Windy Gap Firming Project

Appendix A to FEIS

Hydrologic Model Output:
Streamflow and Reservoir Data

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Table A-1. Windy Gap Firming Project Participant Demands, Firm Yield and Average Yield for each Alternative.

Month	Existing Conditions			No Action			Chimney Hollow with Prepositioning			Chimney Hollow with Jasper East			Chimney Hollow with Rockwell			Dry Creek and Rockwell		
	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)
Oct	1,520	0	780	3,820	940	2,080	2,627	2,627	2,627	2,550	2,550	2,550	2,550	2,550	2,550	2,580	2,580	2,580
Nov	2,350	0	1,440	2,980	0	1,820	2,473	2,473	2,473	2,380	2,380	2,380	2,380	2,380	2,380	2,490	2,490	2,490
Dec	2,350	0	1,270	2,980	0	1,650	2,473	2,473	2,473	2,380	2,380	2,380	2,380	2,380	2,380	2,490	2,490	2,490
Jan	2,350	0	1,110	2,980	0	1,420	2,473	2,473	2,473	2,380	2,380	2,380	2,380	2,380	2,380	2,490	2,490	2,490
Feb	2,350	0	960	2,980	0	1,260	2,473	2,473	2,473	2,380	2,380	2,380	2,380	2,380	2,380	2,490	2,490	2,490
Mar	2,350	0	850	2,980	0	1,120	2,473	2,473	2,473	2,380	2,380	2,380	2,380	2,380	2,380	2,490	2,490	2,490
Apr	1,040	0	680	1,605	0	960	1,342	1,342	1,342	1,350	1,350	1,350	1,350	1,350	1,350	1,380	1,380	1,380
May	930	0	820	1,540	0	1,360	1,308	1,308	1,308	1,300	1,300	1,300	1,300	1,300	1,300	1,330	1,330	1,330
Jun	930	0	660	1,540	106	1,150	1,308	1,308	1,308	1,300	1,300	1,300	1,300	1,300	1,300	1,330	1,330	1,330
Jul	1,490	0	960	3,020	183	2,360	2,153	2,153	2,153	2,130	2,130	2,130	2,130	2,130	2,130	2,170	2,170	2,170
Aug	1,500	0	910	3,420	0	2,410	2,385	2,385	2,385	2,340	2,340	2,340	2,340	2,340	2,340	2,380	2,380	2,380
Sep	1,520	0	830	3,820	0	2,320	2,627	2,627	2,627	2,550	2,550	2,550	2,550	2,550	2,550	2,580	2,580	2,580
Total	20,680	0	1,1270	33,665	1,229	19,910	26,115	26,115	26,115	25,420	25,420	25,420	25,420	25,420	25,420	26,200	26,200	26,200

Table A-2. Windy Gap Non-Participant Demands, Firm Yield, and Average Yield for each Alternative.

Month	Existing Conditions			No Action			Chimney Hollow with Prepositioning			Chimney Hollow with Jasper East			Chimney Hollow with Rockwell			Dry Creek and Rockwell		
	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)
Oct	10	0	10	290	0	100	290	0	110	290	0	110	290	0	110	290	0	110
Nov	10	0	0	70	0	20	70	0	30	70	0	30	70	0	30	70	0	30
Dec	10	0	0	70	0	20	70	0	30	70	0	30	70	0	30	70	0	30
Jan	0	0	0	50	0	20	50	0	20	50	0	20	50	0	20	50	0	20
Feb	0	0	0	40	0	10	40	0	10	40	0	10	40	0	10	40	0	10
Mar	10	0	0	60	0	20	60	0	20	60	0	20	60	0	20	60	0	20
Apr	10	0	0	120	0	60	120	0	70	120	0	70	120	0	70	120	0	70
May	30	0	30	730	0	610	730	0	610	730	0	620	730	0	620	730	0	620
Jun	40	0	30	1050	0	670	1,050	0	670	1,050	0	690	1,050	0	690	1,050	0	690
Jul	50	0	30	870	0	400	870	0	440	870	0	440	870	0	440	870	0	440
Aug	30	0	20	440	0	150	440	0	170	440	0	170	440	0	170	440	0	170
Sep	20	0	20	310	0	110	310	0	120	310	0	110	310	0	110	310	0	120
Total	220	0	140	4,100	0	2,190	4,100	0	2,300	4,100	0	2,320	4,100	0	2,320	4,100	0	2,330

Table A-3. Middle Park Water Conservancy District Demands, Firm Yield and Average Yield for each Alternative.

Month	Existing Conditions			No Action			Chimney Hollow with Prepositioning			Chimney Hollow with Jasper East			Chimney Hollow with Rockwell			Dry Creek and Rockwell		
	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)	Demand (ac-ft)	Firm Yield (ac-ft)	Average Yield (ac-ft)
Oct	21	0	15	429	0	292	429	0	419	429	0	419	429	0	419	429	0	419
Nov	21	0	15	429	0	292	429	0	419	429	0	419	429	0	419	429	0	419
Dec	21	0	15	429	0	292	429	0	419	429	0	419	429	0	419	429	0	419
Jan	21	0	15	429	0	287	429	0	415	429	0	415	429	0	415	429	0	415
Feb	21	0	15	429	0	283	429	0	410	429	0	410	429	0	410	429	0	410
Mar	21	0	15	429	0	283	429	0	372	429	0	330	429	0	354	429	0	362
Apr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sep	21	0	15	429	0	298	429	429	425	429	429	425	429	429	426	429	429	426
Total	145	0	102	3,000	0	2,026	3,000	429	2,880	3,000	429	2,839	3,000	429	2,864	3,000	429	2,871

Table A-4. Lake Granby Spills (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Existing Conditions	**0**	**18**	**352**	**216**	**41**	**10**	**5**	**0**	**53**
Alt 1 (No Action)	0	17	316	189	37	9	4	0	**48**
Alt 2 (Proposed Action)	0	13	260	163	24	9	4	0	**40**
Alt 3	0	14	282	170	28	10	4	0	**42**
Alt 4	0	14	282	170	28	10	4	0	**42**
Alt 5	0	14	282	168	28	10	4	0	**42**
Flow change from Existing Conditions									
Alt 1 (No Action)	0	-1	-37	-27	-4	0	-1	0	**-6**
Alt 2 (Proposed Action)	0	-5	-92	-53	-17	0	0	0	**-14**
Alt 3	0	-4	-70	-46	-12	0	-1	0	**-11**
Alt 4	0	-4	-70	-46	-12	0	-1	0	**-11**
Alt 5	0	-4	-71	-47	-12	0	-1	0	**-11**
Percent change in flow from Existing Conditions									
Alt 1 (No Action)	0%	-4%	-10%	-13%	-9%	-4%	-18%	0%	**-11%**
Alt 2 (Proposed Action)	0%	-26%	-26%	-24%	-41%	-3%	-9%	0%	**-26%**
Alt 3	0%	-22%	-20%	-21%	-30%	2%	-12%	0%	**-21%**
Alt 4	0%	-22%	-20%	-21%	-30%	2%	-12%	0%	**-21%**
Alt 5	0%	-22%	-20%	-22%	-30%	2%	-13%	0%	**-21%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Existing Conditions	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
All Alternatives	0	0	0	0	0	0	0	0	**0**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Existing Conditions	**0**	**123**	**845**	**887**	**249**	**23**	**0**	**0**	**178**
Alt 1 (No Action)	0	122	845	744	249	25	0	0	**166**
Alt 2 (Proposed Action)	0	126	859	696	155	30	0	0	**156**
Alt 3	0	132	845	722	188	23	0	0	**160**
Alt 4	0	132	845	722	188	23	0	0	**160**
Alt 5	0	131	839	719	174	23	0	0	**158**

Table A-4 (cont'd). Lake Granby Spills (cfs).

Flow change from Existing Conditions									
Alt 1 (No Action)	0	-1	0	-143	0	2	0	0	**-12**
Alt 2 (Proposed Action)	0	2	14	-191	-94	7	0	0	**-22**
Alt 3	0	8	0	-166	-61	0	0	0	**-18**
Alt 4	0	8	0	-165	-61	0	0	0	**-18**
Alt 5	0	8	-6	-169	-75	0	0	0	**-21**
Percent change in flow from Existing Conditions									
Alt 1 (No Action)	0%	-1%	0%	-16%	0%	9%	0%	0%	**-7%**
Alt 2 (Proposed Action)	0%	2%	2%	-22%	-38%	29%	0%	0%	**-13%**
Alt 3	0%	7%	0%	-19%	-25%	1%	0%	0%	**-10%**
Alt 4	0%	7%	0%	-19%	-25%	1%	0%	0%	**-10%**
Alt 5	0%	6%	-1%	-19%	-30%	0%	0%	0%	**-12%**

Table A-5. Adams Tunnel Diversions (cfs).

Average Year (1950-1996)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Existing Conditions	**409**	**523**	**417**	**285**	**430**	**406**	**224**	**206**	**263**	**252**	**225**	**404**	**336**
Alt 1	415	522	416	285	450	411	295	236	283	262	235	410	**351**
Alt 2	450	518	343	282	477	421	282	282	321	276	254	450	**362**
Alt 3	424	523	357	292	479	411	335	285	304	267	247	414	**361**
Alt 4	424	524	357	292	479	411	335	285	304	267	247	414	**361**
Alt 5	435	530	357	291	476	414	320	277	304	271	252	423	**362**
Flow change from Existing Conditions													
Alt 1	6	-1	-1	-1	20	5	72	30	20	10	10	6	**15**
Alt 2	41	-6	-74	-3	47	15	58	76	58	24	29	47	**26**
Alt 3	15	0	-60	6	50	5	112	79	41	15	22	11	**25**
Alt 4	15	0	-60	6	49	5	111	79	42	15	22	11	**25**
Alt 5	26	6	-60	6	46	8	96	71	42	19	27	20	**26**
Percent change in flow from Existing Conditions													
Alt 1	2%	0%	0%	0%	5%	1%	32%	15%	8%	4%	4%	2%	**4%**
Alt 2	10%	-1%	-18%	-1%	11%	4%	26%	37%	22%	10%	13%	12%	**8%**
Alt 3	4%	0%	-14%	2%	12%	1%	50%	38%	16%	6%	10%	3%	**7%**
Alt 4	4%	0%	-14%	2%	12%	1%	50%	38%	16%	6%	10%	3%	**7%**
Alt 5	6%	1%	-14%	2%	11%	2%	43%	35%	16%	8%	12%	5%	**8%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**452**	**541**	**426**	**293**	**550**	**550**	**541**	**407**	**458**	**296**	**250**	**449**	**434**
All Alternatives	457	541	426	293	550	550	542	410	468	299	261	448	**437**
No change in flow between Existing Conditions and all other alternatives in dry years.													
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**372**	**497**	**426**	**293**	**255**	**134**	**85**	**105**	**116**	**219**	**168**	**340**	**250**
Alt 1	386	500	426	293	310	135	134	211	120	223	190	349	**272**
Alt 2	424	465	297	250	379	153	108	135	150	242	212	381	**265**
Alt 3	391	491	364	293	399	135	172	261	150	230	196	339	**284**
Alt 4	391	491	364	293	399	135	172	260	150	230	196	339	**284**
Alt 5	398	508	364	293	382	135	151	207	151	238	200	344	**280**

Table A-5 (cont'd). Adams Tunnel Diversions (cfs).

Flow change from Existing Conditions													
Alt 1	13	3	0	0	55	0	49	106	3	4	22	9	**22**
Alt 2	51	-32	-129	-43	124	19	23	30	34	23	44	40	**16**
Alt 3	18	-7	-62	0	144	0	87	156	34	11	28	-1	**35**
Alt 4	19	-7	-62	0	144	0	87	156	34	11	28	-1	**35**
Alt 5	26	11	-62	0	127	0	67	102	35	19	32	3	**30**
Percent change in flow from Existing Conditions													
Alt 1	4%	1%	0%	0%	22%	0%	58%	102%	3%	2%	13%	3%	**9%**
Alt 2	14%	-7%	-30%	-15%	49%	14%	27%	29%	29%	10%	26%	12%	**6%**
Alt 3	5%	-1%	-15%	0%	56%	0%	103%	149%	29%	5%	17%	0%	**14%**
Alt 4	5%	-1%	-15%	0%	56%	0%	103%	149%	29%	5%	17%	0%	**14%**
Alt 5	7%	2%	-15%	0%	50%	0%	79%	97%	30%	8%	19%	1%	**12%**

Table A-6. Windy Gap Diversions (AF).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Existing Conditions	**4522**	**17648**	**11053**	**2869**	**439**	**0**	**0**	**0**	**36532**
Alt 1	4522	18571	12462	6780	1238	0	0	0	**43573**
Alt 2	4521	19866	14618	6006	1072	0	0	0	**46084**
Alt 3	4521	19738	14204	8050	1538	0	0	0	**48052**
Alt 4	4521	19738	14195	8007	1536	0	0	0	**47997**
Alt 5	4521	20070	14726	7720	1446	0	0	0	**48483**
Flow change from Existing Conditions									
Alt 1	0	923	1408	3911	799	0	0	0	**7041**
Alt 2	0	2218	3565	3137	633	0	0	0	**9552**
Alt 3	0	2090	3151	5181	1099	0	0	0	**11520**
Alt 4	0	2090	3142	5138	1097	0	0	0	**11466**
Alt 5	0	2421	3672	4850	1007	0	0	0	**11951**
Percent change in flow from Existing Conditions									
Alt 1	0%	5%	13%	136%	182%	0%	0%	0%	**19%**
Alt 2	0%	13%	32%	109%	144%	0%	0%	0%	**26%**
Alt 3	0%	12%	29%	181%	250%	0%	0%	0%	**32%**
Alt 4	0%	12%	28%	179%	250%	0%	0%	0%	**31%**
Alt 5	0%	14%	33%	169%	229%	0%	0%	0%	**33%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Existing Conditions	**1049**	**3723**	**2658**	**374**	**0**	**0**	**0**	**0**	**7804**
All Alternatives	1049	3723	2658	374	0	0	0	0	**7804**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Existing Conditions	**2808**	**20532**	**14280**	**892**	**0**	**0**	**0**	**0**	**38512**
Alt 1	2808	21384	16116	17029	6532	0	0	0	**63870**
Alt 2	2808	29670	22293	15516	3636	0	0	0	**73923**
Alt 3	2808	29003	21738	19215	6177	0	0	0	**78940**
Alt 4	2808	29000	21729	19084	6153	0	0	0	**78775**
Alt 5	2808	29676	21745	18463	4851	0	0	0	**77543**

Table A-6 (cont'd). Windy Gap Diversions (AF).

Flow change from Existing Conditions									
Alt 1	0	852	1836	16137	6532	0	0	0	**25357**
Alt 2	0	9138	8013	14624	3636	0	0	0	**35411**
Alt 3	0	8471	7458	18323	6177	0	0	0	**40428**
Alt 4	0	8468	7449	18192	6153	0	0	0	**40262**
Alt 5	0	9144	7465	17571	4851	0	0	0	**39031**
Percent change in flow from Existing Conditions									
Alt 1	0%	4%	13%	1809%	0%	0%	0%	0%	**66%**
Alt 2	0%	45%	56%	1639%	0%	0%	0%	0%	**92%**
Alt 3	0%	41%	52%	2054%	0%	0%	0%	0%	**105%**
Alt 4	0%	41%	52%	2039%	0%	0%	0%	0%	**105%**
Alt 5	0%	45%	52%	1970%	0%	0%	0%	0%	**101%**

Table A-7. Big Thompson River Streamflow below Lake Estes (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Existing Conditions	**39**	**176**	**410**	**186**	**114**	**59**	**39**	**26**	**92**
Alt 1	39	176	415	188	114	59	39	26	**93**
Alt 2	40	191	425	204	117	60	40	26	**97**
Alt 3	40	183	415	189	114	59	39	26	**93**
Alt 4	40	183	415	189	114	59	39	26	**93**
Alt 5	40	185	418	191	115	59	39	26	**94**
Flow change from Existing Conditions									
Alt 1	0	0	5	2	0	0	0	0	**1**
Alt 2	1	15	14	18	3	1	1	0	**4**
Alt 3	1	7	5	3	0	0	0	0	**1**
Alt 4	1	7	5	3	0	0	0	0	**1**
Alt 5	1	10	7	5	1	0	0	0	**2**
Percent change in flow from Existing Conditions									
Alt 1	0%	0%	1%	1%	0%	0%	0%	0%	**1%**
Alt 2	2%	9%	4%	9%	3%	1%	2%	1%	**5%**
Alt 3	2%	4%	1%	2%	0%	0%	0%	0%	**1%**
Alt 4	2%	4%	1%	2%	0%	0%	0%	0%	**1%**
Alt 5	2%	5%	2%	2%	1%	0%	0%	1%	**2%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Existing Conditions	**36**	**165**	**274**	**156**	**97**	**50**	**38**	**23**	**74**
All Alternatives	36	165	274	157	97	50	38	23	**74**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Existing Conditions	**38**	**128**	**362**	**328**	**162**	**65**	**38**	**25**	**101**
Alt 1	38	128	363	328	162	65	38	25	**101**
Alt 2	37	134	381	336	162	65	38	25	**103**
Alt 3	38	128	363	328	162	65	38	25	**101**
Alt 4	38	128	363	328	162	65	38	25	**101**
Alt 5	38	128	363	328	162	65	38	25	**101**

Table A-7 (cont'd). Big Thompson River Streamflow below Lake Estes (cfs).

Flow change from Existing Conditions									
Alt 1	0	0	0	0	0	0	0	0	**0**
Alt 2	0	6	19	8	0	0	0	0	**3**
Alt 3	0	0	0	0	0	0	0	0	**0**
Alt 4	0	0	0	0	0	0	0	0	**0**
Alt 5	0	0	0	0	0	0	0	0	**0**
Percent change in flow from Existing Conditions									
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Alt 2	-1%	4%	5%	2%	0%	0%	0%	0%	**3%**
Alt 3	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Alt 4	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	**0%**

Table A-8. Colorado River Streamflow below Lake Granby at USGS gage (cfs).

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Annual
Average Year (1950-1996)									
Exist. Conditions	**20**	**84**	**400**	**258**	**68**	**28**	**25**	**20**	**82**
Alt 1	20	83	363	232	65	28	24	20	**76**
Alt 2	20	81	310	213	56	27	24	20	**69**
Alt 3	20	82	332	218	59	28	24	20	**72**
Alt 4	20	82	332	218	59	28	24	20	**72**
Alt 5	20	82	331	217	58	28	24	20	**72**
Flow change from Existing Conditions									
Alt 1	0	-1	-37	-26	-3	0	-1	0	**-6**
Alt 2	0	-3	-90	-45	-13	-1	-1	0	**-13**
Alt 3	0	-2	-68	-40	-10	0	-1	0	**-10**
Alt 4	0	-2	-68	-40	-10	0	-1	0	**-10**
Alt 5	0	-2	-69	-41	-10	0	-1	0	**-10**
Percent change in flow from Existing Conditions									
Alt 1	0%	-1%	-9%	-10%	-4%	-2%	-4%	0%	**-7%**
Alt 2	0%	-3%	-23%	-17%	-18%	-3%	-3%	2%	**-15%**
Alt 3	0%	-3%	-17%	-15%	-14%	-1%	-4%	0%	**-12%**
Alt 4	0%	-3%	-17%	-15%	-14%	-1%	-4%	0%	**-12%**
Alt 5	0%	-3%	-17%	-16%	-15%	-1%	-4%	0%	**-13%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Exist. Conditions	**20**	**57**	**57**	**57**	**30**	**20**	**20**	**20**	**30**
All Alternatives	20	57	57	57	30	20	20	20	**30**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Exist. Conditions	**20**	**181**	**886**	**896**	**245**	**33**	**20**	**20**	**199**
Alt 1	20	180	886	769	245	35	20	20	**189**
Alt 2	20	184	899	721	167	37	20	24	**180**
Alt 3	20	189	886	747	192	31	20	20	**183**
Alt 4	20	189	886	747	192	31	20	20	**183**
Alt 5	20	189	880	743	178	31	20	20	**181**
Flow change from Existing Conditions									
Alt 1	0	-1	0	-127	0	2	0	0	**-11**
Alt 2	0	2	14	-175	-77	4	0	4	**-19**
Alt 3	0	8	0	-149	-52	-3	0	0	**-17**
Alt 4	0	8	0	-149	-52	-3	0	0	**-17**
Alt 5	0	8	-6	-153	-66	-3	0	0	**-19**
Percent change in flow from Existing Conditions									
Alt 1	0%	-1%	0%	-14%	0%	6%	0%	0%	**-5%**
Alt 2	0%	1%	2%	-20%	-32%	11%	0%	18%	**-10%**
Alt 3	0%	5%	0%	-17%	-21%	-8%	0%	0%	**-8%**
Alt 4	0%	5%	0%	-17%	-21%	-8%	0%	0%	**-8%**
Alt 5	0%	4%	-1%	-17%	-27%	-9%	0%	0%	**-9%**

Table A-9. Colorado River Streamflow above Windy Gap (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Exist. Conditions	**213**	**545**	**1137**	**519**	**168**	**83**	**79**	**78**	**260**
Alt 1	213	544	1084	487	164	82	78	78	**252**
Alt 2	213	540	1020	462	152	82	78	79	**243**
Alt 3	213	541	1047	469	156	82	78	78	**246**
Alt 4	213	541	1047	469	156	82	78	78	**246**
Alt 5	213	540	1045	467	155	82	78	78	**246**
Flow change from Existing Conditions									
Alt 1	0	-1	-52	-32	-3	0	-1	0	**-7**
Alt 2	0	-5	-117	-57	-16	-1	-1	0	**-16**
Alt 3	0	-4	-90	-50	-12	0	-1	0	**-13**
Alt 4	0	-4	-90	-50	-12	0	-1	0	**-13**
Alt 5	0	-4	-91	-52	-12	0	-1	0	**-13**
Percent change in flow from Existing Conditions									
Alt 1	0%	0%	-5%	-6%	-2%	-1%	-1%	0%	**-3%**
Alt 2	0%	-1%	-10%	-11%	-9%	-1%	-1%	1%	**-6%**
Alt 3	0%	-1%	-8%	-10%	-7%	0%	-1%	0%	**-5%**
Alt 4	0%	-1%	-8%	-10%	-7%	0%	-1%	0%	**-5%**
Alt 5	0%	-1%	-8%	-10%	-7%	0%	-2%	0%	**-5%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Exist. Conditions	**145**	**197**	**187**	**133**	**94**	**66**	**67**	**74**	**104**
All Alternatives	145	197	187	133	94	66	67	74	**104**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Exist. Conditions	**179**	**1041**	**2660**	**1730**	**462**	**124**	**82**	**86**	**558**
Alt 1	179	1040	2604	1565	462	126	82	86	**539**
Alt 2	179	1044	2618	1517	367	128	82	89	**529**
Alt 3	179	1050	2605	1543	397	121	82	87	**533**
Alt 4	179	1050	2605	1543	398	121	82	87	**533**
Alt 5	179	1049	2598	1540	383	121	82	87	**531**
Flow change from Existing Conditions									
Alt 1	0	-1	-56	-165	0	2	0	0	**-19**
Alt 2	0	2	-42	-213	-95	4	0	3	**-29**
Alt 3	0	8	-55	-187	-64	-3	0	2	**-25**
Alt 4	0	8	-55	-187	-64	-3	0	2	**-25**
Alt 5	0	8	-62	-190	-78	-3	0	2	**-27**
Percent change in flow from Existing Conditions									
Alt 1	0%	0%	-2%	-10%	0%	2%	0%	0%	**-3%**
Alt 2	0%	0%	-2%	-12%	-21%	3%	0%	4%	**-5%**
Alt 3	0%	1%	-2%	-11%	-14%	-2%	0%	2%	**-5%**
Alt 4	0%	1%	-2%	-11%	-14%	-2%	0%	2%	**-5%**
Alt 5	0%	1%	-2%	-11%	-17%	-2%	0%	2%	**-5%**

Table A-10. Colorado River Streamflow below Windy Gap at USGS gage (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Exist. Conditions	**137**	**258**	**951**	**472**	**161**	**83**	**79**	**78**	**209**
Alt 1	137	242	875	377	144	82	78	78	**192**
Alt 2	137	217	774	365	135	82	78	79	**180**
Alt 3	137	220	808	338	131	82	78	78	**180**
Alt 4	137	220	808	339	131	82	78	78	**180**
Alt 5	137	214	798	341	132	82	78	78	**179**
Flow change from Existing Conditions									
Alt 1	0	-16	-76	-95	-16	0	-1	0	**-17**
Alt 2	0	-41	-177	-108	-26	-1	-1	0	**-29**
Alt 3	0	-38	-143	-135	-30	0	-1	0	**-29**
Alt 4	0	-38	-143	-134	-29	0	-1	0	**-29**
Alt 5	0	-44	-153	-131	-29	0	-1	0	**-30**
Percent change in flow from Existing Conditions									
Alt 1	0%	-6%	-8%	-20%	-10%	-1%	-1%	0%	**-8%**
Alt 2	0%	-16%	-19%	-23%	-16%	-1%	-1%	1%	**-14%**
Alt 3	0%	-15%	-15%	-28%	-18%	0%	-1%	0%	**-14%**
Alt 4	0%	-15%	-15%	-28%	-18%	0%	-1%	0%	**-14%**
Alt 5	0%	-17%	-16%	-28%	-18%	0%	-2%	0%	**-14%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Exist. Conditions	**127**	**136**	**142**	**127**	**94**	**66**	**67**	**74**	**93**
All Alternatives	127	136	142	127	94	66	67	74	**93**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Exist. Conditions	**132**	**707**	**2420**	**1716**	**462**	**124**	**82**	**86**	**505**
Alt 1	132	692	2333	1288	355	126	82	86	**451**
Alt 2	132	561	2243	1265	308	128	82	89	**427**
Alt 3	132	578	2239	1231	297	121	82	87	**423**
Alt 4	132	578	2239	1233	297	121	82	87	**424**
Alt 5	132	566	2233	1239	305	121	82	87	**423**
Flow change from Existing Conditions									
Alt 1	0	-15	-87	-427	-106	2	0	0	**-54**
Alt 2	0	-146	-177	-450	-154	4	0	3	**-78**
Alt 3	0	-130	-181	-485	-165	-3	0	2	**-81**
Alt 4	0	-129	-181	-483	-164	-3	0	2	**-81**
Alt 5	0	-141	-187	-476	-157	-3	0	2	**-81**
Percent change in flow from Existing Conditions									
Alt 1	0%	-2%	-4%	-25%	-23%	2%	0%	0%	**-11%**
Alt 2	0%	-21%	-7%	-26%	-33%	3%	0%	4%	**-15%**
Alt 3	0%	-18%	-7%	-28%	-36%	-2%	0%	2%	**-16%**
Alt 4	0%	-18%	-7%	-28%	-36%	-2%	0%	2%	**-16%**
Alt 5	0%	-20%	-8%	-28%	-34%	-2%	0%	2%	**-16%**

Table A-11. Willow Creek Streamflow at USGS/NCWCD gage (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Exist. Conditions	**6**	**51**	**143**	**32**	**12**	**3**	**8**	**8**	**25**
Alt 1	6	51	127	26	11	3	8	8	**23**
Alt 2	6	49	116	20	9	4	8	8	**22**
Alt 3	6	50	121	22	10	3	8	8	**22**
Alt 4	6	50	121	22	10	3	8	8	**22**
Alt 5	6	49	120	21	10	3	7	8	**22**
Flow change from Existing Conditions									
Alt 1	0	0	-16	-6	-1	0	0	0	**-2**
Alt 2	0	-2	-27	-11	-3	0	0	0	**-4**
Alt 3	0	-1	-22	-10	-2	0	0	0	**-3**
Alt 4	0	-1	-22	-10	-2	0	0	0	**-3**
Alt 5	0	-2	-23	-11	-2	0	0	0	**-3**
Percent change in flow from Existing Conditions									
Alt 1	0%	0%	-11%	-19%	-5%	0%	0%	0%	**-7%**
Alt 2	0%	-4%	-19%	-36%	-25%	3%	0%	1%	**-14%**
Alt 3	0%	-3%	-15%	-32%	-18%	0%	-1%	3%	**-12%**
Alt 4	0%	-3%	-15%	-32%	-18%	0%	-1%	3%	**-12%**
Alt 5	0%	-4%	-16%	-34%	-16%	0%	-4%	3%	**-12%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Exist. Conditions	**4**	**0**	**10**	**0**	**2**	**2**	**6**	**7**	**5**
All Alternatives	4	0	10	0	2	2	6	7	**5**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Exist. Conditions	**5**	**184**	**434**	**112**	**58**	**14**	**7**	**11**	**73**
Alt 1	5	184	378	75	58	14	7	11	**65**
Alt 2	5	184	378	75	40	14	7	11	**64**
Alt 3	5	184	378	75	46	14	7	12	**64**
Alt 4	5	184	378	75	46	14	7	12	**64**
Alt 5	5	184	378	75	46	14	7	13	**64**
Flow change from Existing Conditions									
Alt 1	0	0	-56	-38	0	0	0	0	**-8**
Alt 2	0	0	-56	-38	-18	0	0	0	**-9**
Alt 3	0	0	-56	-38	-12	0	0	2	**-9**
Alt 4	0	0	-56	-38	-12	0	0	2	**-9**
Alt 5	0	0	-56	-38	-12	0	0	2	**-9**
Percent change in flow from Existing Conditions									
Alt 1	0%	0%	-13%	-34%	0%	0%	0%	0%	**-11%**
Alt 2	0%	0%	-13%	-34%	-30%	0%	0%	0%	**-13%**
Alt 3	0%	0%	-13%	-34%	-20%	0%	0%	15%	**-12%**
Alt 4	0%	0%	-13%	-34%	-20%	0%	0%	15%	**-12%**
Alt 5	0%	0%	-13%	-34%	-20%	0%	0%	18%	**-12%**

Table A-12. Colorado River Streamflow at Hot Sulphur Springs at USGS/NCWCD gage (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Exist. Conditions	**146**	**278**	**953**	**482**	**170**	**87**	**87**	**83**	**216**
Alt 1	146	262	877	386	153	87	86	83	**199**
Alt 2	146	237	776	374	144	86	86	84	**187**
Alt 3	146	240	810	347	140	87	86	84	**187**
Alt 4	146	240	810	348	140	87	86	84	**187**
Alt 5	146	235	800	351	141	87	86	84	**186**
Flow change from Existing Conditions									
Alt 1	0	-16	-76	-95	-16	0	-1	0	**-17**
Alt 2	0	-41	-177	-108	-26	-1	-1	0	**-29**
Alt 3	0	-38	-143	-135	-30	0	-1	0	**-29**
Alt 4	0	-38	-143	-134	-29	0	-1	0	**-29**
Alt 5	0	-44	-153	-131	-29	0	-1	0	**-30**
Percent change in flow from Existing Conditions									
Alt 1	0%	-6%	-8%	-20%	-10%	-1%	-1%	0%	**-8%**
Alt 2	0%	-15%	-19%	-22%	-15%	-1%	-1%	1%	**-14%**
Alt 3	0%	-14%	-15%	-28%	-17%	0%	-1%	0%	**-13%**
Alt 4	0%	-14%	-15%	-28%	-17%	0%	-1%	0%	**-13%**
Alt 5	0%	-16%	-16%	-27%	-17%	0%	-2%	0%	**-14%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Exist. Conditions	**137**	**137**	**139**	**142**	**101**	**67**	**75**	**80**	**98**
All Alternatives	137	137	139	142	101	67	75	80	**98**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Exist. Conditions	**150**	**730**	**2414**	**1709**	**468**	**127**	**90**	**90**	**511**
Alt 1	150	715	2328	1282	361	129	90	90	**457**
Alt 2	150	584	2237	1259	314	130	90	93	**433**
Alt 3	150	601	2234	1224	303	124	90	91	**430**
Alt 4	150	601	2234	1227	303	124	90	91	**430**
Alt 5	150	589	2227	1233	311	124	90	92	**429**
Flow change from Existing Conditions									
Alt 1	0	-15	-87	-427	-106	2	0	0	**-54**
Alt 2	0	-146	-177	-450	-154	4	0	3	**-78**
Alt 3	0	-130	-181	-485	-165	-3	0	2	**-81**
Alt 4	0	-129	-181	-483	-164	-3	0	2	**-81**
Alt 5	0	-141	-187	-476	-157	-3	0	2	**-81**
Percent change in flow from Existing Conditions									
Alt 1	0%	-2%	-4%	-25%	-23%	2%	0%	0%	**-10%**
Alt 2	0%	-20%	-7%	-26%	-33%	3%	0%	4%	**-15%**
Alt 3	0%	-18%	-7%	-28%	-35%	-2%	0%	2%	**-16%**
Alt 4	0%	-18%	-7%	-28%	-35%	-2%	0%	2%	**-16%**
Alt 5	0%	-19%	-8%	-28%	-34%	-2%	0%	2%	**-16%**

Table A-13. Colorado River below Williams Fork (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Exist. Conditions	**186**	**308**	**1194**	**735**	**276**	**191**	**232**	**209**	**341**
Alt 1	186	292	1118	641	261	190	231	208	**324**
Alt 2	186	267	1017	629	251	190	231	209	**312**
Alt 3	186	270	1051	602	247	190	231	209	**312**
Alt 4	186	270	1051	603	247	190	231	209	**312**
Alt 5	186	264	1041	606	248	190	230	209	**311**
Flow change from Existing Conditions									
Alt 1	0	-16	-76	-94	-15	-1	-1	0	**-17**
Alt 2	0	-41	-176	-106	-24	-1	-1	0	**-29**
Alt 3	0	-38	-143	-133	-28	-1	-1	0	**-29**
Alt 4	0	-38	-143	-132	-28	-1	-1	0	**-29**
Alt 5	0	-44	-153	-129	-27	-1	-2	0	**-30**
Percent change in flow from Existing Conditions									
Alt 1	0%	-5%	-6%	-13%	-5%	-1%	-1%	0%	**-5%**
Alt 2	0%	-13%	-15%	-14%	-9%	-1%	-1%	0%	**-9%**
Alt 3	0%	-12%	-12%	-18%	-10%	0%	-1%	0%	**-9%**
Alt 4	0%	-12%	-12%	-18%	-10%	0%	-1%	0%	**-8%**
Alt 5	0%	-14%	-13%	-18%	-10%	0%	-1%	0%	**-9%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Exist. Conditions	**190**	**148**	**146**	**338**	**266**	**178**	**214**	**206**	**204**
All Alternatives	190	148	146	338	266	178	214	206	**204**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Exist. Conditions	**216**	**803**	**2965**	**2314**	**639**	**215**	**242**	**220**	**704**
Alt 1	216	788	2878	1887	533	217	242	220	**651**
Alt 2	216	657	2787	1864	485	219	242	223	**626**
Alt 3	216	674	2784	1829	475	212	242	222	**623**
Alt 4	216	674	2784	1832	475	212	242	222	**623**
Alt 5	216	662	2778	1838	482	212	242	222	**623**
Flow change from Existing Conditions									
Alt 1	0	-15	-87	-427	-106	2	0	0	**-54**
Alt 2	0	-146	-177	-450	-154	4	0	3	**-78**
Alt 3	0	-130	-181	-485	-165	-3	0	2	**-81**
Alt 4	0	-129	-181	-483	-164	-3	0	2	**-81**
Alt 5	0	-141	-187	-476	-157	-3	0	2	**-81**
Percent change in flow from Existing Conditions									
Alt 1	0%	-2%	-3%	-18%	-17%	1%	0%	0%	**-8%**
Alt 2	0%	-18%	-6%	-19%	-24%	2%	0%	2%	**-11%**
Alt 3	0%	-16%	-6%	-21%	-26%	-1%	0%	1%	**-12%**
Alt 4	0%	-16%	-6%	-21%	-26%	-1%	0%	1%	**-11%**
Alt 5	0%	-18%	-6%	-21%	-25%	-1%	0%	1%	**-12%**

Table A-14. Colorado River Streamflow near Kremmling at USGS gage (cfs).

Average Year (1950-1996)									
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Annual**
Existing Conditions	**664**	**1145**	**2619**	**1745**	**1026**	**909**	**832**	**583**	**969**
Alt 1	664	1129	2542	1660	1010	901	830	583	**952**
Alt 2	664	1104	2442	1647	1002	899	830	583	**940**
Alt 3	664	1107	2476	1620	998	901	830	583	**940**
Alt 4	664	1107	2476	1621	998	901	830	583	**940**
Alt 5	664	1101	2466	1624	999	901	830	583	**939**
Flow change from Existing Conditions									
Alt 1	0	-15	-76	-85	-16	-8	-1	0	**-17**
Alt 2	0	-40	-176	-98	-24	-10	-1	0	**-29**
Alt 3	0	-37	-143	-125	-28	-8	-2	0	**-29**
Alt 4	0	-37	-142	-124	-28	-8	-2	0	**-29**
Alt 5	0	-43	-153	-121	-28	-8	-2	0	**-30**
Percent change in flow from Existing Conditions									
Alt 1	0%	-1%	-3%	-5%	-2%	-1%	0%	0%	**-2%**
Alt 2	0%	-4%	-7%	-6%	-2%	-1%	0%	0%	**-3%**
Alt 3	0%	-3%	-5%	-7%	-3%	-1%	0%	0%	**-3%**
Alt 4	0%	-3%	-5%	-7%	-3%	-1%	0%	0%	**-3%**
Alt 5	0%	-4%	-6%	-7%	-3%	-1%	0%	0%	**-3%**
Dry Year Average (1954, 1966, 1977, 1981, 1989)									
Existing Conditions	**615**	**422**	**473**	**924**	**943**	**866**	**674**	**547**	**622**
All Alternatives	615	422	473	924	943	866	674	547	**622**
No change in flow between Existing Conditions and all other alternatives in dry years.									
Wet Year Average (1957, 1983, 1984, 1986, 1995)									
Existing Conditions	**764**	**2231**	**5885**	**4725**	**1694**	**945**	**804**	**633**	**1681**
Alt 1	764	2216	5798	4298	1588	947	804	633	**1627**
Alt 2	764	2086	5707	4274	1540	948	804	637	**1603**
Alt 3	764	2102	5704	4240	1529	942	804	635	**1600**
Alt 4	764	2102	5704	4242	1530	942	804	635	**1600**
Alt 5	764	2091	5697	4249	1537	942	804	635	**1600**
Flow change from Existing Conditions									
Alt 1	0	-15	-87	-427	-106	2	0	0	**-54**
Alt 2	0	-145	-178	-450	-154	4	0	4	**-78**
Alt 3	0	-129	-182	-485	-165	-3	0	2	**-81**
Alt 4	0	-129	-181	-483	-164	-3	0	2	**-81**
Alt 5	0	-140	-188	-476	-157	-3	0	2	**-81**
Percent change in flow from Existing Conditions									
Alt 1	0%	-1%	-1%	-9%	-6%	0%	0%	0%	**-3%**
Alt 2	0%	-7%	-3%	-10%	-9%	0%	0%	1%	**-5%**
Alt 3	0%	-6%	-3%	-10%	-10%	0%	0%	0%	**-5%**
Alt 4	0%	-6%	-3%	-10%	-10%	0%	0%	0%	**-5%**
Alt 5	0%	-6%	-3%	-10%	-9%	0%	0%	0%	**-5%**

Table A-15. Colorado River Stage below Windy Gap Reservoir at USGS gage (feet).

Average Year (1950-1996)								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Exist. Conditions	**0.68**	**0.90**	**1.81**	**1.19**	**0.71**	**0.58**	**0.57**	**0.57**
Alt 1	0.67	0.88	1.71	1.05	0.69	0.58	0.57	0.57
Alt 2	0.67	0.83	1.59	1.03	0.67	0.58	0.57	0.57
Alt 3	0.67	0.84	1.63	0.99	0.66	0.58	0.57	0.57
Alt 4	0.67	0.84	1.63	1.00	0.66	0.58	0.57	0.57
Alt 5	0.67	0.83	1.61	1.00	0.67	0.58	0.57	0.57
Change in stage from Existing Conditions								
Alt 1	0.00	-0.03	-0.10	-0.13	-0.03	0.00	0.00	0.00
Alt 2	0.00	-0.07	-0.22	-0.16	-0.04	0.00	0.00	0.00
Alt 3	0.00	-0.06	-0.18	-0.19	-0.05	0.00	0.00	0.00
Alt 4	0.00	-0.06	-0.18	-0.19	-0.05	0.00	0.00	0.00
Alt 5	0.00	-0.07	-0.19	-0.19	-0.05	0.00	0.00	0.00
Percent change in stage from Existing Conditions								
Alt 1	-0.1%	-3.0%	-5.4%	-11.3%	-4.0%	-0.2%	-0.3%	0.0%
Alt 2	-0.3%	-7.8%	-12.2%	-13.2%	-6.1%	-0.3%	-0.2%	0.1%
Alt 3	-0.3%	-7.1%	-10.1%	-16.2%	-7.0%	-0.2%	-0.3%	0.1%
Alt 4	-0.3%	-7.1%	-10.0%	-16.1%	-7.0%	-0.2%	-0.3%	0.1%
Alt 5	-0.3%	-8.1%	-10.7%	-15.8%	-6.8%	-0.2%	-0.4%	0.1%
Dry Year Average (1954, 1966, 1977, 1981, 1989)								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Exist. Conditions	**0.65**	**0.67**	**0.68**	**0.65**	**0.60**	**0.55**	**0.55**	**0.57**
All Alternatives	0.65	0.67	0.68	0.65	0.60	0.55	0.55	0.57
No change in stage between Existing Conditions and all alternatives in dry years.								
Wet Year Average (1957, 1983, 1984, 1986, 1995)								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Exist. Conditions	**0.69**	**1.58**	**3.20**	**2.59**	**1.19**	**0.66**	**0.58**	**0.59**
Alt 1	0.69	1.56	3.12	2.19	1.03	0.67	0.58	0.59
Alt 2	0.68	1.39	3.05	2.16	0.96	0.66	0.58	0.59
Alt 3	0.68	1.41	3.05	2.13	0.95	0.66	0.58	0.59
Alt 4	0.68	1.41	3.05	2.13	0.95	0.66	0.58	0.59
Alt 5	0.68	1.39	3.04	2.14	0.96	0.65	0.58	0.59
Change in stage from Existing Conditions								
Alt 1	0.00	-0.02	-0.08	-0.40	-0.16	0.00	0.00	0.00
Alt 2	-0.01	-0.19	-0.15	-0.43	-0.23	0.00	0.00	0.01
Alt 3	-0.01	-0.17	-0.15	-0.46	-0.25	-0.01	0.00	0.00
Alt 4	-0.01	-0.17	-0.15	-0.46	-0.25	-0.01	0.00	0.00
Alt 5	-0.01	-0.19	-0.16	-0.45	-0.24	-0.01	0.00	0.00
Percent change in stage from Existing Conditions								
Alt 1	-0.1%	-1.4%	-2.4%	-15.4%	-13.7%	0.5%	0.0%	0.0%
Alt 2	-1.0%	-12.2%	-4.6%	-16.5%	-19.3%	0.2%	0.0%	1.0%
Alt 3	-0.8%	-10.9%	-4.7%	-17.9%	-20.8%	-1.1%	0.0%	0.5%
Alt 4	-0.8%	-10.9%	-4.7%	-17.8%	-20.7%	-1.1%	0.0%	0.5%
Alt 5	-0.9%	-11.8%	-4.9%	-17.5%	-19.8%	-1.3%	0.0%	0.6%

Table A-16. Colorado River Stage near Kremmling at USGS gage (feet).

