



TRINITY RIVER RESTORATION PROGRAM (TRRP) PHASE II PLANNING AND ANALYSIS

TWO DIMENSIONAL HYDRODYNAMIC BASED LOGIC MODELING (2D-HBLM) TOOL

Draft Report Summary - September 2014

SYSTEM-WIDE 2D HYDRAULIC MODEL DEVELOPMENT – PART I

In Development

HABITAT MODULE EVALUATION METRICS DEVELOPMENT – PART II

In Development

LOGIC MODEL STATISTICAL ANALYSIS DEVELOPMENT AND RESULTS – PART III

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LIST OF ACRONYMS AND ABBREVIATIONS

2-D	two-dimensional
AMOEBA	A Multidirectional Optimal Ecotope-Based Algorithm
Cfs	cubic feet per second
CAR	Conditional Autoregressive
ESL	Environmental Study Limit
WUA	weighted usable area

1 SUMMARY

A Logic Model was collaborative effort between the Trinity River Restoration Program's (TRRP) Design Team, Inter-Disciplinary Team (IDT), Habitat Team, Program Statistician, Bureau of Reclamation's Technical Service Center (TSC), and consulting firm, Anchor QEA. The Logic Model is a statistical prioritization tool that helps identify the most desirable locations for channel rehabilitation actions within the TRRP 40 mile restoration reach. Evaluation metrics of habitat quality, connectivity to spawning areas, and river complexity were derived from two-dimensional (2-D) hydraulic modeling, statistical techniques, and empirical observations. The 40 mile restoration reach was split into 200 meter river segments based on the TRRP's Science Advisory Board (SAB) Dataframe developed during their Phase I Review analysis. The 200 meter segments or "Panels" were ranked based on the above metrics, scored with a weighting scheme, and summarized by a cluster analysis and Environmental Study Limits (ESLs). Top candidates for restoration actions were identified in the clusters containing three or more panels as: 1) 3 panels beginning in Dutch Creek; 2) 19 panels beginning Below Lorenz (the canyon); 3) 7 panels beginning in Chapman Ranch; 4) 7 panels beginning in Pear Tree Gulch; and 5) 5 panels beginning in Indian Creek (Vitzthum Gulch) (in ascending order of desirability). Summaries by ESL were relatively consistent with these results, with a few exceptions resulting from use of arbitrary boundaries that cross panels of varying quality.

2 APPROACH

Five metrics were chosen to represent fish habitat quality, connectivity, and river complexity. Habitat quality was defined by weighted usable area (WUA) at 300 cubic feet per second (cfs) and 1,500 cfs to capture variation in habitat quality at lower flows. Connectivity was defined by the total number of redds observed within each panel and three upstream panels (i.e., a running total of four panels). Complexity was defined by the standard deviation in bed elevation and standard deviation of stream power at 8,500 cfs. Each panel was ranked relative to the remaining panels (1 to 319) for all five metrics (Table 1), with ascending ranks for habitat quality and complexity and descending ranks for connectivity (redds). Thus, panels with low WUA values, low variation in complexity, and proximity to a large number of redds would receive lower rankings across the five metrics. Low ranks therefore represent a greater desirability for restoration actions.

Panels were scored by summing the total ranks across the five metrics, with each metric weighted according to values shown in Table 1. Ranks of all five metrics were multiplied by their respective weighting and summed by panel. For example, habitat rank at 300 cfs with median accretion has a weighting of 1.50 (33.3% influence), whereas the standard deviation of bed elevation has a weighting of 0.50 (11.1% influence). Each increase in habitat rank and standard deviation of bed elevation rank, therefore, represents a corresponding increase of 1.50 and 0.50 in the total score, respectively. Scores were then scaled relative to the least desirable candidate for a restoration action (i.e., highest score). Scores for each panel, therefore, represents existing habitat quality with the influence of connectivity to spawning habitat and measures of river channel complexity.

Scores across multiple panels were then analyzed to identify segments of the river most suitable for restoration action. First, a cluster analysis was used to identify regions of similar scores that were spatially grouped. This provided a mechanism to evaluate areas desirable for restoration irrespective of arbitrary boundaries. Second, mean scores were provided across ESLs to provide context in how river segments used in past evaluations rank under this approach.

Metrics judged to be important for assessing project feasibility were calculated based on both clusters and ESLs. These included percent public ownership, road length, bedrock area, topography, and geomorphic potential (the first principal component of velocity, average bed shear stress, average first derivative of shear stress, and stream power at 6,000 cfs). These metrics are intended to provide additional detail for consideration in selecting restoration sites.

Table 1
Weighting of Metrics Used in the Logic Model in Panel Scoring

Metric	Weight	Relative influence
Habitat (300 cfs TA 0.50) rank	1.50	0.333
Habitat (1,500 cfs) rank	1.00	0.222
Total redds (2011 – 2013) rank	1.00	0.222
SD of bed elevation (m) rank	0.50	0.111

SD of unit stream power (8,500 cfs) rank	0.50	0.111
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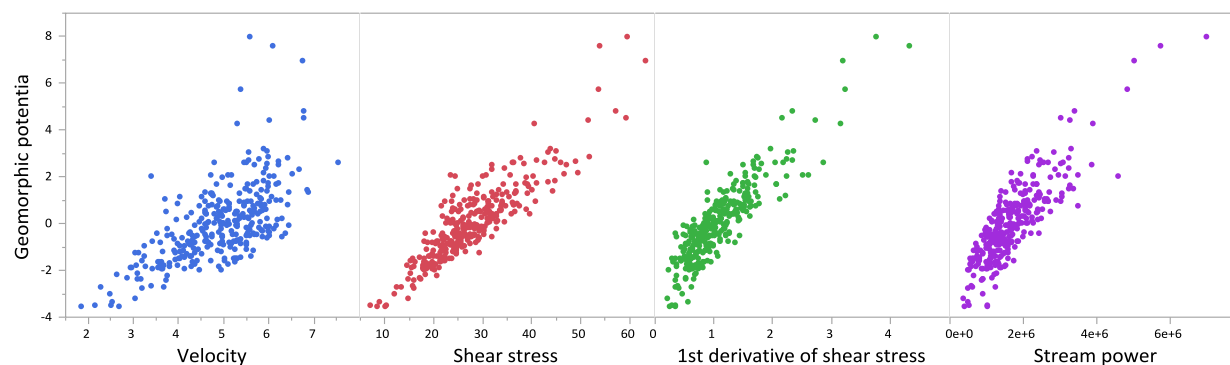
3 ADDITIONAL DETAILS

3.1 Principal Components Analysis

A principal components analysis was used to model variation within a set of metrics to produce a smaller number of independent linear combinations (i.e., principal components; JMP[®] 11, SAS Institute, Cary, North Carolina). The first principal component of variables related to geomorphic potential at 6,000 cfs—including velocity, average bed shear stress, average first derivative of shear stress, and stream power—was derived to show the most prominent direction of these metrics using a single variable. Model outputs at 6,000 cfs were selected to represent geomorphic processes at higher flows. The resulting first principal component translated well to the directionality of all four metrics, providing a single measure of geomorphic potential (Figure 1).

Figure 1

First Principal Component of Geomorphic Potential (y-axis) Compared to the Four Variables Used in the Analysis



Note: As the first principal component increases, geomorphic potential at 6,000 cfs also increases.

3.2 Weighted Usable Area

Fine-scale in-water escape cover data were not available for all 319 panels of the modeled restoration reach. As such, estimating WUA in all panels via the 40-mile 2-D model was not possible. Given the strong evidence for spatial autocorrelation among the panels along the longitudinal gradient of the 40 miles, Anchor QEA opted to predict the WUA for panels

missing cover data via a spatial regression model. For those panels containing cover data, Anchor QEA estimated the relationship between WUA and panel wetted area, edge length, slope, and sinuosity using Conditional Autoregressive (CAR) spatial models. CAR models capture the spatial autocorrelation among neighboring panels (Schabenberger and Gotway 2005), where we considered panels as neighbors if they shared a common border. We then predicted the WUA values for panels not containing cover data via universal kriging (Schabenberger and Gotway 2005). The CAR models were fit using functions from the *spdep* package (Bivand et al. 2014) implemented using R statistical software (R Core Team 2013).

3.3 Clustering Analysis

To investigate if contiguous panels sorted into spatial clusters given their scores for construction suitability, Anchor QEA applied the methods of Aldstadt and Getis (2006), which are based on the G statistic of Ord and Getis (1995). This method of cluster detection applies the A Multidirectional Optimal Ecotope-Based Algorithm (AMOEBA) that uses spatial autocorrelation to identify spatial clusters. Anchor QEA implemented the algorithm using the AMOEBA package (Valles 2014) for R statistical software (R Core Team 2013).

4 RESULTS

A total of 150 spatially-related clusters of similar scores were identified. The top ten clusters of ascending desirability for restoration are shown in Table 2, including all clusters (top) and clusters including a minimum of three panels (bottom). Mean feasibility metrics for the identified clusters are shown in Table 3 for consideration. Likewise, mean scores and feasibility metrics grouped by all 56 ESLs are shown in Table 4.

Table 2
Top Ten Panel Clusters Ranked by Ascending Desirability for Restoration

All Cluster Sizes			
Cluster ID	Number of Panels	Mean Score	Associated Upstream ESL
96	3	28.7%	Dutch Creek
68	1	31.0%	Douglas City
108	1	33.0%	Sheridan Creek
84	2	34.5%	Lorenz Gulch

92	19	35.2%	Below Lorenz (the canyon)
104	7	35.6%	Chapman Ranch
39	1	36.0%	China Gulch
150	7	38.6%	Pear Tree Gulch
50	2	39.5%	Below Steel Bridge
128	1	40.0%	Hocker Flat
Clusters Including at Least Three Panels			
Cluster ID	Number of Panels	Mean Score	Associated Upstream ESL
96	3	28.7%	Dutch Creek
92	19	35.2%	Below Lorenz (the canyon)
104	7	35.6%	Chapman Ranch
150	7	38.6%	Pear Tree Gulch
60	5	40.2%	Indian Creek (Vitzthum Gulch)
102	4	40.5%	Soldier Creek
114	3	41.3%	Oregon Gulch
94	6	42.7%	Dutch Creek
118	7	45.4%	Sky Ranch
31	4	46.8%	Tom Lang Gulch

Table 3
Mean Feasibility Metrics Associated with Clusters Identified in Table 2

Cluster ID	Associated upstream ESL	Percent Public Ownership	Road Length (ft)	Bedrock Area (ft³)	Topography (ft³ × 10⁶)	Geomorphic potential (PCA)
96	Dutch Creek	52%	3,719	0	4.6	-0.38
68	Douglas City	41%	4,462	0	1.0	-3.20
108	Sheridan Creek	49%	425	0	9.1	-0.60
84	Lorenz Gulch	100%	3,015	0	8.7	-0.71
92	Below Lorenz (the canyon)	52%	2,871	1,332	15.8	1.30
104	Chapman Ranch	68%	2,335	0	5.8	-0.52
39	China Gulch	16%	2,471	0	19.1	0.21
150	Pear Tree Gulch	100%	2,008	225	12.8	-0.26
50	Below Steel Bridge	35%	4,265	0	8.0	-0.21
128	Hocker Flat	50%	3,163	0	5.0	-0.46

