

Table AQ 9-1. V\* and Bulk Spawning Gravel Sampling Locations.

River/Reach	Bypass Reach	Peaking Reach	Total number of bulk spawning gravel samples collected	Recommended total number of pools for V* survey	Total number of V* pools surveyed in 2006	Total number of V* pools surveyed in 2007	Total number of V* pools not surveyed due to access conditions
Duncan Creek							
Duncan Creek	●		4	10	0	10	0
Middle Fork American River							
French Meadows Reservoir – Middle Fork Interbay	● <sup>1</sup>		9	20	2	15	3
Middle Fork Interbay – Ralston Afterbay	●		4	10	6	3	1
Below Ralston Afterbay		● <sup>1</sup>	8	10	0	8	2
Rubicon River							
Hell Hole Reservoir – South Fork Rubicon River	●		4	10	0	9	1
South Fork Rubicon River– Ralston Afterbay	● <sup>1</sup>		8	20	1	17	2
Long Canyon Creek							
North Fork Long Canyon Creek	●		4	10	0	10	0
South Fork Long Canyon Creek	●		4	10	0	10	0
Long Canyon Creek	●		5	10	0	9	1
Comparison Streams							
North Fork of the Middle Fork American River (NFMF)			4	10	3	0	7
North Fork American River (NF)			4	5	0	5	0
	<b>Total:</b>		<b>58</b>	<b>125</b>	<b>12</b>	<b>96</b>	<b>17</b>

<sup>1</sup>Two instream flow study sites are located along the reach.

Table AQ 9-2. V\* Measurement Results 2006 and 2007.

Stream	Pool Number	River Mile	Avg Length (ft)	Avg Width (ft)	Pool Bed Surface Area (ft <sup>2</sup> )	Avg Residual Pool Volume (ft <sup>3</sup> )	Avg Fines Thickness (ft)	Avg Fines Surface Area (ft <sup>2</sup> )	Avg Volume Fine Sediment (ft <sup>3</sup> )	Calculated V*	
<b>Duncan Creek</b>											
Duncan Creek	1	6.16	72	7	504	1638	<0.1	trace	trace	<0.001	
	2	6.53	45	30	1350	1350	0.0	0.0	0.0	0.000	
	3	6.47	51	1	68	119	0.2	3.0	0.6	0.005	
	4	6.41	45	30	1350	6075	0.0	0.0	0.0	0.000	
	5	6.37	51	12	612	1224	0.1	3.0	0.3	0.0002	
	6	6.35	54	6	324	486	<0.1	trace	trace	<0.001	
	7	6.34	78	8	624	624	<0.1	trace	trace	<0.001	
	8	6.3	39	45	1755	3510	<0.1	trace	trace	<0.001	
	9	6.28	54	18	972	1944	0.2	16.0	3.2	0.002	
	10	6.2	60	8	480	720	0.0	0.0	0.0	0.000	
<b>Weighted 2007 V*</b>										<b>0.0002</b>	
<b>Middle Fork American River (MFAR)</b>											
French Meadows Reservoir to Middle Fork Interbay	1	45	81	30	2430	7290	0.3	30	9	0.001	
	2	44.92	51	30	1530	3060	<0.1	trace	trace	<0.001	
	3	44.9	87	36	3132	3132	0.2	56	11	0.004	
