

Tables

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Site Type	Site Name	Statistical Summary	HARD_WU	PH_FWU	MN_WF	ZN_WF	CU_WF	CD_WF	PB_WF	FE_WU	AL_WF
SW-044 N = 263	SNAKE R AB DEER C NR MONTEZUMA, CO. Sources: Boyer (most); USGS (WRD/GD), EPA	Average # Values Maximum Minimum	34.5 166 67.9 13.6	4.15 141 5.25 3.3	682 198 1368 58	374 198 754 29	15.7 195 129 0	1.81 163 17 0	13.9 100 213 0	911 5 1060 770	2840 196 5726 432
1-SAD N = 17 [SW-044]	SNAKE RIVER ABOVE DEER CREEK Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	50.0 17 64.6 32.3	3.88 15 4.30 3.45	1018 17 1590 513	628 17 1007 311	16.1 17 22 10	2.89 17 4.6 1.4			4528 17 6188 2513
SW-043 N = 227	DEER C AT MOUTH NR MONTEZUMA, CO. Sources: Boyer (most); USGS (WRD/GD), EPA	Average # Values Maximum Minimum	34.0 164 67.0 17.7	6.95 144 8.2 6.1	19.1 195 143 0	22.5 191 204 0	3.27 175 28 0	1.24 154 16 0	18.8 102 121 0	191 6 340 64	81.3 188 987 0
2-DAS N = 17 [SW-043]	DEER CREEK ABOVE SNAKE RIVER Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	34.3 17 46.2 23.7	7.24 15 7.80 6.02	4.2 17 8.5 2.3	4.09 17 6.9 2.1	0.90 17 2.73 0.50	0.43 17 0.51 0.32			12.5 17 51.3 2.5
3-SBD N = 17	SNAKE RIVER BELOW DEER CREEK Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	42.8 17 58.6 27.8	5.54 15 6.23 4.89	539 17 1176 224	335 17 737 138	7.16 17 14.1 1.9	1.49 17 3.4 0.7			896 17 3382 45
SW-045 N = 224	SNAKE R AB MONTEZUMA, CO. Sources: Boyer (most); USGS (GD)	Average # Values Maximum Minimum	34.5 164 71.1 12.7	5.59 140 7.3 4.51	420 194 1032 20	235 194 779 16	9.7 184 71 0	1.56 161 20 0	13.5 79 92 0	400 3 447 374	1083 193 5147 0
SW-123 N = 212	SNAKE RIVER ABV SAINTS JOHN CREEK Sources: Boyer (all samples).	Average # Values Maximum Minimum	39.5 154 77.4 19.5	6.44 134 7.5 5.51	304 184 553 2	284 184 1931 2	6.55 164 90 0	1.37 149 10 0	15 89 158 0		529 182 2059 0
4-MONT N = 17	SNAKE RIVER AT MONTEZUMA Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	45.6 17 64.4 29.2	6.13 15 6.89 5.47	412 17 618 205	306 17 518 138	3.48 17 8.9 0.85	1.16 17 1.9 0.43			230 17 793 16
USGS #s N = 10	SNAKE R AB PERU C NR MONTEZUMA, CO Sources: USGS-WRD/CDPHE/URS(EPA)/USGS-GD	Average Number of Analyses Maximum Minimum	52.3 7 69 30	6.73 10 7.3 6.2	360 10 619 160	382 10 608 179	2.80 10 6 0.9	0.76 10 1.9 0	1.45 8 2.5 0	350 8 530 240	139 10 500 12.3
5-SAP N = 17 [see USGS sites]	SNAKE RIVER ABOVE PERU CREEK Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	51.7 17 90.9 31.8	6.84 15 7.31 6.19	294 17 465 2.5	287 17 613 122	1.33 17 2.3 0.82	0.77 17 1.5 0.49			38.5 17 127 7
APENN N = 12	PERU CREEK ABOVE PENN MINE Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	44.4 12 52.9 41.1	6.72 10 7.62 6.04	114 12 292 31	132 12 262 68	1.27 12 2.49 0.82	0.48 12 0.90 0.32			18.4 12 28.1 8.0
7-PENN N = 11	PERU MINE EFFLUENT, DS FROM POND Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	371 11 405 348	4.10 9 5.01 3.26	20152 11 23111 17193	20664 11 27802 14679	2688 11 5598 651	98.8 11 129 68.8			14303 11 21455 6010
8-BPENN N = 12	PERU CREEK BELOW PENN MINE Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	52.9 12 68.7 44.0	6.07 10 6.64 5.50	729 12 1517 426	877 12 2003 420	72.51 12 257.89 11.70	3.64 12 8.81 1.50			209 12 913 19.8
9-CINN N = 12	CINNAMON GULCH AT PERU CREEK Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	48.8 12 74.8 36.6	4.17 10 4.79 3.94	1973 12 2773 1598	1173 12 1654 969	139 12 201 113	5.83 12 7.59 4.90			3477 12 5197 2830
10-BCINN N = 12	PERU CREEK BELOW CINNAMON GULCH Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	56.4 12 71.8 46.6	4.91 10 5.38 4.37	1448 12 2095 895	1367 12 2356 803	136 12 274 61.8	5.83 12 10.4 3.37			1408 12 2253 613
11-WARD N = 5	WARDEN GULCH Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	68.3 5 76.1 59.1	3.81 3 4.02 3.58	2120 5 2494 1504	1640 5 1814 1427	33.7 5 101 15.8	8.25 5 10 6.0			9373 5 12236 2808
SW-049 N = 18	PERU C AT MOUTH NR MONTEZUMA, CO. Sources: USGS/USGS-GD/CDPHE/EPA (Site 39355710)	Average Number of Analyses Maximum Minimum	39.7 15 60.3 24	6.07 15 7.20 4.4	556 18 1020 120	765 17 1700 140	39.2 18 91.4 2	2.56 18 5.11 0.46	2.98 18 13 0	364 15 1000 80.5	399 17 1785 9.7
12-PAS N = 17 [SW-049]	PERU CREEK ABOVE SNAKE RIVER Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average # Values Maximum Minimum	53.7 17 82.0 36.6	5.76 15 6.78 4.82	788 17 1103 430	956 17 1616 473	45.4 17 82.0 10.9	3.81 17 6.1 2.0			599 17 2405 16

