.00	0.00 – 6.30	0.00 – 11.00	0.00 – 10.00
Cover				
n	268	395	108	300
Mode	Boulder	No cover	FWD	No cover
Distance to cover (m)				
n	240	268	107	172
Mean	0.50	0.58	0.33	0.31
SE	0.04	0.04	0.05	0.03
Min – max	0.00 – 2.00	0.10 – 2.00	0.00 – 2.00	0.00 – 2.00

Table 3.―Stream morphology and riparian land use obtained during microhabitat availability surveys conducted where radio-tagged early migrant spring Chinook salmon were located.

	Morphology			50-m riparian land use (%)		
Reach and statistic	Stream width (m)	Bank angle (°)	Undercut bank (m)	Forest	Agriculture	Developed
High gradient	7.93	47.75	0.02	25.33	64.50	10.17
Low gradient	12.14	48.06	0.01	0.00	91.67	8.33
Mean	10.04	47.91	0.02	12.67	78.09	9.25
CV (%)[a]	0.30	0.00	0.35	1.41	0.25	0.14

[a] (SD/mean) × 100.
[b] Upstream of Valley River confluence.

Table 4.—Characteristics of surveyed stream reaches in Catherine Creek used by radio-tagged early migrant spring Chinook salmon as overwintering habitat.

Stream reach and location	Upstream geographic coordinates (UTM)		Downstream geographic coordinates (UTM)		Reach length (m)	Number of transects	Number of survey points
High gradient							
Union	11T	0433044 5006485	11T	0432917 5006566	0.126	10	141
Recycling Center	11T	0430525 5006833	11T	0430425 5006812	0.126	10	124
Pyles Creek	11T	0428785 5007414	11T	0428523 5007559	0.108	10	132
Low gradient							
Davis Dam	11T	0427666 5009439	11T	0427661 5009765	0.18	10	97
Wilkinson Road	11T	0426936 5013741	11T	0426895 5013901	0.36	10	118
Godley Lane	11T	0430177 5016526	11T	0430253 5016489	0.084	7	86
Total					0.984	57	698

Table 5.—Particle size categories and associated continuous variables used to visually estimate dominant and subdominant surface substrate size for all radio-tagged fish relocations and habitat availability survey points.

Category	Particle size (mm)	Continuous variable
Bedrock		13
Large boulder	>1024	12
Medium boulder	508-1024	11
Small boulder	256-508	10
Large cobble	128-256	9
Small cobble	64-128	8
Very coarse gravel	32-64	7
Coarse gravel	16-32	6
Medium gravel	8-16	5
Fine gravel	2-8	4
Sand	0.062-2.0	3
Silt	0.004-0.062	2
Clay	<0.004	1

Table 6.—Cover categories, associated continuous variables, and cover abbreviations used to describe nearest dominant cover for each fish location and habitat availability survey point.

Cover category	Continuous variable	Cover abbreviation
No cover	1	NC
Coarse woody debris	2	CWD
Fine woody debris	3	FWD
Root wad	4	RW
Aquatic emersed vegetation	5	VAE
Submersed aquatic vegetation	6	VAS
Terrestrial vegetation	7	VT
Undercut bank	8	UB
Boulder	9	B

Table 7.—Detections of radio-tagged early migrant Catherine Creek juvenile Chinook salmon at stationary radio receivers positioned between Lower Davis Dam and Rhinehart Lane. Detection date and time associated with the initial detection for each code are reported in addition to the total number of detection.

Receiver location	Tag code	Date	Time	Number of detections
Lower Davis Dam	34	10/31/2009	18:43	3
	47	1/15/2010	7:16	60
	61	11/17/2009	18:22	1
	65	1/23/2010	6:06	1
	66	1/11/2010	17:20	1
	92	1/11/2010	5:45	1
Gekeler Lane	58	1/10/2010	7:46	3
Booth Lane	93	3/8/2010	14:26	1
Alicel Lane	No detections	N/A	N/A	N/A
Rhinehart Lane	No detections	N/A	N/A	N/A

Table 8.—Summarized weight, length, elapsed time, and absolute growth characteristics for recaptured PIT tagged and radio-tagged Catherine Creek juvenile spring Chinook salmon during fall and winter 2009-2010.

		Weight characteristics			Length characteristics			
Group and Statistic	Time Interval (d)	Capture (g)	Recapture (g)	Difference (g)	Capture (mm)	Recapture (mm)	Difference (mm)	Absolute Growth (g/d)
PIT tagged (n = 13)								
Mean	23.46	5.59	5.73	0.08	79.21	80.54	1.00	0.021
SE	7.41	0.28	0.28	0.15	1.26	1.23	0.28	0.017
Min	1.0	4.1	4.5	-0.90	71.0	73.0	0.00	-0.040
Max	94.0	8.3	7.9	1.10	91.0	91.0	3.00	0.200
Radio-tagged (n = 5)								
Mean	30.00	9.20	9.08	-0.39	93.40	94.40	1.00	-0.010
SE	15.69	0.23	0.22	0.30	0.68	0.75	0.45	0.006
Min	9.0	8.7	8.4	-1.60	91.0	93.0	0.00	-0.030
Max	92.0	9.8	9.8	0.03	95.0	97.0	2.00	0.003

Table 9.—Monthly and overwintering median, mean, standard error, minimum, and maximum linear range for radio-tagged Catherine Creek early migrant spring Chinook salmon.

Month and season	n	Median linear range (km)	Mean linear range (km)	SE	Min (km)	Max (km)
October	9	5.82	5.58	1.41	0.49	11.91
November	38	1.91	2.69	0.41	0.00	8.40
December	56	0.09	0.81	0.23	0.00	11.14
January	53	0.81	3.71	0.73	0.00	25.56
February	11	0.00	0.03	0.03	0.00	0.30
March	3	0.00	0.00	0.00	0.00	0.00
Fall – winter	81	10.83	12.96	1.05	2.82	56.77

Table 10.—Spatial (i.e., high and low gradient) summary of weekly relocation microhabitat data for radio-tagged Catherine Creek early migrant spring Chinook salmon and results of statistical comparisons between microhabitat use and availability. The Kolmogorov-Smirnov two-sample test was applied to continuous variables, while categorical variables were compared using a likelihood-ratio chi-square test. Mean is reported for variables depth, bottom velocity, mean column velocity, distance to bank and distance to cover, while mode is reported for dominant substrate and cover.

	N		Mean/Mode		SE			
Reach and variable	Use	Available	Use	Available	Use	Available	Statistic	*P*
High gradient								
Depth (m)	255	395	0.61	0.24	0.02	0.01	$D = 0.5486$	<0.0001
Bottom velocity (m/s)	243	395	0.07	0.20	0.01	0.01	$D = 0.3259$	<0.0001
Mean velocity (m/s)	243	395	0.16	0.34	0.01	0.02	$D = 0.3386$	<0.0001
Dominate substrate	267	395	5.00	4.00	0.07	0.06	$D = 0.2503$	<0.0001
Distance to bank (m)	262	395	2.19	1.87	0.09	0.07	$D = 0.1637$	0.0004
Cover	268	395	9.00	1.00	0.18	0.17	$X^2 = 209.5994$	<0.0001
Distance to cover (m)	240	268	0.50	0.58	0.04	0.04	$D = 0.3284$	<0.0001
Low gradient								
Depth (m)	108	300	0.83	0.52	0.04	0.02	$D = 0.3604$	<0.0001
Bottom velocity (m/s)	102	300	0.06	0.08	0.01	0.01	$D = 0.1829$	0.0123
Mean velocity (m/s)	104	300	0.12	0.20	0.01	0.01	$D = 0.2456$	0.0002
Dominate substrate	105	300	2.00	2.00	0.07	0.04	$D = 0.2119$	0.0019
Distance to bank (m)	107	301	2.64	2.63	0.20	0.13	$D = 0.1806$	0.0116
Cover	108	300	3.00	1.00	0.21	0.16	$X^2 = 125.7392$	<0.0001
Distance to cover (m)	107	172	0.33	0.31	0.05	0.03	$D = 0.4105$	<0.0001

Table 11.—Comparison statistics for high and low gradient microhabitat use of Catherine Creek early migrant juvenile spring Chinook salmon. The Komogorov-Smirnov two-sample test was conducted on continuous variables, and categorical variables were compared using a likelihood-ratio chi-square test.

Variable	Statistic	*P*
Depth (m)	0.320479	<0.0001
Bottom velocity (m/s)	0.147906	0.0863
Mean velocity (m/s)	0.151432	0.0709
Dominate substrate	0.823649	<0.0001
Distance to bank (m)	0.112685	0.2896
Cover	144.0807	<0.0001
Distance to cover (m)	0.116527	0.2434

Table 12.—Reach specific statistics and significance values from comparisons of retained microhabitat use and availability principal component scores. The Komogorov-Smirnov two-sample test was used to compare component scores.

Reach and principal component	*D* statistic	*P*-value
High gradient		
PC1	0.2335	<0.0001
PC2	0.4449	<0.0001
PC3	0.4993	<0.0001
Low gradient		
PC1	0.1830	0.0124
PC2	0.1745	0.0197

Table 13.—High gradient principal component eigenvector values (i.e., loadings), eigenvalues, and cumulative variance explained of microhabitat use and availability for radio-tagged juvenile Catherine Creek early migrant spring Chinook salmon.

	PCA axis		
Variable and statistic	1	2	3
Depth (m)	0.2247	0.2175	0.7891
Bottom velocity (m/s)	0.5389	-0.0557	-0.2937
Mean velocity (m/s)	0.5787	-0.0193	-0.1752
Dominate substrate	0.0555	0.7465	-0.4196
Distance to cover (m)	0.3533	-0.5387	-0.0579
Distance to bank (m)	0.4431	0.3189	0.2845
Eigenvalue	2.5703	1.1799	1.1112
Cumulative variance explained (%)	42.8	62.5	81.0

Table 14.—Low gradient principal component eigenvector values (i.e., loadings), eigenvalues, and cumulative variance explained of microhabitat use and availability for radio-tagged juvenile Catherine Creek early migrant spring Chinook salmon.

	PCA axis	
Variable and statistic	1	2
Depth (m)	0.3226	-0.5226
Bottom velocity (m/s)	0.5544	0.1328
Mean velocity (m/s)	0.5903	0.1328
Dominate substrate	0.1885	0.5224
Distance to cover (m)	0.4268	-0.3766
Distance to bank (m)	0.1499	0.5261
Eigenvalue	2.3567	1.4858
Cumulative variance explained (%)	39.3	64.0

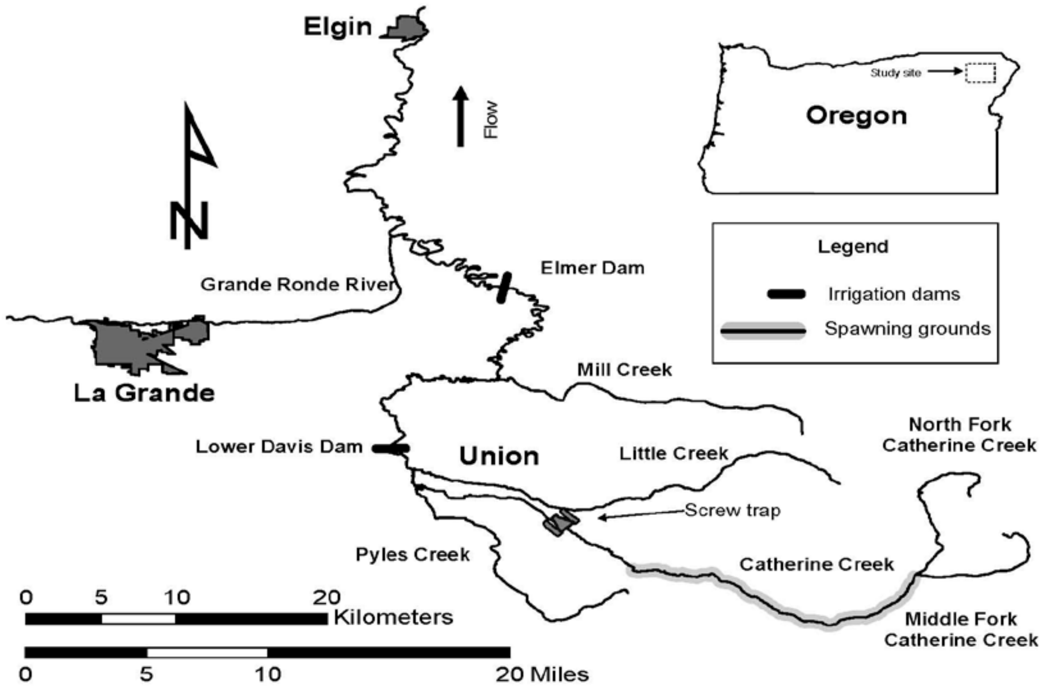

Figure 1.—Map of the Grande Ronde Valley with the study area bounded downstream by Elgin, OR and upstream by Union, OR.

(a) Rotary screw trap used to sample early migrant juvenile Chinook salmon.

(b) Surgical implantation of a radio transmitter into a juvenile Chinook salmon.