Average Year (1950-1996)								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Exist. Conditions	**4.68**	**6.01**	**8.67**	**7.22**	**5.66**	**5.32**	**5.11**	**4.43**
Alt 1	4.68	5.97	8.55	7.06	5.62	5.30	5.11	4.43
Alt 2	4.68	5.91	8.39	7.03	5.60	5.30	5.11	4.43
Alt 3	4.68	5.92	8.44	6.98	5.59	5.30	5.11	4.43
Alt 4	4.68	5.92	8.44	6.98	5.59	5.30	5.11	4.43
Alt 5	4.68	5.90	8.43	6.99	5.59	5.30	5.11	4.43
Change in stage from Existing Conditions								
Alt 1	0.00	-0.04	-0.12	-0.17	-0.04	-0.02	0.00	0.00
Alt 2	0.00	-0.10	-0.28	-0.20	-0.06	-0.03	0.00	0.00
Alt 3	0.00	-0.09	-0.23	-0.25	-0.07	-0.02	0.00	0.00
Alt 4	0.00	-0.09	-0.23	-0.24	-0.07	-0.02	0.00	0.00
Alt 5	0.00	-0.11	-0.24	-0.24	-0.07	-0.02	-0.01	0.00
Percent change in stage from Existing Conditions								
Alt 1	0.0%	-0.7%	-1.4%	-2.3%	-0.7%	-0.4%	-0.1%	0.0%
Alt 2	-0.1%	-1.7%	-3.2%	-2.7%	-1.1%	-0.5%	-0.1%	0.0%
Alt 3	-0.1%	-1.6%	-2.6%	-3.4%	-1.3%	-0.4%	-0.1%	0.0%
Alt 4	-0.1%	-1.6%	-2.6%	-3.4%	-1.3%	-0.4%	-0.1%	0.0%
Alt 5	-0.1%	-1.8%	-2.8%	-3.3%	-1.2%	-0.4%	-0.1%	0.0%
Dry Year Average (1954, 1966, 1977, 1981, 1989)								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Exist. Conditions	**4.49**	**4.01**	**4.17**	**5.31**	**5.39**	**5.19**	**4.70**	**4.33**
All Alternatives	4.49	4.01	4.17	5.31	5.39	5.19	4.70	4.33
No change in stage between Existing Conditions and all alternatives in dry years.								
Wet Year Average (1957, 1983, 1984, 1986, 1995)								
	Apr	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**
Exist. Conditions	**5.03**	**8.26**	**12.17**	**11.20**	**7.25**	**5.46**	**5.04**	**4.57**
Alt 1	5.03	8.23	12.08	10.81	7.03	5.46	5.04	4.57
Alt 2	5.02	8.02	12.01	10.79	6.93	5.46	5.04	4.58
Alt 3	5.02	8.04	12.01	10.76	6.91	5.44	5.04	4.58
Alt 4	5.02	8.04	12.01	10.76	6.91	5.44	5.04	4.58
Alt 5	5.02	8.02	12.00	10.76	6.93	5.44	5.04	4.58
Change in stage from Existing Conditions								
Alt 1	0.00	-0.03	-0.08	-0.39	-0.22	0.00	0.00	0.00
Alt 2	-0.01	-0.24	-0.16	-0.42	-0.31	0.00	0.00	0.01
Alt 3	-0.01	-0.22	-0.16	-0.45	-0.33	-0.02	0.00	0.00
Alt 4	-0.01	-0.22	-0.16	-0.45	-0.33	-0.02	0.00	0.00
Alt 5	-0.01	-0.23	-0.16	-0.44	-0.32	-0.02	0.00	0.01
Percent change in stage from Existing Conditions								
Alt 1	0.0%	-0.3%	-0.7%	-3.5%	-3.0%	0.0%	0.0%	0.0%
Alt 2	-0.2%	-2.9%	-1.3%	-3.7%	-4.3%	-0.1%	0.0%	0.2%
Alt 3	-0.2%	-2.6%	-1.3%	-4.0%	-4.6%	-0.3%	0.0%	0.1%
Alt 4	-0.2%	-2.6%	-1.3%	-4.0%	-4.6%	-0.3%	0.0%	0.1%
Alt 5	-0.2%	-2.8%	-1.4%	-3.9%	-4.4%	-0.3%	0.0%	0.1%

Table A-17. Carter Lake Elevations (feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5729**	**5738**	**5746**	**5751**	**5753**	**5751**	**5741**	**5721**	**5707**	**5705**	**5709**	**5718**
Alt 1	5729	5738	5746	5751	5752	5750	5740	5720	5706	5704	5709	5718
Alt 2	5729	5737	5745	5750	5752	5750	5740	5721	5707	5704	5709	5718
Alt 3	5729	5738	5746	5751	5752	5751	5740	5720	5706	5704	5709	5719
Alt 4	5729	5738	5746	5751	5752	5751	5740	5720	5706	5704	5709	5719
Alt 5	5729	5738	5746	5751	5752	5750	5740	5720	5706	5704	5709	5719
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	-1	-1	-1	-1	-1	-1	0	0
Alt 2	0	0	-1	-1	-1	-1	-1	0	0	-1	-1	0
Alt 3	0	0	0	0	0	-1	-1	-1	-1	0	0	0
Alt 4	0	0	0	0	0	-1	-1	-1	-1	0	0	0
Alt 5	0	0	0	0	-1	-1	-1	-1	-1	-1	0	0
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5729**	**5738**	**5746**	**5753**	**5754**	**5750**	**5736**	**5716**	**5704**	**5704**	**5709**	**5718**
Alt 1	5729	5738	5746	5753	5754	5749	5736	5716	5704	5704	5709	5718
Alt 2	5729	5738	5747	5753	5754	5750	5736	5716	5705	5703	5708	5719
Alt 3	5729	5738	5746	5752	5754	5749	5736	5716	5704	5704	5708	5718
Alt 4	5729	5738	5746	5752	5754	5749	5736	5716	5704	5704	5708	5718
Alt 5	5729	5737	5745	5752	5753	5749	5735	5716	5704	5703	5708	5718
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0
Alt 2	1	0	0	0	0	0	0	0	0	-1	-1	0
Alt 3	0	0	0	0	0	0	0	0	0	-1	0	0
Alt 4	0	0	0	0	0	0	0	0	0	-1	0	0
Alt 5	0	-1	-1	-1	-1	-1	-1	0	0	-1	-1	0
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5729**	**5737**	**5746**	**5750**	**5752**	**5756**	**5753**	**5736**	**5718**	**5706**	**5711**	**5719**
Alt 1	5729	5737	5746	5750	5752	5755	5752	5734	5715	5705	5710	5719
Alt 2	5730	5738	5745	5748	5750	5754	5752	5734	5715	5706	5711	5720
Alt 3	5729	5738	5746	5751	5752	5755	5752	5735	5716	5706	5711	5720
Alt 4	5729	5738	5746	5751	5752	5755	5752	5735	5716	5706	5711	5719
Alt 5	5729	5738	5746	5750	5752	5755	5752	5734	5716	5705	5711	5719
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	-1	-1	-2	-2	-1	-1	0
Alt 2	1	1	-1	-2	-2	-2	-2	-2	-2	0	0	1
Alt 3	1	1	1	0	0	0	-1	-2	-2	0	0	1
Alt 4	1	1	1	0	0	0	-1	-2	-2	-1	0	1
Alt 5	1	1	0	0	0	-1	-1	-2	-2	-1	0	1

Table A-18. Carter Lake Surface Area (acres).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1016**	**1056**	**1092**	**1114**	**1119**	**1115**	**1070**	**980**	**913**	**901**	**924**	**968**
Alt 1	1016	1056	1092	1113	1117	1110	1064	974	908	898	922	967
Alt 2	1016	1054	1089	1110	1115	1111	1067	978	912	898	921	968
Alt 3	1018	1057	1093	1113	1118	1111	1066	976	910	899	923	970
Alt 4	1018	1057	1093	1113	1118	1111	1066	976	910	899	923	970
Alt 5	1017	1056	1091	1112	1117	1111	1065	976	910	897	922	969
Surface area change from Existing Conditions												
Alt 1	0	0	0	0	-2	-4	-6	-6	-5	-4	-2	-1
Alt 2	0	-1	-3	-4	-4	-4	-3	-2	-1	-4	-3	0
Alt 3	2	2	1	0	-1	-3	-5	-4	-3	-2	0	2
Alt 4	2	2	1	0	-1	-3	-5	-4	-3	-2	0	2
Alt 5	2	1	-1	-2	-2	-4	-5	-4	-3	-4	-2	1
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%	0%	0%	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1017**	**1057**	**1093**	**1119**	**1124**	**1107**	**1048**	**956**	**900**	**901**	**922**	**967**
Alt 1	1017	1057	1093	1119	1123	1105	1046	955	900	898	922	967
Alt 2	1019	1058	1095	1120	1124	1107	1049	958	902	895	918	969
Alt 3	1017	1056	1093	1119	1123	1106	1047	955	900	897	920	967
Alt 4	1017	1056	1093	1119	1123	1106	1047	955	900	897	920	967
Alt 5	1015	1054	1089	1116	1122	1105	1046	954	898	893	917	966
Surface area change from Existing Conditions												
Alt 1	0	0	0	0	-1	-2	-2	-1	0	-2	0	0
Alt 2	2	1	1	1	0	0	1	2	2	-6	-4	2
Alt 3	0	0	-1	0	-1	-1	-1	-1	0	-4	-2	0
Alt 4	0	0	-1	0	-1	-1	-1	-1	0	-4	-2	0
Alt 5	-1	-3	-4	-3	-2	-2	-2	-2	-2	-7	-5	-1
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	0%	0%
Alt 3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1015**	**1054**	**1091**	**1111**	**1118**	**1130**	**1121**	**1049**	**964**	**909**	**934**	**970**
Alt 1	1015	1054	1091	1111	1116	1127	1116	1041	952	902	928	969
Alt 2	1019	1057	1088	1102	1109	1125	1115	1040	953	907	934	974
Alt 3	1018	1058	1093	1112	1118	1129	1116	1042	955	906	933	973
Alt 4	1018	1058	1093	1112	1118	1129	1116	1042	955	906	933	973
Alt 5	1018	1057	1091	1110	1117	1128	1116	1041	954	906	933	973
Surface area change from Existing Conditions												
Alt 1	0	0	0	0	-2	-3	-6	-9	-12	-6	-5	-2
Alt 2	4	3	-3	-9	-9	-5	-6	-9	-10	-2	0	4
Alt 3	3	3	3	1	0	-2	-5	-8	-8	-2	0	2
Alt 4	3	3	3	1	0	-2	-5	-8	-8	-2	0	2
Alt 5	3	2	0	-1	-1	-2	-6	-8	-10	-3	-1	2
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%	-1%	0%
Alt 2	0%	0%	0%	-1%	-1%	0%	-1%	-1%	-1%	0%	0%	0%
Alt 3	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%
Alt 4	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%

Table A-19. Horsetooth Reservoir Elevations (feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5395**	**5403**	**5410**	**5414**	**5416**	**5420**	**5418**	**5406**	**5396**	**5390**	**5388**	**5390**
Alt 1	5395	5402	5410	5413	5416	5420	5417	5405	5395	5390	5387	5390
Alt 2	5393	5401	5406	5407	5410	5414	5412	5401	5393	5388	5385	5387
Alt 3	5395	5403	5409	5412	5415	5419	5417	5405	5396	5390	5388	5390
Alt 4	5395	5403	5409	5412	5415	5419	5417	5405	5396	5390	5388	5390
Alt 5	5395	5402	5409	5411	5414	5418	5416	5404	5395	5390	5387	5389
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0
Alt 2	-2	-2	-4	-6	-6	-6	-6	-4	-3	-3	-3	-3
Alt 3	0	0	-1	-2	-1	-1	-1	-1	0	0	0	0
Alt 4	0	0	-1	-2	-1	-1	-1	-1	0	0	0	0
Alt 5	0	0	-1	-3	-2	-2	-2	-1	-1	0	-1	-1
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5394**	**5402**	**5410**	**5412**	**5411**	**5411**	**5405**	**5395**	**5386**	**5389**	**5386**	**5388**
Alt 1	5394	5403	5410	5412	5411	5411	5405	5394	5386	5389	5385	5388
Alt 2	5392	5400	5406	5405	5403	5402	5397	5388	5383	5386	5382	5385
Alt 3	5394	5403	5409	5410	5409	5408	5403	5393	5386	5389	5385	5388
Alt 4	5394	5403	5409	5410	5409	5408	5403	5393	5386	5389	5385	5388
Alt 5	5393	5402	5408	5408	5406	5406	5400	5391	5385	5388	5384	5387
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0
Alt 2	-2	-2	-4	-7	-8	-8	-9	-7	-3	-3	-3	-3
Alt 3	0	0	-1	-2	-2	-2	-2	-2	0	0	0	0
Alt 4	0	0	-1	-2	-2	-2	-2	-2	0	0	0	0
Alt 5	-1	-1	-2	-4	-5	-5	-5	-3	-1	-1	-1	-1
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5397**	**5403**	**5410**	**5414**	**5419**	**5425**	**5425**	**5415**	**5404**	**5393**	**5392**	**5393**
Alt 1	5396	5403	5410	5414	5419	5425	5424	5415	5404	5392	5391	5393
Alt 2	5396	5402	5406	5408	5413	5421	5421	5411	5400	5390	5390	5391
Alt 3	5397	5403	5410	5413	5418	5425	5424	5415	5405	5393	5393	5394
Alt 4	5397	5403	5410	5413	5418	5425	5424	5415	5405	5393	5393	5394
Alt 5	5397	5403	5409	5412	5418	5424	5424	5414	5404	5393	5393	5394
Elevation change from Existing Conditions												
Alt 1	-1	0	-1	-1	0	0	0	0	0	-1	-1	-1
Alt 2	-1	-1	-4	-7	-6	-4	-3	-4	-4	-3	-2	-2
Alt 3	0	0	-1	-1	0	0	0	0	0	0	1	0
Alt 4	0	0	-1	-1	0	0	0	0	0	0	1	0
Alt 5	0	0	-1	-2	-1	-1	-1	-1	0	0	1	0

Table A-20. Horsetooth Reservoir Surface Area (acres).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1570**	**1664**	**1759**	**1803**	**1834**	**1892**	**1854**	**1703**	**1579**	**1505**	**1475**	**1505**
Alt 1	1569	1663	1757	1801	1832	1888	1849	1697	1574	1501	1471	1502
Alt 2	1546	1639	1706	1722	1751	1813	1781	1648	1541	1472	1438	1470
Alt 3	1570	1666	1748	1783	1818	1879	1842	1696	1576	1504	1474	1504
Alt 4	1570	1666	1748	1783	1818	1879	1842	1696	1576	1504	1474	1504
Alt 5	1566	1661	1741	1770	1804	1866	1830	1687	1570	1499	1468	1497
Surface area change from Existing Conditions												
Alt 1	-1	-1	-2	-2	-2	-4	-6	-6	-5	-4	-4	-3
Alt 2	-24	-24	-53	-81	-83	-79	-74	-55	-38	-33	-36	-35
Alt 3	0	2	-11	-21	-16	-14	-13	-7	-3	-1	-1	-1
Alt 4	0	2	-11	-21	-16	-14	-13	-7	-3	-1	-1	-1
Alt 5	-5	-2	-18	-33	-30	-26	-25	-16	-8	-6	-7	-8
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	-2%	-1%	-3%	-5%	-5%	-4%	-4%	-3%	-2%	-2%	-2%	-2%
Alt 3	0%	0%	-1%	-1%	-1%	-1%	-1%	0%	0%	0%	0%	0%
Alt 4	0%	0%	-1%	-1%	-1%	-1%	-1%	0%	0%	0%	0%	0%
Alt 5	0%	0%	-1%	-2%	-2%	-1%	-1%	-1%	-1%	0%	0%	-1%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1560**	**1661**	**1754**	**1778**	**1769**	**1764**	**1697**	**1565**	**1458**	**1491**	**1446**	**1482**
Alt 1	1561	1663	1757	1780	1771	1765	1694	1560	1454	1486	1445	1483
Alt 2	1531	1636	1702	1696	1675	1662	1588	1481	1411	1456	1402	1438
Alt 3	1560	1665	1743	1751	1741	1735	1668	1546	1452	1487	1441	1478
Alt 4	1560	1665	1743	1751	1741	1735	1668	1546	1452	1487	1441	1478
Alt 5	1547	1653	1726	1726	1710	1701	1631	1521	1444	1482	1431	1464
Surface area change from Existing Conditions												
Alt 1	1	3	3	2	2	1	-3	-6	-4	-4	-1	1
Alt 2	-29	-25	-52	-82	-94	-102	-109	-84	-46	-35	-44	-44
Alt 3	0	4	-12	-27	-28	-29	-29	-19	-6	-3	-5	-4
Alt 4	0	4	-12	-28	-28	-29	-29	-20	-6	-3	-5	-4
Alt 5	-13	-8	-29	-52	-59	-63	-66	-44	-14	-9	-15	-18
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	-2%	-1%	-3%	-5%	-5%	-6%	-6%	-5%	-3%	-2%	-3%	-3%
Alt 3	0%	0%	-1%	-2%	-2%	-2%	-2%	-1%	0%	0%	0%	0%
Alt 4	0%	0%	-1%	-2%	-2%	-2%	-2%	-1%	0%	0%	0%	0%
Alt 5	-1%	0%	-2%	-3%	-3%	-4%	-4%	-3%	-1%	-1%	-1%	-1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1594**	**1670**	**1760**	**1812**	**1872**	**1962**	**1955**	**1820**	**1684**	**1537**	**1532**	**1548**
Alt 1	1585	1664	1754	1806	1868	1960	1952	1815	1680	1529	1522	1537
Alt 2	1582	1656	1710	1727	1794	1907	1904	1766	1630	1505	1502	1523
Alt 3	1597	1675	1753	1799	1866	1959	1954	1821	1689	1543	1544	1554
Alt 4	1597	1675	1753	1799	1866	1959	1954	1821	1689	1543	1544	1554
Alt 5	1594	1673	1748	1787	1855	1952	1946	1813	1679	1538	1540	1550
Surface area change from Existing Conditions												
Alt 1	-8	-6	-6	-7	-4	-3	-4	-5	-5	-8	-11	-11
Alt 2	-12	-14	-49	-86	-79	-55	-51	-54	-54	-32	-30	-24
Alt 3	3	4	-7	-14	-7	-3	-2	1	4	6	12	6
Alt 4	3	4	-7	-14	-7	-3	-2	1	4	6	12	6
Alt 5	0	2	-12	-25	-18	-10	-9	-7	-6	1	7	2
Percent change in surface area from Existing Conditions												
Alt 1	-1%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%
Alt 2	-1%	-1%	-3%	-5%	-4%	-3%	-3%	-3%	-3%	-2%	-2%	-2%
Alt 3	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	1%	0%
Alt 4	0%	0%	0%	-1%	0%	0%	0%	0%	0%	0%	1%	0%
Alt 5	0%	0%	-1%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%

Table A-21. Lake Granby Elevations (feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**8258**	**8254**	**8250**	**8248**	**8253**	**8263**	**8268**	**8269**	**8268**	**8266**	**8264**	**8262**
Alt 1	8255	8251	8247	8245	8250	8260	8267	8267	8266	8264	8262	8259
Alt 2	8251	8246	8242	8241	8246	8257	8264	8264	8263	8260	8258	8255
Alt 3	8255	8251	8247	8245	8249	8259	8265	8266	8265	8263	8261	8259
Alt 4	8255	8251	8247	8245	8249	8259	8265	8266	8265	8263	8261	8259
Alt 5	8255	8251	8247	8246	8249	8259	8265	8266	8265	8263	8261	8259
Elevation change from Existing Conditions												
Alt 1	-3	-3	-3	-3	-3	-2	-2	-2	-2	-2	-2	-2
Alt 2	-7	-8	-8	-8	-7	-6	-5	-5	-5	-6	-6	-7
Alt 3	-3	-3	-3	-3	-4	-3	-3	-3	-3	-3	-3	-3
Alt 4	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
Alt 5	-3	-3	-3	-2	-3	-4	-3	-3	-3	-3	-3	-3
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**8263**	**8259**	**8255**	**8253**	**8253**	**8256**	**8255**	**8252**	**8248**	**8269**	**8270**	**8267**
Alt 1	8261	8257	8253	8250	8251	8254	8253	8250	8246	8267	8268	8265
Alt 2	8258	8253	8249	8247	8248	8250	8250	8245	8240	8264	8266	8263
Alt 3	8261	8256	8252	8251	8251	8253	8253	8249	8245	8266	8267	8265
Alt 4	8261	8256	8252	8251	8251	8253	8253	8249	8245	8266	8267	8265
Alt 5	8261	8256	8253	8251	8252	8254	8253	8249	8245	8266	8267	8265
Elevation change from Existing Conditions												
Alt 1	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Alt 2	-5	-6	-6	-5	-5	-5	-5	-6	-8	-5	-4	-4
Alt 3	-3	-3	-2	-2	-2	-2	-2	-3	-3	-3	-3	-3
Alt 4	-3	-3	-2	-2	-2	-2	-2	-3	-3	-3	-3	-3
Alt 5	-2	-2	-2	-2	-2	-2	-2	-2	-3	-3	-3	-2
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**8257**	**8254**	**8250**	**8248**	**8253**	**8266**	**8277**	**8280**	**8280**	**8265**	**8262**	**8260**
Alt 1	8253	8250	8245	8243	8248	8262	8275	8280	8280	8262	8259	8257
Alt 2	8248	8244	8240	8239	8245	8260	8274	8279	8280	8258	8254	8252
Alt 3	8253	8249	8246	8243	8248	8261	8274	8279	8279	8261	8257	8256
Alt 4	8253	8249	8246	8243	8248	8261	8274	8279	8279	8261	8257	8256
Alt 5	8253	8249	8246	8244	8248	8261	8274	8279	8279	8261	8257	8256
Elevation change from Existing Conditions												
Alt 1	-4	-4	-4	-5	-5	-4	-2	0	0	-3	-3	-4
Alt 2	-9	-10	-9	-9	-8	-6	-3	-1	-1	-7	-8	-8
Alt 3	-5	-5	-4	-4	-5	-5	-3	-1	-1	-4	-5	-5
Alt 4	-5	-5	-4	-4	-5	-5	-3	-1	-1	-4	-5	-5
Alt 5	-5	-5	-4	-4	-5	-5	-3	-1	-1	-4	-5	-5

Table A-22. Lake Granby Surface Area (acres).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**6221**	**6026**	**5824**	**5732**	**5970**	**6440**	**6722**	**6750**	**6691**	**6597**	**6512**	**6392**
Alt 1	6094	5891	5680	5584	5830	6327	6632	6662	6595	6493	6401	6274
Alt 2	5868	5644	5440	5359	5620	6159	6497	6524	6440	6324	6221	6075
Alt 3	6075	5880	5692	5600	5798	6270	6582	6610	6542	6445	6362	6246
Alt 4	6076	5880	5692	5601	5799	6271	6583	6611	6542	6446	6363	6246
Alt 5	6073	5878	5696	5609	5803	6265	6575	6607	6541	6445	6363	6245
Surface area change from Existing Conditions												
Alt 1	-127	-135	-144	-148	-140	-113	-90	-88	-96	-104	-111	-118
Alt 2	-353	-382	-384	-374	-351	-281	-225	-226	-251	-273	-290	-317
Alt 3	-146	-147	-132	-132	-172	-170	-140	-140	-149	-152	-150	-147
Alt 4	-145	-146	-132	-132	-171	-169	-140	-139	-149	-151	-149	-146
Alt 5	-148	-148	-128	-123	-167	-174	-147	-143	-150	-152	-149	-147
Percent change in surface area from Existing Conditions												
Alt 1	-2%	-2%	-2%	-3%	-2%	-2%	-1%	-1%	-1%	-2%	-2%	-2%
Alt 2	-6%	-6%	-7%	-7%	-6%	-4%	-3%	-3%	-4%	-4%	-4%	-5%
Alt 3	-2%	-2%	-2%	-2%	-3%	-3%	-2%	-2%	-2%	-2%	-2%	-2%
Alt 4	-2%	-2%	-2%	-2%	-3%	-3%	-2%	-2%	-2%	-2%	-2%	-2%
Alt 5	-2%	-2%	-2%	-2%	-3%	-3%	-2%	-2%	-2%	-2%	-2%	-2%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**6469**	**6263**	**6061**	**5957**	**5998**	**6108**	**6076**	**5910**	**5727**	**6751**	**6802**	**6662**
Alt 1	6381	6169	5960	5853	5894	6007	5975	5805	5611	6663	6723	6579
Alt 2	6224	5991	5787	5691	5734	5852	5817	5600	5336	6526	6606	6447
Alt 3	6346	6137	5950	5858	5890	5991	5955	5776	5574	6611	6675	6539
Alt 4	6347	6138	5950	5859	5890	5992	5956	5777	5574	6612	6675	6540
Alt 5	6350	6142	5964	5879	5914	6017	5983	5792	5573	6614	6679	6544
Surface area change from Existing Conditions												
Alt 1	-88	-94	-101	-104	-103	-100	-101	-106	-116	-88	-79	-83
Alt 2	-246	-273	-274	-266	-263	-256	-259	-311	-391	-225	-196	-215
Alt 3	-123	-126	-111	-99	-108	-116	-121	-135	-154	-140	-127	-123
Alt 4	-123	-126	-111	-98	-107	-116	-120	-134	-153	-139	-127	-122
Alt 5	-120	-121	-98	-78	-84	-91	-93	-118	-154	-137	-123	-119
Percent change in surface area from Existing Conditions												
Alt 1	-1%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-1%	-1%	-1%
Alt 2	-4%	-4%	-5%	-4%	-4%	-4%	-4%	-5%	-7%	-3%	-3%	-3%
Alt 3	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-3%	-2%	-2%	-2%
Alt 4	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-2%	-3%	-2%	-2%	-2%
Alt 5	-2%	-2%	-2%	-1%	-1%	-1%	-2%	-2%	-3%	-2%	-2%	-2%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**6192**	**6013**	**5819**	**5714**	**5968**	**6619**	**7151**	**7298**	**7297**	**6545**	**6426**	**6339**
Alt 1	5999	5806	5599	5486	5745	6429	7068	7298	7295	6412	6256	6158
Alt 2	5738	5529	5352	5280	5581	6317	6984	7253	7270	6227	6043	5925
Alt 3	5966	5787	5607	5505	5718	6373	7019	7259	7262	6348	6188	6108
Alt 4	5967	5788	5608	5506	5719	6374	7020	7259	7262	6349	6189	6109
Alt 5	5964	5785	5611	5516	5722	6366	7003	7249	7261	6347	6186	6105
Surface area change from Existing Conditions												
Alt 1	-193	-207	-221	-228	-223	-190	-84	0	-2	-133	-170	-181
Alt 2	-454	-484	-468	-435	-388	-302	-167	-45	-27	-318	-383	-414
Alt 3	-226	-226	-212	-209	-250	-246	-132	-39	-35	-197	-238	-231
Alt 4	-225	-225	-211	-208	-250	-246	-132	-39	-35	-196	-238	-230
Alt 5	-228	-228	-208	-198	-246	-254	-148	-49	-36	-198	-240	-233
Percent change in surface area from Existing Conditions												
Alt 1	-3%	-3%	-4%	-4%	-4%	-3%	-1%	0%	0%	-2%	-3%	-3%
Alt 2	-7%	-8%	-8%	-8%	-6%	-5%	-2%	-1%	0%	-5%	-6%	-7%
Alt 3	-4%	-4%	-4%	-4%	-4%	-4%	-2%	-1%	0%	-3%	-4%	-4%
Alt 4	-4%	-4%	-4%	-4%	-4%	-4%	-2%	-1%	0%	-3%	-4%	-4%
Alt 5	-4%	-4%	-4%	-3%	-4%	-4%	-2%	-1%	0%	-3%	-4%	`-4%

Table A-23. Windy Gap Firming Project Participant Demands, Firm Yield, and Average Yield (AF), Cumulative Effects.

Month	Existing Conditions			No Action			Chimney Hollow with Prepositioning			Dry Creek and Rockwell		
	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)
Oct	1,520	0	780	3,820	579	1,807	2,452	2,452	2,452	2,366	2,366	2,366
Nov	2,350	0	1,440	2,980	0	1,719	2,175	2,175	2,175	2,228	2,228	2,228
Dec	2,350	0	1,270	2,980	0	1,497	2,175	2,175	2,175	2,228	2,228	2,228
Jan	2,350	0	1,110	2,980	0	1,240	2,175	2,175	2,175	2,228	2,228	2,228
Feb	2,350	0	960	2,980	0	1,060	2,175	2,175	2,175	2,228	2,228	2,228
Mar	2,350	0	850	2,980	0	921	2,175	2,175	2,175	2,228	2,228	2,228
Apr	1,040	0	680	1,605	0	897	1,221	1,221	1,221	1,221	1,221	1,221
May	930	0	820	1,540	0	1,344	1,191	1,191	1,191	1,176	1,176	1,176
Jun	930	0	660	1,540	0	1070	1,191	1,191	1,191	1,176	1,176	1,176
Jul	1,490	0	960	3,020	0	2,247	1,995	1,995	1,995	1,970	1,970	1,970
Aug	1,500	0	910	3,420	0	2,235	2,224	2,224	2,224	2,168	2,168	2,168
Sep	1,520	0	830	3,820	0	2,112	2,452	2,452	2,452	2,366	2,366	2,366
Total	20,680	0	11,270	33,365	579	18,149	23,601	23,601	23,601	23,583	23,583	23,583

Table A-24. Windy Gap Firming Project Non-Participant Demands, Firm Yield, and Average Yield (AF), Cumulative Effects.

Month	Existing Conditions			No Action			Chimney Hollow with Prepositioning			Dry Creek and Rockwell		
	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)
Oct	10	0	10	290	0	70	290	0	80	290	0	80
Nov	10	0	0	70	0	20	70	0	20	70	0	20
Dec	10	0	0	70	0	20	70	0	20	70	0	20
Jan	0	0	0	50	0	10	50	0	10	50	0	10
Feb	0	0	0	40	0	10	40	0	10	40	0	10
Mar	10	0	0	60	0	20	60	0	20	60	0	20
Apr	10	0	0	120	0	60	120	0	60	120	0	60
May	30	0	30	730	0	600	730	0	600	730	0	610
Jun	40	0	30	1,050	0	630	1,050	0	650	1,050	0	650
Jul	50	0	30	870	0	340	870	0	350	870	0	360
Aug	30	0	20	440	0	130	440	0	140	440	0	140
Sep	20	0	20	310	0	80	310	0	90	310	0	90
Total	220	0	140	4,100	0	1,990	4,100	0	2,050	4,100	0	2,070

Table A-25. Middle Park Water Conservancy District Demands, Firm Yield, and Average Yield (AF), Cumulative Effects.

Month	Existing Conditions			No Action			Chimney Hollow with Prepositioning			Dry Creek and Rockwell		
	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)	Demand (AF)	Firm Yield (AF)	Average Yield (AF)
Oct	21	0	15	429	0	289	429	0	407	429	0	409
Nov	21	0	15	429	0	274	429	0	401	429	0	401
Dec	21	0	15	429	0	274	429	0	401	429	0	401
Jan	21	0	15	429	0	269	429	0	397	429	0	397
Feb	21	0	15	429	0	260	429	0	387	429	0	392
Mar	21	0	15	429	0	255	429	0	347	429	0	338
Apr	0	0	0	0	0	0	0	0	0	0	0	0
May	0	0	0	0	0	0	0	0	0	0	0	0
Jun	0	0	0	0	0	0	0	0	0	0	0	0
Jul	0	0	0	0	0	0	0	0	0	0	0	0
Aug	0	0	0	0	0	0	0	0	0	0	0	0
Sep	21	0	15	429	0	0	429	429	419	429	429	419
Total	147	0	105	3,000	0	1,922	3,000	429	2,759	3,000	429	2,757

Table A-26. Lake Granby Spills (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**0**	**0**	**0**	**0**	**18**	**352**	**216**	**41**	**10**	**5**	**0**	**0**	**53**
Alt 1	0	0	0	0	17	296	176	28	7	5	0	0	**44**
Alt 2	0	0	0	0	13	227	160	24	3	5	0	0	**36**
Alt 5	0	0	0	0	14	250	163	24	6	4	0	0	**39**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	-1	-56	-40	-13	-3	0	0	0	**-9**
Alt 2	0	0	0	0	-5	-125	-56	-17	-6	0	0	0	**-17**
Alt 5	0	0	0	0	-4	-102	-53	-16	-4	0	0	0	**-15**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	-5%	-16%	-18%	-32%	-29%	5%	0%	**0%**	-18%
Alt 2	0%	0%	0%	0%	-26%	-35%	-26%	-41%	-68%	2%	0%	**0%**	-32%
Alt 5	0%	0%	0%	0%	-23%	-29%	-24%	-40%	-38%	-6%	0%	**0%**	-28%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 5	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 5	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**0**	**0**	**0**	**0**	**123**	**845**	**887**	**249**	**23**	**0**	**0**	**0**	**178**
Alt 1	0	0	0	0	122	845	744	171	25	0	0	0	**160**
Alt 2	0	0	0	0	125	858	664	154	29	0	0	0	**153**
Alt 5	0	0	0	0	130	843	689	151	23	0	0	0	**154**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	-1	0	-144	-77	2	0	0	0	**-19**
Alt 2	0	0	0	0	2	13	-224	-95	6	0	0	0	**-25**
Alt 5	0	0	0	0	7	-2	-199	-98	0	0	0	0	**-25**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	-1%	0%	-16%	-31%	8%	0%	0%	**0%**	-11%
Alt 2	0%	0%	0%	0%	1%	2%	-25%	-38%	27%	0%	0%	**0%**	-14%
Alt 5	0%	0%	0%	0%	6%	0%	-22%	-39%	1%	0%	0%	**0%**	-14%

Table A-27. Adams Tunnel Diversions (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**409**	**523**	**417**	**285**	**430**	**406**	**224**	**206**	**263**	**252**	**225**	**404**	**336**
Alt 1	411	518	416	283	446	411	295	232	278	258	232	405	**348**
Alt 2	439	515	343	282	473	420	277	280	315	274	253	441	**359**
Alt 5	427	527	357	291	473	412	318	268	297	267	248	417	**358**
Flow change from Existing Conditions													
Alt 1	2	-5	-1	-2	17	5	71	26	15	6	8	1	**12**
Alt 2	31	-8	-74	-3	43	14	53	74	52	22	28	38	**23**
Alt 5	19	3	-60	6	43	6	94	63	34	15	23	13	**22**
Percent change in flow from Existing Conditions													
Alt 1	1%	-1%	0%	-1%	4%	1%	32%	13%	6%	2%	3%	**0%**	4%
Alt 2	7%	-2%	-18%	-1%	10%	3%	24%	36%	20%	9%	12%	**9%**	7%
Alt 5	5%	1%	-14%	2%	10%	1%	42%	30%	13%	6%	10%	**3%**	6%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**452**	**541**	**426**	**293**	**550**	**550**	**541**	**407**	**458**	**296**	**250**	**449**	**434**
Alt 1	456	541	426	293	550	550	538	399	462	299	261	449	**435**
Alt 2	507	550	364	293	550	550	550	543	530	301	278	484	**458**
Alt 5	494	550	364	293	550	550	550	498	486	302	276	467	**448**
Flow change from Existing Conditions													
Alt 1	4	0	0	0	0	0	-3	-8	4	3	10	0	**1**
Alt 2	55	9	-62	0	0	0	9	136	73	6	27	36	**24**
Alt 5	42	9	-62	0	0	0	9	91	28	6	26	19	**14**
Percent change in flow from Existing Conditions													
Alt 1	1%	0%	0%	0%	0%	0%	0%	-2%	1%	1%	4%	**0%**	0%
Alt 2	12%	2%	-15%	0%	0%	0%	2%	33%	16%	2%	11%	**8%**	6%
Alt 5	9%	2%	-15%	0%	0%	0%	2%	22%	6%	2%	10%	**4%**	3%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**372**	**497**	**426**	**293**	**255**	**134**	**85**	**105**	**116**	**219**	**168**	**340**	**250**
Alt 1	385	500	426	288	307	135	134	210	118	222	185	348	**271**
Alt 2	399	457	297	250	374	153	106	133	150	241	211	379	**262**
Alt 5	389	507	364	293	386	135	144	167	166	236	195	340	**276**
Flow change from Existing Conditions													
Alt 1	13	3	0	-5	52	0	49	106	2	3	17	8	**21**
Alt 2	26	-40	-129	-43	118	18	21	28	34	21	43	39	**12**
Alt 5	16	9	-62	0	131	0	59	62	50	17	28	0	**26**
Percent change in flow from Existing Conditions													
Alt 1	3%	1%	0%	-2%	20%	0%	58%	101%	2%	1%	10%	**2%**	8%
Alt 2	7%	-8%	-30%	-15%	46%	14%	25%	27%	29%	10%	26%	**11%**	5%
Alt 5	4%	2%	-15%	0%	51%	0%	70%	60%	43%	8%	16%	**0%**	10%

Table A-28. Windy Gap Diversions (AF), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**0**	**0**	**0**	**4522**	**17648**	**11053**	**2869**	**439**	**0**	**0**	**0**	**0**	**36532**
Alt 1	0	0	0	4376	17449	10585	5661	902	0	0	0	0	**38973**
Alt 2	0	0	0	4368	18851	12697	4098	777	0	0	0	0	**40791**
Alt 5	0	0	0	4368	19055	12561	6071	937	0	0	0	0	**42991**
Flow change from Existing Conditions													
Alt 1	0	0	0	-146	-199	-469	2792	463	0	0	0	0	**2441**
Alt 2	0	0	0	-154	1203	1643	1229	338	0	0	0	0	**4259**
Alt 5	0	0	0	-154	1406	1507	3202	498	0	0	0	0	**6459**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	-3%	-1%	-4%	97%	105%	0%	0%	0%	**0%**	7%
Alt 2	0%	0%	0%	-3%	7%	15%	43%	77%	0%	0%	0%	**0%**	12%
Alt 5	0%	0%	0%	-3%	8%	14%	112%	113%	0%	0%	0%	**0%**	18%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**0**	**0**	**0**	**1049**	**3723**	**2658**	**374**	**0**	**0**	**0**	**0**	**0**	**7804**
Alt 1	0	0	0	1038	2288	534	0	0	0	0	0	0	**3860**
Alt 2	0	0	0	1038	2288	534	0	0	0	0	0	0	**3860**
Alt 5	0	0	0	1038	2288	534	0	0	0	0	0	0	**3860**
Flow change from Existing Conditions													
Alt 1	0	0	0	-11	-1436	-2124	-374	0	0	0	0	0	**-3944**
Alt 2	0	0	0	-11	-1435	-2124	-374	0	0	0	0	0	**-3944**
Alt 5	0	0	0	-11	-1435	-2124	-374	0	0	0	0	0	**-3944**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	-1%	-39%	-80%	-100%	0%	0%	0%	0%	**0%**	-51%
Alt 2	0%	0%	0%	-1%	-39%	-80%	-100%	0%	0%	0%	0%	**0%**	-51%
Alt 5	0%	0%	0%	-1%	-39%	-80%	-100%	0%	0%	0%	0%	**0%**	-51%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**0**	**0**	**0**	**2808**	**20532**	**14280**	**892**	**0**	**0**	**0**	**0**	**0**	**38512**
Alt 1	0	0	0	2801	20804	17894	15463	5157	0	0	0	0	**62118**
Alt 2	0	0	0	2801	28406	22218	13167	2826	0	0	0	0	**69417**
Alt 5	0	0	0	2801	28575	21711	16016	2595	0	0	0	0	**71699**
Flow change from Existing Conditions													
Alt 1	0	0	0	-8	272	3614	14571	5157	0	0	0	0	**23606**
Alt 2	0	0	0	-8	7874	7938	12275	2826	0	0	0	0	**30905**
Alt 5	0	0	0	-8	8043	7431	15124	2595	0	0	0	0	**33186**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	1%	25%	1633%	0%	0%	0%	0%	**0%**	61%
Alt 2	0%	0%	0%	0%	38%	56%	1376%	0%	0%	0%	0%	**0%**	80%
Alt 5	0%	0%	0%	0%	39%	52%	1696%	0%	0%	0%	0%	**0%**	86%

Table A-29. Big Thompson River Streamflow below Lake Estes (cfs), Cumulative Effects.

Average Year (1950-1996)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Existing Conditions	**12**	**12**	**14**	**39**	**176**	**410**	**186**	**114**	**59**	**39**	**26**	**16**	**92**
Alt 1	12	12	14	39	176	415	188	114	59	39	26	16	**93**
Alt 2	12	12	14	40	189	423	203	117	60	40	26	16	**96**
Alt 5	12	12	14	40	183	416	190	115	59	39	26	16	**94**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	5	2	0	0	0	0	0	**1**
Alt 2	0	0	0	1	14	13	17	3	1	1	0	0	**4**
Alt 5	0	0	0	1	7	5	4	1	0	0	0	0	**2**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	-1%	0%	1%	1%	0%	0%	0%	0%	**0%**	1%
Alt 2	0%	0%	0%	2%	8%	3%	9%	3%	1%	2%	1%	**0%**	4%
Alt 5	0%	0%	0%	2%	4%	1%	2%	1%	0%	0%	1%	**0%**	2%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**9**	**9**	**12**	**36**	**165**	**274**	**156**	**97**	**50**	**38**	**23**	**15**	**74**
Alt 1	9	9	12	36	165	274	154	97	50	38	23	15	**74**
Alt 2	9	9	12	36	165	274	165	97	50	38	23	15	**75**
Alt 5	9	9	12	36	165	274	165	97	50	38	23	15	**75**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	0	-2	0	0	0	0	0	**0**
Alt 2	0	0	0	0	0	0	9	0	0	0	0	0	**1**
Alt 5	0	0	0	0	0	0	9	0	0	0	0	0	**1**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	0%	-1%	0%	0%	0%	0%	**0%**	0%
Alt 2	0%	0%	0%	0%	0%	0%	6%	0%	0%	0%	0%	**0%**	1%
Alt 5	0%	0%	0%	0%	0%	0%	6%	0%	0%	0%	0%	**0%**	1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**12**	**12**	**15**	**38**	**128**	**362**	**328**	**162**	**65**	**38**	**25**	**16**	**101**
Alt 1	12	12	15	38	128	363	328	162	65	38	25	16	**101**
Alt 2	12	12	15	37	134	381	335	162	65	38	25	16	**103**
Alt 5	12	12	15	38	128	363	328	162	65	38	25	16	**101**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 2	0	0	0	0	6	18	7	0	0	0	0	0	**3**
Alt 5	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 2	0%	0%	0%	-1%	4%	5%	2%	0%	0%	0%	0%	**0%**	3%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%

Table A-30. Colorado River Streamflow below Lake Granby at USGS gage (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**20**	**20**	**20**	**20**	**84**	**400**	**258**	**68**	**28**	**25**	**20**	**20**	**82**
Alt 1	20	20	20	20	83	344	223	57	25	25	20	20	**73**
Alt 2	20	20	20	20	81	279	210	55	22	24	20	20	**66**
Alt 5	20	20	20	20	82	300	213	55	24	24	20	20	**68**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	-1	-56	-35	-11	-3	0	0	0	**-9**
Alt 2	0	0	0	0	-3	-121	-48	-13	-6	0	0	0	**-16**
Alt 5	0	0	0	0	-2	-100	-45	-13	-4	-1	0	0	**-14**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	-1%	-14%	-14%	-16%	-10%	0%	0%	**0%**	-11%
Alt 2	0%	0%	0%	0%	-4%	-30%	-19%	-19%	-22%	-1%	2%	**0%**	-19%
Alt 5	0%	0%	0%	0%	-3%	-25%	-17%	-19%	-15%	-3%	0%	**0%**	-17%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**20**	**20**	**20**	**20**	**57**	**57**	**57**	**30**	**20**	**20**	**20**	**20**	**30**
Alt 1	20	20	20	20	57	57	57	30	20	20	20	20	**30**
Alt 2	20	20	20	20	57	57	57	30	20	20	20	20	**30**
Alt 5	20	20	20	20	57	57	57	30	20	20	20	20	**30**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 5	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**20**	**20**	**20**	**20**	**181**	**886**	**896**	**245**	**33**	**20**	**20**	**20**	**199**
Alt 1	20	20	20	20	180	886	768	175	35	20	20	20	**183**
Alt 2	20	20	20	20	183	899	689	167	37	20	23	20	**177**
Alt 5	20	20	20	20	188	884	714	163	31	20	20	20	**177**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	-1	0	-128	-69	2	0	0	0	**-17**
Alt 2	0	0	0	0	2	13	-207	-78	3	0	3	0	**-22**
Alt 5	0	0	0	0	7	-2	-182	-81	-3	0	0	0	**-22**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	-1%	0%	-14%	-28%	5%	0%	0%	**0%**	-8%
Alt 2	0%	0%	0%	0%	1%	1%	-23%	-32%	10%	0%	16%	**0%**	-11%
Alt 5	0%	0%	0%	0%	4%	0%	-20%	-33%	-8%	0%	0%	**0%**	-11%

Table A-31. Colorado River Streamflow above Windy Gap (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**65**	**69**	**88**	**213**	**545**	**1137**	**519**	**168**	**83**	**79**	**78**	**68**	**260**
Alt 1	61	66	85	211	510	981	441	144	76	77	75	64	**233**
Alt 2	61	66	85	211	505	903	425	141	72	77	75	64	**224**
Alt 5	61	66	85	211	506	930	429	141	75	76	75	64	**227**
Flow change from Existing Conditions													
Alt 1	-4	-3	-3	-2	-35	-156	-78	-23	-6	-2	-4	-4	**-27**
Alt 2	-4	-3	-3	-2	-39	-234	-94	-26	-10	-2	-3	-4	**-35**
Alt 5	-4	-3	-3	-2	-38	-207	-90	-27	-8	-3	-3	-4	**-33**
Percent change in flow from Existing Conditions													
Alt 1	-6%	-5%	-3%	-1%	-6%	-14%	-15%	-14%	-8%	-2%	-5%	**-6%**	-10%
Alt 2	-6%	-5%	-3%	-1%	-7%	-21%	-18%	-16%	-12%	-3%	-4%	**-6%**	-14%
Alt 5	-6%	-5%	-3%	-1%	-7%	-18%	-17%	-16%	-9%	-4%	-4%	**-6%**	-13%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**60**	**63**	**90**	**145**	**197**	**187**	**133**	**94**	**66**	**67**	**74**	**65**	**104**
Alt 1	55	60	88	144	187	168	125	82	60	64	71	60	**97**
Alt 2	55	60	88	144	187	168	124	82	60	64	71	60	**97**
Alt 5	55	60	88	144	187	168	124	82	60	64	71	60	**97**
Flow change from Existing Conditions													
Alt 1	-5	-3	-2	-1	-10	-19	-8	-11	-6	-2	-3	-5	**-6**
Alt 2	-5	-3	-2	-1	-10	-19	-9	-11	-6	-2	-3	-5	**-6**
Alt 5	-5	-3	-2	-1	-10	-19	-9	-11	-6	-2	-3	-5	**-6**
Percent change in flow from Existing Conditions													
Alt 1	-8%	-5%	-2%	-1%	-5%	-10%	-6%	-12%	-9%	-3%	-4%	**-7%**	-6%
Alt 2	-8%	-5%	-2%	-1%	-5%	-10%	-7%	-12%	-9%	-3%	-4%	**-7%**	-6%
Alt 5	-8%	-5%	-2%	-1%	-5%	-10%	-7%	-12%	-9%	-3%	-4%	**-7%**	-6%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**72**	**77**	**85**	**179**	**1041**	**2660**	**1730**	**462**	**124**	**82**	**86**	**77**	**558**
Alt 1	68	72	81	177	989	2440	1457	374	122	82	82	72	**503**
Alt 2	68	72	81	177	992	2454	1377	354	124	82	85	72	**496**
Alt 5	68	72	81	177	997	2439	1402	348	118	82	83	72	**496**
Flow change from Existing Conditions													
Alt 1	-4	-4	-4	-2	-52	-220	-273	-88	-2	1	-4	-5	**-55**
Alt 2	-4	-4	-4	-2	-49	-206	-353	-107	0	1	-1	-5	**-62**
Alt 5	-4	-4	-4	-2	-44	-221	-328	-113	-6	1	-2	-5	**-62**
Percent change in flow from Existing Conditions													
Alt 1	-6%	-6%	-5%	-1%	-5%	-8%	-16%	-19%	-1%	1%	-5%	**-6%**	-10%
Alt 2	-6%	-6%	-5%	-1%	-5%	-8%	-20%	-23%	0%	1%	-1%	**-6%**	-11%
Alt 5	-6%	-6%	-5%	-1%	-4%	-8%	-19%	-25%	-5%	1%	-3%	**-6%**	-11%

Table A-32. Colorado River Streamflow below Windy Gap at USGS gage (cfs), Cumulative Effects.

Average Year (1950-1996)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Existing Conditions	**65**	**69**	**88**	**137**	**258**	**951**	**472**	**161**	**83**	**79**	**78**	**68**	**209**
Alt 1	61	66	85	138	226	803	348	130	76	77	75	64	**179**
Alt 2	61	66	85	138	199	690	359	129	72	77	75	64	**168**
Alt 5	61	66	85	138	196	719	330	125	75	76	75	64	**167**
Flow change from Existing Conditions													
Alt 1	-4	-3	-3	0	-32	-148	-124	-31	-6	-2	-4	-4	**-30**
Alt 2	-4	-3	-3	0	-59	-261	-114	-32	-10	-2	-3	-4	**-41**
Alt 5	-4	-3	-3	0	-61	-232	-142	-35	-8	-3	-3	-4	**-42**
Percent change in flow from Existing Conditions													
Alt 1	-6%	-5%	-3%	0%	-12%	-16%	-26%	-19%	-8%	-2%	-5%	**-6%**	-14%
Alt 2	-6%	-5%	-3%	0%	-23%	-27%	-24%	-20%	-12%	-3%	-4%	**-6%**	-20%
Alt 5	-6%	-5%	-3%	0%	-24%	-24%	-30%	-22%	-9%	-4%	-4%	**-6%**	-20%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**60**	**63**	**90**	**127**	**136**	**142**	**127**	**94**	**66**	**67**	**74**	**65**	**93**
Alt 1	55	60	88	126	149	159	125	82	60	64	71	60	**92**
Alt 2	55	60	88	126	149	159	124	82	60	64	71	60	**92**
Alt 5	55	60	88	126	149	159	124	82	60	64	71	60	**92**
Flow change from Existing Conditions													
Alt 1	-5	-3	-2	-1	13	17	-2	-11	-6	-2	-3	-5	**-1**
Alt 2	-5	-3	-2	-1	13	17	-3	-11	-6	-2	-3	-5	**-1**
Alt 5	-5	-3	-2	-1	13	17	-3	-11	-6	-2	-3	-5	**-1**
Percent change in flow from Existing Conditions													
Alt 1	-8%	-5%	-2%	-1%	10%	12%	-2%	-12%	-9%	-3%	-4%	**-7%**	-1%
Alt 2	-8%	-5%	-2%	-1%	10%	12%	-3%	-12%	-9%	-3%	-4%	**-7%**	-1%
Alt 5	-8%	-5%	-2%	-1%	10%	12%	-3%	-12%	-9%	-3%	-4%	**-7%**	-1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**72**	**77**	**85**	**132**	**707**	**2420**	**1716**	**462**	**124**	**82**	**86**	**77**	**505**
Alt 1	68	72	81	130	651	2139	1206	290	122	82	82	72	**417**
Alt 2	68	72	81	130	530	2080	1163	308	124	82	85	72	**400**
Alt 5	68	72	81	130	533	2074	1141	306	118	82	83	72	**397**
Flow change from Existing Conditions													
Alt 1	-4	-4	-4	-2	-57	-281	-510	-172	-2	1	-4	-5	**-88**
Alt 2	-4	-4	-4	-2	-177	-340	-552	-153	0	1	-1	-5	**-104**
Alt 5	-4	-4	-4	-2	-175	-346	-574	-156	-6	1	-2	-5	**-108**
Percent change in flow from Existing Conditions													
Alt 1	-6%	-6%	-5%	-2%	-8%	-12%	-30%	-37%	-1%	1%	-5%	**-6%**	-17%
Alt 2	-6%	-6%	-5%	-2%	-25%	-14%	-32%	-33%	0%	1%	-1%	**-6%**	-21%
Alt 5	-6%	-6%	-5%	-2%	-25%	-14%	-33%	-34%	-5%	1%	-3%	**-6%**	-21%

Table A-33. Willow Creek Streamflow at USGS/NCWCD gage (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**8**	**9**	**14**	**6**	**51**	**143**	**32**	**12**	**3**	**8**	**8**	**9**	**25**
Alt 1	8	9	14	6	51	127	23	10	4	8	8	9	**23**
Alt 2	8	9	14	6	49	114	20	9	3	8	8	9	**21**
Alt 5	8	9	14	6	49	120	20	9	4	8	8	9	**22**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	-16	-9	-2	0	0	0	0	**-2**
Alt 2	0	0	0	0	-2	-29	-11	-3	0	0	0	0	**-4**
Alt 5	0	0	0	0	-2	-23	-11	-3	0	0	0	0	**-3**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	-11%	-29%	-15%	2%	3%	0%	**0%**	-9%
Alt 2	0%	0%	0%	0%	-4%	-20%	-36%	-27%	-13%	2%	1%	**0%**	-15%
Alt 5	0%	0%	0%	0%	-3%	-16%	-36%	-25%	2%	-1%	2%	**0%**	-13%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**8**	**8**	**12**	**4**	**0**	**10**	**0**	**2**	**2**	**6**	**7**	**7**	**5**
Alt 1	8	8	12	4	0	10	0	2	2	6	7	7	**5**
Alt 2	8	8	12	4	0	10	0	2	2	6	7	7	**5**
Alt 5	8	8	12	4	0	10	0	2	2	6	7	7	**5**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 2	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Alt 5	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**	0%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**9**	**10**	**18**	**5**	**184**	**434**	**112**	**58**	**14**	**7**	**11**	**12**	**73**
Alt 1	9	10	18	5	184	378	75	52	14	7	11	12	**65**
Alt 2	9	10	18	5	184	378	75	40	14	7	11	12	**64**
Alt 5	9	10	18	5	184	378	75	40	14	7	12	12	**64**
Flow change from Existing Conditions													
Alt 1	0	0	0	0	0	-56	-38	-6	0	0	0	0	**-8**
Alt 2	0	0	0	0	0	-56	-38	-18	0	0	0	0	**-9**
Alt 5	0	0	0	0	0	-56	-38	-18	0	0	2	0	**-9**
Percent change in flow from Existing Conditions													
Alt 1	0%	0%	0%	0%	0%	-13%	-34%	-10%	0%	0%	-1%	**0%**	-11%
Alt 2	0%	0%	0%	0%	0%	-13%	-34%	-30%	0%	0%	0%	**0%**	-13%
Alt 5	0%	0%	0%	0%	0%	-13%	-34%	-30%	0%	0%	15%	**0%**	-13%

Table A-34. Colorado River at Hot Sulphur Springs at USGS/NCWCD gage (cfs), Cumulative Effects.

