Findings Report for Stanshaw Creek Habitat and Instream Flow Assessment

Prepared for the Karuk Tribe

By

Ross Taylor and Associates

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Stanshaw Creek is a small tributary of the Klamath River with a drainage area of approximately four square miles (Figure 1). The creek's confluence with the Klamath River is located at N41.4764518; W123.5111116 (Figure 1). Stanshaw Creek has approximately 5,500 feet of potential fish-bearing habitat (up to sustained slope >15% on the USGS topographic map). The first 2,500 feet has a channel slope of approximately 9% and the next 3,000 feet has an overall slope of nearly 11%. The mouth of Stanshaw Creek enters the Klamath River approximately 1,400 feet downstream of Highway 96 (at CalTrans post-mile 8.20).

In November of 2014, the Karuk Tribe requested that Ross Taylor and Associates (RTA) conduct a habitat assessment of Stanshaw Creek. Ross Taylor is an American Fisheries Society Certified Fisheries Professional (#3438) with 28 years of field experience in northern California watersheds. Since 2009, Taylor has also served as the lead fisheries scientist for the State Water Resources Control Board (SWRCB) in conjunction with monitoring the fisheries of Rush and Lee Vining creeks, the primary tributaries to Mono Lake that are also subject to water withdrawals by Los Angeles Department of Water and Power (LADWP). Taylor was tasked by the SWRCB to develop instream flow recommendations to achieve lake level recovery targets, enhance stream and fish restoration, as well as maintain LADWP's ability to reliably export water.

Stanshaw Creek – Sampling Methods:

The objective of conducting the habitat survey was to determine the suitability of Stanshaw Creek in supporting the rearing and spawning of coho salmon and steelhead. The Karuk Tribe also requested that RTA make instream flow recommendations that would provide perennial flow to lower Stanshaw Creek sufficient to maintain off-channel rearing habitat and connectivity with the Klamath River.

On November 17, 2014 RTA performed the Stanshaw Creek habitat assessment using methods consistent with those described in the California Department of Fish and Wildlife (CDFW) *California Salmonid Stream Habitat Restoration Manual*. RTA walked Stanshaw Creek from its confluence with the Klamath River upstream for approximately 4,300 feet and measured and recorded the following habitat metrics: wetted channel widths, active channel widths, pool frequency, pool type, maximum pool depths, pool tail-water depths, and pool cover. Distances between pools were estimated by counting paces (2.5 feet/pace) and lengths of pools were measured to the nearest 0.1 foot with a stadia rod. The stadia rod was also used to measure pool widths and depths to the nearest 0.1 foot. Riparian canopy shading was estimated with a densiometer. RTA also made observations regarding: presence of potential migration barriers to adult and juvenile salmonids, quality of potential instream rearing and spawning habitat, and fish presence. Quality of pool habitat was classified as "poor, fair or good" consistent with shelter rating values in the *California Salmonid Stream Habitat Restoration Manual*. At two locations along Stanshaw Creek, RTA estimated streamflow using a timed-float methodology. All data and observations were recorded in a bound, waterproof field notebook.

RTA also inspected the Stanshaw Creek surface water diversion located approximately 4,200 feet upstream of Highway 96. This diversion is maintained and utilized by the Marble Mountain Ranch (MMR) for power generation and other domestic uses. None of the water diverted from Stanshaw Creek by the MMR is returned to Stanshaw Creek; all non-consumptive flow is bypassed into Irving Creek.

To assist in making flow recommendations for Stanshaw Creek, RTA was also provided a spreadsheet of streamflow measurements made between September 2000 and August 2014 at key locations within Stanshaw and Irving creeks. Additional information and technical reports regarding the use of off-channel ponds by juvenile coho salmon were utilized in developing flow recommendations.

Stanshaw Creek – Habitat Typing Results:

The habitat typing survey was started at 11:00 hours and was completed at 15:25 hours. Starting at the off-channel pond, Taylor walked approximately 4,300 feet of Stanshaw Creek and took measurements at 26 pool habitat units and one run habitat unit. These 27 habitat units encompassed 364 feet of channel length or 8.4% of the surveyed reach. The remaining channel reaches in-between the 26 pools and one run consisted of high-gradient riffles, step-runs/step-pools, and cascades. The small pools present within the step-runs/step-pools and many of the high-gradient riffles were too short in length to separate out as individual habitat units (the CDFW protocol defines that a habitat unit must be longer than the wetted channel width). The Stanshaw Creek habitat typing data are tabulated in Appendix A.