	4	44.9	87	24	2088	3132	0.3	11	3	0.001	
	5	44.89	45	36	1620	6480	0.0	0	0	0.000	
	6	44.89	69	45	3105	7763	0.2	10	2	0.0002	
	7	44.86	114	36	4104	5130	0.8	455	364	0.071	
	8	44.83	69	33	2277	3416	0.0	0	0	0.000	
	9	44.8	69	33	2277	3416	0.3	114	34	0.010	
	10	44.79	45	33	1485	4455	0.1	45	5	0.001	
	11	36.25	177	65	11417	42241	<0.1	trace	trace	<0.001	
	12	36.2	117	34	3978	11934	0.0	0	0	0.000	
	13	36.18	102	33	3366	6732	<0.1	trace	trace	<0.001	
	14	36.16	36	57	2052	8208	<0.1	trace	trace	<0.001	
	15	36.11	219	45	9855	44348	<0.1	trace	trace	<0.001	
	<b>Weighted 2007 V*</b>										<b>0.003</b>
	16	36.06	168	50	8400	11797	0.2	895	179	0.020	
17	35.98	221	55	12155	7263	0.3	1150	345	0.030		
<b>Weighted 2006 V*</b>										<b>0.027</b>	
Middle Fork Interbay to Ralston Afterbay	1	29.4	164	52	8528	23368	0.1	5220	522	0.020	
	2	29.3	208	40	8320	2600	0.1	830	83	0.030	
	3	29.25	175	33	5775	12343	0.4	102	41	0.003	
	4	29.2	106	63	6678	1080	0.2	395	79	0.070	
	5	26.08	173	58	10034	12269	0.2	2280	456	0.040	
	6	25.94	268	46	12328	16722	0.2	2880	576	0.030	
	<b>Weighted 2006 V*</b>										<b>0.025</b>
	7	26.69	165	45	7425	18563	<0.1	trace	trace	<0.001	
	8	26.36	150	39	5850	23400	0.0	0	0	0.000	
9	26.29	147	42	6174	16670	0.0	0	0	0.000		
<b>Weighted 2007 V*</b>										<b>0.000</b>	
Below Ralston Afterbay	1	14.8	1155	96	110880	388080	0.1	2880	288	0.003	
	2	14.35	270	75	20250	70875	0.3	220	66	0.003	
	3	14.25	660	81	53460	294030	0.1	3116	312	0.006	
	4	13.9	825	150	123750	618750	0.4	8800	3520	0.028	
	5	13.6	819	75	61425	307125	0.1	180	18	0.0003	
	6	4.6	420	120	50400	705600	0.5	7200	3600	0.071	
	7	4.2	942	90	84780	763020	0.2	2100	420	0.005	
	8	3.7	822	99	81378	732402	0.2	6105	1221	0.015	
<b>Weighted 2007 V*</b>										<b>0.002</b>	
<b>Rubicon River</b>											
Hell Hole Reservoir to South Fork Rubicon River	1	25.91	429	63	27027	101351	0.8	275	220	0.002	
	2	25.81	228	45	10260	12825	0	0	0	0.000	
	3	25.71	213	45	9585	16774	0.1	200	20	0.001	
	4	25.63	246	63	15498	42620	0.5	2000	1000	0.023	
	5	25.46	204	30	6120	7650	0	0	0	0.000	
	6	25.37	138	60	8280	35190	0.1	300	30	0.001	
	7	25.28	114	36	4104	7182	0.0	0	0	0.000	
	8	25.06	357	45	16065	40163	0.1	10	1	0.00002	
	9	25.01	138	27	3726	7825	<0.1	trace	trace	<0.001	
<b>Weighted 2007 V*</b>										<b>0.005</b>	

