

Appendix O

**SAN JUAN RIVER TROUT HABITAT
SUITABILITY ASSESSMENT**

R.A. Valdez & Associates

*172 West 1275 South, Logan, Utah 84321
(435) 752-9606; (435) 752-1004 FAX*

January 24, 2002

Mr. Kirk Lashmett
Bureau of Reclamation
835 East 2nd Ave., Suite 300
Durango, CO 81301

Dear Kirk:

I have run the program PHABSIM for Windows for the cross sections taken on the San Juan River in January, 1997. Enclosed are the following results:

1. Table 1 provides weighted usable area for all transects for adult rainbow trout by flow stage in the San Juan River. Note that I am providing three versions of this table; one for the South Platte adult rainbow trout curve, one for the Gosse/BOR curve, and one for the Miller results provided in the BOR report. Please note that the first two data sets are from data generated from runs that I did with PHABSIM using the South Platte and Gosse/BOR curves. The table showing the Miller results is from the BOR report. I added percentage figures to illustrate the proportion of habitat above and below Texas Hole.
2. Figures 1-3 are of the weighted usable areas by flow stage for (a) South Platte adult rainbow trout curve, and (b) Gosse/BOR adult rainbow trout curve. Please note the greater amount of habitat reflected with the South Platte curve than in the Gosse/BOR curve. The reason for this is primarily because the Gosse/BOR curve drops from suitability of 1.0 before velocities reach 1.0 fps. This explains why weighted usable area with the Gosse/BOR curve does not increase with flow—habitat is not suitable at velocities above about 1 fps. The South Platte curve is what one would expect with rainbow trout, where velocities are suitable past 2 fps. The Gosse/BOR curve reflects winter data and data collected from fish in deep, quiet holes.
3. Table 2 is a summary of habitat suitability criteria (HSC) for the South Platte rainbow trout data and for the Gosse/BOR data collected from the San Juan River. I have provided these data to document the data used in the PHABSIM model.

4. Figures 4-9 show suitability criteria for velocity, depth, and substrate, as plotted from the data presented in Table 2. Note especially the velocity criteria for the two data sets. The South Platte HSC show that habitat remains highly suitable (index of 0.81) to a velocity of 2.45 fps, while the Gosse/BOR curve decreases dramatically in suitability at velocities above 0.98 fps.

The data in their present form were difficult to run because of the following characteristics of the datasets:

1. Transects were not linked, making it impossible to run the more powerful aspects of the PHBASIM model, including MANSQ, WSP, and STDQ. This also presents problems on slope determination for the model to derive velocities. As a result, some modeled velocities had to be adjusted with Manning's "n" to more closely approximate measured velocities at a given flow.
2. The datasets were lacking calibration data on water surface elevations and velocities. Without calibrations (i.e., measures of water surface elevation and velocities at flows other than the two measured flows – 250 and 500 cfs), model precision is weak. Supplemental data are provided in the dataset, but their source is unknown. Good calibration data would have been collected with programs such as R2 Cross or WinXS Pro.
3. The data provided to me contain duplicate data sets for each transect to provide length dimension to the transect, in lieu of linking transects. This duplicate transect is treated as a second transect by the PHBASIM models. These duplicate datasets essentially say that the river for that reach is represented by a single cross section.
4. Transect measures were taken at only two flows, 250 and 500 cfs. This is in the lower range of flows for the San Juan River, below channel capacity, and makes prediction of the full range of fish habitat impossible. A better approach would have been to take at least one additional set of measurements at a flow of about 1,000 to 2,000 cfs. The rule of thumb for good cross sectional data is to apply the data to 2.5 times the highest flow and 0.5 times the lowest. This would put reliable prediction of WUA for data collected at 250 and 500 cfs at a range of 125 to 1,250 cfs. However, lack of calibration measurements and failure to link the cross sections makes even this range of habitat predictions imprecise. Nevertheless, I ran the model for a range of 200 to 4,000 cfs to see how the model would behave, knowing that WUA predictions beyond about 1,000 cfs are probably unreliable.

5. Failure to measure a broader range of flows also presented problems with the split channel cross sections. High flows likely topped the intervening bank, linking the two channels, but there were no data connecting the two channels at higher flows. I tried to adjust for this as best as possible within the constraints of the model.
6. I used the mapped lengths for each transect as provided in the BOR report to delineate the length of the cross section. This is a common strategy when single cross sections are used.

I sincerely hope that the information I have provided is helpful to Reclamation in assessment of alternative for the reoperation of Navajo Dam. Please contact me if you need additional information.

Sincerely,

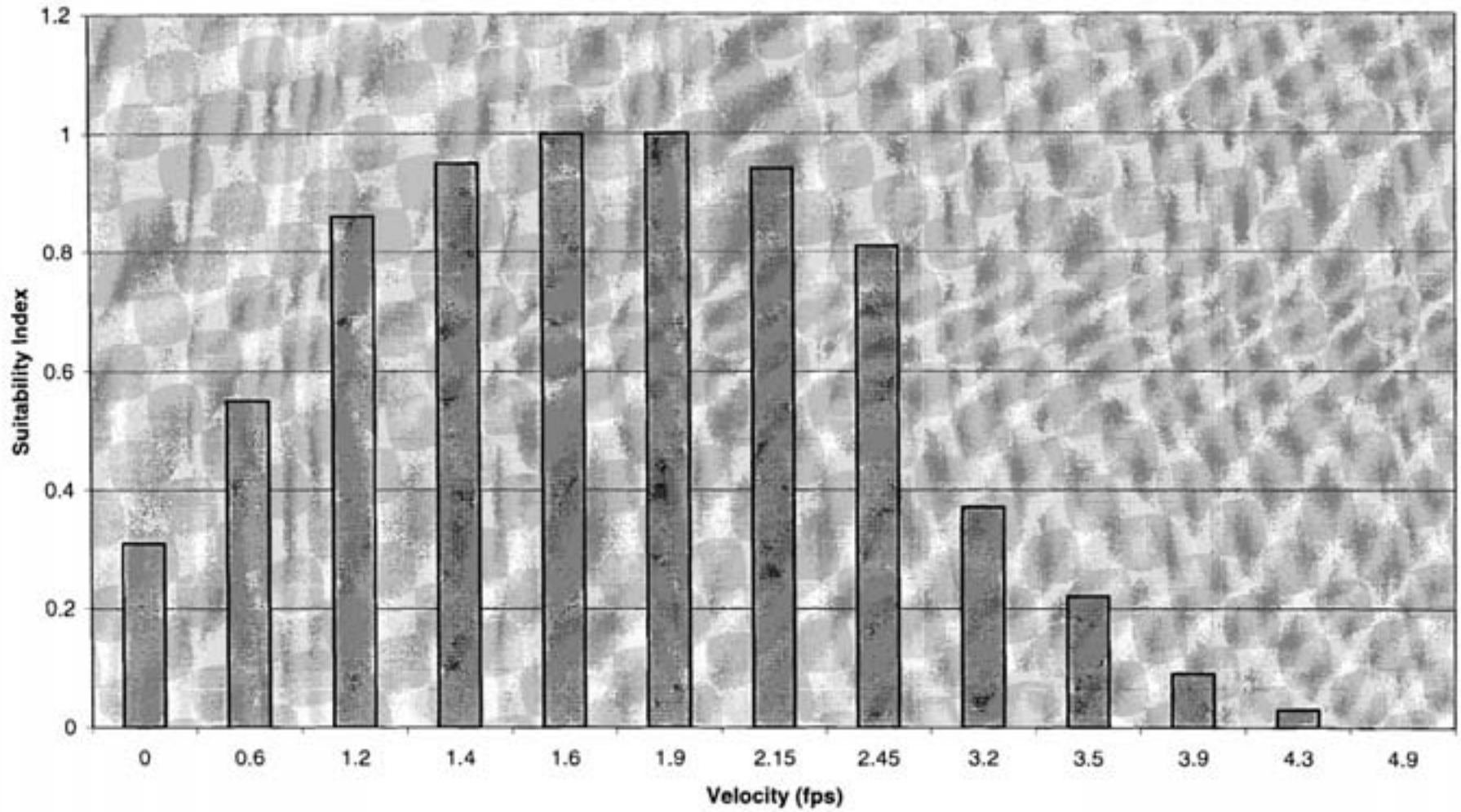
Richard A. Valdez, Ph.D.