Three types of pools were observed within Stanshaw Creek: 12 plunge pools (PLP), 11 main channel pools (MCP), and three dammed pools (DMP). Maximum depths within these 26 pools ranged between 1.0 and 2.8 feet deep with an average of 1.6 feet. Cover within pools was relatively sparse and was comprised primarily of boulders and bubble curtain. Large wood was present as cover habitat in only four pools. Suitably-sized spawning substrate was present at five locations within Stanshaw Creek: two locations were downstream of Highway 96 and three were between Highway 96 and the MMR diversion. Stanshaw Creek's moderate channel slope and confinement most likely limits the amount of small cobble/gravel accumulations at pool-tails.

During the habitat typing survey two fish were observed, both upstream of Highway 96. These fish were salmonids and were most likely resident coastal rainbow trout or juvenile steelhead. The riparian zone along Stanshaw Creek was comprised mostly of hardwoods with some conifer. A densiometer reading was made at approximately the 2,000 foot location and was 73.5%, even though a significant amount of leaf fall had already occurred. During the summer months, it appears that Stanshaw Creek receives ample shading from the riparian over-story.

Several impediments to fish migration were noted during the Stanshaw Creek habitat assessment. The culverts underneath Highway 96 are mostly likely a complete barrier to juvenile and resident salmonids as well as a severe impediment to adult salmon and steelhead. There are two arch culverts of the following dimensions: 9.0 ft span by 6.5 ft rise. The floors and side walls up about one foot-high are concrete and the arches are structural steel plate. Both arches are set a moderate (and uneven) slope and are approximately 125 feet in length. A first-pass stream crossing assessment was conducted at this crossing in 2003 by the Humboldt State University engineering department's pilot study for CalTrans, but the crossing was never surveyed and fully assessed for fish passage. Just upstream of Highway 96, a natural bedrock and boulder cascade probably blocks most fish passage. This cascade has an eight to ten foot drop over a distance of approximately 30 feet. A second cascade was also observed approximately 3,500 feet up Stanshaw Creek that had a drop of six to seven feet over a 30-foot distance. Additionally, several plunge pools had drops that exceeded three feet.

Because the MMR diversion is located on U.S. Forest Service property, RTA was able to inspect the diversion during the 11/17/14 stream habitat assessment. Stanshaw Creek was being diverted by the placement of rocks across the channel which shunted nearly all of the surface flow into an open ditch. At the point-of-diversion (POD), the diversion was not screened and RTA conservatively estimated that 80-90% of the surface flow was being diverted into the ditch. Approximately 300 feet of the diversion ditch was inspected and the following was noted: (1) a bypass existed to possibly return excess flow to Stanshaw Creek; however all the diverted flow was going down the ditch and (2) this reach of the ditch had failed in several spots and was crudely repaired with cinder blocks, plastic sheeting and fill material. Leakage and erosion was noted at these locations.

The off-channel pond at the mouth of Stanshaw Creek was also examined on 11/17/14 by RTA. The creek channel made a nearly 90 degree turn to flow into the head of the pond, with flow directed towards the pond with hand placed rocks. A secondary channel straight to the Klamath River was dry. The pond had two outlet channels to the Klamath River and both were dry on 11/17/14; however one appeared to have recently been flowing (from leaf debris line).

<u>Stanshaw Creek – Streamflow:</u>

RTA made two streamflow measurements, using a timed-float methodology where a short reach of channel was selected that had relatively uniform width and depth. In each reach, five timed floats were conducted using buoyant sticks in which a stop watch was used to time how long it took each stick to travel the pre-determined distance (four feet at each location). The short reach's area was computed as average length x average depth; then flow (ft^3/sec) was calculated by multiplying the area (ft^2) by the average velocity of the five timed floats (ft/sec). The first streamflow estimate was made just upstream of the off-channel pond and was 1.3 cfs. The second streamflow measurement was made at 4,180 feet up Stanshaw Creek and equaled 0.8 cfs. RTA did not conduct a timed-float within the MMR diversion or in Stanshaw Creek immediately below the POD; however the surface flow immediately below the POD was very low. These streamflow measurements and observations on 11/17/14 indicate that between MMR 's POD and the off-channel pond, Stanshaw Creek was gaining surface flow – possibly influenced by the above average September-November rainfall, continued runoff from recent rainfall, leakage from the MMR diversion canal, and/or the seasonal lack of transpiration by the riparian vegetation.