Cluster ID	Associated upstream ESL	Percent Public Ownership	Road Length (ft)	Bedrock Area (ft ³)	Topography (ft ³ × 10 ⁶)	Geomorphic potential (PCA)
60	Indian Creek (Vitzthum Gulch)	89%	1,746	0	7.9	-1.59
102	Soldier Creek	93%	1,052	0	13.3	0.18
78	Middle Steiner Flat	100%	2,521	376	11.3	1.61
114	Oregon Gulch	54%	2,232	0	3.8	-1.43
6	Cableway	35%	5,488		3.2	-1.01
36	Poker Bar	2%	6,474	0	9.5	-0.97
94	Dutch Creek	77%	-	11	6.3	-0.63
14	Upper Rush Creek	1%	5,947		3.6	-1.88
140	Valdor Gulch	0%	9,246	0	6.8	0.61
20	Dark Gulch	17%	2,728	0	6.6	-2.46
118	Sky Ranch	56%	4,864	153	6.3	0.71
45	Below Limekiln Gulch	100%	1,812	0	7.1	0.50
97	Evans Bar	63%	3,785	262	3.0	-1.50
120	Lower Junction City	4%	5,009	0	9.3	0.41
31	Tom Lang Gulch	6%	5,326	0	14.5	-0.70

Table 4
Trinity River ESL Segments Ranked by Ascending Desirability for Restoration

ESL Name	Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total Redds (2011-2013)	SD of Bed Elevation (m)	SD of Unit Stream Power (8,500 cfs)	Mean Score	Percent Public Ownership	Road Length (feet)	Bedrock Area	Topography (cubic feet x 106)	Geomorphic Potential
Chapman Ranch	85	77	154	69	125	38.3%	71%	2,570	0	4.52	-0.46
Below Pear Tree	107	63	215	135	10	43.0%	100%	2,795	0	13.59	-1.32
Below Lorenz (the canyon)	70	59	121	241	217	43.2%	58%	2,675	1,084	15.74	1.96
Dutch Creek	103	135	97	149	124	44.0%	72%	723	181	7.57	-0.38
Pear Tree Gulch	86	64	173	215	108	44.2%	100%	1,354	166	11.95	0.29
Deep Gulch	149	143	47	140	89	44.3%	41%	2,066	0	10.26	-0.56
Soldier Creek	115	88	150	171	121	47.0%	87%	1,151	0	12.39	0.05
Evans Bar	136	156	121	87	106	48.5%	77%	3,485	257	4.68	-0.68
Lower Steiner Flat (not built)	106	85	165	157	184	48.6%	100%	1,683	327	8.38	1.00
Trinity House Gulch	83	131	187	92	179	48.7%	69%	1,859	0	6.33	0.23
Lorenz Gulch	82	76	234	202	155	51.4%	80%	2,683	17	6.20	0.46
Indian Creek (Vitzthum Gulch)	111	115	182	196	103	51.6%	64%	2,201	0	7.87	-1.54
Sky Ranch	134	132	97	168	211	52.2%	55%	4,464	45	6.34	0.83
Below Steel Bridge	72	128	202	169	200	52.3%	38%	3,481	0	9.11	-0.05
Tom Lang Gulch	124	104	176	138	188	52.9%	14%	4,426	0	14.59	-0.44
Cableway	163	268	10	160	94	54.5%	44%	5,015	6	6.99	-1.22
Upper Junction City	160	149	87	210	147	55.0%	38%	5,760	208	5.43	0.66
Oregon Gulch	179	177	105	96	114	55.2%	60%	3,182	0	3.80	-0.45
Middle Steiner Flat	105	96	203	205	236	56.8%	100%	2,048	471	11.50	1.56
Sheridan Creek	210	193	90	105	56	57.0%	73%	2,401	0	7.91	-1.27
Below Tom Lang Gulch	267	197	47	67	21	58.0%	29%	7,396	0	14.46	-1.84
Below Evans Bar	214	211	65	133	84	59.0%	83%	3,300	0	10.39	0.54

ESL Name	Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total Redds (2011-2013)	SD of Bed Elevation (m)	SD of Unit Stream Power (8,500 cfs)	Mean Score	Percent Public Ownership	Road Length (feet)	Bedrock Area	Topography (cubic feet x 106)	Geomorphic Potential
Elkhorn	107	92	309	138	152	59.4%	44%	2,402	374	12.83	0.61
China Gulch	124	133	181	196	267	61.4%	53%	2,213	0	12.49	0.12
Lower Steiner Flat (built)	178	121	171	156	194	61.8%	100%	2,413	1,294	10.36	1.30
Lower Junction City	152	127	193	149	236	62.0%	6%	4,575	0	8.99	0.85
Hatchery	218	215	19	105	267	62.8%	100%	113,816	0	4.55	0.35
Upper Conner Ck	88	86	304	214	232	62.8%	61%	2,309	326	7.06	1.00
Hoadly Gulch	228	221	15	185	156	63.0%	44%	6,122	0	4.31	-0.78
Below Limekiln Gulch	171	183	155	174	140	63.3%	100%	1,632	0	10.42	-0.11
Douglas City	164	115	257	81	212	64.3%	58%	5,734	0	3.40	-1.03
Valdor Gulch	157	152	227	155	156	64.8%	9%	4,096	0	7.16	0.38
Upper Steiner Flat	196	141	161	177	190	65.7%	100%	2,604	271	10.71	1.29
Dark Gulch	167	212	184	159	142	67.1%	23%	3,005	0	7.76	-1.43
Hocker Flat	169	169	268	101	152	68.6%	20%	3,284	773	5.93	-0.29
Lower Rush Creek	206	243	88	119	240	68.8%	52%	2,830	0	3.63	-0.69
Sawmill	251	260	30	159	152	69.1%	73%	2,652	180	5.65	-0.93
McIntyre Gulch	179	202	222	130	133	69.4%	42%	1,992	0	9.33	-0.70
Poker Bar	213	180	150	211	142	69.5%	21%	5,850	288	9.60	-0.04
Limekiln Gulch	210	234	169	122	111	70.1%	100%	1,269	0	11.76	-0.20
Upper Rush Creek	266	261	50	125	128	70.1%	13%	5,287	0	3.52	-2.09
Conner Ck	148	140	293	124	242	70.5%	19%	3,060	571	6.62	0.86
Reading Creek	145	158	256	190	224	70.5%	66%	3,061	461	8.73	1.07
Steel Bridge Road Day Use	224	211	122	208	144	71.0%	93%	2,145	498	11.15	0.12
Lowden Ranch	196	226	171	186	163	72.6%	75%	7,320	0	6.92	-1.51
Wheel Gulch	238	214	172	158	98	73.2%	14%	3,390	0	6.01	-0.47
Sven Olbertson	254	281	4	222	199	73.3%	99%	3,140	371	5.02	2.73

ESL Name	Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total Redds (2011-2013)	SD of Bed Elevation (m)	SD of Unit Stream Power (8,500 cfs)	Mean Score	Percent Public Ownership	Road Length (feet)	Bedrock Area	Topography (cubic feet x 106)	Geomorphic Potential
Below Sven Olbertson	219	233	12	282	318	73.5%	100%	3,773	160	8.00	6.84
Indian Creek (Upper Douglas City)	274	211	196	41	69	73.5%	99%	2,305	0	6.13	-1.21
Below China Gulch	247	290	109	103	116	74.0%	100%	931	0	15.10	0.08
Below Dark Gulch (Bucktail Hole)	146	185	180	313	296	75.0%	72%	8,304	108	6.30	2.03
Deadwood Creek	253	279	13	196	247	75.0%	82%	3,527	18	11.06	2.17
Indian Creek	223	206	200	160	143	75.1%	67%	3,369	553	9.80	-0.50
Below Conner Ck	247	217	284	77	144	82.5%	36%	4,343	0	12.85	-0.49
Below Lower Junction City	313	182	301	16	175	88.0%	18%	6,641		3.98	-0.04
Below Valdor Gulch	199	236	295	279	230	91.0%	4%	1,545	0	3.70	1.47

Note: Mean Panel Ranking for the Five Logic Model Metrics Along with Mean Feasibility Metrics Shown for Evaluation. Colors are shaded from red (low scores) to green (high scores) according to ranking scheme described in the approach.

5 REFERENCES

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APPENDIX A

DEFINITIONS

APPENDIX A

DEFINITIONS

Bedrock area	Amount of bedrock (cubic feet) in each panel as noted in the SAB data frame.
Cluster ID	Grouping of panels identified by cluster analysis.
ESL Name	Environmental study limits used by the Trinity River Restoration Program.
Geomorphic potential (first principal component)	Values calculated by PCA analysis using velocity, average bed shear stress, average first derivative of shear stress, and stream power at 6,000 cfs. Increasing principal component values translate to increasing stream power at high flows.
Habitat (1500 cfs)	WUA for each panel based on modeled output at 1,500 cfs.
Habitat (300 cfs TA 0.50)	WUA for each panel based on modeled output at 300 cfs with median accretion values.
Panel ID	200-meter segment identified in 2-D modeling efforts.
Percent public ownership	Total area publically-owned divided by the total area within each panel.
Road length (feet)	Total length of all roads within each panel.
SD of bed elevation (m)	Standard deviation of bed elevation within each panel.
SD of unit stream power (8,500 cfs)	Standard deviation of unit stream power at 8,500 cfs within each panel.
Topography (cubic feet $\times 10^6$)	Total topography above the river level at 300 cfs.
Total redds (2011-2013)	Total redds enumerated in each panel in addition to the total number of redds in each of the three nearest upstream panels.