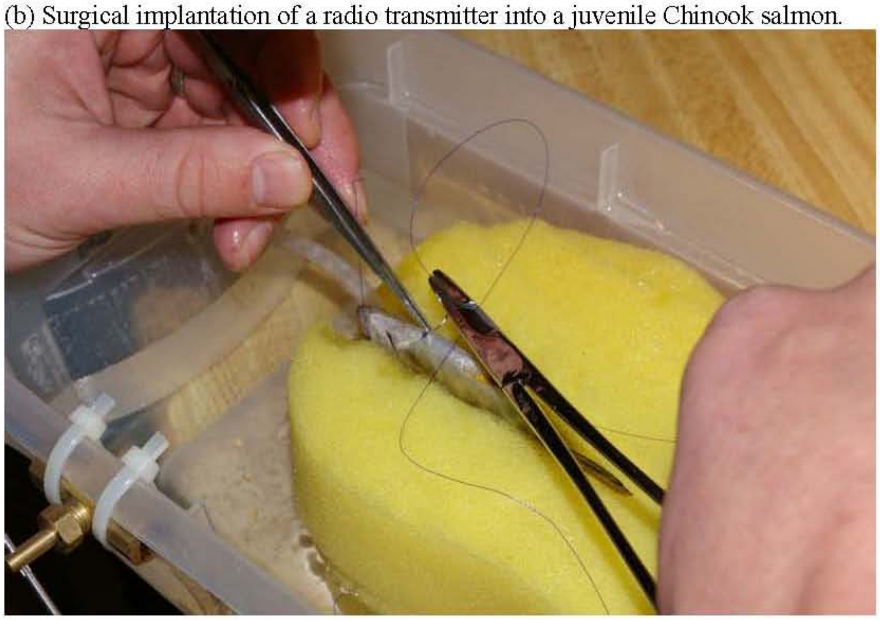

Figure 2.—Photos of the sampling and tagging techniques employed during the fall and winter of 2009/2010.

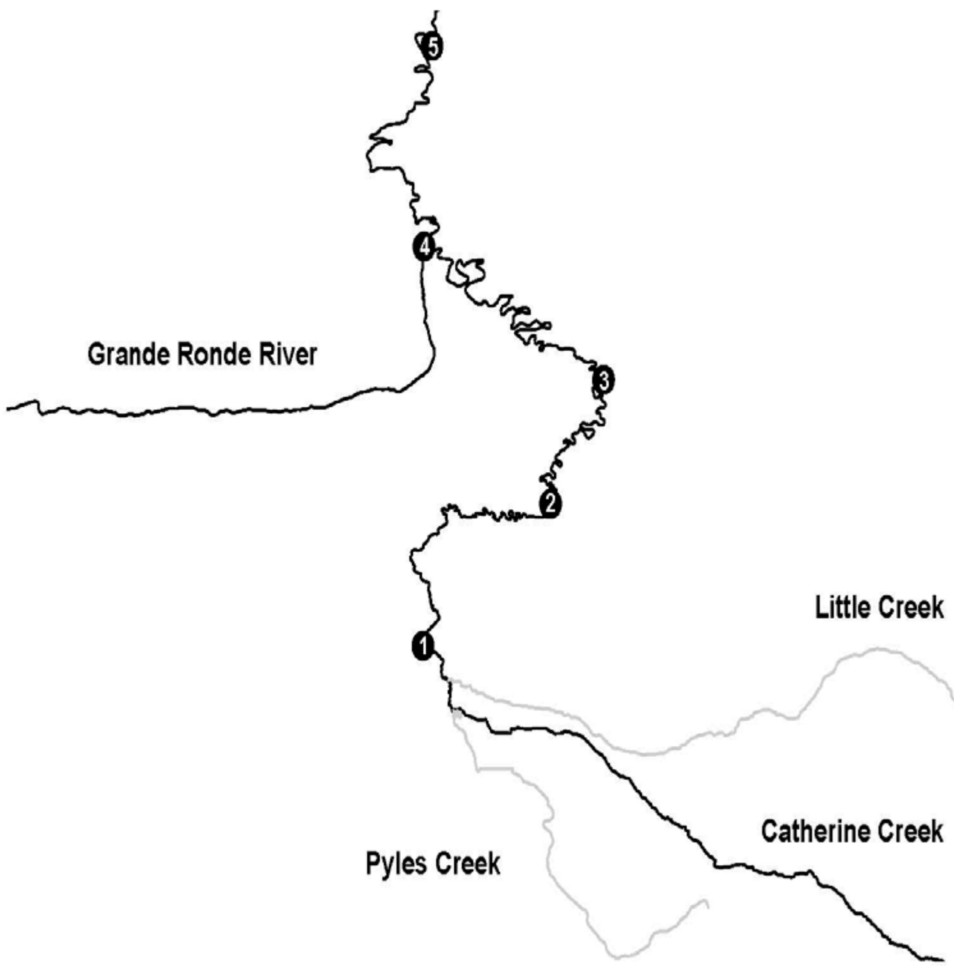

Figure 3.—Map of numbered stationary radio receiver locations installed to document downstream movement of Catherine Creek early migrant juvenile Chinook salmon overwintering in the Grand Ronde Valley. Numbered sites are in close proximity to (1) lower Davis Dam; (2) Gekler Lane; (3) Booth Lane; (4) Alicel Lane and (5) Rhinehart Lane.

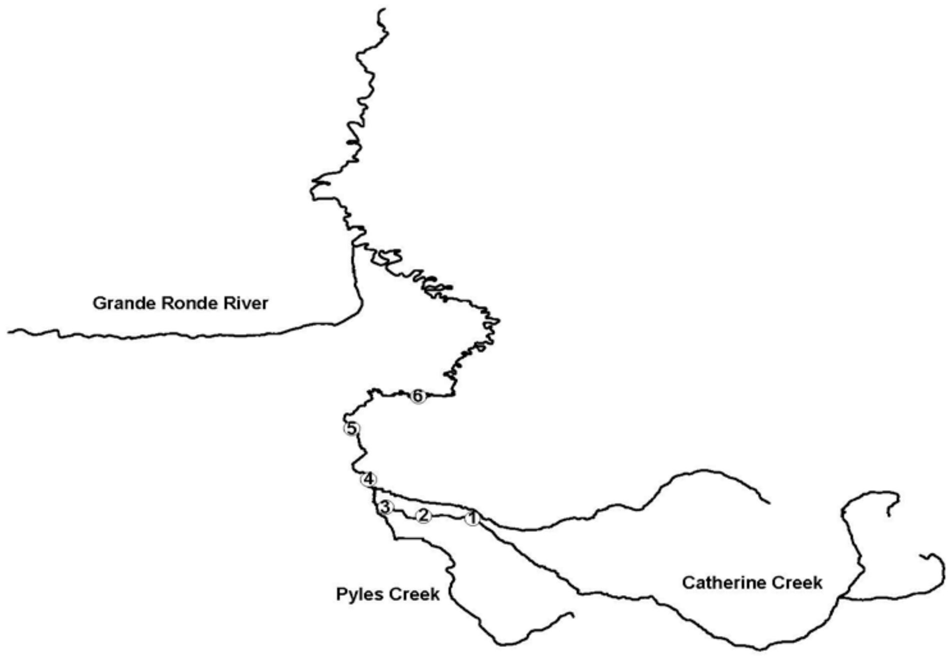

Figure 4.—Map of numbered stream reaches surveyed to quantify Catherine Creek early migrant juvenile Chinook salmon overwintering habitat availability. Numbered sites are in close proximity to (1) Union (Swackhammer fish ladder); (2) Union Recycling Center; (3) mouth of Pyles Creek; (4) HWY 203 Bridge; (5) Wilkinson Road and (6) Godley Lane.

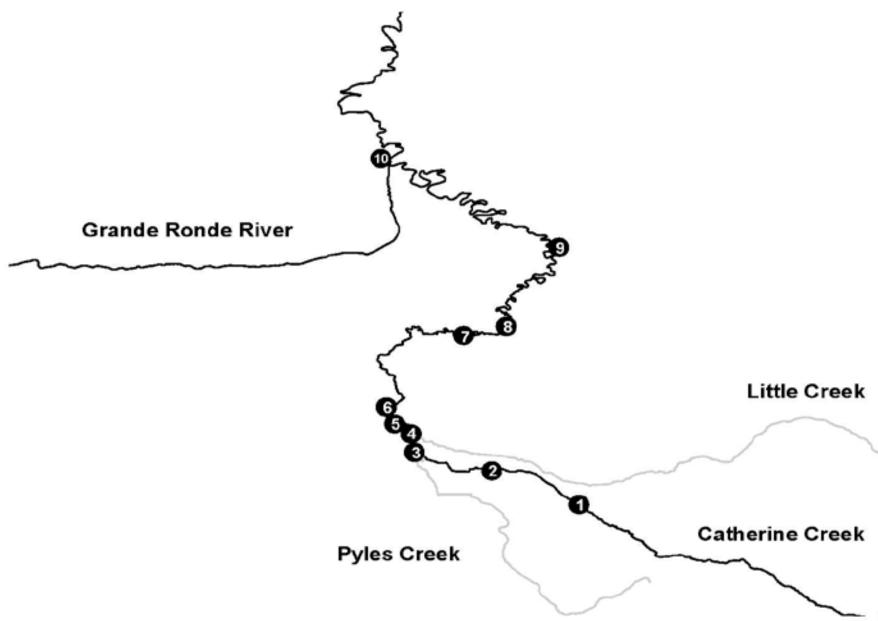

Figure 5.—Map of numbered temperature logger locations installed to document water temperatures associated with the fall migration and overwintering periods of Catherine Creek early migrant spring Chinook salmon. Numbered sites are in close proximity to (1) Catherine Creek screw trap; (2) 10th Street; (3) Miller Lane; (4) HWY 203; (5) lower Davis Dam (above); (6) lower Davis Dam (below); (7) Godley Lane; (8) Gekler Lane; (9) Booth Lane and (10) Alicel Lane.

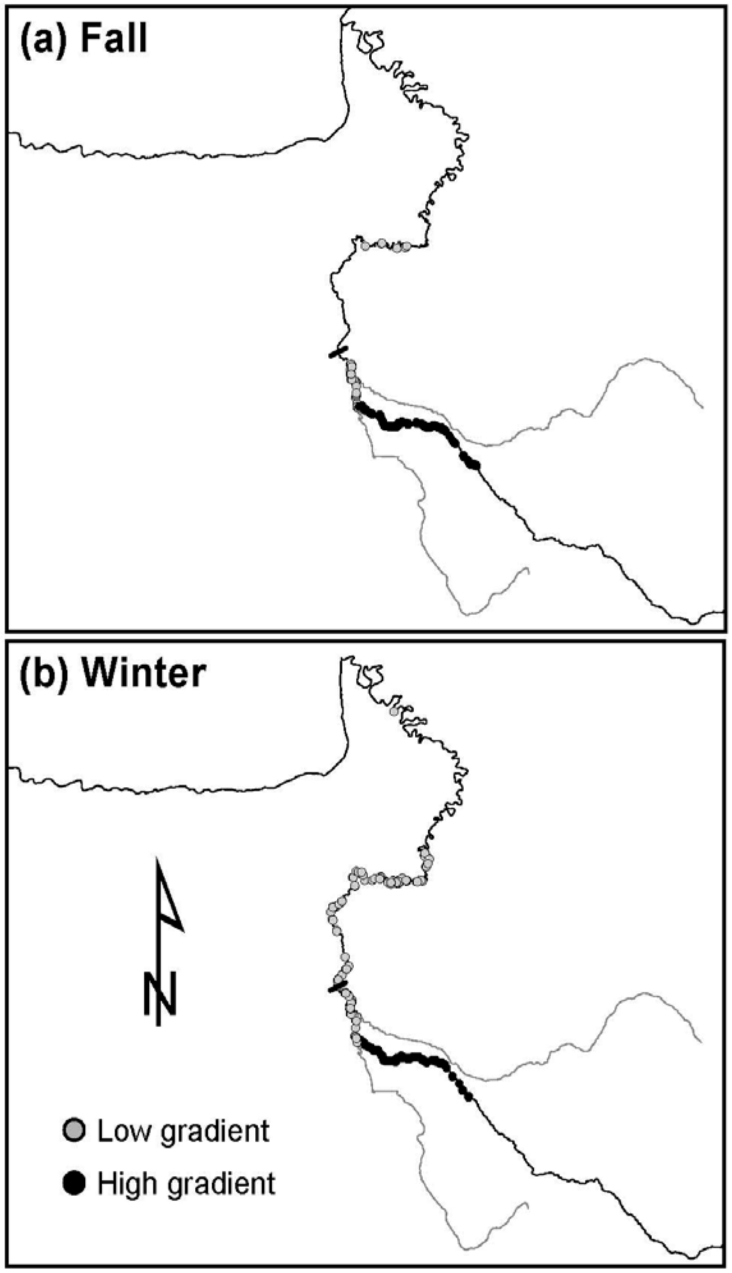

Figure 6.—Seasonal maps characterizing early migrant juvenile Chinook salmon relocations during fall migration and overwinter.

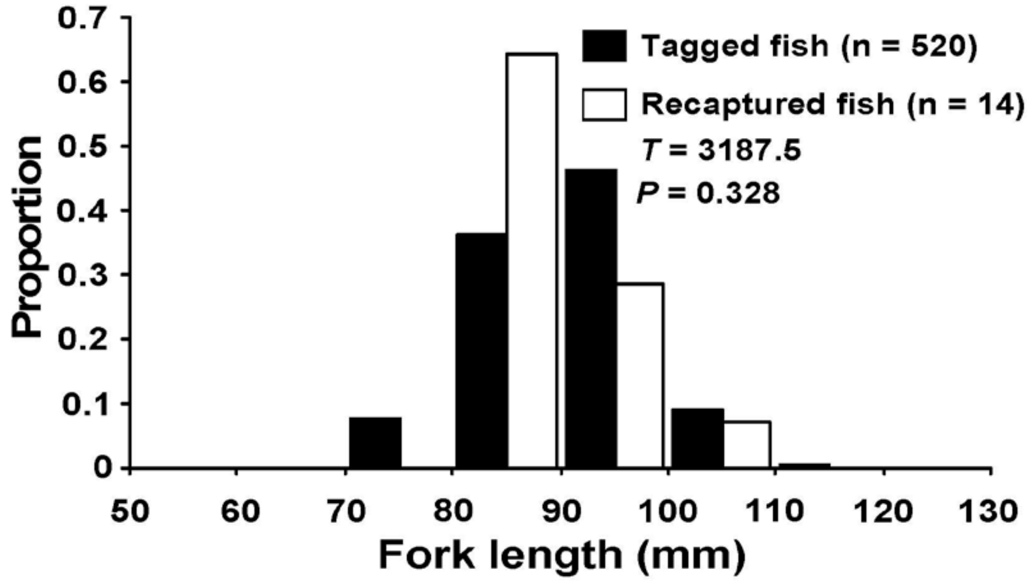

Figure 7.—Fork length comparison of PIT tagged Catherine Creek early migrant Chinook salmon sampled during the fall migration to recaptured PIT tagged fish from overwintering habitat. Recaptured PIT tagged fish were sampled from portions of Catherine Creek occupied by radio-tagged fish. Lengths were compared using the Mann-Whitney rank sum test.

