

FINAL DESIGN REPORT FOR SAND CREEK RESTORATION

Prepared For:

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Mixed Flow Analysis for GSB Design

HEC-RAS Plan: PROP - Shear River: Sand Creek Reach: Reach 1-3

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear LOB (lb/sq ft)	Shear Chan (lb/sq ft)	Shear ROB (lb/sq ft)	Shear Total (lb/sq ft)
Reach 1-3	12465	2-YR	154.80	7177.88	7178.61	7178.61	7178.93	0.030420	6.96	41.58	64.16	1.44	1.23	1.37	1.19	1.23
Reach 1-3	12465	5-YR	475.50	7177.88	7179.32	7179.32	7179.97	0.026123	10.15	88.42	68.89	1.50	2.10	2.33	2.00	2.08
Reach 1-3	12465	100-YR	1643.00	7177.88	7180.95	7180.95	7182.35	0.021154	15.19	207.29	74.10	1.53	3.56	4.04	3.50	3.59
Reach 1-3	12366		Culvert													
Reach 1-3	12253	2-YR	154.80	7168.00	7171.46		7171.46	0.000084	1.04	246.90	78.44	0.10	0.02	0.02	0.02	0.02
Reach 1-3	12253	5-YR	475.50	7168.00	7173.17		7173.21	0.000200	2.09	387.71	85.37	0.16	0.05	0.06	0.05	0.06
Reach 1-3	12253	100-YR	1643.00	7168.00	7176.23		7176.40	0.000477	4.41	667.79	97.68	0.27	0.18	0.25	0.19	0.20
Reach 1-3	12070	2-YR	154.80	7168.31	7171.20		7171.37	0.001757	4.03	73.24	51.57	0.43	0.09	0.30	0.14	0.15
Reach 1-3	12070	5-YR	475.50	7168.31	7172.74	7171.68	7173.03	0.002101	5.93	170.81	69.96	0.51	0.22	0.55	0.30	0.31
Reach 1-3	12070	100-YR	1643.00	7168.31	7175.41	7173.79	7176.03	0.002822	9.50	372.93	81.57	0.64	0.60	1.21	0.79	0.77
Reach 1-3	11880	2-YR	154.80	7165.99	7167.13	7166.96	7167.44	0.022922	8.19	44.92	59.63	1.35	1.18	1.63	0.99	1.08
Reach 1-3	11880	5-YR	475.50	7165.99	7167.90	7167.90	7168.45	0.024415	11.92	103.07	89.83	1.52	1.92	2.91	1.63	1.75
Reach 1-3	11880	100-YR	1643.00	7165.99	7169.24	7169.24	7170.29	0.024519	17.01	234.62	104.53	1.66	3.52	4.97	3.32	3.42
Reach 1-3	11569	2-YR	154.80	7159.96	7160.56	7160.41	7160.68	0.021267	5.15	60.99	108.23	1.17	0.75	0.80	0.75	0.75
Reach 1-3	11569	5-YR	475.50	7159.96	7161.21	7160.88	7161.43	0.016137	7.31	134.07	116.84	1.15	1.12	1.26	1.19	1.15
Reach 1-3	11569	100-YR	1643.00	7159.96	7162.43	7161.98	7163.02	0.018608	12.33	284.92	183.68	1.38	2.34	2.86	2.64	2.48
Reach 1-3	11368	2-YR	154.80	7153.99	7155.09	7155.09	7155.56	0.029398	9.06	34.56	39.74	1.52	1.49	2.02	1.80	1.65
Reach 1-3	11368	5-YR	475.50	7153.99	7156.03	7156.03	7157.00	0.029471	13.67	75.69	66.36	1.69	2.52	3.75	3.06	2.77