Average Year (1950-1996)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Existing Conditions	**69**	**72**	**93**	**146**	**278**	**953**	**482**	**170**	**87**	**87**	**83**	**72**	**216**
Alt 1	65	69	90	146	245	803	355	137	80	85	80	68	**185**
Alt 2	65	69	90	146	218	689	365	136	76	85	80	68	**174**
Alt 5	65	69	90	146	216	719	336	133	79	84	80	68	**174**
Flow change from Existing Conditions													
Alt 1	-4	-3	-3	0	-33	-150	-127	-32	-7	-2	-4	-4	**-31**
Alt 2	-4	-3	-3	0	-60	-263	-116	-33	-11	-2	-3	-4	**-42**
Alt 5	-4	-3	-3	0	-63	-234	-145	-37	-9	-3	-3	-4	**-42**
Percent change in flow from Existing Conditions													
Alt 1	-6%	-5%	-3%	0%	-12%	-16%	-26%	-19%	-8%	-2%	-4%	**-6%**	-14%
Alt 2	-6%	-5%	-3%	0%	-22%	-28%	-24%	-20%	-13%	-3%	-4%	**-6%**	-19%
Alt 5	-6%	-5%	-3%	0%	-22%	-25%	-30%	-22%	-10%	-3%	-4%	**-6%**	-20%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**63**	**64**	**95**	**137**	**137**	**139**	**142**	**101**	**67**	**75**	**80**	**69**	**98**
Alt 1	58	61	93	136	149	154	136	88	61	73	77	64	**96**
Alt 2	58	61	93	136	149	154	135	88	61	73	77	64	**96**
Alt 5	58	61	93	136	149	154	135	88	61	73	77	64	**96**
Flow change from Existing Conditions													
Alt 1	-5	-4	-2	-1	12	15	-5	-13	-7	-2	-3	-5	**-2**
Alt 2	-5	-4	-2	-1	12	15	-6	-13	-7	-2	-3	-5	**-2**
Alt 5	-5	-4	-2	-1	12	15	-6	-13	-7	-2	-3	-5	**-2**
Percent change in flow from Existing Conditions													
Alt 1	-8%	-6%	-2%	-1%	9%	11%	-4%	-13%	-10%	-3%	-3%	**-7%**	-2%
Alt 2	-8%	-6%	-2%	-1%	9%	11%	-4%	-13%	-10%	-3%	-3%	**-7%**	-2%
Alt 5	-8%	-6%	-2%	-1%	9%	11%	-4%	-13%	-10%	-3%	-3%	**-7%**	-2%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**78**	**82**	**91**	**150**	**730**	**2414**	**1709**	**468**	**127**	**90**	**90**	**82**	**511**
Alt 1	74	77	86	148	672	2132	1196	294	124	89	85	77	**422**
Alt 2	74	77	86	148	552	2073	1154	313	125	89	89	77	**405**
Alt 5	74	77	86	148	554	2066	1132	311	120	89	87	77	**402**
Flow change from Existing Conditions													
Alt 1	-4	-5	-4	-3	-58	-283	-513	-173	-3	0	-4	-5	**-89**
Alt 2	-4	-5	-4	-3	-178	-342	-555	-154	-1	0	-1	-5	**-105**
Alt 5	-4	-5	-4	-3	-176	-348	-577	-157	-7	0	-3	-5	**-108**
Percent change in flow from Existing Conditions													
Alt 1	-6%	-6%	-5%	-2%	-8%	-12%	-30%	-37%	-2%	0%	-5%	**-6%**	-17%
Alt 2	-6%	-6%	-5%	-2%	-24%	-14%	-32%	-33%	-1%	0%	-1%	**-6%**	-21%
Alt 5	-6%	-6%	-5%	-2%	-24%	-14%	-34%	-34%	-5%	0%	-3%	**-6%**	-21%

Table A-35. Colorado River Streamflow below Williams Fork (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**179**	**189**	**210**	**186**	**308**	**1194**	**735**	**276**	**191**	**232**	**209**	**184**	**341**
Alt 1	177	188	212	181	273	1085	597	265	200	243	208	181	**317**
Alt 2	177	188	212	182	246	971	607	264	196	242	208	181	**306**
Alt 5	177	188	212	182	244	1000	578	261	199	242	208	181	**306**
Flow change from Existing Conditions													
Alt 1	-2	-1	2	-4	-34	-109	-138	-10	10	10	-1	-3	**-24**
Alt 2	-2	-1	2	-4	-61	-223	-128	-11	6	10	-1	-3	**-35**
Alt 5	-2	-1	2	-4	-64	-193	-157	-15	8	9	-1	-3	**-35**
Percent change in flow from Existing Conditions													
Alt 1	-1%	-1%	1%	-2%	-11%	-9%	-19%	-4%	5%	4%	-1%	**-2%**	-7%
Alt 2	-1%	-1%	1%	-2%	-20%	-19%	-17%	-4%	3%	4%	0%	**-2%**	-10%
Alt 5	-1%	-1%	1%	-2%	-21%	-16%	-21%	-5%	4%	4%	0%	**-2%**	-10%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**173**	**180**	**213**	**190**	**148**	**146**	**338**	**266**	**178**	**214**	**206**	**186**	**204**
Alt 1	187	197	229	174	160	162	258	274	198	219	221	199	**207**
Alt 2	187	197	229	174	160	161	258	274	198	219	221	199	**207**
Alt 5	187	197	229	174	160	161	258	274	198	219	221	199	**207**
Flow change from Existing Conditions													
Alt 1	13	17	16	-16	12	15	-80	8	20	5	15	14	**3**
Alt 2	13	17	16	-16	12	15	-80	8	20	5	15	14	**3**
Alt 5	13	17	16	-16	12	15	-80	8	20	5	15	14	**3**
Percent change in flow from Existing Conditions													
Alt 1	8%	9%	8%	-8%	8%	10%	-24%	3%	11%	2%	8%	**7%**	2%
Alt 2	8%	9%	8%	-8%	8%	10%	-24%	3%	11%	2%	8%	**7%**	1%
Alt 5	8%	9%	8%	-8%	8%	10%	-24%	3%	11%	2%	8%	**7%**	1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**191**	**205**	**213**	**216**	**803**	**2965**	**2314**	**639**	**215**	**242**	**220**	**202**	**704**
Alt 1	192	207	215	200	737	2728	1844	482	215	253	222	203	**626**
Alt 2	192	207	215	200	616	2668	1802	501	216	253	225	203	**609**
Alt 5	192	207	215	200	619	2662	1780	498	211	253	223	203	**606**
Flow change from Existing Conditions													
Alt 1	1	1	2	-16	-66	-237	-470	-157	0	10	2	1	**-78**
Alt 2	1	1	2	-16	-187	-296	-512	-138	1	10	5	1	**-95**
Alt 5	1	1	2	-16	-185	-303	-534	-141	-4	10	3	1	**-98**
Percent change in flow from Existing Conditions													
Alt 1	0%	1%	1%	-7%	-8%	-8%	-20%	-25%	0%	4%	1%	**0%**	-11%
Alt 2	0%	1%	1%	-7%	-23%	-10%	-22%	-22%	1%	4%	2%	**0%**	-13%
Alt 5	0%	1%	1%	-7%	-23%	-10%	-23%	-22%	-2%	4%	2%	**0%**	-14%

Table A-36. Colorado River Streamflow near Kremmling at USGS gage (cfs), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Year (1950-1996)													
Existing Conditions	**495**	**521**	**557**	**664**	**1145**	**2619**	**1745**	**1026**	**909**	**832**	**583**	**523**	**969**
Alt 1	491	519	558	643	975	2114	1303	953	864	812	563	504	**859**
Alt 2	490	519	558	643	948	2002	1313	953	859	812	564	504	**848**
Alt 5	490	519	558	643	945	2030	1286	948	862	811	564	504	**848**
Flow change from Existing Conditions													
Alt 1	-4	-2	1	-20	-170	-504	-442	-73	-46	-19	-20	-19	**-110**
Alt 2	-4	-2	1	-20	-197	-617	-432	-73	-50	-20	-20	-19	**-121**
Alt 5	-4	-2	1	-20	-199	-588	-459	-78	-47	-20	-20	-19	**-122**
Percent change in flow from Existing Conditions													
Alt 1	-1%	0%	0%	-3%	-15%	-19%	-25%	-7%	-5%	-2%	-3%	**-4%**	-11%
Alt 2	-1%	0%	0%	-3%	-17%	-24%	-25%	-7%	-5%	-2%	-3%	**-4%**	-13%
Alt 5	-1%	0%	0%	-3%	-17%	-22%	-26%	-8%	-5%	-2%	-3%	**-4%**	-13%
Dry Year Average (1954, 1966, 1977, 1981, 1989)													
Existing Conditions	**454**	**483**	**557**	**615**	**422**	**473**	**924**	**943**	**866**	**674**	**547**	**493**	**622**
Alt 1	471	505	581	586	388	353	748	914	826	670	542	495	**591**
Alt 2	471	504	581	586	388	348	748	914	826	671	542	494	**590**
Alt 5	471	504	581	586	388	348	748	914	826	671	542	494	**590**
Flow change from Existing Conditions													
Alt 1	17	22	24	-29	-34	-120	-176	-29	-40	-4	-4	2	**-31**
Alt 2	17	22	24	-29	-34	-125	-176	-29	-39	-4	-5	2	**-32**
Alt 5	17	22	24	-29	-34	-125	-176	-29	-39	-4	-5	2	**-32**
Percent change in flow from Existing Conditions													
Alt 1	4%	5%	4%	-5%	-8%	-25%	-19%	-3%	-5%	-1%	-1%	**0%**	-5%
Alt 2	4%	4%	4%	-5%	-8%	-26%	-19%	-3%	-5%	-1%	-1%	**0%**	-5%
Alt 5	4%	4%	4%	-5%	-8%	-26%	-19%	-3%	-5%	-1%	-1%	**0%**	-5%
Wet Year Average (1957, 1983, 1984, 1986, 1995)													
Existing Conditions	**576**	**622**	**639**	**764**	**2231**	**5885**	**4725**	**1694**	**945**	**804**	**633**	**600**	**1681**
Alt 1	569	619	635	698	2015	4956	3930	1430	924	760	611	581	**1481**
Alt 2	569	619	635	698	1894	4897	3888	1449	924	760	615	581	**1464**
Alt 5	569	619	635	698	1896	4891	3866	1446	919	760	613	581	**1461**
Flow change from Existing Conditions													
Alt 1	-7	-3	-4	-66	-216	-929	-794	-264	-21	-44	-22	-19	**-200**
Alt 2	-7	-3	-4	-66	-337	-988	-837	-245	-21	-44	-19	-19	**-217**
Alt 5	-7	-3	-4	-66	-335	-994	-859	-248	-25	-44	-20	-19	**-220**
Percent change in flow from Existing Conditions													
Alt 1	-1%	-1%	-1%	-9%	-10%	-16%	-17%	-16%	-2%	-5%	-3%	**-3%**	-12%
Alt 2	-1%	-1%	-1%	-9%	-15%	-17%	-18%	-14%	-2%	-5%	-3%	**-3%**	-13%
Alt 5	-1%	-1%	-1%	-9%	-15%	-17%	-18%	-15%	-3%	-5%	-3%	**-3%**	-13%

Table A-37. Colorado River at Hot Sulphur Springs Channel Maintenance Flows (1950-1996), Cumulative Effects.

				Average flow (cfs)			
Recurrence Interval	**Flow Range**	**Range of Dates Flow Occurs**	**When most of Flow Occurs**	**Existing Conditions**	**No Action**	**Proposed Action**	**Alternative 5**
0.8x1.5-yr flow to 2-yr flow	**510 cfs to 1,240 cfs**	late March - mid-October	May through July	768	787	794	796
2-yr flow to 5-yr flow	**1,240 cfs to 3,160 cfs**	May 1 to late September	June and July	2,018	2,085	1,984	2,035
5-yr flow to 10-yr flow	**3,160 cfs to 4,600 cfs**	late May to mid-July	June	3,750	3,723	3,699	3,701
10-yr flow to 25-yr flow	**4,600 cfs to 6,520 cfs**	late May to mid-July	June	5,016	5,290	5,252	5,246
At or greater than 25-yr flow	**6,520 cfs or greater**	12-Jul	one day	6,545	6,545	-	-

		Average Number of Days/Year Flow Occurs				Percentage of Years Flow Occurs			
Recurrence Interval	**Flow Range**	**Existing Conditions**	**No Action**	**Proposed Action**	**Alt 5**	**Existing Conditions**	**No Action**	**Proposed Action**	**Alt 5**
0.8x1.5-yr flow to 2-yr flow	**510 cfs to 1,240 cfs**	23	21	21	19	62%	49%	47%	47%
2-yr flow to 5-yr flow	**1,240 cfs to 3,160 cfs**	23.5	21	21	21	38%	34%	32%	32%
5-yr flow to 10-yr flow	**3,160 cfs to 4,600 cfs**	10.5	8	9	9.5	28%	26%	17%	17%
10-yr flow to 25-yr flow	**4,600 cfs to 6,520 cfs**	4	8	8	7.5	13%	4%	4%	4%
At or greater than 25-yr flow	**6,520 cfs or greater**	1	1	0	0	2%	2%	0%	0%

		Number of Days Occurs in 47-yr model period			
Recurrence Interval	**Flow Range**	**Existing Conditions**	**No Action**	**Proposed Action**	**Alt 5**
0.8x1.5-yr flow to 2-yr flow	**510 cfs to 1,240 cfs**	663	476	463	423
2-yr flow to 5-yr flow	**1,240 cfs to 3,160 cfs**	423	331	315	311
5-yr flow to 10-yr flow	**3,160 cfs to 4,600 cfs**	137	98	73	76
10-yr flow to 25-yr flow	**4,600 cfs to 6,520 cfs**	24	16	16	15
At or greater than 25-yr flow	**6,520 cfs or greater**	1	1	0	0

Table A-38. Colorado River Stage below Windy Gap Reservoir at USGS gage (feet), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**0.55**	**0.56**	**0.59**	**0.68**	**0.90**	**1.81**	**1.19**	**0.71**	**0.58**	**0.57**	**0.57**	**0.55**
Alt 1	0.54	0.55	0.58	0.67	0.85	1.62	1.01	0.66	0.57	0.57	0.57	0.55
Alt 2	0.54	0.55	0.58	0.67	0.80	1.48	1.02	0.66	0.56	0.57	0.57	0.55
Alt 5	0.54	0.55	0.58	0.67	0.80	1.51	0.98	0.65	0.57	0.57	0.57	0.55
Change in stage from Existing Conditions												
Alt 1	-0.01	-0.01	0.00	0.00	-0.06	-0.19	-0.18	-0.05	-0.01	0.00	-0.01	-0.01
Alt 2	-0.01	-0.01	0.00	0.00	-0.10	-0.33	-0.17	-0.05	-0.02	0.00	-0.01	-0.01
Alt 5	-0.01	-0.01	0.00	0.00	-0.10	-0.29	-0.21	-0.06	-0.01	0.00	-0.01	-0.01
Percent change in stage from Existing Conditions												
Alt 1	-1.2%	-1.0%	-0.7%	-0.1%	-6.1%	-10.3%	-15.0%	-7.3%	-2.0%	-0.5%	-1.0%	-1.3%
Alt 2	-1.2%	-1.0%	-0.7%	-0.3%	-11.3%	-18.2%	-14.2%	-7.5%	-3.1%	-0.7%	-0.9%	-1.3%
Alt 5	-1.2%	-1.0%	-0.7%	-0.3%	-11.5%	-16.3%	-17.5%	-8.3%	-2.4%	-0.8%	-1.0%	-1.3%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
Existing Conditions	**0.54**	**0.55**	**0.59**	**0.65**	**0.67**	**0.68**	**0.65**	**0.60**	**0.55**	**0.55**	**0.57**	**0.55**
Alt 1	0.53	0.54	0.59	0.65	0.69	0.71	0.65	0.58	0.54	0.55	0.56	0.54
Alt 2	0.53	0.54	0.59	0.65	0.69	0.71	0.65	0.58	0.54	0.55	0.56	0.54
Alt 5	0.53	0.54	0.59	0.65	0.69	0.71	0.65	0.58	0.54	0.55	0.56	0.54
Change in stage from Existing Conditions												
Alt 1	-0.01	-0.01	0.00	0.00	0.02	0.03	0.00	-0.02	-0.01	0.00	0.00	-0.01
Alt 2	-0.01	-0.01	0.00	0.00	0.02	0.03	-0.01	-0.02	-0.01	0.00	0.00	-0.01
Alt 5	-0.01	-0.01	0.00	0.00	0.02	0.03	-0.01	-0.02	-0.01	0.00	0.00	-0.01
Percent change in stage from Existing Conditions												
Alt 1	-1.5%	-1.1%	-0.6%	-0.1%	3.2%	4.1%	-0.7%	-3.1%	-1.9%	-0.7%	-0.8%	-1.4%
Alt 2	-1.5%	-1.1%	-0.6%	-0.1%	3.2%	4.0%	-0.9%	-3.1%	-1.9%	-0.7%	-0.8%	-1.4%
Alt 5	-1.5%	-1.1%	-0.6%	-0.1%	3.2%	4.0%	-0.9%	-3.1%	-1.9%	-0.7%	-0.8%	-1.4%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
Existing Conditions	**0.56**	**0.57**	**0.58**	**0.69**	**1.58**	**3.20**	**2.59**	**1.19**	**0.66**	**0.58**	**0.59**	**0.57**
Alt 1	0.56	0.56	0.58	0.68	1.50	2.98	2.10	0.93	0.66	0.58	0.58	0.56
Alt 2	0.56	0.56	0.58	0.68	1.34	2.93	2.05	0.96	0.66	0.58	0.58	0.56
Alt 5	0.56	0.56	0.58	0.68	1.34	2.92	2.03	0.96	0.65	0.58	0.58	0.56
Change in stage from Existing Conditions												
Alt 1	-0.01	-0.01	-0.01	-0.01	-0.08	-0.22	-0.49	-0.26	-0.01	0.00	-0.01	-0.01
Alt 2	-0.01	-0.01	-0.01	-0.01	-0.24	-0.27	-0.54	-0.23	-0.01	0.00	0.00	-0.01
Alt 5	-0.01	-0.01	-0.01	-0.01	-0.24	-0.28	-0.56	-0.24	-0.02	0.00	0.00	-0.01
Percent change in stage from Existing Conditions												
Alt 1	-1.3%	-1.3%	-1.2%	-0.9%	-5.2%	-7.0%	-19.0%	-21.7%	-1.1%	0.2%	-1.2%	-1.3%
Alt 2	-1.3%	-1.3%	-1.2%	-1.7%	-15.2%	-8.6%	-20.7%	-19.5%	-0.9%	0.2%	-0.2%	-1.3%
Alt 5	-1.3%	-1.3%	-1.2%	-1.6%	-15.1%	-8.8%	-21.6%	-19.9%	-2.3%	0.2%	-0.7%	-1.3%

Table A-39. Colorado River Stage near Kremmling at USGS gage (feet), Cumulative Effects.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Year (1950-1996)												
Existing Conditions	**4.18**	**4.25**	**4.36**	**4.68**	**6.01**	**8.67**	**7.22**	**5.66**	**5.32**	**5.11**	**4.43**	**4.26**
Alt 1	4.17	4.25	4.36	4.62	5.58	7.82	6.30	5.45	5.20	5.06	4.38	4.21
Alt 2	4.17	4.25	4.36	4.61	5.51	7.63	6.32	5.45	5.19	5.06	4.38	4.21
Alt 5	4.17	4.25	4.36	4.61	5.51	7.67	6.26	5.44	5.20	5.05	4.38	4.21
Change in stage from Existing Conditions												
Alt 1	-0.01	-0.01	0.00	-0.07	-0.43	-0.85	-0.92	-0.21	-0.12	-0.05	-0.06	-0.05
Alt 2	-0.01	-0.01	0.00	-0.07	-0.50	-1.04	-0.91	-0.21	-0.13	-0.05	-0.06	-0.05
Alt 5	-0.01	-0.01	0.00	-0.07	-0.51	-1.00	-0.96	-0.22	-0.12	-0.06	-0.06	-0.05
Percent change in stage from Existing Conditions												
Alt 1	-0.3%	-0.1%	0.1%	-1.5%	-7.1%	-9.8%	-12.7%	-3.7%	-2.2%	-1.0%	-1.3%	-1.3%
Alt 2	-0.3%	-0.1%	0.1%	-1.5%	-8.4%	-12.0%	-12.6%	-3.7%	-2.4%	-1.1%	-1.3%	-1.3%
Alt 5	-0.3%	-0.1%	0.1%	-1.5%	-8.4%	-11.5%	-13.3%	-3.9%	-2.3%	-1.1%	-1.3%	-1.3%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
Existing Conditions	**4.06**	**4.14**	**4.36**	**4.49**	**4.01**	**4.17**	**5.31**	**5.39**	**5.19**	**4.70**	**4.33**	**4.17**
Alt 1	4.11	4.21	4.43	4.41	3.90	3.82	4.87	5.30	5.09	4.68	4.32	4.18
Alt 2	4.11	4.21	4.43	4.41	3.90	3.80	4.87	5.30	5.09	4.68	4.31	4.18
Alt 5	4.11	4.21	4.43	4.41	3.90	3.80	4.87	5.30	5.09	4.68	4.31	4.18
Change in stage from Existing Conditions												
Alt 1	0.05	0.06	0.07	-0.08	-0.11	-0.35	-0.45	-0.09	-0.10	-0.01	-0.01	0.01
Alt 2	0.05	0.06	0.07	-0.08	-0.11	-0.37	-0.45	-0.09	-0.10	-0.01	-0.01	0.00
Alt 5	0.05	0.06	0.07	-0.08	-0.11	-0.37	-0.45	-0.09	-0.10	-0.01	-0.01	0.00
Percent change in stage from Existing Conditions												
Alt 1	1.2%	1.5%	1.6%	-1.8%	-2.8%	-8.5%	-8.4%	-1.7%	-1.9%	-0.3%	-0.3%	0.1%
Alt 2	1.2%	1.5%	1.6%	-1.8%	-2.8%	-8.8%	-8.4%	-1.7%	-1.9%	-0.3%	-0.3%	0.1%
Alt 5	1.2%	1.5%	1.6%	-1.8%	-2.8%	-8.8%	-8.4%	-1.7%	-1.9%	-0.3%	-0.3%	0.1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
Existing Conditions	**4.41**	**4.55**	**4.59**	**5.03**	**8.26**	**12.17**	**11.20**	**7.25**	**5.46**	**5.04**	**4.57**	**4.48**
Alt 1	4.39	4.54	4.58	4.84	7.85	11.40	10.42	6.69	5.39	4.93	4.51	4.43
Alt 2	4.39	4.54	4.58	4.83	7.64	11.34	10.37	6.73	5.39	4.93	4.52	4.43
Alt 5	4.39	4.54	4.58	4.83	7.65	11.34	10.35	6.72	5.38	4.93	4.52	4.43
Change in stage from Existing Conditions												
Alt 1	-0.02	-0.01	-0.01	-0.19	-0.40	-0.76	-0.79	-0.55	-0.07	-0.11	-0.06	-0.05
Alt 2	-0.02	-0.01	-0.01	-0.19	-0.62	-0.82	-0.83	-0.52	-0.07	-0.11	-0.05	-0.05
Alt 5	-0.02	-0.01	-0.01	-0.19	-0.61	-0.83	-0.86	-0.53	-0.08	-0.11	-0.06	-0.05
Percent change in stage from Existing Conditions												
Alt 1	-0.5%	-0.2%	-0.2%	-3.7%	-4.9%	-6.3%	-7.0%	-7.6%	-1.4%	-2.3%	-1.3%	-1.2%
Alt 2	-0.5%	-0.2%	-0.2%	-3.9%	-7.5%	-6.7%	-7.4%	-7.2%	-1.4%	-2.3%	-1.1%	-1.2%
Alt 5	-0.5%	-0.2%	-0.2%	-3.9%	-7.4%	-6.8%	-7.6%	-7.3%	-1.5%	-2.3%	-1.2%	-1.2%

Table A-40. Carter Lake Elevations (feet), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**5729**	**5738**	**5746**	**5751**	**5753**	**5751**	**5741**	**5721**	**5707**	**5705**	**5709**	**5718**
Alt 1	5729	5738	5746	5751	5752	5750	5740	5720	5706	5704	5709	5718
Alt 2	5729	5737	5745	5750	5752	5750	5740	5721	5707	5704	5709	5719
Alt 5	5729	5738	5746	5751	5752	5751	5740	5720	5707	5704	5709	5719
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	-1	-1	-1	-1	-1	0	0	0
Alt 2	0	0	-1	-1	-1	-1	-1	0	0	0	0	0
Alt 5	0	0	0	0	0	-1	-1	-1	0	0	0	0
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**5729**	**5738**	**5746**	**5753**	**5754**	**5750**	**5736**	**5716**	**5704**	**5704**	**5709**	**5718**
Alt 1	5729	5738	5746	5753	5754	5749	5736	5716	5705	5704	5709	5718
Alt 2	5730	5738	5747	5753	5754	5750	5736	5717	5705	5704	5709	5719
Alt 5	5729	5737	5745	5752	5753	5749	5736	5716	5704	5704	5708	5718
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0
Alt 2	1	0	0	0	0	0	0	1	0	-1	0	1
Alt 5	0	0	-1	-1	0	0	0	0	0	-1	-1	0
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**5729**	**5737**	**5746**	**5750**	**5752**	**5756**	**5753**	**5736**	**5718**	**5706**	**5711**	**5719**
Alt 1	5729	5737	5746	5751	5752	5755	5752	5734	5715	5705	5710	5719
Alt 2	5730	5738	5745	5748	5750	5754	5751	5734	5715	5706	5711	5720
Alt 5	5729	5738	5746	5750	5752	5755	5752	5735	5716	5706	5711	5720
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	-1	-1	-2	-2	-1	-1	0
Alt 2	1	1	-1	-2	-2	-2	-2	-2	-2	0	0	1
Alt 5	1	1	0	0	0	-1	-1	-2	-2	0	0	1

Table A-41. Carter Lake Surface Area (acres), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**1016**	**1056**	**1092**	**1114**	**1119**	**1115**	**1070**	**980**	**913**	**901**	**924**	**968**
Alt 1	1016	1056	1093	1113	1117	1110	1065	975	910	899	923	968
Alt 2	1016	1054	1089	1110	1115	1111	1068	979	913	899	922	969
Alt 5	1018	1057	1091	1112	1117	1111	1066	977	912	900	924	970
Surface area change from Existing Conditions												
Alt 1	0	0	0	0	-2	-4	-5	-5	-3	-2	-1	0
Alt 2	0	-1	-3	-4	-4	-4	-2	-1	0	-2	-1	1
Alt 5	2	1	-1	-1	-2	-3	-4	-3	-1	-1	0	2
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**1017**	**1057**	**1093**	**1119**	**1124**	**1107**	**1048**	**956**	**900**	**901**	**922**	**967**
Alt 1	1017	1057	1093	1119	1123	1106	1048	957	902	899	922	967
Alt 2	1019	1059	1095	1120	1124	1108	1050	959	902	897	921	971
Alt 5	1016	1055	1090	1117	1122	1105	1047	955	900	897	920	967
Surface area change from Existing Conditions												
Alt 1	0	0	0	0	-1	-1	0	1	2	-1	0	0
Alt 2	3	2	1	1	0	1	2	3	2	-4	-2	3
Alt 5	0	-2	-3	-2	-2	-2	-1	-1	0	-4	-3	0
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**1015**	**1054**	**1091**	**1111**	**1118**	**1130**	**1121**	**1049**	**964**	**909**	**934**	**970**
Alt 1	1015	1054	1092	1112	1116	1127	1116	1041	953	905	930	969
Alt 2	1019	1057	1087	1101	1109	1125	1115	1040	954	908	935	974
Alt 5	1019	1057	1092	1110	1118	1129	1117	1042	955	908	935	974
Surface area change from Existing Conditions												
Alt 1	0	0	1	1	-2	-3	-6	-9	-11	-4	-4	-1
Alt 2	4	3	-3	-10	-9	-6	-7	-9	-10	-1	1	4
Alt 5	4	3	1	-1	0	-2	-5	-7	-9	-1	1	3
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%
Alt 2	0%	0%	0%	-1%	-1%	-1%	-1%	-1%	-1%	0%	0%	0%
Alt 5	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%

Table A-42. Horsetooth Reservoir Elevation (feet), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**5395**	**5403**	**5410**	**5414**	**5416**	**5420**	**5418**	**5406**	**5396**	**5390**	**5388**	**5390**
Alt 1	5395	5403	5410	5414	5416	5420	5417	5405	5395	5390	5388	5390
Alt 2	5394	5401	5407	5408	5410	5415	5413	5402	5393	5388	5386	5388
Alt 5	5395	5403	5409	5411	5414	5419	5416	5405	5395	5390	5388	5390
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0
Alt 2	-1	-1	-4	-6	-6	-5	-5	-4	-2	-2	-2	-2
Alt 5	0	0	-1	-2	-2	-2	-2	-1	0	0	0	0
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**5394**	**5402**	**5410**	**5412**	**5411**	**5411**	**5405**	**5395**	**5386**	**5389**	**5386**	**5388**
Alt 1	5394	5403	5410	5412	5411	5411	5405	5394	5386	5389	5386	5388
Alt 2	5393	5401	5407	5406	5405	5404	5398	5390	5384	5387	5383	5386
Alt 5	5394	5402	5408	5408	5407	5406	5401	5392	5386	5388	5385	5388
Elevation change from Existing Conditions												
Alt 1	0	0	0	0	0	0	0	0	0	0	0	0
Alt 2	-1	-1	-3	-5	-6	-7	-7	-5	-2	-2	-3	-3
Alt 5	0	0	-2	-3	-4	-4	-4	-2	0	-1	-1	-1
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**5397**	**5403**	**5410**	**5414**	**5419**	**5425**	**5425**	**5415**	**5404**	**5393**	**5392**	**5393**
Alt 1	5396	5403	5410	5414	5419	5425	5424	5415	5404	5392	5391	5393
Alt 2	5397	5402	5407	5408	5414	5422	5421	5411	5400	5391	5391	5393
Alt 5	5397	5403	5410	5413	5418	5424	5424	5414	5404	5393	5393	5394
Elevation change from Existing Conditions												
Alt 1	-1	0	0	0	0	0	0	0	0	-1	-1	-1
Alt 2	0	-1	-3	-6	-5	-3	-3	-4	-4	-2	-1	-1
Alt 5	0	0	-1	-2	-1	-1	-1	-1	0	0	1	0

Table A-43. Horsetooth Reservoir Surface Area (acres), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**1570**	**1664**	**1759**	**1803**	**1834**	**1892**	**1854**	**1703**	**1579**	**1505**	**1475**	**1505**
Alt 1	1570	1663	1758	1803	1833	1889	1850	1699	1575	1502	1473	1504
Alt 2	1553	1645	1714	1732	1762	1823	1790	1657	1548	1480	1447	1479
Alt 5	1569	1664	1745	1775	1809	1870	1834	1691	1573	1501	1472	1502
Surface area change from Existing Conditions												
Alt 1	0	0	-1	-1	-1	-3	-4	-4	-4	-3	-2	-1
Alt 2	-17	-18	-45	-72	-72	-69	-64	-46	-30	-25	-28	-26
Alt 5	-1	1	-14	-28	-25	-22	-20	-12	-6	-4	-3	-3
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	-1%	-1%	-3%	-4%	-4%	-4%	-3%	-3%	-2%	-2%	-2%	-2%
Alt 5	0%	0%	-1%	-2%	-1%	-1%	-1%	-1%	0%	0%	0%	0%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**1560**	**1661**	**1754**	**1778**	**1769**	**1764**	**1697**	**1565**	**1458**	**1491**	**1446**	**1482**
Alt 1	1562	1664	1757	1781	1771	1766	1696	1562	1455	1487	1445	1483
Alt 2	1541	1648	1716	1712	1692	1680	1608	1502	1431	1463	1410	1447
Alt 5	1555	1660	1734	1734	1720	1712	1644	1535	1453	1484	1435	1472
Surface area change from Existing Conditions												
Alt 1	2	3	3	3	2	1	-1	-3	-2	-3	-1	1
Alt 2	-19	-13	-39	-66	-77	-84	-89	-64	-27	-27	-36	-35
Alt 5	-5	-1	-21	-44	-49	-52	-53	-30	-5	-7	-11	-11
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Alt 2	-1%	-1%	-2%	-4%	-4%	-5%	-5%	-4%	-2%	-2%	-2%	-2%
Alt 5	0%	0%	-1%	-2%	-3%	-3%	-3%	-2%	0%	0%	-1%	-1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**1594**	**1670**	**1760**	**1812**	**1872**	**1962**	**1955**	**1820**	**1684**	**1537**	**1532**	**1548**
Alt 1	1586	1665	1756	1809	1872	1963	1954	1817	1682	1529	1521	1537
Alt 2	1592	1662	1717	1735	1802	1912	1907	1769	1634	1514	1514	1537
Alt 5	1597	1674	1752	1791	1857	1953	1947	1813	1679	1540	1542	1553
Surface area change from Existing Conditions												
Alt 1	-8	-5	-4	-3	0	0	-2	-3	-3	-8	-11	-10
Alt 2	-2	-9	-43	-78	-70	-50	-48	-51	-51	-23	-19	-11
Alt 5	3	4	-8	-21	-15	-9	-9	-7	-6	3	9	6
Percent change in surface area from Existing Conditions												
Alt 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	-1%
Alt 2	0%	-1%	-2%	-4%	-4%	-3%	-2%	-3%	-3%	-1%	-1%	-1%
Alt 5	0%	0%	0%	-1%	-1%	0%	0%	0%	0%	0%	1%	0%

Table A-44. Lake Granby Elevations (feet), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**8258**	**8254**	**8250**	**8248**	**8253**	**8263**	**8268**	**8269**	**8268**	**8266**	**8264**	**8262**
Alt 1	8254	8250	8246	8244	8249	8259	8265	8266	8265	8263	8261	8258
Alt 2	8249	8245	8241	8239	8244	8255	8262	8263	8261	8259	8256	8253
Alt 5	8254	8250	8246	8244	8248	8258	8264	8265	8263	8262	8260	8257
Elevation change from Existing Conditions												
Alt 1	-4	-4	-4	-4	-4	-3	-3	-3	-3	-3	-3	-3
Alt 2	-9	-9	-9	-9	-9	-7	-6	-6	-7	-7	-8	-8
Alt 5	-4	-4	-4	-4	-5	-5	-4	-4	-4	-4	-4	-4
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**8263**	**8259**	**8255**	**8253**	**8253**	**8256**	**8255**	**8252**	**8248**	**8269**	**8270**	**8267**
Alt 1	8260	8256	8252	8249	8250	8252	8251	8248	8244	8266	8267	8265
Alt 2	8257	8252	8248	8246	8247	8249	8248	8243	8238	8263	8265	8262
Alt 5	8260	8256	8252	8250	8251	8253	8252	8248	8244	8265	8267	8264
Elevation change from Existing Conditions												
Alt 1	-3	-3	-3	-3	-3	-3	-4	-4	-4	-3	-3	-3
Alt 2	-6	-7	-7	-7	-7	-7	-7	-8	-10	-6	-5	-6
Alt 5	-3	-3	-3	-2	-3	-3	-3	-4	-4	-4	-3	-3
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**8257**	**8254**	**8250**	**8248**	**8253**	**8266**	**8277**	**8280**	**8280**	**8265**	**8262**	**8260**
Alt 1	8252	8248	8244	8242	8247	8261	8275	8279	8280	8261	8258	8256
Alt 2	8247	8243	8239	8238	8244	8259	8273	8278	8278	8257	8253	8250
Alt 5	8252	8248	8244	8242	8247	8260	8273	8278	8278	8259	8256	8255
Elevation change from Existing Conditions												
Alt 1	-5	-5	-6	-6	-6	-5	-3	-1	-1	-4	-5	-5
Alt 2	-11	-11	-11	-10	-9	-7	-5	-2	-2	-8	-9	-10
Alt 5	-6	-6	-5	-5	-6	-6	-4	-2	-2	-5	-6	-6

Table A-45. Lake Granby Surface Area (acres), Cumulative Effects.

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**6221**	**6026**	**5824**	**5732**	**5970**	**6440**	**6722**	**6750**	**6691**	**6597**	**6512**	**6392**
Alt 1	6048	5844	5631	5535	5779	6275	6578	6609	6544	6444	6353	6227
Alt 2	5793	5568	5360	5277	5539	6086	6422	6444	6361	6247	6145	5999
Alt 5	6019	5824	5638	5549	5742	6208	6516	6545	6482	6389	6307	6191
Surface area change from Existing Conditions												
Alt 1	-173	-182	-192	-198	-191	-165	-144	-141	-147	-153	-159	-165
Alt 2	-428	-458	-463	-456	-431	-354	-300	-306	-330	-350	-367	-393
Alt 5	-202	-203	-185	-183	-228	-232	-207	-205	-209	-208	-205	-202
Percent change in surface area from Existing Conditions												
Alt 1	-3%	-3%	-3%	-3%	-3%	-3%	-2%	-2%	-2%	-2%	-2%	-3%
Alt 2	-7%	-8%	-8%	-8%	-7%	-5%	-4%	-5%	-5%	-5%	-6%	-6%
Alt 5	-3%	-3%	-3%	-3%	-4%	-4%	-3%	-3%	-3%	-3%	-3%	-3%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**6469**	**6263**	**6061**	**5957**	**5998**	**6108**	**6076**	**5910**	**5727**	**6751**	**6802**	**6662**
Alt 1	6337	6123	5912	5803	5839	5939	5898	5726	5533	6617	6679	6535
Alt 2	6167	5932	5726	5627	5665	5770	5724	5500	5234	6459	6548	6390
Alt 5	6306	6100	5920	5835	5866	5963	5923	5731	5513	6563	6636	6500
Surface area change from Existing Conditions												
Alt 1	-133	-140	-149	-154	-158	-168	-178	-184	-194	-134	-122	-127
Alt 2	-302	-332	-336	-330	-333	-338	-352	-410	-493	-292	-254	-272
Alt 5	-163	-163	-141	-122	-131	-145	-153	-180	-214	-188	-166	-162
Percent change in surface area from Existing Conditions												
Alt 1	-2%	-2%	-2%	-3%	-3%	-3%	-3%	-3%	-3%	-2%	-2%	-2%
Alt 2	-5%	-5%	-6%	-6%	-6%	-6%	-6%	-7%	-9%	-4%	-4%	-4%
Alt 5	-3%	-3%	-2%	-2%	-2%	-2%	-3%	-3%	-4%	-3%	-2%	-2%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Existing Conditions	**6192**	**6013**	**5819**	**5714**	**5968**	**6619**	**7151**	**7298**	**7297**	**6545**	**6426**	**6339**
Alt 1	5944	5748	5538	5425	5687	6384	7023	7258	7268	6360	6203	6104
Alt 2	5668	5464	5285	5212	5514	6257	6925	7187	7202	6154	5972	5852
Alt 5	5907	5727	5549	5453	5661	6308	6945	7193	7206	6291	6130	6049
Surface area change from Existing Conditions												
Alt 1	-248	-265	-282	-289	-281	-236	-129	-39	-29	-185	-224	-235
Alt 2	-524	-549	-534	-502	-454	-362	-227	-110	-95	-391	-454	-487
Alt 5	-285	-286	-270	-262	-308	-311	-207	-105	-91	-254	-296	-290
Percent change in surface area from Existing Conditions												
Alt 1	-4%	-4%	-5%	-5%	-5%	-4%	-2%	-1%	0%	-3%	-3%	-4%
Alt 2	-8%	-9%	-9%	-9%	-8%	-5%	-3%	-2%	-1%	-6%	-7%	-8%
Alt 5	-5%	-5%	-5%	-5%	-5%	-5%	-3%	-1%	-1%	-4%	-5%	-5%

Windy Gap Firming Project

Appendix B to FEIS

Hydrologic Changes to Granby Reservoir, Horsetooth Reservoir, and Grand Lake with Modified Prepositioning

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Table B-1. Granby Reservoir Contents (acre-feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**392085**	**366820**	**341591**	**330560**	**359922**	**421577**	**460226**	**464045**	**455930**	**442984**	**431303**	**415026**
Alt 2 Area	359164	333073	309648	300375	330056	396632	439632	441352	429544	414755	402277	384138
Alt 2 Area Change	-32921	-33747	-31942	-30186	-29866	-24945	-20594	-22693	-26386	-28230	-29027	-30889
Alt 2 % Difference	-8%	-9%	-9%	-9%	-8%	-6%	-4%	-5%	-6%	-6%	-7%	-7%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**425474**	**397704**	**371255**	**358008**	**363122**	**377224**	**373173**	**352229**	**329995**	**464189**	**471203**	**451956**
Alt 2 Area	394625	364951	339932	328369	333527	347717	343469	321213	297947	438564	446722	424554
Alt 2 Area Change	-30849	-32753	-31323	-29639	-29594	-29507	-29704	-31015	-32048	-25625	-24482	-27401
Alt 2 % Difference	-7%	-8%	-8%	-8%	-8%	-8%	-8%	-9%	-10%	-6%	-5%	-6%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**388275**	**365149**	**341064**	**328406**	**359729**	**446172**	**518555**	**537833**	**537752**	**435839**	**419616**	**407788**
Alt 2 Area	351653	327835	305140	294188	325712	416860	504480	533073	527621	406038	387365	373101
Alt 2 Area Change	-36622	-37314	-35924	-34219	-34017	-29311	-14075	-4760	-10131	-29801	-32251	-34688
Alt 2 % Difference	-9%	-10%	-11%	-10%	-9%	-7%	-3%	-1%	-2%	-7%	-8%	-9%

Alt 2 = Chimney Hollow with Prepositioning.

Table B-2. Granby Reservoir Elevation (feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**8258**	**8254**	**8250**	**8248**	**8253**	**8263**	**8268**	**8269**	**8268**	**8266**	**8264**	**8262**
Alt 2 Area	8253	8248	8244	8243	8248	8259	8265	8266	8264	8262	8260	8257
Alt 2 Area Change	-5	-6	-6	-5	-5	-4	-3	-3	-4	-4	-4	-5
Alt 2 % Difference	-7%	-8%	-9%	-9%	-7%	-5%	-4%	-4%	-5%	-5%	-6%	-6%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**8263**	**8259**	**8255**	**8253**	**8253**	**8256**	**8255**	**8252**	**8248**	**8269**	**8270**	**8267**
Alt 2 Area	8258	8254	8250	8248	8249	8251	8250	8246	8242	8265	8266	8263
Alt 2 Area Change	-5	-5	-5	-5	-5	-5	-5	-5	-6	-4	-4	-4
Alt 2 % Difference	-6%	-7%	-7%	-7%	-7%	-7%	-7%	-8%	-9%	-5%	-4%	-5%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**8257**	**8254**	**8250**	**8248**	**8253**	**8266**	**8277**	**8280**	**8280**	**8265**	**8262**	**8260**
Alt 2 Area	8252	8248	8244	8242	8247	8262	8275	8279	8279	8260	8257	8255
Alt 2 Area Change	-6	-6	-6	-6	-6	-4	-2	-1	-2	-5	-5	-5
Alt 2 % Difference	-8%	-9%	-10%	-10%	-9%	-6%	-2%	-1%	-2%	-6%	-7%	-7%

Alt 2 = Chimney Hollow with Prepositioning. Minimum reservoir elevation (dead pool) = 8186 feet.

Table B-3. Granby Reservoir Surface Area (acres).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**6221**	**6026**	**5824**	**5732**	**5970**	**6440**	**6722**	**6750**	**6691**	**6597**	**6512**	**6392**
Alt 2 Area	5966	5753	5552	5469	5726	6253	6573	6585	6499	6390	6298	6160
Alt 2 Area Change	-255	-273	-272	-263	-245	-186	-150	-165	-192	-207	-214	-232
Alt 2 % Difference	-4%	-5%	-5%	-5%	-4%	-3%	-2%	-2%	-3%	-3%	-3%	-4%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**6469**	**6263**	**6061**	**5957**	**5998**	**6108**	**6076**	**5910**	**5727**	**6751**	**6802**	**6662**
Alt 2 Area	6240	6012	5810	5714	5757	5874	5839	5653	5447	6565	6624	6462
Alt 2 Area Change	-229	-252	-251	-243	-240	-233	-237	-258	-280	-186	-178	-200
Alt 2 % Difference	-4%	-4%	-4%	-4%	-4%	-4%	-4%	-4%	-5%	-3%	-3%	-3%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**6192**	**6013**	**5819**	**5714**	**5968**	**6619**	**7151**	**7298**	**7297**	**6545**	**6426**	**6339**
Alt 2 Area	5906	5709	5512	5413	5688	6403	7047	7261	7220	6326	6185	6076
Alt 2 Area Change	-286	-304	-308	-301	-280	-217	-105	-37	-78	-219	-241	-263
Alt 2 % Difference	-5%	-5%	-5%	-5%	-5%	-3%	-1%	-1%	-1%	-3%	-4%	-4%

Alt 2 = Chimney Hollow with Prepositioning.

Table B-4. Carter Lake Contents (acre-feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**79799**	**88414**	**96909**	**102489**	**104132**	**102811**	**91807**	**72239**	**58704**	**56419**	**60765**	**69731**
Alt 2 Area	80459	88875	97065	102381	103614	101966	90924	71414	58197	56270	61165	70494
Alt 2 Area Change	659	461	156	-108	-518	-846	-883	-825	-507	-149	399	762
Alt 2 % Difference	1%	1%	0%	0%	0%	-1%	-1%	-1%	-1%	0%	1%	1%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**79931**	**88647**	**97205**	**104144**	**105531**	**100778**	**86821**	**67320**	**56214**	**56315**	**60530**	**69616**
Alt 2 Area	80436	88991	97507	104407	105619	100805	87041	67627	56536	56051	60756	70268
Alt 2 Area Change	504	344	302	264	89	27	220	307	322	-264	226	651
Alt 2 % Difference	1%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**79608**	**88093**	**96588**	**101685**	**103760**	**107865**	**104952**	**87135**	**68882**	**57867**	**62712**	**70223**
Alt 2 Area	80475	88971	97467	102296	103485	106804	103514	85484	67086	57633	62959	70990
Alt 2 Area Change	867	877	878	612	-275	-1061	-1438	-1652	-1796	-234	246	768
Alt 2 % Difference	1%	1%	1%	1%	0%	-1%	-1%	-2%	-3%	0%	0%	1%

Alt 2 = Chimney Hollow with Prepositioning.

Table B-5. Carter Lake Elevation (feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5729**	**5738**	**5746**	**5751**	**5753**	**5751**	**5741**	**5721**	**5707**	**5705**	**5709**	**5718**
Alt 2 Area	5730	5738	5746	5751	5752	5751	5740	5720	5706	5704	5710	5719
Alt 2 Area Change	1	0	0	0	0	-1	-1	-1	-1	0	0	1
Alt 2 % Difference	1%	0%	0%	0%	0%	-1%	-1%	-1%	-1%	0%	0%	1%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5729**	**5738**	**5746**	**5753**	**5754**	**5750**	**5736**	**5716**	**5704**	**5704**	**5709**	**5718**
Alt 2 Area	5729	5738	5747	5753	5754	5750	5736	5716	5705	5704	5709	5719
Alt 2 Area Change	1	0	0	0	0	0	0	0	0	0	0	1
Alt 2 % Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5729**	**5737**	**5746**	**5750**	**5752**	**5756**	**5753**	**5736**	**5718**	**5706**	**5711**	**5719**
Alt 2 Area	5730	5738	5746	5751	5752	5755	5752	5735	5716	5706	5711	5720
Alt 2 Area Change	1	1	1	1	0	-1	-1	-2	-2	0	0	1
Alt 2 % Difference	1%	1%	1%	0%	0%	-1%	-1%	-1%	-2%	0%	0%	1%

Alt 2 = Chimney Hollow with Prepositioning. Minimum reservoir elevation (dead pool) = 8186 feet.