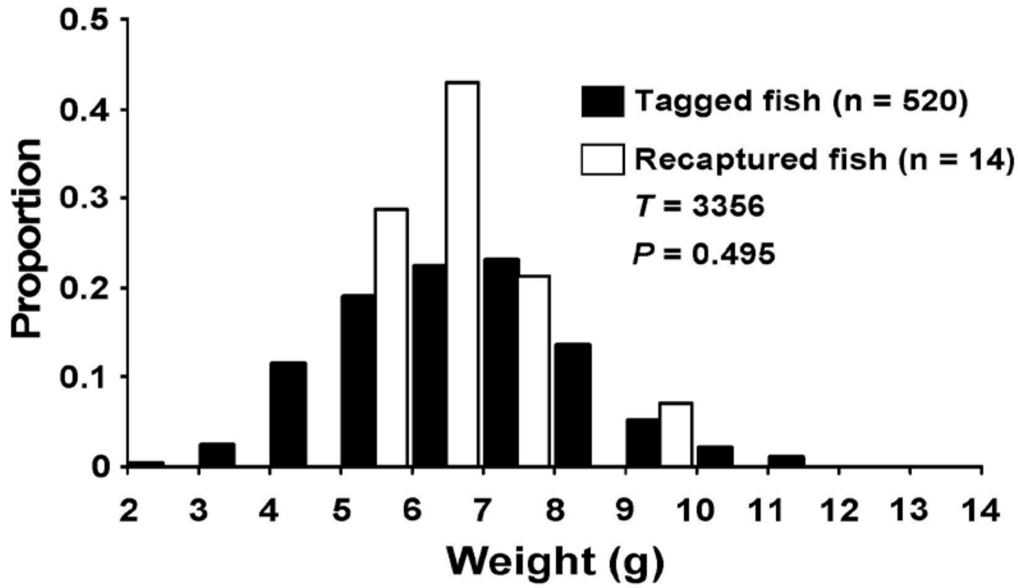

Figure 8.—Weight comparison of PIT tagged Catherine Creek early migrant Chinook salmon sampled during the fall migration to recaptured PIT tagged fish from overwintering habitat. Recaptured PIT tagged fish were sampled from portions of Catherine Creek occupied by radio-tagged fish. Weights were compared using the Mann-Whitney rank sum test.

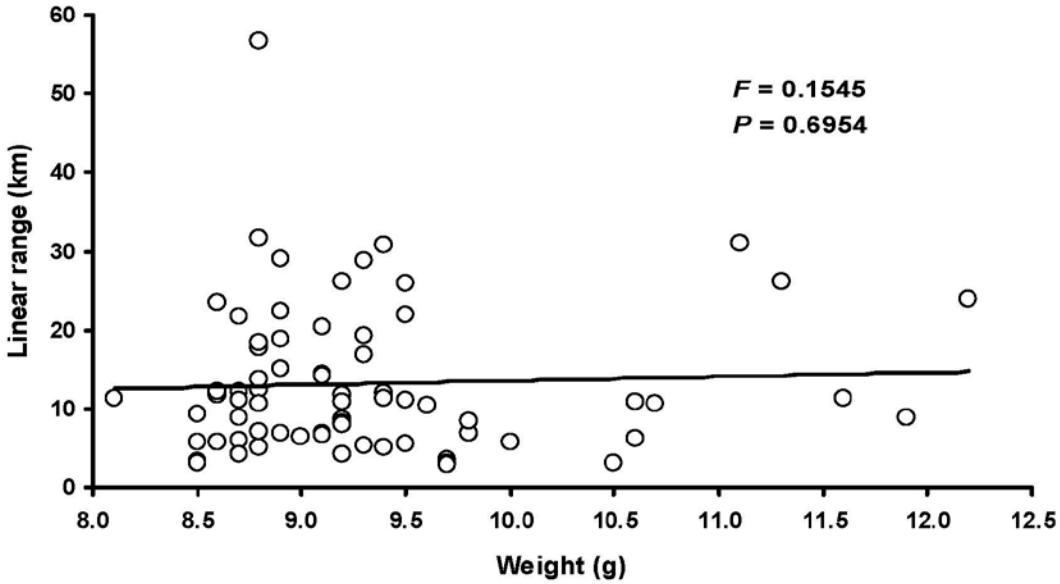

Figure 9.—Linear regression of weight and total linear range of radio-tagged early migrant juvenile spring Chinook salmon from Catherine Creek.

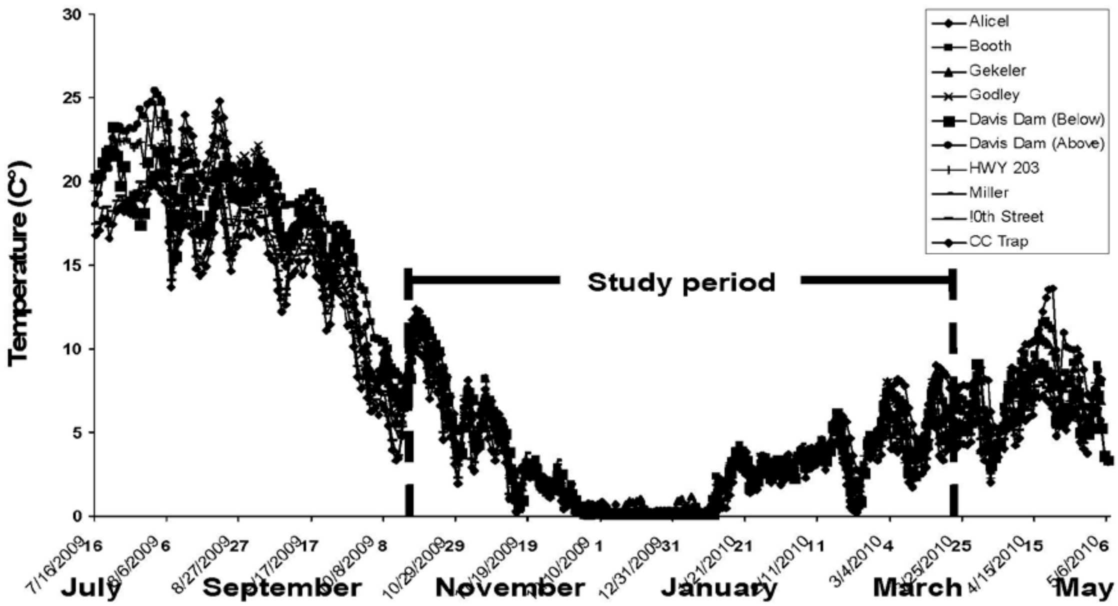

Figure 10.—Continuous water temperature data from lower Catherine Creek. The study period is designated by dashed lines and spans from late-October to late-March.

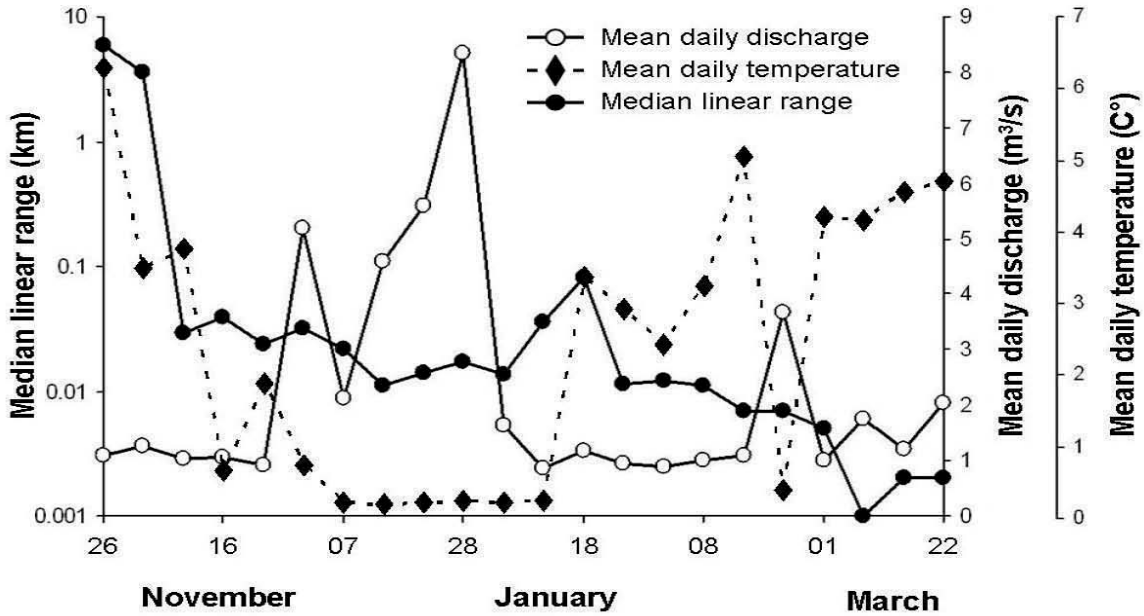

Figure 11.—Catherine Creek early migrant spring Chinook salmon median linear range per week during the fall migration and overwintering periods. Associated environmental variables discharge and water temperature are provided for comparison.

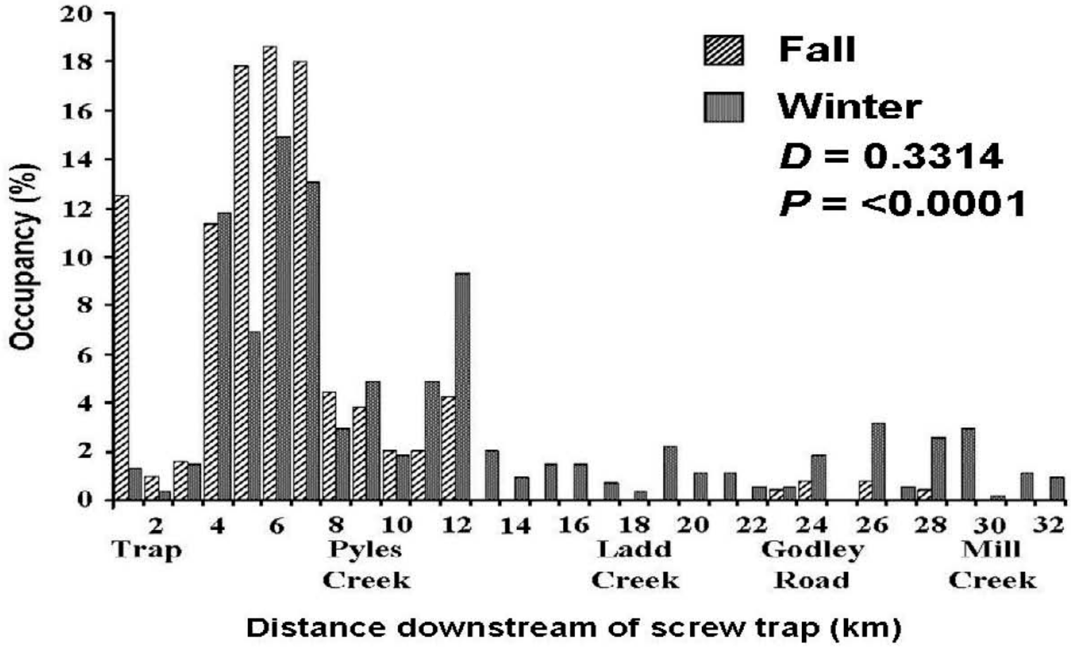

Figure 12.—Fall and winter occupancy by Catherine Creek early migrant spring Chinook salmon. Generated numbered reaches initialize at the Catherine Creek rotary screw trap and end at the confluence of the historic Grande Ronde River and Catherine Creek. Fall and winter relocations were compared using the Kolmogorov-Smirnov two-sample test.

