

Middle Yuba River 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
- 1.1 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 all benefit 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 “pool” 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 the Middle Yuba River Below Our House Dam

The 12.0 mile section of the Middle Yuba River Reach between Our House Diversion Dam and the confluence with the North Yuba River is comprised of a variety of parent materials, most notably resistant granitic rocks, and is bisected by the Big Bend-Wolf Creek fault within 1 mile of the junction with the North Yuba River. The overall gradient is 1.2 percent, with one break at the Big Bend/Wolf Fault (2.5% below the fault, and 1.1% above). There are numerous lower gradient sections, many of which are upstream of sharp bends that form “knickpoints.”

This is a confined channel, with extensive sections of bedrock forming the channel; specifically, RM 9-10.2, and RM 11.4-11.7 where the channel is almost exclusively bedrock. Trench pools are indicative of the bedrock-dominated sections, though shallow, mid-channel pools also form in the bedrock sections. Cobble or boulder bars and resistant bedrock and boulder banks resist lateral and vertical movement of the channel.

There is a hydrologic break at Oregon Creek, separating this river section into Our House Diversion Dam Reach (Middle Yuba River upstream of Oregon Creek) and the Oregon Creek Reach of the Middle Yuba River (Middle Yuba River downstream of Oregon Creek) (Figure 1).

3.0 Proposed Study Sites

3.1 Our House Diversion Dam Reach

This reach is approximately 7.5 miles of the Middle Yuba River and extends from Our House Diversion Dam at RM 12.0 to the confluence of the Middle Yuba River and Oregon Creek at RM 4.5. Access in this reach is very limited because of very steep and rugged topography, few roads to the river bottom, and considerable private ownership of the access roads and lands along the river.

There are only two accessible sections in this reach because all the roads are privately owned and have gates and permission to access the river was not granted. The upper accessible section extends 0.4 miles from just below the weir at the base of Our House Dam (RM 11.9) downstream to a bedrock-controlled mid-channel pool (RM 11.5, Figure 2). Vertical side walls

prevent access below this point. There are sixteen habitat units within this 0.4 mi upper accessible section (Table 1). The least common habitat type (“LCS”) is high gradient riffles but there is only one representative in the accessible area, likewise for low gradient riffles. Therefore, the LCS is run/step run with four representatives. A random number generator table created the first LCS as the 4th RUN (HMU#12); the second LCS was the 1st RUN (HMU #3). While these LCS provide a starting point for transect selection, due to the limited habitats, it is recommended that entire accessible area be reviewed by Relicensing Participants.

The other accessible section extends 0.3 miles from the Oregon Creek confluence upstream to the upper end of public land (RM 4.6 – 4.9, Figure 3). There are ten habitat units in this lower, publicly-owned and accessible section upstream of Oregon Creek (Table 2). Additional analysis such as coarse substrate quantification can occur (according to Section 5.2.4.9 of Channel Morphology Study Plan 1.1) upstream of the public land but it is not recommended to site transects on non-public lands. High gradient riffles and low gradient riffles were the least common habitat types but there were insufficient representatives within the publicly-owned and accessible section. Therefore, RUN/STEP with three representatives is the LCS. A random number generator ordered the units in the same order as they are ordered within the channel. Therefore, LCS#1 is HMU#1, and LCS#2 is HMU#8. While these LCS provide a starting point for transect selection, due to the limited habitats, it is recommended that entire accessible area be reviewed by Relicensing Participants.

Table 3 provides a summary of the habitat frequencies for the reach, and for notes as to transect selection for the entire reach.

3.2 Oregon Creek Reach

This reach is approximately 4.5 miles of the Middle Yuba River and extends downstream from the confluence of the Middle Yuba River and Oregon Creek at RM 4.5 to the confluence of the Middle Yuba River with the North Yuba River at RM 0.0. There is only one accessible section in the Oregon Creek Reach of the Middle Yuba River that has an adequate number and diversity of habitat types. This upper section is located below Highway 49 and below the intensive private development, on public lands (Figure 3).

