

Log Cabin Diversion Dam Reach

(Oregon Creek downstream of Log Cabin Diversion Dam)

Study Site and Transect Field Selection Package

1.0 Introduction

This information package was developed by Yuba County Water Agency (YCWA) to aid in field selecting study sites and transects as part of relicensing of the Yuba River Development Project (FERC Project No. 2246).

YCWA will select study sites and transects in collaboration with Relicensing Participants for the following studies and in accordance with procedures described in the respective plans.

- 3.10 Instream Flow
- 1.0 Channel Morphology
- 6.1 Riparian Habitat
- 3.8 Fish Population
- 3.1 Aquatic Macroinvertebrates

In their review of these study plans, Relicensing Participants recommended that YCWA co-locate study sites and/or transects to the extent feasible. YCWA agrees, but with the understanding that “co-location” will not be at the expense of properly sited and collected data for any individual study. If co-locating a site or transect does not work for a particular study, study sites or transects for that study will be selected independent of the other studies.

YCWA recommends that the PHABSIM method (Instream Flow 3.10) be the “driver” in the selection process since it requires the largest number of study sites and/or transects and the study site/transect selection protocol is relatively strict. Because PHABSIM study sites and transects will be selected to represent the range of hydraulic and channel types in the study reach there should be adequate opportunities for co-locating other studies with the PHABSIM study sites and transects. YCWA agrees to adjust the selection of PHABSIM study sites and transects to accommodate co-location if the co-located studies benefit all studies without compromising the methods or selection protocol of the individual studies.

PHABSIM study sites and transects will be selected in accordance with Instream Flow Study Plan 3.10, Section 5.3.5 – Study Site and Transect Selection. Section 5.3.5.2 – Transect Selection and Placement describes the “Least-Common-Selector” (LCS) process, a stratified random sampling approach based on the least-available sampled mesohabitat type (Payne 1992¹). While the LCS is the preferred method and is the method described in the study plan, YCWA may be required to deviate from this method in certain stream reaches where restricted access to

¹ Payne, T.R. 1992. Stratified random selection process for the placement of Physical Habitat Simulation (PHABSIM) transects. Paper presented at AFS Western Division Meeting, July 13-16, in Fort Collins, CO.

the stream limits the population of habitat units from which the LCS can be randomly selected. Any deviations will be described later in this field package.

Study sites and transects for studies 3.10 Instream Flow, 1.1 Channel Morphology, and 6.1 Riparian Habitat will be selected concurrently, while study sites for 3.8 Fish Population and 3.1 Aquatic Macroinvertebrates will be selected at a later time with the intent of co-locating, to the extent feasible, these studies with the other study sites. Because stream fish population and macroinvertebrate study methods are not transect based, possible co-location of these studies with other studies will be by study site only.

2.0 General Morphology of Log Cabin Diversion Dam Reach (Oregon Creek)

There are three gradient breaks within the 4.1 mile Oregon Creek, between which fluvial processes vary. Oregon Creek flows mostly through resistant plutonic granitic material, though there is a short, steep section near the upstream end that is composed of competent metasedimentary material. There is a short 4.6 percent gradient section just above the confluence with the Middle Yuba River, and a 3.7 percent gradient section upstream of Celestial Valley. Celestial Valley appears to be a long-term depositional area and has an overall gradient of 1.6 percent (Figure 1). The Celestial Valley Sub-reach is highly modified by human activity; channel location has been modified by roads, grazing, berms, and suburban development. It is also heavily vegetated with blackberry vines.

Initial classification of Oregon Creek characterized two types: the steeper 3-8 percent confined channel type near the downstream end of the reach and immediately below Log Cabin Dam; and the lower gradient, 1-3 percent confined section through Celestial Valley. There is also a short 1-3 percent gradient confined section as the creek approaches its confluence with the Middle Yuba River.

The stream is confined throughout between either terraces or steep valley walls. The steeper sections are dominated by cascades, falls, and plunge pools, whereas the Celestial Valley section is dominated by long planar runs and low gradient riffles, with minimal three-dimensional heterogeneity. Habitat is dominated by low gradient riffles, pocket-water, and mid-channel pools. Instream cover is dominated by boulders. There is minimal accumulation of trout spawning-size gravel, and only sparse quantities of large woody material.