Enclosures: 2 tables, 9 figures

cc: S. McCall

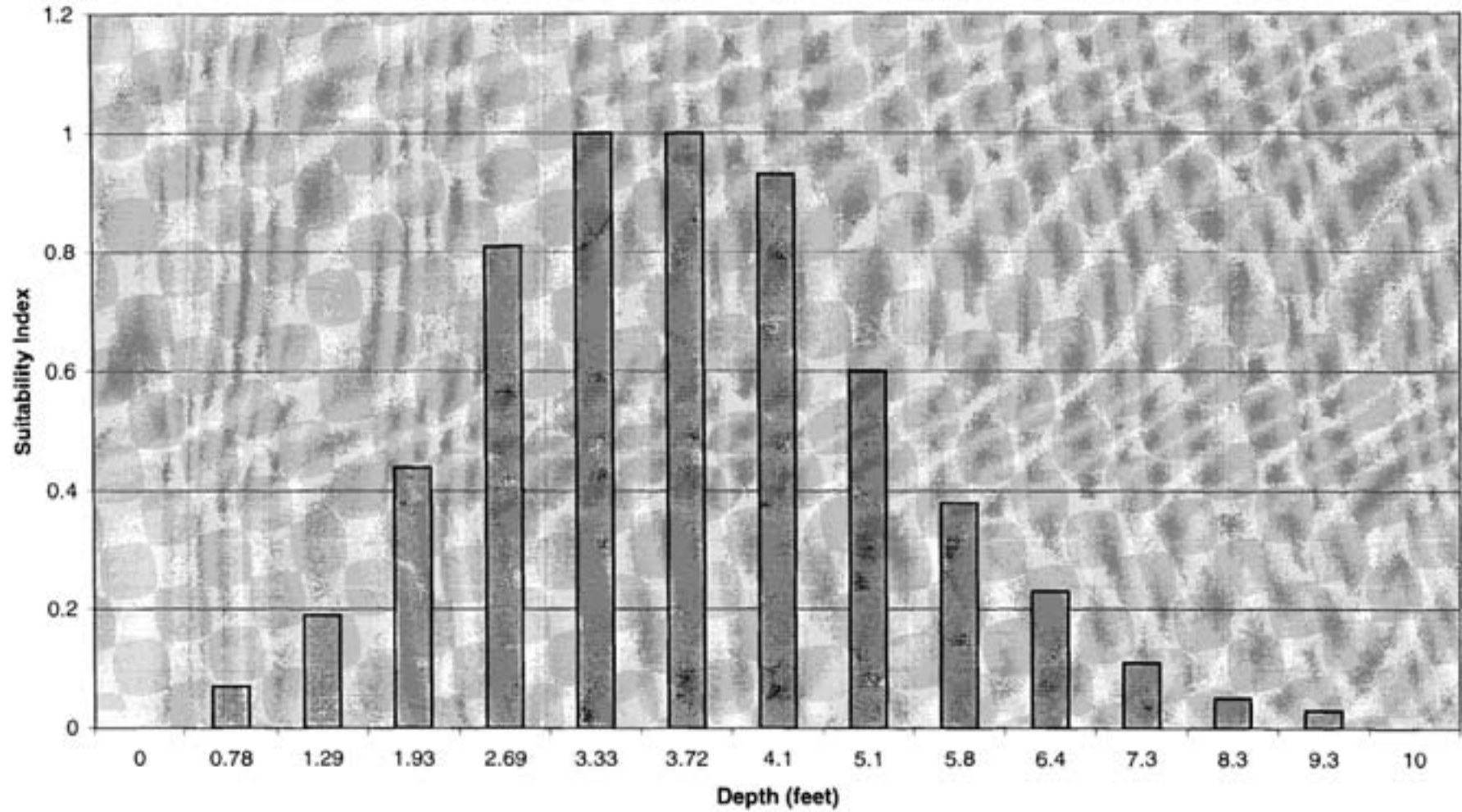
VELOCITY

■ SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT



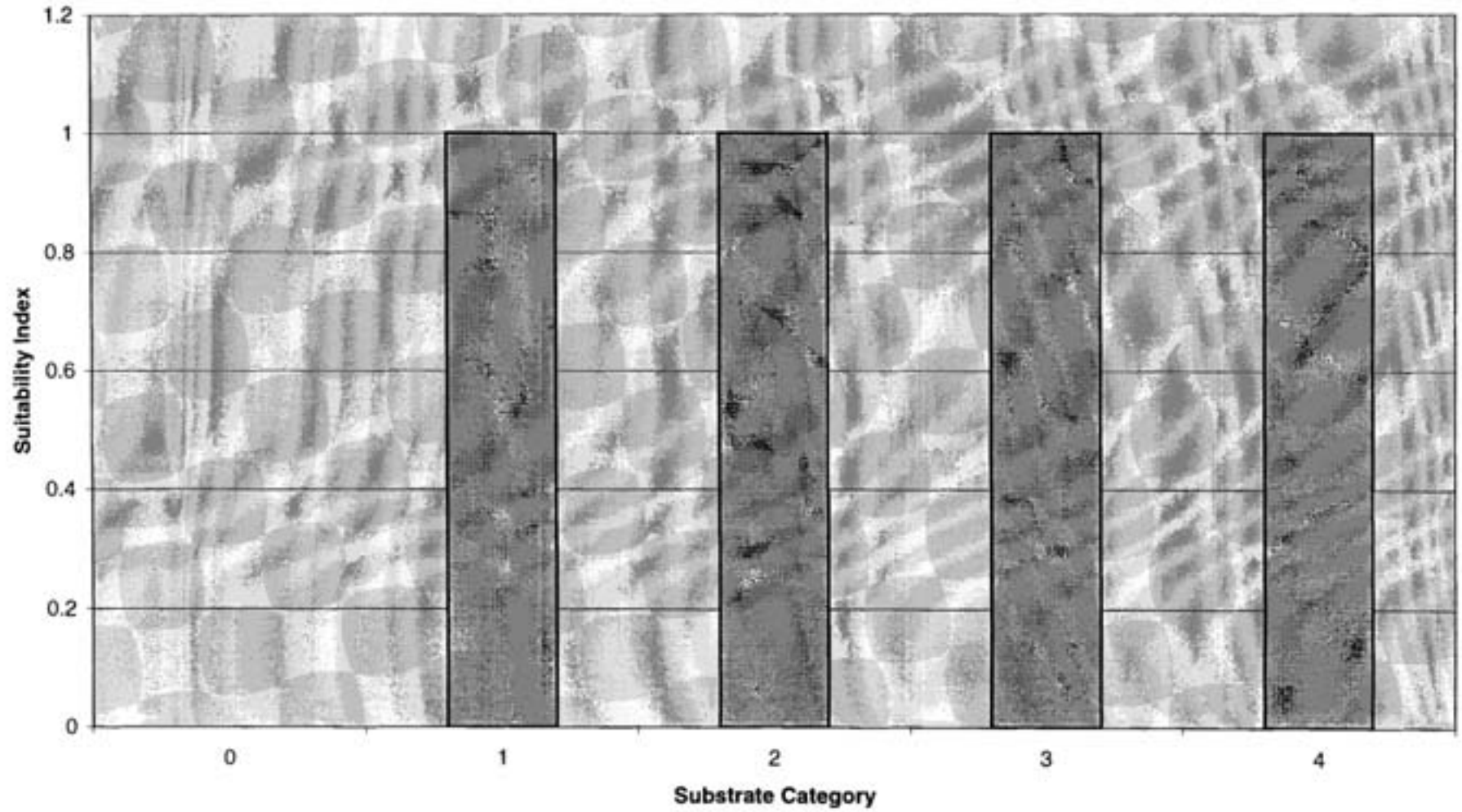
DEPTH

■ SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT



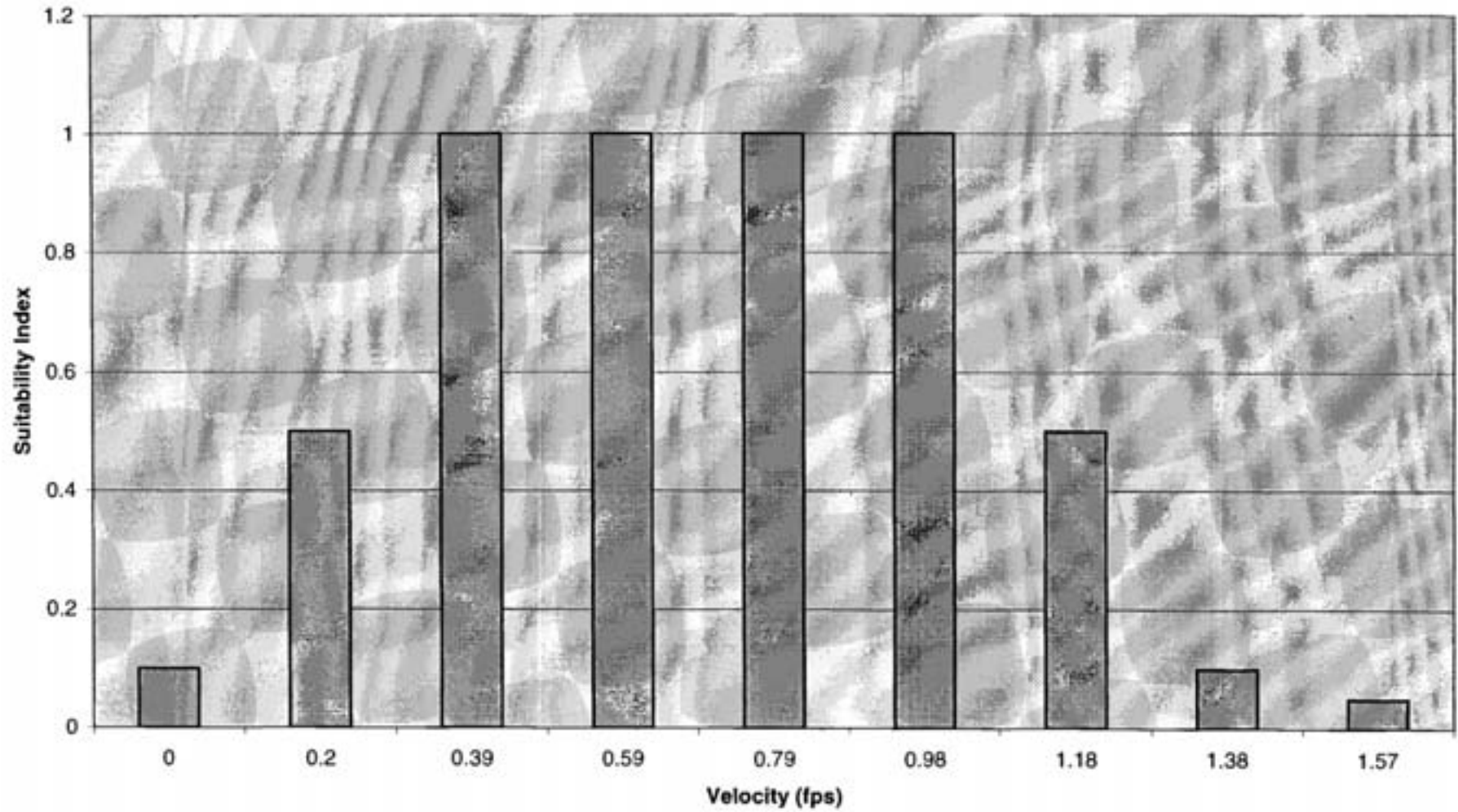
SUBSTRATE

■ SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT



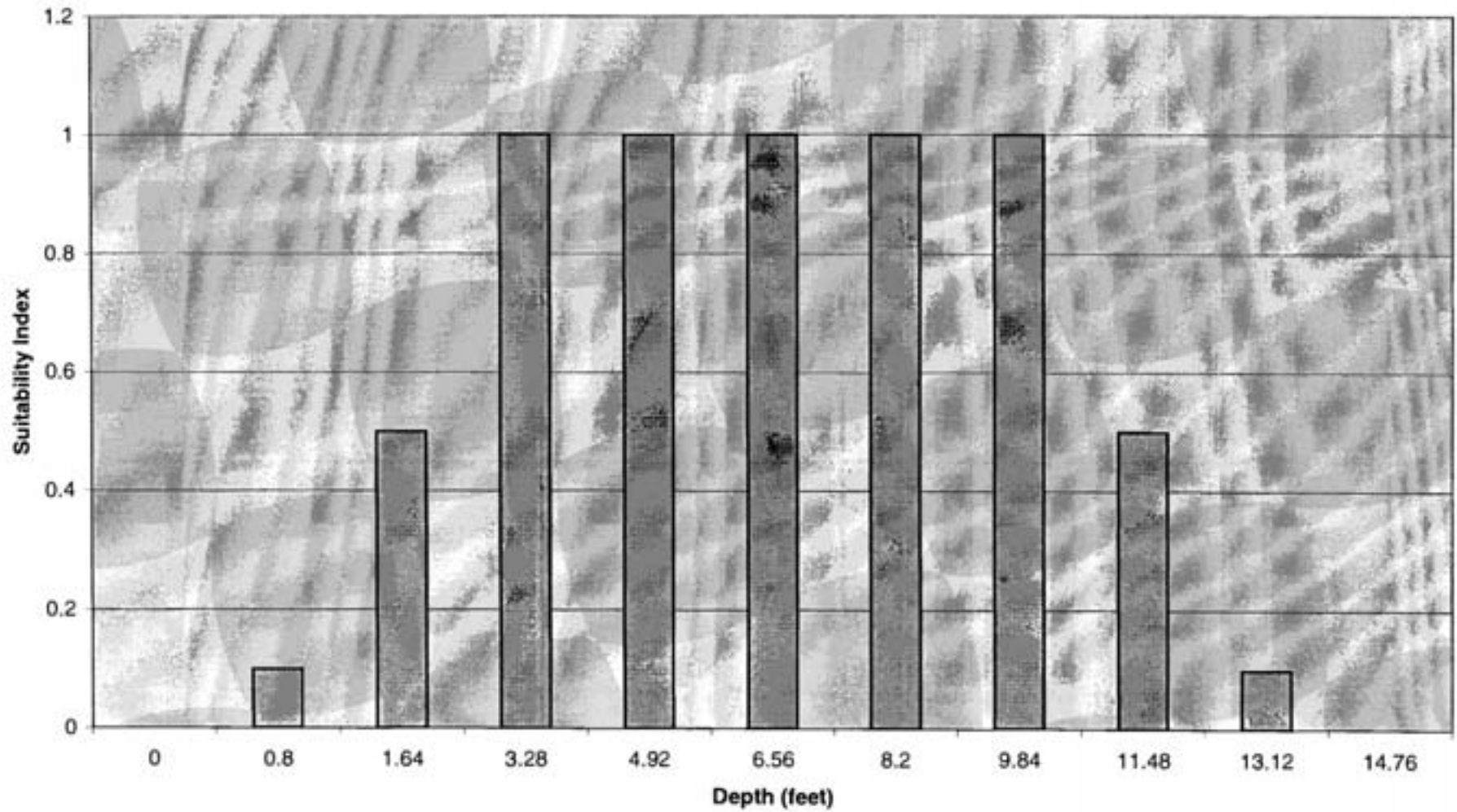
VELOCITY

■ GOSSE/BOR RAINBOW TROUT (1996) - ADULTS



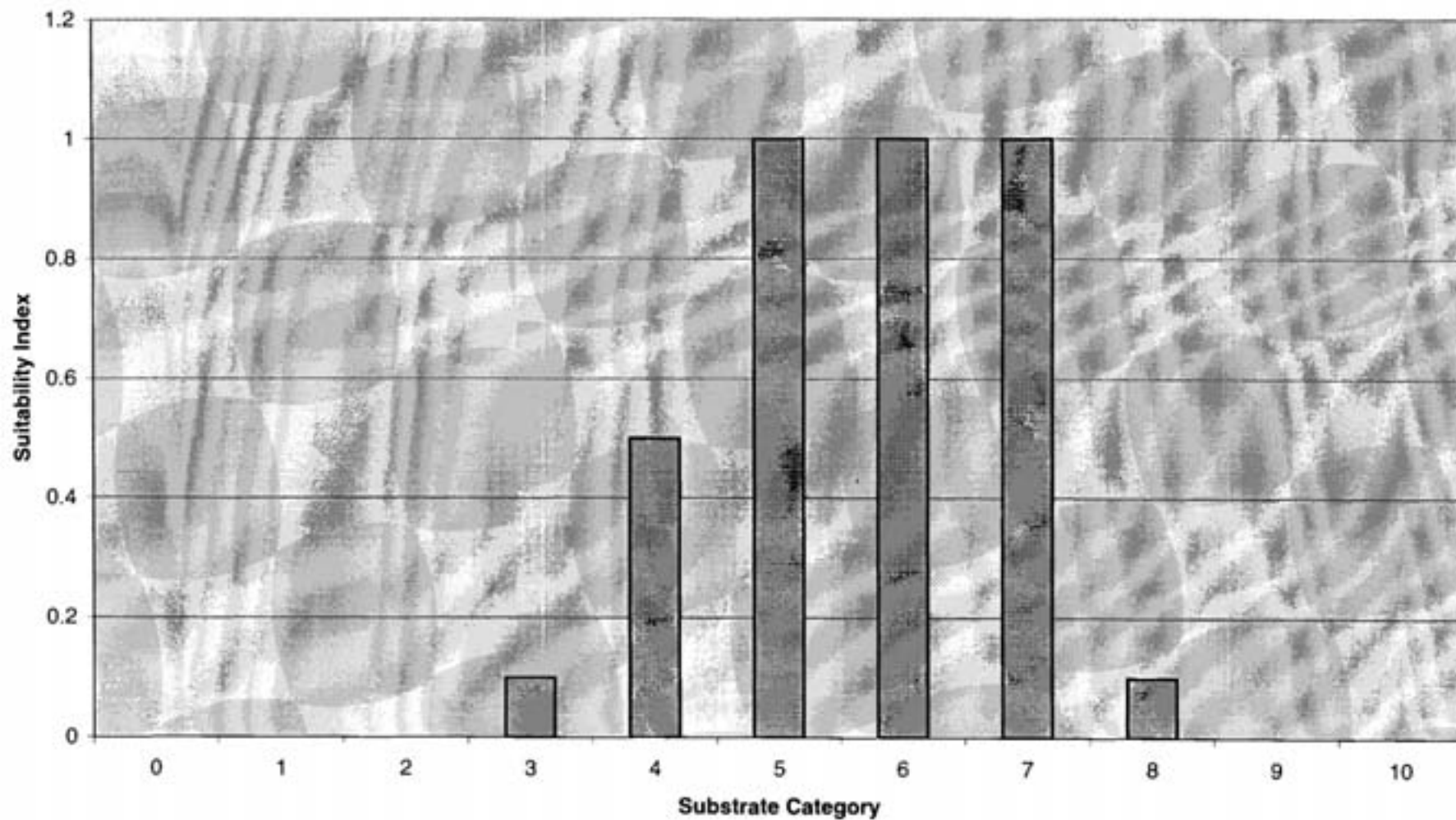
DEPTH

GOSSE/BOR RAINBOW TROUT (1996) - ADULTS



SUBSTRATE

GOSSE/BOR RAINBOW TROUT (1996) - ADULTS



HABITAT SUITABILITY CRITERIA USED FOR SAN JUAN RIVER PHABSIM

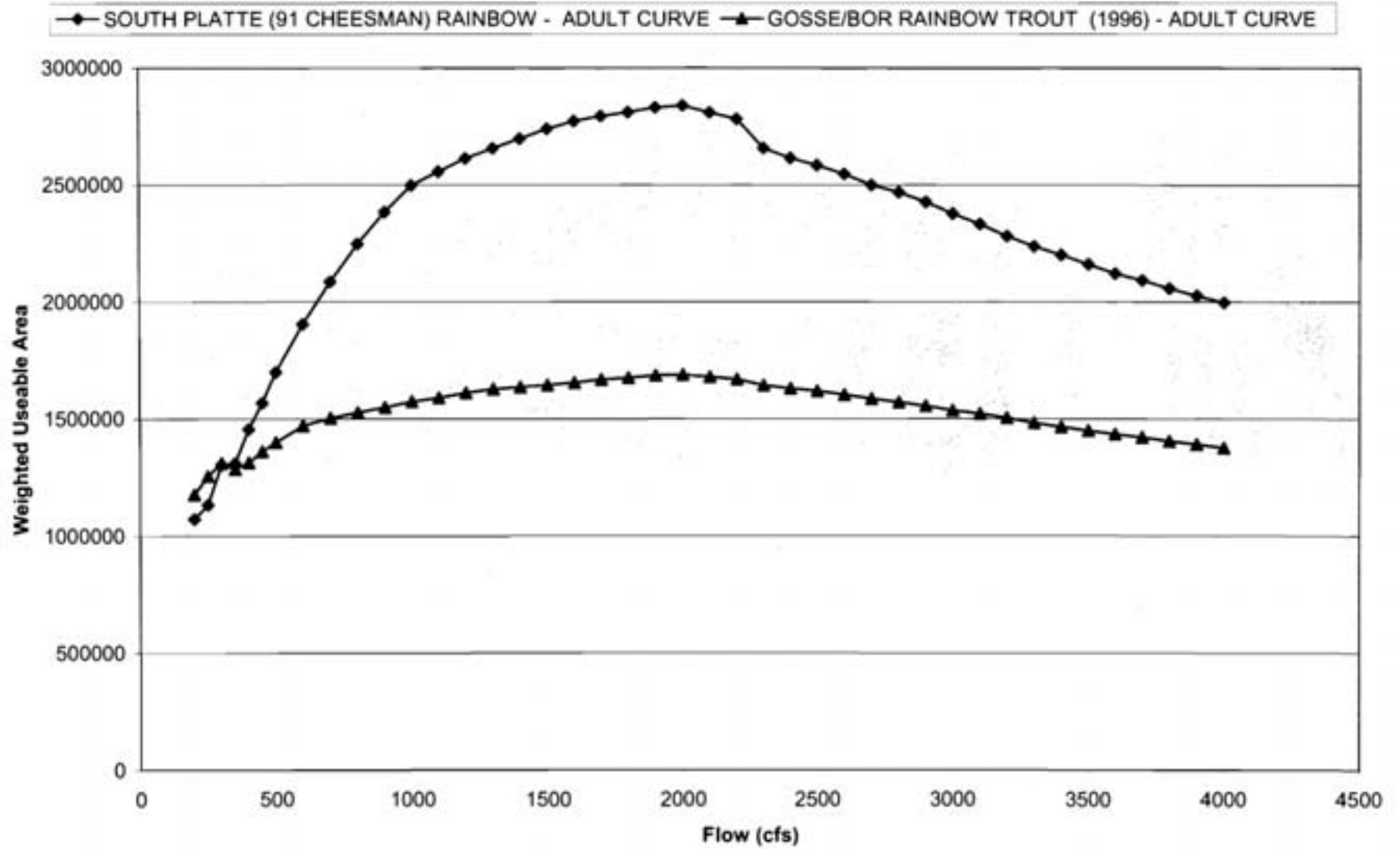
SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT

Velocity	SI	Depth	SI	Substrate	SI
0	0.31	0	0	0	0
0.6	0.55	0.78	0.07	1	1
1.2	0.86	1.29	0.19	2	1
1.4	0.95	1.93	0.44	3	1
1.6	1	2.69	0.81	4	1
1.9	1	3.33	1		
2.15	0.94	3.72	1		
2.45	0.81	4.1	0.93		
3.2	0.37	5.1	0.6		
3.5	0.22	5.8	0.38		
3.9	0.09	6.4	0.23		
4.3	0.03	7.3	0.11		
4.9	0	8.3	0.05		
		9.3	0.03		
		10	0		

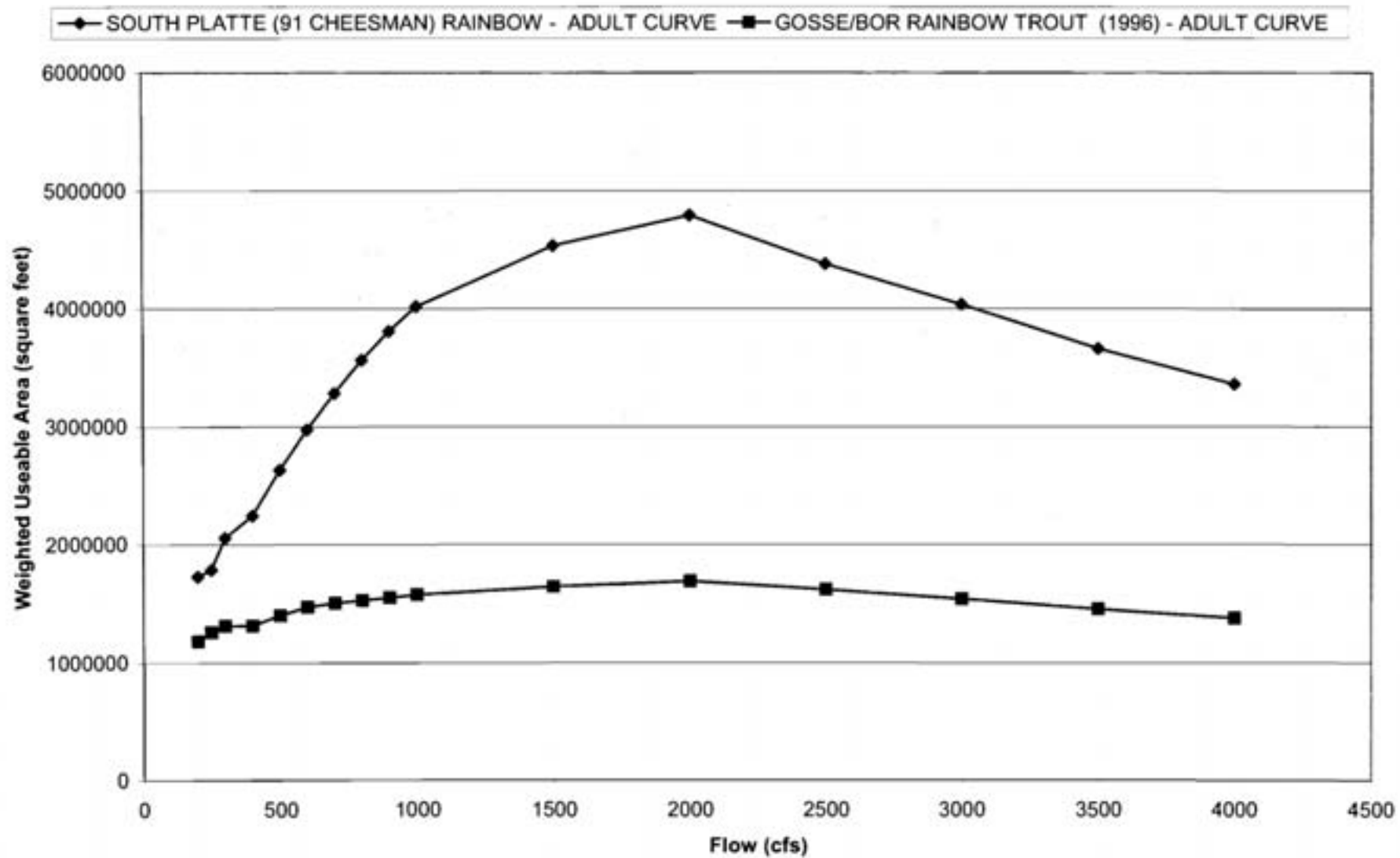
GOSSE/BOR RAINBOW TROUT (1996) - ADULTS

Velocity	SI	Depth	SI	Substrate	SI
0	0.1	0	0	0	0
0.2	0.5	0.8	0.1	1	0
0.39	1	1.64	0.5	2	0
0.59	1	3.28	1	3	0.1
0.79	1	4.92	1	4	0.5
0.98	1	6.56	1	5	1
1.18	0.5	8.2	1	6	1
1.38	0.1	9.84	1	7	1
1.57	0.05	11.48	0.5	8	0.1
		13.12	0.1	9	0
		14.76	0	10	0