This section was not ground-mapped so habitat frequency was obtained from video mapping (Figure 1, Table 4). Note that video mapping is not continuous so there are habitat units between the units shown in Table 2 that may be eligible for transect placement. The time stamp column indicates the location on the video where the habitat was identified. Pocket-water (POW) is the least common selector and four POW units are at the lower end of the accessible section within a distance that is practical for repeated measurements (Figure 4). Below these POW’s it appears that the channel narrows through a bedrock notch, which would not be navigable during high flows. Since these 4 POW’s really are a sequence of the same habitat, it is recommended that the Relicensing Participants begin at the most downstream POW and begin selecting in the upstream direction. The section continues to a low-gradient riffle just downstream of the intensive use and development of Freemans Crossing (Figure 5).

Table 5 provides a summary of the habitat frequencies for the reach, and columns for notes as to transect selection for the Oregon Creek Reach.

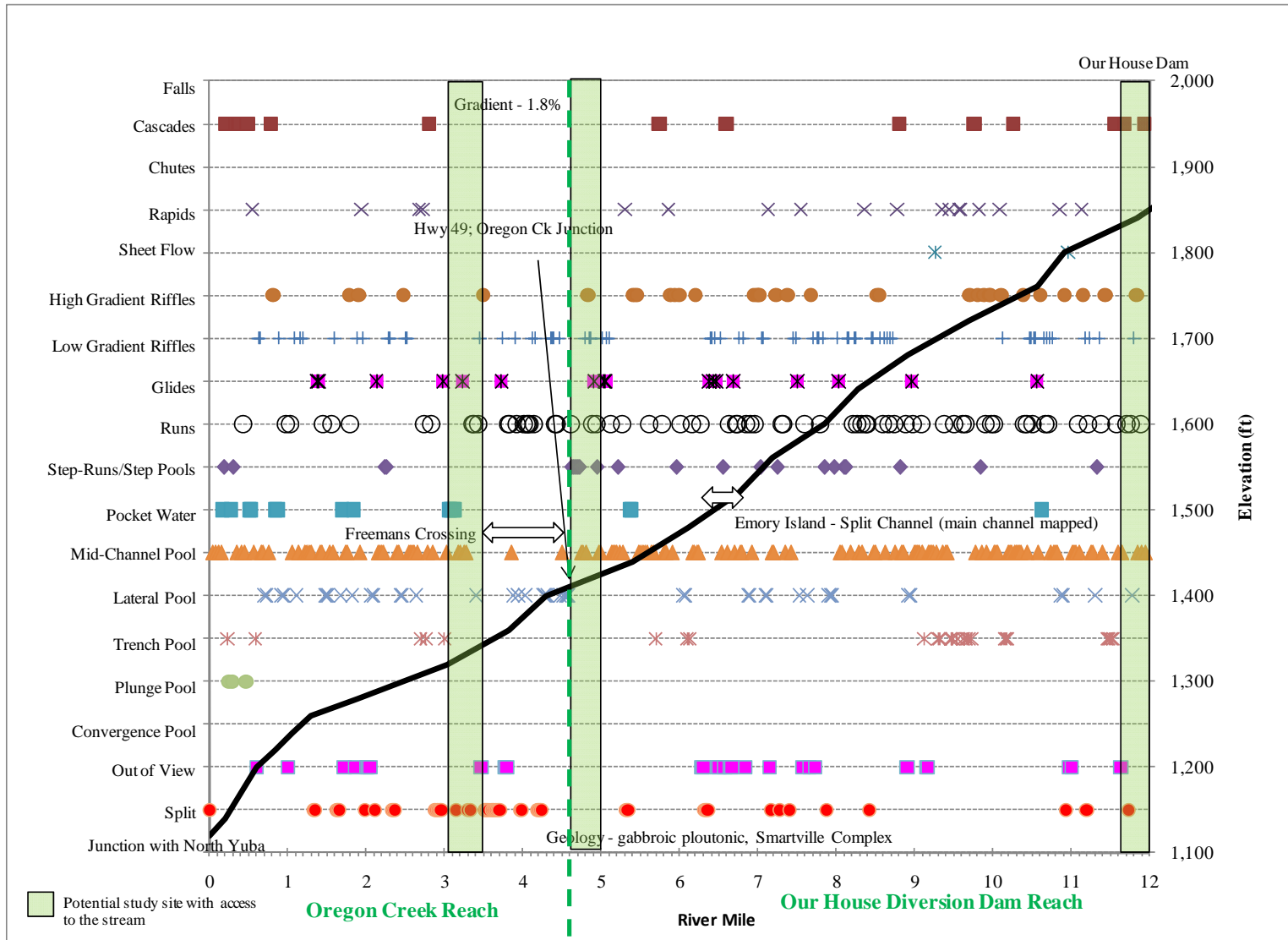


Figure 1. Middle Yuba River reaches, video-based habitat mapping units, longitudinal profile and potential study sites.