Table AQ 9-2. V\* Measurement Results 2006 and 2007 (continued).

Stream	Pool Number	River Mile	Avg Length (ft)	Avg Width (ft)	Pool Bed Surface Area (ft <sup>2</sup> )	Avg Residual Pool Volume (ft <sup>3</sup> )	Avg Fines Thickness (ft)	Avg Fines Surface Area (ft <sup>2</sup> )	Avg Volume Fine Sediment (ft <sup>3</sup> )	Calculated V*
<b>Rubicon River (continued)</b>										
South Fork Rubicon River to Ralston Afterbay	1	21.17	243	54	13122	52488	1.5	150	225	0.004
	2	21.05	447	69	30843	138794	1.0	6000	6000	0.043
	3	20.9	60	45	2700	2700	0.0	0	0	0.000
	4	20.78	240	69	16560	53820	0.1	1125	113	0.002
	5	20.74	165	36	5940	17820	0.0	0	0	0.000
	6	20.64	216	57	12312	24624	<0.1	trace	trace	<0.001
	7	20.45	534	60	32040	16020	0.0	0	0	0.000
	8	20.25	315	63	19845	89303	0.0	0	0	0.000
	9	3.55	204	51	10404	20808	2.0	50	100	0.005
	10	3.48	534	78	41652	179104	<0.1	trace	trace	<0.001
	11	3.32	255	93	23715	213435	0.8	144	108	0.001
	12	3.18	360	66	23760	95040	<0.1	trace	trace	<0.001
	13	3	372	75	27900	97650	<0.1	trace	trace	<0.001
	14	1.6	330	66	21780	87120	0.8	400	320	0.005
	15	1.48	390	60	23400	198900	1.5	16200	24300	0.081
	16	1.14	300	71	21240	233640	0.1	2100	210	0.001
	17	0.91	285	75	21375	101531	<0.1	trace	trace	<0.001
	<b>Weighted 2007 V*</b>									
18	0.7	258	76	19608	58282	0.3	5460	1638	<b>0.030</b>	
<b>Long Canyon Creek</b>										
North Fork Long Canyon Creek	1	2.03	30	12	360	270	0.3	30.0	9.0	0.025
	2	1.96	48	21	1008	2016	0.3	15.0	3.8	0.004
	3	1.94	55	7	385	385	0.2	5.0	0.8	0.002
	4	1.93	36	6	198	119	0.0	0.0	0.0	0.000
	5	1.9	10	13	130	65	0.1	1.0	0.1	0.001
	6	1.88	36	11	396	317	0.1	1.0	0.1	0.0003
	7	1.86	60	12	720	540	0.1	4.0	0.4	0.001
	8	1.84	19	8	152	76	0.2	4.5	0.9	0.006
	9	1.81	35	11	385	193	0.0	0.0	0.0	0.000
	10	1.79	39	6	234	94	<0.1	trace	trace	<0.001
<b>Weighted 2007 V*</b>										<b>0.004</b>
South Fork Long Canyon Creek	1	2.59	19	13	247	198	<0.1	trace	trace	<0.001
	2	2.59	47	12	564	282	0.0	0.0	0.0	0.000
	3	2.57	87	21	1827	2375	0.2	85.3	12.8	0.007
	4	2.53	39	19	741	741	0.0	0.0	0.0	0.000
	5	2.45	113	16	1808	2712	0.1	50.0	5.0	0.003
	6	2.36	60	20	1200	1201	0.0	0.0	0.0	0.000
	7	2.34	90	18	1620	1620	<0.1	trace	trace	<0.001
	8	2.29	53	13	689	482	0.0	0.0	0.0	0.000
	9	2.26	95	18	1710	855	0.4	15.0	6.0	0.004
	10	2.23	100	18	1800	900	<0.1	trace	trace	<0.001
<b>Weighted 2007 V*</b>										<b>0.002</b>
Long Canyon Creek	1	9.09	63	17	1071	3481	0.0	0.0	0.0	0.000
	2	9.08	20	20	400	1200	0.0	0.0	0.0	0.000
	3	9.06	57	20	1140	2565	0.0	0.0	0.0	0.000
	4	9	96	42	4032	6048	0.0	0.0	0.0	0.000
	5	8.86	150	45	6750	5063	0.0	0.0	0.0	0.000
	6	8.8	96	75	7200	14400	0.0	0.0	0.0	0.000
	7	8.73	87	20	1740	3828	0.0	0.0	0.0	0.000
	8	8.61	42	51	2142	6426	<0.1	trace	trace	<0.001
	9	8.6	90	12	1080	2160	<0.1	trace	trace	<0.001
<b>Weighted 2007 V*</b>										<b>0.000</b>
<b>Comparison Streams</b>										
North Fork American River	1	31.6	1017	120	122040	549180	0.0	0	0	0.000
	2	31.5	1200	90	108000	432000	5.0	1200	6000	0.014
	3	30.7	705	105	74025	740250	3.0	5000	15000	0.020
	4	30.4	840	90	75600	151200	0.0	0	0	0.000
	5	29.6	810	90	72900	200475	0.0	0	0	0.000
<b>Weighted 2007 V*</b>										<b>0.010</b>
North Fork of the Middle Fork American River	1	2.9	146.2	53	7749	5086	0.2	1800	360	0.07
	2	2.85	176	47	8272	5332	0.1	1840	184	0.03
	3	2.75	75	35	2625	3455	0.2	610	122	0.03
<b>Weighted 2006 V*</b>										<b>0.046</b>

Table AQ 9-3. Particle Size Results for Potential Spawning Gravel Samples.