Table 1 -- Hardness, pH, and Key Trace-Metals Statistics, Snake River Watershed

Site Type	Site Name	Statistical Summary	HARD_WU	PH_FWU	MN_WF	ZN_WF	CU_WF	CD_WF	PB_WF	FE_WU	AL_WF
SW-050	SNAKE RIVER BLW MOUTH OF PERU CREEK N = 14 Sources: USGS/USGS-GD/CDPHE/EPA (Site 39355710)	Average Number of Analyses Maximum Minimum	43.8 11 70.3 4.4	6.50 14 7.1 5.2	493 14 791 280	617 12 962 349	21.1 12 44.3 2.05	2.19 12 3.47 0.8	1.44 12 2.8 0.233	332 10 670 10	134 12 500 9.7
13-SBP	SNAKE RIVER BELOW PERU CREEK N = 17 Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average #Values Maximum Minimum	55.2 17 80.1 35.4	6.86 15 7.28 6.17	470 17 660 295	564 17 933 284	6.60 17 12.6 4.1	1.96 17 3.2 1.1			27.4 17 78.2 18.4
JGSW02	JONES GULCH AT KEYSTONE N = 24 Source: Hydrosphere/USFS	Average Number of Analyses Maximum Minimum	40.0 18 49 31	6.92 17 7.54 5.90	2.50 18 2.5 2.5	8.85 14 15 3	1.24 14 8.4 0.25	0.06 6 0.1 0.05	0.08 6 0.1 0.05	59.0 15 280 5	5.83 6 14 1.5
SW-117	SNAKE RIVER 300 FT ABV NORTH FORK N = 25 Source: A-Basin Study (Site RivRunabvNForkSnake)	Average Number of Analyses Maximum Minimum	7.01 25 7.4 6.4	343 25 570 190	469 25 690 240	4.08 25 8 2.5	1.65 25 5 0.8	0.50 25 0.5 0.5		227 18 480 80	
14-SANF	SNAKE RIVER ABOVE NF SNAKE RIVER N = 17 Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average #Values Maximum Minimum	63.4 17 74.5 37.3	7.06 15 7.34 6.32	313 17 432 239	397 17 588 250	4.14 17 5.6 2.92	1.36 17 2.1 0.94			39.4 17 135 15.4
SW-083	NORTH FORK SNAKE RIVER ABOVE SNAKE RIVER N = 11 Source: A-Basin Study (Site NorthForkSnake)	Average Number of Analyses Maximum Minimum	7.65 11 7.9 6.5	2.50 11 2.5 2.5	3.05 11 6 2.5	3.06 11 2.5 2.5	2.50 11 1.1 0.05	0.15 11 1 0.5	0.55 11 340 10	145 11 11 10	
15-NFS	NF SNAKE RIVER ABOVE SNAKE RIVER N = 17 Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average #Values Maximum Minimum	36.3 17 48.3 25.8	7.69 15 8.09 7.12	2.18 17 2.7 0.57	3.01 17 7.8 0.70	3.01 17 1.8 0.82	1.01 17 0.51 0.32			5.56 17.00 17.4 3.7
SW-082	SNAKE RIVER BELOW NORTH FORK SNAKE RIVER N = 25 Source: A-Basin Study (Site KeyCondoblnNFork)	Average Number of Analyses Maximum Minimum	7.20 25 7.5 6.4	246 25 410 140	317 25 470 150	2.96 25 7 2.5	1.12 25 2.5 0.5	0.54 25 1 0.5		226 18 450 70	