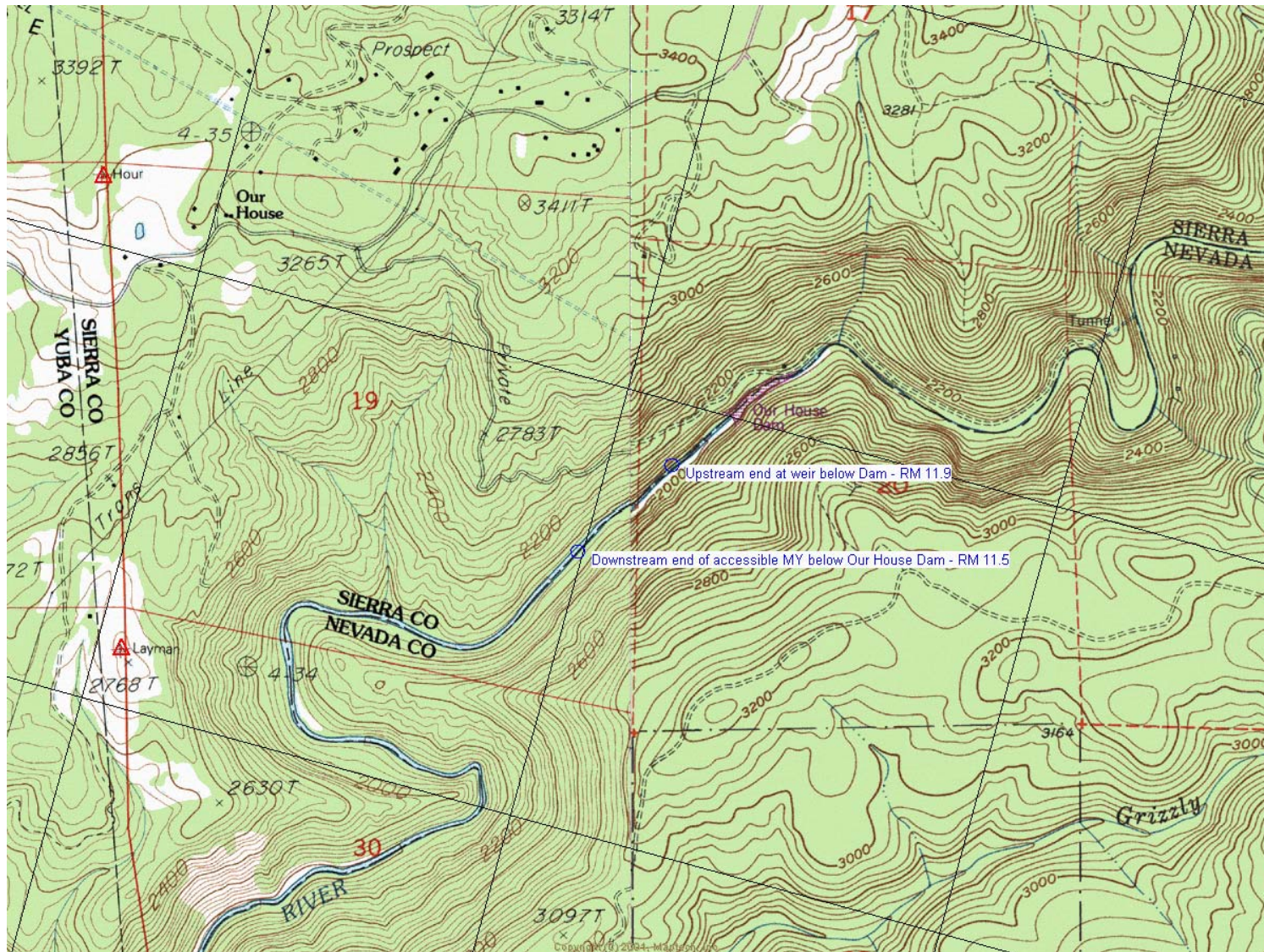


Figure 2. Accessible location for the Middle Yuba in the Our House Diversion Dam Reach below Our House Dam.

Table 1. Ground-based habitat mapping units on the Middle Yuba in the Our House Diversion Dam Reach, below Our House Diversion.

Section Number	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
MY < OH Dam		1	MCP	130	11.87	60	10	difficult access to bottom - lot, UTM's taken at top of pool - between U1 and U2, PHOTO DTA1 1443 LDS from near top of U1
MY < OH Dam		2	CAS	73	11.89	55.67		1% gradient
MY < OH Dam	2	3	RUN	68	11.91	48		large boulders on margin
MY < OH Dam			SPLIT	70	11.92	57.67		5% gradient, half channel is step run, half is HGR
MY < OH Dam		4	MCP	50	11.93	62.5	4	small flow around boulders RBA, 2 foots long boulder step top of pool, PHOTO DTA1 1449 photo of step at top of U4 from LBA LDS
MY < OH Dam	3	5	RUN	111	11.94	58		
MY < OH Dam		6	LAP	87	11.97	62.33	3.5	sandy deposition LBA, scour hole meets min pool requirements, control at base low and maybe inconsequential at high flow
MY < OH Dam		7	LGR	109	11.98	59		3.5% gradient, modelable
MY < OH Dam			SPLIT	35	12.00			half of channel is run half is POW
MY < OH Dam		8	HGR	95	12.01	75.67		5% grade
MY < OH Dam		9	MCP	104	12.03	57.75	3.75	
MY < OH Dam	4	10	RUN	63	12.05	68		some surface agitation, but too deep to be riffle
MY < OH Dam		11	MCP	165	12.06	60.33	5.5	Top of pool is run-like, but no control, so included in pool
MY < OH Dam	1	12	RUN	40	12.09	55		some surface agitation, but very deep
MY < OH Dam		13	MCP	125	12.10	83	6	Run - with constriction at mid-pool but still deep and weak control; Top of LBA bar within BF, three 6" fish
MY < OH Dam		14	CAS	50	12.12	51.5		11% gradient
MY < OH Dam			SPLIT	140	12.13			step-run on one side, split on other
MY < OH Dam		15	MCP	162	12.16	50	6.5	seven 5" suckers, dark stripe down back photo DTA1 1461
MY < OH Dam		16	MCP	178	12.19	68.5	8	photo of dam LUS DTA1 1464, photo of wier 1463, staff gauge reads 17.10 on