Reach 1-3	11368	100-YR	1643.00	7153.99	7158.33	7158.33	7159.43	0.016147	16.75	260.10	142.36	1.42	2.58	4.38	2.23	2.50
Reach 1-3	11206	2-YR	154.80	7151.03	7153.22	7152.81	7153.42	0.003125	4.22	66.72	70.43	0.54	0.13	0.37	0.19	0.18
Reach 1-3	11206	5-YR	475.50	7151.03	7154.77	7153.83	7154.97	0.001922	4.93	224.81	137.95	0.47	0.17	0.41	0.19	0.19
Reach 1-3	11206	100-YR	1643.00	7151.03	7156.19	7155.63	7156.69	0.003815	8.76	454.11	174.08	0.70	0.58	1.15	0.52	0.62
Reach 1-3	11103	2-YR	154.80	7150.00	7151.47	7151.22	7151.78	0.013942	7.55	42.92	38.45	1.10	1.16	1.28	0.65	0.96
Reach 1-3	11103	5-YR	475.50	7150.00	7151.95	7151.95	7153.35	0.045519	16.48	62.81	44.51	2.08	4.89	5.53	2.80	3.97
Reach 1-3	11103	100-YR	1643.00	7150.00	7153.69	7153.69	7154.54	0.019817	16.66	283.22	143.67	1.53	2.40	4.57	2.34	2.43
Reach 1-3	10925	2-YR	154.80	7148.00	7149.06	7148.97	7149.27	0.014420	3.68	42.10	68.49	0.83		0.55		0.55
Reach 1-3	10925	5-YR	475.50	7148.00	7149.87	7149.61	7150.15	0.009001	4.22	112.74	104.87	0.72		0.60		0.60
Reach 1-3	10925	100-YR	1643.00	7148.00	7150.98	7150.75	7151.66	0.010242	6.61	248.49	129.57	0.84		1.22		1.22
Reach 1-3	10797	2-YR	154.80	7145.39	7147.43	7147.17	7147.59	0.011767	3.24	47.85	59.02	0.63	0.07	0.60		0.59
Reach 1-3	10797	5-YR	475.50	7145.39	7148.14	7147.91	7148.55	0.018364	5.17	93.64	117.85	0.78	0.29	1.55	0.52	1.40
Reach 1-3	10797	100-YR	1643.00	7145.39	7149.35	7149.14	7149.97	0.017191	7.00	284.94	156.61	0.77	1.00	2.74	1.61	1.94
Reach 1-3	10713	2-YR	154.80	7144.30	7146.46		7146.63	0.011196	3.33	49.44	107.80	0.67		0.52	0.05	0.32
Reach 1-3	10713	5-YR	475.50	7144.30	7147.27		7147.45	0.008697	3.75	155.78	145.09	0.54		0.80	0.39	0.58
Reach 1-3	10713	100-YR	1643.00	7144.30	7148.40		7148.77	0.010588	5.59	371.61	212.30	0.61	0.53	1.71	1.13	1.15
Reach 1-3	10617	2-YR	154.80	7143.44	7145.51		7145.64	0.010027	2.94	52.66	68.26	0.59		0.48		0.48
Reach 1-3	10617	5-YR	475.50	7143.44	7146.31		7146.56	0.010761	4.07	138.59	194.63	0.58	0.19	1.01	0.14	0.48
Reach 1-3	10617	100-YR	1643.00	7143.44	7147.56		7147.86	0.008825	5.16	414.87	235.18	0.55	0.74	1.51	0.72	0.97
Reach 1-3	10543	2-YR	154.80	7142.46	7144.87		7144.99	0.007069	2.87	54.39	81.05	0.57		0.35	0.02	0.29
Reach 1-3	10543	5-YR	475.50	7142.46	7145.60		7145.83	0.008151	3.97	142.32	166.60	0.58	0.06	0.74	0.33	0.43
Reach 1-3	10543	100-YR	1643.00	7142.46	7146.85		7147.21	0.008072	5.50	392.82	213.49	0.59	0.63	1.36	0.80	0.92