RTA was also provided a spreadsheet of 101 streamflow measurements made by the Karuk Tribe and the USFS Orleans Ranger District in June - October between 2000 and 2014. On any given date, streamflow measurements were typically made at two or more of the following locations: above the MMR POD, within the MMR diversion, in the MMR diversion return to Irving Creek, and/or in Stanshaw Creek at various locations downstream of MMR's POD. These flow measurements consistently document the MMR diversion taking most of the streamflow and very little flow present in lower Stanshaw Creek. In most cases, the channel between MMR's POD and the off-channel pond was a losing reach, in which streamflow continued to decrease in a downstream direction. Table 1 provides four example dates of Stanshaw Creek streamflow measurements.

Table 1. Streamflow measurements at various locations within Stanshaw Creek.

Measurement Location	Date of Measurement	Streamflow (cfs)	Measurement Taken by
100 ft upstream of MMR Diversion	09/04/03	2.4	Orleans RD
Within flume diversion to MMR	09/04/03	1.9	Orleans RD
Diversion outflow into Irving Ck	09/04/03	1.5	Orleans RD
200 ft downstream of MMR diversion	09/04/03	0.3	Orleans RD
In Irving Creek- directly in diversion near road xing	08/30/11	2.7	Karuk Tribe
In Stanshaw Creek by Highway 96	08/30/11	0.4	Karuk Tribe
In Stanshaw Creek just above MMR diversion	09/13/11	3.2	Karuk Tribe
In Stanshaw Creek just below MMR diversion	09/13/11	0.5	Karuk Tribe
In Stanshaw Creek by Highway 96	09/13/11	0.6	Karuk Tribe
150 ft upstream of MMR Diversion	10/04/12	2.0	Orleans RD
120 ft downstream of MMR Diversion	10/04/12	0.7	Orleans RD
In Stanshaw Creek 40 ft upstream of pond	10/04/12	0.4	Orleans RD

<u>Stanshaw Creek – Discussion and Streamflow Recommendations:</u>

While both juvenile coho salmon and steelhead have been documented in Stanshaw Creek, the creek's moderate channel slope and relative lack of suitably-sized substrate diminishes its importance as a significant spawning stream within the Klamath River watershed. However, the off-channel pond located at Stanshaw Creek's confluence with the Klamath River provides excellent habitat for both summer and winter rearing of non-natal coho salmon. In recent years, off-channel habitat in the form of beaver ponds, ox-bows and sloughs has gained recognition as a vital component in the life history strategies of coho salmon (Pollock et al. 2004). Utilization of the Stanshaw Creek pond by non-natal coho salmon was documented in a recent Humboldt State University Master's thesis (Witmore 2014). This research confirmed excellent growth rates of juvenile coho salmon that reared in the Stanshaw Creek pond. Witmore's research along with the ongoing Yurok-Karuk Coho Ecology project has demonstrated that off-channel ponds along the Klamath River corridor are extremely important habitats for non-natal coho originating from numerous upstream tributaries, including the Shasta and Scott rivers. The quantity and quality of the Klamath River's off-channel habitat may likely limit the production of coho salmon smolts, thus the identification and protection of these habitats is extremely important.

Requirements for good growth and viable rearing habitat in off-channel ponds include sufficient streamflow to: maintain good water quality in summer months, provide adequate drift of food items, and to provide connectivity between the pond and mainstem Klamath River for fish access into and out of the pond. Fish migration between the pond and the Klamath River is important in the late-spring to early-summer period and also during the fall months. Fall access is necessary for movement of age-0 coho salmon into ponds for over-wintering; whereas spring to early-summer access is necessary for the out-migration of age-1 coho salmon smolts. Access into the early summer months may also allow juvenile fish to leave a stressfully warm mainstem Klamath River for cooler water temperatures in ponds and other off-channel habitats. The HSU thesis research with PIT tagged coho salmon revealed that throughout the summer months some fish made daily movements between off-channel ponds and the main river, possibly to forage in the mainstem when it was cooler and then migrating back into the ponds during the daytime when the mainstem was warmer. Thus, maximizing pond-to-river connectivity is important to account for the wide range of life history tactics documented by the mixture of coho sub-populations utilizing off-channel habitats along the Klamath River corridor.