Table B-6. Carter Lake Surface Area (acres).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1016**	**1056**	**1092**	**1114**	**1119**	**1115**	**1070**	**980**	**913**	**901**	**924**	**968**
Alt 2 Area	1019	1058	1093	1113	1117	1112	1066	976	910	900	926	972
Alt 2 Area Change	3	2	1	0	-2	-3	-4	-4	-3	-1	2	4
Alt 2 % Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1017**	**1057**	**1093**	**1119**	**1124**	**1107**	**1048**	**956**	**900**	**901**	**922**	**967**
Alt 2 Area	1019	1058	1095	1120	1124	1107	1049	957	902	899	924	971
Alt 2 Area Change	2	2	1	1	0	0	1	2	2	-1	1	3
Alt 2 % Difference	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1015**	**1054**	**1091**	**1111**	**1118**	**1130**	**1121**	**1049**	**964**	**909**	**934**	**970**
Alt 2 Area	1019	1058	1094	1113	1117	1127	1116	1042	955	908	935	974
Alt 2 Area Change	4	4	4	2	-1	-3	-5	-7	-9	-1	1	4
Alt 2 % Difference	0%	0%	0%	0%	0%	0%	0%	-1%	-1%	0%	0%	0%

Alt 2 = Chimney Hollow with Prepositioning.

Table B-7. Horsetooth Reservoir Contents (acre-feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**95275**	**107063**	**119226**	**124883**	**128797**	**136336**	**131433**	**112084**	**96326**	**87209**	**83572**	**87201**
Alt 2 Area	94834	107110	117426	121430	125856	133090	128192	109840	94481	85557	82367	86273
Alt 2 Area Change	-442	47	-1799	-3454	-2941	-3246	-3241	-2244	-1844	-1652	-1205	-928
Alt 2 % Difference	0%	0%	-2%	-3%	-2%	-2%	-2%	-2%	-2%	-2%	-1%	-1%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**93978**	**106733**	**118625**	**121645**	**120491**	**119895**	**111307**	**94664**	**81539**	**85468**	**80166**	**84444**
Alt 2 Area	92938	106773	116981	118377	117397	116940	108727	93630	81596	83730	78781	82842
Alt 2 Area Change	-1040	40	-1644	-3268	-3094	-2955	-2580	-1033	57	-1738	-1386	-1602
Alt 2 % Difference	-1%	0%	-1%	-3%	-3%	-2%	-2%	-1%	0%	-2%	-2%	-2%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**98237**	**107911**	**119336**	**126038**	**133750**	**145665**	**144729**	**126990**	**109704**	**91118**	**90557**	**92445**
Alt 2 Area	98260	108299	118113	123170	131751	143984	142590	124773	107496	89424	89409	92059
Alt 2 Area Change	23	389	-1223	-2868	-1998	-1680	-2138	-2217	-2209	-1694	-1148	-385
Alt 2 % Difference	0%	0%	-1%	-2%	-1%	-1%	-1%	-2%	-2%	-2%	-1%	0%

Alt 2 = Chimney Hollow with Prepositioning.

Table B-8. Horsetooth Reservoir Elevation (feet).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5395**	**5403**	**5410**	**5414**	**5416**	**5420**	**5418**	**5406**	**5396**	**5390**	**5388**	**5390**
Alt 2 Area	5395	5403	5409	5412	5414	5419	5416	5404	5395	5389	5387	5389
Alt 2 Area Change	0	0	-1	-2	-2	-2	-2	-1	-1	-1	-1	-1
Alt 2 % Difference	0%	0%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	0%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5394**	**5402**	**5410**	**5412**	**5411**	**5411**	**5405**	**5395**	**5386**	**5389**	**5386**	**5388**
Alt 2 Area	5394	5402	5409	5410	5409	5409	5404	5394	5386	5388	5385	5387
Alt 2 Area Change	-1	0	-1	-2	-2	-2	-2	-1	0	-1	-1	-1
Alt 2 % Difference	-1%	0%	-1%	-1%	-1%	-1%	-1%	-1%	0%	-1%	-1%	-1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**5397**	**5403**	**5410**	**5414**	**5419**	**5425**	**5425**	**5415**	**5404**	**5393**	**5392**	**5393**
Alt 2 Area	5397	5403	5409	5413	5418	5424	5424	5414	5403	5391	5391	5393
Alt 2 Area Change	0	0	-1	-2	-1	-1	-1	-1	-1	-1	-1	0
Alt 2 % Difference	0%	0%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	0%

Alt 2 = Chimney Hollow with Prepositioning. Minimum reservoir elevation (dead pool) = 8186 feet.

Table B-9. Horsetooth Reservoir Surface Area (acres).

Average Year (1950-1996)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1570**	**1664**	**1759**	**1803**	**1834**	**1892**	**1854**	**1703**	**1579**	**1505**	**1475**	**1505**
Alt 2 Area	1567	1664	1745	1776	1811	1867	1829	1685	1564	1491	1465	1497
Alt 2 Area Change	-4	0	-14	-27	-23	-25	-25	-18	-15	-14	-10	-8
Alt 2 % Difference	0%	0%	-1%	-2%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%
Dry Year Average (1954, 1966, 1977, 1981, 1989)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1560**	**1661**	**1754**	**1778**	**1769**	**1764**	**1697**	**1565**	**1458**	**1491**	**1446**	**1482**
Alt 2 Area	1551	1661	1741	1752	1745	1741	1677	1557	1458	1476	1434	1469
Alt 2 Area Change	-8	0	-13	-26	-24	-23	-20	-8	0	-14	-12	-13
Alt 2 % Difference	-1%	0%	-1%	-1%	-1%	-1%	-1%	-1%	0%	-1%	-1%	-1%
Wet Year Average (1957, 1983, 1984, 1986, 1995)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exist. Conditions	**1594**	**1670**	**1760**	**1812**	**1872**	**1962**	**1955**	**1820**	**1684**	**1537**	**1532**	**1548**
Alt 2 Area	1594	1673	1750	1790	1857	1950	1940	1802	1667	1523	1523	1545
Alt 2 Area Change	0	3	-10	-22	-15	-12	-16	-17	-17	-14	-9	-3
Alt 2 % Difference	0%	0%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	-1%	0%

Alt 2 = Chimney Hollow with Prepositioning.

Windy Gap Firming Project

Appendix C to FEIS

Preliminary Draft

Section 404(b)(1) Effects Analysis

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Appendix C
Preliminary Draft
Section 404(b)(1) Effects Analysis
Windy Gap Firming Project

1. INTRODUCTION

The Bureau of Reclamation (Reclamation), as the lead agency responsible for preparation of the Windy Gap Firming Project (WGFP) Environmental Impact Statement (EIS), with the assistance of the U.S. Army Corps of Engineers (Corps), a cooperating agency responsible for compliance with the Clean Water Act (CWA), conducted a preliminary draft 404(b)(1) effects analysis concurrent with preparation of the EIS. The purpose of the preliminary draft 404(b)(1) effects analysis was to assist in the development of the least environmentally damaging practicable alternative (LEDPA) to the aquatic ecosystem and provide preliminary project compliance with the 404(b)(1) guidelines.

Because the proposed WGFP would involve the discharge of dredged and fill material into wetlands or other waters of the U.S., a permit is required from the Corps under Section 404 of the CWA. The Municipal Subdistrict, Northern Colorado Water Conservancy District (Subdistrict), acting by and through the Windy Gap Firming Project Water Activity Enterprise, has notified the Corps that it will seek a Section 404 permit for the WGFP. Issuance of a permit would be a Corps federal action. This preliminary draft 404(b)(1) effects analysis is being provided to the Corps so that the Corps may conduct the 404(b)(1) compliance determination on the Municipal Subdistrict, Northern Colorado Water Conservancy District's permit application for this project.

Sections 2 and 3 of this document include an overview of the 404(b)(1) guidelines and the alternative analysis process. The remaining sections of the document discuss the potential effects associated with the proposed discharge of dredged or fill material under the alternative actions per Subparts C to H of 404(b)(1) guidelines.

2. PROJECT PURPOSE

The purpose of the WGFP is deliver a firm annual yield of about 30,000 AF of water from the existing Windy Gap Project to meet a portion of the water deliveries anticipated from the original Windy Gap Project and to provide up to 3,000 AF of storage to firm water deliveries for the Middle Park Water Conservancy District (MPWCD). Firm water deliveries from the Windy Gap Project are needed to meet a portion of the existing and future demands of the Project Participants. Project Participants include the City and County of Broomfield, , the towns of Erie and Superior, the cities of Evans, Fort Lupton, Greeley, Lafayette, Longmont, Louisville, Loveland, Little Thompson Water District, Central Weld County Water District, Platte River Power Authority, and the MPWCD.

3. 404(B)(1) GUIDELINES

Projects subject to the individual permitting process by the Corps under the CWA must comply with the Section 404(b)(1) guidelines (40 CFR, Part 230) for discharge of dredged and fill material into waters of the U.S. Section 404(b)(1) guidelines of the CWA require that "except as provided under Section 404(b)(2), no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (Section 230.10(a)). The guidelines consider an alternative practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes."

4. ALTERNATIVES ANALYSIS

A number of alternatives were considered to meet the purpose and need of the proposed WGFP to firm the yield of the existing Windy Gap Project. The initial range of alternatives included 171 different project elements that individually or in combination might meet the project need. A series of alternatives screening criteria were developed based on 404(b)(1) guidelines as well as NEPA guidelines (CEQ 1986) to evaluate alternatives and narrow down the selection of alternatives for inclusion in the EIS. Screening criteria were the project purpose and need, logistical and technological considerations, and environmental consequences. Cost was not used as a screening criterion. Environmental screening criteria included a preference for alternatives with the least impact to wetlands and those that avoided reservoir construction on perennial streams. The results of the alternative screening process resulted in the selection of the following alternatives for evaluation in the EIS:

1. No Action— Reclamation would not approve the connection of new WGFP facilities to C-BT facilities. The Subdistrict would maximize the delivery of Windy Gap water to participants under existing agreements between Reclamation and the Subdistrict. Participants would seek to maximize their delivery of Windy Gap water using existing facilities. In addition, the City of Longmont would enlarge Ralph Price Reservoir to firm its Windy Gap water. The City of Lafayette would not participate in the Windy Gap Project
2. Proposed Action by the Subdistrict—Chimney Hollow Reservoir (90,000 AF) with prepositioning (allowing storage of C-BT water in Chimney Hollow Reservoir).
3. Chimney Hollow Reservoir (70,000 AF) and Jasper East Reservoir (20,000 AF).
4. Chimney Hollow Reservoir (70,000 AF) and Rockwell/Mueller Creek Reservoir (20,000 AF).
5. Dry Creek Reservoir (60,000 AF) and Rockwell/Mueller Creek Reservoir (30,000 AF).

Additional discussion of the alternatives selection process is found in Chapter 2 of the WGFP FEIS (Reclamation 2011) and the WGFP Alternatives Report (ERO Resources Corporation (ERO) 2005). The summary comparison of the effects of the alternatives on environmental resources was modified from the summary table in the FEIS to facilitate the 404(b)(1) effects analysis. It should be noted that, in Table C-1, changes between existing conditions and conditions under each alternative are noted using arrows, (↑) for an increase and (↓) for a decrease.

5. POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM (SUBPART C)

5.1. Substrate (230.20)

5.1.1. Definition and Types of Possible Effects

The substrate of the aquatic ecosystem underlies open waters of the United States and constitutes the surface of wetlands. It consists of organic and inorganic solid materials and includes water and other liquids or gases that fill the spaces between solid particles.

The discharge of dredged or fill material can result in varying degrees of change in the complex physical, chemical, and biological characteristics of the substrate. Discharges, which alter substrate elevation or contours, can result in changes in water circulation, depth, current pattern, water fluctuation, and water temperature. Discharges may adversely affect bottom-dwelling organisms at the site by smothering immobile forms or forcing mobile forms to migrate. Benthic forms present prior to a discharge are unlikely to recolonize on the discharged material if it is very dissimilar from that of the discharge site. Erosion, slumping, or lateral displacement of surrounding bottom of such deposits can adversely affect areas of the substrate outside the perimeters of the disposal site by changing or destroying habitat. The bulk and composition of the discharged material and the location, method, and timing of discharges may all influence the degree of impact on the substrate.

The Wetlands section of the WGFP FEIS (Reclamation 2011) contains a description of wetlands and other waters that would be affected by the WGFP. Additional information is found in the Vegetation Resources Technical Report (ERO 2007a). The Aquatic Resources Technical Report (Miller Ecological 2010) contains detailed information about effects to aquatic resources.

5.1.2. Alternative 1—No Action

Under the No Action Alternative, about 0.4 acres of substrate under wetlands and other waters would be affected. The effects would occur primarily from the inundation of wetland and waters from raising the Button Rock Dam at Ralph Price Reservoir. Additional wetlands or waters could be affected with dam enlargement depending on final design.

5.1.3. Alternative 2—Chimney Hollow Reservoir (Proposed Action)

The construction of Chimney Hollow Reservoir would involve discharge of fill in wetlands in the dam footprint and in locations where access roads and pipelines cross wetlands and other waters. Wetlands and other waters in the Chimney Hollow Reservoir footprint also would be inundated by water storage. Total permanent and temporary effects to the substrate under wetlands and other waters would be about 3.1 acres.

Table C-1. Comparison of direct and indirect effects by alternative, organized based on CFR 40 Part 230, Section 404(b)(1) guidelines.

Impact Topic	Existing Conditions	**Alternative 1 No Action** **Enlarge Ralph Price Reservoir** Enlargement of Ralph Price Reservoir by 13,000 AF for storage of the City of Longmont's Windy Gap water	**Alternative 2 Proposed Action** **Chimney Hollow Reservoir** A 90,000 AF Chimney Hollow Reservoir with prepositioning to allow storage of C-BT water in Chimney Hollow	**Alternative 3** **Chimney Hollow Reservoir and Jasper East Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Jasper East Reservoir	**Alternative 4** **Chimney Hollow Reservoir and Rockwell Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Rockwell Reservoir	**Alternative 5** **Dry Creek Reservoir and Rockwell Reservoir** A 60,000 AF Dry Creek Reservoir and a 30,000 AF Rockwell Reservoir
5. POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM (SUBPART C)						
5.1. SUBSTRATE (230.20)	The substrate of the aquatic ecosystem underlies open waters of the United States and constitutes the surface of wetlands. Small areas of wetlands border Ralph Price Reservoir, and N. St. Vrain Creek. Chimney Hollow, Dry Creek, and Rockwell and Mueller creeks support wetlands along the drainage. The Jasper East Reservoir site contains natural and irrigated wetlands. The substrate of East and West Slope channel beds were also evaluated.	Ralph Price Reservoir enlargement would inundate about 0.3 acre of wetlands and about 0.1 acre of North St. Vrain Creek. Dam construction could result in additional impacts to St. Vrain Creek.	About 1.6 acres of wetlands would be permanently impacted and about 0.1 acre would be temporarily disturbed. Permanent effects to other waters would be about 1.3 acres. Indirect effects to riffle and pools (e.g., substrate) on the Colorado River and Willow Creek from a reduction in flow are not predicted to impact the channel-forming process or result in stream sedimentation.	Chimney Hollow Reservoir would permanently impact 1.5 acres of wetlands and temporarily disturb about 0.1 acre. Permanent effects to other waters would be about 1.3 acres. Construction of Jasper East Reservoir would permanently affect 21.2 acres of wetlands and temporarily disturb 4.8 acres. Permanent effects to other waters would be about 6.3 acres. Total permanent wetland impacts for both reservoirs would be 22.7 acres.	Wetland and water impacts at Chimney Hollow would be the same as Alternative 3. Permanent wetland impacts at Rockwell Reservoir would be 3 to 13.6 acres with a temporary wetland impact of 2 to 5 acres. Permanent effects to other waters would be 3.6 acres. Total permanent wetland impacts for both reservoirs would range from 4.5 to 15.1 acres pending field studies.	Dry Creek Reservoir construction would permanently impact 6.2 acres of wetlands and temporarily disturb 0.3 acre. Permanent effects to other waters would be 2.8 acres. Rockwell Reservoir permanent wetland impacts would be 3 to 15.6 acres with a temporary impact of 2 to 5 acres. Permanent effects to other waters would be 3.7 acres. Total permanent wetland impacts for both reservoirs would range from 9.2 to 21.8 acres.
5.2. SUSPENDED PARTICULATES/TURBIDITY (230.21)	Suspended particulates in the aquatic ecosystem consist of fine-grained mineral particles and organic particles.	Granby Res TSS no change. Shadow Mountain Res TSS 5%↑. Grand Lake TSS no change. Low TSS in existing or new East Slope Reservoirs.	Granby Res TSS 4.3%↑. Shadow Mountain Res TSS 5%↑. Grand Lake TSS 5.6%↑. Low TSS in existing or new East Slope Reservoirs.	Granby Res TSS 4.3%↑. Shadow Mountain Res TSS 5%↑. Grand Lake TSS 5.6%↑. Low TSS in existing or new East Slope Reservoirs.	Granby Res TSS 4.3%↑. Shadow Mountain Res TSS 5%↑. Grand Lake TSS 5.6%↑. Low TSS in existing or new East Slope Reservoirs.	Granby Res TSS 4.3%↑. Shadow Mountain Res TSS 5%↑. Grand Lake TSS no change. Low TSS in existing or new East Slope Reservoirs.
5.3. WATER (230.22) Ground water quality	Existing ground water quality is influenced by the constituents in bedrock formations and recharge from surface water sources.	Alluvial ground water quality in the Colorado River, Willow Creek, East Slope streams, and in affected reservoirs would not be measurably affected.	Effects would be similar to No Action, although surface water quality changes would be slightly greater. Effects to ground water quality would not be measurable within the natural variability of ground water quality.	Effects would be similar to the Proposed Action.	Effects would be similar to the Proposed Action.	Effects would be similar to the Proposed Action.
5.3. WATER (230.22) **SURFACE WATER QUALITY** **West Slope** **Abbreviations:** TP = total phosphorus P = phosphorus TN = total nitrogen Mn = Manganese DO = dissolved oxygen (mg/L) TOC = total organic carbon Chlorophyll *a* = a measure of algae concentration Trophic state = a measure of productivity MWAT = maximum weekly average temperature	**Colorado River historical water quality below Windy Gap Reservoir (range/avg.):** Temperature: 0 to 22°C/7.7°C DO: 4.3 to 12.1/9.1 mg/L Ammonia: 0.005 to 0.14/0.04 mg/L P: 0.01 to 0.99/0.14 mg/L There have been a few exceedances of water quality standards in the Colorado River including the MWAT above the Williams Fork and DO below Windy Gap and near Kremmling.	**Colorado River.** With average July 25 flows: DO would decrease 0.1 mg/L, ammonia would increase 1.3 µg/L, and inorganic P would increase up to 0.9 µg/L. Assuming diversions to the minimum 90 cfs streamflow for July 25: DO would decrease 0.5 mg/L, ammonia would increase 9.1 µg/L, and inorganic P would increase up to 5.1 µg/L. Modeling indicates an increase in the potential for exceedance of the chronic and acute temperature standards for aquatic life between Windy Gap and the Williams Fork from mid-July to August. Simulated annual increases in chronic temperature exceedances were as high as 1 additional week above the WAT standard relative to existing conditions and as high as 5 additional days above the DM standard relative to existing conditions. Temperature standard exceedances were simulated to increase from existing conditions in 4 out of the 15 years evaluated. Water quality would remain within standards, with the exception of increased potential for exceeding the temperature standard or being below the DO spawning standard at several	**Colorado River.** With average July 25 flows: DO would decrease 0.1 mg/L, ammonia would increase 1.7 µg/L, and inorganic P would increase up to 1.5 µg/L. Assuming diversions to the minimum 90 cfs streamflow for July 25: DO would decrease 0.6 mg/L, ammonia would increase 9.3 µg/L, and inorganic P would increase up to 5.7 µg/L. Modeling indicates an increase in the potential for exceedance of the chronic and acute temperature standards for aquatic life between Windy Gap and the Williams Fork from mid-July to August. Simulated annual increases in chronic temperature exceedances were as high as 3 additional weeks above the WAT standard relative to existing conditions and as high as 7 additional days above the DM standard relative to existing conditions. Temperature standard exceedances were simulated to increase from existing conditions in 4 out of the 15 years evaluated. Water quality standards for other parameters would be met except as noted for No Action.	**Colorado River.** With average July 25 flows: DO would decrease 0.1 mg/L, ammonia would increase 1.6 µg/L, and inorganic P would increase up to 0.9 µg/L. Assuming diversions to the minimum 90 cfs streamflow for July 25: DO would increase 0.5 mg/L, ammonia would increase 8.9 µg/L, and inorganic P would increase up to 5.0 µg/L. Temperature standard exceedances would be slightly less than the Proposed Action. Water quality standards for other parameters would be met except as noted for No Action.	**Colorado River.** With average July 25 flows: DO would decrease 0.1 mg/L, ammonia would increase 1.6 µg/L, and inorganic P would increase up to 0.9 µg/L. Assuming diversions to the minimum 90 cfs streamflow for July 25: DO would decrease 0.5 mg/L, ammonia would increase 8.9 µg/L, and inorganic P would increase up to 5.0 µg/L. Temperature standard exceedances would be slightly less than the Proposed Action. Water quality standards for other parameters would be met except as noted for No Action.	**Colorado River.** With average July 25 flows: DO would decrease 0.1 mg/L, ammonia would increase 1.5 µg/L, and inorganic P would increase up to 0.8 µg/L. Assuming diversions to the minimum 90 cfs streamflow for July 25: DO would decrease 0.5 mg/L, ammonia would increase 8.9 µg/L, and inorganic P would increase up to 4.9 µg/L. Modeling indicates an increase in the potential for exceedance of the chronic and acute temperature standards for aquatic life between Windy Gap and the Williams Fork from mid-July to August. Temperature standard exceedances would be slightly less than the Proposed Action. Water quality standards for other parameters would be met except as noted for No Action.

Impact Topic	Existing Conditions	**Alternative 1 No Action** **Enlarge Ralph Price Reservoir** Enlargement of Ralph Price Reservoir by 13,000 AF for storage of the City of Longmont's Windy Gap water	**Alternative 2 Proposed Action** **Chimney Hollow Reservoir** A 90,000 AF Chimney Hollow Reservoir with prepositioning to allow storage of C-BT water in Chimney Hollow	**Alternative 3** **Chimney Hollow Reservoir and Jasper East Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Jasper East Reservoir	**Alternative 4** **Chimney Hollow Reservoir and Rockwell Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Rockwell Reservoir	**Alternative 5** **Dry Creek Reservoir and Rockwell Reservoir** A 60,000 AF Dry Creek Reservoir and a 30,000 AF Rockwell Reservoir
		locations when diversions reduce flow to the minimum streamflow.				
		Willow Creek. No change in temperature and slight increase in nutrient and metal concentrations. Water quality would remain within standards.	**Willow Creek.** Temperature would decrease 0.2°C and nutrient and metal concentrations would increase slightly. Water quality would remain within standards.	**Willow Creek.** Same as Proposed Action.	**Willow Creek.** Same as Proposed Action.	**Willow Creek.** Same as Proposed Action.
		Granby Reservoir. TP concentrations would increase 6.3%, TN would increase 0.3%; no change in average chlorophyll *a*, clarity, and trophic state; minimum DO would decrease 2.2%. Dissolved manganese concentrations would continue to exceed standards and DO concentrations would continue to be below the standard.	**Granby Reservoir.** TP concentrations would increase 12.7%, TN would increase 0.7%, average chlorophyll *a* would increase 2.4%, no change in clarity or trophic state, and minimum DO would decrease 4.4%. Dissolved manganese concentrations would continue to exceed standards and DO concentrations would continue to be below the standard.	**Granby Reservoir.** TP concentrations would increase 4.0%; TN would decrease 2.1%; and no change in average chlorophyll *a*, clarity, trophic state, or minimum DO. No improvement in DO and manganese concentrations, which currently exceed the standard (Mn) or are below the standard (DO).	**Granby Reservoir.** TP concentrations would increase 3.2%; TN would decrease 2.8%; and no change in average chlorophyll *a*, clarity, trophic state, or minimum DO. No improvement in DO and manganese concentrations, which currently exceed the standard (Mn) or are below the standard (DO).	**Granby Reservoir.** TP concentrations would increase 1.6%; TN would decrease 3.5%; and no change in average chlorophyll *a*, clarity, trophic state, or minimum DO. No improvement in DO and manganese concentrations, which currently exceed the standard (Mn) or are below the standard (DO).
		Shadow Mountain Reservoir. TP concentrations would increase 5.6%; TN would increase 1.1%; average chlorophyll *a* would increase 1.8%; and no change in clarity, trophic state, or minimum DO. No change in manganese concentrations, which currently exceed the standard.	**Shadow Mountain Reservoir.** TP concentrations would increase 11.3%, TN would increase 1.8%, average chlorophyll *a* would increase 1.8%, and no change in clarity or trophic state. Minimum DO would decrease 1.4%. A decrease in DO would contribute to continued exceedance of the manganese standard.	**Shadow Mountain Reservoir.** TP concentrations would increase 8.1%; TN would increase 0.4%; average chlorophyll *a* would increase 1.8%; and no change in clarity, trophic state, or minimum DO. No change in manganese concentrations, which currently exceed the standard.	**Shadow Mountain Reservoir.** TP concentrations would increase 4.8%; TN would decrease 0.7%; and no change in average chlorophyll *a*, clarity, trophic state, or minimum DO. No change in manganese concentrations, which currently exceed the standard.	**Shadow Mountain Reservoir.** TP concentrations would increase 3.2%; TN would decrease 1.1%; and no change in average chlorophyll *a*, clarity, trophic state, or minimum DO. No change in manganese concentrations, which currently exceed the standard.
		Grand Lake. TP concentrations would increase 6.0%, TN would increase 0.4%, average chlorophyll *a* would increase 4.2%, clarity would decrease 3.8%, no change in trophic state, and minimum DO would decrease 11.1%. Lower DO would contribute to continued exceedance of the manganese standard.	**Grand Lake.** TP concentrations would increase 12.0%, TN would increase 1.6%, average chlorophyll *a* would increase 6.1%, clarity would decrease 3.8%, no change in trophic state, and minimum DO would decrease 7.4%. Lower DO would contribute to continued exceedance of the manganese standard.	**Grand Lake.** TP concentrations would increase 6.0%, TN would decrease 0.4%, average chlorophyll *a* would increase 4.2%, clarity would decrease 3.8%, no change in trophic state, and minimum DO would decrease 5.6%. Lower DO would contribute to continued exceedance of the manganese standard.	**Grand Lake.** TP concentrations would increase 6.0%, TN would decrease 0.4%, average chlorophyll *a* would increase 2.0%, clarity would decrease 3.8%, no change in trophic state, and minimum DO would decrease 5.6%. Lower DO would contribute to continued exceedance of the manganese standard.	**Grand Lake.** TP concentrations would increase 4.8%, TN would decrease 0.8%, average chlorophyll *a* would increase 2.0%, no change in clarity or trophic state, and minimum DO would decrease 5.6%. Lower DO would contribute to continued exceedance of the manganese standard.
					Rockwell Reservoir. Predicted to be oligotrophic-mesotrophic and retain some TN and P, reducing nutrient delivery to Granby Reservoir.	**Rockwell Reservoir.** Same as Alternative 4.
				Jasper East Reservoir. Predicted to be oligotrophic-mesotrophic and retain some TN and P, reducing nutrient delivery to Granby Reservoir.		
SURFACE WATER QUALITY **East Slope** Note: Water quality would not exceed standards in East Slope streams or reservoirs except as noted.	**N. St. Vrain Creek.** High quality mountain stream with limited upstream influence from human activity. Mn concentrations have been high at times from natural sources.	**N. St. Vrain Creek.** Depending on changes in flows, temperature on a monthly basis would increase up to 1°C or decrease up to 5°C. DO concentrations on a monthly basis would range from a decrease of 0.5 mg/L to an increase of 2.0 mg/L.	**N. St. Vrain Creek.** No effect.	**N. St. Vrain Creek.** No effect.	**N. St. Vrain Creek.** No effect.	**N. St. Vrain Creek.** No effect.
	St. Vrain Creek. High quality stream with periodic elevated phosphorus and ammonia concentrations. TMDL for ammonia downstream from Lefthand Creek.	**St. Vrain Creek.** Estimated ammonia concentrations below Longmont WWTP would increase the most in October (to 2.7 mg/L) and would be higher than action alternatives because of potentially higher maximum WWTP discharges.	**St. Vrain Creek.** Estimated ammonia concentrations below Loveland WWTP would increase the most in October (to 2.5 mg/L).	**St. Vrain Creek.** Same as Proposed Action.	**St. Vrain Creek.** Same as Proposed Action.	**St. Vrain Creek.** Same as Proposed Action.

Impact Topic	Existing Conditions	**Alternative 1 No Action** **Enlarge Ralph Price Reservoir** Enlargement of Ralph Price Reservoir by 13,000 AF for storage of the City of Longmont's Windy Gap water	**Alternative 2 Proposed Action** **Chimney Hollow Reservoir** A 90,000 AF Chimney Hollow Reservoir with prepositioning to allow storage of C-BT water in Chimney Hollow	**Alternative 3** **Chimney Hollow Reservoir and Jasper East Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Jasper East Reservoir	**Alternative 4** **Chimney Hollow Reservoir and Rockwell Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Rockwell Reservoir	**Alternative 5** **Dry Creek Reservoir and Rockwell Reservoir** A 60,000 AF Dry Creek Reservoir and a 30,000 AF Rockwell Reservoir
	Big Thompson River. High water quality below Lake Estes. Water quality declines downstream from increased concentrations of nutrients and iron. Ammonia concentrations occasionally exceed standards during the winter below Loveland.	**Big Thompson River.** Nitrogen and phosphorus concentrations would increase slightly due to additional Windy Gap deliveries through the Adams Tunnel, but would be less than other alternatives because imports would be lower. Ammonia concentrations would decrease slightly below the Loveland WWTP.	**Big Thompson River.** Nitrogen and phosphorus concentrations would increase slightly due to additional Windy Gap deliveries through the Adams Tunnel. Ammonia concentrations would decrease below the Loveland WWTP.	**Big Thompson River.** Same as Proposed Action.	**Big Thompson River.** Same as Proposed Action.	**Big Thompson River.** Same as Proposed Action.
	Big Dry Creek. Water quality influenced by WWTP return flows, agricultural runoff, and urban areas. Ammonia and iron concentrations occasionally exceed standards. **Coal Creek.** Water quality declines downstream from foothills. A TMDL has been established for ammonia.	**Big Dry Creek and Coal Creek.** Increased WWTP discharges would increase ammonia concentrations and the potential for exceeding the water quality standard.	**Big Dry Creek and Coal Creek.** Same as No Action.	**Big Dry Creek and Coal Creek.** Same as No Action.	**Big Dry Creek and Coal Creek.** Same as No Action.	**Big Dry Creek and Coal Creek.** Same as No Action.
	Cache la Poudre River. Water quality declines downstream from the headwaters. Ammonia and DO occasionally exceed standards.	**Cache la Poudre River.** Estimated ammonia concentrations would increase the most in November (to 1.4 mg/L).	**Cache la Poudre River.** Estimated ammonia concentrations would increase the most in January (to 1.4 mg/L).	**Cache la Poudre River.** Same as Proposed Action.	**Cache la Poudre River.** Same as Proposed Action.	**Cache la Poudre River.** Same as Proposed Action.
	Carter Lake. Exceeds temperature standard. On M&E list for copper and arsenic and 303(d) list for fish consumption due to mercury.	**Carter Lake.** TP concentrations would increase 5.1%, TN would increase 1.8%, average chlorophyll *a* would increase 5.6%, clarity would decrease 3.6%, no change in trophic state or temperature, and a slight decrease in DO.	**Carter Lake.** TP concentrations would increase 9.1%, TN would increase 4%, average chlorophyll *a* would increase 11.1%, clarity would decrease 3.6%, no change in trophic state or temperature, and a slight decrease in DO.	**Carter Lake.** TP concentrations would increase 3.0%, TN would increase 1.3%, no change in average chlorophyll *a*, clarity would decrease 3.6%, no change in trophic state or temperature, and a slight decrease in DO.	**Carter Lake.** Same as Alternative 3.	**Carter Lake.** TP concentrations would increase 3.0%, TN would increase 1.8%, average chlorophyll *a* would increase 5.6%, clarity would decrease 3.6%, no change in trophic state or temperature, and a slight decrease in DO.
	Horsetooth Reservoir. Exceeds standard for temperature, DO, and dissolved Mn. On M&E list for DO, copper, and arsenic and 303(d) list for fish consumption due to mercury.	**Horsetooth Reservoir.** TP concentrations would increase 5.1%; TN would increase 2.6%; average chlorophyll *a* would increase 5.7%; no change in clarity, temperature, or trophic state; and a slight decrease in DO. Lower DO concentrations would contribute to continued exceedances of the manganese standard. TOC may increase.	**Horsetooth Reservoir.** TP concentrations would increase 11.1%, TN would increase 5.8%, average chlorophyll *a* would increase 11.4%, clarity would decrease 3.8%, no change in trophic state or temperature, and a slight decrease in DO. Lower DO would contribute to continued exceedances of the manganese standard. TOC may increase.	**Horsetooth Reservoir.** TP concentrations would increase 4%; TN would increase 4.0%; average chlorophyll *a* would increase 5.7%; no change in clarity, temperature, or trophic state; and a slight decrease in DO. Lower DO concentrations would contribute to continued exceedances of the manganese standard. TOC may increase.	**Horsetooth Reservoir.** TP concentrations would increase 4.0%; TN would increase 3.6%; average chlorophyll *a* would increase 5.7%; no change in clarity, temperature, or trophic state; and a slight decrease in DO. Lower DO concentrations would contribute to continued exceedances of the manganese standard. TOC may increase.	**Horsetooth Reservoir.** TP concentrations would increase 3.0%; TN would increase 3.6%; average chlorophyll *a* would increase 5.7%; no change in clarity, temperature, or trophic state; and a slight decrease in DO. Lower DO concentrations would contribute to continued exceedances of the manganese standard. TOC may increase.
	Chimney Hollow No water quality data – intermittent stream.	**(No Chimney Hollow Reservoir)**	**Chimney Hollow Reservoir.** Predicted to be oligotrophic, slightly lower water quality than Alternatives 3 and 4.	**Chimney Hollow Reservoir.** Similar to Proposed Action, but with slightly better water quality.	**Chimney Hollow Reservoir.** Similar to Proposed Action, but with slightly better water quality.	**(No Chimney Hollow Reservoir)**
	Dry Creek Reservoir. No water quality data – intermittent stream.	**(No Dry Creek Reservoir)**	**(No Dry Creek Reservoir)**	**(No Dry Creek Reservoir)**	**(No Dry Creek Reservoir)**	**Dry Creek Reservoir.** Predicted to be oligotrophic.
	Ralph Price Reservoir. Limited data, assumed high quality due to location.	**Ralph Price Reservoir.** TP concentrations would decrease 3.9%, TN would decrease 5.9%, average chlorophyll *a* would decrease 33.0%, no change in clarity or trophic state, and a slight increase in DO.	**(No Ralph Price Reservoir)**	**(No Ralph Price Reservoir)**	**(No Ralph Price Reservoir)**	**(No Ralph Price Reservoir)**

Impact Topic	Existing Conditions	**Alternative 1 No Action** **Enlarge Ralph Price Reservoir** Enlargement of Ralph Price Reservoir by 13,000 AF for storage of the City of Longmont's Windy Gap water	**Alternative 2 Proposed Action** **Chimney Hollow Reservoir** A 90,000 AF Chimney Hollow Reservoir with prepositioning to allow storage of C-BT water in Chimney Hollow	**Alternative 3** **Chimney Hollow Reservoir and Jasper East Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Jasper East Reservoir	**Alternative 4** **Chimney Hollow Reservoir and Rockwell Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Rockwell Reservoir	**Alternative 5** **Dry Creek Reservoir and Rockwell Reservoir** A 60,000 AF Dry Creek Reservoir and a 30,000 AF Rockwell Reservoir
5.4. CURRENT PATTERNS AND WATER CIRCULATION (230.23) **SURFACE WATER HYDROLOGY** **West Slope**						
WG diversions (avg. annual)	36,532 AF	43,573 AF	46,084 AF	48,052 AF	47,997 AF	48,483 AF
WG diversions (avg. annual wet year)	64,200 AF (max)	63,870 AF	73,923 AF	78,940 AF	78,775 AF	77,543 AF
WG diversions (avg. annual dry year)	0	Same as existing conditions	Same as existing conditions	Same as existing conditions	Same as existing conditions	Same as existing conditions
Avg. annual Colo. R. flow blw. WG Res.	151,358 AF	138,914 AF (8%↓)	130,375 AF (14%↓)	130,370 AF (14%↓)	130,453 AF (14%↓)	129,861 AF(14%↓)
Avg. annual Colo. R. flow blw. Blue R.	701,801 AF	689,357 AF (2%↓)	680,512 AF (3%↓)	680,807 AF (3%↓)	680,890 AF (3%↓)	680,118 AF (3%↓)
Avg. annual Willow Creek flow	18,294 AF	16,933 AF (7%↓)	15,727 AF (14%↓)	16,138 AF (12%↓)	16,148 AF (12%↓)	16,149 AF (12%↓)
Grand L./Shadow Mountain Res. storage change	Baseline	None	None	None	None	None
Average monthly change in Granby Res. storage volume from existing conditions	331,000 AF – 464,000 AF	3 to 5%↓	7 to 13%↓	4 to 6%↓	4 to 6%↓	4 to 6%↓
East Slope						
Avg. annual Big Thompson R. flow blw. Lake Estes	66,702 AF	67,145 AF (1%↑)	69,884 AF (5%↑)	67,666 AF (1%↑)	67,667 AF (1%↑)	68,146 AF (2%↑)
Avg. annual Big Thompson R. flow at Canyon mouth	89,367 AF	89,325 AF (0%)	92,308 AF (3%↑)	90,294 AF (1%↑)	90,295 AF (1%↑)	90,740 AF (2%↑)
Avg. mo. decrease in Carter Lake storage	NA	0 to 2%↓	0 to 1%↓	0 to 1%↓	0 to 1%↓	0 to 1%↓
Avg. mo. decrease in Horsetooth Res. storage	NA	0 to 1%↓	3 to 8%↓	0 to 2%↓	0 to 2%↓	0 to 3%↓
WGFP firm yield	0 AF	1,229 AF	26,559 AF	25,849 AF	25,849 AF	26,629 AF
5.5. NORMAL WATER FLUCTUATIONS (230.24) **STREAM MORPHOLOGY AND FLOODPLAINS** **West Slope**	Native Colorado River flows have changed substantially following completion of the C-BT project and other water uses in the basin; however, the river channel has remained relatively stable. The Colorado River existing bankfull discharge at the Windy Gap gage is about 765 cfs. Flushing flows of greater than 450 cfs for three consecutive days occur about 28 days per year on average.	Colorado River channel maintenance flows (0.8 x 1.5- to 25-year flows) below Windy Gap Reservoir at Hot Sulphur Springs would occur during about 2 to 9% less years. At the Kremmling gage channel maintenance flows would occur during 0 to 3% less years. Projected changes in peak flows and channel maintenance flows are unlikely to substantially affect channel morphology or change sediment transport. Flushing flows greater than 450 cfs would occur 23 days per year on average. Flows would remain adequate to transport fine sediment and prevent deposition. Changes in the magnitude, timing, and frequency of Granby Reservoir spills are not expected to alter channel morphology or sediment transport. Willow Creek flow equal to or greater than the 2-year peak flow discharge would occur slightly less frequently. The potential for flooding on the Colorado River and Willow Creek would decrease with lower flows.	Effects would be similar to No Action except that channel maintenance flows below Windy Gap Reservoir would occur slightly less frequently. Flushing flows greater than 450 cfs would occur 20 days per year on average. Adequate flow should be available to maintain channel capacity, provide periodic scouring, and transport sediment in the Colorado River and Willow Creek.	Effects would be similar to No Action except that channel maintenance flows below Windy Gap Reservoir would occur slightly less frequently. Flushing flows greater than 450 cfs would be similar to the Proposed Action. Jasper East Reservoir could potentially capture flood flows in this small watershed.	Effects would be similar to No Action except that channel maintenance flows below Windy Gap Reservoir would occur slightly less frequently. Flushing flows greater than 450 cfs would be similar to the Proposed Action. Rockwell Reservoir could potentially capture flood flows in this small watershed.	Effects would be similar to No Action except that channel maintenance flows below Windy Gap Reservoir would occur slightly less frequently. Flushing flows greater than 450 cfs would be similar to the Proposed Action. Rockwell Reservoir could potentially capture flood flows in this small watershed.

Impact Topic	Existing Conditions	**Alternative 1 No Action** **Enlarge Ralph Price Reservoir** Enlargement of Ralph Price Reservoir by 13,000 AF for storage of the City of Longmont's Windy Gap water	**Alternative 2 Proposed Action** **Chimney Hollow Reservoir** A 90,000 AF Chimney Hollow Reservoir with prepositioning to allow storage of C-BT water in Chimney Hollow	**Alternative 3** **Chimney Hollow Reservoir and Jasper East Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Jasper East Reservoir	**Alternative 4** **Chimney Hollow Reservoir and Rockwell Reservoir** A 70,000 AF Chimney Hollow Reservoir and a 20,000 AF Rockwell Reservoir	**Alternative 5** **Dry Creek Reservoir and Rockwell Reservoir** A 60,000 AF Dry Creek Reservoir and a 30,000 AF Rockwell Reservoir
East Slope	East Slope streamflow, stream morphology, and sediment loads have been altered by land use practices and water use in varying degrees from the Continental Divide to the Plains.	Predicted changes in North St. Vrain Creek and St. Vrain Creek flows upstream of Lyons would be well within the historical range of flow and are unlikely to measurably affect stream morphology or sediment transport. A larger Ralph Price Reservoir could reduce the potential for downstream flooding. Relatively small increases in flows in the Big Thompson River and below WWTPs in St. Vrain Creek, Big Dry Creek, and Coal Creek would be unlikely to measurably affect channel morphology. These flow increases would not substantially increase the risk of flooding.	Effects would be similar to No Action except there would be no effect to North St. Vrain Creek or St. Vrain Creek upstream of Lyons. Chimney Hollow Reservoir could potentially capture flood flows in this small watershed.	Effects would be similar to No Action except there would be no effect to North St. Vrain Creek or St. Vrain Creek upstream of Lyons. Chimney Hollow Reservoir could potentially capture flood flows in this small watershed.	Effects would be similar to No Action except there would be no effect to North St. Vrain Creek or St. Vrain Creek upstream of Lyons. Chimney Hollow Reservoir could potentially capture flood flows in this small watershed.	Effects would be similar to No Action except there would be no effect to North St. Vrain Creek or St. Vrain Creek upstream of Lyons. Dry Creek Reservoir could potentially capture flood flows in this small watershed.
6. POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM (SUBPART D)						
6.1. THREATENED AND ENDANGERED SPECIES (230.30)	No habitat for threatened or endangered species is found at the alternative reservoir sites, with the exception of a small area of potential lynx habitat at the Rockwell Reservoir site. Endangered Colorado River fish species are present downstream from the Windy Gap diversion site near Grand Junction.	Depletion effects to Colorado River endangered fish would be similar to the Proposed Action. No other federally listed species would be impacted.	Increased WGFP diversions of 21,317 AF would result in an adverse effect to four Colorado River endangered fish species. The Subdistrict would pay a one-time depletion fee in accordance with the Recovery Program and previous biological opinion for depletions in the Colorado River. No other federally listed species would be impacted.	Depletion effects to Colorado River endangered fish would be similar to the Proposed Action.	Depletion effects to Colorado River endangered fish would be similar to the Proposed Action. The loss of about 5 acres of potential lynx habitat may affect, but is unlikely to adversely affect, lynx.	Depletion effects to Colorado River endangered fish would be similar to the Proposed Action. The loss of about 9 acres of potential lynx habitat may affect, but is unlikely to adversely affect, lynx
6.2. FISH, CRUSTACEANS, MOLLUSKS, AND OTHER AQUATIC ORGANISMS IN THE FOOD WEB (230.31) **FISH** **West Slope**	Colorado River supports a high quality fish and macroinvertebrate population. Brown trout populations from 4,000 to 11,000 per mile. Rainbow trout populations have been reduced due to whirling disease. Native white sucker and longnose suckers are present. Brown trout are also the most common species present in Willow Creek. Rockwell Creek, Mueller Creek, and an unnamed drainage at Jasper East Reservoir have intermittent flows and are unlikely to support a fishery. Three Lakes support rainbow trout, kokanee, brown trout, and lake trout. Lakes support self-sustaining and stocked populations.	Anticipated increases in Windy Gap diversions under No Action would be less than the Proposed Action. Thus, the effect on Colorado River and Willow Creek aquatic habitat would be slightly less than described for the Proposed Action. Fish habitat would increase in spring and decrease in late summer as a result of Windy Gap diversions. Temperature standard exceedances were simulated to increase from existing conditions in 4 out of the 15 years evaluated. Exceedance of the chronic and acute temperature standards were simulated to occur at a slightly lower frequency and duration than the Proposed Action. Higher stream temperatures may result in less fit individuals and possible fish mortality, particularly if the acute temperature standard is exceeded frequently. No change in fish populations are predicted for the Three Lakes.	The greatest effect to trout habitat in the Colorado River from WGFP diversions would occur between Windy Gap Reservoir and Williams Fork. Adult rainbow trout habitat would be more affected than brown trout habitat. The largest decrease in habitat would occur in August of average and wet years, although WGFP diversions in August of greater than 100 AF would increase from 6 times under existing conditions in the 47-year study period to 15 times. The greatest increase in habitat would occur in June. The potential for exceedance of the aquatic life temperature standards would increase primarily after July 15. Temperature standard exceedances were simulated to increase from existing conditions in 4 out of the 15 years evaluated, which may result in less fit individuals and possible fish mortality if the acute temperature standard is exceeded frequently. Predicted maximum periodic decreases in fish habitat are unlikely to impact fish populations at most locations. Willow Creek rainbow and brown trout habitat would	Effects would be similar to the Proposed Action, but exceedance of the temperature standards would be slightly less than the Proposed Action.	Effects would be similar to the Proposed Action, but exceedance of the temperature standards would be slightly less than the Proposed Action.	Effects would be similar to the Proposed Action, but exceedance of the temperature standards would be slightly less than the Proposed Action.