Location	Instream Unit No.	Habitat Type <sup>1</sup>	River Mile	Spawning Gravel (SG)	Geometric Mean (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>16</sub> (mm)
<b>Instream Flow Study Streams</b>								
<b>Duncan Creek</b>								
D6.3	203	MCP	6.2	1	15.9	37.7	16.1	7.6
	193	MCP	6.3	2	11.6	26.1	11.6	5.2
	188	STP	6.36	3-R	16.2	40.7	18.4	6.1
	188	STP	6.36	4-R	17.6	50.0	22.3	6.0
<b>Middle Fork American River</b>								
MF44.7	728	STP	44.94	1	9.7	35.7	14.1	2.0
	721	MCP	44.86	2-R	9.6	32.9	15.2	1.8
	721	MCP	44.86	3-R	9.7	34.3	14.0	2.0
	717	MCP	44.8	4	7.4	29.0	10.0	1.4
MF36.2	694	RUN	36.17	1-R	9.0	33.5	9.7	3.6
	694	RUN	36.17	2-R	8.4	21.9	7.9	3.4
	694	RUN	36.17	3	11.1	65.5	9.6	2.8
	690	MCP	36.11	4	15.2	50.9	25.0	3.1
	690	MCP	36.11	5	12.3	39.6	16.0	3.3
MF26.2	334	HGR	26.32	1	11.5	38.5	18.1	2.1
	330	HGR	26.32	2	18.5	52.6	26.4	5.5
	327	POW	26.18	3-R	7.3	24.4	8.9	1.9
	327	POW	26.18	4-R	8.5	41.4	10.2	1.8
MF14.1	187	LGR	14.5	1-R	10.9	39.8	16.5	1.9
	187	LGR	14.5	2-R	17.5	54.0	26.1	4.5
	183	LSP	14.2	3	9.0	38.1	9.4	2.1
	177	SRN	13.64	4	21.2	63.7	39.0	5.0
MF4.8	83	SRN	4.72	1-R	9.9	46.6	16.1	1.3
	83	SRN	4.72	2-R	10.1	44.3	18.6	1.1
	81	MCP	4.61	3	16.4	46.1	22.9	6.8
	79	MCP	4.44	4	16.0	49.7	27.8	4.2
<b>Rubicon River</b>								
R25.7	820	MCP	25.91	1-R	17.0	39.9	18.7	8.9
	820	MCP	25.92	2-R	16.4	41.2	18.5	8.3
	807	LSP	25.63	3	16.5	55.5	24.2	3.7
	795	LGR	25.2	4	10.0	39.1	15.1	1.9
R20.9	679	MCP	20.87	1	11.7	34.6	15.6	3.3
	665	RUN	20.51	2	9.2	37.6	11.7	1.9
	662	MCP	20.4	3-R	6.1	20.7	7.5	1.5
	662	MCP	20.4	4-R	8.1	26.1	9.5	2.2
R3.5	81	MCP	3.31	1-R	19.5	67.9	28.2	5.0
	81	MCP	3.31	2-R	16.0	42.7	19.4	6.6
	76	MCP	3.12	3	12.8	52.9	15.1	3.2
	71	LSP	3.02	4	9.3	28.5	10.0	3.3

**Table AQ 9-3. Particle Size Results for Potential Spawning Gravel Samples (continued).**

Location	Instream Unit No.	Habitat Type <sup>1</sup>	River Mile	Spawning Gravel (SG)	Geometric Mean (mm)	D <sub>84</sub> (mm)	D <sub>50</sub> (mm)	D <sub>16</sub> (mm)
<b>Instream Flow Study Streams</b>								
<b>Long Canyon Creek</b>								
North Fork Long Canyon Creek (NFLC1.9)	109	STP	1.94	1	12.9	99.4	11.8	2.6
	103	LSP	1.98	2	10.0	39.2	12.5	2.3
	93	SRN	2.06	3-R	11.4	51.1	15.0	2.1
	93	SRN	2.06	4-R	17.6	53.5	27.3	4.1
South Fork Long Canyon Creek (SFLC2.3)	97	MCP	2.34	1 <sup>2</sup>	11.5	54.5	17.1	2.0
	93	LSP	2.39	2	16.3	64.9	27.5	9.0
	77	SRN	2.53	3-R	16.8	62.1	22.7	3.9
	77	SRN	2.53	4-R	13.8	42.6	17.7	3.7
Long Canyon Creek (LC9.0)	136	RUN	8.84	1	32.2	105.5	38.8	9.2
	134	MCP	8.88	2	17.4	61.6	33.2	2.3
	131	LGR	8.98	3-R	25.6	107.8	28.8	2.3
	131	LGR	8.98	4-R	14.4	57.3	18.3	2.7
	126	STP	9.08	5	13.9	36.0	18.5	4.6
<b>Comparison Streams</b>								
North Fork of the Middle Fork American River (NFMF2.3)	*	MCP	31.25	1	9.9	18.2	10.6	5.8
	*	LGR	30.7	2-R	10.8	30.3	12.7	3.7
	*	LGR	30.7	3-R	11.1	25.0	12.2	5.2
	*	LGR	30.5	4	14.6	61.8	13.6	4.6
North Fork American River (NF31.3)	*	MCP	2.87	1	15.1	40.7	19.9	5.5
	*	POW	2.78	2	8.6	31.1	12.7	1.6
	*	MCP	2.74	3-R	7.8	28.0	11.3	1.3
	*	MCP	2.74	8-R	25.5	100.1	41.7	3.9