Development of instream flow recommendations is often an iterative process involving multiple streamflow measurements, water quality measurements, and direct observations of fish presence and habitat preference/utilization. Identification of the impacts caused by reduced flows is also necessary in making instream flow recommendations. For Stanshaw Creek, flow recommendations should address: (1) maximizing seasonal connectivity between pond and Klamath River, (2) maintenance of pond volume and water quality during summer months, and (3) maintenance of viable salmonid and benthic macro-invertebrate (BMI) habitat between Highway 96 and MMR's POD.

<u>Flow Recommendation for Connectivity:</u> Based on the 11/17/14 streamflow measurement just upstream of the pond, 1.3 cfs was insufficient in providing connectivity between the pond and the Klamath River. When inspected by RTA on 11/17/14, the lowest of the two outlet channels was approximately 0.1 ft higher than the pond's water surface. Preliminary recommendation is for 2.0-2.5 cfs in Stanshaw Creek, measured at pond entrance. RTA also recommends that instream flow measurements are made when sufficient connectivity exists to either confirm or fine-tune this instream flow recommendation. Seasonal connectivity flows should be achieved at least between April-June and October-November. Maintaining connectivity throughout the summer months would allow daily movements between the pond and mainstem Klamath River. RTA acknowledges that seasonal connectivity is also influenced by Klamath River discharge and the pond may be inundated at higher flows.

<u>Flow Recommendation for Pond Maintenance:</u> Based on discussions with the Karuk Tribal fisheries staff, extremely low flows to the Stanshaw Creek pond during the past three summers has led to reduced pond volume, poor water quality, and even direct mortality of juvenile coho salmon (Soto, pers. comm.). These observations coincided when measured flows in lower

Stanshaw Creek were less than 1.0 cfs, typically between 0.4 and 0.7 cfs. Preliminary recommendation is for 1.3-1.5 cfs in Stanshaw Creek, measured at pond entrance. RTA also recommends that instream flow measurements are made in conjunction with water quality measurements (temperature and dissolved oxygen) to either confirm or fine-tune this instream flow recommendation. Streamflow should be measured just above the pond entrance. Water temperature within the pond should be monitored hourly with data loggers and dissolved oxygen should be measured periodically throughout the summer. Stage plate readings should be made daily to track changes in pond volume.

Flow Recommendation for Salmonid and BMI Habitat: Currently, the MMR bypasses all non-consumptive water from Stanshaw Creek into Irving Creek. This practice has a detrimental effect to the entire reach of Stanshaw Creek below the POD by reducing instream habitat of resident coastal rainbow trout, juvenile steelhead, juvenile coho salmon and BMI productivity. Reduced BMI productivity may ultimately affect the growth of coho salmon residing in the off-channel pond and in lower Stanshaw Creek (up to the Highway 96 crossing). Reduced flows in Stanshaw Creek also increases travel time of water moving downstream, potentially increasing thermal loading before entering the pond. Reduced flows may also impact the drift of BMI from the creek into the pond, a potentially important food source for juvenile coho residing in the pond. The MMR also temporarily stores diverted Stanshaw Creek water in a pond before releasing into Irving Creek. During the summer, this practice most likely results in a thermal loading of the water prior to release. RTA recommends that all non-consumptive water diverted by the MMR is returned to Stanshaw Creek at the highest location feasible within Stanshaw Creek. Efforts should also be made to minimize thermal loading of this return flow.

Additional Recommendations:

1. Installation of a control gate at the POD so that MMR diverts only their allocated flow. Control gate should also provide the downstream channel its required minimum flows as a priority over the MMR diversion. Diversion at POD should be properly screened.