16-SBNF	SNAKE RIVER BELOW NF SNAKE RIVER N = 17 Source: CU-Boulder (Sabre Duran & Andrew Todd)	Average #Values Maximum Minimum	48.0 17 64.5 32.8	7.29 15 7.81 6.65	218 17 318 151	248 17 397 144	3.23 17 4.8 1.10	0.80 17 1.6 0.47			35.4 17 61.6 8.2
CCSW02	CAMP CREEK AT KEYSTONE N = 22 Source: Hydrosphere/USFS	Average Number of Analyses Maximum Minimum	41.0 19 62 33	6.83 19 7.69 5.55	21.4 20 47 2.5	26.4 16 47 13	1.16 16 3.6 0.25	0.06 7 0.1 0.05	0.21 7 0.5 0.05	1244 16 7740 110	46.7 7 110 13
SRSW01	SNAKE RIVER INTAKE (BELOW CAMP CREEK) N = 21 Source: Hydrosphere/USFS	Average Number of Analyses Maximum Minimum	45.6 17 62 30	7.26 20 7.9 6.9	186 20 310 76	271 21 400 19	3.91 16 10 0.5	0.51 18 1.9 0.1	2.30 17 19 0.1	665 17 6670 5	28.0 1 1 5
SW-061	SNAKE RIVER AT CONF (AB KEYSTONE GULCH) N = 38 Source: River Watch (Site 51)	Average Number of Analyses Maximum Minimum	51.3 36 150 24	7.05 38 8.15 5.66	179 35 273 100	307 32 423 211	4.62 36 16.6 1.4	0.72 36 1.27 0.34	0.10 37 3.7 0	172 37 565 0	
KGSW01	UPPER KEYSTONE GULCH AT KEYSTONE N = 15 Source: Hydrosphere/USFS	Average Number of Analyses Maximum Minimum	31.4 13 57 27	6.73 11 7.43 5.67	3.54 12 15 2.5	6.30 10 10 2	1.96 11 17 0.25	0.26 6 0.8 0.05	0.13 6 0.5 0.05	65.9 11 320 20	4.00 5 5 3
MZSW01	MOZART CREEK AT KEYSTONE N = 20 Source: Hydrosphere/USFS	Average Number of Analyses Maximum Minimum	30.4 17 39 24	6.98 17 7.50 6.09	23.9 18 48 6	17.1 13 26 10	0.73 13 1.6 0.25	0.05 4 0.05 0.05	0.05 4 0.05 0.05	339 13 760 180	21.8 4 41 10
KGSW03	LOWER KEYSTONE GULCH AT KEYSTONE N = 15 Source: Hydrosphere/USFS	Average Number of Analyses Maximum Minimum	34.8 13 41 28	6.79 13 7.57 5.76	4.04 13 8 2.5	6.42 12 15 3	0.85 12 2.8 0.25	0.05 6 0.05 0.05	0.08 6 0.2 0.05	218 12 410 80	28.0 6 44 12
SW-062	SNAKE RIVER AT KSS BR (BL FREY GULCH) N = 41 Source: River Watch (Site 52)	Average Number of Analyses Maximum Minimum	46.7 38 60 22	7.19 40 8.06 5.25	159 37 270 84	258 33 380 170	4.40 38 15.1 1.1	0.64 38 1.2 0.33	0.04 39 1.7 0	188 40 590 0	
SW-055	SNAKE RIVER BELOW KEYSTONE, CO. N = 174 Sources: CDH? (2 sites), USGS (GD), EPA	Average # Values Maximum Minimum	49.8 149 75 24	7.60 113 10.2 6.6	170 69 384 0.5	218 66 466 0.5	4.61 66 14 0.5	0.83 66 1.7 0	1.85 66 4 0	210 66 1740 0	23.3 14 41 0.5