Oregon Creek has been separated into two sub-reaches based primarily on gradient, which strongly affects habitat types and fluvial processes (Figure 2):

- Log Cabin Sub-Reach – two sections
 - Lower Section – Middle Yuba Junction (RM 0) to Allegheny Road Bridge (RM 1.92)
 - Upper Section – upper end of Celestial Valley Sub-Reach (RM 3.1) to Log Cabin Diversion Dam (RM 4.1)
- Celestial Valley Sub-Reach – Allegheny Road Bridge at RM 1.92 to RM 3.1

Study sites have been proposed on lands that are publicly owned and accessible, and least common selectors have been selected from that population.

3.0 Proposed Study Sites

3.1 Log Cabin Sub-Reach

The Log Cabin Sub-Reach is split into two segments by the inset Celestial Valley Sub-Reach. The lower section extends from the confluence with the Middle Yuba River (RM 0.0) up to the Allegheny Road crossing of Oregon Creek at ~RM 1.92 (Figure 1). The upper segment of the Sub-Reach is 1 mile long and extends from the upstream extent of the Celestial Valley Sub-Reach at RM 3.1 to the Log Cabin Diversion Dam at RM 4.1. Access to the lower section is best via the Oregon Creek Campground and the abandoned road that accessed the covered bridge at RM 0.15. It is recommended that the Oregon Creek Campground be avoided due to heavy recreational use. Another location is a patch of public land just upstream of RM 3.1 to which road access through a mill site exists. Runs/Step Runs are the least common selector but there are none within the lower section. The next least common selector is low-gradient riffles, and there is only one. Therefore, the accessible pocket-water (i.e., within 0.5 miles of access and/or on public land) have been numbered and ordered using a random number generator. The first LCS to be chosen was the 8th-occurring POW, then the 5th, then the 11th, then the 12th and these four LCS are labeled 1 through 4 on Table 1. Table 2 provides a summary of the habitat frequencies for the reach, and for notes as to transect selection for the entire reach.

3.2 Celestial Valley Sub-Reach

The inset Celestial Valley Sub-Reach extends from RM 1.92 to RM 3.1. A potential study site was selected for this sub-reach that is mostly on public land. The proposed study site shown on Figure 1 and Figure 2 represents a range of habitat types (Figure 1, Table 3). The beginning of the proposed study site is at the Allegheny Road bridge across Oregon Creek. Pocket-water is the least common habitat type but has only one representative in the publicly owned section of the sub-reach. Therefore, run/step run (RUN/STEP) was selected as the LCS and the runs/step runs in the public land were numbered from downstream to upstream (Table 3). The Random Number generator ordered the units in the same order (1, 2, 3). So the first LCS is HMU#160 right under the Allegheny Bridge. Table 4 provides a summary of the habitat frequencies for the reach, and for notes as to transect selection for the entire reach.