2. Implement water conservation measures such as: enclose MMR's diversion in a pipe instead of an open ditch, relocate POD farther upstream to create more drop or head pressure, upgrade MMR's hydropower system to a more efficient system, consider other sources of power generation (such as solar during summer when flows are low).

3. Enforcement of existing CDFW code #5937 and implementation of SWRCB's Water Code section 1259.4. State and federal agencies should require the MMR to follow existing codes and regulations regarding minimum streamflow requirements so that the MMR's diversion avoids causing indirect and direct take of an ESA-listed fish species.

Literature Cited

Pollock, M.M., G.R. Pess, and T.J. Beechie. 2004. The importance of beaver ponds to coho salmon production in the Stillaguamish River Basin, Washington, USA. North American Journal of Fisheries Management 24: 749-760.

Witmore, S.K. 2014. Seasonal growth, retention, and movement of juvenile coho salmon in natural and constructed habitats of the mid-Klamath River. Master's Thesis, Humboldt State University.

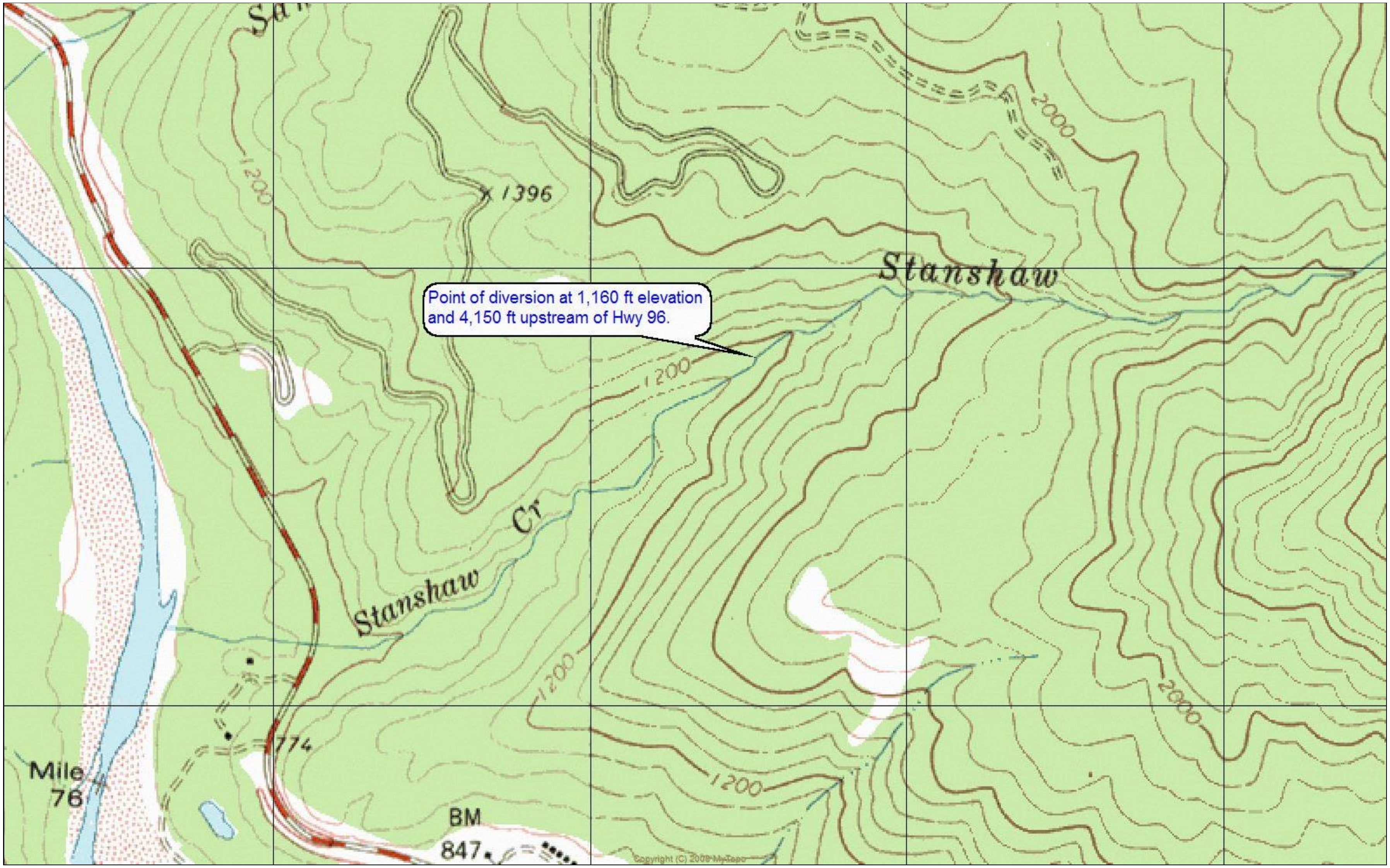

Figure 1. Stanshaw Creek and location of the Marble Mountain Ranch's point of diversion.