<sup>1</sup>MCP:mid channel pool; STP:step pool; LSP:lateral scour pool; SRN:step run; RUN:run; LGR:low gradient riffle; HGR:high gradient riffle; POW:pocket water

<sup>2</sup>Does not contain material from surface sample

\* = Instream unit number not applicable

R = Replicate side-by-side sample

**Table AQ 9-4. Fine Sediment Content of Potential Spawning Gravel Samples.**

Location	Instream Unit No.	Habitat Type <sup>1</sup>	River Mile	Spawning Gravel (SG)	Gravel Prior to Cleaning		Gravel Following Winnowing of Fine Sediment	
					Cumulative Percent Finer than 1 mm	Cumulative Percent Finer than 6.4 mm	Cumulative Percent Finer than 1 mm	Cumulative Percent Finer than 6.4 mm
<b>Instream Flow Study Streams</b>								
<b>Duncan Creek</b>								
D6.3	203	MCP	6.2	1	0.5%	10.0%	0.3%	6%
	193	MCP	6.3	2	0.2%	22.0%	0.2%	13%
	188	STP	6.36	3	0.4%	16.0%	0.3%	9%
	188	STP	6.36	4	1.0%	17.0%	0.7%	10%
<b>Middle Fork American River</b>								
MF44.7	728	STP	44.94	1	7.0%	<b>32.0%</b>	4.7%	19%
	721	MCP	44.86	2	8.1%	29.0%	5.4%	17%
	721	MCP	44.86	3	10.6%	<b>38.0%</b>	7.1%	22%
	717	MCP	44.8	4	7.5%	<b>32.0%</b>	5.0%	19%
MF36.2	694	RUN	36.17	1	2.1%	<b>31.0%</b>	1.4%	18%
	694	RUN	36.17	2	1.1%	<b>36.0%</b>	0.7%	21%
	694	RUN	36.17	3	4.1%	<b>39.0%</b>	2.7%	23%
	690	MCP	36.11	4	3.5%	19.0%	2.3%	11%
	690	MCP	36.11	5	3.3%	26.0%	2.2%	15%
MF26.2	334	HGR	26.32	1	8.1%	26.0%	5.4%	15%
	330	HGR	26.32	2	2.8%	17.0%	1.9%	10%
	327	POW	26.18	3	7.6%	<b>37.0%</b>	5.1%	21%
	327	POW	26.18	4	7.9%	<b>37.0%</b>	5.3%	21%
MF14.1	187	LGR	14.5	1	4.8%	<b>32.0%</b>	3.2%	19%
	187	LGR	14.5	2	3.9%	19.0%	2.6%	11%
	183	LSP	14.2	3	5.5%	<b>37.0%</b>	3.7%	21%
	177	SRN	13.64	4	5.8%	18.0%	3.9%	10%
MF4.8	83	SRN	4.72	1	12.1%	<b>33.0%</b>	8.1%	19%
	83	SRN	4.72	2	<b>14.7%</b>	<b>31.0%</b>	9.8%	18%
	81	MCP	4.61	3	9.1%	15.0%	6.1%	9%
	79	MCP	4.44	4	5.0%	20.0%	3.4%	12%
<b>Rubicon River</b>								
R25.7	820	MCP	25.91	1	2.7%	8.0%	1.8%	5%
	820	MCP	25.92	2	3.9%	10.0%	2.6%	6%
	807	LSP	25.63	3	2.7%	22.0%	1.8%	13%
	795	LGR	25.2	4	6.9%	<b>34.0%</b>	4.6%	20%
R20.9	679	MCP	20.87	1	3.3%	25.0%	2.2%	15%
	665	RUN	20.51	2	6.9%	<b>34.0%</b>	4.6%	20%
	662	MCP	20.4	3	10.6%	<b>42.0%</b>	7.1%	24%
R3.5	662	MCP	20.4	4	6.7%	<b>35.0%</b>	4.5%	20%
	81	MCP	3.31	1	4.0%	18.0%	2.7%	10%
	81	MCP	3.31	2	3.9%	15.0%	2.6%	9%
	76	MCP	3.12	3	5.6%	27.0%	3.8%	16%
	71	LSP	3.02	4	3.5%	30.0%	2.3%	17%