APPENDIX B

VALUES USED FOR LOGIC MODEL BY PANEL

APPENDIX B

VALUES USED FOR LOGIC MODEL BY PANEL

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet × 10 ⁶)	Geomorphic potential ²
0	P	14,913.9	17,013.3	154	154	6.55	91.92	100%	548,932	0	2.47	0.84
1	P	20,592.5	18,769.9	394	548	1.28	88.17	100%	5,374	0	5.58	0.39
2	P	23,552.9	23,203.3	2,384	2,932	1.36	57.09	100%	5,541	0	5.63	0.57
3	P	24,859.5	25,732.4	525	3,457	1.14	57.29	100%	4,947	0	3.54	-0.60
4	P	32,845.6	40,643.3	476	3,779	1.30	52.04	100%	4,284	0	5.52	0.53
5	E	25,885.9	40,992.1	420	3,805	2.25	33.36	98%	5,500	0	3.93	-0.54
6	E	22,857.6	22,595.6	321	1,742	2.47	49.81	100%	1,816	0	6.23	1.15
7	P	24,134.0	38,102.5	250	1,467	2.13	79.11	100%	2,103	371	4.90	7.59
8	P	33,734.4	35,623.8	87	1,078	2.71	133.09	100%	3,021	160	7.37	5.71
9	P	17,327.1	19,082.5	114	772	3.34	111.74	100%	4,525	0	8.63	7.96
10	P	30,595.0	37,741.3	401	852	1.57	68.08	95%	4,364	0	4.01	3.01
11	P	21,092.8	25,865.7	270	872	3.07	49.66	69%	2,690	18	18.11	1.32
12	P	22,138.2	27,120.5	80	865	2.16	32.75	69%	3,752	6	15.81	-1.57
13	E	27,055.4	46,012.1	446	1,197	1.61	35.44	36%	5,331	0	5.66	-1.27
14	E	10,001.7	36,034.3	342	1,138	2.11	31.70	30%	7,561		3.63	-0.74
15	E	17,375.9	21,001.2	75	943	1.64	39.46	39%	3,414		2.86	-1.28
16	E	28,301.2	28,537.6	179	1,042	1.11	52.57	42%	7,663		3.68	0.02
17	E	17,050.6	23,299.8	110	706	2.43	44.51	39%	5,464	0	4.76	0.05
18	E	25,997.8	18,774.1	22	386	3.21	32.39	52%	5,239	0	4.49	-2.42
19	E	42,483.6	30,342.0	190	501	1.65	30.93	53%	4,002		2.68	-1.43
20	E	30,863.8	40,646.9	73	395	1.05	51.61	94%	1,390		3.13	0.25
21	E	14,980.6	19,387.4	27	312	2.41	55.07	92%	3,297	0	9.01	-0.78
22	E	16,577.1	22,405.7	25	315	2.69	24.34	68%	2,856	0	13.68	-0.84
23	E	51,489.3	60,672.5	88	213	1.66	67.35	100%	1,881	0	4.78	1.03
24	E	58,106.6	58,713.3	92	232	1.28	42.97	100%	792	0	2.77	-1.80
25	E	26,070.9	31,257.6	39	244	2.38	42.58	61%	2,601	75	4.63	-1.88
26	E	29,212.7	20,673.5	51	270	2.19	32.68	15%	4,393	284	4.48	-1.95
27	E	36,668.6	32,097.1	96	278	1.13	15.39	1%	3,542		4.53	-2.79
28	E	23,763.2	27,349.7	78	264	1.42	57.27	0%	5,464		2.79	-0.96
29	E	19,107.5	14,752.1	55	280	1.46	48.64	1%	5,947		3.55	-1.88
30	E	18,725.9	34,467.9	73	302	1.55	37.25	3%	7,841		3.20	-1.28
31	P	32,667.1	33,257.9	29	235	2.46	40.81	43%	5,575		3.36	-2.41

¹ WUA values for each panel are estimated by 2-D model outputs (E) or predicted (P) by a spatial linear regression.

² First principal of PCA analysis using velocity, average bed shear stress, average first derivative of shear stress, and stream power at 6,000 cfs. Increasing values represent increasing stream power at high flows.

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
32	P	34,213.0	30,184.0	25	182	2.18	14.13	56%	3,398		3.55	-3.58
33	E	43,469.4	46,484.8	18	145	2.28	10.28	0%	4,927	0	4.52	-3.35
34	E	32,998.5	29,443.4	50	122	1.25	93.01	1%	5,604		2.62	-0.45
35	E	20,215.8	32,462.1	54	147	1.38	49.03	61%	2,874	0	0.95	-1.74
36	E	25,019.8	31,466.4	2	124	1.60	90.46	84%	1,644	0	2.69	0.94
37	P	25,278.7	31,758.5	50	156	1.35	36.73	84%	3,377	0	3.58	-1.77
38	P	27,141.8	36,330.3	60	166	2.39	72.90	75%	1,804	0	1.92	0.51
39	E	15,564.2	18,169.5	12	124	1.54	56.32	9%	3,020	0	7.98	-0.87
40	E	16,929.2	18,311.6	4	126	1.67	65.73	0%	4,260	0	4.68	-1.18
41	E	32,778.0	37,900.4	26	102	1.40	46.44	0%	862		2.43	-0.92
42	E	23,524.5	48,334.1	12	54	1.50	32.32	0%	1,078	0	2.82	-1.32
43	E	15,567.2	65,913.9	44	86	1.34	71.12	0%	4,180	0	3.79	0.20
44	E	29,590.7	36,540.4	17	99	2.00	17.95	0%	1,244	0	4.05	-1.80
45	E	23,409.7	15,980.6	6	79	2.83	38.01	13%	4,095	0	12.77	-1.88
46	E	28,274.8	36,438.7	84	151	1.04	28.74	34%	836	0	5.41	-0.83
47	E	20,216.7	27,124.3	23	130	2.04	32.49	12%	39	0	12.82	-1.52
48	E	13,900.7	24,765.1	5	118	1.34	52.59	18%	3,950	0	3.27	-2.20
49	E	12,978.6	19,022.0	3	115	1.68	31.54	16%	1,506	0	9.90	-2.72
50	E	16,152.5	16,013.2	8	39	2.53	36.31	35%	3,771	0	11.76	-1.95
51	E	14,546.0	9,360.8	14	30	3.18	50.92	72%	1,004	0	21.33	0.15
52	E	17,740.5	17,423.6	28	53	2.41	45.66	37%	6,219	0	7.18	-2.14
53	E	15,309.2	20,060.3	39	89	2.12	61.58	57%	10,282		3.41	-1.62
54	E	18,220.6	20,418.4	7	88	3.88	72.21	72%	8,304	108	6.30	2.03
55	P	12,390.7	13,032.0	1	75	2.26	55.55	45%	7,957		4.06	-1.28
56	E	15,386.0	21,788.8	13	60	1.82	49.75	23%	7,049	0	4.61	-2.34
57	E	39,593.5	56,479.0	10	31	2.22	15.73	94%	2,690	0	11.63	-3.51
58	E	17,622.4	20,773.6	30	54	1.69	52.29	100%	3,429	0	13.25	-0.79
59	E	26,212.4	25,075.1	75	128	1.44	29.40	100%	4,313	0	8.71	-2.69
60	E	24,742.3	28,210.3	25	140	3.50	35.24	100%	6,479	0	2.71	-1.87
61	P	19,808.6	22,128.3	13	143	3.67	70.49	96%	19,572	0	2.66	0.45
62	P	24,480.1	35,824.1	29	142	1.37	47.98	43%	7,069	0	7.75	-0.05
63	E	14,999.5	17,776.4	12	79	1.95	28.59	22%	3,228	0	5.46	-1.44
64	E	12,684.1	15,373.8	36	90	1.23	65.54	85%	490	0	5.31	0.57
65	P	16,757.3	18,422.6	9	86	1.30	52.69	100%		0	8.23	1.55
66	P	10,486.9	8,452.2	9	66	2.94	61.78	71%	1234	0	24.80	0.57
67	E	18,956.4	15,936.7	9	63	1.95	47.48	3%	2655	0	13.44	-0.21
68	E	19,677.7	22,943.5	42	69	0.90	55.55	0%	5794	0	6.11	-0.65
69	P	14,905.2	15,227.6	5	65	1.62	60.58	0%	3319	0	14.77	0.41
70	P	19,093.4	17,103.0	54	110	1.06	30.47	5%	7759	0	12.47	-1.21
71	E	14,326.6	15,735.0	48	149	1.82	52.77	14%	4108	0	15.06	-0.07
72	E	19,786.4	14,431.3	34	141	2.18	33.24	4%	6116	0	15.50	-1.94
73	P	25,246.1	21,179.0	51	187	1.36	24.14	29%	7396	0	14.46	-1.84

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
74	P	26,132.2	26,839.0	8	141	2.12	26.48	33%	4866	0	9.82	-1.86
75	E	30,526.2	32,574.0	46	139	2.45	18.23	35%	3648	0	11.24	-1.78
76	E	22,713.9	23,539.8	33	138	4.93	45.68	4%	9335	0	8.15	0.10
77	P	19,298.9	16,624.2	47	134	5.66	28.13	50%	4113	346	8.84	-1.51
78	P	20,817.8	24,229.4	14	140	3.19	29.31	5%	8243	230	6.91	-1.70
79	E	16,344.0	14,055.0	22	116	1.25	54.53	2%	6474	0	9.48	-0.97
80	E	16,895.6	15,256.8	22	105	1.68	70.79	14%	3559	0	15.87	2.48
81	P	16,767.6	14,923.4	13	71	1.36	91.39	45%	4101	0	12.31	2.85
82	P	19,223.6	12,032.8	3	60	2.64	120.46	33%	6194	0	10.56	4.77
83	E	32,598.7	23,744.2	13	51	3.47	20.56	3%	7847		5.94	-2.74
84	E	34,031.0	43,263.8	56	85	1.71	35.24	1%	5972	0	6.53	-0.09
85	P	21,696.4	21,612.5	17	89	2.21	61.86	12%	4223	0	10.37	0.44
86	P	9,990.4	11,527.9	2	88	1.69	54.25	16%	2471	0	19.11	0.21
87	P	14,997.9	16,157.5	14	89	2.08	62.90	55%	2960	0	10.96	0.79
88	P	17,196.3	17,271.9	60	93	1.99	64.85	88%	74	0	8.33	0.82
89	P	19,117.4	20,091.2	2	78	2.58	72.93	96%	1338	0	13.67	-1.67
90	P	22,609.0	32,830.2	36	112	1.74	43.94	100%		0	12.81	0.83
91	E	29,625.2	34,800.2	49	147	1.58	31.43	100%		0	16.88	-0.11
92	E	21,580.4	31,411.1	26	113	1.28	37.87	100%	931	0	15.61	-0.49
93	E	20,615.1	22,274.3	26	137	2.19	28.83	100%	1459	0	11.84	-1.41
94	E	26,453.6	29,962.3	27	128	1.39	30.82	100%	1383	0	10.03	-1.32
95	P	30,096.0	34,608.5	28	107	0.91	41.96	100%	1334	0	5.35	0.20
96	P	20,745.1	23,200.1	31	112	1.64	29.32	100%	1281	0	10.06	0.75
97	P	15,523.1	20,746.5	6	92	1.62	42.14	100%	1385	0	10.32	-0.91
98	P	35,209.6	33,829.0	14	79	0.88	34.53	100%	1347	0	8.30	-0.92
99	E	19,807.2	23,722.5	8	59	2.24	48.64	100%	787	0	19.00	1.67
100	E	15,911.5	17,202.9	26	54	2.31	41.41	100%	1172	0	19.16	0.31
101	E	18,752.7	19,606.2	5	53	2.00	49.07	100%	1584	0	15.87	-0.47
102	E	23,018.9	25,036.5	26	65	3.06	35.23	100%	1320	0	11.63	-0.94
103	E	20,136.6	21,362.2	104	161	1.17	31.76	100%	1099	0	5.37	0.69
104	E	15,292.9	16,444.8	45	180	2.03	48.55	100%	2525	0	8.82	0.30
105	P	21,638.6	23,287.6	15	190	2.09	38.64	100%	3262	0	8.53	-0.57
106	P	22,179.5	20,601.0	3	167	3.75	38.67	100%	3367	498	9.11	-0.43
107	P	33,033.3	33,386.1	13	76	1.91	35.63	84%	1238	0	11.55	0.42
108	P	24,657.0	22,105.7	75	106	1.35	32.91	88%	1063	0	11.83	-0.52
109	E	16,148.4	17,340.5	12	103	3.48	67.25	91%	1795	0	14.74	1.69
110	E	16,595.1	24,447.0	8	108	3.73	62.58	73%	2466	0	14.12	0.73
111	P	8,693.2	13,668.8	5	100	1.91	43.57	55%	4505	0	10.59	0.06
112	P	11,324.0	12,449.7	20	45	1.90	44.97	15%	4024	0	5.33	-0.47
113	P	17,527.6	18,292.6	31	64	1.13	47.37	7%	2929	0	6.40	-0.52
114	P	15,015.3	13,686.0	17	73	1.61	63.51	6%	1498	0	13.50	0.93
115	E	24,357.9	26,374.0	12	80	1.61	38.19	22%	3288	0	10.83	-1.05