APPENDIX A: HABITAT TYPING SPREADSHEET

STANSHAW CREEK - RTA HABITAT ASSESSMENT 11/17/2014

RIFFLE/STEP-POOLS # OF PACES	RIFFLE/STEP CONVERTED DISTANCE (2.5 FT per PACE)	POOL/FLAT UNIT LENGTH (FT)	CUM. DISTANCE (FT)	POOL/FLAT HABITAT UNIT TYPE	AVERAGE WETTED WIDTH (FT)	MAXIMUM DEPTH (FT)	TAILWATER CONTROL DEPTH (FT)	RESIDUAL DEPTH (FT)	SPAWNING SUBSTRATE (FT^2)	COVER QUALITY	COVER ELEMENTS	COMMENTS AND OBSERVATIONS
44	110											
		12.1	122.1	MCP	6.6	2.0	0.3	1.7	0	FAIR	U/C BK, BOULDERS	
66	165											
		13.4	300.5	RUN	7.0	1.0	0.4	0.6	0	POOR	SM BOULDERS	
32	80											
		12.1	392.6	MCP	8.5	1.5	0.5	1.0	0	FAIR	LWD, BUB CURT.	PLUNGE AT TOP OF UNIT = 0.7 FT
45	112.5											
		12.7	517.8	MCP	8.4	1.6	0.4	1.2	0	FAIR	SM BOULDERS, BUB CURT.	PLUNGE AT TOP OF UNIT = 1.1 FT
15	37.5											
		11.6	566.9	DMP	8.5	1.1	0.3	0.8	0	POOR	SM BOULD	TAILWATER LOOKS LIKE PLACED ROCKS
5	12.5											
		21.4	600.8	DMP	11.5	2.8	0.4	2.4	0	GOOD	BOULDERS, BUB CURT, LWD	DROP AT TAILWATER = 1.7 FT
7	17.5											
		11.3	629.6	PLP	6.8	1.5	0.4	1.1	0	FAIR	BOULDERS, BUB CURT.	PLUNGE DROP = 0.7 FT
33	82.5											
		12.2	724.3	PLP	8.0	1.3	0.2	1.1	15	GOOD	BOULDERS, BUB CURT, LWD	PLUNGE DROPS: LB = 4.2 FT; RB = 2.5 FT
9	22.5											
		26.5	773.3	MCP	12.6	1.0	0.3	0.7	20	FAIR	SM BOULDERS	SOME BACK-WATERING FROM PREVIOUS UNIT
33	82.5											
		14.8	870.6	MCP	11.7	1.9	0.3	1.6	0	FAIR	BOULDERS, BUB. CURT.	PLUNGE AT TOP OF UNIT = 1.1 FT
76	190											
		11.3	1071.9	PLP	9.2	2.2	0.4	1.8	0	FAIR	BOULDERS, BUB CURT.	PLUNGE AT TOP OF UNIT = 1.8 FT
70	175											
		16.2	1263.1	PLP	18.7	2.1	0.4	1.7	0	POOR	SM BOULDERS	OUTLET POOL OF HWY 96 CULVERTS
		123.0	1386.1	CULVERT	18.0	N/A	N/A	N/A	N/A	N/A	N/A	TWO ARCHES, SPAN=9FT X RISE=6.5FT. CON.FLOOR AND WALLS
10	25											
		16.5	1427.6	MCP	16.5	2.0	0.4	1.6	0	POOR	SMALL BOULDER	CASCADE INTO POOL = 8-10 FT DROP OVER 32.5 FT DISTANCE
25	62.5											
		10.5	1500.6	PLP	7.8	1.6	0.3	1.3	0	GOOD	BOULDERS, BUB CURT, LWD	OBSERVED SALMONID, 8-10" TROUT
30	75		1575.6									TRIB ENTERS FROM LB, APPROX. 30% OF FLOW
11	27.5											