Note: Adapted from Appendix Table B-3.

Table 2 – Summary of Applicable Stream Standards, Upper Colorado Basin Segments 6 and 7

A. Stream Segment

COUCBL06

Snake River, Source to Dillon Reservoir

<u>Chronic:</u>	Cd ug/L	Cu ug/L	Fe dis ug/L	Fe trec ug/L	Pb ug/L	Mn ug/L	Zn ug/L
Avg HRD-calculated TVS	1.2	4.3	300	1000	1.0	50	56.8
Type of Stream Standard	TVS	TVS	WS	Numeric	TVS	TVS/WS	TVS
Temporary Modification	2.3	17					654
SWQC-USGS/UC-Boulder 85th% _s	2.0	16.6	542	194	9.0	664	462
# Values	841	911	896	232	518	949	934
Exceedance (85th% > TVS)?	No	No	Yes	No	Yes	Yes	No
<u>Acute:</u>							
TVS acute, based on minimum HRD segment	0.12	0.71			1.9	1054.8	8.3
Type of Stream Standard	TVS (tr)*	TVS	none	none	TVS	none	TVS
SWQC-USGS max * exceed?	20	129			213	1590	1931
	1	1			1	1	1
*Need to apply to TR-Cd.							
TVS Based On The Hardness Equations							
<u>Average Hardness as CaCO₃</u> = 42.1 mg/L All TMs units in ug/L							
<u>Lowest Hardness:</u> 4.40 mg/L N= 920							
Trace Metal Species	D-Cd	D-Cu			D-Pb	D-Mn	D-Zn
Acute	Standard	1.67	6.0		24.9	2238	56.3
	Trout	1.45	NA		NA	NA	NA
Chronic	Standard	1.18	4.28		0.97	1237	57
	Trout	NA	NA		NA	NA	NA
SWQC-USGS/UC-Boulder data reported as 15th, 85th percentile or mean as appropriate; zero values are below reporting limit.							
Max values include reporting limit if all below.							
<u>Lowest Hardness TVS:</u>							
Parameter	Cd	Cu			Pb	Mn	Zn
Acute	Standard	0.14	0.71		1.9	1055	8.3
	Trout	0.12	NA		NA	NA	NA
Average	1.4	9.2	256	246	7.8	411	313
# Values	841	911	896	232	518	949	934
Maximum	20	129	2010	2150	213	1590	1931
Minimum	0	0	0	0	0	0	0
85th %tile	CD WF	CU WF	FE WF	FE WU	PB WF	MN WF	ZN WF
	2.0	16.6	542	194	9.0	664	462
(50th %)							