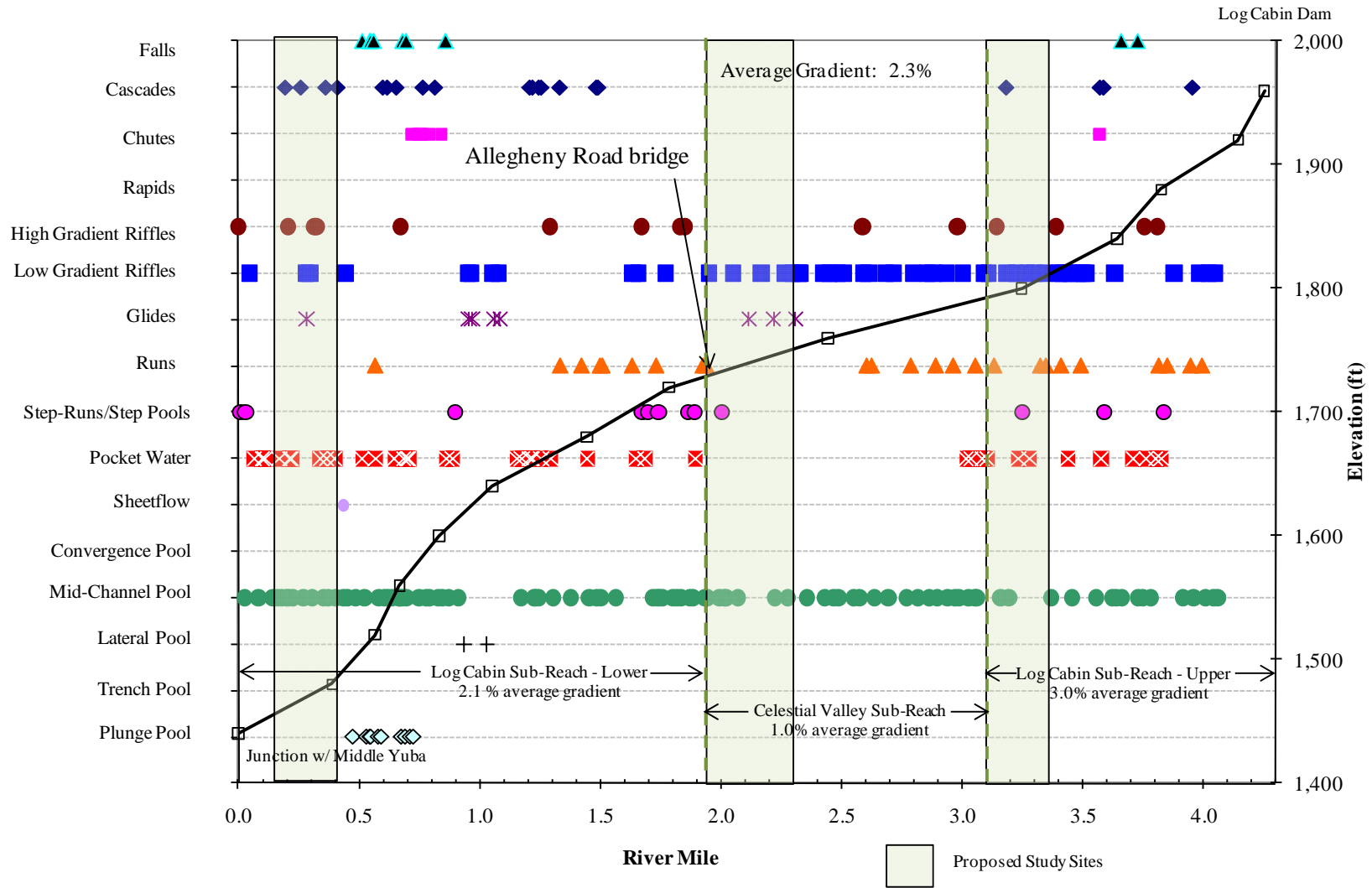


Figure 1. Habitat types, longitudinal profile, sub-reaches, and potential study sites for Log Cabin Diversion Dam Reach (Oregon Creek).