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			decrease primarily in July. Streamflow changes are unlikely to affect macroinvertebrate populations. No change in fish populations are predicted for the Three Lakes.			
East Slope	East Slope streams contain game and nongame fish species. Fish abundance varies by location with cold water species present near foothills and warm water species further east. Chimney Hollow and Dry Creek are an intermittent streams and do not support a fishery. Carter Lake and Horsetooth Reservoir are managed by CDOW for recreational fishing. Species include walleye, smallmouth bass, wiper, and trout species. Ralph Price Reservoir is stocked with brown and rainbow trout.	Projected increases in flow in the Big Thompson River, Big Dry Creek, and Coal Creek would slightly enhance fish habitat. A slight reduction in fish habitat in North St. Vrain Creek and St. Vrain Creek above Lyons is possible with reduced flow in some summer months, but higher flows in the fall and winter would benefit fish habitat. Changes in reservoir storage and water quality in Carter Lake and Horsetooth Reservoir would not measurably impact fish habitat. A larger Ralph Price Reservoir would benefit fish, but productivity would remain low.	Effects to East Slope fish in streams and reservoirs would be similar to No Action except there would be no impact in North St. Vrain Creek or St. Vrain Creek upstream of Lyons. Chimney Hollow could support a fishery similar to other Front Range reservoirs.	Effects would be similar to the Proposed Action. Jasper East Reservoir would support a fishery, but large fluctuations in water levels may reduce productivity.	Effects would be similar to the Proposed Action. Rockwell Reservoir would support a fishery, but large fluctuations in water levels may reduce productivity.	Effects would be similar to the Proposed Action. Dry Creek Reservoir would support a fishery similar to Chimney Hollow Reservoir. Rockwell Reservoir would support a fishery, but large fluctuations in water levels may reduce productivity.
6.3. IMPACTS ON OTHER WILDLIFE (230.32)	All reservoir sites support habitat for big game and a diversity of birds, small mammals, reptiles, and amphibians. Several state species of concern are found at Chimney Hollow, Dry Creek, and Rockwell reservoir sites.	Enlargement of Ralph Price Reservoir would result in a loss of 77 acres of elk and mule deer winter range and white-tailed deer, black bear, and mountain lion overall range; the loss of habitat for other terrestrial wildlife species and birds; and displacement of wildlife during construction. No known loss of raptor nests, but suitable habitat is present for several species. Bald eagles, osprey, and waterfowl may benefit from a larger reservoir. About 0.1 acre of potential habitat for northern leopard frog and gartersnake would be lost.	Construction of Chimney Hollow Reservoir would result in a loss of 810 acres of elk winter range, mule deer winter range and concentration areas, and black bear fall concentration areas. Expansion of mountain lion and black bear conflict areas are possible with planned recreation activity. Fragmentation of habitat that would alter local movement patterns by elk, deer, and other wildlife. Foraging and nest habitat would be lost for a variety of bird, mammal, and reptile species. No known raptor nests would be directly affected. A golden eagle nest on the hogback ¼ mile east of the reservoir is outside of the CDOW-recommended buffer. About 7 acres of bald eagle winter range would be temporarily impacted, but the reservoir would provide bald eagle foraging habitat. Potential habitat for northern leopard frog (2.5 acres) and common gartersnake (50 acres) would be lost. Habitat for several CNHP-tracked butterfly species would be lost.	Chimney Hollow Reservoir construction would result in the permanent loss of 675 acres of elk winter range, mule deer winter range and concentration areas, and black bear fall concentration areas. Other effects at Chimney Hollow would be similar to the Proposed Action. Construction of Jasper East Reservoir would result in the loss of about 480 acres of moose and mule deer summer range and 24 acres of elk winter range. The new reservoir could displace or shift elk movement toward U.S. 34 or residential development. About 93 acres of black bear summer concentration area would be impacted. Habitat for ground-nesting and tree-nesting birds would be lost or disturbed. About 3 acres of bald eagle winter range would be lost. The new reservoir would provide foraging habitat for bald eagle, osprey, and waterfowl. About 125 acres of potential greater sage grouse habitat would be lost, which could affect eastward expansion of a known population. Sagebrush also could provide habitat for sage sparrow, a CNHP-tracked species.	Chimney Hollow Reservoir effects would be the same as Alternative 3. Rockwell Reservoir would result in the permanent loss of 312 acres of summer range for moose and mule deer and 73 acres of elk winter range. Habitat for primarily ground-nesting birds would be lost as well as a variety of terrestrial mammals. No known raptor nests would be impacted. Bald eagle winter range would be temporarily affected where the pipeline crosses the Colorado River. The reservoir would provide foraging habitat for bald eagle, osprey, and other water birds. Potential habitat for the state threatened boreal toad and state species of concern northern leopard frog and common gartersnake would be lost in riparian areas. The loss of 290 acres of sagebrush habitat within a sage grouse production and brood rearing area would adversely affect a declining population.	Dry Creek Reservoir would permanently impact 650 acres of elk winter range, mule winter range, and winter concentration areas. About 619 acres of black bear fall concentration area and overall mountain lion habitat would be lost. A red-tailed hawk nest and habitat for other migratory bird species would be lost. There would a permanent impact to 165 acres of bald eagle winter range, but the reservoir would provide foraging habitat. About 8.5 acres of known northern leopard frog habitat would be lost and about 30 acres of suitable common gartersnake habitat would be lost. Habitat for a variety of CNHP-tracked butterfly species would be lost. Impacts at the Rockwell Reservoir site would be similar to Alternative 4. Differences include a loss of 393 acres of moose and mule deer summer range and 97 acres of elk winter range. In addition, there would be a permanent impact to 334 acres of sage grouse breeding and brood rearing habitat.
7. POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES (SUBPART E)						
7.1. SANCTUARIES AND REFUGES (230.40)	None of the alternatives would result in direct impacts to sanctuaries or wildlife areas. All of the alternatives would result in a change in Colorado River flow through portions of the					

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	CDOW Hot Sulphur Springs State Wildlife Area (SWA) and Kemp-Breeze SWA. Access or use of these SWAs would not be impacted.					
7.2. WETLANDS (230.41)	Small areas of wetlands border Ralph Price Reservoir, and N. St. Vrain Creek. Chimney Hollow, Dry Creek, and Rockwell and Mueller creeks support wetlands along the drainage. The Jasper East Reservoir site contains natural and irrigated wetlands.	Ralph Price Reservoir enlargement would inundate about 0.3 acre of wetlands and about 0.1 acre of North St. Vrain Creek. Dam construction could result in additional impacts to St. Vrain Creek.	About 1.6 acres of wetlands would be permanently impacted and about 0.1 acre would be temporarily disturbed. Permanent effects to other waters would be about 1.3 acres.	Chimney Hollow Reservoir would permanently impact 1.5 acres of wetlands and temporarily disturb about 0.1 acre. Permanent effects to other waters would be about 1.3 acres. Construction of Jasper East Reservoir would permanently affect 21.2 acres of wetlands and temporarily disturb 4.8 acres. Permanent effects to other waters would be about 6.3 acres. Total permanent wetland impacts for both reservoirs would be 22.7 acres.	Wetland and water impacts at Chimney Hollow would be the same as Alternative 3. Permanent wetland impacts at Rockwell Reservoir would be 3 to 13.6 acres with a temporary wetland impact of 2 to 5 acres. Permanent effects to other waters would be 3.6 acres. Total permanent wetland impacts for both reservoirs would range from 4.5 to 15.1 acres pending field studies.	Dry Creek Reservoir construction would permanently impact 6.2 acres of wetlands and temporarily disturb 0.3 acre. Permanent effects to other waters would be 2.8 acres. Rockwell Reservoir permanent wetland impacts would be 3 to 15.6 acres with a temporary impact of 2 to 5 acres. Permanent effects to other waters would be 3.7 acres. Total permanent wetland impacts for both reservoirs would range from 9.2 to 21.8 acres.
7.3. MUDFLATS (230.42)	Very minimal effects to mudflats for any alternative.					
7.4. VEGETATED SHALLOWS (230.43)	Very minimal effects to vegetated shallows for any alternative.					
7.5. RIFFLE AND POOL COMPLEXES (230.45)	Stream morphology for each alternative is discussed in Section 5.5. Normal Water Fluctuations.	Enlargement of Ralph Price Reservoir would inundate about 500 feet of North St. Vrain Creek at the reservoir inlet that may contain riffles and pools. Riffle and pool complexes on North St. Vrain Creek below the dam could be impacted if dam enlargement extends into the channel.	Dredge and fill activities associated with construction of any of the new reservoirs would have no direct effect on riffle and pool complexes because the reservoirs would be located on intermittent and ephemeral drainages that do not flow continuously. Indirect effects to riffle and pools on the Colorado River and Willow Creek from a reduction in flow are not predicted to impact channel forming process or result in stream sedimentation.			
8. POTENTIAL IMPACTS ON HUMAN USE CHARACTERISTICS (SUBPART F)						
8.1. MUNICIPAL AND PRIVATE WATER SUPPLIES (230.50)	Discharges can affect the quality of water supplies and water can be rendered unpalatable or unhealthy by the addition of suspended particulates, viruses and pathogenic organisms, and dissolved materials.	There would be no exceedance of water quality standards for a water supply in the Colorado River or Willow Creek. Lower DO concentrations in Granby Reservoir and Grand Lake would increase manganese concentrations. The No Action Alternative would have a greater impact on DO concentrations than the other alternatives. As a result, the water supply standard for manganese would remain above the standard in Granby Reservoir and Grand Lake.	There would be no exceedance of water quality standards for a water supply in the Colorado River or Willow Creek. Lower DO concentrations in Granby Reservoir, Shadow Mountain, and Grand Lake may slightly increase the manganese concentration. This would result in continued exceedance of the water supply standard for Granby Reservoir and Shadow Mountain Reservoir and possible exceedance in Grand Lake.	There would be no exceedance of water quality standards for a water supply in the Colorado River or Willow Creek. There would be no increase in DO or manganese concentrations in Granby Reservoir or Shadow Mountain Reservoir. Lower DO concentrations in Grand Lake may slightly increase the manganese concentration, which could lead to exceedance of the standard.	Same as Alternative 3.	Same as Alternative 3.
8.2. RECREATIONAL AND COMMERCIAL FISHERIES (230.51)	Recreational and commercial fisheries consist of harvestable fish, crustaceans, shellfish, and other aquatic organisms used by man.	Dredge and fill activities associated with reservoir and facility construction on the East Slope for any of the alternatives would have no impact on recreational or commercial fishery because the reservoirs would be constructed on intermittent and ephemeral streams that do not support				

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		a fishery. The predicted changes in fish habitat in the Colorado River and Willow Creek from flow reductions under all the alternatives would result in a slight decrease in available fish habitat, but are not predicted to adversely impact fishing opportunities. Projected increases in streamflow to East Slope streams from the import of water would result in a slight increase in available fish habitat. Predicted increases and decreases in flow in North St. Vrain Creek under the No Action Alternative would result in small reductions and improvements in fish habitat related to the timing of reservoir storage and release. Changes in water levels and water quality in the Three Lakes, Carter Lake, and Horsetooth Reservoir would not impact fishing opportunities.				
8.3. WATER-RELATED RECREATION (230.52) **West Slope**	The Colorado River, primarily downstream of the Blue River confluence, provides two popular stretches for kayaking and rafting. Big Gore Canyon is a 9.2-mile reach of difficult rapids and the Pumphouse reach provides a less technical boating opportunity. Grand Lake, Shadow Mountain Reservoir, and Granby Reservoir support boating, fishing, nearby camping, and hiking. Windy Gap Reservoir provides wildlife viewing and picnicking. The Rockwell and Jasper East Reservoir sites have limited public recreation.	Impacts to preferred boating flows in Big Gore Canyon and Pumphouse would be similar to the Proposed Action. Preferred kayaking flows in Byers Canyon (>400 cfs) would occur about 8 days less per year in 18 years out of the 47-year study period. Predicted effects to aquatic habitat, as discussed for Aquatic Resources, are not predicted to measurably impact sport fishing in the Colorado River or Willow Creek. There would be no change in water levels in Grand Lake and Shadow Mountain Reservoir that would affect recreation. Granby Reservoir surface area in the summer would decrease less than 2% on average and boat ramps would remain accessible except in dry years when water levels could drop below the Arapaho Bay boat ramp in August.	Preferred boating flows in Big Gore Canyon (850 to 1,250 cfs) would average 3 days or less than existing conditions in 10 years out of the 47-year study period. For the Pumphouse reach, preferred boating flows (1,100 to 2,200 cfs would occur about 1 day less per year on average in 15 years out of the 47-year study period. Preferred kayaking flows in Byers Canyon (>400 cfs) would occur about 12 days less per year in 18 years out of the 47-year study period. Predicted effects to aquatic habitat, as discussed for Aquatic Resources, are not predicted to measurably impact sport fishing in the Colorado River or Willow Creek. There would be no change in water levels in Grand Lake and Shadow Mountain Reservoir that would affect recreation. Granby Reservoir surface area would decrease 6% on average in the summer. Boat ramps would remain accessible except in dry years when water levels could drop below the Arapaho Bay boat ramp in May and August, and possibly the Stillwater and Sunset boat ramps for a portion of the summer.	Impacts to preferred boating flows in Big Gore Canyon and Pumphouse would be similar to the Proposed Action. Preferred kayaking flows in Byers Canyon (>400 cfs) would occur about 11 days less per year in 18 years out of the 47-year study period. Predicted effects to aquatic habitat, as discussed for Aquatic Resources, are not predicted to measurably impact sport fishing in the Colorado River or Willow Creek. There would be no change in water levels in Grand Lake and Shadow Mountain Reservoir that would affect recreation. Granby Reservoir water levels would decrease slightly less than under the Proposed Action with similar potential effects to boat ramps.	Impacts to preferred boating flows in Big Gore Canyon, Pumphouse, and Byers Canyon would be similar to the Proposed Action. Predicted effects to aquatic habitat, as discussed for Aquatic Resources, are not predicted to measurably impact sport fishing in the Colorado River or Willow Creek. There would be no change in water levels in Grand Lake and Shadow Mountain Reservoir that would affect recreation. Granby Reservoir water levels would decrease slightly less than under the Proposed Action with similar potential effects to boat ramps.	Impacts to preferred boating flows in Big Gore Canyon, Pumphouse, and Byers Canyon would be similar to the Proposed Action. Predicted effects to aquatic habitat, as discussed for Aquatic Resources, are not predicted to measurably impact sport fishing in the Colorado River or Willow Creek. There would be no change in water levels in Grand Lake and Shadow Mountain Reservoir that would affect recreation. Granby Reservoir water levels would decrease slightly less than under the Proposed Action with similar potential effects to boat ramps.
RECREATION **East Slope**	The Big Thompson River, North St. Vrain, and St. Vrain provide areas for kayaking and fishing. Smaller East Slope streams in the project area experience limited fishing use and wildlife viewing.	Kayaking opportunities in North St. Vrain Creek below Longmont Reservoir would be reduced in July when flows drop below 150 cfs. Increased flows in the Big Thompson River would maintain acceptable	No effect on North St. Vrain flows or kayaking. Increased flows in the Big Thompson River would maintain existing kayaking. Average monthly water surface area in Carter Lake would decrease less than 1% and	Similar to the Proposed Action except the average monthly water surface area at Horsetooth Reservoir would decrease less than 1%. Jasper East Reservoir could provide recreation opportunities if a managing	Same as Alternative 3. Rockwell Reservoir could provide recreation opportunities if a managing entity is found, although wide fluctuations in water levels could reduce suitability.	Same as Alternative 3. Dry Creek reservoir could provide recreation opportunities similar to Chimney Hollow if a managing entity is found. Rockwell Reservoir could provide recreation opportunities if a

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	Carter Lake and Horsetooth Reservoir are popular boating, fishing, and camping areas owned by Reclamation and operated by Larimer County. The Chimney Hollow and Dry Creek reservoir sites do not currently support public recreation. Ralph Price Reservoir is managed by the City of Longmont for fishing and hiking.	kayaking flows. Recreation at Ralph Price Reservoir would be suspended for 2 years until construction is completed. Average monthly water surface area in Carter Lake would decrease less than 1% and Horsetooth surface area would not change. Boat ramp access could be reduced in dry years.	Horsetooth surface area would decrease up to 5%. Water levels could drop below Horsetooth's South Bay-South boat ramp in September, and in dry years access to several boat ramps could be affected. Chimney Hollow Reservoir would provide day use fishing, boating, and hiking opportunities with up to 50,000 annual visitors.	entity is found, although wide fluctuations in water levels could reduce suitability.		managing entity is found, although wide fluctuations in water levels could reduce suitability.
8.4. AESTHETICS (230.53)	The existing visual quality at alternative reservoir locations is generally high because the sites are in areas of limited development. Lands are mostly undeveloped with native and introduced vegetation. The Chimney Hollow and Dry Creek Reservoir sites are in areas with limited public access. West Slope reservoir sites are near county roads.	Visual quality would diminish temporarily during construction from earthwork, vegetation clearing, dust, and traffic. The visual quality at Ralph Price Reservoir would not change substantially from existing conditions, but an additional 77 acres of open water would replace forestland. Lower summer water levels in Granby Reservoir would increase the amount of visible shoreline about 108 acres more than existing conditions. Small decreases in Carter Lake and Horsetooth Reservoir storage are unlikely to be noticeable. Lower streamflows could potentially reduce the visual quality of the Colorado River, but for most viewers, these changes would not be discernible for any of the alternatives.	Temporary visual impacts during construction would be similar to No Action. Chimney Hollow Reservoir would be visible primarily from homes along the hogback to the east. The dam would be visible from locations to the north up to 2.5 miles away including Reclamation offices, scattered residences, and CR 18E. The relocated transmission line would be visible from the lake and homes on the hogback. Because Chimney Hollow would remain near full, shoreline exposure would be limited. Lower summer water levels in Granby Reservoir would increase the amount of visible shoreline about 270 acres more than existing conditions. Small decreases in Carter Lake storage would not be noticeable. Exposed shoreline at Horsetooth Reservoir would increase less than 73 acres on average in the summer.	Visual effects at Chimney Hollow would be similar to the Proposed Action, although the dam would be about 30 feet lower and slightly less visible. Jasper East Reservoir and dam would be visible from scattered residential homes to the west and portions of the Arapaho National Recreation Area, as well as the relocated CR 40. Fluctuations in water levels would expose large areas of shoreline, but water levels would be highest in the summer. Lower summer water levels in Granby Reservoir would increase the amount of visible shoreline about 155 acres more than existing conditions. Small decreases in Carter Lake storage would not be noticeable. Exposed shoreline at Horsetooth Reservoir would increase less than 24 acres on average in the summer.	Visual effects at Chimney Hollow would be the same as Alternative 3. Rockwell Reservoir dams would be visible from the Town of Granby, Grand Elk, Granby Ranch, and U.S. 40. Views of the reservoir would be limited to scattered homes at higher elevations. Visual effects for Granby Reservoir, Carter Lake, and Horsetooth Reservoir would be the same as Alternative 3.	Dry Creek Reservoir would introduce a substantial visual change to the valley, but there are few observation points because most of the area is undeveloped. The dam would be visible from several rural roads and residences. Visual effects of Rockwell Reservoir would be similar to Alternative 4, although the dams would be slightly higher and more visible. Visual effects for Granby Reservoir, Carter Lake, and Horsetooth Reservoir would be the same as Alternative 3.
8.5. PARKS, NATIONAL AND HISTORICAL MONUMENTS, NATIONAL SEASHORES, WILDERNESS AREAS, RESEARCH SITES, AND SIMILAR PRESERVES (230.54)		No direct effects to Parks, National and Historical Monuments, National Seashores, Wilderness Areas, research sites and similar preserves under any of the alternatives.				

5.1.4. Alternative 3—Chimney Hollow Reservoir and Jasper East Reservoir

Alternative 3 would involve discharge of fill in wetlands in the dam footprint for Chimney Hollow and Jasper East reservoirs. Additional wetland effects would occur in locations where access roads and pipelines cross wetlands and other waters. Wetlands and other waters in the Chimney Hollow Reservoir and Jasper East Reservoir footprints also would be inundated by water storage. Total permanent and temporary effects to the substrate under wetlands and waters at both reservoir sites would be about 35.5 acres.

5.1.5. Alternative 4—Chimney Hollow Reservoir and Rockwell/Mueller Creek Reservoir

Alternative 4 would involve discharge of fill in wetlands in the Chimney Hollow Reservoir dam footprint and in the Rockwell/Mueller Creek Reservoir dam footprint. Additional wetland effects would occur in locations where access roads and pipelines cross wetlands and other waters. Wetlands and other waters in the Chimney Hollow Reservoir and Rockwell/Mueller Creek Reservoir footprints also would be inundated by water storage. Total permanent and temporary effects to the substrate under wetlands and other waters at both reservoir sites would range from 13.3-27.3 acres.

5.1.6. Alternative 5—Dry Creek Reservoir and Rockwell/Mueller Creek Reservoir

Alternative 5 would involve discharge of fill in wetlands in the Dry Creek Reservoir dam footprint and in the Rockwell/Mueller Creek Reservoir dam footprint. Additional wetland effects would occur in locations where access roads and pipelines cross wetlands and other waters. Wetlands and other waters in the Dry Creek Reservoir and Rockwell/Mueller Creek Reservoir footprints also would be inundated by water storage. Total permanent and temporary effects to the substrate under wetlands and other waters at both reservoir sites would range from 20.0 to 35.6 acres.

5.2. Suspended Particulate Materials/Turbidity (230.21)

5.2.1. Definition and Types of Possible Effects

Suspended particulates in the aquatic ecosystem consist of fine-grained mineral particles, usually smaller than silt, and organic particles. Suspended particulates may enter water bodies as a result of land runoff, flooding, vegetative and planktonic breakdown, resuspension of bottom sediments, and human activities including dredging and filling. Particulates may remain suspended in the water column for variable periods of time as a result of such factors as agitation of the water mass, particulate specific gravity, particle shape, and physical and chemical properties of particle surfaces.

The discharge of dredge or fill material can result in greatly elevated levels of suspended particulates in the water column for varying lengths of time. These new levels may reduce light penetration and lower the rate of photosynthesis and the primary productivity of an aquatic area if they last long enough. Sight dependent species may suffer reduced feeding ability leading to limited growth and lowered resistance to disease if high levels of suspended particulates persist. The biological and the chemical content of the suspended material may react with the dissolved oxygen in the water, which can result in oxygen depletion. Toxic metals and organics, pathogens, and viruses absorbed or adsorbed to fine-grained particulates in the material may become biologically available to organisms either in the water

column or on the substrate. Significant increases in suspended particulate levels create turbid plumes that are highly visible and aesthetically displeasing. The extent and persistence of these adverse impacts caused by discharges depend upon the relative increase in suspended particulates above the amount occurring naturally; the duration of the higher levels; the current patterns, water level, and fluctuations present when such discharges occur; the volume, rate, and duration of the discharge; particulate deposition; and the seasonal timing of the discharge.

The Water Quality section of the WGFP FEIS (Reclamation 2011) contains information on the estimated effects to suspended particulates. Additional information is found in the Water Resource Technical Report (ERO and Boyle 2007), the Stream Water Quality Technical Report (ERO and AMEC 2008), and the Lake and Reservoir Water Quality Report (AMEC 2008).

5.2.2. Suspended Particulate Effects Common to All Alternatives

All of the alternatives would result in additional diversions from the Colorado River at Windy Gap Reservoir with delivery to Granby Reservoir. Alternatives 3, 4, and 5 could also take delivery of Colorado River diversions to new Jasper East and Rockwell/Mueller Creek reservoirs before delivery to Granby Reservoir. Sediment concentrations in the Colorado River fluctuate and are generally highest during high flows. Total suspended solids (TSS) in Granby Reservoir are not predicted to change under the No Action Alternative, but are estimated to increase 4.3 percent under all the action alternatives. TSS is estimated to increase about 5 percent in Shadow Mountain Reservoir under all the alternatives. There would be no change in TSS in Grand Lake under the No Action Alternative and Alternative 5, but TSS is estimated to increase 5.6 percent under Alternatives 2, 3, and 4. Suspended particulate concentrations may become elevated in the Three Lakes (Granby Reservoir, Shadow Mountain Reservoir, and Grand Lake) under Alternatives 3, 4, and 5 when the Jasper East or Rockwell/Mueller Creek reservoirs are drawn down rapidly or contain low volumes of stored water that are pumped to Granby Reservoir.

Delivery of Windy Gap water through the C-BT system to Carter Lake and Horsetooth Reservoir would generally have low suspended particulates under all the alternatives.

5.2.3. Alternative 1—No Action

The water used to fill the enlarged Ralph Price Reservoir would come from additional capture and storage of North St. Vrain Creek in exchange for Windy Gap deliveries to the St. Vrain River. North St. Vrain Creek water is of a high quality with low suspended particulates. Suspended particulates concentrations in the reservoir could be elevated from erosion of newly inundated shoreline. Windy Gap water deliveries to St. Vrain Creek via the C-BT system to replace water stored in Ralph Price Reservoir is generally of high quality with low suspended particulate concentrations similar to existing conditions.

5.2.4. Alternative 2—Chimney Hollow Reservoir (Proposed Action)

Water delivery to Chimney Hollow Reservoir through the C-BT system would be low in suspended particulates. Because water levels in the reservoir would remain near full most of the time and the watershed source area to the reservoir is small, suspended particulate concentrations would be low.

5.2.5. Alternative 3—Chimney Hollow Reservoir and Jasper East Reservoir

Water delivery to Chimney Hollow Reservoir through the C-BT system would be low in suspended particulates. Greater water level fluctuations in Chimney Hollow Reservoir would increase the potential for particulate suspension compared to Alternative 2. The watershed source area to the reservoir is small and would contribute a minor quantity of sediment to the reservoir.

Water levels in Jasper East Reservoir would fluctuate substantially increasing the potential for suspension or re-suspension of sediments. The watershed source area to the reservoir is small and would contribute a minor quantity of sediment to the reservoir.

5.2.6. Alternative 4—Chimney Hollow Reservoir and Rockwell/Mueller Creek Reservoir

Suspended sediment effects at Chimney Hollow Reservoir would be the same as Alternative 3.

Water levels in Rockwell/Mueller Creek Reservoir would fluctuate substantially increasing the potential for suspension or re-suspension of sediments. The watershed source area to the reservoir is small and would contribute a minor quantity of sediment to the reservoir.

5.2.7. Alternative 5—Dry Creek Reservoir and Rockwell/Mueller Creek Reservoir

Water delivery to Dry Creek Reservoir through the C-BT system would generally be low in suspended particulates. Water level fluctuations in the reservoir would result in some shoreline erosion and the potential for suspension of sediment. The watershed source area to the reservoir is small and would contribute a minor quantity of sediment to the reservoir.

5.3. Water (230.22)

5.3.1. Definition and Types of Possible Effects

Water is the part of the aquatic ecosystem in which organic and inorganic constituents are dissolved and suspended. It constitutes part of the liquid phase and is contained by the substrate. Water forms part of a dynamic aquatic life-supporting system. Water clarity, nutrients and chemical content, physical and biological content, dissolved gas levels, pH, and temperature contribute to its life-sustaining capabilities.

The discharge of dredged or fill material can change the chemistry and the physical characteristics of the receiving water at a disposal site through the introduction of chemical constituents in suspended or dissolved form.

Changes in the clarity, color, odor, and taste of water and the addition of contaminants can reduce or eliminate the suitability of water bodies for populations of aquatic organisms, and for human consumption, recreation, and aesthetics. The introduction of nutrients or organic material to the water column as a result of the discharge can lead to a high biochemical oxygen demand (BOD), which in turn can lead to reduced dissolved oxygen, thereby potentially affecting the survival of many aquatic organisms. Increases in nutrients can favor one group of organisms such as algae to the detriment of other more desirable types such as submerged aquatic vegetation, potentially causing adverse health effects, objectionable tastes and odors, and other problems.

The Water Quality section of the WGFP FEIS (Reclamation 2011) contains detailed information about the estimated effects on water quality. Additional information is found in the Stream Water Quality Technical Report (ERO and AMEC 2008), the Lake and Reservoir Water Quality Technical Report (AMEC 2008), and the Upper Colorado Dynamic Temperature Modeling Report (Hydros 2011).

5.3.2. Water Quality Effects by Stream and Reservoir

Colorado River. Water quality effects to the Colorado River resulting from flow changes would be similar under all of the action alternatives, because the flow changes would be similar. The No Action Alternative would have less impact on water quality because less water would be diverted from the Colorado River. All alternatives would result in an increase in Colorado River stream temperature below Windy Gap Reservoir. Specific conductivity would increase below the Williams Fork and dissolved oxygen would decrease slightly at minimum streamflows. Ammonia and inorganic phosphorus concentrations would increase for all alternatives. Water quality standards would be met with the exception of an increased potential for exceeding the chronic and acute temperature standards during periods of low flow and dropping below the dissolved oxygen standard in portions of the Colorado River during low flow.

Willow Creek. Willow Creek would see a slight reduction in water temperature and a slight increase in the concentration of ammonia, iron, and copper under all the alternatives. Water quality standards would be met under all alternatives.

Granby Reservoir. All of the alternatives result in an increase in total phosphorus concentrations and no change in Secchi-disk depth (clarity) or trophic state in Granby Reservoir. The No Action and Proposed Action alternatives would have an increase in total nitrogen concentrations and the other alternatives a slight decrease. Average chlorophyll *a* concentrations would increase under the Proposed Action and remain the same for other alternatives. Dissolved oxygen concentrations would decrease under the No Action and the Proposed Action alternatives and remain unchanged for other alternatives. Dissolved oxygen concentrations in the hypolimnion and manganese concentrations, which currently exceed water quality standards would continue to exceed standards. Temperature would not change under any of the alternatives.

Shadow Mountain Reservoir. Total phosphorus concentrations would increase under all the alternatives in Shadow Mountain Reservoir. Total nitrogen would increase under the No Action Alternative and Alternatives 2 and 3 and decrease for Alternatives 4 and 5. Chlorophyll *a* would increase under Alternatives 1 to 3 and would not change for Alternatives 4 and 5. None of the alternatives would affect Secchi disk depth or the trophic state of the reservoir. Dissolved oxygen would decrease under the Proposed Action alternative and would not change under other alternatives. The lower dissolved oxygen concentration for the Proposed Action alternative indicates the manganese water quality standard may not be met, similar to existing conditions. Temperature and water quality standards for other parameters would continue to be met under all alternatives.

Grand Lake. Total phosphorus is estimated to increase under all the alternatives in Grand Lake. Total nitrogen would increase under No Action and the Proposed Action and would decrease for Alternatives 3 to 5. Average chlorophyll *a* is estimated to increase for all alternatives. Secchi-disk depth would decrease for all alternatives except Alternative 5. There would be no change in trophic status for any of the alternatives. Dissolved oxygen concentrations would decrease for all alternatives,

which would result in continued exceedance of the manganese standard. Temperature and water quality standards for other parameters would continue to be met under all alternatives.

Jasper East Reservoir. Jasper East Reservoir, which is a feature of Alternative 3, is predicted to be oligotrophic to mesotrophic. Water quality in a newly constructed Jasper East Reservoir would generally be good, but would have higher total phosphorus concentrations and similar nitrogen concentrations compared to the Three Lakes reservoirs. Chlorophyll *a* concentrations would be lower than the Three Lakes and Secchi-disk would be greater.

Big Thompson River. Additional deliveries of Windy Gap water to the Big Thompson River below Lake Estes would result in a slight increase in nitrogen and phosphorus concentrations under all alternatives. All of the alternatives would result in a slight decrease in ammonia concentrations below the Loveland Wastewater Treatment Plant (WWTP) and an increase in copper. No exceedance of water quality standards is predicted for any of the alternatives.

North St. Vrain Creek. Increases and decreases in stream temperature and dissolved oxygen below Ralph Price Reservoir would occur depending on monthly flow changes under the No Action Alternative.

St. Vrain Creek. Minimal effects to St. Vrain water quality between the confluence with North St. Vrain Creek and the St. Vrain Supply Canal under the No Action Alternative are predicted. St. Vrain Creek below the Longmont WWTP would experience increased discharges from Windy Gap return flows resulting in an increase in ammonia and iron concentrations and a decrease in manganese concentration under all the alternatives. No exceedance of water quality standards is predicted.

Big Dry Creek. Additional WWTP discharges for all alternatives below the Broomfield WWTP would result in an increase in ammonia concentrations that could increase the potential for exceedance of the water quality standard, which occurs occasionally under current conditions. Iron and manganese concentrations would go down under all alternatives.

Coal Creek. All the alternatives would result in higher streamflow and ammonia concentrations below Superior, Louisville, Lafayette, and Erie WWTPs. The potential for exceedance of the ammonia standard is possible during low flows.

Cache la Poudre River. Ammonia and copper concentrations in the Cache la Poudre River below the Greeley WWTP would increase under all the alternatives. No exceedance of water quality standards is projected.

Carter Lake. Total phosphorus and total nitrogen would increase under all the alternatives. Chlorophyll *a* would increase under the No Action Alternative, the Proposed Action alternative, and Alternative 5 and would not change for Alternatives 3 and 4. All alternatives would result in a decrease in Secchi-disk depth, but there would be no change in trophic status or temperature. Dissolved oxygen is likely to decrease with potential for an increase in manganese levels; the Proposed Action alternative would have the greatest effect. No exceedance of water quality standards is likely for any of the alternatives.

Horsetooth Reservoir. Total phosphorus, total nitrogen, and chlorophyll *a* concentrations would increase under all the alternatives. Secchi-disk depth would decrease for the Proposed Action alternative and would not change for other alternatives. There would be no change in the trophic status

of the reservoir under any of the alternatives. All alternatives may slightly reduce dissolved oxygen concentrations, which would result in continued exceedance of the manganese standard.

New Reservoir Sites. Construction of new reservoirs at Chimney Hollow, Dry Creek, Jasper East, or Rockwell/Mueller Creek would inundate and fill the existing ephemeral or intermittent streams. Water quality below the dams would be similar to that described for each of the new reservoirs as describe below.

Chimney Hollow Reservoir and Dry Creek Reservoirs. The water quality of both reservoirs would be similar. Both reservoirs are predicted to be oligotrophic and would not exceed water quality standards.

Rockwell/Mueller Creek Reservoir. Water quality in Rockwell/Mueller Creek Reservoir would be similar to Jasper East Reservoir under Alternatives 4 and 5.

5.4. Current Patterns and Water Circulation (230.23)

5.4.1. Definition and Types of Possible Effects

Current patterns and water circulation are the physical movements of water in the aquatic ecosystem. Currents and circulation respond to natural forces as modified by basin shape and cover, physical and chemical characteristics of water strata and masses, and energy dissipating factors.

The discharge of dredged or fill material can modify current patterns and water circulation by obstructing flow, changing the direction or velocity of water flow and circulation, or otherwise changing the dimensions of a water body. As a result, adverse changes can occur in: location, structure, and dynamics of aquatic communities; shoreline and substrate erosion and deposition rates; the deposition of suspended particulates; the rate and extent of mixing of dissolved and suspended components of the water body; and water stratification.

The Surface Water Hydrology and Stream Morphology and Floodplain sections of the WGFP FEIS (Reclamation 2011) contain information about the estimated changes in streamflow that would occur under the various alternatives and effects to stream morphology. Additional details are found in the Water Resource Technical Report (ERO and Boyle 2007).

5.4.2. Effects Similar for all Alternatives

All of the alternatives would result in additional pumping of water from the Colorado River at the existing Windy Gap Reservoir. No new water diversions or structures are required. Water diversions would result in a change in the volume and velocity of flows downstream from Windy Gap Reservoir primarily during May and June. Water pumped from Windy Gap Reservoir would be delivered to Granby Reservoir under all the alternatives and under Alternatives 3, 4, and 5 could also be delivered to new West Slope reservoirs prior to delivery to Granby Reservoir. The frequency of 2-year peak discharges at Hot Sulphur Springs would occur about 1 percent less than under existing conditions under all the alternatives. Channel maintenance flows would also occur about 1 percent less under the alternatives. The sediment transport rate of the Colorado River would still exceed the sediment supply and no aggradation of the channel is likely. A reduction in spills from Granby Reservoir would also affect flows in the Colorado River above the Windy Gap Reservoir. Granby Reservoir spills under all

the alternatives would continue to provide flows sufficient to maintain channel capacity, provide periodic scouring, and sediment transport.

All alternatives would continue to result in transbasin diversions from the West Slope through the existing C-BT system and delivery to WGFP Participants on the East Slope in the same manner as currently occurs. Additional deliveries from the Adams Tunnel to the Big Thompson River below Lake Estes would be relatively small and are unlikely to affect channel morphology under any of the alternatives. The additional return flows to East Slope streams below Participant WWTPs on the Big Thompson River, St. Vrain Creek, Coal Creek, and Big Dry Creek are not expected to materially affect stream morphology or sediment transport because flows would be well within historical flows and the channel forming processes of these streams are already highly modified in the urban environment.

Construction of new reservoirs at Chimney Hollow, Dry Creek, Jasper East, or Rockwell/Mueller Creek would capture water from the existing ephemeral and intermittent streams, but would release water below the dam similar to current flows.

5.4.3. Alternative 1—No Action

Alternative 1 requires an exchange of Windy Gap water for North St. Vrain water captured in the enlarged Ralph Price Reservoir. This would result in a change in flows in North St. Vrain Creek and St. Vrain Creek below the reservoir until the water is replaced at Lyons from the St. Vrain Supply Canal. The volume of flow changes are well within the historical range of flows and would not substantially affect stream morphology in North St. Vrain or St. Vrain Creek. Enlargement of Ralph Price Reservoir would increase reservoir storage capacity by 13,000 AF, but would not substantially change current patterns and water circulation.

5.5. Normal Water Fluctuations (230.24)

5.5.1. Definition and Types of Possible Effects

Normal water fluctuations in a natural aquatic system consist of daily, seasonal, and annual tidal and flood fluctuations in water level. Biological and physical components of such a system are either attuned to or characterized by these periodic water fluctuations.

The discharge of dredge or fill material can alter the normal water-level fluctuation pattern of an area, resulting in prolonged periods of inundation, exaggerated extremes of high and low water, or a static nonfluctuating water level. Such water level modifications may change salinity patterns, alter erosion or sedimentation rates, aggravate water temperature extremes, and upset the nutrient and dissolved oxygen balance of the aquatic ecosystem. In addition, these modifications can alter or destroy communities and populations of aquatic animals and vegetation; induce populations of nuisance organisms; modify habitat; reduce food supplies; restrict movement of aquatic fauna; destroy spawning areas; and change adjacent, upstream, and downstream areas.

The Surface Water Hydrology section of the WGFP FEIS (Reclamation 2011) contains detailed information about the estimated changes in streamflow and water storage that would occur under the alternatives. Additional information is found in the Water Resource Technical Report (ERO and Boyle 2007). The Stream Water Quality Technical Report (ERO and AMEC 2008) and the Lake and Reservoir Water Quality Technical Report (AMEC 2008) contain detailed information about potential

effects to water quality. The Vegetation Resources Technical Report contains detailed information about potential effects to wetlands and riparian resources along the Colorado River, Willow Creek, and East Slope streams. The Wildlife Resources Technical Report (ERO 2007b) and Aquatic Resource Technical Report (Miller Ecological 2010) contain information about potential effects to aquatic fauna and threatened and endangered species.

5.5.2. Alternative Effects

Dredge and fill activities associated with new reservoir and dam construction and the associated inundation of the channels would directly impact existing periodic flows of these ephemeral and intermittent streams. New reservoirs would fluctuate according to specific operating conditions. Chimney Hollow Reservoir water levels would fluctuate the least under the Proposed Action alternative. Chimney Hollow Reservoir in Alternatives 3 and 4 and Dry Creek Reservoir in Alternative 5 would have moderate seasonal levels of fluctuation. Jasper East Reservoir and Rockwell/Mueller Creek Reservoir would fluctuate substantially throughout the year and from year to year.

Indirect effects of the discharge of fill material associated with dam construction result in a change in streamflow and reservoir levels at other locations. All of the alternatives would result in a change in flows in the Colorado River below Windy Gap Reservoir, as well as below Granby Reservoir. The majority of flow reductions would occur during May and June, but could occur from April to August. The largest percent reduction in flow below Windy Gap Reservoir would occur in July. Colorado River flow below Windy Gap Reservoir in July would decrease from about 20 percent for the No Action Alternative to 23 percent for the Proposed Action alternative, and 28 percent for Alternatives 3, 4, and 5. There would be no change in Colorado River flow from existing conditions during dry years as a result of the WGFP. Colorado River diversions would reduce the potential for flooding downstream of Windy Gap Reservoir. All of the alternatives would also result in a reduction in streamflow for Willow Creek below Willow Creek Reservoir. The largest volume change in Willow Creek would be in June and the greatest percentage change in July.

Water levels in Granby Reservoir, Carter Lake, and Horsetooth Reservoir would be lower under all the alternatives. The greatest fluctuation in water levels would occur under the Proposed Action alternative. Water levels in Shadow Mountain Reservoir and Grand Lake would not change for any alternative.

All of the alternatives would result in increased streamflows on the East Slope at several locations. The Big Thompson River below Lake Estes would receive additional deliveries of Windy Gap water, and streams below Participant WWTPs would have increased discharges from Windy Gap return flows following municipal use. Predicted small changes in East Slope streamflow would slightly increase the potential for flooding, but the flow increases would generally be small relative to existing flows.

5.6. Salinity Gradients (230.25)

Salinity gradients form where salt water from the ocean meets and mixes with fresh water from land.

The project area is not located in or near an ocean; therefore, salinity gradients would not be affected by the Project.

6. POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM (SUBPART D)

6.1. Threatened, Endangered, and Candidate Species (230.30)

6.1.1. Definition and Types of Possible Effects

An endangered species is a plant or animal in danger of extinction throughout all or a significant portion of its range. A threatened species is one in danger of becoming an endangered species in the foreseeable future throughout all or a significant portion of its range. The major potential impacts on threatened or endangered species from the discharge of dredged or fill material include covering or otherwise directly killing a species, the impairment or destruction of habitat, and facilitating incompatible activities.

The Threatened and Endangered Species section of the WGFP FEIS (Reclamation 2011) contains information about threatened and endangered species that could be affected by the alternatives. Additional detailed information is found in the Vegetation Resources Technical Report (ERO 2007a), Wildlife Resources Technical Report (ERO 2007b), and Aquatic Resource Technical Report (Miller Ecological 2010).

6.1.2. All Alternatives

Impacts to the endangered species in the Colorado River were originally addressed in the 1981 FWS Biological Opinion for the original Windy Gap Reservoir based on an estimated average annual diversion of 57,300 AF. A Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin was initiated on January 22, 1988. The Recovery Program was intended to be the reasonable and prudent alternative for individual projects to avoid the likelihood of jeopardy to endangered fish from depletions in the Upper Colorado River Basin. A Section 7 agreement was implemented on October 15, 1993 by Recovery Program participants. Incorporated in this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP), which identifies actions currently believed to be required to recover the endangered fish. On December 20, 1999, the Service issued a final programmatic biological opinion (PBO) for Reclamation's Operation and Depletions, Other Depletions, and Funding and Implementation of Recovery Program Actions in the Upper Colorado River above the Confluence with the Gunnison River. The Service determined that projects that fit under the umbrella of the Colorado River PBO would avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts.

Reclamation reinitiated consultation with the Service because the stream depletions associated with the Preferred WGFP Alternative would adversely impact bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker. The Service issued a biological opinion on February 12, 2010 for the Preferred Alternative (Appendix D of the FEIS). The biological opinion determined that the original Windy Gap Project meets the criteria for coverage under the PBO because a Recovery Agreement was signed by the Subdistrict in March 2000 and the depletions existed when the Recovery Program was initiated. Because it was not a new depletion, no additional fees were submitted for compliance with the PBO. Hydrologic modeling for the PBO determined that the existing average annual depletions caused by the Windy Gap Project between 1981 and 1999 was 18,779 AF. The

proposed WGFP would cause an additional average annual depletion of 21,317 AF/year. The average annual water depletion from the Colorado River as a result of the Windy Gap Project, including the additional depletions of the proposed WGFP, would be an estimated 40,096 AF/year.

In order for the WGFP to rely on the Recovery Program to offset the new average annual depletions of 21,317 AF, the Subdistrict would need to make a monetary contribution for water depletions greater than 100 AF to help fund their share of the costs of recovery actions. The Subdistrict would pay a one-time depletion fee prior to construction of the project at the appropriate rate per acre-foot in the year of payment. At 2010 rates of $18.99/AF, the cost for increased depletions of 21,317 AF for the Proposed Action would be $404,809.83.

The No Action Alternative and Alternative 3 would have no effect on other threatened or endangered species. Construction of Rockwell/Mueller Creek Reservoir (Alternatives 4 and 5) may affect, but is unlikely to adversely affect lynx.

6.2. Fish, Crustaceans, Mollusks, and Other Aquatic Organisms (230.31)

6.2.1. Definition and Types of Possible Effects

Aquatic organisms in the food web include a variety of plant and animal species. The discharge of dredge or fill material can variously affect populations of fish, crustaceans, mollusks, and other food web organisms through the release of contaminants that adversely affect adults, juveniles, larvae, or eggs, or result in the establishment or proliferation of an undesirable competitive species at the expense of the desired species.

The Aquatic Resources section of the WGFP FEIS (Reclamation 2011) provides information on the estimated effects to fish and aquatic life. Additional information is found in the Aquatic Resource Technical Report (Miller Ecological 2010).

6.2.2. Alternative Effects

Construction of new reservoirs (Chimney Hollow, Jasper East, and Rockwell/Mueller Creek) under the action alternatives would have no direct effects on fish because the reservoirs would not be constructed on perennial drainages. Portions of Dry Creek at the Dry Creek Reservoir site support minnows and aquatic invertebrates that would be impacted by reservoir construction. These drainages may support other aquatic invertebrates or insects. The new reservoirs as well as enlargement of Ralph Price Reservoir under the No Action Alternative would provide habitat for establishing fish and other aquatic organisms. Chimney Hollow Reservoir under the Proposed Action alternative may be managed to support a sport fishery. This also may occur under other alternatives and reservoir sites if a managing entity is found. Suitability of Jasper East Reservoir and Rockwell/Mueller Creek Reservoir for establishing a sport fishery may be difficult because of fluctuations in water levels.

Effects to fish and other aquatic life are possible in the Colorado River from the changes in streamflow. All of the alternatives would result in a decrease in fish habitat below Windy Gap Reservoir. Overall, the modeled changes in fish habitat in the Colorado River for all alternatives indicate the most substantial changes in habitat would occur between Windy Gap Reservoir and the confluence with the Williams Fork River in both average and wet years. For the remainder of the

Colorado River downstream of the Williams Fork, a reduction in habitat also would occur in average or wet years, but would not result in a substantial change (<15 percent) from existing conditions.

The largest reductions in fish habitat would occur during August of average and wet years when Windy Gap diversions occur. The hydrologic model indicates that WGFP diversions of more than 100 AF in August would increase from 6 times in the 47-year hydrologic modeling period to 15 times. Actual WGFP pumping in August is likely to be less because new reservoirs would typically be close to full in years when the WGFP diversions are in priority in August and the cost of pumping is high for the limited water that is available. Adult rainbow trout would have the largest reduction of all species and life stages. Fall spawning brown trout or spring spawning rainbow trout would not be affected by Windy Gap diversions.

The predicted flow regime in the Colorado River as a result of the No Action Alternative and action alternatives would still include the components for stream health, but at lower levels than existing conditions or the native natural flows that were present prior to settlement and human influence. Peak flows that exceed bankfull volumes on a regular basis and predicted future flow regimes would continue to provide the necessary conditions to create and maintain channel morphology and aquatic habitat. In addition, a range of channel maintenance flows would provide the conditions to maintain riparian habitat. Modeled baseflows under all alternatives would maintain benthic invertebrate populations. Sediment transport capacity of the Colorado River would still exceed the available sediment supply. Colorado River flows would continue to regularly move medium-sized gravels for trout spawning habitat. Winter flows, combined with the habitat created by periodic high-flow events, would continue to provide refuge habitat during winter conditions. Projected increases in the exceedance of chronic and acute stream temperature standards under the alternatives would increase the stress on fish populations, although predicted exceedances as a result of the WGFP would occur only in about 4 out of 15 years, assuming very warm July and August air temperatures. Increased stream temperature, particularly the acute DM temperatures, has the greatest potential for affecting trout species in the Colorado River between Windy Gap Reservoir and the Williams Fork.

No adverse effect to fish or aquatic organisms is predicted for the Three Lakes as a result of changes in reservoir storage or water quality for any of the alternatives.

Projected increases in flow in the Big Thompson River, St. Vrain Creek, Big Dry Creek, and Coal Creek would slightly enhance fish habitat under all alternatives. A slight reduction in fish habitat in North St. Vrain and St. Vrain Creek above Lyons is possible with reduced flow in some summer months under the No Action Alternative; however, higher flows in the fall and winter would benefit fish habitat. Predicted changes in reservoir storage and water quality in Carter Lake and Horsetooth Reservoir would not adversely impact fish habitat under all alternatives. A larger Ralph Price Reservoir under the No Action Alternative would slightly benefit fish.

6.3. Impacts on Other Wildlife (230.32)

6.3.1. Definition and Types of Possible Effects

Wildlife associated with aquatic ecosystems are resident and transient mammals, birds, reptiles, and amphibians. The discharge of dredged or fill material can result in the loss or change of breeding and nesting areas, escape cover, travel corridors, and preferred food sources for resident and transient

wildlife species associated with the aquatic ecosystem. These adverse impacts upon wildlife habitat may result from changes in water levels, water flow and circulation, salinity, chemical content, and substrate characteristics and elevation. Increased water turbidity can adversely affect wildlife species that rely upon sight to feed, and disrupt the respiration and feeding of certain aquatic wildlife and food chain organisms. The availability of contaminants from the discharge of dredged or fill material may lead to the bioaccumulation of such contaminants in wildlife. Changes in such physical and chemical factors of the environment may favor the introduction of undesirable plant and animal species at the expense of resident species and communities. In some aquatic environments, lowering plant and animal species diversity may disrupt the normal functions of the ecosystem and lead to reductions in overall biological productivity.

The Wildlife section of the WGFP FEIS (Reclamation 2011) describes potential direct and indirect effects to wildlife that could result from the alternatives. The Wildlife Resources Technical Report (ERO 2007b) provides additional details.

6.3.2. Alternative Effects

Reservoir and dam construction for any of the new reservoirs would fill or inundate riparian and wetland habitat present along the ephemeral and intermittent drainages where these reservoirs are located. This would result in the loss of suitable habitat for a variety of migratory birds, amphibians, and reptiles. Chimney Hollow and Dry Creek reservoirs would support development of riparian vegetation for wildlife because reservoir levels would remain fairly stable. Chimney Hollow Reservoir under the Proposed Action alternative has the greatest potential for creating shoreline wildlife habitat because it would have the least fluctuation in water levels. Jasper East Reservoir and Rockwell/Mueller Creek Reservoir are unlikely to develop substantial riparian vegetation development and wildlife habitat because of wide fluctuations in water levels. All of the reservoirs would create additional waterfowl and water bird habitat. New reservoirs may also support foraging habitat for osprey and bald eagles.

All action alternatives would result in reduced flows in the Colorado River downstream of Granby Reservoir and in Willow Creek downstream of Willow Creek Reservoir (ERO and Boyle 2007). These reduced flows are not anticipated to cause a loss of riparian or wetland vegetation and hence would not adversely impact wildlife habitat bordering streams. Likewise, predicted fluctuations in existing reservoir water levels is not expected to adversely impact the limited adjacent riparian vegetation that support wildlife.