SAN JUAN RIVER - ADULT RAINBOW TROUT

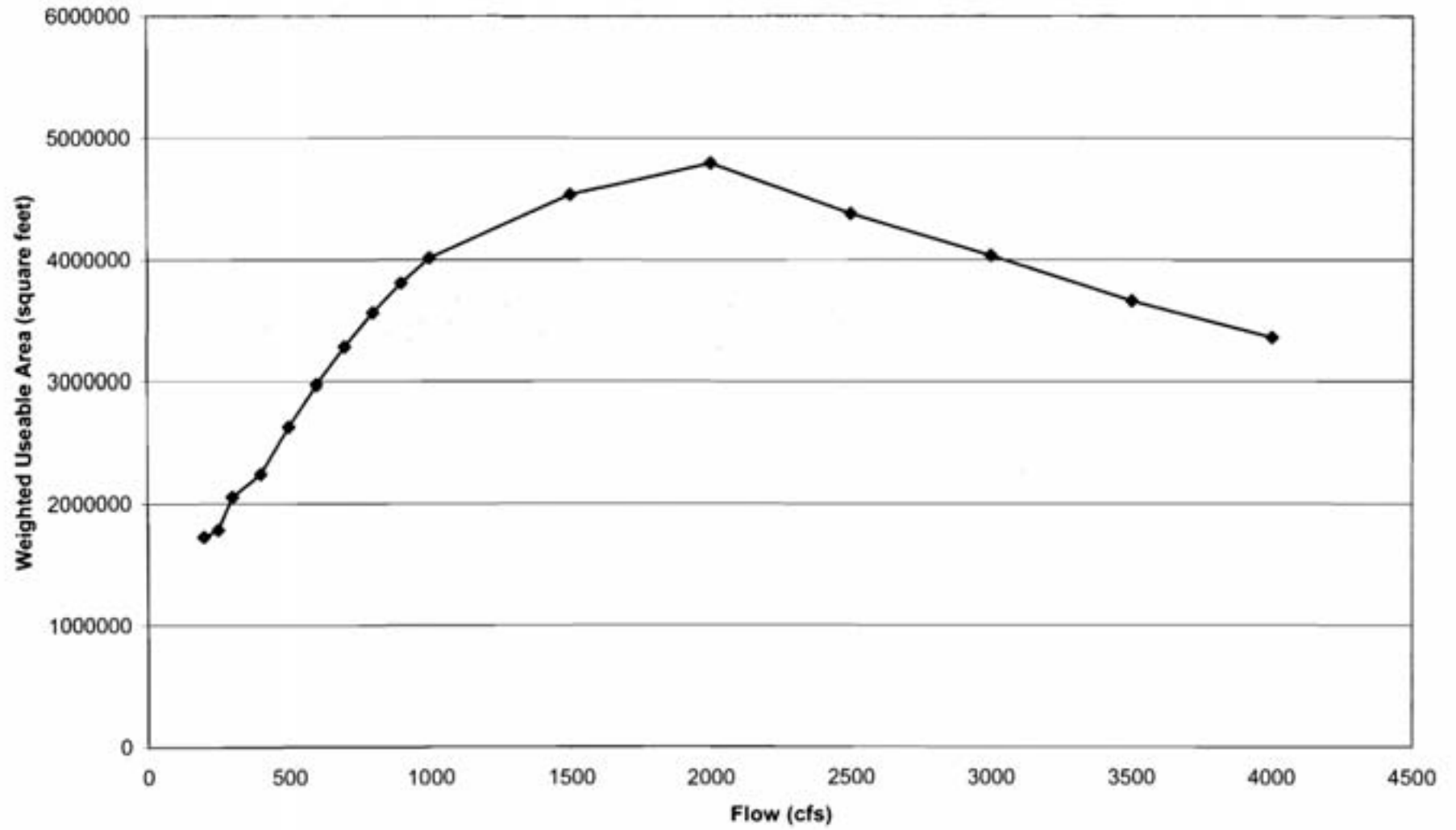


SAN JUAN RIVER - ADULT RAINBOW TROUT



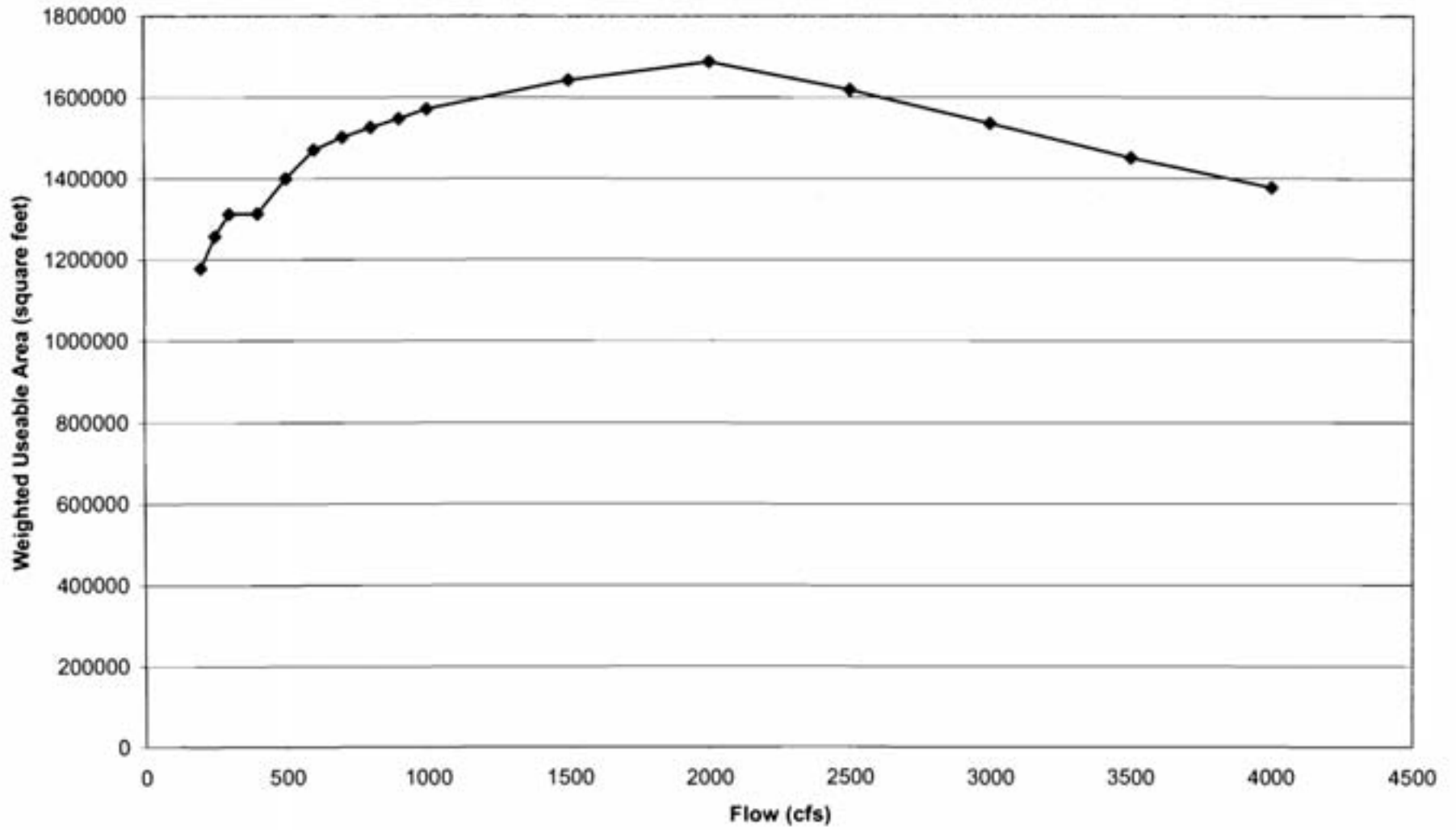
SAN JUAN RIVER - ADULT RAINBOW TROUT

—◆— SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT CURVE



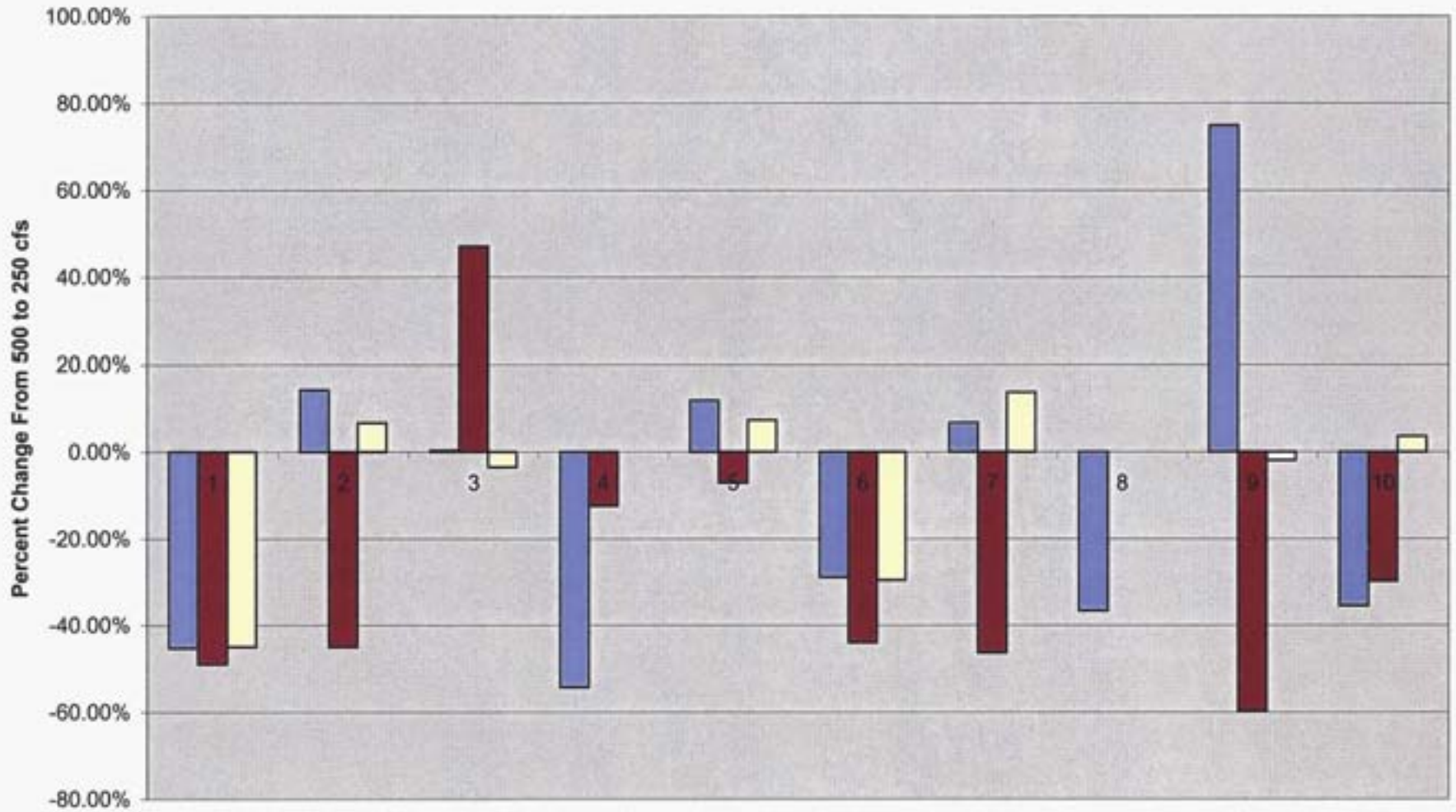
SAN JUAN RIVER - ADULT RAINBOW TROUT

—◆— GOSSE/BOR RAINBOW TROUT (1996) - ADULT CURVE



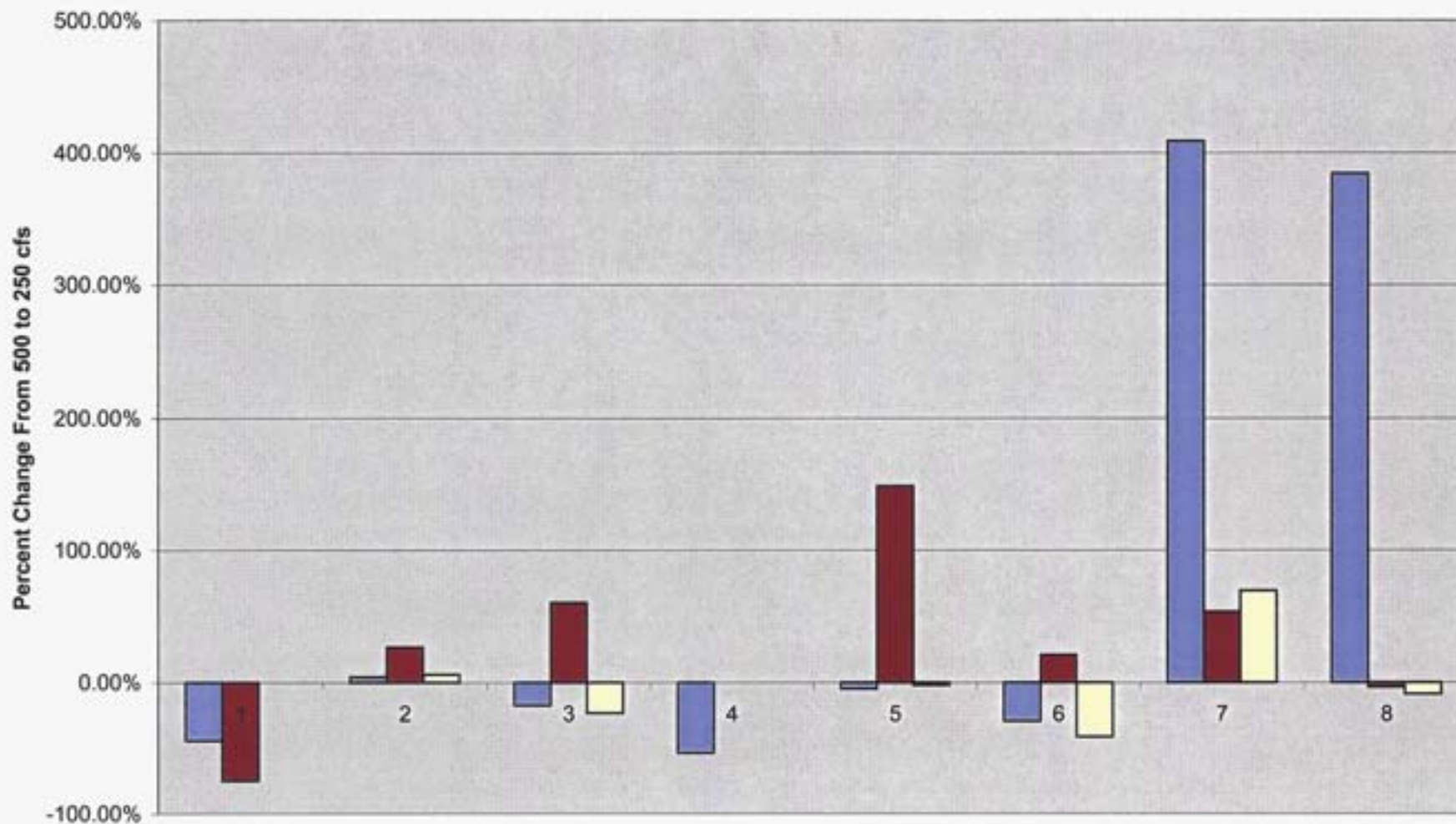
IANG WUA ABOVE TEXAS HOL

MILLER RESULTS
 SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT CURVE
 GOSSE/BOR RAIN W TROUT (1996) ADULT CURVE



CHANGE IN WUA BELOW TEXAS HOLE

■ MILLER RESULTS ■ SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT CURVE
□ GOSSE/BOR RAINBOW TROUT (1996) - ADULT CURVE



XSEC 10	XSEC 11L	XSEC 11R	XSEC 12	XSEC 13	XSEC 14	TOTAL
38259.95	0	79210.31	40045.98	91126.95	17061.31	1072559
45142.19	0	98932.32	40974.86	110974.8	20645.18	1132927
51792.54	0	128525	42602.12	127973.4	24739.16	1303516
57818.73	0	150468.9	44559.51	139979.7	24326.99	1311636
62550.25	0	186906.5	46708.19	153483.2	22837.94	1455225
67641.33	0	210873.2	48518.3	162405.5	21242.31	1566899
72282.92	0	245652.5	49551.72	170134.6	19927.9	1697098
79785.05	0	301028.3	51381.79	173682.3	15574.98	1903079
85570.27	0	353874.3	52179.57	173456.3	12004.08	2084356
89764.18	0	401709.8	53020.87	166900.1	8860.7	2245556
92605.1	0	447423	53022.48	153848.6	6454.35	2382482
95799.12	0	482283.1	52565.32	142063.4	4757.9	2495836
96252.77	0	502789.7	52089.26	121357.7	3277.27	2555305
98076.38	0	518787	51774.13	107222.2	2195.39	2610911
100296.3	0	529776.2	51502.88	92061.73	1646.55	2655077
102160.5	0	538007.5	50731.36	82360.41	1245.13	2696539
104696.2	0	544574.6	49833.6	71032.57	953.01	2738402
106582.9	0	547725.8	48823.11	62363.27	853.04	2771121
109028.1	0	546152.2	47425.34	56706.63	733.51	2792589
110789.7	0	544308.6	46597.35	49206.53	637.25	2809764
112454	0	543157.3	45722.42	44377.88	544.75	2829177
113577.6	0	535988.7	45037.23	39487.5	494.8	2838556
114726.3	0	516665.3	44651.73	34010.47	439.17	2808550