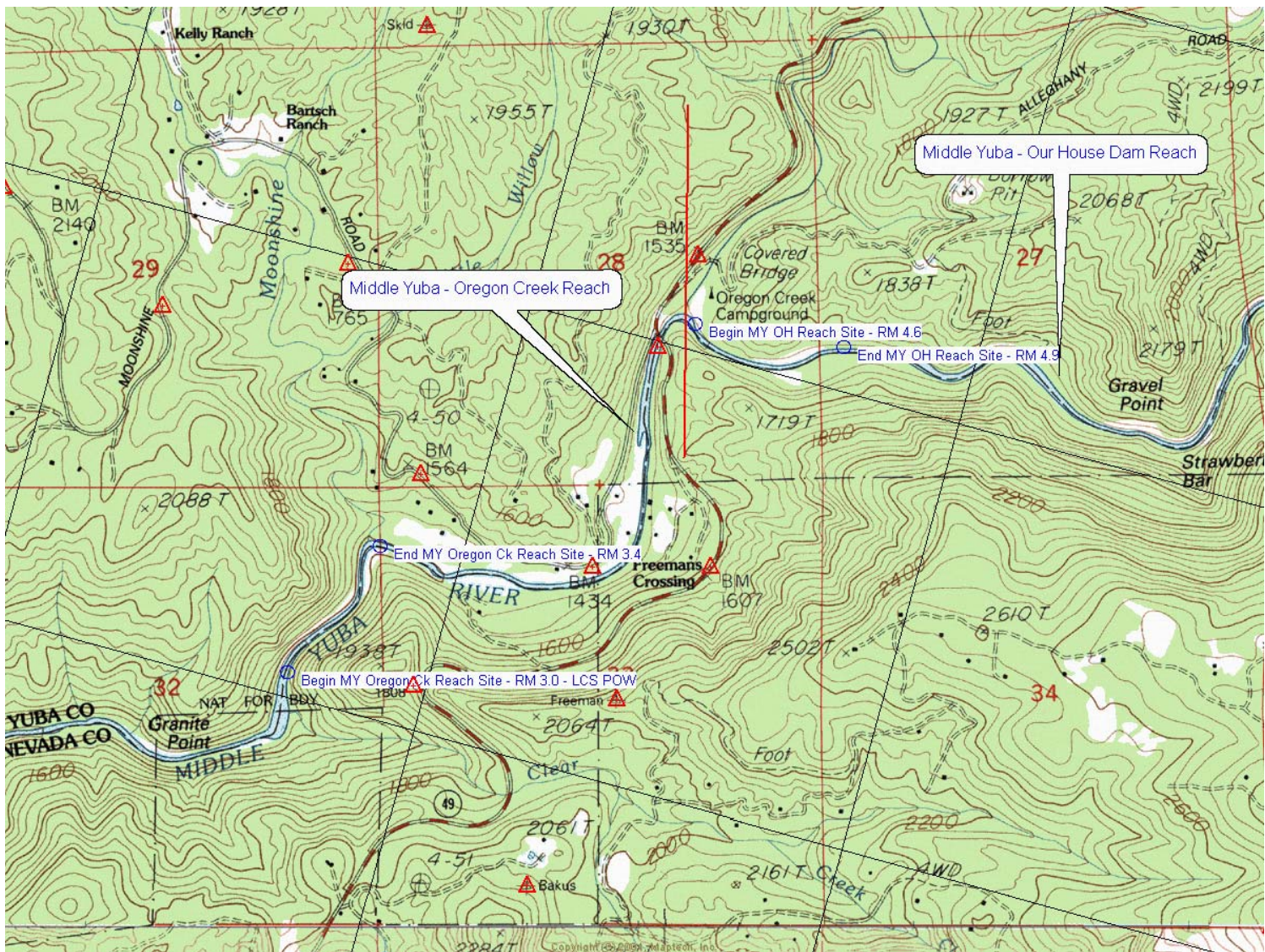


Figure 3. Middle Yuba - Location map for sites above (Middle Yuba Our House Dam Reach) and below (Middle Yuba Oregon Creek Reach) Oregon Creek in vicinity of Highway 49.

Table 2. Ground based habitat mapping unit on the Middle Yuba Our House Dam Reach above Oregon Creek. Units 1-10 (green shaded) are those within the accessible area on public land.