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
116	E	21,850.9	25,188.2	11	71	1.12	33.28	25%	1402	0	9.20	-0.59
117	P	19,795.0	20,797.4	27	67	1.16	41.06	16%	1900	0	8.69	-0.60
118	P	15,144.9	17,800.7	3	53	1.44	44.65	83%	1384	0	7.55	-1.21
119	E	21,561.3	23,979.6	38	79	3.23	37.28	87%	1360	0	7.78	-1.96
120	E	20,589.4	29,048.9	11	79	2.48	22.38	56%	3110	0	7.75	-0.39
121	E	17,969.1	26,583.9	29	81	2.44	26.42	23%	4171	0	7.50	-0.51
122	E	15,761.6	17,375.8	9	87	1.86	43.37	1%	1996	0	12.77	-0.66
123	E	16,301.2	15,286.6	7	56	2.66	32.68	9%	4484	0	11.31	-1.64
124	E	18,100.3	14,798.5	54	99	2.22	28.84	83%	2927	0	7.18	-2.40
125	E	14,705.6	10,627.9	27	97	1.96	35.62	66%	1593	0	7.41	-1.64
126	E	12,612.4	9,913.2	4	92	1.99	56.19	94%	1417	0	7.20	-0.88
127	E	8,844.7	7,154.0	8	93	2.51	40.86	100%	1415	0	7.23	-1.40
128	E	13,470.8	11,452.0	19	58	1.89	37.54	100%	1379	0	10.38	-1.61
129	P	26,813.3	32,298.4	76	107	1.87	36.00	95%	2053	0	3.62	-1.65
130	P	18,609.7	21,451.0	4	107	1.70	19.54	70%	577	0	4.13	-3.02
131	E	20,872.8	22,589.4	8	107	2.28	22.26	47%	572	0	2.49	-3.54
132	E	23,129.3	22,095.3	45	133	2.40	14.43	39%	4593	0	7.65	-3.52
133	E	23,714.5	11,981.6	6	63	3.26	82.25	90%	3608	553	12.50	-0.33
134	E	26,384.1	23,877.2	45	104	1.77	53.68	89%	2792	0	8.80	2.79
135	E	21,523.7	18,520.3	7	103	2.49	64.40	93%	1229	0	13.85	1.24
136	E	24,260.9	22,171.6	22	80	1.71	52.24	87%	1305	0	11.74	-0.14
137	P	15,970.2	26,386.7	11	85	1.81	35.55	78%	4205	0	11.07	-0.49
138	P	19,353.3	31,681.2	22	62	1.32	29.12	54%	5213	0	7.79	-0.81
139	P	19,413.8	18,155.3	3	58	1.62	47.79	24%	6218	0	5.97	-0.33
140	P	28,626.0	28,260.9	17	53	1.18	29.90	66%	4626	0	13.42	-0.88
141	E	24,265.0	22,524.5	17	59	1.53	40.90	70%	2696	0	12.49	0.51
142	E	25,179.6	22,582.7	32	69	1.51	25.59	97%	3059	0	6.01	-0.82
143	E	25,258.9	23,312.7	16	82	1.03	22.62	100%	2523	0	4.95	-1.85
144	E	23,660.8	22,387.7	28	93	0.96	31.08	100%	1559		7.23	-1.16
145	E	42,483.2	19,580.4	7	83	1.27	45.00	100%	2080	0	6.34	-0.99
146	P	36,125.9	23,494.0	12	63	1.19	62.74	96%	6891	0	6.90	1.00
147	E	17,726.7	14,561.4	21	68	1.53	69.95	48%	4455	0	2.61	-2.23
148	E	10,572.2	7,967.5	2	42	1.56	15.49	41%	4462	0	0.95	-3.20
149	E	19,524.6	18,133.4	17	52	1.46	69.46	46%	7129	0	3.12	0.33
150	E	18,045.6	34,362.3	4	44	1.91	61.31	34%	6297	0	5.98	2.59
151	P	9,805.3	11,690.8	23	46	2.19	56.88	42%	3877	0	21.58	1.14
152	P	18,498.8	19,245.5	22	66	1.58	42.51	1%	4400	0	15.01	-0.50
153	P	16,875.1	18,807.5	22	71	1.64	42.10	33%	6146		3.62	0.24
154	P	19,053.9	18,553.8	3	70	2.35	63.34	82%	596	0	3.77	1.28
155	E	23,345.7	26,051.4	18	65	1.59	61.56	72%	2364	0	10.39	2.12
156	E	19,033.1	14,961.7	23	66	2.73	78.81	79%	1825	0	12.41	3.20
157	E	21,710.6	19,322.3	11	55	1.94	52.12	80%	2580	0	7.83	0.92

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
158	E	23,078.7	21,600.2	5	57	1.78	54.87	100%	3136	79	2.29	-0.25
159	E	13,527.8	16,737.8	6	45	2.82	49.50	100%	1236	802	7.66	1.11
160	E	14,199.2	14,165.7	6	28	2.63	40.10	100%	1214	502	5.48	-0.10
161	E	22,526.2	19,235.7	66	83	1.13	39.93	100%	1791	0	11.34	0.42
162	E	19,476.0	17,960.2	13	91	3.63	58.19	100%	2511	304	11.96	2.08
163	P	19,093.8	16,434.7	34	119	2.11	45.17	100%	3511	237	8.83	1.38
164	P	11,045.0	11,761.0	13	126	1.87	58.65	100%	2917	592	7.43	1.28
165	E	14,753.5	11,858.7	19	79	1.90	66.31	100%	2124	159	15.14	1.94
166	E	18,596.0	16,810.2	6	72	2.63	63.24	100%	1705	204	14.96	2.60
167	P	18,801.2	20,050.3	12	50	2.33	39.76	100%	1446	930	8.47	0.40
168	E	19,781.4	16,413.0	43	80	1.57	43.40	100%	1387	850	9.95	0.73
169	E	11,355.6	10,997.1	14	75	1.98	38.42	100%	1895	0	5.61	0.48
170	E	15,244.2	13,965.1	39	108	1.91	63.12	100%	1701	0	5.81	2.73
171	E	16,224.6	15,530.4	27	123	1.83	47.27	100%	2211	0	10.79	0.38
172	E	16,301.6	16,401.6	17	97	1.89	43.43	100%	1219	131	9.76	0.68
173	E	18,154.1	16,737.1	26	109	1.78	52.46	100%	2366	2,377	10.52	0.73
174	E	19,099.5	14,090.5	33	103	1.55	46.96	100%	2250	0	9.09	1.28
175	E	19,166.0	14,959.9	3	79	1.40	54.55	100%	1663	193	11.13	2.70
176	E	21,300.2	21,619.2	22	84	3.32	38.95	100%	3374	1,312	10.70	0.49
177	P	7,916.0	8,853.9	2	60	2.90	29.62	100%	2773	0	10.62	-0.22
178	P	11,118.1	9,424.2	51	78	1.79	36.96	100%	3256	0	6.85	-1.20
179	P	18,402.1	17,770.2	14	89	1.39	43.39	100%	2717	0	4.55	0.06
180	P	16,040.3	15,483.0	7	74	1.61	34.69	100%	1321	0	3.97	-0.24
181	E	14,942.4	13,370.0	9	81	2.21	57.55	58%	5067		4.72	1.75
182	E	10,548.5	9,797.2	5	35	2.80	65.22	42%	3638	0	4.93	3.08
183	E	19,850.7	21,233.9	12	33	3.48	41.42	63%	10	17	7.74	0.00
184	E	19,465.3	17,185.3	37	63	2.22	41.81	50%	1855	0	13.46	0.91
185	E	19,793.2	16,820.1	34	88	2.49	49.83	73%	4339	7	8.34	1.41
186	E	16,662.9	15,307.0	17	100	2.42	92.42	100%	2301	56	7.11	4.49
187	P	19,375.4	25,969.1	1	89	2.43	105.57	100%	2221	102	7.64	6.94
188	P	12,983.6	11,129.5	23	75	2.36	63.57	100%	2122	24	16.28	2.64
189	P	15,862.6	14,470.4	25	66	2.21	55.42	65%	1455	69	22.30	1.36
190	P	11,596.8	12,413.8	38	87	1.50	66.30	8%	2429	0	15.75	2.14
191	E	14,514.3	10,086.5	14	100	2.37	77.40	1%	2073	0	9.08	1.79
192	E	12,382.9	11,453.4	50	127	5.72	97.53	0%	2054	159	16.48	4.42
193	E	12,109.6	14,007.0	36	138	3.88	98.03	0%	1832	1,995	15.86	4.24
194	E	10,857.2	9,998.2	50	150	2.49	81.34	0%	3514	4,352	14.96	2.61
195	E	11,593.1	8,477.1	9	145	3.51	66.15	0%	5524	2,991	13.70	2.05
196	E	9,173.3	9,881.7	31	126	3.75	48.89	0%	3724	3,086	12.61	1.17
197	P	9,436.6	10,456.0	16	106	3.18	50.91	5%	3568	244	19.03	1.65
198	P	12,335.7	10,819.8	49	105	3.11	44.43	87%	1120	510	19.20	0.78
199	E	12,464.8	11,422.7	6	102	3.53	37.48	100%		2,345	21.96	0.32