115603	0	504100.3	44558.67	28749.59	385.82	2780748
116228.7	0	493298.3	44597.96	24862.9	368.25	2655670
117473.2	0	475409	44780.21	21482.25	353.2	2613526
119248.9	0	464005.3	45111.63	19096.43	338.93	2582166
120917.8	0	452325.4	45439.25	16852.25	317.34	2545218
122579.5	0	437988.3	45612.05	14519.46	291.48	2498423
124694.2	0	428654	46329.46	12994.09	271.41	2467381
126328.8	0	420019.2	47426.66	11564.76	243.74	2425844
128082.1	0	403427.8	48664.56	10634.4	240.34	2375884
129613.7	0	391799.6	49884.93	9225.7	236.31	2330746
131471.4	0	377849.1	50899.55	7710.5	232.43	2279917
132910.1	0	367496.7	51900.93	7064.54	232.92	2236881
134552.6	0	35627.4	52686.64	6651.72	230.64	2200568
136187.2	0	742278	53652.99	6225.21	230.28	2159837
137738.1	0	343155	54232.62	5825.66	224.67	2120782
139333.5	0	337908.5	55372.62	5460.07	229.34	2092073
140953.5	0	330230.7	56873.71	5399.84	241.86	2056236
142583.9	0	326122.9	58336.36	5323.87	257.64	2026091
144389.3	0	319513	59310.44	5267.21	287.21	1995545
145884.3	0	313662.6	60329.72	5182.72	317.47	1966097
147789.1	0	308730.9	61008.69	4907.65	335.91	1936522
149255.8	0	305304.1	61905.19	5160.35	371.15	1911680
150981.9	0	301982.1	62140	5443.17	393.88	1888330
152600.8	0	299533.8	62414.45	5730.89	426.11	1867029
154045.6	0	297577.4	62490.47	5912.98	473.06	1842530
155777.8	0	296760.3	62664.32	6180.24	503.6	1825843
156998.3	0	295769.9	63018.47	6435.04	563.02	1808188
158426.6	0	295050.3	62970.29	6574.35	611.06	1791598
159613.7	0	294819.7	63091.26	6878.13	680.85	1779273
160796.9	0	295024.2	63335.86	7066.7	734.89	1768008
161962.2	0	294664.1	63535.21	7266.25	808.44	1753070
163027.9	0	295067.8	63508.35	7503.83	863.19	1742192
164104.7	0	293184.8	63620.21	7616.11	947.44	1724899
165005.3	0	294566.3	63574.1	7728.35	1016.1	1718459
166292.4	0	296280.6	63560.25	7837.98	1086.9	1711633
167264	0	298566	63132.37	7937.37	1182.74	1682699
168293.6	0	298580.1	62874.57	8169.62	1250.17	1674107
169178.1	0	0	62407.27	8300.19	1345.38	1094121
170115.2	0	0	61964.08	8538.6	1416.67	1089042