Section Number	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
> Oregon Creek	1	1	STEP	388	4.50	51.2		gradient 4.5%, step-run with riffle - step characteristics on half or less of channel punctuating. Difficult to model due to oblique flow and multiple water surfaces
> Oregon Creek		2	MCP	258	4.55	66	6	artificial downstream control - boulder dam, 15% embedded; staff gauge with no housing - out of water half thru habitat; top at pool greatly modified for slough-boxes not characteristic of entire pool
> Oregon Creek		3	LGR	49	4.56	61.5		spawning gravels in this habitat but frequent modification for slough - boxes, so unmeasurable, 2% gradient
> Oregon Creek		3	MCP	167	4.59	57.33	7	tail of pool very modified, but lots of spawning gravel
> Oregon Creek		4	HGR	102	4.61	42		modelable sections, 7% gradient
> Oregon Creek		5	LGR	170.5	4.64	39.67		High-flow side channel, 4% gradient; excellent modelability; Carex nudata - great bank stabilizer, establishes sediment in high turbidity areas both banks 70% coverage. Elevated flood plain LBA (same size as wetted channel). Some tree-root exposure due to long-term erosion/modifications - not an active erosional feature. High flow side channel on LBA. 3% gradient.
> Oregon Creek		6	HGR	40	4.65	42.33		Highly modified riffle-crest - damned above pool with boulders and cobble, 8% gradient
> Oregon Creek		7	MCP	88.5	4.67	53	5	Dammed pool *DO NOT MODEL*, destabilized banks - dug-out banks creating positive feed-back mechanism
> Oregon Creek	2	8	RUN	124	4.69	57.33		Run, but because of dams & dug out banks, creating pools at banks, and step-pool for length of run. Highly modified; after high-flows remove dams, will probably be a run!

Section Number	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
> Oregon Creek		9	GLI	210	4.73	50		Subdominant bank substrate is SND. Deeper section in middle of glide - obviously modified; some erosion due to modification; run like at top, pool-like in middle, narrow cobble bar LBA -- elevated flood plain
> Oregon Creek	3	10	STEP	110	4.75	44.67		step-run with short HGR separating steps - lots of catwater
> Oregon Creek		11	MCP	280	4.80	62.25	4.75	10" brown trout, head of pool 28' run - ambiguous start
> Oregon Creek		12	LGR	117	4.83	56		3% gradient, some sandy deposits along shoreline
> Oregon Creek		13	GLI	321	4.89	57.67	3.5	3 inch fish, three 4' fish, 2 scour holes 3.5' deep LBA artificially scoured, end of glide oblique - mid - pt taken
> Oregon Creek		14	LGR	223	4.93	65		some indistinct stepping, but lots of surface agitation so calling it a run - slight scour pool RBA
> Oregon Creek		15	RUN	80	4.94	57		almost pocket water but too much surface agitation
> Oregon Creek		16	LGR	119	4.97	52.33		some flat sections - esp at top (not modelable), 3% gradient
> Oregon Creek		17	MCP	226	5.01	57	8	scour hole 1/3 width of channel (12x12) at base of channel
> Oregon Creek		18	MCP	74	5.02	42.67	3.5	pinch-point making ds control
> Oregon Creek		19	STEP	112	5.04	150.33		Lower 2/3 wider and slower upper 1/3 narrow and fast step-run. Lots veg on banks - riparian community
> Oregon Creek		20	MCP	105	5.06	48.5	5	Big hole (pool) at base ~5' deep, max depth 3', w/scour hole at bottom
> Oregon Creek		21	LGR	54	5.07	41.67	3	3% gradient
> Oregon Creek		22	RUN	133	5.10	52		deep boulder run w/some scour, slight control creates pool
> Oregon Creek		23	MCP	92	5.12	36	7	bedrock side LBA
> Oregon Creek		24	RAP	70	5.13	26.5		
> Oregon Creek		25	CHU	47	5.14	22.33		
> Oregon Creek			SPLIT	245	5.19			LBA = RIF/RUN, RBA = RIF/RUN
> Oregon Creek		26	POW	298	5.24	75.5		
> Oregon Creek		27	HGR	325	5.30	76		4% grad, non-modelable multiple water surfaces and flow lines