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
200	E	14,360.8	13,663.6	113	184	2.23	38.12	100%		224	20.53	0.80
201	P	14,946.2	14,602.1	76	244	3.05	38.03	100%		14	22.50	0.93
202	P	11,316.9	9,658.2	92	287	3.71	53.09	100%		3,254	19.19	2.07
203	P	12,688.4	10,136.9	72	353	2.02	45.96	100%		36	17.16	0.12
204	P	12,425.0	9,513.5	23	263	1.98	31.48	100%		51	17.94	0.40
205	P	15,802.4	13,630.1	60	247	1.25	31.68	86%		0	15.28	-0.20
206	P	15,698.2	16,927.1	28	183	2.59	37.53	72%		452	8.55	-0.78
207	E	13,947.9	18,231.5	59	170	3.54	32.31	69%		264	10.19	-0.40
208	E	10,048.2	8,988.1	32	179	1.63	53.60	60%		0	10.28	0.59
209	P	21,189.2	20,504.4	20	139	2.54	36.12	95%		225	9.64	-0.80
210	P	14,641.2	16,310.4	20	131	1.63	48.86	93%		0	9.90	0.18
211	E	10,648.7	15,233.3	18	90	1.66	36.01	73%		8	6.08	-1.17
212	E	11,282.2	14,770.9	22	80	1.86	31.41	79%		0	4.83	-1.98
213	P	16,029.0	18,390.1	3	63	1.08	22.79	80%		0	4.69	-1.52
214	P	20,407.8	21,093.1	132	175	1.09	32.91	81%		0	3.95	-0.35
215	P	14,620.0	15,752.1	12	169	2.38	71.05	54%		14	8.32	1.08
216	P	24,487.1	24,060.9	79	226	1.25	48.47	58%	111	125	7.20	0.82
217	P	15,504.0	19,949.4	21	244	1.56	23.53	55%	1334	0	7.24	-0.21
218	P	6,113.6	10,235.8	2	114	1.72	45.51	54%	4659	0	3.73	0.12
219	E	8,989.4	15,424.2	33	135	1.55	32.20	47%	5163	0	2.85	-1.04
220	E	13,717.8	19,679.9	20	76	1.36	34.74	63%	3785	262	2.97	-1.50
221	P	29,257.2	29,333.8	57	112	0.78	36.29	100%	1535	252	5.80	-0.53
222	P	22,492.5	19,971.2	31	141	2.16	42.41	100%	1925	0	5.43	-0.58
223	E	22,530.9	20,347.3	34	142	0.77	26.69	99%	3840	0	7.28	-0.55
224	E	21,240.3	21,827.2	37	159	1.66	33.30	83%	3300	0	10.39	0.54
225	E	18,585.4	17,695.0	30	132	1.90	29.90	99%	1081	0	7.59	-0.78
226	E	13,946.4	12,110.0	6	107	1.94	55.27	100%	957	0	13.00	1.71
227	P	15,205.2	14,502.8	52	125	1.33	41.56	100%	1262	0	14.98	0.06
228	P	13,112.3	9,672.3	4	92	2.32	35.51	73%	909	0	17.80	-0.29
229	P	21,310.7	18,958.9	7	69	2.29	31.97	63%	1547	0	8.56	-0.46
230	P	16,309.2	13,949.7	22	85	1.44	39.45	29%	3963	0	4.77	-0.28
231	E	14,492.5	13,044.3	15	48	1.07	41.25	55%	4946	0	4.16	-0.27
232	E	14,273.6	14,688.1	7	51	1.36	51.24	64%	5239	0	4.02	0.77
233	P	15,073.8	14,164.3	104	148	1.45	34.77	97%	453	0	4.35	-0.46
234	P	11,721.8	12,393.6	25	151	1.65	38.91	94%	301	0	3.95	-0.74
235	E	18,141.7	17,559.6	67	203	1.10	26.21	86%	515	0	5.86	-1.76
236	E	11,019.4	10,009.6	70	266	2.03	32.32	49%	925	0	13.41	-0.89
237	P	18,926.4	18,488.6	7	169	1.91	41.46	68%	3490	0	7.33	0.13
238	P	24,569.0	25,501.9	36	180	1.28	29.32	6%	1783	0	10.04	-0.93
239	P	19,056.0	18,194.1	31	144	2.46	37.40	0%		0	18.69	-0.12
240	P	12,226.4	10,145.2	3	77	1.74	30.26	49%	425	0	9.09	-0.60
241	E	22,931.6	20,655.5	39	109	0.99	25.67	87%	410	0	11.21	-1.49

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
242	E	20,895.2	21,455.7	47	120	0.94	24.10	90%	2898	0	5.15	-1.62
243	E	25,430.4	26,582.3	135	224	1.05	26.47	100%	1399	0	3.14	-2.01
244	E	23,030.3	23,627.7	84	305	1.22	24.47	98%	4153	0	3.55	-1.63
245	E	35,045.8	34,477.3	106	372	2.68	38.77	89%	5123	0	4.51	-1.41
246	E	21,126.3	21,591.8	31	356	0.94	32.94	78%	1590	0	4.30	-1.10
247	P	18,976.7	18,383.3	17	238	1.22	26.82	60%	2746	0	4.32	-1.66
248	P	16,332.3	17,230.6	12	166	1.34	27.70	23%	2360	0	2.92	-1.52
249	E	29,965.7	31,403.2	27	87	2.25	39.92	56%	5340	0	2.57	-0.01
250	E	16,254.4	16,685.2	19	75	1.77	67.66	82%	3872	0	4.90	2.03
251	E	21,165.6	19,028.5	80	138	1.67	45.87	66%	3607	0	5.36	0.23
252	E	12,812.6	10,879.3	9	135	1.25	58.35	67%	4754	0	6.57	1.31
253	P	17,082.1	15,275.9	15	123	2.78	53.66	46%	5319	45	6.88	0.94
254	P	17,164.5	20,622.9	46	150	1.63	64.91	60%	6547	0	6.17	1.65
255	P	18,326.9	20,119.3	56	126	2.59	37.88	36%	2095	0	6.72	0.00
256	E	20,477.1	20,740.6	51	168	1.21	40.13	66%	4077	245	7.74	0.48
257	E	10,665.8	8,895.2	7	160	3.45	50.22	74%	4945	170	4.93	1.00
258	E	13,234.2	12,178.5	4	118	2.46	35.11	40%	6311	0	5.38	-0.40
259	E	31,470.4	31,755.2	99	161	2.77	31.08	6%	6851	0	3.97	-0.10
260	P	22,166.9	22,114.3	1	111	2.14	54.13	6%	6615	0	5.13	2.33
261	E	18,658.5	16,853.2	7	111	1.06	46.32	2%	6115	0	9.50	0.23
262	E	12,697.9	10,198.2	-	107	3.79	54.59	6%	3903	0	9.17	0.59
263	E	23,570.4	23,477.7	9	17	1.60	69.12	9%	3708	0	8.30	1.72
264	E	39,058.3	20,232.3	10	26	1.04	44.73	18%	6641		3.98	-0.04
265	E	22,474.7	21,654.4	4	23	2.02	55.50	21%	3261	439	10.36	1.31
266	E	18,268.9	18,420.5	2	25	1.46	71.09	34%	2405	1,474	1.89	-1.13
267	E	15,070.3	14,137.6	-	16	2.76	35.57	38%	3153	1,083	7.37	-0.41
268	E	29,950.6	28,491.6	34	40	0.91	34.67	28%	5371	95	8.60	-0.13
269	E	25,858.6	26,966.6	9	45	1.14	35.62	2%	4034	0	4.13	-0.48
270	E	18,442.1	18,477.9	12	55	1.55	31.28	0%	4652	0	2.69	-1.01
271	E	17,530.6	20,195.1	35	90	1.17	44.11	0%	1341	0	6.90	-0.88
272	E	18,567.2	19,220.4	9	65	1.70	49.03	6%	2178	0	6.38	0.58
273	P	13,725.7	12,785.0	-	56	1.25	36.76	50%	3163	0	5.03	-0.46
274	P	15,549.0	14,811.6	-	44	2.80	75.66	11%	1101		4.75	1.21
275	E	10,560.6	10,325.4	-	9	2.57	73.36	29%	4272		6.37	2.56
276	E	10,160.6	10,069.5	8	8	2.59	38.94	96%	2566	0	5.02	1.04
277	P	10,791.1	10,584.7	1	9	2.75	69.41	93%	1726	345	8.98	0.99
278	P	28,776.8	27,471.0	24	33	0.99	39.96	76%	1882	306	10.16	-0.78
279	E	20,942.0	21,494.6	3	36	1.27	49.25	29%	2141	0	4.65	-0.02
280	E	14,461.0	13,600.4	3	31	1.53	58.66	5%	2542		5.57	0.94
281	E	21,747.0	21,816.2	22	52	1.27	60.09	0%	3997	0	5.70	-0.71
282	E	16,625.6	15,665.9	-	28	2.66	65.55	14%		571	12.89	1.62
283	E	22,460.0	22,192.3	3	28	1.46	40.37	39%	2188	0	2.89	0.75

Panel ID ¹		Habitat (300 cfs TA 0.50)	Habitat (1500 cfs)	Total redds (2011-2013)	Moving total of redds (4 panels)	SD of bed elevation (m)	SD of unit stream power (8,500 cfs)	Percent public ownership	Road length (feet)	Bedrock area	Topography (cubic feet x 10 ⁶)	Geomorphic potential ²
284	E	12,421.2	12,068.3	-	25	2.06	91.30	28%	4432	0	8.00	2.58
285	P	22,687.5	21,815.6	4	7	1.74	42.57	42%	3503	0	17.63	-0.09
286	P	24,573.7	22,639.5	54	61	0.90	38.40	29%	5183	0	8.06	-0.88
287	P	18,744.5	16,027.2	18	76	1.42	39.12	36%	2927	0	12.86	-0.51
288	P	33,422.7	31,791.1	31	107	2.20	34.87	24%	3038	0	5.01	-0.82
289	E	32,147.5	30,083.7	37	140	3.54	48.05	8%	2110	0	4.21	0.51
290	E	20,136.1	17,308.3	-	86	1.22	22.81	2%	4340	0	4.26	-1.51
291	P	22,643.5	27,477.6	2	70	1.82	30.33	0%	4537	0	3.70	-0.01
292	P	3,393.6	4,965.3	-	39	2.35	54.11	0%	9246	0	6.82	0.61
293	P	17,976.9	20,331.7	4	6	1.43	42.16	7%	6433		5.27	-0.24
294	P	25,432.7	27,507.4	28	34	1.21	25.18	1%	5204		4.26	-0.45
295	E	24,928.2	24,529.7	5	37	1.58	31.93	3%	4860		3.78	-0.62
296	E	18,473.4	16,613.2	-	37	1.62	32.95	0%	3812		3.77	-0.33
297	E	23,867.0	24,974.4	28	61	1.03	39.39	6%	2322	0	2.74	-0.45
298	E	18,329.6	17,846.9	72	105	3.00	39.36	38%	2998	0	9.74	0.51
299	P	18,315.3	18,063.7	18	118	1.57	65.35	0%	1997	0	11.35	1.44
300	P	15,460.4	15,228.6	1	119	3.24	58.65	30%	1687	0	18.38	0.95
301	E	15,527.9	15,245.7	1	92	2.79	47.46	2%	2405	0	5.52	2.33
302	E	20,372.9	23,686.1	11	31	2.83	53.84	4%	1545	0	3.70	1.47
303	E	25,120.3	26,393.4	3	16	2.01	45.42	0%	3198	727	7.51	0.73
304	E	12,621.6	12,023.2	2	17	1.95	84.75	3%	1585	0	16.59	2.49
305	P	17,560.4	16,562.8	3	19	1.52	53.94	24%	2029	0	13.45	0.85
306	P	11,662.4	9,693.8	8	16	2.22	50.72	57%	2275	0	14.53	1.46
307	P	12,887.9	13,584.4	4	17	1.31	30.56	56%	4440	0	8.05	-0.51
308	P	16,526.9	15,372.3	-	15	1.81	27.80	67%	1887	21	13.40	-0.67
309	E	15,736.4	12,881.3	1	13	1.41	30.30	100%	1399	0	16.25	-0.08
310	E	18,989.6	17,307.6	26	31	1.42	37.69	100%	1103	49	10.52	0.80
311	E	20,220.0	16,905.0	46	73	1.51	25.57	100%	1353	0	12.55	-1.16
312	E	15,381.8	13,649.7	67	140	3.99	37.96	100%	1464	79	12.34	-0.74
313	E	9,985.4	9,502.3	1	140	2.58	37.99	100%	1334	370	11.06	2.03
314	E	9,992.5	8,384.2	-	114	2.59	47.25	100%	1410	0	8.78	0.19
315	E	11,723.4	12,352.5	7	75	3.01	32.62	100%	1460	0	16.45	0.64
316	E	10,349.7	8,360.5	3	11	1.85	19.39	100%	1358	0	16.64	-1.44
317	P	19,117.1	16,626.0	83	93	1.68	17.52	100%	2583	0	16.79	-1.39
318	P	17,159.8	13,959.1	-	93	1.57	20.14	100%	4445	0	7.34	-1.14