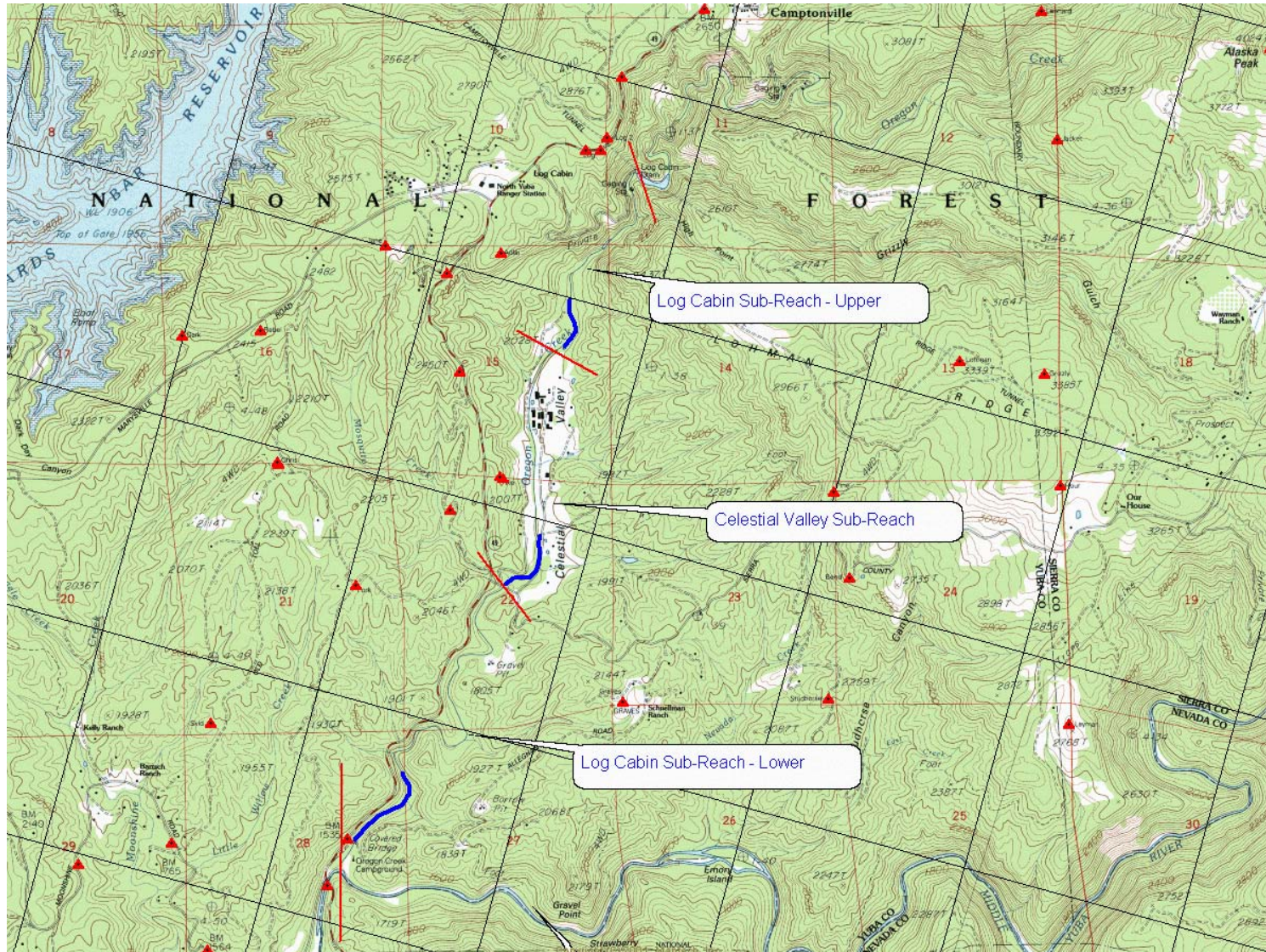


Figure 2. Log Cabin Diversion Dam Reach (Oregon Creek) sub-reaches (breaks represented by red lines) and potential study sites (represented by blue lines).

Table 1. Ground based habitat mapping unit on Log Cabin Sub-Reach (Log Cabin Diversion Dam Reach [Oregon Creek]). Shaded units are those downstream and upstream of the proposed study sites.

Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
Lower		1	HGR	60	0.00	30		S.C. begins 60' u/s from junction. Begin at junction with M Yuba, 6%HGR - transverse - NM
Lower		2	STEP	80	0.01	27		S.C. LBA lots of flat pockets, modelable
Lower		3	MCP	36	0.02	17	1.75	temp logger casing returned to water, r.c. = max 1.8, area = 2m ² , barely meets
Lower		4	STEP	80	0.03	19.67	1.75	short (10') sc pool near base, heavy blackberry, nm - too many steps transpose.
Lower		5	LGR	117	0.04	32.67		3.5% - M.(0.3 deg), 2" trout, small frog
Lower		6	POW	102	0.07	48.33		S.C. holes around boulders, flat complex 3D flow, trail to car park
Lower		7	MCP	89	0.08	39.33	1.75	r.c. = 1' area > 2m ² , separated at 55' by mid control, short upper pool
Lower		8	POW	58	0.10	40		SPLIT between U8 and U9 107' STEP/HGR/POW (photos: 1186, 1187, 1188). Covered Bridge
Lower		9	POW	180	0.11	54.5	2.5	in a series of steps, lms flat, separated by short boulder steps, split by boulder pile at upper end
Lower		10	MCP	108	0.14	34.33	3.5	some sand ~10%, ~ 5 cm deep
Lower		11	MCP	41	0.16	31	3	small mini pool @ base on LBA, sand 3x4 ~5 cm
Lower		12	POW	66	0.17	31.67		
Lower		13	MCP	63	0.18	31	3.5	lots of sand on banks represents high flow
Lower		14	CAS	40	0.19	33		9% gradient - CAS because pocket pools
Lower		15	MCP	48	0.20	37	4.5	
Lower		16	HGR	20	0.21	25		13%, no pocket water
Lower		17	MCP	26	0.21	24	3.75	short but significant depth
Lower		18	POW	36	0.21	20.67		spawn gravel patches with some sand
Lower	2	19	POW	54	0.22	26.67		short steps @ base and top
Lower		20	MCP	154	0.23	21	3.5	2" fish, 4" brown, 2" fish
Lower		21	CAS	72	0.26	24		12% gradient, thin colluvial sandy soil over bedrock, undermine > failure, 2" fish, pocket pools
Lower		22	MCP	57	0.27	24	1.57	"Federal Mining claim over ch #2, ROCKPROPERTIES USA CAMC#" @ top.

Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
Lower		23	LGR	30	0.28	29		spawning gravel embedded, Mining Claim trail to HWY 49, Photo 1205 deleted
Lower		24	GLI	71	0.28	29.5		spawning gravel too embedded, small sc hole around boulder at base
Lower		25	LGR	63	0.30	34		gravel too embedded, top formed by dug-out minning debris
Lower		26	MCP	58	0.31	32.5	7	two 3" trout, max dep < digging; d/s control excavated water,
Lower		27	HGR	43	0.32	25		CHARACTERIZED UNITS 27 TO 36, S.C. starts - debris U-28.
Lower		28	HGR	80	0.32			7% nm
Lower		29	POW	83	0.34	46.5		lots of Indian Rhubarb
Lower		30	MCP	40	0.35	44	2.5	0.75 r.c., sc <- LBD
Lower		31	CAS	49	0.36	36		8%, 2 degrees, Pockety therefore CAS, nm - too many splits, flag tied @ top
Lower		32	POW	29	0.37	30		
Lower		33	MCP	150	0.37	33.67	4	tons of 2" fish, six 4" fish, long deep pool; boulder cover, some spawning gravel, pocket water at top
Lower	1	34	POW	27	0.40	26		
Lower		35	MCP	28	0.40	23	2.5	
Lower		SPLIT	CAS	158	0.41	24.67		9% non-modelable, 3.3 degrees. Frog - adult couldn't identify - cream throat, black spots. Considered CAS because pockets of depth and flat.
Lower		SPLIT	MCP	33	0.44	25	2.75	MCP > LGR > top of split. SPLIT begins at base of continues to top of U35.
Lower		SPLIT	LGR	58	0.44			
Lower		SPLIT	MCP	122	0.45		3	fish 2" - 4"
Lower		36	PLP	61	0.47	46	10	4" trout sand on margin but not at max depth
Lower		37	MCP	65	0.48	33	3.5	Falls at base not a barrier, no sand
Lower		38	SHT	92	0.50	30.25		
Lower		39	FALL	17	0.51	66		Falls height (min) LB = 2' RB = 1.5' :PERM
Lower		40	POW	43	0.51	66		
Lower		41	MCP	51	0.52	25	5	
Lower		42	PLP	71	0.53	24.33	6	separated from U41 by Bldr control, sand deep ~50%
Lower		43	FALL	13	0.54	15		

Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
Upper		225	POW	44	3.10	25	1.5	rc = 0.5, boulder/cobble, no movement n 1 > t, poor sc. (doesn't meet rd), no flow uniformity THEREFORE POW, END SURVEY.
Upper		226	LGR	120.5	3.11	15.67		LGR because surface agitation, although may resemble POW @ high flows, 2% gradient.
Upper		227	RUN	51	3.13	17.5		Not POW because shallow and no divergent flows. Used unit #225 for truthing.
Upper		228	HGR	86	3.14	17		4%, big boulders
Upper		229	MCP	124	3.16	32	5	top of pool run - like due to slight control
Upper		230	CAS	16	3.18	6.33		7% gradient
Upper		231	LGR	29	3.19	12		2% gradient
Upper		232	MCP	157	3.19	26.75	6	top of pool narrow & run-like with weak control
Upper		233	LGR	61	3.22	19.33		3%, maybe split channel @ higher flows
Upper	3	234	POW	89	3.23	32		
Upper		235	STEP	98	3.25	21		weakly stepped but steps present. Modified therefore stranded rocks in wetted channel photos DTA2 2138 LDS. Top step looks like maybe half LGR in higher flows
Upper		236	LGR	61	3.27	16.33		1% gradient
Upper	4	237	POW	105	3.28	23		POW best describes, would be GLI but very ununiform/boulder substrate
Upper		238	LGR	136	3.30	19.25		modified at middle, rock-boulder dam at road crossing; photos DTA2 # 2142, 2143. 2.5% gradient. Red-legged adult frog (Photos: DTA2 #'s 2144, 2145, 2146 are of juvenile RLF, #'s 2147, 2148 are of adult RLF).
		239	RUN	91	3.32	25.33		spawn gravel out of water, POW-like, but much too shallow, no scour around boulders, no surface agitation so not LGR
		240	LGR	32	3.34	19.5		3% gradient
		241	RUN	108	3.35	19.67		POW-like, but shallow, little scour, more POW-like at base.
		242	MCP	94	3.37	41.5	5.5	
		243	HGR	83	3.39	21.33		4% gradient, some steps on LBA, not mappable

Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
		244	LGR	47	3.40	25.5		4" fish, LGR due to surface agitation, 1% gradient
		245	RUN	44	3.41	17		
		246	LGR	104	3.42	22.33		
		247	POW	39	3.44	26.5		
		248	LGR	44	3.45	27.5		
		249	MCP	89	3.45	34		
			SPLIT	43	3.47			
		250	LGR	71	3.48	23		1% surface agitation present, channel wide and almost divergent; some indistinct run-like features, not stepped.

Table 2. Habitat frequency based on ground-mapped data and target transects for Log Cabin Sub-Reach (Log Cabin Diversion Dam Reach [Oregon Creek]).

Log Cabin Sub-Reach					
Habitat	Length (ft)	Length Frequency	Adjusted Length Frequency	Estimated Minimum # Target Transects*	# Selected (PHABSIM)
High gradient riffles	562	4%	0%	0	
Low gradient riffles	2,044	15%	17%	3	
Runs/Step-Runs	1,621	12%	13%	2	
Glides	551	4%	0%	0	
Pocket Water	2,351	18%	19%	3	
Pools	6,078	46%	50%	9	
TOTAL	13,206	100%	100%	17	

*for Instream Flow Study only

Table 3. Ground based habitat mapping units for Celestial Valley Sub-Reach (Log Cabin Diversion Dam Reach [Oregon Creek]). Green shading indicates public land upon which transects should be placed.

Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
		154	HGR	66	1.85	30		5% gradient, modelable
		155	STEP	50	1.86	45		oblique flow, multiple water surfaces, pocket-like (poor exp of step), 3% grad.
		156	MCP	82	1.87	37.67	2	
		157	MCP	32	1.89	32	2	RC = 0.5, max depth = 2, area < 3 meters
		158	STEP	28	1.89	34.5		cobble/ boulder bar creates split, few steps
Celestial Valley		159	POW	156	1.89	40		bedrock pool/ shallow pocket water - directly under Celestial Valley Road bridge (Allegheny Road)
Celestial Valley	1	160	RUN	45	1.92	27.5		bedrock under bridge (Allegheny Road)
Celestial Valley		162	MCP	32	1.93	36	2.75	
Celestial Valley	2	163	RUN	27	1.94	19.5		
Celestial Valley		164	MCP	38	1.94	27.33	3	tributary LBA ~ 0.5 cfs
Celestial Valley		165	LGR	230	1.95	34.25		california newt!, short run at bottom, one LBA midchannel modelable; modification & some pools formed from mining. SWITCH TO MAPPING @ UTM: 0666246/ 4364489
Celestial Valley		166	MCP	48	1.99	34	1.06	
Celestial Valley	3	167	STEP	53	2.00	33		3% gradient
Celestial Valley		168	MCP	32	2.01	30.5	1.13	
Celestial Valley		169	MCP	151	2.02	31.67	2.78	pool 168 & 169 separated by strong bedrock boulder outcrop, weak control mid-pool
Celestial Valley		170	LGR	108	2.05	30.67		2.5% gradient, 75% of channel RBA riffle-like, although steplike RBA NOT MODELABLE because more than one habitat type across transverse (2/3 riffle, 1/3 run)
Celestial Valley		171	MCP	243	2.07	41.67	3.5	+ 0.5 feet for average BF depth
Celestial Valley		172	GLI	274	2.11	29.75		
Celestial Valley		173	LGR	264	2.17	32.5		2% gradient, sedges, banks - heavy blackberry cobble is sand matrix with some boulder. Modelable at higher flows (through rocks and multiple flow line at current flow)
Celestial Valley		174	GLI	43	2.22	44		Glide at base of pool, poor control between GLI & Pool (U174 & 175)

Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
Celestial Valley		175	MCP	225	2.22	32.75	3.1	poor sc but enough shallow, slow, wide. Photo DTA1 1424 LUS butterfly
Celestial Valley		176	LGR	41	2.27	24		3% grad, boulder and cobble substrate
Celestial Valley		177	MCP	113	2.28	28.75	2.5	railroad bridge crosses unit, cobble/ boulder substrate, 30% each
Celestial Valley		178	LGR	60	2.30	27.67		2% gradient
Celestial Valley		179	GLI	78	2.31	25.33	1.2	rc = 0.75, max depth = 1.2 therefore does not meet, slow, therefore Glide
Celestial Valley		180	LGR	27	2.32	25		2%, run-like character
Celestial Valley		181	LGR	156	2.33	25.25		3% gradient
Celestial Valley		182	MCP	337	2.36	36	4.25	strong downstream control < boulders; short run at top, lots of sand surrounds cobbles and boulders but not in big depth, cat tails increase overhanging veg. Boulder/cobble substrate
Celestial Valley		183	LGR	53	2.42	25		boulder/cobble, 3%
Celestial Valley		184	MCP	98	2.43	29	2.25	boulder/cobble w/ sand
Celestial Valley		185	LGR	86	2.45	27.67		not modelable, too many WSE's, 4% grad.
Celestial Valley		186	MCP	83	2.47	31	2	cobble/boulder/sand
Celestial Valley		187	LGR	26	2.48	28		2% gradient
Celestial Valley		188	MCP	108	2.49	33	2.5	rc'= 0.6, shallow at top
Celestial Valley		189	LGR	214	2.51	33.33		2.5% grad
Celestial Valley		190	MCP	132	2.55	35.33	3	sand fills pool
Celestial Valley		191	MCP	68	2.57	28	3	boulder control separates 190 & 191, fence at goat pasture, modification/disturbance
Celestial Valley		192	HGR	26	2.59	27		6% grad, boulder/riffle, non modelable
Celestial Valley		193	LGR	71	2.59	22.5		3% gradient, lower w/ poorly formed steps; flater/deeper - lumped cobble bar on LBA.
Celestial Valley		194	RUN	46	2.60	19.5	1.25	rc = 0.75, r.d. = 0.5 doesn't meet; deeper therefore run
Celestial Valley		195	LGR	63	2.61	24		4% gradient, flag, modelable at top only
Celestial Valley		196	RUN	50	2.62	34.33		wide, shallow
Celestial Valley		197	MCP	255	2.63	46.33	4.25	long, deep, filled with sand; adjacent to log yard; +1 for BFD (WD 1-12,50 (w) 1-12,25 (w); 150 LBD BE
Celestial Valley		198	LGR	49	2.68	32.5		3% gradient
Celestial Valley		199	MCP	132	2.69	32.33	1.75	bridge 666325/ 4365576, sand/boulder substrate 30% embedded.
Celestial Valley		200	LGR	278	2.72	28.6		3%, modelable in flatter sections but