XSEC 10	XSEC 11L	XSEC 11R	XSEC 12	XSEC 13	XSEC 14	TOTAL
15341.48	0	20553.75	69437.8	33960.52	2399.78	1177006
14519.07	0	23156.39	80520.4	27033.24	3190.84	1255976
13974.02	0	25336.86	94927.28	23290.14	3962.08	1310940
14917.69	0	25418.55	106598.1	19507.98	4279.69	1285528
16007.32	0	25888.51	117111.4	17790.52	4150.5	1312593
16857.75	0	25717.13	127679.2	15936.54	3560.42	1359438
18910.16	0	23620.92	137029.8	15960.23	3494.64	1398511
23122.88	0	19376.65	146398.2	17708.86	3830.31	1469493
27088.45	0	15669.77	151409.7	20058.1	4207.44	1501191
30834.6	0	12485.01	156814.9	22189.27	4518.77	1525217
34100.01	0	10318.17	160535.8	23843.82	4788.36	1547164
36866.14	0	9317.62	160706.3	25342.38	5011.82	1571423
38722.09	0	8503.35	160246	26949.16	5197.51	1587819
40575.77	0	8622.49	158932.1	28133.23	5370.47	1606880
42354.23	0	8186.47	154251.1	29350.38	5610.91	1625068
43360.77	0	7705.33	147370.4	30747.01	5787.01	1633906
45045.5	0	7155.26	140471.6	31870.7	6019.31	1642157
46411.86	0	6698.09	134255.9	32951.02	6252.27	1652670
47514.64	0	6315.19	128324.3	34168.1	6415.72	1665407
48460.84	0	5946.99	123428.7	35171.56	6643.06	1672655
49372.71	0	5614.58	118591.7	36333.19	6828.18	1683690
50119	0	5191.72	114341.8	37317.99	7074.1	1686890
50749.41	0	4681.87	110636.1	38092.28	7310.47	1677726
50848.72	0	4544.85	107010.2	38921.59	7543.55	1667917
51407.69	0	4546.99	104154.2	39755.08	7775.67	1640582
52030.46	0	4534.01	102014.3	40588.42	8009.61	1628142
52891.42	0	4529.9	100196	41421.89	8244.74	1617612
53350.79	0	4555.45	98485.73	42255.36	8476.98	1602020
53710.36	0	4574.45	97005.13	43088.7	8706.48	1584884
54476.1	0	4600.16	95407.36	43922.18	8935.72	1569837
55198.97	0	4612.68	93433.58	44698.27	9165.95	1553813
55244.9	0	4612.15	92060.98	45401.17	9396.78	1534833
55063.53	0	4608.91	91643.09	45950.96	9622.9	1520753
55226.41	0	4590.92	89328.73	46499.56	9847.42	1504250
54813.04	0	4584.62	83612.42	47180.79	10069.4	1482783
54728.6	0	4573.59	77596.49	47710.26	10283.9	1465009
54629.02	0	4561.36	71683.17	48193.06	10498.39	1449705
54724.96	0	4544.09	66503.41	48675.88	10659.27	1434794
54916.25	0	4525.8	61500.66	49158.68	10873.75	1420473
54486.19	0	4508.97	55607.12	49762.22	11088.25	1404853
54609.12	0	4509.52	50710.55	50244.95	11302.74	1390678
54613.82	0	4508.73	45918.99	50711.23	11505.42	1376284
54484.65	0	4508.3	41883.58	51127.94	11704.93	1361089
54486.45	0	4507.79	37908.69	51440.46	11854.52	1344302
54439.91	0	4505.96	33179.3	51857.16	12054.01	1328708
54462.76	0	4502.97	29293.23	52258.75	12203.61	1313765
54357.21	0	4503.24	25490.97	52615.03	12402.68	1299244
54195.04	0	4503.52	20975.66	52838.47	12600.56	1286435
54236.43	0	4503.79	19689.98	53106.89	12748.96	1275251
54079.43	0	4504.06	19088.01	53345.8	12946.83	1263800
54357.82	0	4504.33	18568.02	53524.96	13095.22	1256087
53689.91	0	4504.61	17886.83	53701.77	13293.09	1244795
53284.61	0	4504.88	17311.28	53800.23	13429.46	1233229
53041.87	0	4505.15	16540.2	53862.79	13602.7	1222172
52841.59	0	4505.42	15795.07	53946.2	13726.15	1210678
52741.85	0	4505.61	15135.86	53997.18	13890.8	1200895
52694.07	0	4505.88	14833.11	54025.03	14004.91	1189267
52815.8	0	4506.15	14614.12	54052.87	14114.27	1180375
52942.48	0	4506.42	14396.75	54080.7	14260.13	1133526
53058.87	0	4506.61	14179.42	54117.82	14361.22	1126911
53006.04	0	0	13894.15	54145.67	14490.43	1036558
52937.27	0	0	13678.59	54173.5	14587.37	1032342

SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT CURVE						SAN JUAN RIVER - ADULT RAINBOW TROUT 01						
Discharge	XSEC 1	XSEC 2	XSEC 3	XSEC 4L	XSEC 4R	XSEC 5	XSEC 6	XSEC 7L	XSEC 7R	XSEC 8	Above TH	XSEC 9L
200	57806.26	45308.83	24740.15	88129.58	90884.43	129188.1	28491.1	100151.5	57940.04	32234.58	654874.5	0
250	70522.99	56342.12	30679.49	104624.9	93825.16	154085.5	34841.23	0	72366.09	35593.21	652880.7	0
300	82471.46	67109.91	28930.09	119456.5	97185.2	179894.2	41764.15	0	94012.24	40873.82	751697.6	0
400	110109.51	85962.31	24482.33	0	101316.7	229565.6	53320.54	0	136716.7	46209.2	787682.8	0
500	138290.95	102427.66	20855.51	0	101000.73	275044	64872.78	0	179687.6	50703.24	932882.5	0
600	167671.09	116935.54	19023.56	0	98652.45	316339.3	75572.42	0	220193.5	54593.91	1068982	0
700	198620.34	125355.79	18065.74	0	94607.57	356130.8	82754.65	0	258848.8	60450.05	1194834	0
800	232523.17	131662.39	17417.12	0	90236.89	394336.1	90048.8	0	293839	65795.74	1315859	0
900	268198.69	135301.61	17105.32	0	85508.44	427133.8	95482.52	0	327277	68431.39	1424439	0
1000	302214.63	137834.47	17104.01	0	80756.61	456272.8	99964.06	0	352776	72320.43	1519243	0
1500	456381.34	132298.47	16426.34	0	63388.37	535099.8	106172.5	0	398340.5	85824.59	1793932	0
2000	559732.25	140513.05	17677.11	0	50192.74	581387.4	111544.2	0	392060.2	98811.41	1951918	0
2500	567306.06	149187.83	17259.38	0	42970.15	575687.2	102792.3	0	339406.4	0	1794609	0
3000	491834.5	163577.47	17648	0	38528.61	558238.4	92949.05	0	295095.7	0	1657872	0
3500	402635.56	176447.67	17498.33	0	34590.57	533854.1	78073.7	0	255486.7	0	1498587	0
4000	315051.88	187369.47	18631.08	0	30191.41	513271	65986.54	0	233714.5	0	1364216	0

XSEC 9R	XSEC 10	XSEC 11L	XSEC 11R	XSEC 12	XSEC 13	XSEC 14	Below TH	TOTAL
151980.4	38259.95	0	79210.31	40045.98	91126.95	17061.31	417684.9	1727434
163377.3	45142.19	0	98932.32	40974.86	110974.8	20645.18	480046.7	1785808
176186.7	51792.54	0	128525	42602.12	127973.4	24739.16	551818.8	2055214
195056.1	62550.25	0	186906.5	46708.19	153483.2	22837.94	667542.1	2242908
206665.9	72282.92	0	245652.5	49551.72	170134.6	19927.9	764215.6	2629981
212645	79785.05	0	301028.3	51381.79	173682.3	15574.98	834097.4	2972061
212438.2	85570.27	0	353874.3	52179.57	173456.3	12004.08	889522.7	3279190
209442.9	89764.18	0	401709.8	53020.87	166900.1	8860.7	929698.6	3561417
204690.1	92605.1	0	447423	53022.48	153848.6	6454.35	958043.6	3806921
199124.3	95799.12	0	482283.1	52565.32	142063.4	4757.9	976593.1	4015079
173379.7	104696.2	0	544574.6	49833.6	71032.57	953.01	944469.6	4532334
152051.5	113577.6	0	535988.7	45037.23	39487.5	494.8	886637.3	4790474
139755.5	119248.9	0	464005.3	45111.63	19096.43	338.93	787556.6	4376775
126962.8	128082.1	0	403427.8	48664.56	10634.4	240.34	718012.1	4033756
115676.8	136187.2	0	349278	53652.99	6225.21	230.28	661250.5	3658424
102562.5	144389.3	0	319513	59310.44	5267.21	267.21	631329.6	3359761

GOSSE/BOR RAINBOW TROUT (1996) - ADULT CURVE

Discharge	XSEC 1	XSEC 2	XSEC 3	XSEC 4L	XSEC 4R	XSEC 5	XSEC 6	XSEC 7L	XSEC 7R	XSEC 8	XSEC 9L	XSEC 9R
200	79523.81	67848.55	6547.19	51574.4	141452.63	240158.2	55095.39	20575.18	15034.47	34485.86	0	323016.84
250	92345.25	70676.77	10760	56767.7	145067.42	274392.6	60217.96	0	16938.2	35892.04	0	344497.78
300	102851.52	71033.38	10996.09	61666.2	129890.47	301465.6	65681.92	0	18533.19	33997.46	0	353334.22
400	130716.54	65391.1	10794.48	0	122918.38	349811.1	59025.21	0	18936.7	33143.09	0	340907.81
500	167782.52	66302.52	11155.33	0	135201.55	389550.2	52975.03	0	17277.99	34656.47	0	324593.47
600	207582.72	74669.31	12773.05	0	136000.59	402641.2	51419.31	0	14173.46	37518.36	0	322277.97
700	247294.92	84066.57	14652.27	0	134632.22	386260.9	48188.3	0	11461.99	39520.97	0	316679.25
800	287904.91	92435.6	15161.94	0	139163.2	362720.9	48547.33	0	9132.42	39533.56	0	303774.41
900	328762.25	100493.95	15580.11	0	146982.58	343212.8	42258.68	0	7547.45	36991.82	0	291748.25
1000	365578.69	109224.57	14688.19	0	155391.14	321589.9	38037.71	0	6815.56	35877.11	0	286975.84
1500	488410	134983.25	14309.25	0	152364.13	305705.3	22780.12	0	5233.86	26771.54	0	261036.91
2000	579985.56	135352.19	18594.96	0	125534.13	335625.6	22143.71	0	3797.6	22803.08	0	229008.11
2500	617472.94	129180.19	21026.6	0	119479.72	322191	17732.53	0	3313.48	0	0	179931.91
3000	617463.38	132745.66	23147.43	0	119157.89	269273.3	14971.82	0	3373.67	0	0	147984.16
3500	612838.94	139006.72	24697.28	0	116468.88	204006.7	15042.71	0	3336.51	0	0	144542.72
4000	610306.06	142328.28	26182.24	0	105342.12	160356.2	15791.9	0	3298.02	0	0	145421.38

XSEC 10	XSEC 11L	XSEC 11R	XSEC 12	XSEC 13	XSEC 14	TOTAL
15341.48	0	20553.75	69437.8	33960.52	2399.78	1177006
14519.07	0	23156.39	80520.4	27033.24	3190.84	1255976
13974.02	0	25336.86	94927.28	23290.14	3962.08	1310940
16007.32	0	25888.51	117111.4	17790.52	4150.5	1312593
18910.16	0	23620.92	137029.8	15960.23	3494.64	1398511
23122.88	0	19376.65	146398.2	17708.86	3830.31	1469493
27088.45	0	15669.77	151409.7	20058.1	4207.44	1501191
30834.6	0	12485.01	156814.9	22189.27	4518.77	1525217
34100.01	0	10318.17	160535.8	23843.82	4788.36	1547164
36866.14	0	9317.62	160706.3	25342.38	5011.82	1571423
45045.5	0	7155.26	140471.6	31870.7	6019.31	1642157
50119	0	5191.72	114341.8	37317.99	7074.1	1686890
52891.42	0	4529.9	100196	41421.89	8244.74	1617612
55244.9	0	4612.15	92060.98	45401.17	9396.78	1534833
54829.02	0	4561.36	71583.17	48193.06	10498.39	1449705
54613.82	0	4508.73	45918.99	50711.23	11505.42	1376284