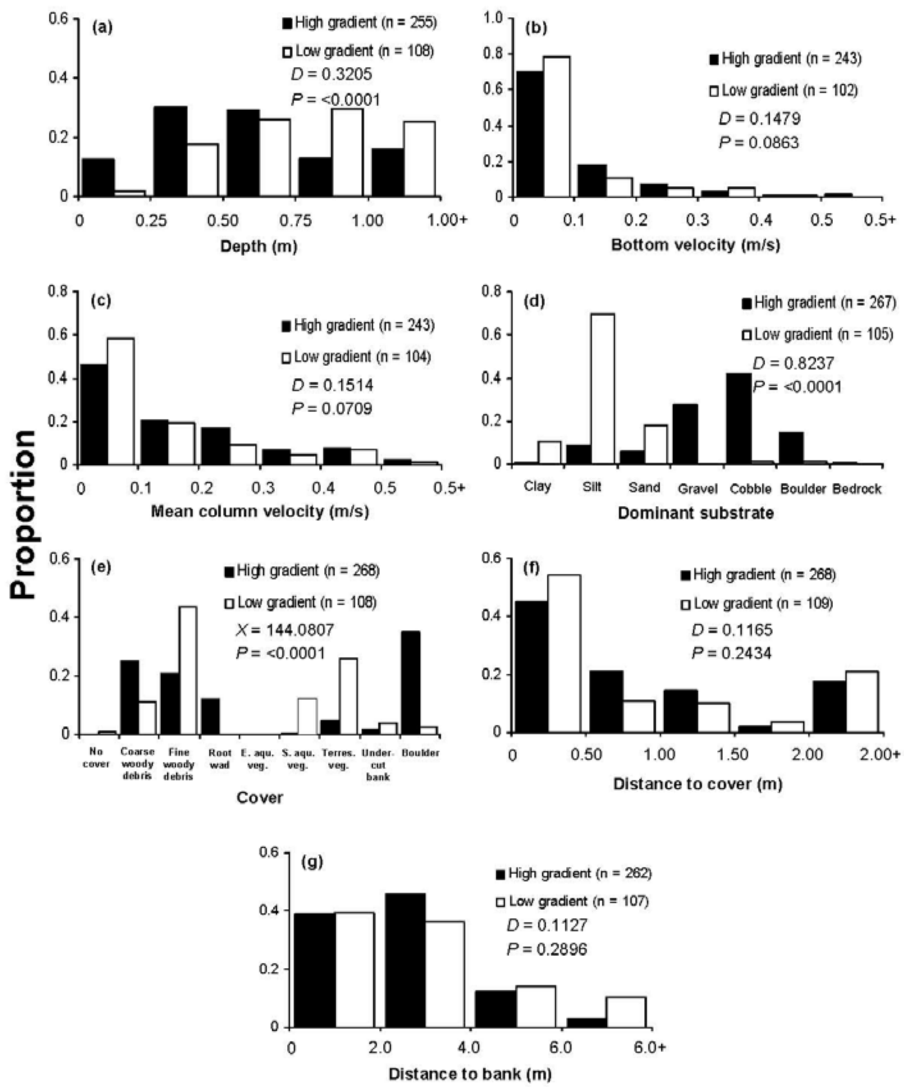

Figure 13.—Catherine Creek spring Chinook salmon high and low gradient microhabitat use variables depth (a), bottom velocity (b), mean column velocity (c), dominant substrate (d), cover (e), distance to cover (f), and distance to bank (g) and associated statistics. Continuous variables were compared using a Kolmogorov-Smirnov two-sample test; categorical variables were compared using a likelihood-ratio chi-square test.

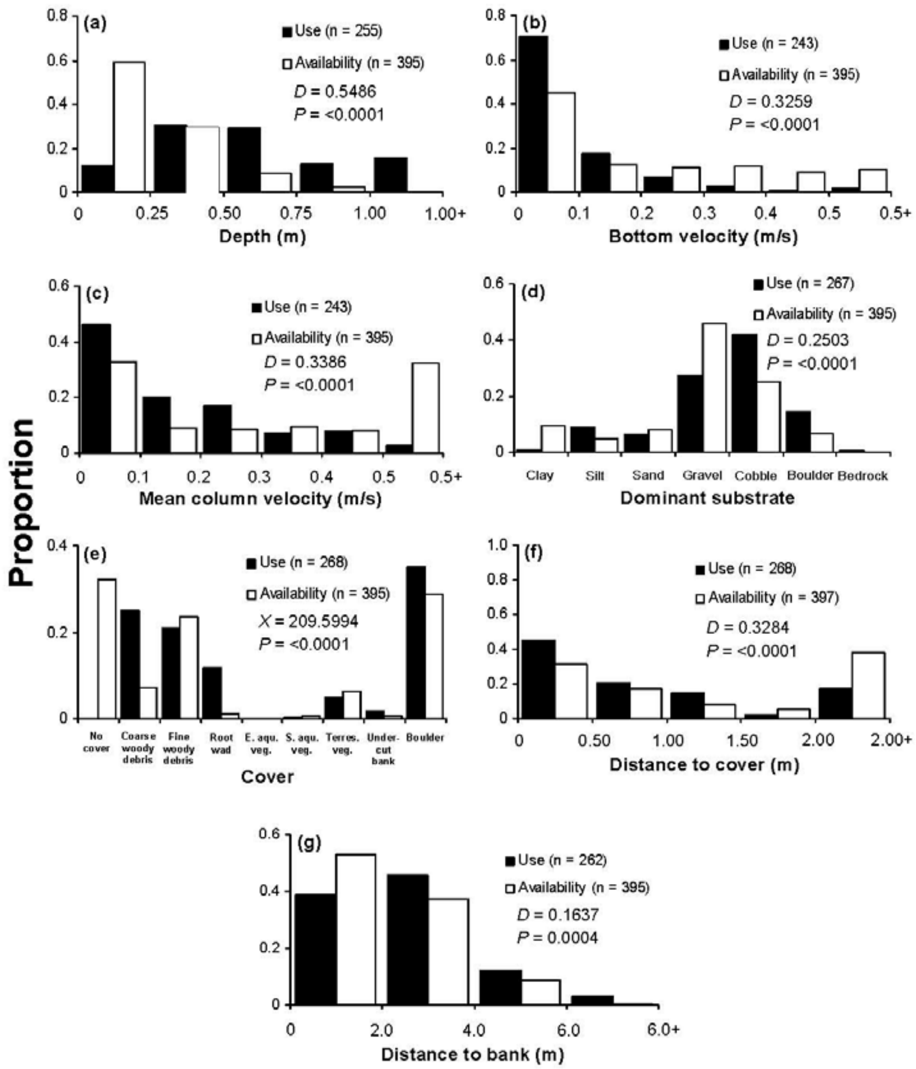

Figure 14.—Catherine Creek spring Chinook salmon high gradient microhabitat use and availability frequency distributions and associated statistics for variables depth (a), bottom velocity (b), mean column velocity (c), dominant substrate (d), cover (e), distance to cover (f) and distance to bank (g). Continuous variables were compared using a Kolmogorov-Smirnov two-sample test; categorical variables were compared using a likelihood-ratio chi-square test.

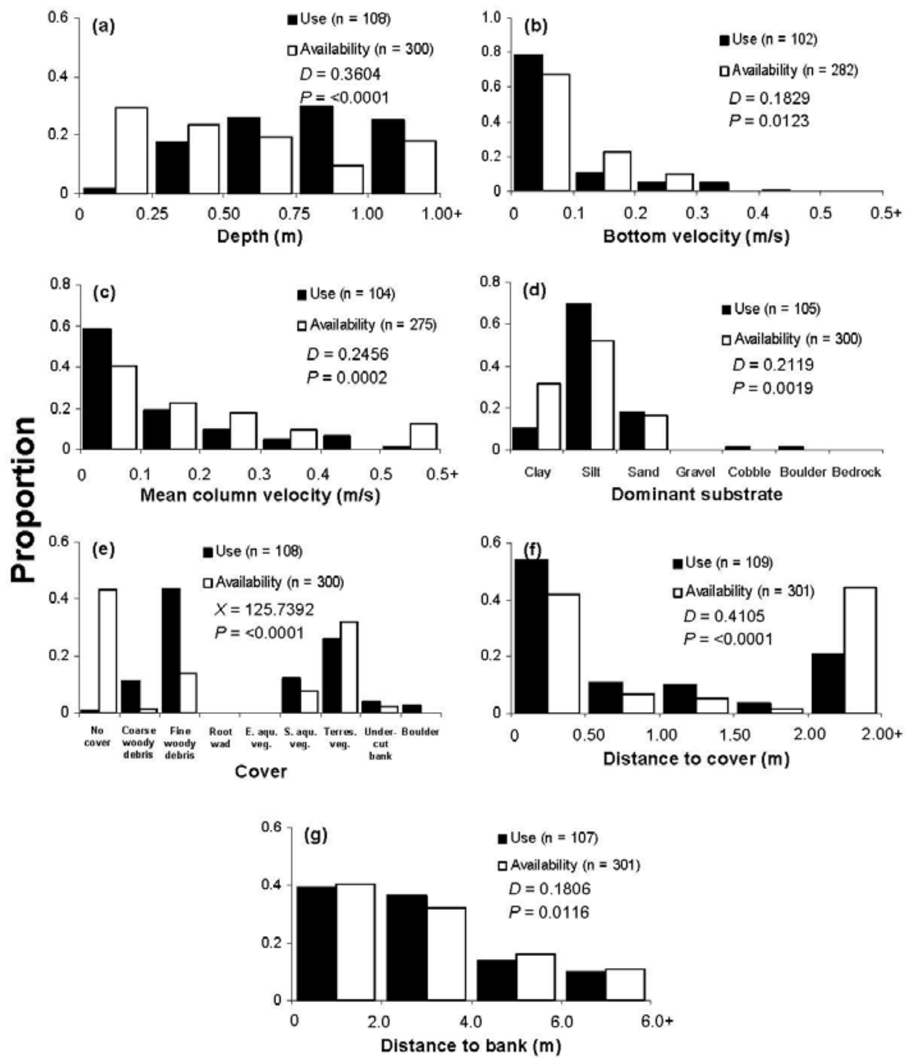

Figure 15.—Catherine Creek spring Chinook salmon low gradient microhabitat use and availability frequency distributions and associated statistics for variables depth (a), bottom velocity (b), mean column velocity (c), dominant substrate (d), cover (e), distance to cover (f) and distance to bank (g). Continuous variables were compared using a Kolmogorov-Smirnov two-sample test; categorical variables were compared using a likelihood-ratio chi-square test.

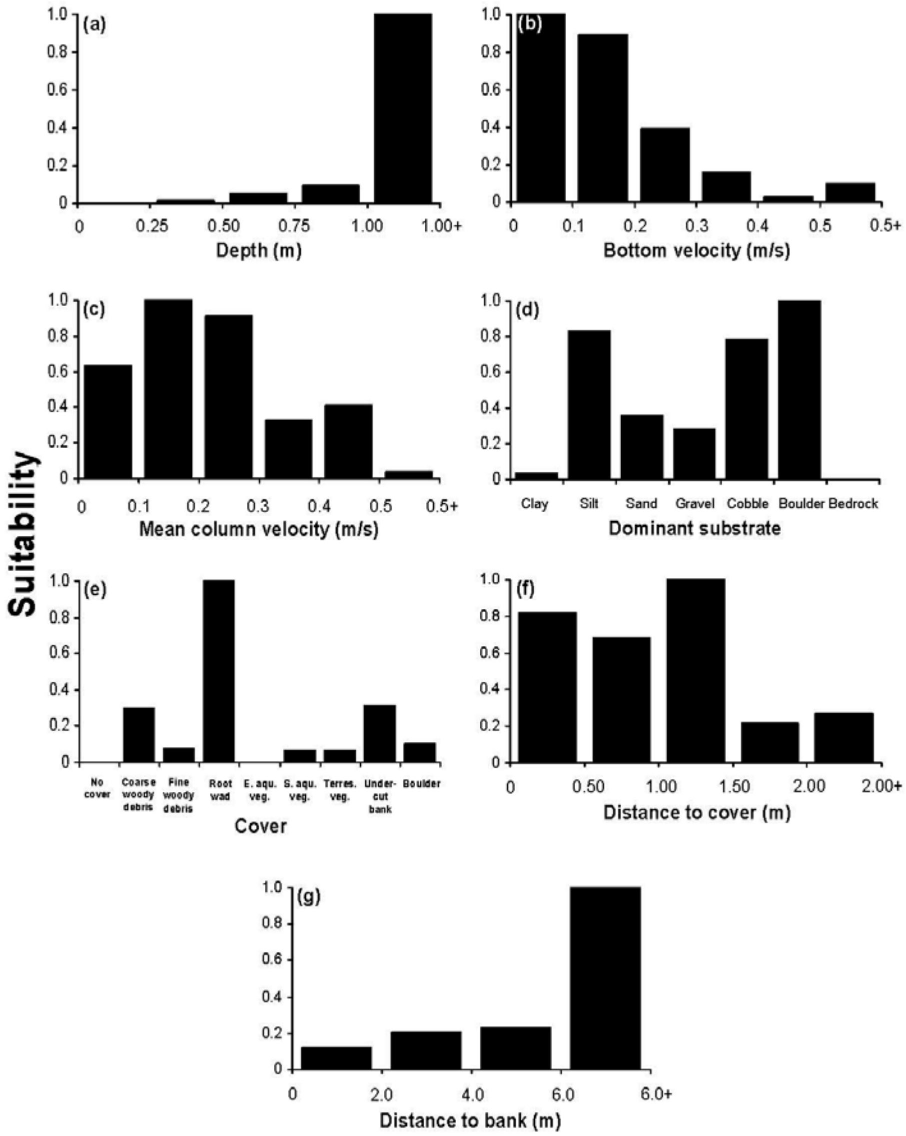

Figure 16.—Catherine Creek spring Chinook salmon high gradient microhabitat suitability indexes for variables depth (a), bottom velocity (b), mean column velocity (c), dominant substrate (d), cover (e), distance to cover (f) and distance to bank (g).