APPENDIX C

RANKS USED FOR LOGIC MODEL BY

PANEL

APPENDIX C

RANKS USED FOR LOGIC MODEL BY PANEL

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011- 2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
0	Hatchery	76	126	67	319	311	622	52%	1
1	Hatchery	203	160	19	52	307	663	56%	1
2	Hatchery	246	228	4	66	248	758	64%	2
3	Hatchery	262	251	3	30	250	787	66%	2
4	Hatchery	302	309	2	56	217	901	76%	3
5	Sven Olbertson	273	311	1	219	85	874	73%	3
6	Sven Olbertson	237	224	5	246	209	812	68%	3
7	Sven Olbertson	252	308	6	200	303	944	79%	3
8	Below Sven Olbertson	306	300	9	268	319	1062	89%	3
9	Below Sven Olbertson	132	166	15	296	317	686	58%	4
10	Deadwood Creek	295	306	14	105	286	958	81%	5
11	Deadwood Creek	210	252	12	286	207	826	69%	5
12	Cableway	225	262	13	202	77	752	63%	5
13	Cableway	281	313	7	115	96	847	71%	5
14	Cableway	13	302	8	196	64	460	39%	6
15	Cableway	133	195	11	126	138	538	45%	6
16	Hoadly Gulch	284	271	10	25	222	831	70%	7
17	Hoadly Gulch	127	230	16	239	173	643	54%	8
18	Hoadly Gulch	274	161	20	291	72	774	65%	9
19	Sawmill	316	278	17	129	55	861	72%	10
20	Sawmill	296	310	18	17	216	889	75%	10
21	Sawmill	79	171	25	236	239	552	46%	11
22	Sawmill	118	220	24	267	22	566	48%	11
23	Sawmill	318	318	44	131	284	1047	88%	12
24	Sawmill	319	317	41	53	164	945	79%	12
25	Sawmill	275	279	36	232	163	925	78%	12
26	Sawmill	287	190	31	206	75	792	67%	13
27	Upper Rush Creek	312	287	30	27	4	801	67%	13
28	Upper Rush Creek	250	264	33	78	249	836	70%	13
29	Upper Rush Creek	174	81	29	86	198	513	43%	14
30	Upper Rush Creek	160	296	27	99	111	668	56%	15
31	Upper Rush Creek	300	292	40	243	146	977	82%	16
32	Upper Rush Creek	308	277	50	204	2	892	75%	16
33	Upper Rush Creek	317	314	76	222	1	977	82%	16
34	Upper Rush Creek	303	274	115	43	313	1022	86%	16
35	Lower Rush Creek	196	289	74	72	202	794	67%	16

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011-2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
36	Lower Rush Creek	264	282	111	113	308	1000	84%	16
37	Lower Rush Creek	269	285	66	64	108	841	71%	16
38	Lower Rush Creek	282	303	60	234	297	1052	88%	16
39	Lower Rush Creek	97	147	112	98	246	577	48%	17
40	Lower Rush Creek	126	151	106	134	279	653	55%	17
41	Dark Gulch	301	307	153	75	186	1042	88%	18
42	Dark Gulch	245	315	263	90	70	1026	86%	18
43	Dark Gulch	98	319	186	61	295	830	70%	18
44	Dark Gulch	289	305	158	185	8	993	83%	18
45	Dark Gulch	244	105	202	278	122	873	73%	18
46	Dark Gulch	283	304	68	15	38	823	69%	19
47	Dark Gulch	197	263	102	192	73	793	67%	19
48	Dark Gulch	60	245	119	62	223	597	50%	20
49	Dark Gulch	52	164	123	136	62	464	39%	20
50	Dark Gulch	109	106	284	252	107	733	62%	21
51	Dark Gulch	70	11	297	288	214	664	56%	22
52	Dark Gulch	139	136	266	237	181	820	69%	23
53	Dark Gulch	89	178	175	198	261	716	60%	24
54	Below Dark Gulch (Bucktail Hole)	146	185	180	313	296	889	75%	25
55	Lowden Ranch	41	56	215	221	243	565	47%	26
56	Lowden Ranch	91	208	251	156	208	778	65%	27
57	Lowden Ranch	314	316	293	213	6	1190	100%	28
58	Lowden Ranch	137	193	264	139	220	842	71%	28
59	Lowden Ranch	277	248	103	82	45	830	70%	28
60	Lowden Ranch	261	268	85	301	94	942	79%	28
61	Lowden Ranch	192	215	79	307	291	881	74%	28
62	Lowden Ranch	256	301	80	71	194	898	75%	28
63	Trinity House Gulch	81	140	203	177	37	572	48%	29
64	Trinity House Gulch	47	97	172	42	277	499	42%	29
65	Trinity House Gulch	122	155	187	57	224	666	56%	29
66	Tom Lang Gulch	17	6	234	281	262	537	45%	29
67	Tom Lang Gulch	165	104	243	178	192	780	66%	30
68	Tom Lang Gulch	186	226	229	4	244	858	72%	30
69	Tom Lang Gulch	75	88	238	119	258	627	53%	31
70	Tom Lang Gulch	171	127	132	19	52	551	46%	31
71	Tom Lang Gulch	65	102	72	157	225	463	39%	31
72	Tom Lang Gulch	188	75	82	205	82	583	49%	31
73	Below Tom Lang Gulch	267	197	47	67	21	689	58%	32
74	Poker Bar	276	260	83	199	31	872	73%	33
75	Poker Bar	294	290	90	242	9	947	80%	33
76	Poker Bar	236	234	92	316	182	929	78%	33

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011-2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
77	Poker Bar	179	116	98	317	36	659	55%	34
78	Poker Bar	206	242	86	290	42	803	68%	35
79	Poker Bar	116	70	122	44	235	506	42%	36
80	Poker Bar	125	92	146	137	292	640	54%	37
81	Poker Bar	123	85	224	68	310	683	57%	37
82	Poker Bar	178	46	252	263	318	856	72%	37
83	Poker Bar	299	238	272	298	13	1114	94%	38
84	Poker Bar	307	312	189	143	95	1081	91%	38
85	China Gulch	221	205	176	210	263	949	80%	38
86	China Gulch	11	40	181	140	234	425	36%	39
87	China Gulch	80	108	177	194	266	635	53%	40
88	China Gulch	131	131	162	183	273	718	60%	40
89	China Gulch	176	179	209	255	298	929	78%	41
90	Below China Gulch	233	291	127	146	170	926	78%	41
91	Below China Gulch	290	299	75	109	60	894	75%	41
92	Below China Gulch	219	281	126	54	118	822	69%	41
93	Limekiln Gulch	204	218	95	207	39	742	62%	41
94	Limekiln Gulch	279	275	104	73	54	861	72%	41
95	Limekiln Gulch	293	298	137	6	156	956	80%	41
96	Limekiln Gulch	205	227	128	127	43	748	63%	42
97	Limekiln Gulch	94	192	167	120	158	639	54%	43
98	Limekiln Gulch	310	294	204	3	86	1008	85%	44
99	Limekiln Gulch	191	237	254	218	199	986	83%	44
100	Limekiln Gulch	104	129	265	225	151	738	62%	44
101	Below Limekiln Gulch	162	173	267	186	204	878	74%	44
102	Below Limekiln Gulch	239	247	239	285	93	1034	87%	44
103	Below Limekiln Gulch	195	199	62	33	65	603	51%	45
104	Below Limekiln Gulch	88	113	51	190	197	490	41%	45
105	Steel Bridge Road Day Use	220	229	46	195	128	767	64%	46
106	Steel Bridge Road Day Use	227	187	59	310	129	806	68%	46
107	Steel Bridge Road Day Use	304	293	212	170	102	1097	92%	47
108	Steel Bridge Road Day Use	260	213	144	65	78	819	69%	48
109	Steel Bridge Road Day Use	108	134	150	299	283	737	62%	48
110	Below Steel Bridge	119	243	135	309	264	843	71%	49
111	Below Steel Bridge	4	64	155	171	169	395	33%	50
112	Below Steel Bridge	30	53	277	167	176	547	46%	50
113	Below Steel Bridge	134	150	242	28	190	702	59%	51
114	McIntyre Gulch	82	65	221	116	270	602	51%	52
115	McIntyre Gulch	255	255	198	117	125	957	80%	53
116	McIntyre Gulch	224	249	225	26	83	865	73%	53
117	McIntyre Gulch	190	194	233	32	149	803	67%	54