Minor increases in East Slope streamflow, under all the alternatives, are unlikely to substantially change stream channel characteristics or vegetation composition; hence, existing wildlife habitat values are unlikely to change.

7. POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES (SUBPART E)

The estimated effect to special aquatic sites are discussed in the Aquatic Resource section of the WGFP FEIS (Reclamation 2011) and the Vegetation Resources Technical Report (ERO 2007a).

7.1. Sanctuaries and Refuges (230.40)

7.1.1. Definition and Types of Possible Effects

Sanctuaries and refuges consist of areas designated under state and federal laws or local ordinances to be managed principally for the preservation and use of fish and wildlife resources. Sanctuaries and refuges may be affected by discharges of dredged or fill material that disrupt the breeding, spawning, migratory movements, or other critical life requirements of resident or transient fish and wildlife resources; create unplanned, easy and incompatible human access to remote aquatic areas; create the need for frequent maintenance activity; result in the establishment of undesirable competitive species of plants and animals; change the balance of water and land areas needed to provide cover, food, and other fish and wildlife habitat requirements in a way that modifies sanctuary or refuge management practices.

7.1.2. Alternative Effects

None of the alternatives would result in direct impacts to sanctuaries or wildlife areas. All of the alternatives would result in a change in Colorado River streamflow through portions of the Colorado Division of Wildlife Hot Sulphur Springs SWA and Kemp-Breeze SWA. Access or use of these SWAs would not be impacted.

7.2. Wetlands (230.41)

7.2.1. Definition and Types of Possible Effects

Wetlands consist of areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The discharge of dredged or fill material in wetlands is likely to damage or destroy habitat and adversely affect the biological productivity of wetlands ecosystems by smothering, by dewatering, by permanently flooding, or by altering substrate elevation or periodicity of water movement. The addition of dredged or fill material may destroy wetland vegetation or result in advancement of succession to dry land species. It may reduce or eliminate nutrient exchange by a reduction of the system's productivity, or by altering current patterns and velocities. Disruption or elimination of the wetland system can degrade water quality by obstructing circulation patterns that flush large expanses of wetland systems, by interfering with the filtration function of wetlands, or by changing the aquifer recharge capability of a wetland. Discharges can also change the wetland habitat value for fish and wildlife. When disruptions in flow and circulation patterns occur, apparently minor loss of wetland acreage may result in major losses through secondary impacts. Discharging fill material in wetlands as part of municipal, industrial or recreational development may modify the capacity of wetlands to retain and store floodwaters and to serve as a buffer zone shielding upland areas from wave actions, storm damage and erosion.

The Wetland section of the WGFP FEIS (Reclamation 2011) and the Vegetation Resources Technical Report (ERO 2007a) contain more information on the estimated wetland impacts.

7.2.2. Summary of Effects to Wetlands and Other Waters

The permanent and temporary effects to wetlands and other waters for the alternatives are summarized in Table C-2. A discussion of effects by alternative follows.

Table C-2. Summary of effects to wetlands and other waters by alternative.

Wetlands and Other Waters	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3	Alternative 4	Alternative 5
Wetlands					
Permanent	0.3	1.6	22.7	4.5-15.1	9.2–21.8
Temporary	—	0.1	4.9	2.1-5.1	2.3–5.3
Total	0.3	1.7	27.6	6.6-20.2	11.0–27.1
Other Waters					
Permanent	0.1	1.3	7.6	4.9	6.5
Temporary	—	0.1	0.3	1.8	2.0
Total	0.1	1.4	7.9	6.7	8.5
TOTAL	**0.4**	**3.1**	**35.5**	**13.3—26.9**	**19.5–35.6**

7.2.3. Alternative 1—No Action Alternative

Enlargement of Ralph Price Reservoir under the No Action Alternative would inundate about 0.3 acre of wetlands around the existing shoreline and at stream inlets (Table C-2). At the North St. Vrain Creek inlet and inlets of other small tributaries to the reservoir, about 0.1 acre of waters would be inundated with a higher reservoir water level. Additional effects to waters and wetlands are possible depending on final design for the dam enlargement.

7.2.4. Alternative 2—Chimney Hollow Reservoir (Proposed Action)

The Proposed Action alternative would result in a permanent impact to 1.6 acres of wetlands from dam construction and facility construction, as well as wetlands inundated by the reservoir (Table C-2). An additional 0.1 acre of wetlands would be temporarily disturbed by construction-related activities. The total impacts to wetlands from implementation of Alternative 2 would be 1.7 acres. About 1.4 acre of other waters would be filled by dam construction or inundated by the new reservoir.

7.2.5. Alternative 3—Chimney Hollow Reservoir and Jasper East Reservoir

Alternative 3 would affect a total of 27.6 acres of wetlands from construction of Chimney Hollow Reservoir and Jasper East Reservoir (Table C-2). The majority of wetland impacts would occur at the Jasper East Reservoir site from dam construction and inundation of wetlands. Wetland impacts include 22.7 acres of permanent loss and 4.9 acres of temporary disturbance. Inundation or filling of the small channels at both reservoir sites would impact 7.9 acres of other waters.

7.2.6. Alternative 4—Chimney Hollow Reservoir and Rockwell/Mueller Creek Reservoir

Construction of Chimney Hollow Reservoir and Rockwell/Mueller Creek Reservoir would affect 6.6 to 20.2 acres of wetlands (Table C-2). The range in potential wetland effects is the result of the uncertainty in the amount of wetlands located at the Rockwell/Mueller Creek Reservoir site. Access to this site was denied by the landowners so no field data collection was conducted. The majority of

wetland impacts would occur at the Rockwell/Mueller Creek Reservoir site. About 6.7 acres of other waters would be impacted by construction of both reservoirs under this alternative.

7.2.7. Alternative 5—Dry Creek Reservoir and Rockwell/Mueller Creek Reservoir

Construction of Dry Creek Reservoir and Rockwell/Mueller Creek Reservoir would affect a total of 11.0 to 27.1 acres of wetlands (Table C-2) depending on the wetlands present at the Rockwell site. Wetland impacts at Dry Creek Reservoir would be about 6.5 acres and the remainder of the impacts would be from construction of Rockwell/Mueller Creek Reservoir. About 8.5 acres of other waters would be impacted by construction of both reservoirs.

7.2.8. Indirect Wetland Impacts Similar for All Alternatives

All of the alternatives would result in reduced streamflow in the Colorado River and Willow Creek on the West Slope and increased flows for several East Slope streams. The action alternatives would result in greater diversions from the Colorado River and greater return flows on the East Slope on average than the No Action Alternative. In addition, there would be changes in water levels at Granby Reservoir, Carter Lake, and Horsetooth Reservoir. An evaluation of the projected changes in channel maintenance flows and channel morphology indicates the conditions for growth, establishment, maintenance, and periodic scouring of riparian and wetland vegetation below Granby Reservoir and the Windy Gap diversion is unlikely to change substantially under any of the alternatives. Colorado River minimum flow requirements would be met under all the alternatives and the dry year diversions would not increase from existing conditions. None of the alternatives are predicted to adversely impact wetland and riparian vegetation as a result of changes in Colorado River streamflow.

Small seasonal decreases in Willow Creek flow below Willow Creek Reservoir are not expected to adversely impact channel maintenance flow or the hydrologic requirements for wetland or riparian vegetation adjacent to the stream.

There would be no change in water levels at Shadow Mountain Reservoir or Grand Lake under any of the alternatives; hence, there would be no impact wetlands or riparian vegetation. Lower average water levels in Granby Reservoir and to a lesser extent at Carter Lake and Horsetooth Reservoir are unlikely to adversely affect wetland or riparian vegetation under any of the alternatives because reservoir fluctuations would fall within the historical range of current reservoir fluctuations.

Projected small increases in streamflow from additional imports to the Big Thompson River below Lake Estes under all the alternatives are unlikely to adversely impact channel-forming hydrologic conditions or other conditions supporting riparian and wetland vegetation. The projected increases in streamflow below Participant WWTPs on the Big Thompson River, St. Vrain Creek, Big Dry Creek, and Coal Creek would not be large enough to measurably impact channel characteristics or other factors that are likely to adversely impact or benefit riparian or wetland vegetation. Projected seasonal increases and decreases in North St. Vrain Creek and St. Vrain Creek above Lyons under the No Action Alternative would fall within historical flow fluctuations and are unlikely to impact channel morphology or the hydrologic conditions needed to support wetlands and riparian vegetation.

7.3. Mudflats

Mud flats are broad flat areas along the sea coast and in coastal rivers to the head of tidal influence and in inland lakes, ponds, and riverine systems.

No direct effects to mudflats were identified as part of the WGFP FEIS.

7.4. Vegetated Shallows

Vegetated shallows are permanently inundated areas that under normal circumstances support communities of rooted aquatic vegetation, such as turtle grass and eelgrass in estuarine or marine systems as well as a number of freshwater species in rivers and lakes.

No direct effects to vegetated shallows were identified as part of the WGFP FEIS.

7.5. Riffle and Pool Complexes

7.5.1. Definition and Types of Possible Effects

Steep gradient sections of streams are sometimes characterized by riffle and pool complexes. Discharge of dredged or fill material can eliminate riffle and pool areas by displacement, hydrologic modification, or sedimentation.

The Stream Morphology and Floodplains section of the WGFP FEIS addresses potential effects to streams and the Aquatic Resource section of the FEIS discusses fish habitat (Reclamation 2011). Additional information on fish habitat is found in the Aquatic Resource Technical Report (Miller Ecological 2010). Additional information on stream morphology is found in the Water Resource Technical Report (ERO and Boyle 2007).

7.5.2. Effects Similar for All Alternatives

Dredge and fill activities associated with construction of any of the new reservoirs would have no direct effect on riffle and pool complexes because the reservoirs would be located on intermittent and ephemeral drainages that do not flow continuously. Enlargement of Ralph Price Reservoir would inundate about 500 feet of North St. Vrain Creek at the reservoir inlet that may contain riffles and pools. Riffle and pool complexes on North St. Vrain Creek below the dam could be impacted if dam enlargement extends into the channel.

Indirect effects to riffle and pools on the Colorado River and Willow Creek from a reduction in flow are not predicted to impact channel forming process or result in stream sedimentation. The Aquatic Resource Report addresses changes in fish habitat as a result of flow changes. Increased flows to East Slope streams would not result in adverse effects to channel morphology or existing riffle pool complexes.

8. POTENTIAL IMPACTS ON HUMAN USE CHARACTERISTICS

8.1. Municipal and Private Water Supplies

8.1.1. Definition and Types of Possible Effects

Municipal and private water supplies consist of surface water or ground water that is directed to the intake of a municipal or private water supply system. Discharges can affect the quality of water supplies with respect to color, taste, odor, chemical content and suspended particulate concentration, in such a way as to reduce the fitness of the water for consumption.

The Water Quality section of the WGFP FEIS (Reclamation 2011) discuss potential impacts to water quality. Additional information is found in the Stream Water Quality Technical Report (ERO and AMEC 2008) and the Lake and Reservoir Water Quality Technical Report (AMEC 2008).

8.1.2. Alternative Effects

None of the alternatives would result in exceedance of water quality standards for a water supply in the Colorado River or Willow Creek. Manganese concentrations in Granby Reservoir, Shadow Mountain Reservoir, and Grand Lake currently exceed the manganese standard for a water supply. Lower dissolved oxygen concentrations for the No Action and Proposed Action alternatives may slightly increase manganese concentrations in Granby Reservoir, so there would be no improvement. Under the Proposed Action, a predicted decrease in dissolved oxygen concentration may slightly increase the manganese concentration in Shadow Mountain Reservoir, which would continue to exceed the water supply standard. All of the alternatives would result in lower dissolved oxygen concentrations in Grand Lake, which would increase manganese concentrations. The No Action Alternative would have the greatest impact followed by the Proposed Action alternative. As a result, the water supply standard for manganese would remain above the standard in Grand Lake.

Recent monitoring in Granby Reservoir includes microcystin toxicity testing along with cell counts of dominant cyanobacteria (blue-green algae) (GCWIN 2007). Microcystin is a hepatotoxin that targets the liver and can be produced by some cyanobacteria. The presence or excessive abundance of toxin-producing algae does not translate into the presence of toxins in the water column. In 2007, a water advisory was posted for Grand Lake for two weeks by the Grand County Public Health Nursing Service. This was based on a microcystin measurement of 1.48 μg/l on August 6, 2007 analyzed using the ELISA method. Two follow-up tests using another method (HPLC) on the August 6 samples indicated values of 0.85 and 0.87 μg/l. All microcystin results received through 2009 for Granby Reservoir have been below the detection limit (Clements, pers. comm. 2007; Tollett, pers.comm. 2010). Microcystin toxin levels of more than 1 μg/L are of concern for drinking water purposes (WHO 1998). The highest microcystin test value for 2004, 2005, 2006, 2008, and 2009 was 0.334 μg/l. The relationships between the abundance of toxin-producing algae and levels of microcystin are unclear and are the subject of research efforts. Current research indicates that microcystin production is not only controlled by environmental factors (such as light, nutrients, and grazing pressure) but also by genetic composition (Zurawell et al. 2005). There are toxic and nontoxic strains of microcystin-producing cyanobacteria. Although cell counts are sometimes used to assess the magnitude of a bloom or when to start testing for toxins, they are not an accurate measure of bloom toxicity. Thus, a water body could have optimum

environmental conditions for microcystin production (which are not well understood) and a high microcystin-producing cyanobacteria cell count, and no microcystin production.

Lower dissolved oxygen concentrations in Carter Lake and Horsetooth Reservoir may increase manganese concentrations under all alternatives. Higher manganese concentrations in Carter Lake are unlikely to result in a standard exceedance, but continued exceedance of the water quality standard for manganese would occur at Horsetooth Reservoir.

8.2. Recreational and Commercial Fisheries

8.2.1. Definition and Types of Possible Effects

Recreational and commercial fisheries consist of harvestable fish, crustaceans, shellfish, and other aquatic organisms used by man. The discharge of dredged or fill materials can affect the suitability of recreational and commercial fishing grounds as habitat for populations of consumable aquatic organisms.

The Recreation section of the WGFP FEIS (Reclamation 2011) discusses the potential effects of the WGFP on recreation and angling. Additional information is found in the Recreation Resources Technical Report (ERO 2008) and the Aquatics Resource Technical Report (Miller Ecological 2010).

8.2.2. Alternative Effects

Dredge and fill activities associated with reservoir and facility construction for any of the alternatives would have no impact on recreational or commercial fishery because the reservoirs would be constructed on intermittent and ephemeral streams that do not support a fishery. The predicted changes in fish habitat in the Colorado River and Willow Creek from flow reductions under all the alternatives would result in a decrease in available fish habitat. During periods of low flow, higher water temperatures in the Colorado River could exceed the water quality standard for aquatic life. The No Action Alternative would have the least impact because less water is diverted. The impact to fish habitat in the Colorado River and Willow Creek is not predicted to adversely impact fishing opportunities under any of the alternatives. Projected increases in streamflow to East Slope streams from the import of water would result in a slight increase in available fish habitat. Predicted increases and decreases in flow in North St. Vrain Creek under the No Action Alternative would result in small reductions and improvements in fish habitat related to the timing of reservoir storage and release. Changes in water levels and water quality in the Three Lakes, Carter Lake, and Horsetooth Reservoir would not impact fishing opportunities.

8.3. Water-Related Recreation

8.3.1. Definition and Types of Possible Effects

Water-related recreation encompasses activities undertaken for amusement and relaxation. Activities encompass two broad categories of use: consumptive, e.g., harvesting resources by hunting and fishing; and non-consumptive, e.g. canoeing and sightseeing. One of the more important direct impacts of dredged or fill disposal is to impair or destroy the resources that support recreation activities.

The Recreation section of the WGFP FEIS (Reclamation 2011) contains information on the estimated effect to water-related recreation. The Recreation Resources Technical Report provides additional information on potential effects to recreation (ERO 2008).

8.3.2. Alternative Effects

WGFP diversions from the Colorado River under all of the alternatives would reduce the amount of flows available for rafting and kayaking in Byers Canyon, Gore Canyon, and the Pumphouse reach of the Colorado River. Preferred flows for boating would occur less frequently for all of the alternatives, with the greatest impact under the action alternatives.

Lower water levels in Granby Reservoir under all the alternatives would reduce the surface area for recreation, but substantial impacts to recreation use are unlikely. The relatively small reduction in boatable area on this large reservoir in most years is unlikely to noticeably affect recreation use of the reservoir or the quality of the recreation experience under any of the alternatives. Additional exposed shoreline at lower water levels could reduce the aesthetic value and affect the quality of the visitor experience. The Proposed Action alternative would have the greatest impact. In dry years, in particular, access to some boat ramps would be affected.

The projected changes in Carter Lake and Horsetooth Reservoir water surface area under all of the alternatives is unlikely to adversely affect visitor numbers or recreation activities. A large decline in surface area after several consecutive dry years, particularly under the Proposed Action alternative, could diminish the overall quality of the user experience by increasing the distance between land-based facilities and the water surface and potentially reducing the overall aesthetics of the experience.

Chimney Hollow Reservoir would provide water-based recreation for boating and fishing in Alternatives 2, 3, and 4. Dry Creek could potentially provide similar recreation use. Jasper East Reservoir in Alternative 3 and Rockwell/Mueller Creek Reservoir in Alternatives 4 and 5 would be less suitable for recreation because of large fluctuations in water levels.

8.4. Aesthetics

8.4.1. Definition and Types of Possible Effects

Aesthetics associated with the aquatic ecosystem consist of the perception of beauty by one or a combination of the senses of sight, hearing, touch, and smell. Aesthetics of aquatic ecosystems apply to the quality of life enjoyed by the general public and property owners. The discharge of dredged or fill material can mar the beauty of natural aquatic ecosystems by degrading water quality, creating distracting disposal sites, inducing inappropriate development, encouraging unplanned and incompatible human access, and by destroying vital elements that contribute to the compositional harmony or unity, visual distinctiveness, or diversity of an area.

The Visual Quality section of WGFP FEIS (Reclamation 2011) discusses the estimated effect to visual resources. The Visual Resources Technical Report (HLA and ERO 2008) provides additional detail on the aesthetic conditions for the WGFP alternatives.

8.4.2. Alternative Effects

The dredge and fill activities associated with reservoir construction for the action alternatives would result in a change in the visual characteristics at each of the reservoir sites as described below for each of the alternatives. A decrease in the flow in the Colorado River and Willow Creek and lower water levels in Granby Reservoir on the West Slope may reduce visual quality. The change in Colorado River streamflow is unlikely to be noticeable since most diversions occur at high flows. Lower water levels in Granby Reservoir would expose additional shoreline and reduce the scenic quality. The Proposed Action alternative would have the greatest impact on scenic quality at Granby Reservoir. Reduced water clarity and algal growth have been issues of concern in Grand Lake and Shadow Mountain Reservoir that may contribute to a diminished aesthetic value. Predicted small reductions in water clarity would continue or slightly increase the potential for a diminished recreation experience under all the alternatives. The increased flow in East Slope streams from the import and return flow of Windy Gap water are unlikely to be perceptible and materially change aesthetic values.

8.4.3. Alternative 1—No Action Alternative

The enlargement of Ralph Price Reservoir would increase the surface area of the lake by about 77 acres. The aesthetic quality of the area would be similar to existing conditions. Visibility of the 50-foot higher dam would be limited because of the remote setting.

8.4.4. Alternative 2—Chimney Hollow Reservoir (Proposed Action)

Chimney Hollow Reservoir would be visible from a few homes on the hogback to the east. The dam face would be visible from lands to the north including Reclamation offices, Flatiron Reservoir, scattered residences, and County Road 18E. A relocated transmission line also would be visible from nearby locations.

8.4.5. Alternative 3—Chimney Hollow Reservoir and Jasper East Reservoir

Views of Chimney Hollow Reservoir would be similar to Alternative 2. The Jasper East Reservoir dams would be visible from surrounding lands to the north, east, and south. The dams would be visible from scattered residential areas and County Road 40. Because of wide fluctuations in water levels, substantial shoreline would be visible frequently.

8.4.6. Alternative 4—Chimney Hollow Reservoir and Rockwell/Mueller Creek Reservoir

Views of Chimney Hollow Reservoir would be similar to Alternative 2. The Rockwell/Mueller Creek Reservoir dams would be visible from surrounding lands including the town of Granby. The dams would be visible from scattered residential and commercial areas and county roads. Portions of the east dam would be visible from residential and commercial developments to the east and Highway 40. Views of the reservoir would be limited to scattered homes at higher elevations. Because of wide fluctuations in water levels, substantial shoreline would be visible frequently.

8.4.7. Alternative 5—Dry Creek Reservoir and Rockwell/Mueller Creek Reservoir

Dry Creek Reservoir would be visible from scattered locations to the west and east and from higher elevations to the south. The dam face would be visible from local roads along Little Thompson Creek

and scattered residences. Views of Rockwell/Mueller Creek Reservoir would be similar to Alternative 4, although the dams would be slightly larger and more visible.

8.5. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves (230.540)

8.5.1. Definition and Types of Possible Effects

These preserves consist of areas designated under federal and state laws or local ordinances to be managed for their aesthetic, educational, historical, recreational, or scientific value. The discharge of dredge or fill material into such areas may modify the aesthetic, educational, historical, recreational and/or scientific qualities thereby reducing or eliminating the uses for which such sites are set aside and managed.

8.5.2. Alternative Effects

There would be no direct effects to Parks, National and Historical Monuments, National Seashores, Wilderness Areas, research sites and similar preserves under any of the alternatives.

9. EVALUATION AND TESTING (SUBPART G)

Excavated earth and rock, as well as some dredge and fill materials, would be used for construction of the Chimney Hollow Reservoir dam under the Proposed Action. Excavated material would be obtained from areas within the project site, and would include soil, gravel, and rock. No hazardous material would be used as fill material in waters or wetlands.

10. ACTIONS TO MINIMIZE ADVERSE EFFECTS AND PRACTICABLE STEPS TO MINIMIZE POTENTIAL ADVERSE IMPACTS (SUBPART H)

The screening criteria described in the alternatives selection process in Chapter 2 were used to initially avoid and minimize the environmental impacts of the proposed project. Comments received on the Draft EIS from the public; federal, state, and local agencies; and cooperating agencies provided additional feedback on mitigation measures that would help reduce identified resource impacts (Volume 2 – Appendix F). Since release of the Draft EIS, Reclamation and the Subdistrict have identified additional mitigation measures that would be implemented to minimize impacts of the Proposed Action. Table C-3 provides a summary of resource impacts and associated mitigation commitments. Additional details on mitigation are included in the *Mitigation* section for each of the resources in Chapter 3 of the FEIS. The FWMP prepared by the Subdistrict in cooperation with the CDPW and adopted by the Colorado Wildlife Commission (CWC) on June 9, 2011 and by the CWCB on July 13, 2011 in accordance with CRS § 37-60-122.2 is found in Appendix E. Reclamation expects notification from the Colorado Department of Natural Resources that the FWMP has been incorporated into and made a part of the FEIS as Appendix E and is the position of the State of Colorado on mitigation necessary for fish and wildlife impacts from the WGFP. The FWMP identified the minimum commitments to mitigate fish and wildlife impacts of the WGFP.

Reclamation will incorporate final mitigation measures into the Record of Decision. The Corps may require additional mitigation measures as part of their evaluation for compliance with Section 404 Clean Water Act requirements.

Table C-3. Preliminary 404(b)(1) guidelines mitigation for the Proposed Action.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5. POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM (SUBPART C)			
5.1. Substrate (230.20) (FEIS Mitigation Table 7a, Wetlands and Adjacent Riparian Habitats)	Temporary disturbance of about 0.2 acre of wetlands during Chimney Hollow Reservoir construction.	The Corps will require mitigation for temporary impacts to wetlands.	Temporarily disturbed wetlands would be restored following construction.
5.1. Substrate (230.20) (FEIS Mitigation Table 7b, Wetlands and Adjacent Riparian Habitats)	Permanent impact to about 2 acres of wetlands at Chimney Hollow Reservoir.	The Corps will require mitigation for permanent losses of wetlands. The Subdistrict proposes that wetlands would be mitigated by contribution to an approved wetland mitigation bank. Habitat enhancement at Chimney Hollow Reservoir as identified in the FWMP may include wetland and riparian habitat creation on the lake shoreline. Any wetland creation work would need to be evaluated by Reclamation and the Corps.	Under modified prepositioning, as described for 1c, there would be greater water level fluctuations and lower water levels in Chimney Hollow Reservoir; thus, establishment of shoreline wetlands may be difficult.
5.1 Substrate (230.20) (FEIS Mitigation Table 7c, Wetlands and Adjacent Riparian Habitats)	Permanent impact to about 0.5 acre of waters of the U.S. along Chimney Hollow.	The Corps will require mitigation for permanent impacts to waters of the U.S.	Creation of large open water reservoir.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.1 Substrate (230.20) (FEIS Mitigation Table 7d, Wetlands and Adjacent Riparian Habitats)	Effects on wetlands adjacent to the Colorado River and downstream of the Windy Gap diversion.	The Corps will require mitigation for loss of wetland functions related to this impact. A separate wetlands mitigation plan would be developed by the Subdistrict to mitigate the permanent and temporary effects of the WGFP on wetlands adjacent to the Colorado River. This plan must be approved by the Corps and implemented by the Subdistrict so that all wetland effects are mitigated prior to the completion of construction.	Expected effects to Colorado River wetlands are predicted to be minor and not measurable because of small changes in stream stage and continued flows sufficient for channel maintenance. Additional flushing flows, as noted for 3a, would help maintain wetland vegetation. While not a component of the mitigation plan, the Subdistrict's FWEP includes funding for habitat restoration below Windy Gap Reservoir that may benefit wetland vegetation.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.2 Suspended Particulates/Turbidity (230.21) (FEIS Mitigation Table 3a, Stream Morphology and Floodplain)	Decrease frequency of 2-year peak discharge and in-channel maintenance flows in the Colorado River.	Mitigation requirements will be considered by the Corps. Effects to fisheries from reduced flows are addressed in the FWMP developed by the Subdistrict and the CDPW and adopted by the CWC in accordance with the requirements of CRS § 37-60-122.2.	Mitigation from the original Windy Gap Project would continue (flushing flow of 450 cfs below Windy Gap Reservoir for 50 hours from April 1 to June 30 every 3 years). In addition, the FWMP includes increasing flushing flows to 600 cfs, if such flows have not occurred for at least 50 consecutive hours in the previous 2 years and Subdistrict storage in Granby Reservoir and Chimney Hollow exceeds 60,000 AF on April 1. The frequency of higher volume flows would remain sufficient for maintaining channel morphology. The capacity of the Colorado River would exceed that needed to convey the sediment load.
5.2 Suspended Particulates/Turbidity (230.21) (FEIS Mitigation Table 3b, Stream Morphology and Floodplain)	Small decrease in frequency of 2-year peak discharge and in-channel maintenance flows in Willow Creek.	Mitigation requirements will be considered by the Corps.	Minor impact.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.2 Suspended Particulates/Turbidity (230.21) (FEIS Mitigation Table 3c, Stream Morphology and Floodplain)	Potential for flooding along the Colorado River and Willow Creek would decrease.	Mitigation requirements will be considered by the Corps.	
5.2 Suspended Particulates/Turbidity (230.21) (FEIS Mitigation Table 3d, Stream Morphology and Floodplain)	Increased flows on East Slope streams below WWTPs could have slight effects on channel morphology.	Mitigation requirements will be considered by the Corps.	Minor impact.
5.2 Suspended Particulates/Turbidity (230.21) (FEIS Mitigation Table 3e, Stream Morphology and Floodplain)	Flows in East Slope streams would increase slightly.	Mitigation requirements will be considered by the Corps.	Minor impact.
5.3. Water (230.22) (FEIS Mitigation Table 2a, Groundwater)	Small changes in Colorado River, Willow Creek, and East Slope stream stage that would not significantly impact alluvial ground water levels.	Mitigation requirements will be considered by the Corps.	Minor impact.
5.3. Water (230.22) (FEIS Mitigation Table 2b, Groundwater)	Small changes in surface water quality in West and East Slope streams and reservoirs would have minor effects on ground water quality.	Mitigation requirements will be considered by the Corps.	Minor impact.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.3. Water (230.22) (FEIS Mitigation Table 4a, Surface Water Quality)	Colorado River temperature between Windy Gap Reservoir and Williams Fork may exceed 18.2°C chronic maximum weekly average temperature (MWAT) or 23.8°C daily maximum (DM) state standard as a result of WGFP diversions that lower flows in the Colorado River. Impacts are most likely in the occasional years when WGFP diversions occur after July 15.	Mitigation requirements will be considered by the Corps. Effects of the WGFP on temperature in the Colorado River are addressed in the FWMP developed with the CDPW in accordance with CRS § 37-60-122.2. Temperature mitigation measures include, among other things, installation of real-time temperature monitoring stations at two locations on the Colorado River below Windy Gap and curtailment of diversions in accordance with the requirements of Section 5.3.3 of the FWMP. In addition, the Subdistrict would use the Windy Gap Project Bypass Valve and Auxiliary Outlet to the maximum extent practicable to release colder water without causing adverse effects to the Windy Gap Project facilities or operations for the bypass of water that is otherwise bypassed from the Windy Gap Project. Other temperature mitigation measures are detailed in Section 5.3.3 of the FWMP. These requirements would be documented in the contract negotiations or in a separate operating or working agreement between Reclamation and the Subdistrict.	Details of temperature mitigation are found in the FWMP (FEIS Appendix E).
5.3. Water (230.22) (FEIS Mitigation Table 4b, Surface Water Quality)	Additional WGFP pumping would increase nutrient (nitrogen and phosphorus) loading in Granby Reservoir, Shadow Mountain Reservoir, and Grand Lake, resulting in increased chlorophyll *a* and manganese (Mn) concentrations and a decrease in DO.	The Subdistrict would develop a proposed nutrient reduction mitigation plan for Reclamation and Corps evaluation. Currently, the Subdistrict's plan includes point source nutrient reductions from WWTP discharges in the Fraser River basin and nonpoint source nutrient reductions from agricultural land in the Willow Creek and Stillwater Creek watershed. Other nutrient reduction measures would be implemented by the Subdistrict as necessary to meet the requirement to provide a documented nutrient reduction credit factor of 1:1 to satisfy Reclamation and Corps mitigation requirements.	Nutrient loading to the Three Lakes system from additional Windy Gap pumping would be offset by nutrient reductions that could occur in the Willow Creek, Fraser River, and Colorado River watersheds above Windy Gap. Nutrient reductions would result in a year-round improvement to water quality in streams where nutrient reduction measures are implemented.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.3. Water (230.22) (FEIS Mitigation Table 4c, Surface Water Quality)	Colorado River DO would decrease below Windy Gap Reservoir. DO concentrations are predicted to remain above the 6.0 mg/L standard. DO could fall below the fish spawning standard of 7.0 mg/L between Windy Gap Reservoir and Williams Fork at low flows; however, reduced DO below the spawning occurring as a result of the WGFP is most likely to occur during the summer months outside of the spring and fall spawning seasons.	Mitigation for temperature (4a) and aquatic resource effects should improve and maintain DO levels above the state standard. Any plan to monitor and mitigate DO changes would be evaluated by the Corps. If DO concentrations fall below the standards and result in water quality standard violations that are attributable to Windy Gap Project pumping, Reclamation, the Corps, and the Subdistrict will discuss the violations and, if necessary, identify and implement additional mitigation measures to address the DO violations.	
5.3. Water (230.22) (FEIS Mitigation Table 4d, Surface Water Quality)	Higher concentration of nutrients in the Colorado River below Windy Gap Reservoir as a result of WGFP pumping that reduces dilution flows.	Mitigation requirements will be considered by the Corps.	Nutrient mitigation described in 5.3 (FEIS Mitigation Table 4b) in the watershed upstream of the Windy Gap diversion would improve Fraser River and Colorado River water quality year-round.
5.3. Water (230.22) (FEIS Mitigation Table 4e, Surface Water Quality)	Slight increase in nutrient and metal concentrations in Willow Creek.	Mitigation requirements will be considered by the Corps.	Nutrient mitigation described in 5.3 (FEIS Mitigation Table 4b) in the Willow Creek watershed would reduce nutrient loading to the creek. The nutrient mitigation plan required must be reviewed and approved by Reclamation and the Corps.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.3. Water (230.22) (FEIS Mitigation Table 4f, Surface Water Quality)	Increased ammonia concentrations in St. Vrain Creek, Big Dry Creek, and Coal Creek as a result of increased discharges from Participant WWTPs.	Mitigation requirements will be considered by the Corps.	WGFP Participants would take appropriate actions, if needed, to meet ammonia discharge limitations in accordance with Colorado water quality standards and as part of their NPDES Permit for WWTP discharges.
5.3. Water (230.22) (FEIS Mitigation Table 4g, Surface Water Quality)	Nutrient increases (TP, TN) resulting in higher chlorophyll *a* concentrations and a decrease in DO in Carter Lake and Horsetooth Reservoir.	Mitigation requirements will be considered by the Corps. In accordance with 4b above, plans to monitor and mitigate nutrient increases in the Three Lakes system should address this issue and the plans must be approved by Reclamation and the Corps.	Measures described in 5.3 (FEIS Mitigation Table 4b) would reduce nutrient loading to waters that would be moved from the West Slope to the East Slope. Any DO issues in Carter Lake or Horsetooth Reservoir would not be exacerbated as a result of the WGFP.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.4. Current Patterns and Water Circulation (230.23) (FEIS Mitigation Table 1a, Surface Water Hydrology)	Reduced spills from Granby Reservoir to the Colorado River as a result of fewer Windy Gap spills.	Mitigation requirements will be considered by the Corps.	Existing Reclamation minimum flow releases below Granby Reservoir would be maintained. The hydrologic model overestimated the frequency of Granby Reservoir spills under existing conditions because the model does not have forecasting capabilities. Thus, actual changes in spill frequency between existing conditions and the Proposed Action are anticipated to be less than the hydrologic model indicates.
5.4. Current Patterns and Water Circulation (230.23) (FEIS Mitigation Table 1b, Surface Water Hydrology)	Reduced flows in Colorado River below Windy Gap diversion.	Mitigation requirements will be considered by the Corps. To assure that water diverted from the Colorado River is used as efficiently as possible; all Participants in the WGFP would be required to have water conservation plans in accordance with the requirements of CRS 37-60-126 prior to the initial delivery of any water after construction of the WGFP. Reduced flows, as they affect temperatures in the Colorado River downstream of Windy Gap, are addressed in the FWMP developed with the CDPW and adopted by the CWC in accordance with the requirements of CRS § 37-60-122.2. See also Sections 5.2 (FEIS Mitigation Table 3a) and 5.3 (FEIS Mitigation Table 4a-d).	Current minimum bypass flows below Windy Gap Reservoir would continue per existing agreements except as modified by the FWMP.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
5.4. Current Patterns and Water Circulation (230.23) (FEIS Mitigation Table 1c, Surface Water Hydrology)	Lower water levels in Granby Reservoir as a result of prepositioning.	Mitigation requirements will be considered by the Corps. In any year when Granby Reservoir is projected to fall below an elevation of 8,250 feet, modified prepositioning, which reduces the delivery of C-BT water from Granby Reservoir to Chimney Hollow Reservoir, would be implemented to maintain higher water levels in Granby Reservoir. Details of this measure would be developed by the Subdistrict and incorporated into a proposed agreement between Reclamation and the Subdistrict with a review and concurrence by the Corps. The objective is to minimize the adverse effects of prepositioning on water levels in Granby Reservoir.	This measure would minimize any potential negative effects on aquatic resources and recreation in Granby Reservoir that may be caused by reduced water levels from prepositioning.
5.4. Current Patterns and Water Circulation (230.23) (FEIS Mitigation Table 1d, Surface Water Hydrology)	Lower water levels in Carter Lake (~1 foot).	Mitigation requirements will be considered by the Corps.	Modified prepositioning as discussed in 5.4 (FEIS Mitigation Table 1c) above would result in less change in Carter Lake water levels (<1 foot lower) and, thus, only minor impacts.
5.4. Current Patterns and Water Circulation (230.23) (FEIS Mitigation Table 1e, Surface Water Hydrology)	Lower water levels in Horsetooth Reservoir (6 feet lower on average).	Mitigation requirements will be considered by the Corps. Note that modified prepositioning would result in less change in water levels (<2 feet lower).	Modified prepositioning as discussed in 5.4 (FEIS Mitigation Table 1c) above would result in less change in Horsetooth Reservoir water levels (<2 feet lower) and, thus, only minor impacts.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
6. POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM (SUBPART D)			
6.1 Threatened and Endangered Species (230.30) (FEIS Mitigation Table 9a, Threatened and Endangered Species)	No impact at Chimney Hollow.	None.	
6.1 Threatened and Endangered Species (230.30) (FEIS Mitigation Table 9b, Threatened and Endangered Species)	Depletion to Colorado River impacts T&E fish.	Mitigation requirements will be considered by the Corps. Section 7 consultation and compliance consistent with the requirements of the Programmatic Biological Opinion (PBO). The Service issued a Biological Opinion on February 12, 2010 for the Preferred Alternative indicating WGFP coverage under the PBO with participation in the Upper Colorado River Recovery Program and payment of depletion fee for additional depletions attributable to the WGFP. Documentation of Section 7 consultation will be submitted to the Corps in order to meet requirements for the Fish and Wildlife Coordination Act.	

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
6.2 Fish, Crustaceans, Mollusks, and Other Aquatic Organisms in the Food Web(230.31) (FEIS Mitigation Table 5a, Aquatic Resources)	Decrease in the amount and frequency of available fish habitat in the Colorado River and an increase in stream temperature.	Mitigation requirements will be considered by the Corps. The Subdistrict will provide mitigation in accordance with the *Fish and Wildlife Mitigation Plan* developed with CDPW in accordance with CRS 37-60-122.2. Measures identified in 5.3 (FEIS Mitigation Table 4a) above will address the effects of temperature increases on aquatic resources.	Bypass flows required at Granby Reservoir and Windy Gap Reservoir by existing agreements would continue and as noted in 3a, the Subdistrict would increase flushing flows under defined conditions. The Subdistrict's FWEP approved by the Wildlife Commission includes a component for stream restoration of the Colorado River below Windy Gap. While these measures are outside of proposed mitigation for the WGFP, they would improve existing aquatic habitat.
6.2 Fish, Crustaceans, Mollusks, and Other Aquatic Organisms in the Food Web(230.31) (FEIS Mitigation Table 5b, Aquatic Resources)	Decrease in the amount and frequency of available fish habitat in Willow Creek.	Mitigation requirements will be considered by the Corps.	Projected changes in aquatic habitat and slightly cooler water temperatures are not predicted to impact existing aquatic populations.
6.2 Fish, Crustaceans, Mollusks, and Other Aquatic Organisms in the Food Web(230.31) (FEIS Mitigation Table 5c, Aquatic Resources)	Lower water levels in Granby Reservoir would slightly reduce available fish habitat.	Mitigation requirements will be considered by the Corps. Modified prepositioning (1c), per the FWMP developed in accordance with CRS § 37-60-122.2, would reduce drawdowns and the loss of habitat in Granby Reservoir.	

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
6.2 Fish, Crustaceans, Mollusks, and Other Aquatic Organisms in the Food Web(230.31) (FEIS Mitigation Table 5d, Aquatic Resources)	Lower water levels in Carter Lake and Horsetooth Reservoir would slightly reduce available fish habitat.	Mitigation requirements will be considered by the Corps. Only a small decrease in Carter Lake and Horsetooth Reservoir water levels and fish habitat would occur with modified prepositioning as discussed for 5.4 (FEIS Mitigation Table 1c).	
6.3 Other Wildlife (230.32) (FEIS Mitigation Table 8a, Wildlife)	Loss of 810 acres of elk winter range, mule deer winter range and concentration area, and black bear foraging area at Chimney Hollow.	Mitigation requirements will be considered by the Corps. The FWMP developed and adopted in accordance with CRS § 37-60-122.2 includes habitat improvements and management measures that compensate for the loss of habitat. The mitigation plan developed in accordance with CRS 37-60-122.2 will be submitted to the Fish and Wildlife Service to meet the requirements of the Fish and Wildlife Coordination Act.	A FWMP was prepared by the Subdistrict in cooperation with the CDPW and adopted in accordance with CRS § 37-60-122.2. Larimer County, Subdistrict, and CDPW would coordinate details of wildlife management in concert with the Chimney Hollow recreation plan.
6.3 Other Wildlife (230.32) (FEIS Mitigation Table 8b, Wildlife)	General loss of habitat for other terrestrial species, birds, amphibians, reptiles, and butterflies at Chimney Hollow.	Mitigation requirements will be considered by the Corps. The FWMP developed in accordance with CRS § 37-60-122.2 includes habitat enhancement and other management actions to protect and improve wildlife habitat at Chimney Hollow Reservoir. Vegetation clearing would be conducted outside of the nesting season of protected bird species or the area would be surveyed prior to disturbance. A buffer would be maintained around active golden eagle nests during the breeding season. The mitigation plan developed in accordance with CRS 37-60-122.2 will be submitted to the Fish and Wildlife Service to meet requirements for the Fish and Wildlife Coordination Act.	

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
6.3 Other Wildlife (230.32) (FEIS Mitigation Table 8c, Wildlife)	Loss of 7 acres of bald eagle winter range at Chimney Hollow.	Mitigation requirements will be considered by the Corps.	This effect is minor as there is sufficient bald eagle wintering habitat in the area. A new reservoir would provide open water foraging habitat for bald eagles.
7. POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES (SUBPART E)			
7.2 Wetlands (230.20) (FEIS Mitigation Table 7a, Wetlands and Adjacent Riparian Habitats)	Temporary disturbance of about 0.2 acre of wetlands during Chimney Hollow Reservoir construction.	The Corps will require mitigation for temporary impacts to wetlands.	
7.2 Wetlands (230.20) (FEIS Mitigation Table 7b, Wetlands and Adjacent Riparian Habitats)	Permanent impact to about 2 acres of wetlands at Chimney Hollow Reservoir.	The Corps will require mitigation for permanent losses of wetlands. Wetlands would be mitigated by contribution to an approved wetland mitigation bank. Habitat enhancement at Chimney Hollow Reservoir as identified in the FWMP may include wetland and riparian habitat creation on the lake shoreline. Any wetland creation work would need to be evaluated by Reclamation and the Corps.	Under modified prepositioning, as described for 1c, there would be greater water level fluctuations and lower water levels in Chimney Hollow Reservoir; thus, establishment of shoreline wetlands may be difficult.
7.2 Wetlands (230.20) (FEIS Mitigation Table 7c, Wetlands and Adjacent Riparian Habitats)	Permanent impact to about 0.5 acre of waters of the U.S. along Chimney Hollow.	The Corps will require mitigation for permanent losses of waters of the U.S.	Creation of large open water reservoir.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
7.2 Wetlands (230.20) (FEIS Mitigation Table 7d, Wetlands and Adjacent Riparian Habitats)	Effects on wetlands adjacent to the Colorado River and downstream of the Windy Gap diversion.	The Corps will require mitigation for loss of wetland functions related to this impact. A separate wetlands mitigation plan would be developed by the Subdistrict to mitigate the permanent and temporary effects of the WGFP on wetlands adjacent to the Colorado River. This plan must be approved by the Corps and implemented by the Subdistrict so that all wetland effects are mitigated prior to the completion of construction.	Expected effects to Colorado River wetlands are predicted to be minor and not measurable because of small changes in stream stage and continued flows sufficient for channel maintenance. Additional flushing flows, as noted for 3a, would help maintain wetland vegetation. While not a component of the mitigation plan, the Subdistrict's FWEP includes funding for habitat restoration below Windy Gap Reservoir that may benefit wetland vegetation.
8. POTENTIAL IMPACTS ON HUMAN USE CHARACTERISTICS (SUBPART F)			
8.3 Water-Related Recreation (230.52) (FEIS Mitigation Table 14a, Recreation)	Reduction in preferred kayaking flow days in Byers Canyon.	Mitigation requirements will be considered by the Corps.	In 29 of 47 years in the period of record, there would be no change. In other years, there would be a slight decrease in the average number of days per year with preferred kayaking flows.

Appendix C Section	Resource Impacts	Mitigation/Environmental Commitments	Notes
8.3 Water-Related Recreation (230.52) (FEIS Mitigation Table 14b, Recreation)	Preferred rafting and kayaking flows in Big Gore and Pumphouse would decrease.	Mitigation requirements will be considered by the Corps. WGFP diversions would be suspended during the Gore Race in August if flows drop below the preferred range (1,250 cfs).	The number of days within the preferred boating flow range would both decrease and increase by less than 3 days per year, on average as a result of the WGFP. Curtailment of WGFP for temperature mitigation per 4a above may periodically increase summer flows.
8.3 Water-Related Recreation (230.52) (FEIS Mitigation Table 14c, Recreation)	Access to Granby Reservoir boat ramps at Arapaho Bay, Stillwater, and Sunset could diminish in some months.	Mitigation requirements will be considered by the Corps. Modified prepositioning discussed in 5.4 (FEIS Mitigation Table 1c) would maintain higher water levels in Granby Reservoir during years when the reservoir is anticipated to fall below an elevation of 8,250 feet, thereby improving boat ramp access.	All boat ramps are expected to remain accessible throughout the recreation season with mitigation.
8.3 Water-Related Recreation (230.52) FEIS (Mitigation Table 14d, Recreation)	Access to the South Bay-South boat ramp in Horsetooth could be impacted.	Mitigation requirements will be considered by the Corps. Modified prepositioning would maintain higher water levels in Horsetooth Reservoir. Boat ramp access would not change with mitigation.	
8.3 Water-Related Recreation (230.52) (FEIS Mitigation Table 14e, Recreation)	Effects on recreational fishing in the Colorado River downstream of the Windy Gap diversion from habitat loss and temperature impacts between Windy Gap and the Blue River.	Mitigation requirements will be considered by the Corps. Stream temperature mitigation measures in the FWMP developed in accordance with CRS § 37-60-122.2 would reduce impacts to fish. Mitigation proposed under aquatic resources and the mitigation plan developed in accordance with CRS § 37-60-122.2 should improve fishing in the Colorado River downstream of Windy Gap.	The Subdistrict's FWEP includes funding for habitat restoration below Windy Gap Reservoir that would benefit aquatic habitat between Windy Gap and the Kemp Breeze State Wildlife Area.

10.1. Actions Concerning the Location of Discharge (230.70)

An extensive alternatives analysis was conducted, consisting of a coarse screening of 171 possible project elements to find an alternative that would minimize effects to wetlands and waters. Level 1 screening criteria eliminated reservoir sites that would impact more than 25 acres of wetlands, fens, or that would directly impact perennial streams (except for enlargement of existing reservoirs on a perennial stream). Three successive levels of screening using additional environmental analysis were used to preliminarily determine the LEDPA.

10.2. Actions Controlling the Material to be Discharged, the Material after Discharge, and the Method of Dispersion and Related Technology (230.71, 230.72, 230.73, and 230.74)

No material that contains hazardous materials will be discharged into a water of the U.S. Best Management Practices (BMPs) will be used to control the material after discharge. Temporary and permanent erosion-control devices will be used during construction of reservoir, road, pipeline, and attendant features, and during canal reconstruction to control discharges and methods of discharges into waters of the U.S.

10.3. Actions Affecting Plant and Animal Populations (230.75)

BMPs would be followed during all phases of WGFP construction. Temporary and permanent erosion control would take place, and would include efforts such as sediment control and revegetation. Weed control and weed management would take place during all phases of construction as well.

Preconstruction clearances will be performed to limit impacts to migratory birds in areas of potential habitat for these species, and construction would be timed so that active nests are not affected.

10.4. Actions Affecting Human Use (230.76)

The discharge site for construction of reservoirs under any of the action alternatives would be located on intermittent and ephemeral streams to avoid direct impacts to important aquatic areas. There is no on-going recreation at any of the action alternative reservoir sites that would be impacted by reservoir construction. Enlargement of Ralph Price Reservoir under the No Action Alternative would temporarily suspended recreation activities at the Button Rock Preserve for several years during dam construction. No discharge would occur near any public water supply intake.

Construction of Chimney Hollow Reservoir under the Proposed Action and Alternatives 2, and 4 would have no impact residential property or existing land uses. Construction of Jasper East Reservoir would displace existing irrigated agricultural activities and livestock grazing, but would not impact any homes. County Road 40 to Willow Creek Reservoir also would have to be relocated to construct Jasper East Reservoir. Construction of Rockwell/Mueller Creek Reservoir would impact four private residences, livestock grazing, and shifting the alignment of an existing County Road. Dry Creek Reservoir construction would impact three residences and llama breeding operation and would impact state land currently leased for moss rock collection.

10.5. Other Actions (230.77)

Additional discussion on mitigation for impacts to wetlands, vegetation, and other resources is described in the WGFP FEIS (Reclamation 2011) and will be finalized in the ROD.