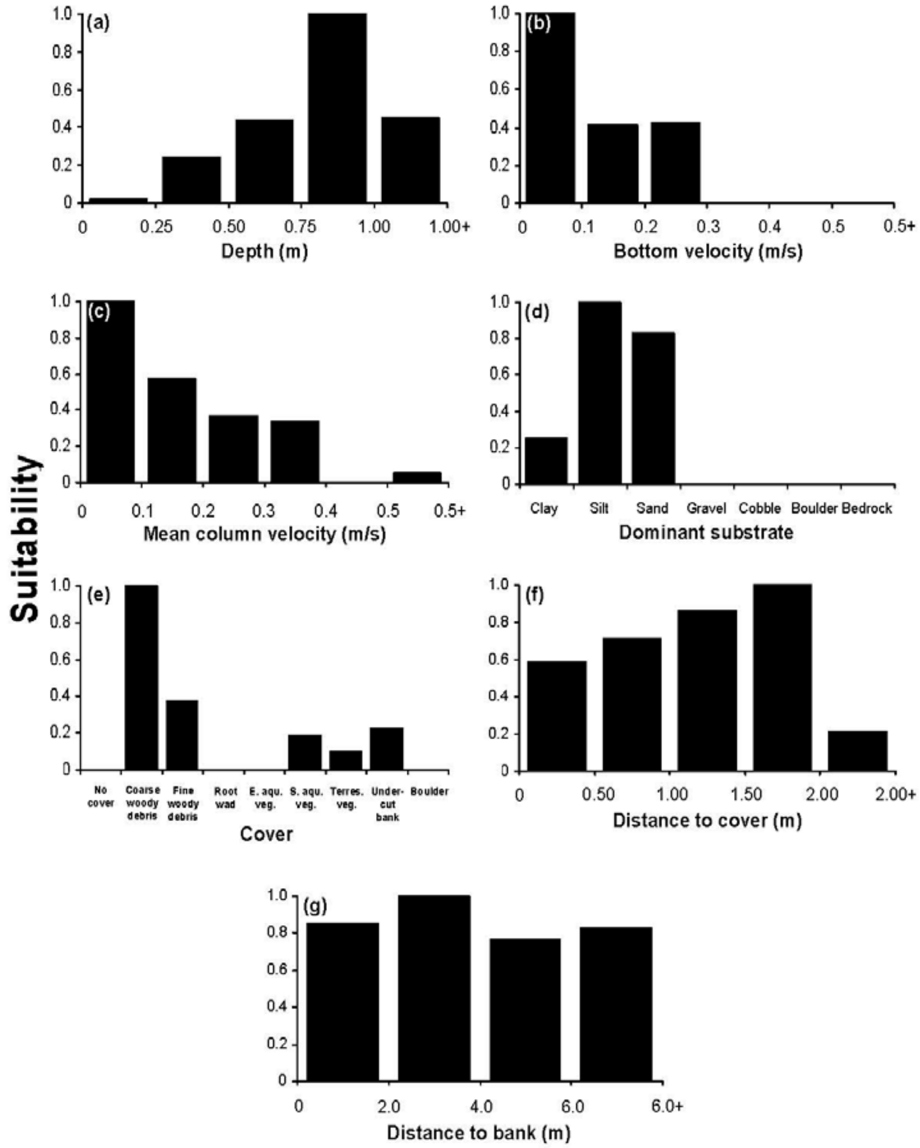

Figure 17.—Catherine Creek spring Chinook salmon low gradient microhabitat suitability indexes for variables depth (a), bottom velocity (b), mean column velocity (c), dominant substrate (d), cover (e), distance to cover (f) and distance to bank (g).

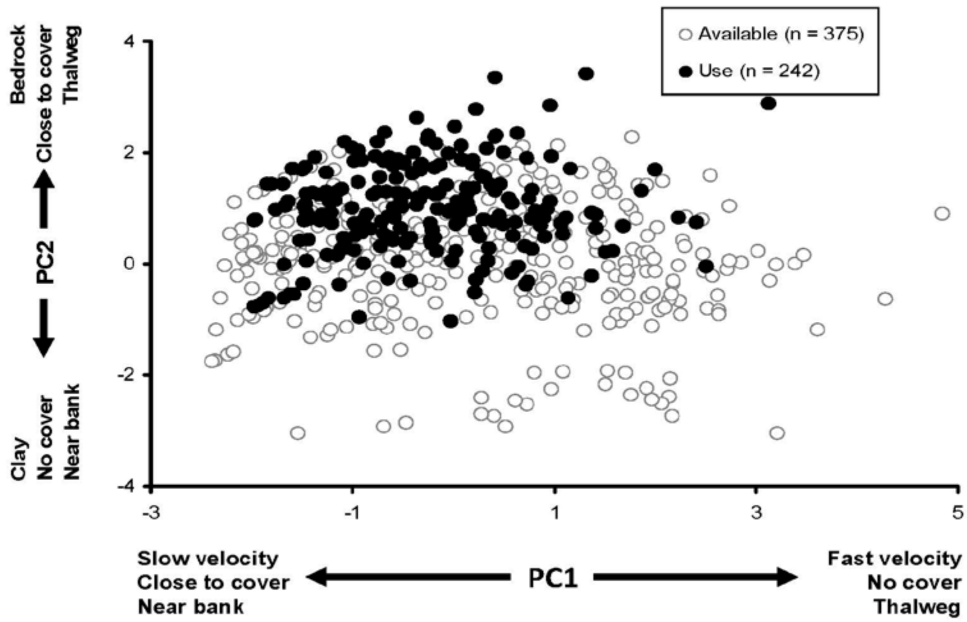

Figure 18.—Plot of juvenile early migrant spring Chinook salmon principal component scores for high gradient microhabitat use and availability, describing microhabitat variable combinations for principal components 1 and 2 that are most important in defining fall migration and overwintering macrohabitat.

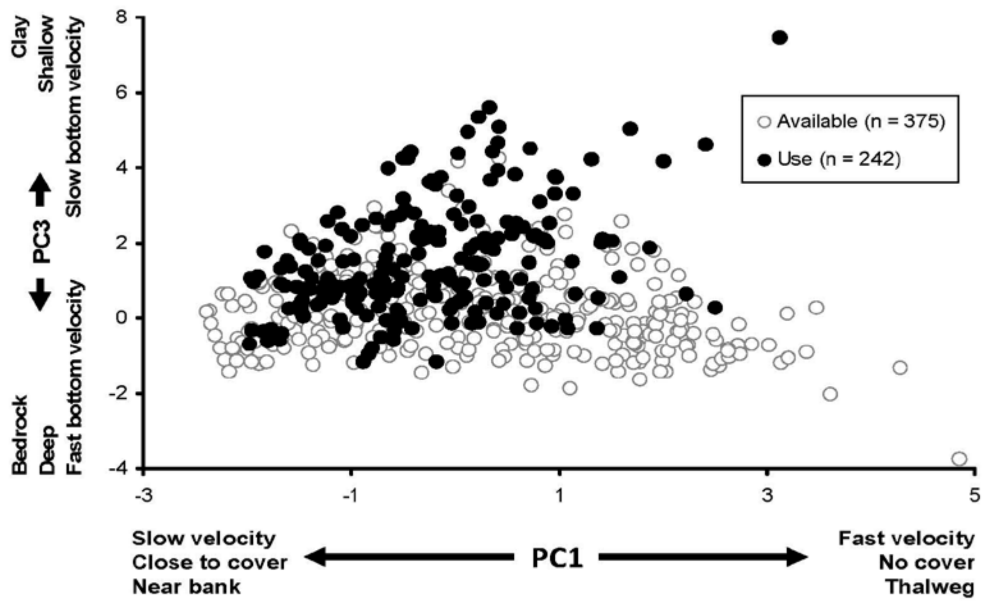

Figure 19.—Plot of juvenile early migrant spring Chinook salmon principal component scores for high gradient microhabitat use and availability, describing microhabitat variable combinations for principal components 1 and 3 that are most important in defining fall migration and overwintering macrohabitat.

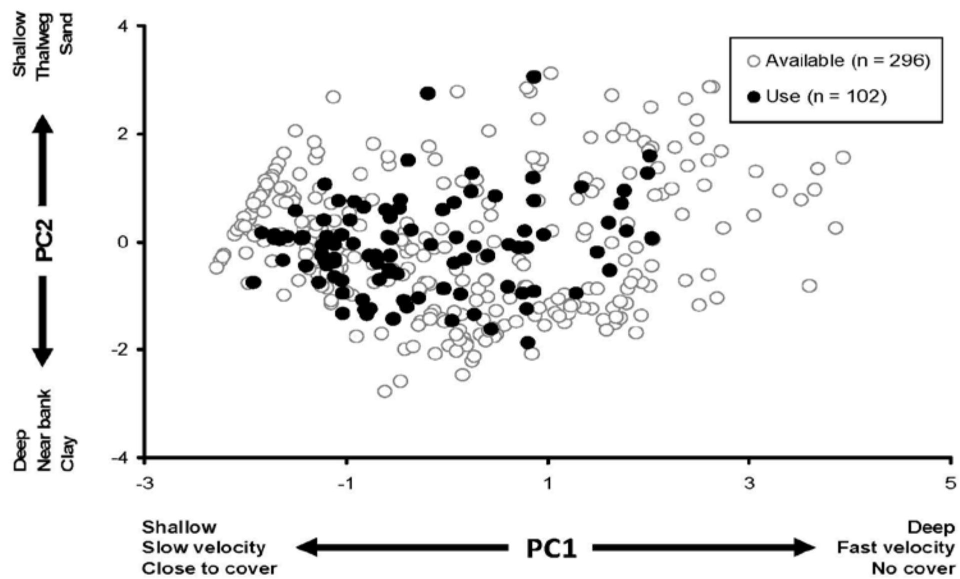

Figure 20.—Plot of juvenile early migrant spring Chinook salmon principal component scores for low gradient microhabitat use and availability, describing microhabitat variable combinations for principal components 1 and 2 that are most important in defining fall migration and overwintering macrohabitat.

APPENDIX I – GEOGRAPHIC INFORMATION SYSTEM (GIS)

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1. Overview

The Catherine Creek Tributary Assessment (TA) provides technical information to decision makers tasked with implementing habitat rehabilitation projects pertaining to Reclamation responsibilities described in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. The goal of the TA is to describe and prioritize the potential for habitat rehabilitation within discrete stream segments. The Catherine Creek TA's findings provides the basis for future, detailed studies that identify site-specific projects that will promote viable, sustainable steelhead and spring Chinook populations within the Grande Ronde subbasin.

The TA is conducted over a geographic extent that generally encompasses a watershed. Specific to the Catherine Creek TA this translates to the Catherine Creek hydrologic system from the confluence with State Ditch, upstream past the towns of Cove and Union, and including the tributaries and headwaters of Catherine Creek. Though primary emphasis is placed on conditions and processes within the watershed, broader scale information is required for regional context.

The Catherine Creek TA is a relatively coarse-level investigation sufficient to provide the scientific basis for describing 1] spatio-temporal distribution and habitat use of listed steelhead and Spring Chinook, 2] geomorphic conditions and processes that influence habitat dynamics, 3] abiotic and biotic in-stream conditions, and 4] land use within the watershed that may affect habitat quality and condition.

The role of Geographic Information Systems (GIS) in conducting the TA is to make geospatial and spatio-temporal data and analytical tools available to resource specialists to: 1] describe the properties associated with specific site locations based on spatially coincident phenomena, 2] identify inter-connectivity and dynamics within the landscape over time that influences site conditions, and 3] create cartographic products to present the assessment area information.

2. Technical Approach

The Catherine Creek TA was conducted in collaboration with the following partners and contributors:

- Grande Ronde Model Watershed
- Union County Soil and Water Conservation District
- Oregon Department of Fish and Wildlife
- Natural Resource Conservation Service

- Bureau of Reclamation
- NOAA Fisheries
- Confederated Tribes of the Umatilla Indian Reservation
- U.S. Fish and Wildlife Service
- Oregon Water Resources Department

In addition, the area had been studied prior to conducting the TA, which suggests the existence of pertinent data and information for the Grande Ronde subbasin that could contribute to the conduct of the TA. Therefore, the technical approach in building geospatial data holdings for the Catherine Creek TA emphasized:

1. Identification and acquisition of existing data and information;
2. Developing a strategy to integrate multi-source geospatial into a common project library and identify standardized site and / or feature reference;
3. Identifying information gaps and data needs, filling information gaps and meeting associated data needs by processing data or generating new data sets; and
4. The design and development of a data library structure to facilitate data-sharing and distribution between the various Catherine Creek TA partners and contributors.

3. GIS Tasks

GIS-specific tasks included the acquisition of data, data processing, and spatial analyses, production of cartographic maps and figures, and geospatial data management in terms of compilation, storage, and distribution. Data acquisition, processing, and management are described below. Detailed description of the data that were acquired and the processing that was performed is organized by data theme and annotated with summarized metadata reporting identification and source information (complete metadata records are available with the data). The results of geospatial data management are presented as an outline of the compiled library. The cartographic maps and figures are presented in the various other reports for which they were specifically produced.

3.1 Data Acquisition

Existing data includes reference geospatial data authored and maintained by government agencies for use in various applications (e.g., National Hydrography Dataset and National Elevation Dataset maintained by USGS, National Agriculture Imagery Program (NAIP) administered by USDA's Farm Service Agency). Other existing data pertinent to the Catherine Creek TA was created specifically for local or regional studies and is often more detailed, in both resolution and content. As such, the data acquisition effort involved searching various sources to assemble a comprehensive, multi-scale geospatial data library for use in the Catherine Creek TA. The data acquisition effort was important in that using existing data minimizes the laborious effort of creating data (or otherwise, recreating, and/or duplicating data) and provides a valid basis to associate or correlate the current TA with previous or potential future work undertaken within the study area.

3.2 Data Processing and Creation

While existing data are specific to target themes they generally cover broad spatial extent and are attributed with a large number and wide range of data values. This is done intentionally so the data can be applied and are relevant at regional, national, and even global scales. Much of the data processing performed for the Catherine Creek TA involved spatially filtering datasets into more manageable subsets. Likewise, the number of attributes may have been reduced and/or other TA-specific attributes added to make the subset applicable to the immediate information requirements of the TA. In other cases, data are received in formats that are not readily useable in GIS and require processing to be made functional. The processing may include conversion from ASCII or binary files, geo-rectification and geo-referencing or other preparation of source data that makes it amenable to spatial processing and analysis.

Not all the geospatial data needs for the Catherine Creek TA are met in acquiring existing data. The creation of new data is in fact a significant part of conducting the TA and is undertaken by various resource specialists. Data created from field collection and the products of modeling are described in the perspective specialists' report.