**Table AQ 9-4. Fine Sediment Content of Potential Spawning Gravel Samples (continued).**

Location	Instream Unit No.	Habitat Type <sup>1</sup>	River Mile	Spawning Gravel (SG)	Gravel Prior to Cleaning		Gravel Following Winnowing of Fine Sediment	
					Cumulative Percent Finer than 1 mm	Cumulative Percent Finer than 6.4 mm	Cumulative Percent Finer than 1 mm	Cumulative Percent Finer than 6.4 mm
<b>Instream Flow Study Streams</b>								
<b>Long Canyon Creek</b>								
North Fork Long Canyon Creek (NFLC1.9)	109	STP	1.94	1	4.6%	<b>31.0%</b>	3.1%	18%
	103	LSP	1.98	2	6.4%	<b>33.0%</b>	4.3%	19%
	93	SRN	2.06	3	4.9%	22.0%	3.3%	13%
	93	SRN	2.06	4	4.2%	20.0%	2.8%	12%
South Fork Long Canyon Creek (SFLC2.3)	97	MCP	2.34	1	7.4% <sup>2</sup>	<b>32%</b> <sup>2</sup>	5% <sup>2</sup>	19% <sup>2</sup>
	93	LSP	2.39	2	9.5%	22.0%	6.4%	13%
	77	SRN	2.53	3	4.7%	20.0%	3.1%	12%
	77	SRN	2.53	4	2.1%	24.0%	1.4%	14%
Long Canyon Creek (LC9.0)	136	RUN	8.84	1	0.9%	10.0%	0.6%	6%
	134	MCP	8.88	2	9.3%	21.0%	6.2%	12%
	131	LGR	8.98	3	1.6%	16.0%	1.1%	9%
	131	LGR	8.98	4	4.2%	29.0%	2.8%	17%
	126	STP	9.08	5	2.4%	20.0%	1.6%	12%
<b>Comparison Streams</b>								
North Fork American River (NF31.3)	*	MCP	31.25	1	3.1%	17.0%	2.1%	10%
	*	LGR	30.7	2	12.4%	<b>32.0%</b>	8.3%	19%
	*	LGR	30.7	3	<b>14.1%</b>	<b>33.0%</b>	9.4%	19%
	*	LGR	30.5	4	3.5%	19.0%	2.3%	11%
North Fork of the Middle Fork American River (NFMF2.3)	*	MCP	2.87	1	1.2%	16.0%	0.8%	9%
	*	POW	2.78	2	3.0%	25.0%	2.0%	15%
	*	MCP	2.74	3	1.1%	19.0%	0.7%	11%
	*	MCP	2.74	4	1.2%	22.0%	0.8%	13%

<sup>1</sup>MCP:mid channel pool; STP:step pool; LSP:lateral scour pool; SRN:step run; RUN:run; LGR:low gradient riffle; HGR:high gradient riffle; POW:pocket water

<sup>2</sup>Does not contain fine sediment content from surface sample

\*\*\* Instream unit number not applicable

**Bold indicates fine sediment threshold exceeded**

**Table AQ 9-5. Particle Size Composition Summary for Hell Hole Reservoir Sediment Study.**

<b>Particle Size Region<sup>1</sup></b>	<b>Sand &lt;2 mm</b>	<b>Fine Gravel 2-8 mm</b>	<b>Medium Gravel 8-45 mm</b>	<b>Coarse Gravel 45-64 mm</b>	<b>Cobble 64-256 mm</b>	<b>Boulder/Bedrock &gt;256 mm</b>
1	100%	0%	0%	0%	0%	0%
2	100%	0%	0%	0%	0%	0%
3	100%	0%	0%	0%	0%	0%
4	100%	0%	0%	0%	0%	0%
5	31%	36%	33%	0%	0%	0%
6	0%	5%	57%	28%	10%	0%
7	14%	24%	62%	0%	0%	0%
8	15%	14%	64%	7%	1%	0%
9	90%	0%	0%	0%	0%	10%
10	80%	0%	0%	15%	0%	5%
11	50%	0%	0%	30%	0%	20%
12	40%	20%	20%	10%	0%	10%
13	15%	6%	48%	22%	8%	0%
14	70%	3%	3%	10%	0%	15%
15	80%	0%	0%	5%	0%	15%
16	85%	0%	0%	5%	0%	10%
17	90%	0%	0%	0%	0%	10%
18	0%	0%	0%	100%	0%	0%
19	29%	17%	44%	10%	1%	0%
20	57%	13%	14%	7%	6%	2%
21	80%	3%	3%	10%	0%	5%
22	80%	5%	5%	0%	0%	10%
23	85%	5%	5%	0%	0%	5%
24	80%	0%	0%	15%	0%	5%
23	85%	5%	5%	0%	0%	5%
24	80%	0%	0%	15%	0%	5%

<sup>1</sup>Particle Size Region refers to defined areas located on Map AQ 9-3. Bulk Particle Size and Pebble Count Locations on Hell Hole Reservoir.