PERCENT CHANGE IN WUA FROM 500 TO 250 CFS

SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT CURVE

ABOVE TEXAS HOLE Change from 500 to 250

Transect	500	250	Sq Ft	Percent
1	138,291	70,523	-67,768	-49.00%
2	102,428	56,342	-46,086	-44.99%
3	20,856	30,679	9,824	47.10%
4L	119,456	104,625	-14,832	-12.42%
4R	101,001	93,825	-7,176	-7.10%
5	275,044	154,085	-120,959	-43.98%
6	64,873	34,841	-30,032	-46.29%
7L	100,152	100,152	0	0.00%
7R	179,688	72,366	-107,322	-59.73%
8	50,703	35,593	-15,110	-29.80%
Subtotal	1,152,491	753,032	-399,459	-34.66%

BELOW TEXAS HOLE

9L	124,674	31,359	-93,315	-74.85%
9R	163,377	206,666	43,289	26.50%
10	45,142	72,283	27,141	60.12%
11L	152,641	152,641	0	0.00%
11R	98,932	245,652	146,720	148.30%
12	40,975	49,552	8,577	20.93%
13	110,975	170,135	59,160	53.31%
14	20,645	19,928	-717	-3.47%
Subtotal	757,361	948,215	190,854	25.20%
SUMMARY	1,909,852	1,701,247	-208,605	-10.92%

GOSSE/BOR RAINBOW TROUT (1996) - ADULT CURVE

ABOVE TEXAS HOLE Change from 500 to 250

Transect	500	250	Sq Ft	Percent
1	167,783	92,345	-75,437	-44.96%
2	66,303	70,677	4,374	6.60%
3	11,155	10,760	-395	-3.54%
4L	56,768	56,768	0	0.00%
4R	135,202	145,067	9,866	7.30%
5	389,550	274,393	-115,158	-29.56%
6	52,975	60,218	7,243	13.67%
7L	20,575	20,575	0	0.00%
7R	17,278	16,938	-340	-1.97%
8	34,656	35,892	1,236	3.57%
Subtotal	952,245	783,633	-168,611	-17.71%

BELOW TEXAS HOLE

9L	21,164	21,164	0	0.00%
9R	324,593	344,498	19,904	6.13%
10	18,910	14,519	-4,391	-23.22%
11L	31,359	31,359	0	0.00%
11R	23,621	23,156	-465	-1.97%
12	137,030	80,520	-56,509	-41.24%
13	15,960	27,033	11,073	69.38%
14	3,495	3,191	-304	-8.69%
Subtotal	576,132	545,440	-30,691	-5.33%
SUMMARY	1,528,376	1,329,074	-199,303	-13.04%

MILLER RESULTS

ABOVE TEXAS HOLE

Change from 500 to 250

Transect	500	250	Sq Ft	Percent
1	91,406	50,042	-41,364	-45.25%
2	15,740	17,968	2,228	14.16%
3	1,934	1,940	6	0.31%
4L	6,004	2,747	-3,257	-54.25%
4R	69,081	77,249	8,168	11.82%
5	245,338	174,433	-70,905	-28.90%
6	20,202	21,557	1,355	6.71%
7L	76,604	48,525	-28,079	-36.65%
7R	8,896	15,559	6,663	74.90%
8	14,345	9,254	-5,091	-35.49%
Subtotal	549,550	419,274	-130,276	-23.71%

BELOW TEXAS HOLE

9L	2,630	1,473	-1,157	-43.99%
9R	250,620	261,197	10,577	4.22%
10	12,740	10,530	-2,210	-17.35%
11L	2,853	1,323	-1,530	-53.63%
11R	17,351	16,552	-799	-4.60%
12	73,530	52,060	-21,470	-29.20%
13	4,635	23,590	18,955	408.95%
14	185	896	711	384.32%
Subtotal	364,544	367,621	3,077	0.84%
SUMMARY	914,094	786,895	-127,199	-13.92%

TABLE 1. Weighted Usable Area (WU) for all transects for adult rainbow trout by flow stage in the San Juan River

SOUTH PLATTE (91 CHEESMAN) RAINBOW - ADULT CURVE

Flow (cfs)	Below TH	% of Total	Above TH	% of Total	Grand Total
200	417,685	38.94%	654,875	61.06%	1,072,559
250	480,047	42.37%	652,881	57.63%	1,132,927
300	551,819	42.33%	751,698	57.67%	1,303,516
400	667,542	45.87%	787,683	54.13%	1,455,225
500	764,216	45.03%	932,883	54.97%	1,697,098
600	834,097	43.83%	1,068,982	56.17%	1,903,079
700	889,523	42.68%	1,194,834	57.32%	2,084,356
800	929,699	41.40%	1,315,859	58.60%	2,245,558
900	958,044	40.21%	1,424,439	59.79%	2,382,482
1000	976,593	39.13%	1,519,243	60.87%	2,495,836
1500	944,470	34.49%	1,793,932	65.51%	2,738,402
2000	886,637	31.24%	1,951,918	68.76%	2,838,556
2500	787,557	30.50%	1,794,609	69.50%	2,582,166
3000	718,012	30.22%	1,657,872	69.78%	2,375,884
3500	661,250	30.62%	1,498,587	69.38%	2,159,837
4000	631,330	31.64%	1,364,216	68.36%	1,995,545

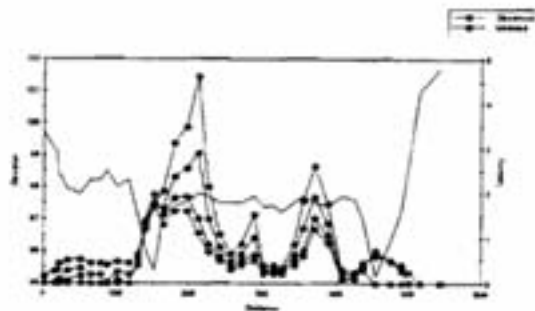
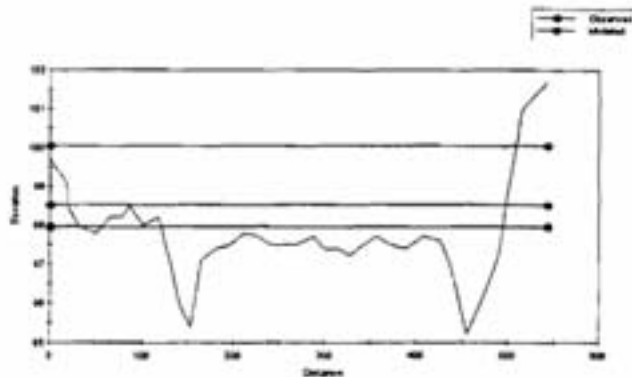
GOSSE/BOR RAINBOW TROUT (1996) - ADULT CURVE

Flow (cfs)	Below TH	% of Total	Above TH	% of Total	Grand Total
200	464,710	39.48%	712,296	60.52%	1,177,006
250	492,918	39.25%	763,058	60.75%	1,255,976
300	514,825	39.27%	796,116	60.73%	1,310,940
400	521,856	39.76%	790,737	60.24%	1,312,593
500	523,609	37.44%	874,902	62.56%	1,398,511
600	532,715	36.25%	936,779	63.75%	1,469,493
700	535,113	35.65%	966,078	64.35%	1,501,191
800	530,617	34.79%	994,600	65.21%	1,525,217
900	525,334	33.95%	1,021,830	66.05%	1,547,164
1000	524,220	33.36%	1,047,203	66.64%	1,571,423
1500	491,599	29.94%	1,150,557	70.06%	1,642,157
2000	443,053	26.26%	1,243,837	73.74%	1,686,890
2500	387,216	23.94%	1,230,396	76.06%	1,617,612
3000	354,700	23.11%	1,180,133	76.89%	1,534,833
3500	334,308	23.06%	1,115,398	76.94%	1,449,705
4000	312,680	22.72%	1,063,605	77.28%	1,376,284

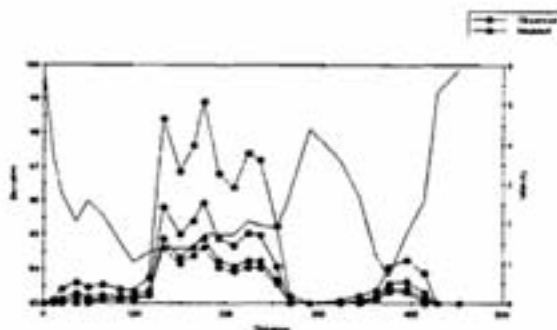
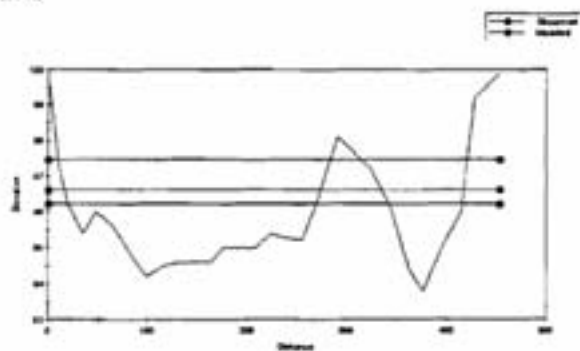
MILLERS RESULTS

Flow (cfs)	Below TH	% of Total	Above TH	% of Total	Grand Total
200	348,079	48.03%	376,647	51.97%	724,726
250	367,625	46.72%	419,279	53.28%	786,904
300	377,394	45.89%	445,032	54.11%	822,426
350	380,913	45.02%	465,180	54.98%	846,093
400	374,144	43.30%	489,862	56.70%	864,006
450	367,656	41.38%	520,853	58.62%	888,509
500	364,548	39.88%	549,555	60.12%	914,103
600	360,104	37.84%	591,549	62.16%	951,653
800	342,030	35.59%	619,069	64.41%	961,099
1000	326,968	33.30%	654,799	66.70%	981,767
2000	276,483	25.81%	794,776	74.19%	1,071,259
3000	224,162	22.58%	768,431	77.42%	992,593
4000	221,365	24.44%	684,457	75.56%	905,822
5000	198,331	24.32%	617,278	75.68%	815,609
6000	165,895	23.20%	549,283	76.80%	715,178

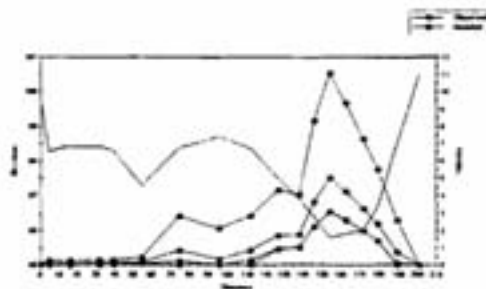
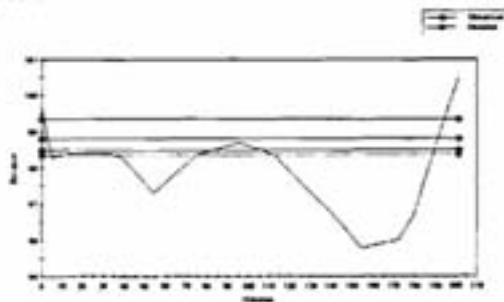
XSEC 1