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Windy Gap Firming Project

Appendix D to FEIS

Biological Opinion

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

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TAILS 65413-2010-F-0033

February 12, 2010

Memorandum

To: Area Manager, Eastern Colorado Area Office, Bureau of Reclamation, Loveland, Colorado

From: Acting Western Colorado Supervisor, Ecological Services, Grand Junction, Colorado

Subject: Windy Gap Firming Project Section 7 Consultation for Colorado River Water Depletions

This responds to your November 17, 2009, request for formal consultation for the subject project under section 7 of the Endangered Species Act (ESA). In accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), the Fish and Wildlife Service (Service) transmits this correspondence to serve as the final biological opinion for Colorado River water depletions associated with the Windy Gap Firming Project (WGFP). This biological opinion only addresses the Colorado River endangered fishes, other species will be addressed separately.

The Municipal Subdistrict, Northern Colorado Water Conservancy District, acting through the Windy Gap Firming Project Water Activity Enterprise (Subdistrict) is proposing to improve the firm yield from the existing Windy Gap Project. The proposed action is to divert additional water from the Colorado River at Windy Gap Reservoir and deliver it through the existing Colorado Big-Thompson Project facilities to a new reservoir east of the continental divide in Larimer County, about 8 miles southwest of Loveland, Colorado. The proposed Chimney Hollow Reservoir would have a capacity of 90,000 acre-feet. This reservoir will provide storage dedicated to the WGFP participants, which will allow additional diversions from the Colorado River to meet participants' needs on the eastern slope.

The original Windy Gap Project was addressed in a March 13, 1981, biological opinion, based on an estimated average annual diversion of 57,300 acre-feet. Since the Windy Gap Project was completed, it has not been able to divert the anticipated amount of water due to junior water rights and inadequate storage in Granby Reservoir. In 1999, the average annual depletions of the Windy Gap project were determined to be 18,779 acre-feet. The purpose of the WGFP is to firm up the project's yield by providing more storage.

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WGFP

A Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin was initiated on January 22, 1988. The Recovery Program was intended to be the reasonable and prudent alternative for individual projects to avoid the likelihood of jeopardy to the endangered fishes from depletions from the Upper Colorado River Basin. In order to further define and clarify the process in the Recovery Program, a section 7 agreement was implemented on October 15, 1993, by the Recovery Program participants. Incorporated into this agreement is a Recovery Implementation Program Recovery Action Plan (RIPRAP) which identifies actions currently believed to be required to recover the endangered fishes in the most expeditious manner.

On December 20, 1999, the Service issued a final programmatic biological opinion (PBO) for Bureau of Reclamation's Operations and Depletions, Other Depletions, and Funding and Implementation of Recovery Program Actions in the Upper Colorado River above the Confluence with the Gunnison River. The Service has determined that projects that fit under the umbrella of the Colorado River PBO would avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletion impacts. The Colorado River PBO states that in order for actions to fall within the umbrella of the PBO and rely on the RIPRAP to offset its depletion, the following criteria must be met.

1. A Recovery Agreement must be offered and signed prior to conclusion of section 7 consultation.

2. A fee to fund recovery actions will be submitted as described in the proposed action for new depletion projects greater than 100 acre-feet(AF)/year. The 2010 fee is $18.99 per acre-foot and is adjusted each year for inflation.

3. Reinitiation stipulations will be included in all individual consultations under the umbrella of this programmatic.

4. The Service and project proponents will request that discretionary Federal control be retained for all consultations under this programmatic.

The original Windy Gap Project fits these criteria because a Recovery Agreement was signed in March of 2000 and the depletions existed when the Recovery Program was initiated. Because it was not a new depletion, no additional fees were submitted for compliance with the PBO. Hydrologic modeling for the PBO determined that the existing average annual depletion caused by the Windy Gap Project between 1981 and 1999 was 18,779 AF. The proposed WGFP would cause an additional average annual depletion of 21,317 AF/year. The average annual water depletion from the Colorado River as a result of the Windy Gap Project, including the additional depletions of the proposed firming project is 40,096 AF/year.

The subject project will cause a new average annual depletion of 21,317 AF of water from the upper Colorado River basin. In order to rely on the Recovery Program to offset the subject depletions, the project sponsors are to make a one-time monetary contribution for water depletions greater than 100 AF to help fund their share of the costs of recovery actions. If the

entire fee is paid at once, the one-time payment is calculated by multiplying the project's average annual new depletion (21,317 AF) by the water users share of Recovery Program costs (the charge) in effect at the time payment is made. For Fiscal Year 2010 (October 1, 2009, to September 30, 2010), the charge is $18.99 per AF for the average annual depletion which equals a total contribution of $404,809.83 for this project's share of the Recovery Program costs. This amount will be adjusted annually for inflation on October 1 of each year based on the Consumer Price Index. If payment is made in Fiscal Year 2010 for 10 percent of the estimated depletions, ten percent of the Fiscal Year 2010 total contribution ($40,480.98), or total payment, will be provided to the Service's designated agent, the National Fish and Wildlife Foundation, at the time of issuance of the Federal approvals from the Bureau of Reclamation. Payment for the remaining 19,185.3 AF of depletions (90 percent) will be due at the time the construction commences at the rate in effect at that time. The payment will be included by the Bureau of Reclamation as a permit stipulation. The funds will be used for acquisition of water rights (or directly-related activities) to meet the instream flow needs of the endangered fishes; or to support other recovery activities for the endangered fishes described in the RIPRAP. All payments should be made to the Foundation.

National Fish and Wildlife Foundation
Attn: Donna McNamara, Finance Department
1133 15th Street, NW, Suite 1100
Washington DC 20005

Each payment is to be accompanied by a cover letter that identifies the project and biological opinion number (ES/GJ-6-CO-99-F-033-CP104) that requires the payment, the amount of payment enclosed, and check number. A copy of the cover letter and a copy of the payment check shall be sent to the Service office issuing this biological opinion. The cover letter also shall identify the name and address of the payor, the name and address of the Federal agency responsible for authorizing the project, and the address of the Service office conducting the section 7 consultation. This information will be used by the Foundation to notify the payor, the lead Federal agency, and the Service that payment has been received. The Foundation is to send notices of receipt to these entities within 5 working days of its receipt of payment.

The Recovery Agreement was signed by the Service and the Subdistrict in March 2000. The Subdistrict agreed to make a one-time contribution to the Recovery Implementation Program to fund recovery actions specified in the Colorado River PBO. Reclamation has agreed to condition its approval documents to retain jurisdiction should section 7 consultation need to be reinitiated. Therefore, the Service concludes that the subject project meets the criteria to rely on the RIPRAP to offset depletion impacts and is not likely to jeopardize the continued existence of the species and is not likely to destroy or adversely modify designated critical habitat.

REINITIATION NOTICE

This concludes formal consultation on the subject action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or

control over the action has been retained (or is authorized by law) and under the following conditions.

a. The amount or extent of take specified in the incidental take statement for the Colorado River PBO is exceeded. The Service has determined that no incidental take, including harm, is anticipated to occur as a result of the depletions contemplated in this opinion because of the implementation of recovery actions. The implementation of the recovery actions contained in the Colorado River PBO will further decrease the likelihood of any take caused by depletion impacts.

b. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in the Colorado River PBO. In preparing the Colorado River PBO, the Service describes the positive and negative effects of the action it anticipates and considered in the section of the opinion entitled "Effects of the Action." New information would include, but is not limited to, not achieving a "positive response" or a significant decline in population, as described in Appendix D of the Colorado River PBO. Significant decline shall mean a decline in excess of normal variations in population (Appendix D). The current population estimate of adult Colorado pikeminnow in the Colorado River is 600 individuals, with a confidence interval of ± 250. Therefore, with the criteria established in Appendix D, a negative population response would trigger reinitiation if the population declined to 350 adults. The Recovery Program has developed recovery goals for the four endangered fishes. If a population meets or exceeds the numeric goal for that species, it will be considered to exhibit a positive response. The Service retains the authority to determine whether a significant decline in population has occurred, but will consult with the Recovery Program's Biology Committee prior to making its determination. In the event of a significant population decline, the Service is to first rely on the Recovery Program to take actions to correct the decline. If nonflow recovery actions have not been implemented, the Service will assess the impacts of not completing these actions prior to reexamining any flow related issues.

New information would also include the lack of a positive population response by the year 2015 or when new depletions reach 50,000 AF/year. According to the criteria outlined in Appendix D of the Colorado River PBO, a positive response would require the adult Colorado pikeminnow population estimate to be 1,100 individuals (±250) in the Colorado River (Rifle, Colorado to the confluence with the Green River). When the population estimate increases above 1,100, a new population baseline is established at the higher population level.

c. The Recovery Action Plan actions listed as part of the proposed action in the Colorado River PBO are not implemented within the required time frames. This would be considered a change in the action subject to consultation; section 7 regulations (50 CFR 402.16 (c)) state that reinitiation of consultation is required if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion. The Recovery Action Plan is an adaptive management plan because additional information, changing priorities, and the development of the States' entitlement may require modification of the Recovery Action Plan. Therefore, the Recovery Action Plan is reviewed annually and updated and changed when necessary and the required time frames include changes in timing approved by means of the normal procedures of the Recovery

Program, as explained in the description of the proposed action. In 2003 and every 2 years thereafter, for the life of the Recovery Program, the Service and Recovery Program will review implementation of the Recovery Action Plan actions to determine timely compliance with applicable schedules.

d. The Service lists new species or designates new or additional critical habitat, where the level or pattern of depletions covered under the Colorado River PBO may have an adverse impact on the newly listed species or habitat. If the species or habitat may be adversely affected by depletions, the Service will reinitiate consultation on the Colorado River PBO as required by its section 7 regulations. The Service will first determine whether the Recovery Program can avoid such impact or can be amended to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for such depletion impacts. If the Recovery Program can avoid the likelihood of jeopardy and/or adverse modification of critical habitat no additional recovery actions for individual projects would be required, if the avoidance actions are already included in the Recovery Action Plan. If the Recovery Program is not likely to avoid the likelihood of jeopardy and/or adverse modification of critical habitat then the Service will reinitiate consultation and develop reasonable and prudent alternatives.

For purposes of any future reinitiation of consultation, depletions have been divided into two categories.

Category 1:

a) existing depletions, both Federal and non-Federal as described in the project description, from the Upper Colorado River Basin above the confluence with the Gunnison River that had actually occurred on or before September 30, 1995 (average annual depletion of approximately 1 million AF/year);

b) depletions associated with the total 154,645 AF/year volume of Green Mountain Reservoir, including power pool (which includes but is not limited to all of the 20,000 AF contract pool and historic user's pool), the Colorado Big-Thompson replacement pool; and

c) depletions associated with Ruedi Reservoir including Round I sales of 7,850 AF, Round II sales of 6,135 AF/year as discussed in the Service's biological opinion to Reclamation dated May 26, 1995, and as amended on January 6, 1999, and the Fryingpan Arkansas Project replacement pool as governed by the operating principles for Ruedi Reservoir but excluding 21,650 AF of the marketable yield.

Category 1 depletions shall remain as Category 1 depletions regardless of any subsequent change, exchange, or abandonment of the water rights resulting in such depletions. Category 1 depletions associated with existing facilities may be transferred to other facilities and remain in Category 1 so long as there is no increase in the amount of total depletions attributable to existing depletions. However, section 7 consultation is still required for Category 1 depletion projects when a new Federal action occurs which may affect

endangered species except as provided by the criteria established for individual consultation under the umbrella of the Colorado River PBO. Reinitiation of this consultation will be required if the water users fail to provide 10,825 AF/year on a permanent basis.

Category 2:

Category 2 is defined as all new depletions up to 120,000 AF/year, this includes all depletions not included in Category 1 that occur after 1995 regardless of whether section 7 consultation has been completed. This category is further divided into two 60,000 AF/year blocks of depletions.

The recovery actions are intended to avoid the likelihood of jeopardy and/or adverse modification of critical habitat and to result in a positive response as described in Appendix D of the Colorado River PBO for both 60,000 AF blocks of depletions in Category 2. However, prior to depletions occurring in the second block, the Service will review the Recovery Program's progress and adequacy of the species response to the Recovery Action Plan actions. According to the criteria outlined in Appendix D, a positive response would require the adult Colorado pikeminnow population estimate to be maintained at approximately 1,100 individuals in the Colorado River (Rifle, Colorado to the confluence with the Green River), unless the criteria in Appendix D is changed because of new information. If the adult Colorado pikeminnow population is maintained at approximately 1,100 adults or whatever is determined to be the recovery goal in the Colorado River, a new population baseline would be established to determine a positive or negative population response.

When population estimates for wild adult humpback chub are finalized, they will also be used to determine population response. As outlined in Appendix D, Colorado pikeminnow and humpback chub population estimates will serve as surrogates for razorback sucker and bonytail to assess the status of their populations for 10 years. Recovery goals for all four species were completed August 1, 2002. If a population meets or exceeds the numeric goal for that species, it will be considered to exhibit a positive response. However, short of reaching a specific recovery goal, trends in certain population indices provide an interim assessment of a species' progress toward recovery. This review will begin when actual depletion levels from the first depletion block reach 50,000 AF/year or the year 2015, whichever comes first.

Calculation of actual depletions is to be accomplished using Cameo gage records and State Division of Water Resources data (Appendix B of the Colorado River PBO). The review will include a determination if all the recovery actions have been satisfactorily completed, that all ongoing recovery actions are continuing, and the status of the endangered fish species. If it is determined that the recovery actions have all been completed and the status of all four endangered fish species has improved (based on criteria in Appendix D), then the Service intends that the Colorado River PBO would remain in effect for new depletions up to 120,000 AF/year (total of both 60,000 AF blocks of Category 2 depletions).

Monitoring, as explained in Appendix D, will be ongoing to determine if a population estimate of 1,100 (± one confidence interval) adult Colorado pikeminnow is maintained. If it is not

maintained, this would be considered new information and section 7 would have to be reinitiated. Population baselines will be adjusted as population estimates change. If the adult Colorado pikeminnow population estimates increase, a new population baseline will be established to determine a positive or negative population response. If the population estimate for Colorado pikeminnow in the year 2015 is greater than 1,100 adults, then the higher number will be used to establish a new population baseline. These numeric values may be revised as new information becomes available. Revisions will be made to Appendix D as needed.

If the 50,000 AF or 2015 review indicates that either the recovery actions have not been completed or the status of all four fish species has not sufficiently improved, the Service intends to reinitiate consultation on the Recovery Program to specify additional measures to be taken by the Recovery Program to avoid the likelihood of jeopardy and/or adverse modification of critical habitat for depletions associated with the second 60,000 AF/year block. Any additional measures will be evaluated every 5 years. If other measures are determined by the Service or the Recovery Program to be needed for recovery prior to the review, they can be added to the Recovery Action Plan according to standard procedures, outlined in that plan. If the Recovery Program is unable to complete those actions which the Service has determined to be required for the second 60,000 AF/year, consultation on projects with a Federal nexus may be reinitiated in accordance with ESA regulations and this opinion's reinitiation requirements. The Service may also reinitiate consultation on the Recovery Program if fish populations do not improve according to the criteria in Appendix D or if any positive response achieved prior to the 50,000 AF or the year 2015 is not maintained. Once a positive response is achieved, failure to maintain it will be considered a negative response.

If the Service reinitiates consultation, it will first provide information on the status of the species and recommendations for improving population numbers to the Recovery Program. The Service will reinitiate consultation with individual projects only if the Recovery Program does not implement recovery actions to improve the status of the listed fish species. The Service will reinitiate consultation first on Category 2 projects and second on Category 1 projects. The Service will only reinitiate consultations on Category 1 depletions if Category 2 depletion impacts are offset to the full extent of the capability of the covered projects as determined by the Service, and the likelihood of jeopardy to the listed fishes and/or adverse modification of critical habitat still cannot be avoided. The Service intends to reinitiate consultations simultaneously on all depletions within the applicable category.

If new information becomes available, if a new species becomes listed, if incidental take occurs, if the total average annual amount of water depleted by this project changes, or if any other project element changes which alters the operation of the project from that which is described in your correspondence and which may affect any endangered or threatened species in a manner or to an extent not considered in this biological opinion (see 50 CFR 402.16), formal section 7 consultation should be reinitiated. Reclamation has agreed to condition its approval documents to retain jurisdiction should section 7 consultation need to be reinitiated.

If you have any questions regarding this consultation or would like to discuss it in more detail, please contact me at (970) 243-2778, extension 26.

Sincerely,

Patricia S. Gelatt
Acting Western Colorado Supervisor

Attachment

cc: FWS/UCREFRP, Denver

PGelatt:BRWindyGapFirmingProjectCRBOCP104.doc:021210:KM

RECOVERY AGREEMENT

This RECOVERY AGREEMENT is entered into this 14th day of January, 2000, by and between the United States Fish and Wildlife Service (USFWS) and the Municipal Subdistrict, Northern Colorado Water Conservancy District (Subdistrict).

WHEREAS, in 1988 the Secretary of Interior, the Governors of Wyoming, Colorado, and Utah, and the Administrator of the Western Area Power Administration signed a Cooperative Agreement to implement the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (Recovery Program); and

WHEREAS, the Recovery Program is intended to recover the endangered fish while providing for water development in the Upper Basin to proceed in compliance with state law, interstate compacts, and the Endangered Species Act; and

WHEREAS, the Colorado Water Congress has passed a resolution supporting the Recovery Program; and

WHEREAS, on December 2, 1999, USFWS issued a Programmatic Biological Opinion (1999 Opinion) concluding that implementation of specified elements of the Recovery Action Plan (Recovery Elements), along with existing and a specified amount of new depletions, are not likely to jeopardize the continued existence of the endangered fish or adversely modify their critical habitat in the Colorado River subbasin within Colorado, exclusive of the Gunnison River subbasin; and

WHEREAS, the 1999 Opinion in the section entitled "Reinitiation Notice" divided depletions into Category 1 or Category 2 for reinitiation purposes; and

WHEREAS, Subdistrict is the owner of the Windy Gap Project (Water Project), which causes or will cause depletions to the Colorado River subbasin within Colorado, exclusive of the Gunnison River subbasin; and

WHEREAS, Subdistrict desires certainty that its depletions can occur consistent with Section 7 and Section 9 of the Endangered Species Act (ESA); and

WHEREAS, USFWS desires a commitment from Subdistrict to the Recovery Program so that the program can actually be implemented to recover the endangered fish and to carry out the Recovery Elements.

NOW, THEREFORE, Subdistrict and USFWS agree as follows[1]

---

[1] Individual Recovery Agreement may be changed to fit specific circumstances.

1. USFWS agrees that implementation of the Recovery Elements specified in the 1999 Opinion will avoid the likelihood of jeopardy and adverse modification under Section 7 of the ESA for depletion impacts caused by Subdistrict's Water Project. Any consultations under Section 7 regarding Water Project's depletions are to be governed by the provisions of the 1999 Opinion.

   USFWS agrees that, except as provided in the 1999 Opinion, no other measures or action shall be required or imposed on Water Project to comply with Section 7 or Section 9 of the ESA with regard to Water Project's depletion impacts or other impacts covered by the 1999 Opinion. Subdistrict is entitled to rely on this Agreement in making the commitment described in paragraph 2.

2. Subdistrict agrees not to take any action which would probably prevent the implementation of the Recovery Elements. To the extent implementing the Recovery Elements requires active cooperation by Subdistrict, Subdistrict agrees to take reasonable actions required to implement those Recovery Elements. Subdistrict will not be required to take any action that would violate its decrees or the statutory authorization for Water Project, or any applicable limits on Subdistrict's legal authority. Subdistrict will not be precluded from undertaking good faith negotiations over terms and conditions applicable to implementation of the Recovery Elements.

3. If USFWS believes that Subdistrict has violated paragraph 2 of this Recovery Agreement, USFWS shall notify both Subdistrict and the Management Committee of the Recovery Program. Subdistrict and the Management Committee shall have a reasonable opportunity to comment to USFWS regarding the existence of a violation and to recommend remedies, if appropriate. USFWS will consider the comments of Subdistrict and the comments and recommendations of the Management Committee, but retains the authority to determine the existence of a violation. If USFWS reasonably determines that a violation has occurred and will not be remedied by Subdistrict despite an opportunity to do so, the USFWS may request reinitiation of consultation on Water Project without reinitiating other consultations as would otherwise be required by the "Reinitiation Notice" section of the 1999 Opinion. In that event, the Water Project's depletions would be excluded from the depletions covered by the 1999 Opnion and the protection provided by the Incidental Take Statement.

4. Nothing in this Recovery Agreement shall be deemed to affect the authorized purposes of Subdistrict's Water Project or USFWS' statutory authority.

5. The signing of this Recovery Agreement does not constitute any admission by Subdistrict regarding the application of the ESA to the depletions of Subdistrict's Water Project. The signing of this Recovery Agreement does not constitute any agreement by either party as to whether the flow recommendations for the 15-Mile Reach described in the 1999 Opinion are biologically or hydrologically necessary to recover the endangered fish.

6. This Recovery Agreement shall be in effect until one of the following occurs:

a. USFWS removes the listed species in the Upper Colorado River Basin from the endangered or threatened species list and determines that the Recovery Elements are no longer needed to prevent the species from being relisted under the ESA; or

b. USFWS determines that the Recovery Elements are no longer needed to recover or offset the likelihood of jeopardy to the listed species in the Upper Colorado River Basin; or

c. USFWS declares that the endangered fish in the Upper Colorado River Basin are extinct; or

d. Federal legislation is passed or federal regulatory action is taken that negates the need for [or eliminates] the Recovery Program.

7. Subdistrict may withdraw from this Recovery Agreement upon written notice to USFWS. If Subdistrict withdraws, USFWS may request reinitiation of consultation on Water Project without reinitiating other consultations as would otherwise be required by the "Reinitiation Notice" section of the 1999 Opinion.

General Manager
Municipal Subdistrict, Northern
Colorado Water Conservancy District

JANUARY 14, 2000
Date

Regional Director, Region 6
U.S. Fish and Wildlife Service

March 20, 2000
Date

Windy Gap Firming Project

Appendix E to FEIS

Fish and Wildlife Mitigation Plan

Windy Gap Firming Project

Fish and Wildlife Mitigation Plan

Prepared for:
The Colorado Wildlife Commission
In accordance with CRS 37-60-122.2

Prepared by:
Municipal Subdistrict
Northern Colorado Water Conservancy District

June 9, 2011

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EXECUTIVE SUMMARY

The Municipal Subdistrict of the Northern Colorado Water Conservancy District (Subdistrict), on behalf of 13 East Slope Windy Gap Project participants, is pursuing a project that will improve the reliability of the water supplies and deliveries from the existing Windy Gap Project. The purpose of this Fish and Wildlife Mitigation Plan (FWMP) for the Windy Gap Firming Project (WGFP) is to comply with the requirements of Colorado State law (CRS 37.60.122.2), including the Procedural Rules for the Wildlife Commission (Chapter 16).

The WGFP is also required to comply with the National Environmental Policy Act (NEPA) by preparing a Final Environmental Impact Statement (FEIS) and with Section 404(b) (1) of the Clean Water Act by applying for a "404 Permit." As part of the 404 permit process, a 401 certification from the Colorado Department of Public Health and Environment is required.

The WGFP participants are committed to comply with all mitigation measures required by the FWMP, the FEIS (and associated Record of Decision), the 404 Permit, and the 401 Certification.

The Subdistrict is also submitting a separate Fish and Wildlife Enhancement Plan (Enhancement Plan) in cooperation with Denver Water to enhance fish and wildlife resources over and above the levels existing without the WGFP and Moffat Project.

In addition to the required mitigation measures in the FWMP and enhancements in the Enhancement Plan, the Subdistrict is participating with several East Slope and West Slope water users, numerous state and federal agencies, and West Slope private entities to enhance the flows in the Colorado River in Grand County by managing and coordinating the release of approximately 5,400 AF of water (1/2 of 10825 Water) that will benefit the Upper Colorado River Endangered Fish Recovery Program.

The goal of the Subdistrict and the WGFP participants is to mitigate for environmental impacts of the WGFP through the measures identified in this Fish and Wildlife Mitigation Plan and to improve the aquatic and riparian habitat of the Colorado River in Grand County with measures identified in the separate Enhancement Plan, while at the same time improving the reliability of the Windy Gap Project water supplies.

This FWMP for the WGFP addresses two main impact areas. On the East Slope the proposed action primarily consists of the construction and operation of a new 90,000 AF water storage facility, Chimney Hollow Reservoir. Although there will be no new construction on the West Slope and all future operations of the Windy Gap Project will be within historic water rights limitations, there will be increased diversions of Colorado River water over the actual amounts historically diverted.

The associated impacts to the Colorado River stream and aquatic resources are addressed in this plan.

With respect to the Colorado River below the Windy Gap diversion, both the WGFP and Denver Water's Moffat Collection Project (Moffat Project) diversions can sometimes have cumulative, or combined, impacts to the river. Since the Moffat Project is also seeking approval through the state and federal regulatory processes, both the Subdistrict and Denver Water have agreed to cooperate in a process of simultaneous development of the mitigation and enhancement plans pursuant to CRS 37-60-122.2. The WGFP Enhancement Plan is being provided to the Wildlife Commission concurrently with this FWMP in a separate document.

WINDY GAP FIRMING PROJECT
FISH AND WILDLIFE MITIGATION PLAN

1.0 INTRODUCTION

The Windy Gap Firming Project (WGFP) is a proposed water supply project that would provide more reliable water deliveries to Front Range and West Slope communities and industries. The Municipal Subdistrict, Northern Colorado Water Conservancy District, acting by and through the WGFP Water Activity Enterprise (Subdistrict) is seeking to construct the project on behalf of the 13 WGFP Participants. Project Participants include the City and County of Broomfield; the towns of Erie and Superior; the cities of Evans, Fort Lupton, Greeley, Lafayette, Longmont, Louisville, and Loveland; the Little Thompson Water District; the Central Weld County Water District; and the Platte River Power Authority.

This Fish and Wildlife Mitigation Plan (FWMP) was developed to satisfy the requirements of Colorado Revised Statute (CRS) 37-60-122.2 and outlines the actions that Project Participants will implement to mitigate the impacts that the WGFP may have on fish and wildlife. The FWMP also addresses concerns regarding WGFP impacts that were identified by CDOW staff in a detailed review of the DEIS impacts. The Subdistrict has also prepared a separate Fish and Wildlife Enhancement Plan (Enhancement Plan), pursuant to CRS 37-60-122.2 to address issues raised by Colorado Division of Wildlife and other stakeholders regarding the current condition of the aquatic environment on the Colorado River, which includes proposed enhancement measures to enhance fish and wildlife resources over and above levels existing without the WGFP.

2.0 PROJECT BACKGROUND

2.1 COLORADO-BIG THOMPSON PROJECT

The Colorado-Big Thompson Project was developed by the U.S. Bureau of Reclamation on behalf of the Northern Colorado Water Conservancy District between 1938 and 1957. The project was designed to provide water for agricultural, municipal, and industrial beneficial uses. The C-BT Project provides supplemental water to 33 cities and towns and is used to help irrigate more than 600,000 acres of northeastern Colorado farmland. On average, about 220,000 AF of water is delivered to northeast Colorado.

Twelve reservoirs, 35 miles of tunnels, 95 miles of canals, and 700 miles of power transmission lines comprise the complex C-BT collection, distribution, and power systems. Willow Creek Reservoir, Shadow Mountain Reservoir, Grand Lake, and

Lake Granby on the west of the Continental Divide collect and store C-BT water from the upper Colorado River basin. Water is pumped from Lake Granby into Shadow Mountain Reservoir where it flows by gravity into Grand Lake. From there, the 13.1-mile Adams Tunnel transports the water under the Continental Divide to the East Slope.

Once the water reaches the East Slope, it is used to generate electricity as it descends almost one-half mile through five power plants on its way to Colorado's Front Range. Carter Lake, Horsetooth Reservoir, and Boulder Reservoir store the water. C-BT water is delivered as needed via canals and pipelines to supplement native water supplies in the South Platte River Basin.

2.2 WINDY GAP PROJECT

During the 1960s, the cities of Boulder, Greeley, Longmont, Loveland, Fort Collins, and the Town of Estes Park determined that additional water supplies were needed to meet their projected municipal demands. The Municipal Subdistrict, Northern Colorado Water Conservancy District, consisting of the incorporated areas of the six entities, was formed in 1970 to develop the Windy Gap Project. Prior to project construction, the Platte River Power Authority acquired all of the City of Fort Collins' allotment contracts, as well as one-half of the City of Loveland's and one-half of the Town of Estes Park's contracts. Allotment contracts are used to allocate 480 units of Windy Gap Project water. Each Windy Gap unit represents a yield of up to 100 AF and, similar to C-BT units, can be bought and sold. The Windy Gap unit holders have changed since the original project was completed.

The Windy Gap Project consists of a diversion dam on the Colorado River, a 445-AF reservoir, a pumping plant, and a 6-mile pipeline to Lake Granby. Currently, Windy Gap Project water is stored and conveyed through C-BT Project facilities prior to delivery to Windy Gap Project allottees. Middle Park Water Conservancy District contractees on the West Slope use Windy Gap water to replace out-of-priority diversions by release of water directly from Lake Granby to the Colorado River.

2.2.1 Windy Gap Project Environmental Impact Statement

In April 1981, Reclamation completed the Final EIS on the effects of using C-BT Project facilities for the "storage, carriage and delivery" of Windy Gap Project water. The 1981 Record of Decision (ROD) for the original Windy Gap Project EIS allowed Reclamation to negotiate a contract with the Subdistrict and the NCWCD for the storage, conveyance, and delivery of Windy Gap Project water using facilities of the C-BT Project.

The original EIS determined that about 56,000 AF of water could be diverted annually from the Colorado River and that about 48,000 AF would be available for delivery to East Slope Windy Gap unit holders after subtracting 3,000 AF for MPWCD and allowances for various storage and conveyances losses. Windy Gap diversions are limited to a rate of 600 cfs and occur primarily during the months of

April to July. Total Windy Gap diversions are measured at the Adams Tunnel and are limited to a maximum of 90,000 AF in any one year and a maximum of 650,000 AF during any consecutive 10-year period pursuant to the *Agreement Concerning the Windy Gap Project and Azure Reservoir and Power Project*, dated April 30, 1980 and the Windy Gap water rights.

2.2.2 Mitigation Measures Included in the Original Windy Gap EIS

The 1981 Windy Gap Project EIS and ROD, as well as subsequent agreements, included a variety of mitigation measures to compensate and offset the effects associated with construction of the Windy Gap Project and its water diversions. Operational mitigation measures are still in place and funding and compensatory mitigation measures have been paid. Mitigation measures are summarized below.

Minimum Streamflow. A Memorandum of Understanding between the Municipal Subdistrict, Northern Colorado Water Conservancy District, NCWCD, and Colorado Division of Wildlife (June 23, 1980) established the following minimum streamflows on a 24-mile reach of the Colorado River downstream of the Windy Gap Project to the mouth of the Blue River that apply when the Windy Gap Project is pumping:

- From the Windy Gap Diversion Point to the mouth of the Williams Fork River: 90 cfs
- From the mouth of the Williams Fork River to the mouth of Troublesome Creek: 135 cfs
- From the mouth of Troublesome Creek to the mouth of the Blue River: 150 cfs

If flows are less than those specified above, Windy Gap must curtail diversions except that the project cannot be required to bypass more than the natural inflow. Additionally, bypass of at least 450 cfs for at least 50 hours during the period of April 1 through June 30 is required at least once every 3 years**.**

Endangered Species. Endangered Species Act Section 7 consultation with the U.S. Fish and Wildlife Service concluded with a Biological Opinion (March 13, 1981) determination that Windy Gap depletions, with the conservation measures listed below is not likely to jeopardize the existence of the endangered squawfish or humpback chub. The Subdistrict agreed to payment of $100,000 for a habitat project and $450,000 for biological investigations on the Colorado River as conservation measures to compensate for the adverse effects of the Windy Gap Project. Specific conservation and recovery measures included:

- The establishment of backwater habitat areas along the mainstem of the Colorado River
- Support of a field research team for 3 years to evaluate habitat improvement techniques for endangered fish
- Bypass flow agreements with CDOW for trout habitat to benefit Colorado River endangered fish downstream of the project area

Azure Agreement. Western Slope objections to the Windy Gap project were resolved in the *Agreement Concerning the Windy Gap Project and the Azure Reservoir and Power Project* dated April 30, 1980, entered into by the Subdistrict and several West Slope entities that had been opposed to the project because of anticipated West Slope impacts. Following negotiations between the Subdistrict and the Colorado River Water Conservation District (CRWCD), a settlement was reached and mitigation measures acceptable to the parties were identified. Other parties to this agreement included: the Northwest Colorado Council of Governments (NWCCOG), Grand County, MPWCD, Three Lakes Water and Sanitation District, the towns of Granby and Hot Sulphur Springs, Winter Park Water and Sanitation District, and 30 ranchers. The purpose of this agreement was to provide compensation to West Slope entities from the transbasin diversion of water and associated impacts. Principal agreements included:

- A commitment by the Subdistrict to fund the construction of the Azure Reservoir and Power Plant, or if infeasible, fund an alternative project or a cash payment to the CRWCD
- Payment of $25,000 to Grand County for salinity studies of the Colorado River
- Payment of $150,000 to the Town of Hot Sulphur Springs for assistance in improving its water treatment facility and $270,000 for improving its wastewater treatment facility
- Payment of $500,000 to plan, construct, and design facilities needed for ranchers to maintain their diversion structures on the Colorado River
- An agreement by the Subdistrict to subordinate its Windy Gap decrees to all present and future in-basin irrigation, domestic, and municipal uses, excluding industrial uses, on the Colorado and Fraser rivers and their tributaries above the Windy Gap Reservoir site
- An agreement by the Subdistrict to volumetric limits on diversions, which included a maximum single-year diversion of 90,000 AF/year and a maximum of 650,000 AF during any consecutive 10-year period. Per the 1985 *Supplement to the 1980 Azure Settlement Agreement*, these diversion limitations apply to deliveries through the Adams Tunnel, as opposed to diversions at Windy Gap Reservoir
- An agreement by the Subdistrict to bypass flows necessary to meet senior downstream water rights
- An agreement by the NCWCD to allow Grand County's use of a rock and gravel quarry on their property
- An agreement by the Subdistrict to cooperate with CDOW and others to allow public use for recreation at Windy Gap Reservoir

In return for these mitigation measures, West Slope interests agreed to drop objections to the Windy Gap conditional water right decrees and cooperate with all the necessary permitting requirements to allow construction of the project.
The 1985 *Supplement to the 1980 Azure Settlement Agreement* was later signed on March 29, 1985 by the Subdistrict, CRWCD, NWCCOG, Grand County

commissioners, and the MPWCD. This agreement was implemented after the planned Azure Reservoir was determined infeasible. The 1985 agreement included the following compensation to West Slope entities:

- Payment of $10.2 million, which was used to fund construction of Wolford Mountain Reservoir on Muddy Creek north of Kremmling, and release of obligations for funding of the Azure Project
- The Subdistrict's agreement to set aside annually, but non-cumulatively, at no cost to the MPWCD, 3,000 AF of water in Lake Granby that is produced each year from Windy Gap supplies, for beneficial use without waste in the MPWCD for all beneficial uses, except instream uses and industrial uses
- Subordination of Windy Gap water rights to either Rock Creek or Wolford Mountain projects; Wolford Mountain Reservoir was completed in 1996

The 1980 and 1985 agreements were incorporated as integral parts of the Windy Gap water rights decrees.

2.3 WINDY GAP FIRMING PROJECT

The proposed WGFP would entail construction of a new water storage reservoir that would provide more reliable water deliveries to Front Range and West Slope communities and industry. Due to limitations and constraints with the existing system, the current Windy Gap facilities, which were completed in 1985, are unable to deliver the anticipated firm yield of water. Water deliveries from the West Slope are limited by storage capacity in Lake Granby and by the delivery capacity of the Adams Tunnel, which delivers water from Grand Lake to the East Slope. As a result, a group of the Windy Gap Project unit holders, working through the Subdistrict, have initiated the proposed WGFP which will firm all or a portion of their individual Windy Gap units to meet a portion of existing and future municipal and industrial water requirements. The proposed action is to add water storage and related facilities to the existing Windy Gap operations that would be capable of delivering a firm annual yield of about 30,000 AF to Project Participants.

The intent of the WGFP is to improve the reliability of the Windy Gap Project and the existing Windy Gap water rights by increasing the firm yield from the existing Windy Gap Project water supply. The Subdistrict's Proposed Action is the construction of Chimney Hollow Reservoir to store Windy Gap Project water. To improve yield, the Subdistrict also is requesting integration of the Colorado-Big Thompson Project (C-BT) and Windy Gap Project operations so that C-BT water can be stored in Chimney Hollow Reservoir. The Proposed Action would require new connections to C-BT East Slope facilities and continued use of C-BT storage and conveyance systems and other existing pipelines, canals, and diversions to deliver Windy Gap water to Project Participants.

The Preferred Alternative includes construction of the 90,000-AF Chimney Hollow Reservoir with a surface area of about 740 acres. This alternative includes

prepositioning, which is the storage of C-BT water, as well as Windy Gap water, in the new reservoir. Water would be conveyed to Chimney Hollow Reservoir via a new pipeline connection to existing East Slope C-BT facilities at the upper end of the existing Flatiron Penstocks, where a new buried pipeline would deliver water to Chimney Hollow Reservoir or Carter Lake. Connections between Chimney Hollow Reservoir and Carter Lake would allow delivery of water to Participants using existing infrastructure. Reservoir construction would require relocation of about 3.8 miles of an existing 115-kV transmission line.

The new Chimney Hollow Reservoir would be located on Subdistrict land, and these lands, along with adjacent Larimer County open space lands, would be managed by Larimer County for recreation. Combined Subdistrict and Larimer County lands would provide about 3,400 acres including the reservoir for recreation and fish and wildlife habitat. Anticipated recreation features include a parking area, trails, boat dock and ramps, picnic facilities, and vault toilets. No overnight camping would be allowed.

2.3.1 Relationship of the Original Windy Gap EIS to Current Firming Project EIS

The WGFP EIS evaluates the potential effects of alternatives associated with firming the yield of the water diverted under the terms of the original Windy Gap Project EIS. The proposed WGFP would not exceed the average annual diversion of 56,000 AF evaluated in the 1981 EIS and ROD or any other diversion-related limitations or water rights. Additional reservoir storage capacity is needed in the WGFP because of the limitations in the C-BT system to store Windy Gap water when it is available. The WGFP EIS evaluates the direct, indirect, and cumulative effects of any new physical disturbances or changes in operation needed by the WGFP. As described above, the original EIS included a number of mitigation measures to offset impacts, several of which are ongoing.

3.0 OTHER CONCURRENT OR RELATED ACTIVITIES

3.1 MOFFAT COLLECTION SYSTEM PROJECT

The Moffat Collection System Project is currently proposed by Denver Water (Denver) to develop 18,000 AF/year of new annual yield to the Moffat Treatment Plant to meet future raw water demands on the East Slope. This project is anticipated to result in additional diversions, primarily from the upper Fraser River and Williams Fork River basins. Denver's proposed additional Fraser River diversions would be located upstream of the Windy Gap Project diversion site on the Colorado River and would directly affect the availability of water for the WGFP. The Moffat Collection System Project Draft EIS prepared by the Corps was released for public review in 2009.

Diversions for the WGFP and Moffat Project would result in changes to flows in the Colorado River below the Windy Gap dam. Denver Water and the Subdistrict have

agreed to cooperate with each other and with the Colorado Department of Natural Resources (DNR) and CDOW in concurrent development of the mitigation plans required under CRS 37-60-122.2 for the two projects. They have jointly developed stream temperature monitoring stations as mitigation (refer to Section 5.3.3 of this FWMP). Additionally, Denver Water and the Subdistrict have proposed enhancement with significant resources and funding to improve current conditions in the river. The WGFP Enhancement Plan is being provided to the Wildlife Commission concurrently with this FWMP in a separate document.

3.2 UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

Reclamation is preparing an Environmental Assessment (EA) to assess the effects of proposed contracts that would provide for permanent release of 10,825 AF/yr of water to the 15-Mile Reach of the upper Colorado River. As a condition of a 1999 Programmatic Biological Opinion (PBO) (U.S. Fish and Wildlife Service 1999), a group of East and West Slope water users is committed to make releases of “10825 water” in late summer and fall in support of the recovery of endangered fish species in the 15-Mile Reach near Grand Junction. The EA will document whether a Finding of No Significant Impact (FONSI) can be issued for the proposed contracts.

The Proposed Action Alternative would use releases from Ruedi Reservoir and Lake Granby, and to a limited extent, storage in and releases from Green Mountain Reservoir when excess capacity is available, to provide 10,825 AF/yr of water for the 15-Mile Reach.

The Proposed Action Alternative involves release of 5,412.5 AF/year from Lake Granby. Releases from Lake Granby would range from 20 to 50 cfs during the period from July 15 to September 30, depending upon the hydrologic year type. This alternative was not included in the hydrologic analyses for either the WGFP or Moffat Project. Accordingly, the flows in the Colorado River below Lake Granby would be increased over flows shown in the Draft EIS for each project.

3.2.1 Coordination of 10825 Project Releases from Lake Granby

Each year, a total of 5,412.5 AF of water is to be released from Lake Granby. The water will be released to benefit the 15-Mile Reach on a fixed delivery schedule to be agreed upon by the parties in the future, and pursuant to applicable federal and state laws. The parties anticipate that the release pattern will depend on the type of hydrologic year (dry, average, or wet) and will be based on the target stream flow in the Colorado River between Lake Granby and Kremmling during late summer and early fall. Releases from Lake Granby will be pursuant to a municipal-recreation contract with a Grand Valley municipal entity within or downstream of the 15-Mile Reach.

Under some hydrologic conditions, releases from Lake Granby made to meet targeted stream flow in the Colorado River downstream of Lake Granby may not coincide with the FWS requirements for the 10825 water at the 15-Mile Reach. In these instances, water released from Lake Granby will be stored in Green Mountain

Reservoir by exchange or substitution pursuant to a contract with Reclamation (subject to availability of storage capacity and exchange potential). This water will then be released at the request of the Service to benefit the 15-Mile Reach.

An Operations Group will be established, consisting of representatives from the water users, FWS, Reclamation, and the State of Colorado Division 5 Engineer. The Operations Group will meet each spring to develop a plan for releasing the 10,825 AF of water during the coming 12 months, and at other times as necessary to fulfill the purposes of this Project. The Subdistrict will propose that CDOW be added as a member of the Operations Group.

4.0 REGULATORY PROCESS

The WGFP is required to obtain numerous federal and state permits, licenses, and approvals. The primary regulatory processes related to the C.R.S. 37-60-122.2 requirement for fish and wildlife mitigation are described below.

4.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) REVIEW

The Subdistrict is seeking approval from Reclamation for approval of a physical connection to C-BT Project facilities and for operations of the Chimney Hollow Reservoir in order to implement the project. As the lead federal agency, Reclamation prepared a Draft Environmental Impact Statement (Reclamation 2008) for the proposed project. The U.S. Army Corps of Engineers (Corps), Western Area Power Administration (Western), and Grand County are cooperating agencies. A Final EIS is expected to be published in mid-2011. If impacts to fish and wildlife are identified in the FEIS that were not identified in the DEIS, Reclamation will coordinate with CDOW and other state agencies as required under the Fish and Wildlife Coordination Act and will make adjustments to project mitigation as appropriate.

4.2 SECTION 404 PERMIT

Because the proposed WGFP would involve the discharge of dredged and fill material into wetlands or other waters of the U.S., a permit is required from the Corps under Section 404 of the Clean Water Act. The Subdistrict, acting by and through the Windy Gap Firming Project Water Activity Enterprise, has notified the Corps that it will seek a Section 404 permit for the WGFP. Issuance of a permit would be a Corps federal action.

4.3 COLORADO FISH AND WILDLIFE MITIGATION PLAN

This FWMP is prepared to satisfy the requirements of C.R.S. 37-60-122.2. The first portion of this statute states:

> (1)(a) The general assembly hereby recognizes the responsibility of the state for fish and wildlife resources found in and around state waters which are affected by the construction, operation, or maintenance of water diversion, delivery, or storage facilities. The general assembly hereby declares that such

> fish and wildlife resources are a matter of state-wide concern and that impacts on such resources should be mitigated by the project applicants in a reasonable manner. It is the intent of the general assembly that fish and wildlife resources that are affected by the construction, operation, or maintenance of water diversion, delivery, or storage facilities should be mitigated to the extent, and in a manner, that is economically reasonable and maintains a balance between the development of the state's water resources and the protection of the state's fish and wildlife resources.

FWMPs for water projects considered under C.R.S. 37-60-122.2 are to be developed by the project applicant, working in cooperation with CDOW, and submitted to the Colorado Wildlife Commission (CWC). If the CWC and applicant agree on the mitigation plan, the CWC forwards the mitigation plan to the Colorado Water Conservation Board (CWCB) for adoption as the official state position on the mitigation actions required of the applicant.

4.3.1 Mitigation and Enhancement Plans

C.R.S. 37-60-122.2 makes a specific distinction between mitigation of impacts caused by the proposed project, and enhancing fish and wildlife resources over existing conditions. This distinction is further defined in the Procedural Rules for the Wildlife Commission (Chapter 16), and clarified in a memorandum dated December 9, 2010 to the Director of the Colorado Division of Wildlife and the Wildlife Commission from the First Assistant Attorney General, Natural Resources and Environment Section. Accordingly, this FWMP includes mitigation measures to address the direct impacts that have been identified for the proposed project. The Subdistrict has also prepared a separate Enhancement Plan, in accordance with CRS 37-60-122.2 to address issues raised by Colorado Division of Wildlife and other stakeholders regarding the current condition of the aquatic environment on the Colorado River, which includes proposed enhancement measures to enhance fish and wildlife resources over and above levels existing without the WGFP. The Subdistrict, as an applicant for one or more federal permits, or licenses, is required by C.R.S. 37-60-122.2 to submit a proposed mitigation plan, but submittal of an enhancement plan is voluntary.

4.3.2 Consultation, Coordination and Public Input

The Subdistrict consulted with Colorado Division of Wildlife (CDOW) U.S. Fish and Wildlife Service (FWS) representatives during preparation of this Plan. In addition, CDOW and FWS were provided an opportunity to review and comment on the Wildlife Resource Technical Report (ERO 2008) and Aquatic Resource Technical Report (Miller Ecological 2008) prepared as part of the EIS process. Both of these reports provide additional details on the impacts of the alternatives evaluated in the EIS. The CDOW and FWS also were given an opportunity to review and comment on the draft EIS.

CRS 37-60-122.2 requires CDOW and Colorado Water Conservation Board review and input on mitigation for fish and wildlife impacts resulting from a federally

approved water project. The review process is intended to provide a balanced review between fish and wildlife protection and water development.[1] Although the procedures for CRS 37-60-122.2 do not require public review and input, the Subdistrict and CDOW have been involved in extensive efforts to allow for public participation. To date, the Wildlife Commission has provided the following public meetings to solicit input on the potential impacts and mitigation for the Moffat Project:

- Wildlife Commission Workshop, October 7, 2010, Las Animas – CDOW presented the proposed fish and wildlife impacts of the WGFP
- Wildlife Commission Public Meetings ("1313" Meetings), October 13, 2010 in Loveland and October 21, 2010 in Granby – Wildlife Commissioners solicited public comment on the potential impacts of the WGFP
- Stakeholder Workshops, January 24-25, 2011, Winter Park – CDOW solicited input on enhancement options for fixing the upper Colorado River between Windy Gap and the Kemp-Breeze State Wildlife Area to ensure a functioning river that supports fish and wildlife resources given anticipated future flows. (Refer to the *WGFP Enhancement Plan* for details.)
- Public Comment Period on Draft Enhancement and Mitigation Plans, Feb. 10-24, 2011 – CDOW invited public review and comment on the February 9th draft plans. The input will be reviewed by CDOW, Denver Water and the Subdistrict while preparing the final plans.
- Wildlife Commission Meeting, March 10, 2011 – Member of the public provided comments on the February 9th draft plans and review process.
- Wildlife Commission Meeting, May 6, 2011 – Members of the public provided comments on the April 7th plans submitted to the Wildlife Commission.

Input from all of these processes has been used to help prepare this plan.

5.0 PROPOSED FISH AND WILDLIFE MITIGATION PLAN

This section constitutes the Mitigation Plan for fish and wildlife impacts that are expected to be caused by the proposed WGFP. Mitigation measures have been developed to address impacts identified in the Draft EIS. The mitigation measures are also intended to address concerns regarding WGFP impacts that were identified by CDOW staff in a detailed review of the DEIS impacts. The impacts are based on a comparison of the existing conditions scenario to the Preferred Alternative, which consists of a 90,000 AF reservoir at the Chimney Hollow site. A detailed description of existing conditions in the project area and the analysis and identification of project impacts are included in the Draft EIS. The Draft EIS and associated Technical Reports prepared in conjunction with the DEIS are the only studies that

[1] See Testimony of Clyde Martz, Direction of the Department of Natural Resources, Senate Testimony HB 87-1158, April 9, 1987

have been conducted that specifically analyze the incremental impacts of the WGFP.