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011- 2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
118	McIntyre Gulch	85	141	268	83	174	665	56%	55
119	McIntyre Gulch	218	240	205	292	112	974	82%	56
120	McIntyre Gulch	202	272	206	247	15	912	77%	56
121	Indian Creek (Vitzthum Gulch)	140	259	196	241	29	800	67%	57
122	Indian Creek (Vitzthum Gulch)	101	135	183	161	165	633	53%	58
123	Indian Creek (Vitzthum Gulch)	112	94	259	264	76	691	58%	59
124	Indian Creek (Vitzthum Gulch)	143	83	159	214	40	584	49%	60
125	Indian Creek (Vitzthum Gulch)	73	32	160	180	100	442	37%	60
126	Indian Creek (Vitzthum Gulch)	45	20	168	184	245	470	40%	60
127	Indian Creek (Vitzthum Gulch)	5	2	163	251	147	372	31%	60
128	Indian Creek (Vitzthum Gulch)	56	38	256	165	116	519	44%	60
129	Indian Creek (Vitzthum Gulch)	280	288	138	163	103	979	82%	61
130	Indian Creek (Vitzthum Gulch)	158	200	139	141	11	652	55%	62
131	Indian Creek	207	223	140	223	14	792	67%	63
132	Indian Creek	242	212	99	235	3	793	67%	63
133	Indian Creek	249	44	244	294	305	961	81%	64
134	Indian Creek	278	239	149	149	229	994	84%	64
135	Indian Creek	217	158	151	248	272	895	75%	64
136	Indian Creek	253	216	199	144	219	976	82%	64
137	Indian Creek	105	256	190	154	98	730	61%	64
138	Indian Creek	180	283	248	59	41	851	72%	64
139	Indian Creek	182	146	257	121	193	833	70%	64
140	Indian Creek	285	269	269	35	47	1007	85%	64
141	Indian Creek	254	221	255	95	148	979	82%	64
142	Indian Creek (Upper Douglas City)	266	222	230	92	26	910	77%	64
143	Indian Creek (Upper Douglas City)	268	231	195	13	16	843	71%	64
144	Indian Creek (Upper Douglas City)	248	219	164	10	56	788	66%	65
145	Indian Creek (Upper Douglas City)	315	172	193	49	177	951	80%	66
146	Douglas City	311	233	245	36	265	1095	92%	66
147	Douglas City	138	78	232	96	290	710	60%	67
148	Douglas City	20	3	282	103	5	369	31%	68
149	Douglas City	185	145	270	87	289	881	74%	69
150	Reading Creek	142	295	280	172	259	1004	84%	69
151	Reading Creek	9	41	276	208	247	558	47%	70
152	Reading Creek	154	169	235	110	161	771	65%	71
153	Reading Creek	124	162	226	128	157	717	60%	72
154	Reading Creek	169	159	227	228	269	888	75%	73
155	Reading Creek	243	254	240	112	260	1045	88%	73
156	Reading Creek	168	87	236	269	302	861	72%	73
157	Reading Creek	222	170	261	175	218	961	81%	73
158	Reading Creek	241	204	258	151	238	1018	86%	73

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011-2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
159	Reading Creek	57	120	278	277	206	725	61%	74
160	Reading Creek	63	74	298	261	143	669	56%	75
161	Upper Steiner Flat	231	168	194	29	141	794	67%	76
162	Upper Steiner Flat	184	143	171	306	252	869	73%	76
163	Upper Steiner Flat	172	112	117	197	178	675	57%	77
164	Middle Steiner Flat	26	42	107	164	254	397	33%	78
165	Middle Steiner Flat	74	43	207	168	282	586	49%	78
166	Middle Steiner Flat	157	121	223	262	268	845	71%	79
167	Middle Steiner Flat	163	177	274	227	139	879	74%	79
168	Lower Steiner Flat (not built)	187	111	200	106	167	728	61%	80
169	Lower Steiner Flat (not built)	31	35	216	181	127	452	38%	81
170	Lower Steiner Flat (not built)	87	68	136	173	267	555	47%	81
171	Lower Steiner Flat (not built)	110	100	113	159	189	552	46%	81
172	Lower Steiner Flat (not built)	113	110	161	166	168	608	51%	81
173	Lower Steiner Flat (built)	145	119	133	152	221	656	55%	81
174	Lower Steiner Flat (built)	173	71	152	100	187	626	53%	81
175	Lower Steiner Flat (built)	177	86	208	76	236	716	60%	82
176	Lower Steiner Flat (built)	215	206	192	295	133	935	79%	83
177	Lorenz Gulch	3	8	253	280	46	429	36%	84
178	Lorenz Gulch	27	12	210	153	110	394	33%	84
179	Lorenz Gulch	151	139	178	74	166	664	56%	85
180	Lorenz Gulch	107	99	220	118	88	583	49%	86
181	Lorenz Gulch	77	58	197	211	251	602	51%	86
182	Lorenz Gulch	18	18	289	275	275	609	51%	86
183	Lorenz Gulch	193	198	291	300	152	1005	84%	87
184	Below Lorenz (the canyon)	183	128	246	215	155	834	70%	87
185	Below Lorenz (the canyon)	189	122	182	249	210	817	69%	87
186	Below Lorenz (the canyon)	121	95	156	238	312	708	59%	88
187	Below Lorenz (the canyon)	181	253	179	240	316	982	83%	89
188	Below Lorenz (the canyon)	53	36	217	230	271	583	49%	90
189	Below Lorenz (the canyon)	103	76	237	212	241	694	58%	91
190	Below Lorenz (the canyon)	33	52	184	91	281	472	40%	92
191	Below Lorenz (the canyon)	69	24	157	231	301	551	46%	92
192	Below Lorenz (the canyon)	40	39	105	318	314	520	44%	92
193	Below Lorenz (the canyon)	37	69	93	314	315	532	45%	92
194	Below Lorenz (the canyon)	24	21	70	250	304	404	34%	92
195	Below Lorenz (the canyon)	32	7	77	302	280	423	36%	92
196	Below Lorenz (the canyon)	7	19	108	311	201	394	33%	92
197	Below Lorenz (the canyon)	8	30	145	289	213	438	37%	92
198	Below Lorenz (the canyon)	39	33	147	287	172	468	39%	92
199	Below Lorenz (the canyon)	44	37	154	303	114	466	39%	92

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011- 2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
200	Below Lorenz (the canyon)	66	63	48	217	124	381	32%	92
201	Below Lorenz (the canyon)	78	79	37	284	123	437	37%	92
202	Below Lorenz (the canyon)	29	15	28	308	226	354	30%	92
203	Below Lorenz (the canyon)	48	25	23	188	184	306	26%	92
204	Below Lorenz (the canyon)	43	14	34	182	61	234	20%	92
205	Below Lorenz (the canyon)	102	61	35	45	63	303	25%	92
206	Dutch Creek	99	125	49	257	115	509	43%	92
207	Dutch Creek	62	149	55	304	69	484	41%	92
208	Dutch Creek	14	10	53	123	227	259	22%	92
209	Dutch Creek	213	186	91	253	105	776	65%	93
210	Dutch Creek	72	109	101	124	200	480	40%	94
211	Dutch Creek	21	90	173	132	104	413	35%	94
212	Dutch Creek	28	82	201	162	59	436	37%	94
213	Dutch Creek	106	153	247	22	17	579	49%	94
214	Dutch Creek	200	196	54	23	79	601	51%	94
215	Dutch Creek	71	103	56	233	293	529	44%	94
216	Dutch Creek	257	241	42	46	196	790	66%	95
217	Dutch Creek	93	175	38	104	19	414	35%	96
218	Evans Bar	2	28	124	145	180	318	27%	96
219	Evans Bar	6	98	96	101	68	288	24%	96
220	Evans Bar	58	174	213	69	89	553	46%	97
221	Evans Bar	288	273	129	2	106	888	75%	98
222	Evans Bar	230	176	84	203	160	787	66%	99
223	Evans Bar	232	184	81	1	32	630	53%	100
224	Below Evans Bar	214	211	65	133	84	706	59%	101
225	Soldier Creek	156	138	100	169	48	581	49%	102
226	Soldier Creek	61	48	141	176	240	489	41%	102
227	Soldier Creek	86	77	110	60	154	423	36%	102
228	Soldier Creek	54	16	169	226	97	428	36%	102
229	Soldier Creek	216	163	231	224	67	864	73%	103
230	Chapman Ranch	114	66	191	84	137	539	45%	104
231	Chapman Ranch	68	57	275	21	150	520	44%	104
232	Chapman Ranch	64	80	273	70	215	592	50%	104
233	Chapman Ranch	84	73	73	85	90	360	30%	104
234	Chapman Ranch	35	51	69	130	131	303	25%	104
235	Chapman Ranch	144	137	45	24	28	424	36%	104
236	Deep Gulch	25	22	32	191	71	223	19%	104
237	Deep Gulch	164	157	57	174	153	624	52%	105
238	Deep Gulch	258	250	52	55	44	739	62%	106
239	Sheridan Creek	170	148	78	244	113	660	55%	107
240	Sheridan Creek	38	26	211	147	49	392	33%	108

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011-2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
241	Sheridan Creek	238	189	134	11	27	699	59%	109
242	Sheridan Creek	208	201	116	8	20	643	54%	110
243	Sheridan Creek	270	258	43	18	30	730	61%	111
244	Sheridan Creek	240	235	26	39	23	652	55%	112
245	Sheridan Creek	309	297	21	266	130	980	82%	113
246	Oregon Gulch	211	203	22	9	80	586	49%	114
247	Oregon Gulch	166	152	39	40	33	477	40%	114
248	Oregon Gulch	115	130	61	63	34	412	35%	114
249	Oregon Gulch	292	280	185	220	140	1083	91%	115
250	Oregon Gulch	111	118	218	150	285	720	61%	116
251	Sky Ranch	212	165	94	135	183	736	62%	117
252	Sky Ranch	50	34	97	47	253	356	30%	118
253	Sky Ranch	128	93	114	273	228	650	55%	118
254	Sky Ranch	130	188	71	125	274	654	55%	118
255	Sky Ranch	149	180	109	258	119	701	59%	118
256	Upper Junction City	201	191	58	37	144	641	54%	118
257	Upper Junction City	22	9	64	297	211	360	30%	118
258	Upper Junction City	55	49	120	245	92	420	35%	118
259	Upper Junction City	297	284	63	272	57	957	80%	119
260	Upper Junction City	226	214	130	201	233	900	76%	119
261	Lower Junction City	159	123	131	20	185	595	50%	120
262	Lower Junction City	49	27	142	312	237	517	43%	120
263	Lower Junction City	247	232	306	114	287	1109	93%	121
264	Below Lower Junction City (Canyon Creek Delta)	313	182	301	16	175	1048	88%	121
265	Hocker Flat	229	207	304	189	242	1070	90%	121
266	Hocker Flat	147	154	302	88	294	868	73%	122
267	Hocker Flat	83	72	309	271	99	691	58%	123
268	Hocker Flat	291	270	283	7	87	1037	87%	124
269	Hocker Flat	272	261	279	31	101	1014	85%	124
270	Hocker Flat	152	156	262	102	58	726	61%	125
271	Hocker Flat	135	181	174	34	171	660	55%	126
272	Hocker Flat	155	167	241	142	203	813	68%	127
273	Hocker Flat	59	54	260	48	109	481	40%	128
274	Upper Conner Ck	96	84	281	276	300	797	67%	129
275	Upper Conner Ck	19	29	315	254	299	649	55%	130
276	Upper Conner Ck	15	23	317	259	132	558	47%	130
277	Upper Conner Ck	23	31	316	270	288	661	56%	130
278	Upper Conner Ck	286	265	292	12	142	1063	89%	131
279	Conner Ck	209	202	288	50	205	931	78%	131
280	Conner Ck	67	60	294	97	256	631	53%	132
281	Conner Ck	223	210	271	51	257	970	82%	133