3.3 Data Storage and Documentation

A defined data management strategy for the collection, creation, sharing, and storage of geospatial data ensures that a relevant, comprehensive, and well-documented collection of geospatial is readily available for timely analyses and reporting in the Catherine Creek TA. The preceding sections have addressed aspects of the technical approach relating to 1) collecting and integrating data from previous, associated studies, 2) making data from multiple sources compatible for use in the current assessment, and 3) processing data into formats that can be used in the various analyses. This section outlines aspects of data management specifically related to data storage and documentation. A well-structured data library facilitates the discovery of data by TA team members and cooperating partners; well-documented data informs users of appropriateness for use.

4. Data Acquisition and Processing

4.1 Aerial Photography

Current and historic aerial photography provides image representation of past and present conditions from which spatially and temporally explicit changes in the landscape can be identified and described.

4.1.1 Historic

Historic aerial photography for 1956, 1964, and 1971 was obtained from the University of Oregon Map Library through the Map and Aerial Photography Research Service (MAPRS). Aerial photographs were requested for the geographic extent covered by the 2007 and 2009 aerial photography. The University of Oregon MAPRS scanned archived contact prints at 600 dots per inch (dpi) and delivered the scanned images to Reclamation in Tiff format. Reclamation Pacific Northwest Regional GIS Specialists (PNGIS) geo-rectified and geo-referenced the individual images for use in GIS.

Reclamation obtained historic aerial photography for 1937 from the Natural Resources Conservation Service office archives in La Grande, Oregon. Idaho Blueprint Service of Boise scanned the contact prints at 450 dpi and provided the imagery to Reclamation's GIS in digital format who then geo-rectified and geo-referenced the digital imagery.

National Agriculture Imaging Program (NAIP) aerial photography for 1994 and 2004 was obtained from the Aerial Photography Field Office (APFO) and delivered as compressed county mosaics (CCMs). The 1994 and 2004 CCMs cover all of Union County, Oregon. The CCMs required no processing by PN GIS to make them useable in GIS.

4.1.2 Current

High-resolution (6-inch spatial resolution, i.e., instantaneous field of view) aerial photography was acquired for all of Catherine Creek in 2007 and 2009 (Figure 1). The 2007 acquisition included Catherine Creek and the immediate valley from the confluence of Catherine Creek and the old channel of the Grande Ronde River (river mile [RM] 23.3) upstream to RM 42.6. The 2009 acquisition included areas downstream and upstream of the 2007 acquisition. The downstream area included Catherine Creek and the immediate valley from the confluence of Catherine Creek and State Ditch (RM 0.0) upstream to RM 23.8. The upstream area extended from RM 42.5 to RM 52 (approximately 2.9 river miles downstream of the confluence of the north and south forks of Catherine Creek). The 2007 and 2009 aerial photography were delivered to Reclamation as ortho-rectified imagery.

NAIP aerial photography for 2009 was accessed through the Oregon Imagery EXPLORER ArcGIS Server (http://navigator.state.or.us/ArcGIS/services).

4.2 Biologic

Geospatial data of fish habitat distribution provide the combined knowledge gained from years of sampling and the professional field experience of numerous biologists. Stream reach based information is compiled for extensive geographic areas.

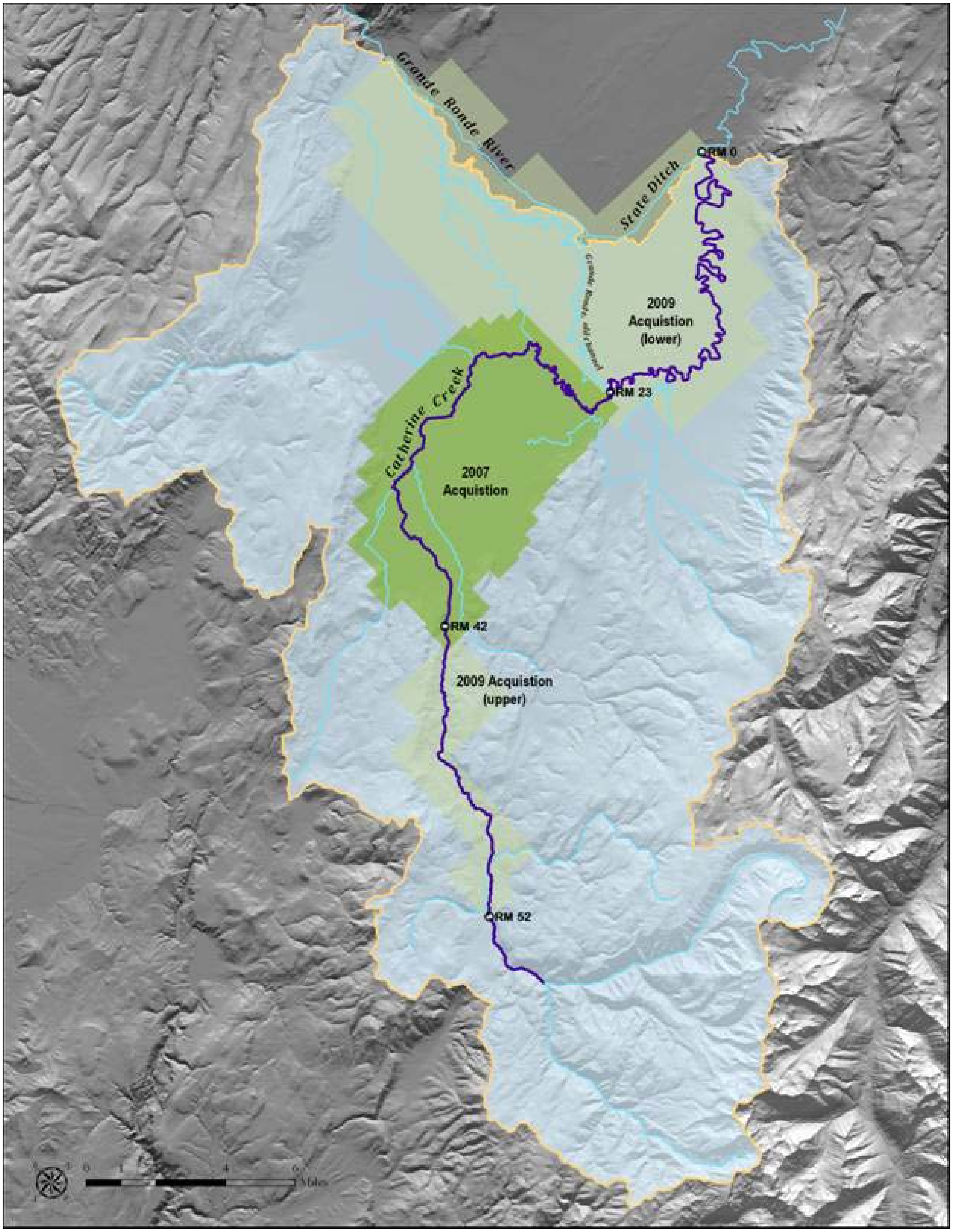

Figure 1. Areas of aerial photography and LiDAR acquisition.

Fish distribution data, as geospatial data, was obtained from the Oregon Department of Fish and Wildlife (ODFW) Natural Resource Information Management Program (NRIMP) for spring Chinook and summer steelhead (http://nrimp.dfw.state.or.us/nrimp/default.aspx?pn=fishdistdata). The data is the product of years of field survey and the professional judgment of ODFW and other natural resource agency staff biologists. The datasets include fish distribution throughout the state of Oregon. The data was clipped to represent fish habitat distribution limited to the Catherine Creek watershed and Grande Ronde subbasin.

An on-going study is being undertaken by ODFW biologist at the La Grande Fish Research Station to track juvenile spring Chinook in the Catherine Creek system. Juvenile Chinook were captured and a small tracking device was implanted in each fish. Using radio telemetry, the locations of the fish were recorded with GPS on a regular basis. Data for the period of October 2009 through March 2010 were provided to PNGIS. Using the geographic coordinates collected with GPS, the tabular data were converted to geospatial data in GIS. The data were also linked to the Catherine Creek river mile (segment) dataset and through a process called ‘spatial join’, the river mile attribute was read into the juvenile location dataset. This enabled summary statistics to be generated for fish location based on river mile with relationships drawn between other features referenced by river mile.

4.3 Climate

As an element of the hydrologic cycle, precipitation data provides important information (in terms of amount and distribution) towards understanding surface hydrologic flows.

Average monthly and annual precipitation data were obtained from the PRISM Climate Group at Oregon State University as separate datasets for each month and the annual summary. The datasets were received in raster format and cover the entire continental United States. PNGIS Specialists clipped the datasets to the boundary extents of the Catherine Creek watershed and Grande Ronde River contributing area. ‘Clipping’ (i.e., reducing the data to the bounds of an area of interest), was performed to reduce the datasets to manageable sizes and facilitate use for cartography. The fields 'inches', 'red', 'green', and 'blue' were added to the PRISM value attribute table. The values ‘inches’ were calculated as a conversion from the source values (millimeters times a factor of 100) to inches. The ‘red’, ‘green’, and ‘blue’ values comprise RGB values to emulate the PRISM colormap and provide consistent symbology between each month’s dataset. This resulted in a gradient of color from low precipitation to high precipitation with precipitation amounts being symbolized by the same color between all maps.

Summary statistics of average monthly and annual precipitation were produced for the Catherine Creek watershed, stratified by watershed (i.e., the hydrologic contributing areas associated with established stream gage stations).

4.4 Elevation

Digital terrain surfaces provide the means to depict landform, model surface hydrologic flow, and study the processes by which landscapes are formed.

LiDAR (Light Detection And Ranging) data were collected in 2007 and 2009 (simultaneous and coincident with aerial photography acquisition, Figure 1) to provide high-resolution terrain surface information for analysis and modeling. The LiDAR data were delivered ready for use; no additional processing was required. This high-resolution data (1-meter postings) is appropriate for use at large scales (narrow geographic extent). At this resolution, historic stream channels within the active channel migration zone are detectable.

NED (National Elevation Dataset) 10-meter digital elevation models (DEMs) were obtained for use at small scales (i.e., broad geographic extent). The datasets were obtained as binary floating-point value (FLT) files with geographic extents of 1/3 arc-second. Files were processed into separate tiles (each tile is 1 degree latitude by 1 degree longitude square) and merged (i.e., seamlessly combined) into one contiguous dataset and was assigned the GCS NAD 83 (Geodetic Coordinate System North American Datum 1983) geographic projection. The merged dataset was processed to remove sinks (an anomalous convergence and termination of surface flow) to prepare the dataset for generating flow models. The ‘corrected’ surface model was then re-projected to the Lambert Conformal Conic NAD 83 geographic projection. This is a conformal projection (all angles at each point are preserved) suitable for mapping a range of scales (continent, region, and medium and large scale) and suitable for use in topographic and geologic applications as well as cartographic presentation. The 10-meter DEM does not reveal the surface detail that is realized with the 1-meter LiDAR-derived surface models, but provides a more manageable dataset (relative to data size and processing overhead) for use at broad geographic extent (extending beyond and thereby including all areas within the Catherine Creek watershed).

Since large areas within the Catherine Creek watershed have minimal topographic relief, the 10-meter DEM was reconditioned to adjust surface elevations and force flow to mapped stream channels. The process (using AGREE) drops surface elevations corresponding to vector flowline. Given the resolution of the DEM, the flow accumulation matrix could construct numerous parallel channels within flat terrain. With reconditioning, flow direction is managed by the adjusted surface and the flow accumulation matrix reflects the actual channel location.

Processing was performed on the 10-meter DEM to compute hydrological terrain parameters, which include flow models (flow direction and flow accumulation matrix) and catchments. Where flow direction and a flow accumulation matrix were interim products, catchments were the final, desired product. Catchments were generated for the Grande Ronde River, Catherine Creek, and stream networks defined based on stream flow measurement locations.

4.5 Geology

Geology and soils data provides insight into the processes and dynamics that shape the landscape in historic and current times as well under potential future scenarios.

Geology data were obtained from the Oregon Department of Geology and Mineral Industries (DOGAMI). The geospatial data were reprocessed to represent surficial geology according to the designations developed by Ferns and McConnell (DOGAMI 2002). The dataset was clipped to the Grande Ronde River contributing area and Catherine Creek watershed. The designations are a combination of field values for 'group' and 'label', so the geographically filtered attribute table was reduced to those two fields.

The Soil Survey Geographic (SSURGO) database was obtained from the USDA Natural Resources Conservation Service for Union County and the Wallowa-Whitman National Forest. The database consists of both geospatial and tabular datasets. The geospatial datasets representing the soil map units (soilsmu_a_625 and soilsmu_a_631) were clipped to the Catherine Creek watershed and linked to tabular datasets through a GIS function "data join." The first join was between the geospatial attribute table and the 'component' table, linking the fields "mucky/". The 'component' table directly links to the geospatial and carries the field "cokey" which enables additional linkage to other tables. The additional linkage made in this case was to the 'cogeomordesc' table using the "cokey" field. The geospatial data were exported to retain the cogeomordesc attributes in the geospatial attribute table. The two geospatial datasets (soilsmu_a_625 and soilsmu_a_631) were combined into a single dataset. The field "geomfname" was used to perform summary statistics and symbolize the dataset in cartography to report and represent geomorphic landform.

4.6 Hydrography

Hydrographic datasets were obtained from the USGS (National Hydrography Dataset (NHD)) and the Pacific Northwest Hydrography Framework (PNHF) as the basis for representing stream networks and water bodies in the Grande Ronde subbasin and Catherine Creek watershed. The datasets were 'clipped' to reduce the national (NHD) and regional (PNHF) to the geographic extents of the Catherine Creek TA. The clipped flow line (stream network) datasets were modified to reflect recent changes to Ladd Creek.

A river mile dataset was created for use as a standardized means to reference locations on Catherine Creek. This was accomplished by copying the Grande Ronde River and Catherine Creek flowlines from source data and creating a single line segment. The line was divided at 528-foot intervals, and the processing results were output to both point and line datasets, representing discrete point locations tenth-mile line segments, respectively.