Sub-critical flow analysis for
Shear/Velocity evaluation of
Naturalized Channel Design

HEC-RAS Plan: PROP - Shear River: Sand Creek Reach: Reach 1-3

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear LOB (lb/sq ft)	Shear Chan (lb/sq ft)	Shear ROB (lb/sq ft)	Shear Total (lb/sq ft)
Reach 1-3	12465	5-YR	475.50	7177.88	7179.32	7179.32	7179.97	0.026123	10.15	88.42	68.89	1.50	2.10	2.33	2.00	2.08
Reach 1-3	12465	100-YR	1643.00	7177.88	7180.95	7180.95	7182.35	0.021154	15.19	207.29	74.10	1.53	3.56	4.04	3.50	3.59
Reach 1-3	12465	FIS	2600.00	7177.88	7181.73	7181.73	7183.86	0.024157	18.86	264.83	74.32	1.70	5.08	5.78	5.02	5.13
Reach 1-3	12366	Culvert														
Reach 1-3	12253	5-YR	475.50	7168.00	7173.17		7173.21	0.000200	2.09	387.71	85.37	0.16	0.05	0.06	0.05	0.06
Reach 1-3	12253	100-YR	1643.00	7168.00	7176.23		7176.40	0.000477	4.41	667.79	97.68	0.27	0.18	0.25	0.19	0.20
Reach 1-3	12253	FIS	2600.00	7168.00	7177.89		7178.16	0.000628	5.72	834.91	104.36	0.32	0.27	0.39	0.29	0.30
Reach 1-3	12070	5-YR	475.50	7168.31	7172.74		7173.03	0.002101	5.93	170.81	69.96	0.51	0.22	0.55	0.30	0.31
Reach 1-3	12070	100-YR	1643.00	7168.31	7175.41	7173.79	7176.03	0.002822	9.50	372.93	81.57	0.64	0.60	1.21	0.79	0.77
Reach 1-3	12070	FIS	2600.00	7168.31	7176.83		7177.69	0.003201	11.46	493.61	87.66	0.70	0.85	1.65	1.11	1.07
Reach 1-3	11880	5-YR	475.50	7165.99	7167.90	7167.90	7168.45	0.024415	11.92	103.07	89.83	1.52	1.92	2.91	1.63	1.75
Reach 1-3	11880	100-YR	1643.00	7165.99	7169.24	7169.24	7170.29	0.024519	17.01	234.62	104.53	1.66	3.52	4.97	3.32	3.42
Reach 1-3	11880	FIS	2600.00	7165.99	7170.00	7170.00	7171.39	0.024399	19.54	316.99	109.70	1.72	4.37	6.12	4.30	4.37
Reach 1-3	11569	5-YR	475.50	7159.96	7161.21	7160.88	7161.43	0.016137	7.31	134.07	116.84	1.15	1.12	1.26	1.19	1.15
Reach 1-3	11569	100-YR	1643.00	7159.96	7162.43	7161.98	7163.02	0.018608	12.33	284.92	183.68	1.38	2.34	2.86	2.64	2.48
Reach 1-3	11569	FIS	2600.00	7159.96	7163.29	7162.67	7164.03	0.016394	14.13	405.84	208.71	1.37	2.60	3.40	3.08	2.80
Reach 1-3	11368	5-YR	475.50	7153.99	7156.03	7156.03	7157.00	0.029471	13.67	75.69	66.36	1.69	2.52	3.75	3.06	2.77
Reach 1-3	11368	100-YR	1643.00	7153.99	7158.33	7158.33	7159.43	0.016147	16.75	260.10	142.36	1.42	2.58	4.38	2.23	2.50
Reach 1-3	11368	FIS	2600.00	7153.99	7159.15	7159.15	7160.55	0.016977	19.28	348.35	156.38	1.50	3.46	5.47	2.96	3.31
Reach 1-3	11206	5-YR	475.50	7151.03	7154.77		7154.97	0.001922	4.93	224.81	137.95	0.47	0.17	0.41	0.19	0.19
Reach 1-3	11206	100-YR	1643.00	7151.03	7156.19		7156.69	0.003815	8.76	454.11	174.08	0.70	0.58	1.15	0.52	0.62
Reach 1-3	11206	FIS	2600.00	7151.03	7157.10		7157.70	0.003990	10.04	615.28	182.16	0.74	0.81	1.43	0.65	0.83
Reach 1-3	11103	5-YR	475.50	7150.00	7151.95	7151.95	7153.35	0.045519	16.48	62.81	44.51	2.08	4.89	5.53	2.80	3.97
Reach 1-3	11103	100-YR	1643.00	7150.00	7153.69	7153.69	7154.54	0.019817	16.66	283.22	143.67	1.53	2.40	4.57	2.34	2.43
Reach 1-3	11103	FIS	2600.00	7150.00	7154.34	7154.34	7155.42	0.020994	19.08	378.68	153.43	1.62	3.23	5.68	3.03	3.22
Reach 1-3	10925	5-YR	475.50	7148.00	7149.87		7150.15	0.009001	4.22	112.74	104.87	0.72		0.60		0.60
Reach 1-3	10925	100-YR	1643.00	7148.00	7150.98		7151.66	0.010242	6.61	248.49	129.57	0.84		1.22		1.22
Reach 1-3	10925	FIS	2600.00	7148.00	7151.60	7151.38	7152.56	0.010090	7.90	330.21	134.40	0.88	0.18	1.59	0.18	1.54
Reach 1-3	10797	5-YR	475.50	7145.39	7148.14	7147.91	7148.55	0.018364	5.17	93.64	117.85	0.78	0.29	1.55	0.52	1.40
Reach 1-3	10797	100-YR	1643.00	7145.39	7149.35	7149.14	7149.97	0.017191	7.00	284.94	156.61	0.77	1.00	2.74	1.61	1.94
Reach 1-3	10797	FIS	2600.00	7145.39	7149.94	7149.76	7150.80	0.019038	8.34	382.70	170.55	0.83	1.52	3.74	2.33	2.66
Reach 1-3	10713	5-YR	475.50	7144.30	7147.27		7147.45	0.008697	3.75	155.78	145.09	0.54		0.80	0.39	0.58
Reach 1-3	10713	100-YR	1643.00	7144.30	7148.40		7148.77	0.010588	5.59	371.61	212.30	0.61	0.53	1.71	1.13	1.15
Reach 1-3	10713	FIS	2600.00	7144.30	7149.03		7149.50	0.010786	6.40	506.88	221.23	0.63	0.91	2.16	1.49	1.53
Reach 1-3	10617	5-YR	475.50	7143.44	7146.31		7146.56	0.010761	4.07	138.59	194.63	0.58	0.19	1.01	0.14	0.48
Reach 1-3	10617	100-YR	1643.00	7143.44	7147.56		7147.86	0.008825	5.16	414.87	235.18	0.55	0.74	1.51	0.72	0.97
Reach 1-3	10617	FIS	2600.00	7143.44	7148.24		7148.60	0.008239	5.70	579.19	247.66	0.54	1.00	1.75	0.94	1.20
Reach 1-3	10543	5-YR	475.50	7142.46	7145.60		7145.83	0.008151	3.97	142.32	166.60	0.58	0.06	0.74	0.33	0.43
Reach 1-3	10543	100-YR	1643.00	7142.46	7146.85		7147.21	0.008072	5.50	392.82	213.49	0.59	0.63	1.36	0.80	0.92
Reach 1-3	10543	FIS	2600.00	7142.46	7147.52		7147.97	0.008055	6.26	542.80	232.97	0.60	0.94	1.69	0.92	1.17