		10.5	1613.6	MCP	9.2	1.3	0.4	0.9	0	POOR	BUB CURTAIN	DROP AT TOP OF UNIT = 3.5FT
17	42.5											
		11.7	1667.8	PLP	7.3	1.6	0.4	1.2	0	POOR	BUB CURTAIN	DROP AT TOP OF UNIT = 3.5FT
8	20											
		18.5	1706.3	MCP	11.8	1.7	0.3	1.4	0	FAIR	BOULDERS, BUB. CURT.	ACTIVELY SCOURED CHANNEL WIDTH = 17FT
27	67.5											
		16.5	1790.3	DMP	11.6	1.7	0.4	1.3	0	FAIR	BOULDERS, BUB. CURT.	FORMED BY BOULDER/LWD JAM W/1.8 FT DROP TO D.S. RIFFLE
87	217.5											
		15.9	2023.7	PLP	8.2	1.6	0.3	1.3	0	POOR	BOULDER, BUB. CURT.	RIPARIAN DENSIO. MEASUREMENT:10,12,13,14 = 73.5%
19	47.5											
		12.4	2083.6	MCP	9.2	1.4	0.4	1.0	0	POOR	BOULDERS	ACTIVELY SCOURED CHANNEL WIDTH = 37FT
20	50		2133.6									DIVERSION DRUM ON RB SIDE WITH OVERFLOW INTO CREEK
35	87.5		2183.6									
		18.3	2289.4	MCP	9.2	1.5	0.3	1.2	0	POOR	BOULDERS	PIPE IS LAID DOWN THE CHANNEL W/DIAMETER = 0.2 FT
13	32.5		2321.9									SCREENED INTAKE
68	170		2491.9									RB HILLSLOPE FAILURE, CHANNEL CONSTRICTED W/MATERIAL
75	187.5											
		15.1	2694.5	MCP	9.8	1.4	0.3	1.1	0	GOOD	BOULDERS, BUB. CURT.	TOOK PHOTO, OVERHANGING BOULDER = GOOD COVER
67	167.5											
		15.5	2877.5	PLP	10.8	1.7	0.3	1.4	12	FAIR	BOULDERS, BUB. CURT.	GOOD SPAWNING AREA, DROP AT TOP OF UNIT = 1.6FT
36	90											
		8.5	2976.0	PLP	22.5	1.4	0.3	1.1	0	POOR	BUBBLE CURTAIN	PLUINGE = FULLY-SPANNING LOG WITH DROP OF 3.5 TO 4.2 FT
32	80											
		16.5	3072.5	PLP	8.8	2.6	0.3	2.3	9	GOOD	BOULDERS, BUB. CURT.	OVERHANGING BOULDER ON RB = GOOD COVER
42	105											
		10.5	3188.0	PLP	7.8	1.7	0.3	1.4	0	FAIR	BOULDERS, BUB. CURT.	
71	177.5											
		17.5	3383.0	PLP	9.4	1.3	0.3	1.0	15	POOR	SEVERAL BOULDERS, OPEN	SPAWNING SUBSTRATE = MOSTLY GRAVELS, THEN COBBLES
40	100		3483.0									TO CASCADE W/6-7 FT DROP OVER APPROX. 30 FT DISTANCE
36	90		3573.0									TO DROP = 3.8 TO 4.4 FT W/1.3 FT DEPTH AT BASE OF DROP
87	217.5		3790.5									TO OBVIOUS < CHANNEL CONFINEMENT AND > CHANNEL SLOPE
128	320		4110.5									TO BOULDER CASCADE W/7-8 FT ELEVATION DROP OVER 30-35 FT
28	70		4180.5									CONDUCTED TIMED FLOAT TO ESTIMATE STREAMFLOW
60	150		4330.5									END OF SURVEY AT FULLY SPANNING LOG W/4 FT DROP