It should be noted that the source hydrographic datasets retain the name "Grande Ronde River" for the stream segment between State Ditch and the historic confluence of Catherine Creek and the Grande River. Since the flow of the Grande Ronde River was diverted through State Ditch, the Grande Ronde River stream channel between most upstream point of State Ditch and Catherine Creek (referred to in the Catherine Creek TA as the old channel of the Grande Ronde River) has become non-existent within some stretches of the former, primary channel. This has resulted in a modification of hydrology within that area. Whereas, prior to the construction of State Ditch, the Catherine Creek watershed would have extended upstream from what is now the old channel of the Grande Ronde River, in the Catherine Creek TA the Catherine Creek watershed extends upstream from the confluence with most downstream point of State Ditch and includes the old channel of the Grande Ronde.

Watershed analyses for the Catherine Creek TA were performed based on present day hydrology. Catherine Creek and the Catherine Creek watershed include what were historically stream channels and catchments of the Grande Ronde River. Watershed analyses for the Catherine Creek TA were performed using modified hydrographic datasets (recognizing hydrologic changes induced by State Ditch) and 10-meter NED.

Other analysis related to hydrography and conducted for the Catherine Creek TA includes the calculation of drainage density within the Catherine Creek watershed.

4.7 Lands and Land Use/Land Cover

Lands and land cover / land use data were obtained from numerous sources, including Union County Assessor's Office, USDA Farm Service Agency (FSA) and Forest Service, and USGS.

4.7.1 Legal boundary

Geospatial data with tax lot parcels for Union County and the associated database identifying legal owners was purchased from Union County (Department of Revenue, Cadastral Information Systems Unit). The purpose in acquiring this dataset was to use it in requesting permission to access property in the course of conducting fieldwork for the Catherine Creek TA. Two copies were maintained; a full copy was provided to the Grande Ronde Model Watershed (GRMW) and the second copy was distributed through the geospatial data library. The geospatial data library copy was purged of all personal information and only contained map tax lot number (a unique identifier for properties) and the property owner's last name. The process for requesting access was to first identify the properties in GIS that would be associated with field survey efforts and record the tax lot map numbers for those properties. This information was provided to GRMW personnel who then request the access permissions. GRMW developed a related database that included point of contact information for each property and records of when contacts were made, type of contact made, purpose of access, and the dates of access.

4.7.2 Land Cover / Land Use

Geospatial data for agriculture in Union County was obtained in both vector and raster data formats. The common land unit geospatial dataset (digitized agricultural field boundaries) was obtained from the FSA. This dataset provided areal delineation but contained no data identifying land use / land cover. It served as the basis for mapping land cover in the area; minimizing digitizing efforts and adopting pre-established boundaries for land cover / land use. Other land cover / land use data developed from Landsat 7 imagery was obtained from the USGS. The USGS National Land Cover Database (NLCD) includes 21 classes of land cover / land use derived the imagery. Other independent datasets including per-pixel estimates of percent imperviousness and percent tree canopy were also obtained with the NLCD. All these datasets were clipped to reduce their extent from national coverage to that of the Grande Ronde River contributing area and Catherine Creek watershed.

Other datasets relating to land cover modification (i.e., wildland fire and timber harvest) within the Wallowa-Whitman National Forest was obtained from the USDA Forest Service.

4.8 Water Quality and Hydrology

FLIR (Forward Looking Infrared) imaging of Catherine Creek was obtained from the Oregon Department of Environmental Quality (ODEQ). The imagery had been acquired by ODEQ in 1999 for the preparation of Total Maximum Daily Load (TMDL) reports. FLIR provides spatially continuous data of surface water temperature and is used to identify spatial variability of temperatures. Thermal changes can be associated with confluences of tributaries, land cover patterns, and subsurface hydrology (groundwater inflow or springs) and thereby used to identify the environmental conditions influencing stream temperature. For purposes of the Catherine Creek TA, this information is applied to assess fish habitat quality.

The 1999 FLIR images are not geo-rectified and therefore not directly suitable for use in GIS. The nadir (ground center point) of each photo was recorded by GPS (Global Positioning System) at the time of capture. The spatially enabled photo points were attributed with photo-specific summary statistics (mean, maximum, and minimum temperature) to produce a temperature profile that could be used in GIS in conjunction with other geospatial data.

An array of gaging stations on the Grande Ronde River and Catherine Creek are providing temporally continuous data for water quality and hydrologic analyses. The array consists of stations that were installed and maintained by the USGS and Oregon Water Resources Department (OWRD) supplemented with stations installed by Reclamation specifically for the Catherine Creek Tributary Assessment. The station locations were created into geospatial data by GPS-derived geographic coordinates of each station. Watershed processing was performed to generate catchments for each gaging stations in order to relate data received from that gaging station to its hydrologically connected area within the tributary assessment study area. Each station represents the most downstream point (i.e., the pour point) of the hydrologically defined catchment. Summary statistics for gaging stations were stratified by catchment.

5. Data Storage and Documentations

A geospatial data library was designed and assembled which contained all the data acquired and collected for the Catherine Creek TA. The purpose of the geospatial data library is to distribute and make the data available to resource specialists conducting the TA. It is therefore imperative to document the geospatial data with Federal Geographic Data Committee (FGDC) compliant metadata. Metadata provides information about the data including general description, sources, processing, spatial reference, access and use restrictions, and contacts. It is also important to organize the library such that it will support a logical search. The Catherine Creek TA geospatial data library is organized by theme and geographic extent. The geographic extents are the Catherine Creek watershed and the Grande Ronde "subbasin" (combined HUC 8-digit subbasins Lower Grande Ronde, Upper Grande Ronde, Wallowa, and Imnaha). A complete listing of the geospatial data library by theme is provided below. Those datasets warranting description are annotated with a summary (identification information and, where applicable, source citation) of the metadata.

Biologic-Ecologic

- **Catherine Creek Watershed**
  - SpringChinook_20091021_20091230 [1]
- **Grande Ronde Subbasin**
  - Chinook_Reaches [2]

Steelhead_Reaches [3]

Climate

Catherine Creek Watershed

Precip_01_Jan_CCW [4]
Precip_02_Feb_CCW [4]
Precip_03_Mar_CCW [4]
Precip_04_Apr_CCW [4]
Precip_05_May_CCW [4]
Precip_06_Jun_CCW [4]
Precip_07_Jul_CCW [4]
Precip_08_Aug_CCW [4]
Precip_09_Sep_CCW [4]
Precip_10_Oct_CCW [4]
Precip_11_Nov_CCW [4]
Precip_12_Dec_CCW [4]
Precip_Annual_CCW [4]

Grande Ronde Subbasin

Precip_01_Jan_GR [4]
Precip_02_Feb_GR [4]
Precip_03_Mar_GR [4]
Precip_04_Apr_GR [4]
Precip_05_May_GR [4]
Precip_06_Jun_GR [4]
Precip_07_Jul_GR [4]
Precip_08_Aug_GR [4]
Precip_09_Sep_GR [4]
Precip_10_Oct_GR [4]
Precip_11_Nov_GR [4]
Precip_12_Dec_GR [4]
Precip_Annual_GR [4]

Elevation

Grande Ronde Subbasin

ned10m_dem [5]
ned10m_hshd [6]

Upper Grande Ronde LiDAR

be_lcath_shd (Lower Catherine Creek 2009 bare earth, hillshade)
be_lowcath (Lower Catherine Creek 2009 bare earth, DEM)
be_ucath_shd (Upper Catherine Creek 2009 bare earth, hillshade)
be_upcath (Upper Catherine Creek 2009 bare earth, DEM)
c_be_dem (Catherine Creek 2007 bare earth, DEM)
c_be_hsd (Catherine Creek 2007 bare earth, hillshade)
c_hh_dem (Catherine Creek 2007 highest hit, DSM)
c_hh_hsd (Catherine Creek 2007 highest hit, hillshade)
hh_lowcath_shd (Lower Catherine Creek 2009 highest hit, hillshade)
hh_lowcath (Lower Catherine Creek 2009 highest hit, DSM)
hh_ucath_shd (Upper Catherine Creek 2009 highest hit, hillshade)
hh_ucath (Upper Catherine Creek 2009 highest hit, DSM)

Geology and Soils

Catherine Creek Watershed

Landform_CCW [7]
SurficialGeology_CCW [8]

Hydrography

Catherine Creek Watershed

CatherineCreek_mainstem_rm [9]
CatherineCreek_mainstem_segment [10]

CatherineCreek_mainstem_wc [11]
CatherineCreekWatershed [12]
Grande Ronde Subbasin
fp100yr_UnionCounty [13]
fp500yr_UnionCounty [14]
GrandeRondeContributingArea [15]
MNHD_carto_20100518 [16]
Landcover
Catherine Creek Watershed
CCW_canopy [17]
CCW_impervious [18]
CCW_landcover [19]
fireHis_pnt_boehne [20]
fireHis_poly_boehne [21]
past_harvest_boehne (Wallowa-Whitman NF Timber Harvest History, 1976-2008)
Grande Ronde Subbasin
GR_canopy [17]
GR_impervious [18]
GR_landcover [19]
Lands
Grande Ronde Subbasin
clu_public_a_or61 [22]
TaxlotParcels_UnionCounty [23]
Water Quality
Grande Ronde Subbasin
Lakes_303d_2004_2006
Streams_303d_1998
Streams_303d_2002
Streams_303d_2004_2006
Imagery
CatherineCreek_Orthos_2008 (associated with LiDAR acquisition, see Product Reports)
CatherineCreekGeorectified_1937 (historical imagery acquired from USDA NRCS (Union County, La Grande Service Center), scanned by Idaho Blueprint Service (Boise, ID), and georectified by Reclamation PN GIS)
CatherineCreekGeorectified_1956 (historical imagery acquired from University of Oregon Map Library, georectified by Reclamation PN GIS)
CatherineCreekGeorectified_1964 (historical imagery acquired from University of Oregon Map Library, georectified by Reclamation PN GIS)
CatherineCreekGeorectified_1971 (historical imagery acquired from University of Oregon Map Library, georectified by Reclamation PN GIS)
LowerCatherineCreek_Orthos_2009 (associated with LiDAR acquisition, see Product Reports)
UnionCounty_CCM (historical imagery acquired from APFO)
naip_1-1_2n_s_or601_2004_2.sid
ortho_e1-1_s_or061_1994.sid
UpperCatherineCreek_Orthos_2009

MetaData Summaries

[1] **Identification Information:**
Originator: Bureau of Reclamation, La Grande Field Office and Oregon Department of Fish and Wildlife La Grande Fish Research Station
Title: Spring Chinook Locations on Catherine Creek, Grande Ronde Subbasin, 21 October 2009 through 30 December 2009
Abstract: Monitored locations of tagged Spring Chinook in Catherine Creek.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for

mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset was created through the joint Reclamation and Oregon Department of Wildlife Spring Chinook Over-wintering Study. The intent of the study is to determine spatio-temporal distibution of Spring Chinook salmon in Catherine Creek, a tributary of the Grande Ronde River. This is an on-going study; this data will be appended as more observations are recorded.

[2] **Identification Information:**
Originator: Oregon Department of Fish and Wildlife
Publication_Date: 20100205
Title: Oregon Fish Habitat Distribution - Spring Chinook
Edition: 1
Abstract: Oregon Fish Habitat Distribution
These data describe areas of suitable habitat believed to be used currently by wild, natural, and/or hatchery fish populations. The term "currently" is defined as within the past five reproductive cycles. This information is based on sampling, the best professional opinion of Oregon Dept. of Fish and Wildlife or other natural resources agency staff biologists or modeling. Habitat distribution data are mapped at a 1:24,000 scale statewide and are based on the Pacific Northwest Framework Hydrography dataset. The data were developed over an extensive time period ranging from 1996 to 2009.
Purpose: To provide an inventory of fish habitat distribution for documentation, mapping and analysis.
Source_Contribution: ODFW District Biologists and fisheries biologists from other state, federal and tribal natural resource agencies.

[3] **Identification Information:**
Originator: Oregon Department of Fish and Wildlife
Publication_Date: 20100309
Title: Oregon Fish Habitat Distribution - Summer Steelhead
Edition: 1
Abstract: Oregon Fish Habitat Distribution
These data describe areas of suitable habitat believed to be used currently by wild, natural, and/or hatchery fish populations. The term "currently" is defined as within the past five reproductive cycles. This information is based on sampling, the best professional opinion of Oregon Dept. of Fish and Wildlife or other natural resources agency staff biologists or modeling. Habitat distribution data are mapped at a 1:24,000 scale statewide and are based on the Pacific Northwest Framework Hydrography dataset. The data were developed over an extensive time period ranging from 1996 to 2009.
Purpose: To provide an inventory of fish habitat distribution for documentation, mapping and analysis.
Source_Contribution: ODFW District Biologists and fisheries biologists from other state, federal and tribal natural resource agencies.

[4] **Identification Information:**
Originator: The PRISM Climate Group at Oregon State University.
Publication_Date: 061206
Title: Catherine Creek Watershed and Grande Ronde Contributing Area Average Monthly and Annual Precipitation, 1971-2000
Abstract: This data set [a subset of the source data set] contains spatially gridded average monthly and annual precipitation for the climatological period 1971-2000. Distribution of the point measurements to a spatial grid was accomplished using the PRISM model, developed and applied by Chris Daly of the PRISM Climate Group at Oregon State University.
Purpose: Display and/or analyses requiring spatially distributed monthly or annual precipitation for the climatological period 1971-2000.