B. Stream Segment

COUCBL07

Peru Creek, Source to Snake River

<u>Chronic:</u>	Cd ug/L	Cu ug/L	Fe dis ug/L	Fe trec ug/L	Pb ug/L	Mn ug/L	Zn ug/L
Avg HRD-calculated TVS	1.3	4.8		1000	1.1	1295	63.9
Type of Stream Standard	TVS	TVS		Numeric	TVS	TVS	TVS
Temporary Modification	5.2	79			6.7		1380
SWQC-USGS/UC-Boulder 85th% _s	6.9	146	339	145	8.0	1678	1578
# Values	139	139	139	52	69	139	139
Exceedance (85th% > TVS)?	Yes	Yes		No	Yes	Yes	Yes
<u>Acute:</u>							
TVS acute, based on Min Hardness	0.04	0.3			0.6	753	3.53
Type of Stream Standard	TVS (tr)*	TVS	none	none	TVS	none	TVS
SWQC-USGS max * exceed?	10.4	274			42.0	3240	2356
	1	1			1	1	1
*Need to apply to TR-Cd.							
TVS Based On The Hardness Equations							
<u>Average Hardness as CaCO₃</u> = 48.4 mg/L All TMs units in ug/L							
<u>Lowest Hardness:</u> 1.60 mg/L N= 169							
Trace Metal Species	D-Cd	D-Cu			D-Pb	D-Mn	D-Zn
Acute	Standard	1.94	6.8		29.1	2345	63
	Trout	1.69	NA		NA	NA	NA
Chronic	Standard	1.31	4.82		1.13	1295	64
	Trout	NA	NA		NA	NA	NA
SWQC-USGS/UC-Boulder data reported as 15th, 85th percentile or mean as appropriate; zero values are below reporting limit.							
Max values include reporting limit if all below.							
<u>Lowest Hardness TVS:</u>							
Parameter	Cd	Cu			Pb	Mn	Zn
Acute	Standard	0.05	0.27		0.6	753	3.5
	Trout	0.04	NA		NA	NA	NA
Average	3.7	69.9	222	931	4.9	870	852
# Values	139	139	139	52	69	139	139
Maximum	10.4	274	2460	18600	42	3240	2356
Minimum	0	0.5	2.2	6.2	0	2.6	2.5
85th %tile	CD WF	CU WF	FE WF	FE WU	PB WF	MN WF	ZN WF
	6.9	146	339	145	8.0	1678	1578
(50th %)							

Table 4 - Post-Remediation Metals Concentrations and Chronic Toxicity Criteria

Dis-TM, ug/L	Snake R. Location	Pre-Remediation	Post Remediation	Rainbow Trout	Brown Trout	Brook Trout	TVS*
Zinc	Below Peru Creek	691	594 - 496	47	200	853	57
	Above North Fork	479	398 - 316	47	200	853	57
	Below North Fork	311	263 - 215	47	200	853	57
Manganese	Below Peru Creek	493	419 - 345	790	2700	1360	1237
	Above North Fork	343	292 - 240	790	2700	1360	1237
	Below North Fork	246	209 - 172	790	2700	1360	1237
Copper	Below Peru Creek	21.1	17.9 - 14.8	1.9	30.8	12.9	4.3
	Above North Fork	4.06	3.5 - 2.8	1.9	30.8	12.9	4.3
	Below North Fork	2.96	2.5 - 2.1	1.9	30.8	12.9	4.3
Cadmium	Below Peru Creek	2.19	1.9 - 1.5	1.4	1.4	2.4	1.2
	Above North Fork	1.65	1.4 - 1.2	1.4	1.4	2.4	1.2
	Below North Fork	1.12	1.0 - 0.78	1.4	1.4	2.4	1.2
Lead	Below Peru Creek	1.44	1.22 - 1.0	5.6	45	57	1
	Above North Fork	0.5	0.4 - 0.35	5.6	45	57	1
	Below North Fork	0.54	0.45 - 0.38	5.6	45	57	1
Aluminum	Below Peru Creek	134	114 - 94	87	87	87	87
	Above North Fork	39	33 - 27	87	87	87	87
	Below North Fork	35	30 - 25	87	87	87	87

* Avg hardness 42.1 mg/l