Section Number	LCS	Original Unit #	Unit Habitat Type	Length (ft)	River Mile	Est avg BFW (ft)	Max. pool depth (ft)	Comments
> Oregon Creek		28	MCP	918	5.48	104.25	8	long tail with some surface agitation, PHOTOS: DTA1 1362 dead metamorph, probably FYF; DTA1 1363 lateral deep RBA to MCP w/no control. This pool becomes unwalkable, too deep w/ few to no places to get out, very deep, wide, bedrock walls w/ full riparian veg community where soils allow.
> Oregon Creek		29	RUN	90	5.49	65		
> Oregon Creek		30	MCP	433	5.58	65	10	END at base of unit 31. FROG SIGHTINGS: DTA1 1367 & 1366

Table 3. Habitat frequency based on video-mapped data and target transects for the Our House Dam Reach of the Middle Yuba River

Middle Yuba - Our House Diversion Dam Reach Habitat Frequency						
PHABSIM Habitat	Number	Number Frequency	Adjusted Number Frequency	Estimated Minimum # Target Transects*	# Selected (Ch. Morph.)	# Selected (PHABSIM)
High gradient riffles	29	10%	11%	2		
Low gradient riffles	45	16%	17%	3		
Runs/Step-Runs	69	24%	25%	4		
Glides	11	4%	0%	0		
Pocket-water	3	1%	0%	0		
Pools	129	45%	47%	8		
TOTAL	286	100%	100%	17		

*for Instream Flow Study

Table 4. Habitats as delineated using video mapping in the Middle Yuba Oregon Creek Reach, below Highway 49. Shading represents units downstream and upstream of accessible public lands.

Time	RM	Habitat
1:49:05	2.80	CAS
1:49:08	2.83	RUN
1:49:11	2.85	MCP
1:49:14	2.87	SPLIT
1:49:17	2.89	SPLIT
1:49:20	2.91	SPLIT
1:49:23	2.93	SPLIT
1:49:26	2.96	SPLIT
1:49:29	2.98	GLI
1:49:32	3.00	TRP
1:49:35	3.03	MCP
1:49:38	3.05	POW
1:49:41	3.08	POW
1:49:44	3.10	POW
1:49:47	3.13	POW
1:49:50	3.15	SPLIT
1:49:53	3.18	MCP
1:49:56	3.20	MCP
1:49:59	3.23	GLI
1:50:02	3.25	MCP
1:50:05	3.28	MCP
1:50:08	3.30	SPLIT
1:50:11	3.33	SPLIT
1:50:14	3.35	RUN
1:50:17	3.38	RUN
1:50:20	3.40	LAP
1:50:23	3.42	RUN
1:50:26	3.44	LGR
1:50:29	3.46	OOV
1:50:32	3.49	HGR
1:50:35	3.51	SPLIT
1:50:38	3.53	SPLIT
1:50:41	3.55	SPLIT
1:50:44	3.57	SPLIT
1:50:47	3.59	SPLIT
1:50:50	3.62	SPLIT
1:50:53	3.64	SPLIT
1:50:56	3.66	SPLIT
1:50:59	3.68	SPLIT
1:51:02	3.70	SPLIT
1:51:05	3.72	GLI



Figure 4. POW at base of proposed site.



Figure 5. LGR at top of proposed site.

Table 5. Habitat frequency based on video-mapped data and target transects for the Oregon Creek Reach of the Middle Yuba River (RM 0 to 4.5).

Middle Yuba - Oregon Creek Reach Habitat Frequency						
PHABSIM Habitat	Number	Number Frequency	Adjusted Number Frequency	Estimated Minimum # Target Transects*	# Selected (Ch. Morph.)	# Selected (PHABSIM)
High gradient riffles	75	29%	30%	5		
Low gradient riffles	22	9%	9%	2		
Runs/Step-Runs	25	10%	10%	2		
Glides	6	2%	0%	0		
Pocket-water	12	5%	5%	2		
Pools	116	45%	46%	8		
TOTAL	256	100%	100%	19		

*for Instream Flow Study

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