[5] **Identification Information:**
Originator: Bureau of Reclamation, Pacific Northwest Region

Title: Grande Ronde Subbasin 10-meter National Elevation Dataset DEM, April 2010
Abstract: National Elevation Dataset 10-meter DEM for Lower Grande Ronde, Upper Grande Ronde, Wallowa, And Imnaha Hydrologic Unit 8 subbasins and surrounding areas.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset provides a digital elevation model for the FCRPS Grande Ronde Subbasin at 10-meter resolution.
Source_Information:
Originator: U.S. Geologcial Survey (USGS)
Publication_Date: 2009
Title: National Elevation Dataset (NED)
Edition: 2
Source_Contribution: geometry and land surface elevation values

[6] **Identification Information:**
Originator: Bureau of Reclamation, Pacific Northwest Region
Title: Grande Ronde Subbasin 10-meter Shaded Relief, April 2010
Abstract: National Elevation Dataset 10-meter DEM for Lower Grande Ronde, Upper Grande Ronde, Wallowa, And Imnaha Hydrologic Unit 8 subbasins and surrounding areas.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset provides a shaded relief for the FCRPS Grande Ronde Subbasin at 10-meter resolution.
Source_Information:
Originator: U.S. Geologcial Survey (USGS)
Publication_Date: 2009
Title: National Elevation Dataset (NED)
Edition: 2
Source_Contribution: geometry and land surface elevation values

[7] **Identification Information:**
Originator: Bureau of Reclamation, Pacific Northwest Regional Office
Title: Catherine Creek River-mile, Union County, OR
Abstract: Catherine Creek river-mile based on Pacific Northwest (PNW) Hydrography Framework water course.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset provides standardized river miles to be used in the Catherine Creek Tributary Assessment which relate (though not extactly*) to river miles published on Grande Ronde Drainage Basin (Water Resources Dept., Salem Oregon, 1975). The 'comments' field in the feature attribute table notes where oxbows have since been separated from the main channel and are currently disconnected.
* Source data were processed in GIS and do not relate directly to the cartographic dimensioning of the water course.
Source_Information:
Originator: OR BLM/USFS
Publication_Date: 20050829
Title: Washington and Oregon Framework Hydrography
Source_Contribution: Geospatial data geometry

[8] **Identification Information:**

Originator: Bureau of Reclamation, Pacific Northwest Regional Office
Title: Catherine Creek Stream Segments, Union County, OR
Abstract: Catherine Creek flowline extracted from the Pacific Northwest (PNW) Hydrography Framework and segmented in tenth-mile intervals.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset provides a standardized flowline, segmented into tenth-mile intervals, and referenced with river mile for use in database relationships for the Catherine Creek Tributary Assessment. River mile segments relate (though not extactly*) to river miles published on Grande Ronde Drainage Basin (Water Resources Dept., Salem Oregon, 1975). The 'comments' field in the feature attribute table notes where oxbows have since been seperated from the main channel and are currently disconnected. * Source data were processed in GIS and do not relate directly to the cartographic dimensioning of the water course.
Source_Information:
Originator: OR BLM/USFS
Publication_Date: 20050829
Title: Washington and Oregon Framework Hydrography
Source_Contribution: Geospatial data geometry

[9] **Identification Information:**

Originator: Bureau of Reclamation, Pacific Northwest Regional Office
Title: Catherine Creek, Union County, OR
Other_Citation_Details: Subset of Washington and Oregon Framework Hydrography (water courses)
Abstract: Catherine Creek flowline extracted from the Pacific Northwest (PNW) Hydrography Framework.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset provides a standardized flowline for developing reference river miles to be used in the Catherine Creek Tributary Assessment.
Source_Information:
Originator: OR BLM/USFS
Publication_Date: 20050829
Title: Washington and Oregon Framework Hydrography
Source_Contribution: Geospatial data geometry

[10] **Identification Information:**

Originator: Bureau of Reclamation, Pacific Northwest Region
Title: Catherine Creek Watershed
Abstract: Catherine Creek Watershed, representing the contributing area of Catherine Creek upstream from the confluence with State Ditch; includes the active stream channel formerly known as Grande Ronde River and also includes the 'abandoned channel'.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset is the Catherine Creek Watershed, defined as the usptream contributing area above the confluence with State Ditch and Grande Ronde River. Catherine Creek hydrology includes the channels previously known as the Grande Ronde River (i.e., 1] the abandoned channel between the former confluence of the Grande Ronde River and Catherine Creek and the upstream diversion of the Grande Ronde River into State Ditch and 2] the segment of the former Grande Ronde beginning at the

downstream portion of the abandonned channel and currently receives primary active flow from Catherine Creek and joins the Grande Ronde River at the downstream mouth of State Ditch).

Source_Information:

Originator: U.S. Geological Survey in cooperation with U.S. Environmental Protection Agency, USDA Forest Service, and other Federal, State and local partners.

Title: NHDFlowline

Edition: NHD090503

Originator: U.S. Geological Survey (USGS)

Publication_Date: 2009

Title: National Elevation Dataset (NED)

Edition: 2

Source_Contribution: Provided elevation values to model the terrain surface for the area of interest.

[11] **Identification Information:**

Originator: Union County, Planning Department

Title: 100-year Floodplain, Union County, OR

Abstract: Digitized shapefile delineating 100yr floodplain

Purpose: Digitized shapefile delineating 100yr floodplain

Supplemental_Information: Digitized shapefile delineating 100yr floodplain. Shapefile contains newly digitized polygons, and corrected vertices from previously digitized info. Polygons have been created based on georeferenced TIF, created from FEMA paper maps, circa 1984 data.

[12] **Identification Information:**

Originator: Union County Planning Department

Title: 500-year Floodplain, Union County, OR

Abstract: Digitized shapefile delineating 500yr floodplain

Purpose: Digitized shapefile delineating 500yr floodplain

Supplemental_Information: Digitized shapefile delineating 100yr floodplain. Shapefile contains newly digitized polygons, and corrected vertices from previously digitized info. Polygons have been created based on georeferenced TIF, created from FEMA paper maps, circa 1984 data.

[13] **Identification Information:**

Originator: Bureau of Reclamation, Pacific Northwest Region

Title: Grande Ronde Contributing Area

Abstract: Grande Ronde River Contributing Area, representing the contributing area of the Grande Ronde River upsteam from the confluence with the Snake River.

Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset is the Grande Ronde River contributing area, defined as the upstream contributing area above the confluence with the Snake River. NOTE: this dataset differs from NHD 8-digit HUCs and FCRPS subbasins in that it is not sub-divided into Upper Grande Ronde, Lower Grande Ronde, and Wallowa subbasins nor does it include the Imnaha HUC8 subbasin.

Source_Information:

Originator: U.S. Geological Survey in cooperation with U.S. Environmental Protection Agency, USDA Forest Service, and other Federal, State and local partners.

Title: NHDFlowline

Edition: NHD090503

Source_Contribution: Provided vector data for reconditioning 1/3 arc second National Elevation Dataset (NED).

Originator: U.S. Geological Survey (USGS)

Publication_Date: 2009

Title: National Elevation Dataset (NED)

Edition: 2
Source_Contribution: Provided elevation values to model the terrain surface for the area of interest.

[14] **Identification Information:**
Originator: Bureau of Reclamation, Pacific Northwest Regional Office
Title: Pacific Northwest Region Cartographic Hydrography, May 2010
Abstract: National Hydrography Dataset modified for use in cartographic products.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff with managed geospatial data resources for mapping and analyses in support of Reclamation projects. The geographic extent of the database covers the Columbia River basin and Pacific Northwest Coast, including Idaho, Oregon, Washington, and portions of California, Nevada, Montana, Utah, and Wyoming.
Source_Information:
Originator: U.S. Geological Survey in cooperation with the U.S. Environmental Protection Agency
Publication_Date: 1999
Title: NHD Flowlines, medium resolution
Source_Contribution: Provides the geometry of the dataset

[15] **Identification Information:**
Originator: Bureau of Reclamation, Pacific Northwest Regional Office
Title: Landform in the Catherine Creek Watershed, May 2010
Abstract: Soil Survey Geographic (SSURGO) data modified for use in cartographic products.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset uses SSURGO data to depict geomorphic landform within the Catherine Creek watershed, Union County, Oregon.
Source_Information:
Originator: U.S. Department of Agriculture, Natural Resources Conservation Service
Publication_Date: 20100209
Title: Soil Survey Geographic (SSURGO) Database for Union County Area, Oregon
Other_Citation_Details: or625
Source_Contribution: Spatial geometry feature attribution
Originator: U.S. Department of Agriculture, Natural Resources Conservation Service
Publication_Date: 20100209
Title: Partial Soil Survey Geographic (SSURGO) Database for Wallowa-Whitman National Forest, Oregon
Other_Citation_Details: or631
Source_Contribution: Spatial geometry feature attribution

[16] **Identification Information:**
Originator: Bureau of Reclamation, Pacific Northwest Regional Office
Title: Surficial Geology Catherine Creek Watershed, May 2010
Abstract: Oregon geology data modified for use in cartographic products.
Purpose: Part of Reclamation's Pacific Northwest Region GIS data holdings to provide Reclamation staff, other Action Agencies, and cooperating partners with managed geospatial data resources for mapping and analyses in support of Reclamation projects related to habitat quality improvement as prescribed in the 2008 Federal Columbia River Power System (FCRPS) Biological Opinion. This specific dataset uses Oregon geology data to depict surficial geology within the Catherine Creek watershed, Union County, Oregon.
Source_Information:
Originator: Oregon Department of Geology and Mineral Industries

Publication_Date: 2009
Title: G_MAP_UNIT
Source_Contribution: Spatial geometry feature attribution

[17] **Identification Information:**
Originator: U.S. Geological Survey
Publication_Date: 20030901
Title: National Land Cover Database Zone 01 Tree Canopy Layer for the Catherine Creek Watershed and Grande River Contributing Area
Edition: 1.0
Abstract: THIS IS A SUBSET OF - The National Land Cover Database 2001 tree canopy layer for mapping zone 01 was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS). One of the primary goals of the project is to generate a current, consistent, seamless, and accurate National Land cover Database (NLCD) circa 2001 for the United States at medium spatial resolution.
Purpose: The goal of this project is to provide the Nation with complete, current and consistent public domain information on its land use and land cover.

[18] **Identification Information:**
Originator: U.S. Geological Survey
Publication_Date: 20030901
Title: National Land Cover Database Zone 01 Imperviousness Layer for the Catherine Creek Watershed and Grande Ronde Contributing Area
Edition: 1.0
Abstract: THIS IS A SUBSET OF - The National Land Cover Database 2001 for mapping zone 01 was produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS). One of the primary goals of the project is to generate a current, consistent, seamless, and accurate National Land Cover Database (NLCD) circa 2001 for the United States at medium spatial resolution.
Purpose: The goal of this project is to provide the Nation with complete, current and consistent public domain information on its land use and land cover.

[19] **Identification Information:**
Originator: U.S. Geological Survey
Publication_Date: 20110216
Title: NLCD 2006 Land Cover for the Catherine Creek Watershed and Grande River Contributing Area
Edition: 1.0
Abstract: THIS IS A SUBSET OF - The National Land Cover Database products are created through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium. The MRLC Consortium is a partnership of federal agencies (www.mrlc.gov), consisting of the U.S. Geological Survey (USGS), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA), the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM) and the USDA Natural Resources Conservation Service (NRCS).

Purpose: The goal of this project is to provide the Nation with complete, current and consistent public domain information on its land use and land cover.

[20] **Identification Information:**
Originator: Fire Staff
Publication_Date: 5/30/2008
Title: Historical Fire Start locations of the Malheur, Umatilla, and Wallowa-Whitman NF's
Edition: 1
Abstract: Initial Start Locations of fires reported into NIFMID by the Pendleton Interagency Dispatch Center, North East Oregon Dispatch Center, or the Malheur NF Dispatch Center.
Purpose: Shows spatial location of Points where fires start. Point of origin for wildfires, escaped fires, and prescribed natural fires.

[21] **Identification Information:**
Originator: Umatilla, Malheur, and Wallowa-Whitman National Forests
Publication_Date: 01/31/2006
Title: Large Fire Perimeters of the Blue Mountains
Edition: 6
Abstract: The final mapped wildfire perimeters of the Blue Mountains of Eastern Oregon
Purpose: The data is tracked at the forest level to track the area affected by fire. Spatial data is stored via a region feature class due to overlapping fire perimeters.

[22] **Identification Information:**
Originator: USDA-FSA Aerial Photography Field Office
Publication_Date: 20080114
Title: Common Land Unit for Union, Oregon
Edition: 20080114
Abstract: The common land unit (CLU) dataset consists of digitized farm tract and field boundaries and associated attribute data. The USDA Farm Service Agency (FSA) defines farm fields as agricultural land that is delineated by natural and man-made boundaries such as road ways, tree lines, waterways, fence lines, etc. Field boundaries are visible features that can be identified and delineated on aerial photography and digital imagery. Farm tracts are defined by FSA as sets of contiguous fields under single ownership. Common land units are used to administer USDA farm commodity support and conservation programs in a GIS environment.
Purpose: This CLU data will aid County Field Service Centers in identifying and delineating farm tracts and field boundaries as they administer USDA programs for their customers. Better providing more accurate time-saving acreage, field and tract information to their customers.

[22] **Identification Information:**
Originator: Deparment of Revenue - Cadastral Information Systems Unit
Publication_Date: 05/31/2001 (original, contains database updates of October 14, 2009)
Publisher: Union County Assessor's Office
Title: TaxlotParcels_UnionCounty
Edition: First
Abstract: Taxlot polygon for Union Countywide, Union County
Purpose: The data was created to have a complete inventory of the real property in Union County. From which other applications (soil maps, flood plains) can be created. All of the data is for the Assessment & Taxation functions

6. References

Parenthetical Reference	Bibliographic Citation
DOGAMI 2002	Oregon Department of Geology and Mineral Industries. 2002. A groundwater case study: Catherine Creek and the Upper Grande Ronde Valley. Cascadia, Volume 2, Number 1, pp. 7-8.