FINAL

Table AQ 9-6. Total Volume of Sediment Accrual Since Operation of Hell Hole Dam (cubic yards).

Particle Size Region	Sediment Volume cubic yards	Sand <2 mm	Fine Gravel 2-8 mm	Medium Gravel 8-45 mm	Coarse Gravel 45-64 mm	Cobble 64-256 mm	Boulder >256 mm
1	341	341	0	0	0	0	0
2	1059	1059	0	0	0	0	0
3	3	3	0	0	0	0	0
4	1400	1400	0	0	0	0	0
5	356	109	127	119	0	0	0
6	1374	0	74	780	383	136	0
7	415	59	99	256	0	0	0
8	2207	353	276	1412	132	33	0
9	2115	1904	0	0	0	0	212
10	1326	1061	0	0	199	0	66
11	13289	6645	0	0	3987	0	2658
12	178	71	36	36	18	0	18
13	2074	311	124	996	327	311	0
14	3637	2546	91	91	364	0	546
15	6419	5135	0	0	321	0	963
16	9133	7763	0	0	457	0	913
17	1422	1280	0	0	0	0	142
18	2015	0	0	0	2015	0	0
19	2644	820	397	1150	159	119	0
20	123756	71778	15366	17635	3300	13407	2475
21	54007	43206	1350	1350	5401	0	2700
22	119822	95858	5991	5991	0	0	11982
23	86867	73837	4343	4343	0	0	4343
24	2141	1713	0	0	321	0	107
25	5496	4397	275	275	275	275	0
<b>TOTAL</b>	<b>443,496</b>	<b>321,648</b>	<b>28,550</b>	<b>34,435</b>	<b>17,658</b>	<b>14,281</b>	<b>27,125</b>
<b>PERCENT of TOTAL</b>		72.5%	6.4%	7.8%	4.0%	3.2%	6.1%

**Table AQ 9-7. Particle Size Composition Summary for North Fork Long Canyon Creek Diversion Sediment Study.**

	<b>Sand &lt;2 mm</b>	<b>Fine Gravel 2-8 mm</b>	<b>Medium Gravel 8-45 mm</b>	<b>Coarse Gravel 45-64 mm</b>	<b>Cobble 64-256 mm</b>	<b>Boulder/Bedrock &gt;256 mm</b>
Sample 1	66%	16%	17%	0%	0%	0%
Sample 2	69%	19%	12%	0%	0%	0%
Sample 3	87%	9%	3%	0%	0%	0%
Sample 4	65%	25%	11%	0%	0%	0%
Sample 5	34%	27%	39%	0%	0%	0%
Sample 6	37%	23%	30%	10%	0%	0%
Sample 7	70%	18%	10%	3%	0%	0%
<b>Combined Average</b>	<b>61%</b>	<b>20%</b>	<b>17%</b>	<b>2%</b>	<b>0%</b>	<b>0%</b>

**Table AQ 9-8. Particle Size Composition Summary for South Fork Long Canyon Creek Diversion Sediment Study.**

	<b>Sand &lt;2 mm</b>	<b>Fine Gravel 2-8 mm</b>	<b>Medium Gravel 8-45 mm</b>	<b>Coarse Gravel 45-64 mm</b>	<b>Cobble 64-256 mm</b>	<b>Boulder/Bedrock &gt;256 mm</b>
Sample 1	19%	24%	45%	12%	0%	0%
Sample 2	24%	21%	49%	6%	0%	0%
Sample 3	25%	17%	47%	11%	0%	0%
Sample 4	12%	8%	53%	16%	11%	0%
Sample 5	17%	13%	57%	14%	0%	0%
<b>Combined Average</b>	<b>19%</b>	<b>17%</b>	<b>50%</b>	<b>12%</b>	<b>2%</b>	<b>0%</b>