Panel ID	ESL Name	Habitat (300 cfs TA 0.50) rank	Habitat (1500 cfs) rank	Total redds (2011-2013) rank	SD of bed elevation (m) rank	SD of unit stream power (8,500 cfs) rank	Score	Score	Cluster ID
282	Conner Ck	120	101	299	265	278	852	72%	133
283	Conner Ck	228	217	300	89	145	976	82%	133
284	Conner Ck	42	47	303	193	309	664	56%	134
285	Below Conner Ck	235	209	318	148	162	1035	87%	135
286	Below Conner Ck	259	225	249	5	126	928	78%	135
287	Wheel Gulch	161	107	214	79	134	669	56%	136
288	Wheel Gulch	305	286	143	209	91	1037	87%	137
289	Wheel Gulch	298	276	87	305	195	1060	89%	137
290	Wheel Gulch	194	133	188	41	18	642	54%	138
291	Wheel Gulch	234	266	228	158	51	950	80%	139
292	Valdor Gulch	1	1	285	229	232	518	44%	140
293	Valdor Gulch	141	183	319	81	159	834	70%	141
294	Valdor Gulch	271	267	290	38	24	995	84%	141
295	Valdor Gulch	263	244	286	111	66	1013	85%	141
296	Valdor Gulch	153	115	287	122	81	733	62%	141
297	Valdor Gulch	251	246	250	14	136	948	80%	141
298	Valdor Gulch	150	142	148	282	135	724	61%	142
299	Valdor Gulch	148	144	121	107	276	679	57%	143
300	Valdor Gulch	92	89	118	293	255	619	52%	143
301	Valdor Gulch	95	91	170	274	191	636	53%	143
302	Below Valdor Gulch	199	236	295	279	230	1084	91%	144
303	Elkhorn	265	257	310	187	179	1148	96%	144
304	Elkhorn	46	45	307	179	306	664	56%	145
305	Elkhorn	136	114	305	94	231	786	66%	146
306	Elkhorn	34	17	311	216	212	593	50%	147
307	Elkhorn	51	59	308	58	53	499	42%	147
308	Elkhorn	117	96	312	155	35	679	57%	147
309	Elkhorn	100	55	313	77	50	582	49%	147
310	Pear Tree Gulch	167	132	296	80	117	777	65%	148
311	Pear Tree Gulch	198	124	222	93	25	702	59%	149
312	Pear Tree Gulch	90	62	88	315	120	503	42%	150
313	Pear Tree Gulch	10	13	89	256	121	306	26%	150
314	Pear Tree Gulch	12	5	125	260	188	372	31%	150
315	Pear Tree Gulch	36	50	219	283	74	502	42%	150
316	Below Pear Tree	16	4	314	160	10	427	36%	150
317	Below Pear Tree	175	117	165	138	7	617	52%	150
318	Below Pear Tree	129	67	166	108	12	487	41%	150

APPENDIX D

CLUSTER ANALYSIS RESULTS

APPENDIX D

CLUSTER ANALYSIS RESULTS

Cluster ID	First panel	Number of panels	Mean score	Reference ESL
1	0	2	54.0%	Hatchery
2	2	2	65.0%	Hatchery
3	4	5	77.0%	Hatchery
4	9	1	58.0%	Below Sven Olbertson
5	10	4	71.0%	Deadwood Creek
6	14	2	42.0%	Cableway
7	16	1	70.0%	Hoadly Gulch
8	17	1	54.0%	Hoadly Gulch
9	18	1	65.0%	Hoadly Gulch
10	19	2	73.5%	Sawmill
11	21	2	47.0%	Sawmill
12	23	3	81.7%	Sawmill
13	26	3	68.0%	Sawmill
14	29	1	43.0%	Upper Rush Creek
15	30	1	56.0%	Upper Rush Creek
16	31	8	79.4%	Upper Rush Creek
17	39	2	51.5%	Lower Rush Creek
18	41	5	80.0%	Dark Gulch
19	46	2	68.0%	Dark Gulch
20	48	2	44.5%	Dark Gulch
21	50	1	62.0%	Dark Gulch
22	51	1	56.0%	Dark Gulch
23	52	1	69.0%	Dark Gulch
24	53	1	60.0%	Dark Gulch
25	54	1	75.0%	Below Dark Gulch (Bucktail Hole)
26	55	1	47.0%	Lowden Ranch
27	56	1	65.0%	Lowden Ranch
28	57	6	78.2%	Lowden Ranch
29	63	4	47.8%	Trinity House Gulch
30	67	2	69.0%	Tom Lang Gulch
31	69	4	46.8%	Tom Lang Gulch
32	73	1	58.0%	Below Tom Lang Gulch
33	74	3	77.0%	Poker Bar
34	77	1	55.0%	Poker Bar
35	78	1	68.0%	Poker Bar
36	79	1	42.0%	Poker Bar
37	80	3	61.0%	Poker Bar
38	83	3	88.3%	Poker Bar
39	86	1	36.0%	China Gulch
40	87	2	56.5%	China Gulch
41	89	7	73.4%	China Gulch
42	96	1	63.0%	Limekiln Gulch
43	97	1	54.0%	Limekiln Gulch
44	98	5	78.2%	Limekiln Gulch
45	103	2	46.0%	Below Limekiln Gulch
46	105	2	66.0%	Steel Bridge Road Day Use
47	107	1	92.0%	Steel Bridge Road Day Use
48	108	2	65.5%	Steel Bridge Road Day Use
49	110	1	71.0%	Below Steel Bridge
50	111	2	39.5%	Below Steel Bridge
51	113	1	59.0%	Below Steel Bridge
52	114	1	51.0%	McIntyre Gulch
53	115	2	76.5%	McIntyre Gulch
54	117	1	67.0%	McIntyre Gulch
55	118	1	56.0%	McIntyre Gulch
56	119	2	79.5%	McIntyre Gulch
57	121	1	67.0%	Indian Creek (Vitzthum Gulch)

Cluster ID	First panel	Number of panels	Mean score	Reference ESL
58	122	1	53.0%	Indian Creek (Vitzthum Gulch)
59	123	1	58.0%	Indian Creek (Vitzthum Gulch)
60	124	5	40.2%	Indian Creek (Vitzthum Gulch)
61	129	1	82.0%	Indian Creek (Vitzthum Gulch)
62	130	1	55.0%	Indian Creek (Vitzthum Gulch)
63	131	2	67.0%	Indian Creek
64	133	11	76.4%	Indian Creek
65	144	1	66.0%	Indian Creek (Upper Douglas)
66	145	2	86.0%	Indian Creek (Upper Douglas)
67	147	1	60.0%	Douglas City
68	148	1	31.0%	Douglas City
69	149	2	79.0%	Douglas City
70	151	1	47.0%	Reading Creek
71	152	1	65.0%	Reading Creek
72	153	1	60.0%	Reading Creek
73	154	5	80.4%	Reading Creek
74	159	1	61.0%	Reading Creek
75	160	1	56.0%	Reading Creek
76	161	2	70.0%	Upper Steiner Flat
77	163	1	57.0%	Upper Steiner Flat
78	164	2	41.0%	Middle Steiner Flat
79	166	2	72.5%	Middle Steiner Flat
80	168	1	61.0%	Lower Steiner Flat (not built)
81	169	6	48.3%	Lower Steiner Flat (not built)
82	175	1	60.0%	Lower Steiner Flat (built)
83	176	1	79.0%	Lower Steiner Flat (built)
84	177	2	34.5%	Lorenz Gulch
85	179	1	56.0%	Lorenz Gulch
86	180	3	50.3%	Lorenz Gulch
87	183	3	74.3%	Lorenz Gulch
88	186	1	59.0%	Below Lorenz (the canyon)
89	187	1	83.0%	Below Lorenz (the canyon)
90	188	1	49.0%	Below Lorenz (the canyon)
91	189	1	58.0%	Below Lorenz (the canyon)
92	190	19	35.2%	Below Lorenz (the canyon)
93	209	1	65.0%	Dutch Creek
94	210	6	42.7%	Dutch Creek
95	216	1	66.0%	Dutch Creek
96	217	3	28.7%	Dutch Creek
97	220	1	46.0%	Evans Bar
98	221	1	75.0%	Evans Bar
99	222	1	66.0%	Evans Bar
100	223	1	53.0%	Evans Bar
101	224	1	59.0%	Below Evans Bar
102	225	4	40.5%	Soldier Creek
103	229	1	73.0%	Soldier Creek
104	230	7	35.6%	Chapman Ranch
105	237	1	52.0%	Deep Gulch
106	238	1	62.0%	Deep Gulch
107	239	1	55.0%	Sheridan Creek
108	240	1	33.0%	Sheridan Creek
109	241	1	59.0%	Sheridan Creek
110	242	1	54.0%	Sheridan Creek
111	243	1	61.0%	Sheridan Creek
112	244	1	55.0%	Sheridan Creek
113	245	1	82.0%	Sheridan Creek
114	246	3	41.3%	Oregon Gulch
115	249	1	91.0%	Oregon Gulch
116	250	1	61.0%	Oregon Gulch
117	251	1	62.0%	Sky Ranch
118	252	7	45.4%	Sky Ranch
119	259	2	78.0%	Upper Junction City

Cluster ID	First panel	Number of panels	Mean score	Reference ESL
120	261	2	46.5%	Lower Junction City
121	263	3	90.3%	Lower Junction City
122	266	1	73.0%	Hocker Flat
123	267	1	58.0%	Hocker Flat
124	268	2	86.0%	Hocker Flat
125	270	1	61.0%	Hocker Flat
126	271	1	55.0%	Hocker Flat
127	272	1	68.0%	Hocker Flat
128	273	1	40.0%	Hocker Flat
129	274	1	67.0%	Upper Conner Ck
130	275	3	52.7%	Upper Conner Ck
131	278	2	83.5%	Upper Conner Ck
132	280	1	53.0%	Conner Ck
133	281	3	78.7%	Conner Ck
134	284	1	56.0%	Conner Ck
135	285	2	82.5%	Below Conner Ck
136	287	1	56.0%	Wheel Gulch
137	288	2	88.0%	Wheel Gulch
138	290	1	54.0%	Wheel Gulch
139	291	1	80.0%	Wheel Gulch
140	292	1	44.0%	Valdor Gulch
141	293	5	76.2%	Valdor Gulch
142	298	1	61.0%	Valdor Gulch
143	299	3	54.0%	Valdor Gulch
144	302	2	93.5%	Below Valdor Gulch
145	304	1	56.0%	Elkhorn
146	305	1	66.0%	Elkhorn
147	306	4	49.5%	Elkhorn
148	310	1	65.0%	Pear Tree Gulch
149	311	1	59.0%	Pear Tree Gulch
150	312	7	38.6%	Pear Tree Gulch