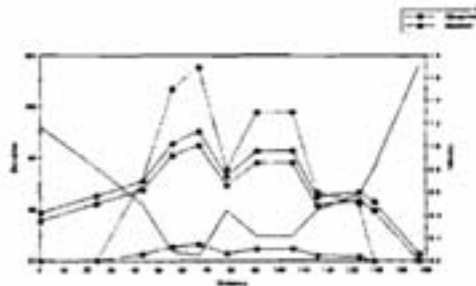
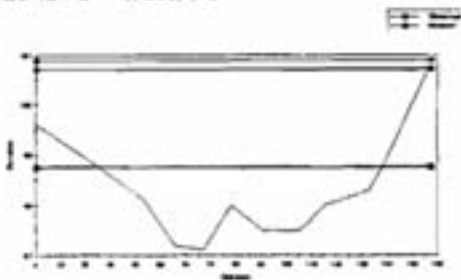
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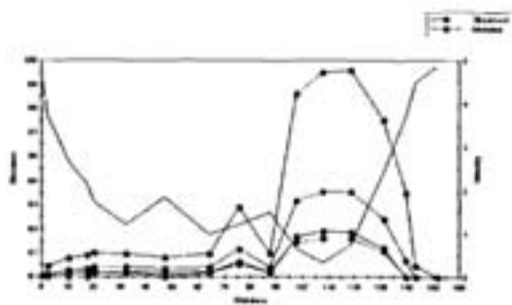
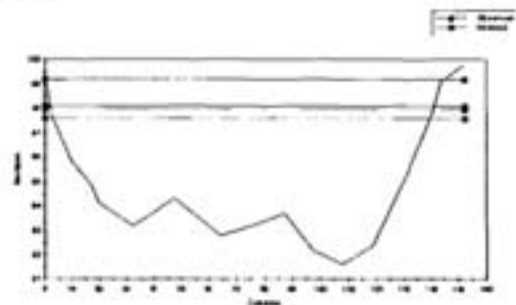
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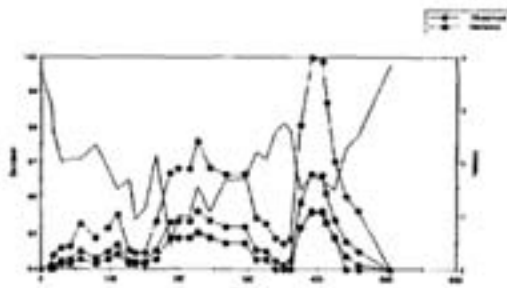
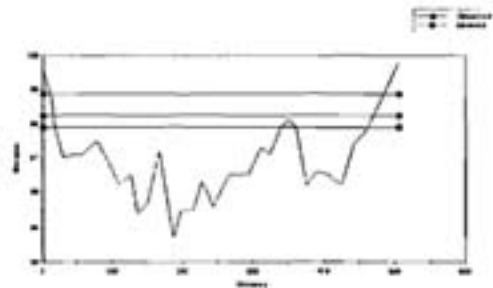
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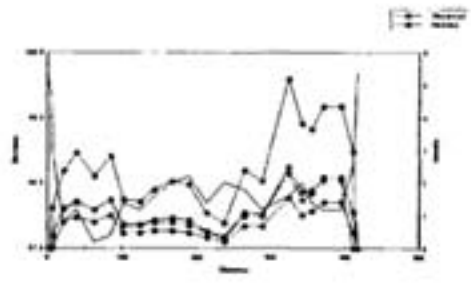
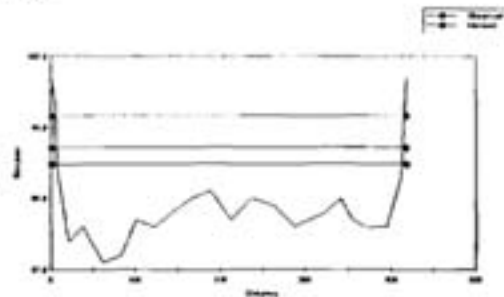
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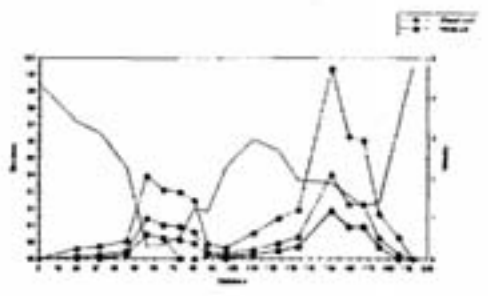
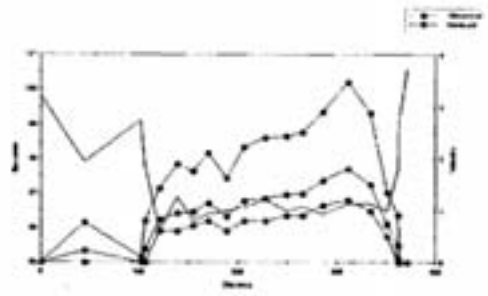


XSEC 5

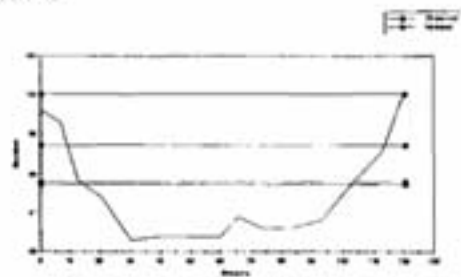


XSEC 6

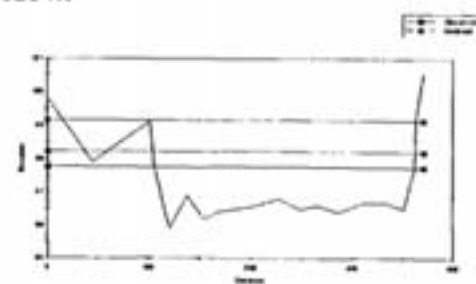




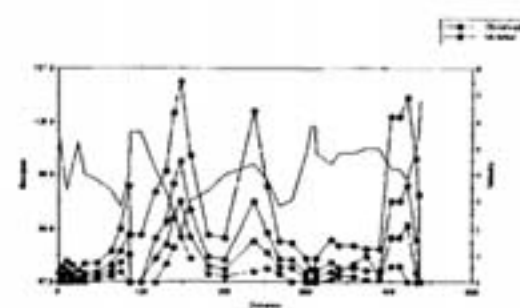
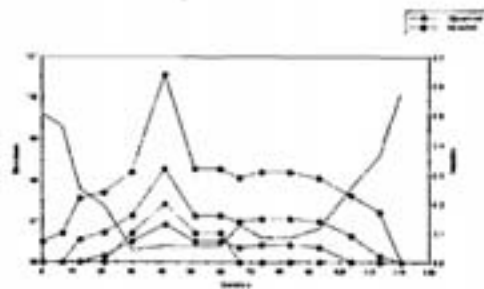
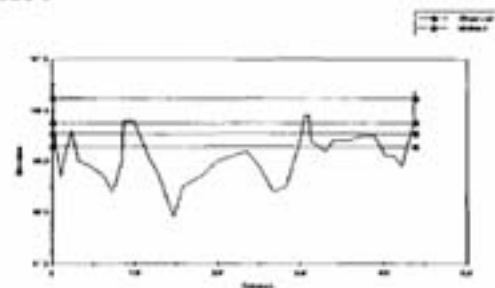
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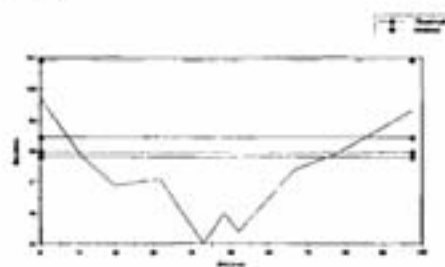
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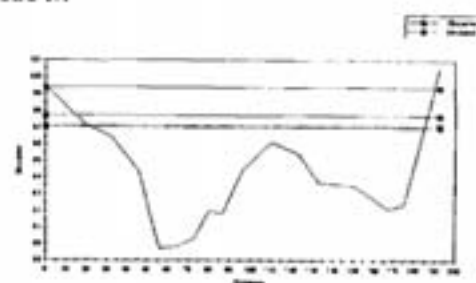
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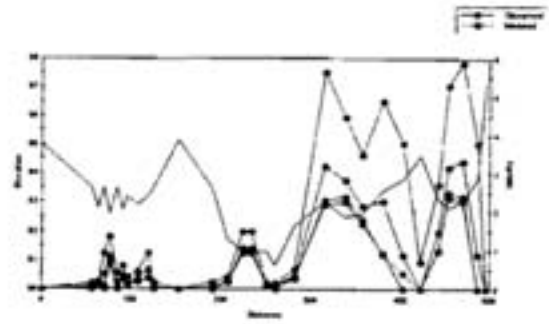
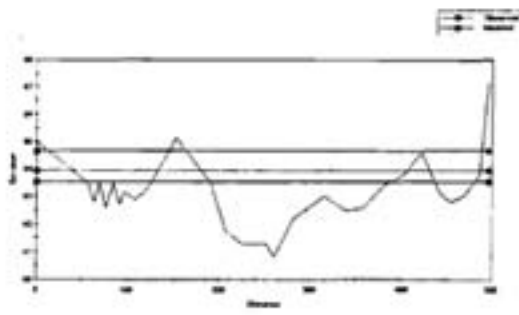
XSEC 9L



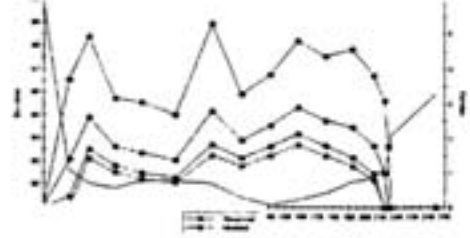
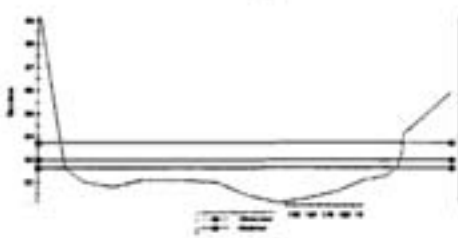
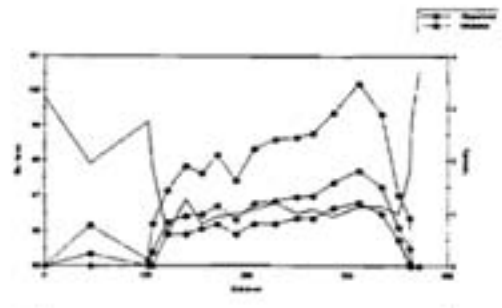
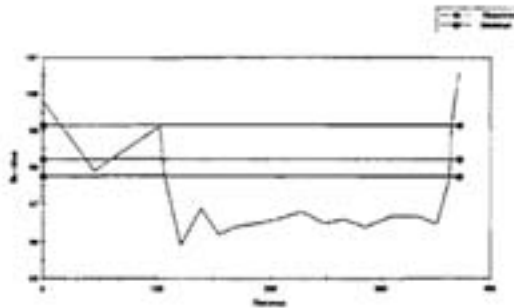
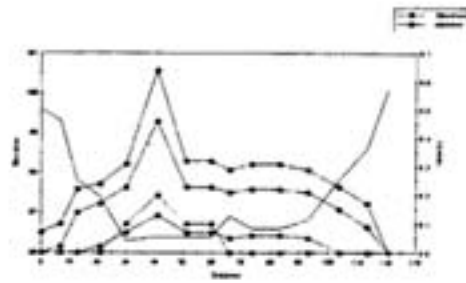
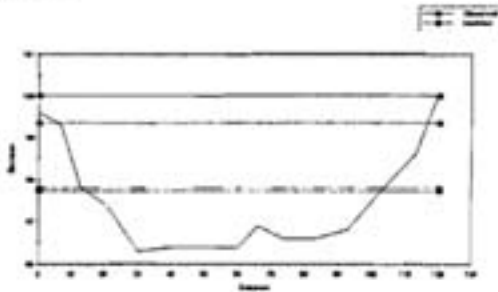
XSEC 9R



XSEC 10



XSEC 11L



XSEC 14