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Section	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
								multiple flow lines elsewhere
Celestial Valley		201	MCP	94	2.77	27.33	1.5	r.c. = 0.04 > meets
Celestial Valley		202	RUN	50	2.79	24		run uniform, deeper than glide, but slow water
Celestial Valley		203	LGR	112	2.80	33		4%, flat section modelable
Celestial Valley		204	MCP	193	2.82	33.75	3.75	sand fills pool, cows, stream side road (boulder/sand), 50% pool tail embeddedness
Celestial Valley		205	LGR	36	2.85	27		boulder/cobble flat at top (but forgot UTM)
Celestial Valley		206	MCP	94	2.86	26.67		
Celestial Valley		207	LGR	60	2.88	25		non modelable, 4% gradient
Celestial Valley		208	RUN	30	2.89	27		
Celestial Valley		209	MCP	201	2.90	36	1.75	filled with sand - boulder/sand substrate, thick green algae, dogs sand piling into stream, 0.05 cfs culvert/ trib LBA, shallow at head, PHOTOS DTA1 1430-1432 dogs, pool, and bank.
Celestial Valley		210	LGR	29	2.93	34		2% grad
Celestial Valley		211	MCP	123	2.94	34.67	2	RUN/GLIDE at tail (~25' long)
Celestial Valley		212	RUN	34	2.96	24.33		boulder/ cobble
Celestial Valley		213	MCP	54	2.97	19	2	boulder/ cobble, 10' step through not mass and boulders separate 212&213
Celestial Valley		214	HGR	25	2.98	29		8% gradient, strong boulder -> psuedo steps, oblique flow, non-modelable
Celestial Valley		215	MCP	82	2.98	25.67	2	flag, long narrow tail (run-like), bldr/cob (less sand), rc = 0.75.
Celestial Valley		216	LGR	93	3.00	31		4% gradient, modelable
Celestial Valley		217	POW	36	3.02	28.5		small scale, multi-thread, boulder dominant
Celestial Valley		218	MCP	56	3.02	29.67	2	rc = 0.5, poor sc; wide, flat, shallow
Celestial Valley		219	POW	86	3.03	29.75		rhubarb
Celestial Valley		220	MCP	20	3.05	21	2	
Celestial Valley		221	RUN	17	3.05	17		
Celestial Valley		222	MCP	127	3.06	28	2	thick algae, rc = 0.5, tail glide-like.
Celestial Valley		223	POW	32	3.08	28		
Celestial Valley		224	LGR	70	3.09	26		boulder, sub cobble, 3% gradient, non-modelable, oblique

Table 4. Habitat frequency based on ground-mapped data and target transects for Celestial Valley Sub-Reach (Log Cabin Diversion Dam Reach [Oregon Creek]).

Celestial Valley Sub-Reach						
Habitat	Length (ft)	Length Frequency	Adjusted Length Frequency	Estimated Minimum # Target Transects*	# Selected (Ch.Morph.)	# Selected (PHABSIM)
High gradient riffles	51	1%	0%	0		
Low gradient riffles	2,126	33%	34%	5		
Runs/Step-Runs	352	6%	6%	2		
Glides	395	6%	6%	2		
Pocket Water	310	5%	5%	2		
Pools	3,139	49%	50%	7		
TOTAL	6,373	100%	100%	18		

*for Instream Flow Study only