**Table AQ 9-9. Peak Flood Flow Estimates at Unimpaired and Impaired Streamflow Gages.**

<b>Stream</b>	<b>Middle Fk American Nr Auburn (pre dam)</b>	<b>Middle Fk American Nr Auburn (post dam)</b>	<b>Duncan Ck Nr French Meadows</b>	<b>Duncan Ck below Diversion Dam</b>
USGS <sup>1</sup> Station ID	11433500	11433500	11427700	11427750
Approx. River Mile	1.5	1.5	8.8	8.4
Peaks in Record	53	20	41	41
Flow Record (WY)	1912-1964	1966-1985	1965-2005	1965-2005
Drainage Area (mi <sup>2</sup> )	614	614	9.94	10.5
<b>Return Interval (year)</b>	<b>Flow (cfs)</b>			
1.005	2,284	310	53	2
1.25	7,912	3,972	258	76
1.50	10,870	6,556	379	154
2.00	15,360	10,840	571	314
2.33	17,800	13,290	679	418
5.00	31,600	28,020	1,323	1,175
10	47,430	45,870	2,107	2,281
25	75,100	78,110	3,553	4,554
50	102,700	111,000	5,064	7,072
100	137,900	153,300	7,058	10,470

<sup>1</sup>USGS: United States Geological Survey

**Table AQ 9-10. Average Duration of Flows Equaling or Exceeding the 1.5-Year Unimpaired Flood Frequency.**

	<b>No. Yrs in Record</b>	<b>Return Interval for 7400 cfs Flow<sup>1</sup> (years)</b>	<b>Avg No. Days 1.5-Yr Unimpaired Flow (7400 cfs) is Equaled or Exceeded</b>
MFAR Nr Auburn (11433500) <b>Unimpaired Flow (cfs)</b>	53	1.5	7
MFAR Nr Auburn (11433500) <b>Impaired Flow (cfs)</b>	20	1.7	7
	<b>No. Yrs in Record</b>	<b>Return Interval for 212 cfs Flow<sup>1</sup> (years)</b>	<b>Avg No. Days 1.5-Yr Unimpaired Flow (212 cfs) is Equaled or Exceeded</b>
Duncan Above Diversion (11427750) <b>Unimpaired Flow (cfs)</b>	47	1.5	17
Duncan Below Diversion (11427750) <b>Impaired Flow (cfs)</b>	43	2.0	6

<sup>1</sup>The flood return interval is calculated using average daily flow data and the Weibull flood frequency plotting positions.

**Table AQ 9-11. Regional Peak Flood Flow Estimates.**

<b>Stream</b>	<b>Middle Fk American Nr Auburn (pre dam)</b>	<b>Rubicon River Nr Georgetown</b>	<b>Duncan Ck Nr French Meadows</b>
USGS Station ID	11433500	11431000	11427750
Drainage Area, A (sq mi)	614	195	10.5
Precipitation, P (in)*	59	56	62
Altitude Index, H (thousands of feet)*	3.4	5.4	6.7
<b>Return Interval (years)</b>	<b>Flow (cfs)</b>		
2	16,090	3,730	282
5	28,275	7,644	697
10	35,958	10,290	996
25	53,196	15,940	1,588
50	65,133	20,174	2,075
100	83,276	26,758	2,853

\*Data were acquired from Waanaen and Crippen, Table 5 (1977)

**Table AQ 9-12. Large Woody Debris within Project Reservoirs and Diversions.**

Location	Minimum Length for Large Woody Debris Classification (ft) <sup>1</sup>	Observation Method	Estimated Count (Pieces counted or density of LWD)	Potential for Hillslope Recruitment	Maintenance Practices
Hell Hole Reservoir	50	boat and walking	40-50 pieces total. Few in Upper Hell Hole Reservoir, 5 pieces behind dam face, most were along northern shoreline at high water mark	Yes, observed along the northwest side of the lower reservoir	Wood on the spillway and dam is collected and burned on site, on average once every five years
French Meadows Reservoir	15	boat, driving along road, and walking	Visual estimate of approximately 1 piece of LWD per every 200-300 feet of shoreline	Yes, active erosion was observed on the shoreline, mostly along the downstream margins of the reservoir	LWD is primarily left in place
Middle Fork Interbay	35	walking	None in reservoir. One piece immediately downstream of reservoir.	Potentially downstream of dam	Woody debris is flushed through the spillway gates, on average once every five years
Ralston Afterbay	120	driving along road and walking	None	Yes, dense vegetation on steep hillslopes surrounding reservoir	Woody debris is flushed through the spillway gates, on average once every five years
Duncan Diversion Pool	22	walking	6 pieces	No	Smaller woody debris is removed from the trash rack, on average once every five years
South Fork Long Canyon Creek Diversion Pool	15	walking	None	No	Smaller woody debris is removed from the trash rack, on average once every five years
North Fork Long Canyon Creek Diversion Pool	15	walking	3 pieces	No	Smaller woody debris is removed from the trash rack, on average once every five years

<sup>1</sup>Minimum width for LWD was 1 ft.