5.1 WGFP PROJECT AREA

The WGFP would have effects on both the east and west sides of the Continental Divide. The West Slope project area shown on Figure 1 includes the Colorado River below Lake Granby, which is affected by changes in Lake Granby spills and increased Windy Gap diversions at the existing Windy Gap Reservoir. Willow Creek below Willow Creek Reservoir is also included in the project area because of small changes in Willow Creek Feeder Canal diversions. Lake Granby is included because water levels would decrease as a result of storage of a portion of Windy Gap water in Chimney Hollow Reservoir. Shadow Mountain Reservoir and Grand Lake are included in the project area because of potential water quality effects, but there would be no change in lake levels.

The East Slope project area shown in Figure 2 includes the Chimney Hollow Reservoir site located west of Carter Lake, which is also shown on Figure 3. Hydrologic changes would occur in the Big Thompson River below Lake Estes from the import of additional Windy Gap water and from slight increases in flow that would occur below Participant wastewater treatment plants (WWTPs) on the Big Thompson River, St. Vrain Creek, Big Dry Creek, and Coal Creek. Carter Lake and Horsetooth Reservoir would experience a change in reservoir levels with the WGFP.

Proposed mitigation measures for the West Slope (Colorado River) area and the East Slope (South Platte Tributaries and Chimney Hollow Reservoir) are described below in separate sections.

5.2 AVOIDANCE AND MINIMIZATION

The Preferred Alternative for the WGFP was selected to minimize environmental impacts as a result of a detailed alternatives analysis conducted by Reclamation and a Section 404(b)(1) alternatives analysis prepared in coordination with the Corps. The alternatives analysis evaluated over 170 project elements which included both structural and non-structural alternatives. The Preferred Alternative consists of a 90,000 AF reservoir at the Chimney Hollow site and has been designed to minimize direct effects to wetlands and other waters of the U.S.

As part of the federal and state permits and approvals, the Subdistrict will implement a variety of best management practices (BMPs) during design and construction to reduce impacts to the environment, including fish and wildlife. Some of the environmental permits and approvals with BMPs and environmental protection measures include:

- Migratory Bird Treaty Act Compliance
- CDPHE Fugitive Dust Control Plan

- CDPHE Stormwater Management Plan
- CDPHE Section 401 Water Quality Certification

The CDOW has developed BMPs and actions to minimize adverse impacts to wildlife resources. The BMPs were specifically developed for the oil and gas industry; however, they can also be applicable to other major construction projects. These BMPs will be considered by the Subdistrict when preparing final design and construction plans. The Subdistrict will consult with the CDOW to implement the appropriate BMPs to avoid or minimize impacts on fish and wildlife resources.

5.3 PROPOSED MITIGATION MEASURES FOR WEST SLOPE (COLORADO RIVER) IMPACTS

Table 1 summarizes West Slope impacts and the proposed mitigation measures for each identified impact. The table also includes a column that outlines issues and concerns regarding WGFP impacts that were identified by CDOW staff in a detailed review of the DEIS impacts. The mitigation measures identified in the table are described in more detail in this section.

5.3.1. Modified Prepositioning to Maintain Higher Water Levels in Lake Granby

This measure addresses Impact CR-3, as well as CR-16, CR-23, ES-1, ES-2, and ES-29.

In any year when Lake Granby is projected to fall below an elevation of 8,250 feet, modified prepositioning, which reduces the delivery of C-BT water from Lake Granby to Chimney Hollow Reservoir, will be implemented to maintain higher water levels in Lake Granby.

Details of this measure will be developed by the Subdistrict and incorporated into a proposed agreement between Reclamation and the Subdistrict with a concurrence by the Corps. The objective is to minimize the adverse effects of prepositioning on water levels in Lake Granby. This measure will minimize any potential negative effects on aquatic resources and recreation in Lake Granby that may be caused by reduced water levels from prepositioning.

5.3.2 Improvements to Flushing Flows in the Colorado River

This measure addresses Impact CR-6, as well as CR-2, CR-14, CR-15 and CR-17.

The Windy Gap Project is currently required to bypass 450 cfs for 50 hours once in every 3 years, if such flows are naturally available in accordance with the *Memorandum of Understanding Between Municipal Subdistrict, Northern Colorado Water Conservancy District and Division of Wildlife, Colorado Department of Natural Resources, Relating to Minimum Stream Flow in Association with the Windy Gap Diversion Project*, dated June 23, 1980. The Subdistrict will modify project operations as follows:

- The flushing flow provision of the 1980 MOU will be modified to increase the required flushing flow from 450 cfs to 600 cfs.
- In any year when flows below Windy Gap have not exceed 600 cfs for at least 50 consecutive hours in the previous two years, and total Subdistrict water supplies in Chimney Hollow and Granby Reservoirs exceed 60,000 AF on April 1, the Subdistrict will cease all Windy Gap pumping for at least 50 consecutive hours to enhance peak flows below Windy Gap.

The intent of this measure is to enhance peak flows below Windy Gap . The Subdistrict will coordinate with CDOW and other water suppliers, including Denver Water, to maximize benefits of the higher flows and minimize any potential negative impacts to aquatic resources.

5.3.3 Temperature Mitigation

This measure addresses Impact CR-9, as well as CR-11 and CR-24.

- Monitoring Stations. The Subdistrict will work with Denver Water to install, operate and maintain two continuous real-time temperature-monitoring stations on the Colorado River; one at the Windy Gap gage and one upstream of the confluence with the Williams Fork River.

- Temperature Thresholds. For the purposes of this mitigation plan, the threshold temperatures will be the following, as measured at the temperature monitoring stations identified above:

  1. MWAT Chronic Threshold: 18.2^{o}C (64.8^{o} F), based on current Maximum Weekly Average Temperature (MWAT) Chronic Standard
  2. DM Acute Threshold: 23.8^{o}C (74.8^{o} F), based on current Daily Maximum (DM) Acute Standard

- MWAT Chronic Threshold Exceedances - Reduction or Curtailment of WGFP Pumping . For the period after July 15th of each year:

  1. At such times as the Weekly Average Temperature (WAT) exceeds the MWAT Chronic Threshold,, the Subdistrict will reduce or curtail WGFP pumping at the Windy Gap diversion to the extent necessary to maintain temperatures within the MWAT Threshold. Reduced pumping may not be sufficient to maintain temperatures below the threshold.

2. Pumping for the original Windy Gap Project, now and after the WGFP is in operation, may occur at any time that the Windy Gap water rights are in priority and sufficient space is available in Lake Granby that such water pumped will not be reasonably expected to spill from the reservoir. Therefore, WGFP pumping will be defined as pumping that occurs at such times as the Northern Colorado Water Conservancy District determines, based on its most probable forecasts of inflows to Lake Granby, that a spill of water from Lake Granby is reasonably foreseeable. All other pumping will be considered to be for the original Windy Gap Project.

- DM Acute Threshold Exceedances - Reduction or Curtailment of Pumping for the WGFP and the original Windy Gap Project .

  1. At such times as the Daily Maximum temperature is within 1 ^{o}C of the DM Acute Threshold, the Subdistrict will reduce or curtail pumping for the original Windy Gap Project or the WGFP at the Windy Gap diversion to the extent necessary to maintain temperatures within the DM Threshold. Reduced pumping may not be sufficient to maintain temperatures below the threshold. In the future, the 1 degree buffer may be altered, based on experience, to maintain compliance with the DM Threshold.

- Limitations on Reduction or Curtailment of Windy Gap pumping. The temperature mitigation measures identified above will be suspended in the event that and at such times as there is no material causal relationship between Windy Gap Project or Windy Gap Firming Project operations and any exceedence of the MWAT Chronic threshold or DM Acute threshold at the monitoring stations identified above. For the purposes of this Paragraph a “material causal relationship” is defined as either an actual measureable impact on temperature using readily available monitoring technology or a modeled impact on temperature that is not *de minimus* and is based on a computer model or studies accepted by the Colorado Division of Wildlife. The Subdistrict will cooperate with future studies to determine what factors, other than flow changes, have effects on water temperatures in the Colorado River below Windy Gap.

- Use of the Windy Gap Bypass Valve and Auxiliary Outlet. The Subdistrict will use the Windy Gap Project Bypass Valve and Auxiliary Outlet to the maximum extent practicable, without causing adverse effects to the Windy Gap Project facilities or operations for the bypass of water that is otherwise bypassed from the Windy Gap Project. This measure is intended to make releases of water from these outlets deeper in the reservoir that may be colder than water bypassed over the spillway.

5.3.4 Nutrient Mitigation to Offset Impacts to Grand Lake Water Quality

This measure addresses Impact CR-10, as well as CR-12, CR-13, CR-26, and ES-8.

The Subdistrict will develop a proposed nutrient reduction mitigation plan for Reclamation and Corps approval. The plan includes point source nutrient reductions from WWTP discharges in the Fraser River and nonpoint source nutrient reductions from agricultural land in the Willow Creek watershed. Other nutrient reduction measures would be implemented as necessary to meet the requirement to provide a documented nutrient reduction credit factor of 1:1 to satisfy Reclamation and the Corps mitigation requirements.

5.3.5 Participation in Upper Colorado River Recovery Program

This measure addresses Impact CR-20.

The Subdistrict will complete Section 7 consultation and compliance consistent with the requirements of the Programmatic Biological Opinion (PBO). The Service issued a Biological Opinion on February 12, 2010 for the Preferred Alternative indicating WGFP coverage under the PBO with Participation in Upper Colorado River Recovery Program and payment of a depletion fee for additional depletions attributable to the WGFP.

Documentation of Section 7 consultation will be submitted to the Corps in order to meet requirements for the Fish and Wildlife Coordination Act.

5.3.6 Curtailment of Windy Gap Diversions during Gore Race

This measure addresses Impact CR-22 and CR-25.

WGFP diversions would be suspended during the Gore Race in August if flows drop below preferred range (1,250 cfs).

5.4 PROPOSED MITIGATION MEASURES FOR EAST SLOPE (SOUTH PLATTE TRIBUTARIES AND CHIMNEY HOLLOW RESERVOIR) IMPACTS

Table 2 summarizes East Slope impacts and the proposed mitigation measures for each identified impact. The table also includes a column that outlines issues and concerns regarding WGFP impacts that were identified by CDOW staff in a detailed review of the DEIS impacts. The mitigation measures identified in the table that are relevant to fish and wildlife resources are described in more detail in this section.

5.4.1 Revegatiation and Weed Control on Areas Impacted by Construction

This measure addresses Impact ES-11.

Revegetation and weed control on all disturbed areas in accordance with an erosion control plan to be developed by the Subdistrict and approved by Reclamation and the Corps. Plan will be developed in coordination with CDOW and incorporate CDOW Oil & Gas BMPs where appropriate.

5.4.2 Wetlands Mitigation

This measure addresses Impact ES-13, ES-14, and ES-15.

Avoid, minimize and mitigate wetland impacts as specified in the 33 CFR Part 332 (Mitigation Rule, 10-Apr-08) and as approved by the Corps. Wetlands would be mitigated by contribution to an approved wetland mitigation bank.

5.4.3 Wildlife Habitat Mitigation at Chimney Hollow Reservoir Site

This measure addresses Impact ES-16 and ES-17.

Subdistrict will develop a plan to replace the values provided by habitat lost or altered by construction of Chimney Hollow Reservoir. Mitigation of impacts to wildlife resources will involve a combination of mitigation strategies and tools, including:

- Restoring habitats temporarily disturbed during reservoir and facility construction
- Working with Larimer County to restore or enhance degraded habitat surrounding Chimney Hollow Reservoir
- Working with CDOW and Larimer County to establish hunting access on the Chimney Hollow property
- Conducting management and education activities to minimize human-wildlife conflicts
- Implementing a migratory bird management plan
- Implementing seasonal restrictions and buffer zones

Details of this plan will include:

Restoration of Temporary Disturbances. The temporary loss of 123 acres of wildlife habitat will be mitigated through reclamation and revegetation of all habitats disturbed during construction and relocation of the transmission line and towers. Temporary loss of vegetation communities due to construction of dams, pipelines, staging, and access roads will be restored with plantings and seed mixes that replicate the vegetation cover types. Vegetation restoration of the transmission line corridor will involve working closely with Western to incorporate strategies for maintenance of stable low-growing vegetative communities that include mechanical cutting, removal of timber, on-site treatment of slash, and planting sustainable, low-growing shrubs and grasses. Plantings and seed mixes will focus on restoring diverse vegetation communities that provide wildlife forage, particularly during fall and winter. A reclamation plan will be developed as part of the construction program and the Stormwater Management Plan.

Habitat Enhancement. Subdistrict will work with Larimer County to develop a land management plan that will include habitat enhancement of vegetation communities surrounding Chimney Hollow Reservoir, which involves planting native species beneficial to wildlife where appropriate. The Subdistrict will provide $50,000 to Larimer County to use in their ongoing habitat management plan. A weed control plan would be developed in cooperation with Larimer County prior to implementing habitat enhancement to improve the quality of lands not specifically within the areas of vegetation enhancement. Weed management will focus on monitoring restored habitats and implementing an integrated weed management approach of mechanical, chemical, and biological control strategies. Integrated weed management strategies also will be used to control existing areas of noxious and invasive species, particularly large patches of thistle and cheatgrass. The weed management plan will be developed prior to construction disturbances and updated periodically through implementation of wildlife enhancement.

Hunting Opportunities. Larimer County will develop a management plan for the Chimney Hollow area. As part of this process, the Subdistrict and Larimer County will work with CDOW and Larimer County to explore opportunities to provide seasonal hunting on portions of the Chimney Hollow Reservoir site and open space to assist with game management and provide additional recreation.

Minimization of Human-Wildlife Conflicts. The displacement of elk and bear into surrounding residential areas as they search for lost food resources will be offset by the habitat enhancement activities and hunting opportunities described above. Additionally, the Subdistrict will work with Larimer County and CDOW to reduce/eliminate wildlife attractants from recreation facilities and establish education/outreach programs and information kiosks/signs informing the public on the dangers of close interactions with wildlife, and methods to avoid and minimize potentially dangerous encounters.

Implementing Migratory Bird Avoidance Plan. The active nesting season for most migratory bird species in Colorado is between April 1 and August 15. Over the past few years, FWS and CDOW have suggested that the best way to avoid a violation of the Migratory Bird Treaty Act (MBTA) is to remove vegetation outside of the active breeding season. The Subdistrict will develop BMPs in accordance with CDOW guidance to avoid disturbing active bird nests at the Chimney Hollow Reservoir site. *Note: Implementing these BMPs demonstrates a good faith effort to avoid incidental violation of the MBTA, but does not guarantee that migratory birds will not still nest in some areas despite these efforts.*

Seasonal Restrictions and Buffer Zones for Raptors. Avoidance and mitigation options for nesting raptors at the Chimney Hollow Reservoir site consists of: 1) conducting nest surveys prior to construction, 2) establishing

reasonable site-specific buffers and seasonal restrictions, 3) implementing seasonal restrictions to avoid and minimize disturbance, and 4) removing inactive nests from the transmission line corridor, construction footprints, reservoir pool area, or other areas of permanent impacts. Currently, there are no expected permanent impacts to existing raptor nests; however, there is the possibility that a new active raptor nest could be established in areas slated for disturbance or inundation. The intent of any mitigation is to encourage individual raptor pairs to nest at selected and more secure locations. BMPs will be developed in accordance with CDOW guidance to avoid, minimize and mitigate potential impacts.

5.4.4 Air Quality Mitigation

This measure addresses Impact ES-23 and ES-24.

Subdistrict will develop a fugitive particulate emissions control plan and BMPs to minimize air quality and noise impacts to wildlife.

5.5 MITIGATION COSTS AND SCHEDULE

Estimated mitigation costs are shown in the following table. Total project costs are estimated to be $273,000,000, which includes construction costs of about $237,000,000. The mitigation schedule will be contingent on the issuance of permits and licenses, construction timetables, project completion, and the ability of the Subdistrict to fill the reservoir. The schedule provided in the following table provides a timetable based on these contingencies.

Mitigation Insurance Policy - The mitigation listed above is based on the Draft EIS for the WGFP that was released for public comment in August of 2008. Since that time and based on comments to the Draft EIS, Reclamation has conducted additional studies related to the preparation of the Final EIS, that in part are designed to further refine the analysis of environmental impacts of the proposed action. If new impacts to fish and wildlife resources are identified in the Final EIS that were not discussed in the Draft EIS and not addressed in this mitigation plan, the Subdistrict will propose mitigation for these new impacts. The additional mitigation will be developed in cooperation with the CDOW prior to submittal to Reclamation for its consideration as a permit condition. The Subdistrict will reserve $600,000 for any new impacts to fish and wildlife resources identified by the Final EIS and required by Reclamation. If Reclamation does not identify new impacts requiring mitigation, the Subdistrict will have no further obligation to reserve this money.

West Slope

Modified prepositioning to reduce Lake Granby fluctuations	Concurrent with project start up	Permanent change in WGFP operation	$0 May have minor effect project yield
Improvements to flushing flows in Colorado River	Concurrent with project start up	No end date	May have effects on project yield but cost cannot be estimated.
Temperature mitigation	Temperature monitoring would begin within one year after issuance of permits. Curtailed diversions occur when Chimney Hollow Reservoir is completed and diversions increase	Diversion curtailments per the established criteria would continue as long as the WGFP is in operation	$50,000 for monitoring stations May have effects on project yield but cost cannot be estimated.
Nutrient mitigation to offset impacts to Grand Lake water quality – will also improve water quality in Colorado River below Windy Gap	Monitoring of baseline conditions will begin in 2011 and nutrient removal will begin concurrent with project start up	Monitoring will continue until 1:1 nutrient offset has been verified. Operation of nutrient reduction projects will continue as long as the WGFP is in operation	$4.3 million (estimated)
Participation in Upper Colorado River Recovery Program	Payment upon issuance of permits; expected by 2011	One time upfront fee	$405,000 (estimated)
Curtailed diversions for annual Gore Race, if needed	Concurrent with project start up	Permanent change in WGFP operation	

East Slope

Revegetation and weed control on areas impacted by construction	Immediately upon completion of specific habitat-disturbing activity	Three years post-restoration or until success criteria are met	$25,000
Wetland mitigation	Within one year of issuance of permit	One time upfront fee	$115,000
Wildlife habitat mitigation at Chimney Hollow Reservoir site	Concurrent or following construction depending on location	Three years post-construction or until success criteria are met	$50,000 (estimated)
Air quality mitigation	Concurrent or following construction depending on location	Until completion of construction	$0

6.0 CONCLUSIONS

The FWMP presents a broad range of mitigation actions to address the potential fish and wildlife impacts of the WGFP. If accepted by the Colorado Wildlife Commission and CWCB, this mitigation plan will represent the official state position on mitigation for the WGFP. Since the state-adopted FWMP is not enforceable by itself, the Subdistrict anticipates that Reclamation and the Corps will determine these mitigation measures are adequate and will impose them within their regulatory requirements for Reclamation's approvals and the Section 404 Permit, respectively.

REFERENCES

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Table 1: WEST SLOPE - Colorado River

Item No.	EIS Impacts	CDOW Issues	Proposed Mitigation	Mitigation Agency
Surface Water Hydrology				
CR-1	Reduced spills from Lake Granby to the Colorado River as a result of fewer Windy Gap spills.	Fewer spills may mean decreased sediment transport in the Colorado River downstream to the Fraser River confluence	None Reclamation minimum flow releases below Lake Granby would be maintained.	
CR-2	Reduced flows in Colorado River below Windy Gap diversion.	Reduced flows impact other resources: -Stream Morphology and Sediment Transport -Surface Water Quality -Aquatic Resources (habitat) -Recreational Fishing -Riparian Health	See Proposed Mitigation for Stream Morphology and Surface Water Quality. Note: Current minimum bypass flows below Windy Gap Reservoir will continue per existing agreements. To assure that water diverted from the Colorado River is used as efficiently as possible, Reclamation will require that all participants in the Windy Gap Firming Project have Water Conservation Plans in accordance with the requirements of CRS 37-60-126 prior to the initial delivery of any water after construction of the WGFP.	Reclamation
CR-3	Lower water levels in Lake Granby as a result of prepositioning.	Lower water levels in Granby (when fisherman access to water is considered) reduce mysid impacts on kokanee growth - a beneficial impact.	In any year when Lake Granby is projected to fall below an elevation of 8,250 feet, modified prepositioning, which reduces the delivery of C-BT water from Lake Granby to Chimney Hollow Reservoir, will be implemented to maintain higher water levels in Lake Granby. Details of this measure will be developed by the Subdistrict and incorporated into a proposed agreement between Reclamation and the Subdistrict with a concurrence by the Corps. The objective is to minimize the adverse effects of prepositioning on water levels in Lake Granby.	Reclamation
Groundwater				
CR-4	Small changes in Colorado River and Willow Creek stream stage would not significantly impact alluvial groundwater levels.	Addressed in terms of stage change as percentage of total flow. Negligible impact on fisheries and riparian zone	None	
CR-5	Small changes in surface water quality in West Slope streams and reservoirs would have minor effect on groundwater quality.	Addressed in terms of stage change as percentage of total flow. Negligible impact on fisheries and riparian zone. Corrected by NPDES permits	None	
Stream Morphology and Floodplain				
CR-6	Decrease in frequency of 2-year peak discharge and in channel maintenance flows in the Colorado River.	Effects of lower flows on stream morphology and sediment transport and potential impacts on aquatic ecosystem, including riparian vegetation, fish and macroinvertebrates.	Note: Mitigation from the original Windy Gap Project would be modified (current flushing flow of 450 cfs below Windy Gap Reservoir for 50 hours from April 1 to June 30 every 3 years would be increased to 600 cfs). At any time when flushing flows have not occurred in previous 2 years, and total Subdistrict water supplies available in Granby and Chimney Hollow Reservoirs exceed 60,000 acre-feet, the Subdistrict will, in coordination with CDOW, cease pumping for 50 hours to enhance peak flows below Windy Gap.	CDOW, Reclamation
CR-7	Small decrease in frequency of 2-year peak discharge and in channel maintenance flows in Willow Creek.		None	CDOW, Reclamation
CR-8	Potential for flooding along the Colorado River and Willow Creek would decrease.		None	

Table 1: WEST SLOPE - Colorado River

Item No.	EIS Impacts	CDOW Issues	Proposed Mitigation	Mitigation Agency
Surface Water Quality				
CR-9	Colorado River temperature between Windy Gap Reservoir and Williams Fork may exceed 18.2 degree centigrade chronic maximum weekly average temperature (MWAT) or 23.8 degree centigrade daily maximum (DM) acute state standard as a result of WGFP diversions that lower flows in the Colorado River. Impact is most likely in the occasional years when WGFP diversions occur after July 15.	Add DM (daily maximum) temperature to the list of monitored statistics. Criteria for use of MWAT and DM; associated decision tree needs to be developed.	1. Install and maintain, for the life of the WGFP, two real time temperature gages in the Colorado River. One will be located downstream of WG Reservoir and one immediately upstream of the Williams Fork at locations agreed to by Reclamation, the Corps, and the Colorado Division of Wildlife. 2. After July 15 if the MWAT temperature threshold (18.2°C, 64.8° F) is exceeded at either station, WGFP pumping will be reduced or curtailed as necessary to maintain temperatures below the threshold. 3. If the DM temperature is within 1°C of the threshold (23.8°C, 74.8° F) at either station, WG and WGFP pumping will be reduced or curtailed as necessary to maintain temperatures below the threshold. 4. The Subdistrict will use the Windy Gap Project Bypass Valve and/or Auxiliary Outlet, to the maximum extent practicable, to release colder water for required project bypasses.	CDOW, Reclamation
CR-10	Additional WGFP pumping would increase nutrient (nitrogen and phosphorus) loading in Lake Granby, Shadow Mountain Reservoir, and Grand Lake, resulting in increased chlorophyll a, and manganese (Mn)		The Subdistrict will develop a proposed nutrient reduction mitigation plan for Reclamation and Corps approval. The plan includes point source nutrient reductions from WWTP discharges in the Fraser River and nonpoint source nutrient reductions from agricultural land in the Willow Creek watershed. Other nutrient reduction measures would be implemented as necessary to meet the requirement to provide a documented nutrient reduction credit factor of 1:1 to satisfy Reclamation and the Corps mitigation requirements.	Reclamation, Corps
CR-11	Decrease in Colorado River DO below Windy Gap Reservoir. DO concentrations predicted to remain above 6.0 mg/L standard. DO could fall below fish spawning standard of 7.0 mg/L between Windy Gap Reservoir and Williams Fork at low flows.		Mitigation for temperature (CR-9) and aquatic resources effects should improve and maintain DO levels above state standard.	CDOW, Reclamation
CR-12	Higher concentration of nutrients in the Colorado River below Windy Gap Reservoir as a result of WGFP pumping that reduces dilution flows.		Nutrient mitigation described in CR-10 in the Windy Gap watershed will reduce nutrient loading to the Colorado River below Windy Gap. The nutrient mitigation plan required by CR-10 must be reviewed and approved by Reclamation and the Corps.	Reclamation, Corps
CR-13	Slight increase in nutrient and metal concentrations in Willow Creek.		Nutrient mitigation described in CR-10 in the Willow Creek watershed will reduce nutrient loading to the creek. The nutrient mitigation plan required by CR-10 must be reviewed and approved by Reclamation and the Corps. Metal concentrations will remain within state standards.	Reclamation, Corps
Aquatic Resources				
CR-14	Decrease in the amount and frequency of available fish habitat in the Colorado River and an increase in stream temperature.	Decrease in habitat during pumping may not be limiting - the decrease is probably related to forgone changes in channel morphology and other factors (upstream development, water quality, other factors in addition to Windy Gap). Concerns about current condition of fishery, including recent trend of lower fish populations, loss of pteronarcys, sculpin, and other aquatic life.	See proposed mitigation for Surface Water Quality (CR-9).	Reclamation, Corps, CDOW
CR-15	Decrease in the amount and frequency of available fish habitat in Willow Creek.		None	
CR-16	Lower water levels in Lake Granby would slightly reduce available fish habitat.	Negligible impact under expected operations.	See proposed mitigation for Surface Water Hydrology (CR-3)	Reclamation

Table 1: WEST SLOPE - Colorado River

Item No.	EIS Impacts	CDOW Issues	Proposed Mitigation	Mitigation Agency
Vegetation				
CR-17	Effects to riparian vegetation along Colorado River from reduced streamflow.		None.	Reclamation, Corps, CDOW
Wetlands				
CR-18	Effects on wetlands adjacent to the Colorado River and downstream of the Windy Gap diversion.		None	
Wildlife				
CR-19	Change in streamflow in the Colorado River and Willow Creek is unlikely to affect terrestrial wildlife resources.		None	
Threatened and Endangered Species				
CR-20	Depletion to Colorado River impacts T&E fish.		Section 7 consultation and compliance consistent with the requirements of the Programmatic Biological Opinion (PBO). The Service issued a Biological Opinion on February 12, 2010 for the Preferred Alternative indicating WGFP coverage under the PBO with participation in Upper Colorado River Recovery Program (UCRRP) and payment of depletion fee for additional depletions attributable to the WGFP. Documentation of Section 7 consultation will be submitted to the Corps in order to meet requirements for the Fish and Wildlife Coordination Act.	Continued participation in the Upper Colorado River Endangered Fish Recovery Program per the USFWS Biological Opinion.
Recreation				
CR-21	Reduction in preferred kayaking flow days in Byers Canyon. In 29 of 47 years in the period of record there would be no change. In other years there would be a slight decrease in average number of days per year with preferred kayaking flows.		None	
CR-22	Preferred rafting and kayaking flows in Big Gore and Pumphouse would decrease. A decrease and increase in the number of days within preferred flow range that averages less than 3 days per year.		None , except WGFP diversions would be suspended during Gore Race in August if flows drop below preferred range (1,250 cfs).	Reclamation
CR-23	Access to Lake Granby boat ramps at Arapaho Bay, Stillwater, and Sunset could diminish in some months.	Proposed change in project operation in dry years will keep Granby higher.	None. Modified prepositioning discussed in CR-3 would maintain higher water levels in Lake Granby during years when the reservoir is anticipated to fall below elevation 8,250 msl thereby improving boat ramp access.	Reclamation
CR-24	Effects on recreational fishing in the Colorado River downstream of the Windy Gap diversion from habitat loss and temperature impacts between Windy Gap and the Blue River.	Includes float fishing.	Proposed mitigation for Surface Water Quality should reduce effects on recreational fishing.	Reclamation, Corps, CDOW

Table 1: WEST SLOPE - Colorado River

Item No.	EIS Impacts	CDOW Issues	Proposed Mitigation	Mitigation Agency
Socioeconomics				
CR-25	Lost recreational boating value in the Colorado River in some years due to lower flows. Although preferred boating flows are not always met, rafting and kayaking opportunities would remain (i.e. flows would rarely drop below minimum flows needed for boating).			
CR-26	Reduction in aesthetic value in Grand Lake if algae concentrations increase.	Additional issues in Shadow Mountain.	Nutrient mitigation measures discussed in CR-10 would offset nutrient loading from increased WGFP pumping.	Reclamation, Corps

Table 2: EAST SLOPE - South Platte Tributaries and Chimney Hollow Reservoir

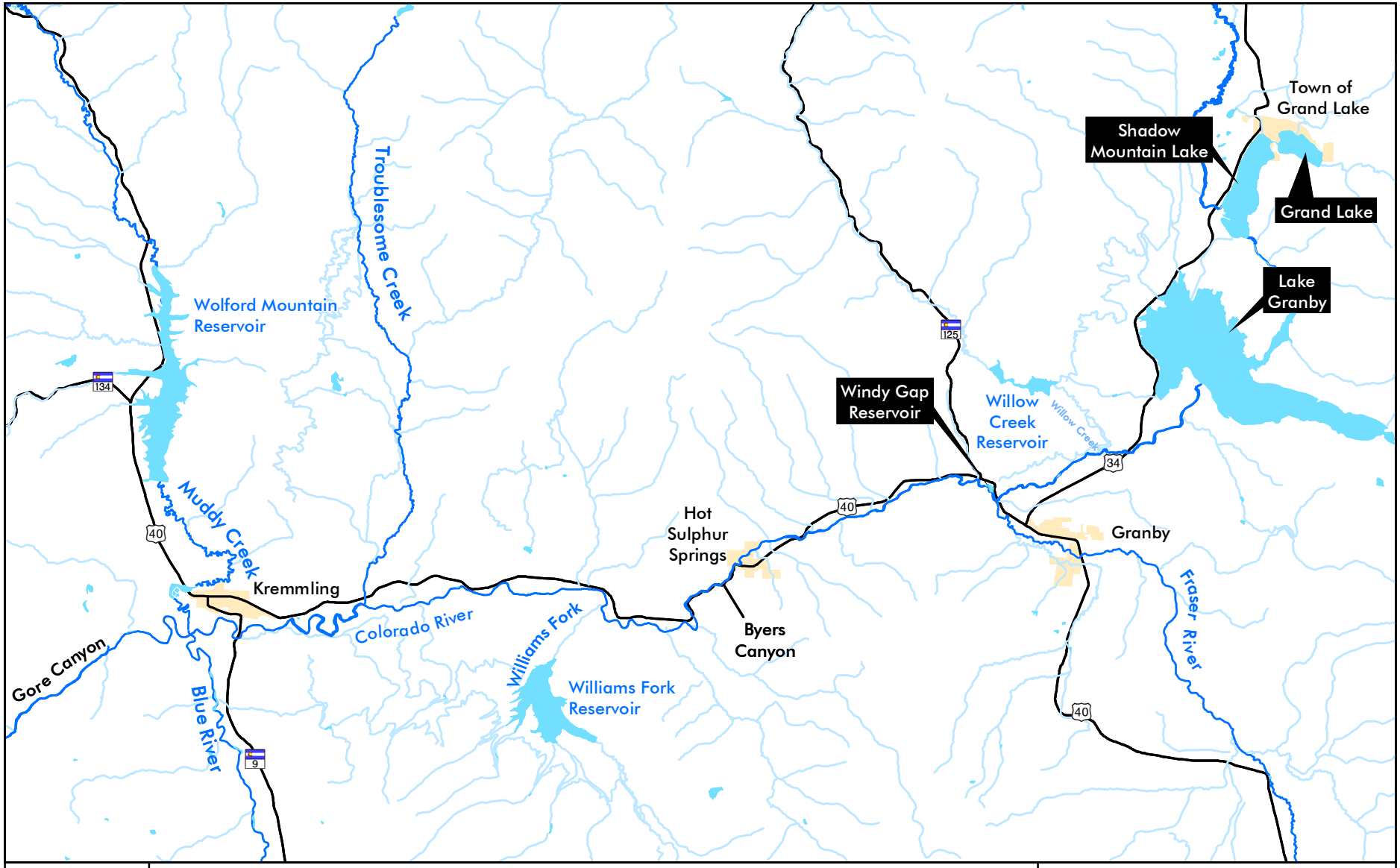
Item No.	EIS Impacts	CDOW Issues/Concerns	Proposed Mitigation	Mitigation Agency
Surface Water Hydrology				
ES-1	Lower water levels in Carter Lake (~1').	Earlier fill is better for walleye.	None. However, modified prepositioning as discussed in CR-3 would result in smaller changes in water levels (<1' lower).	Reclamation
ES-2	Lower water levels in Horsetooth Reservoir (6' lower on avg.).	Higher nutrients and lower DO may complicate 303D listing status.	None. However, modified prepositioning as discussed in CR-3 would result in smaller changes in water levels (<2' lower).	Reclamation
Groundwater				
ES-3	Small changes in East Slope stream stage that would not significantly impact alluvial groundwater levels.	Addressed in terms of stage change as percentage of total flow. Negligible impact on fisheries and riparian zone.	None	
ES-4	Small changes in surface water quality in East Slope streams and reservoirs would have minor effect on groundwater quality.	Addressed in terms of stage change as percentage of total flow. Negligible impact on fisheries and riparian zone. Corrected by NPDES permits.	None	
Stream Morphology and Floodplain				
ES-5	Increased flows on East Slope streams below WWTPs could have slight effect on channel morphology.		None	
ES-6	Flows in East Slope streams would increase slightly.		None	
Surface Water Quality				
ES-7	Increased ammonia concentrations in St. Vrain Creek, Big Dry Creek, Coal Creek as a result of increased discharges from Participant WWTP's.	Based on standards and NDPES permits. Participants must meet ammonia discharge limitations in accordance with Colorado water quality standards and as part of their NPDES Permit for WWTP discharges.	None	
ES-8	Nutrient increases (TP, TN) resulting in higher chlorophyll *a* concentrations and a decrease in DO in Carter Lake and Horsetooth.		None. In accordance with CR-10, plans to monitor and mitigate nutrient increases in the Three Lakes system should address this issue and the plans must be approved by Reclamation and the Corps.	Reclamation, Corps
Aquatic Resources				
ES-9	Construction of Chimney Hollow Reservoir would create potential flat water fishing opportunities if a fishery is established in Chimney Hollow.	Construction of reservoir will replace terrestrial environment with aquatic environment, displacing terrestrial wildlife and allowing the replacement by aquatic wildlife.	None	
ES-10	Lower water levels in Carter Lake and Horsetooth Reservoir would slightly reduce available fish habitat.	Negligible impact under expected operations.	None. However, modified prepositioning as discussed in CR-3 would result in smaller changes in water levels.	

Table 2: EAST SLOPE - South Platte Tributaries and Chimney Hollow Reservoir

Item No.	EIS Impacts	CDOW Issues/Concerns	Proposed Mitigation	Mitigation Agency
Vegetation				
ES-11	Temporary impact to 123 acres of vegetation during construction of Chimney Hollow Reservoir.	Includes pipeline ROW and contractor staging area. Reveg with wildlife friendly seed mixes. 1298 Final BMPs	Revegetation, and weed control on all disturbed areas in accordance with an erosion control plan to be developed by the Subdistrict and approved by Reclamation and the Corps. Plan will be developed in coordination with CDOW and incorporate CDOW Oil & Gas BMPs where appropriate.	Reclamation, Corps, CDOW
ES-12	Permanent loss of 788 acres of vegetation from inundation and dam at Chimney Hollow.	Hunting Access	None. Larimer County maintains land management plan for Chimney Hollow open space area which includes forestry, vegetation management, and weed control.	CDOW
Wetlands				
ES-13	Temporary disturbance of about 0.2 acres of wetlands during Chimney Hollow Reservoir construction.	Corps issue-compensatory mitigation.	Avoid, minimize and mitigate wetland impacts as specified in the 33 CFR Part 332 (Mitigation Rule, 10-Apr-08) and as approved by Reclamation and the Corps.	Corps
ES-14	Permanent impact to about 2 acres of wetlands at Chimney Hollow Reservoir.	Corps issue-compensatory mitigation.	Avoid, minimize and mitigate wetland impacts as specified in the 33 CFR Part 332 (Mitigation Rule, 10-Apr-08) and as approved by the Corps. Wetlands would be mitigated by contribution to an approved wetland mitigation bank.	Corps
ES-15	Permanent impact to about 0.5 acres of waters of the U.S. along Chimney Hollow.	Corps issue-compensatory mitigation.	Avoid, minimize and mitigate wetland impacts as specified in the 33 CFR Part 332 (Mitigation Rule, 10-Apr-08) and as approved by Reclamation and the Corps.	Corps
Wildlife				
ES-16	Loss of 810 acres of elk winter range, mule deer winter range and concentration area, and black bear foraging area at Chimney Hollow.	Access for hunting; improve vegetation to draw elk and/or bears.	Subdistrict will work with CDOW and Larimer County to allow hunting access on property to minimize displacement of game animals to other areas.	
ES-17	General loss of habitat for other terrestrial species, birds, amphibians, reptiles, and butterflies at Chimney Hollow.	Includes reservoir inundation area and pipeline ROW. ≈ 2 mile loss of riparian habitat in inundated stream channel.	Revegetation and weed control on all disturbed areas in accordance with an erosion control plan to be developed by the Subdistrict and approved by Reclamation and the Corps. Plan will be developed in coordination with CDOW and incorporate CDOW Oil & Gas BMPs where appropriate. Implement migratory bird mananagement plan and seasonal restrictions and buffer zones.	
ES-18	Loss of 7 acres of bald eagle winter range at Chimney Hollow. This effect is minor as there is sufficient bald eagle wintering habitat in the area. New reservoir would provide open water foraging habitat for bald eagles.		None	
Threatened and Endangered Species				
ES-19	No impact at Chimney Hollow.		None	
Geology				
ES-20	Potential for uncovering fossils during Chimney Hollow Reservoir construction.		Paleontological survey would be conducted prior to construction and the Denver Museum contacted if important fossils discovered. Paleontological resources will be dealt with in accordance with the programmatic agreement or memorandum of agreement between Reclamation, the State Historic Preservation Officer, the Subdistrict, and possibly the Advisory Council.	Reclamation
Soils				
ES-21	Temporary and permanent loss of soil during Chimney Hollow Reservoir construction.	BMPs for pipelines, dam construction. SWMP (CDPHE) by contractor.	Erosion control and revegetation.	Reclamation
ES-22	Shoreline erosion at Chimney Hollow Reservoir.		None	
Air Quality				
ES-23	Dust and vehicle emissions during Chimney Hollow Reservoir construction.	Adaptive management, blasting for three years.	A fugitive particulate emissions control plan and BMPs would be developed and must be approved by the Corps in order to meet requirements for Colorado Air Quality Control Standards.	Reclamation
ES-24	Increased ambient noise from construction of Chimney Hollow Reservoir.	Displacement of wildlife.	BMPs to minimize noise.	

Table 2: EAST SLOPE - South Platte Tributaries and Chimney Hollow Reservoir

Item No.	EIS Impacts	CDOW Issues/Concerns	Proposed Mitigation	Mitigation Agency
Land Use				
ES-25	A portion of Chimney Hollow would be located on private property or Larimer County property.	Near CH dam - toes of 35 acre parcels on ridge, purchase of horizontal land on edge of CH.	Private land acquisition or the necessary access rights and easements.	Reclamation
ES-26	A portion of Chimney Hollow Reservoir facilities would be located on Reclamation property.	Facilities around Flatiron Reservoir on USBR land - easement w/USBR.	Easements or appropriate permits from Reclamation would be acquired.	Reclamation
ES-27	Sandstone quarry operations could be affected by southern access road to Chimney Hollow Reservoir.	Road uncertain, could be used for hunting access; seasonal closure?	Quarry access would be maintained.	Reclamation
ES-28	Increased construction traffic on CR 18E and CR 31 and impacts to roads during reservoir construction and from recreation access to Chimney Hollow Open Space managed by Larimer County.	Potential for elk/car/truck encounters- add signing.	The Subdistrict would comply with all County road and permitting requirements.	Reclamation
Recreation				
ES-29	Access to the South Bay-South boat ramp in Horsetooth could be impacted.		None. Modified prepositioning discussed in CR-3 would maintain higher water levels in Lake Granby during years when the reservoir is anticipated to fall below elevation 8,250 msl thereby improving boat ramp access.	Reclamation
Cultural Resources				
ES-30	Twenty-four eligible or potential eligible cultural resources could be impacted by construction of Chimney Hollow Reservoir.		Compliance with Section 106 of the National Historic Preservation Act including additional evaluation and mitigation will be conducted in coordination with Reclamation, the Corps of Engineers, and SHPO. Cultural resources will be dealt with in accordance with a Programmatic Agreement or MOA to be developed and signed by Reclamation, the SHPO, and the Subdistrict.	Reclamation, Corps, SHPO
Visual Quality				
ES-31	Temporary impacts from construction of Chimney Hollow Reservoir.	Mostly human, not wildlife.	Revegetation and BMPs.	Reclamation
ES-32	Permanent changes in landscape.		Revegetation, weed control, maintenance.	Reclamation
ES-33	Relocation of transmission line.	115KV line, inline construction, tall poles - raptor protection included in WAPA design standards.	Visual sensitivity analysis conducted in siting relocated transmission line. , Nonspecular, nonreflective wire would be used and possibly nonreflective steel poles. All site disturbances would be revegetated following construction.	Reclamation
Socioeconomics				
ES-34	Property Acquisition.		None Any properties required to be purchased for the project would be purchased for just compensation following an appraisal in accordance with the Water Conservancy Act (CRS 27-45-101 to 153) and other applicable state laws.	



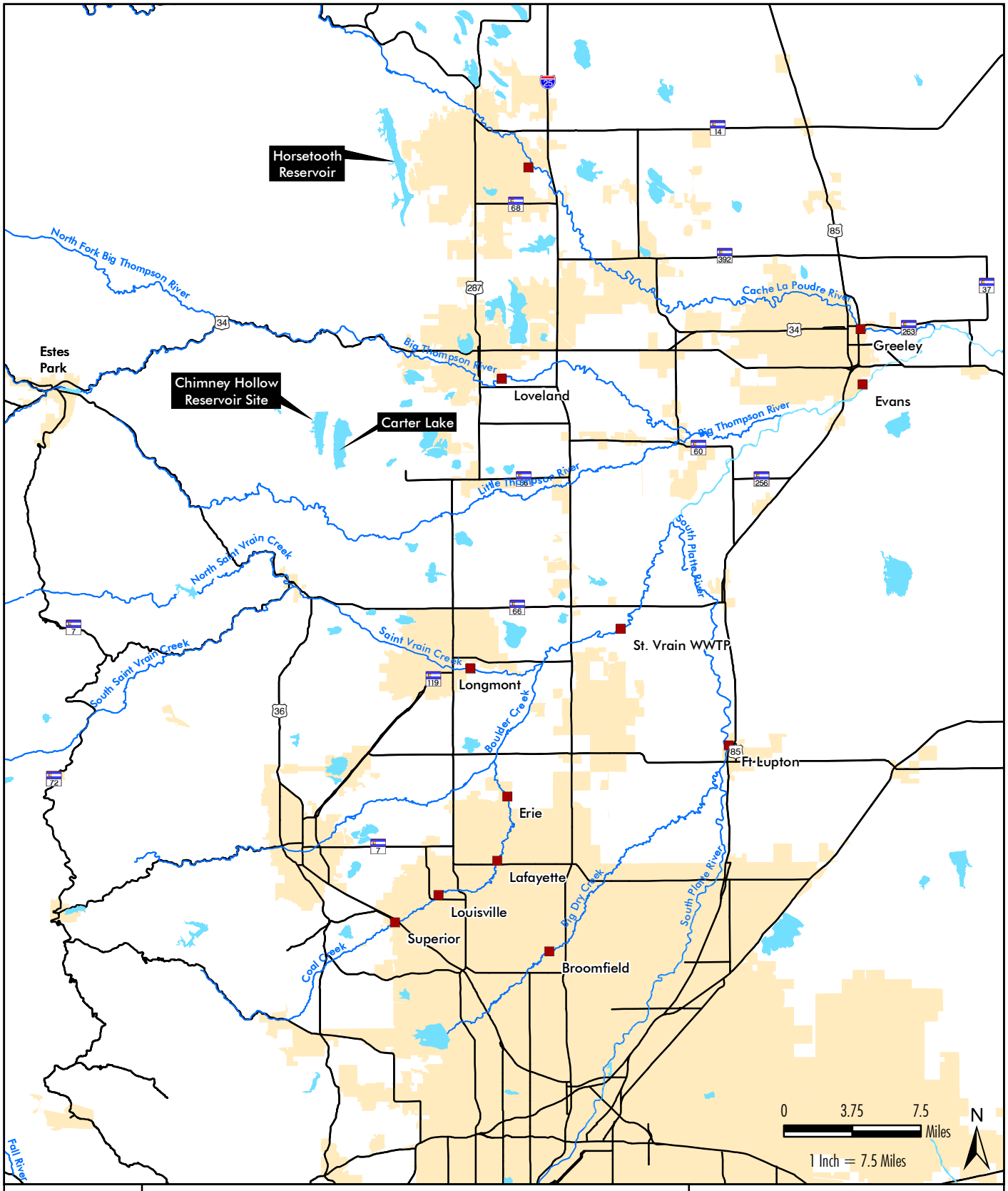
ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

City
Lake or Reservoir
Major Streams
Minor Streams
Highway

0 2 4 Miles
1 Inch = 4 Miles
N

Figure 1
West Slope Project

Prepared for: Windy Gap Firming Project
File: 2390 EIS\WM_WestSlopeWaterResource.mxd (JP)
July 2009

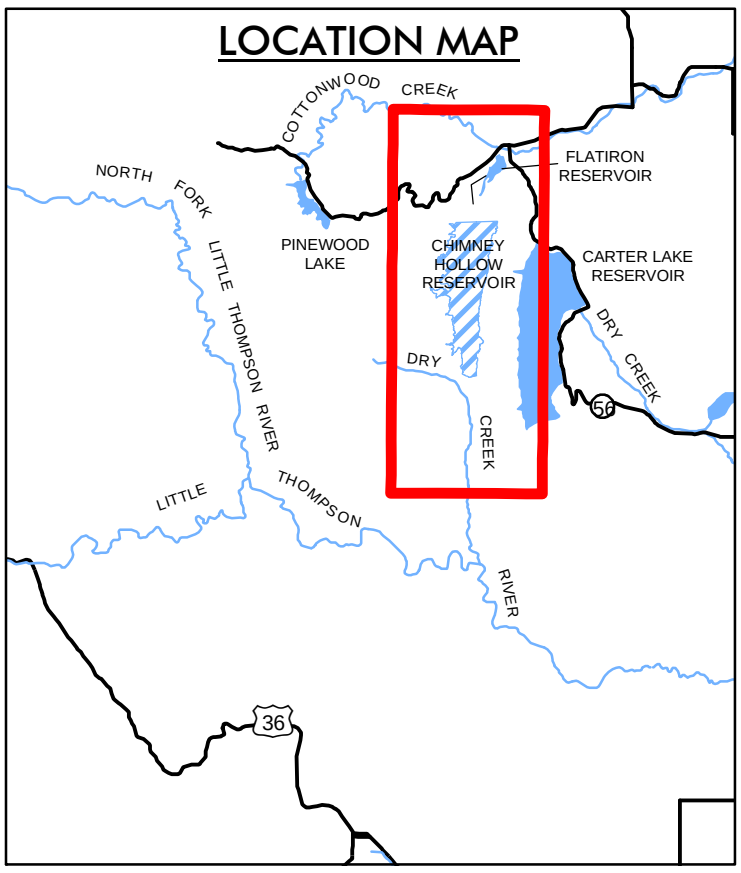


ERO
ERO Resources Corp.
1842 Clarkson Street
Denver, CO 80218
(303) 830-1188
Fax: (303) 830-1199

- Waste Water Treatment Plant
- Lake or Reservoir
- Highway
- Major Streams
- City

Figure 2
East Slope Project

Prepared for: Windy Gap Firming Project
File: 2390 EIS\WM_EastSlopeWaterResource.mxd (JP)
June 2009



Inlet - Outlet Tunnel

Spillway and Channel

New Pipeline

Potential Disturbance Area

Transmission Line Corridor

Chimney Hollow Reservoir

Dam

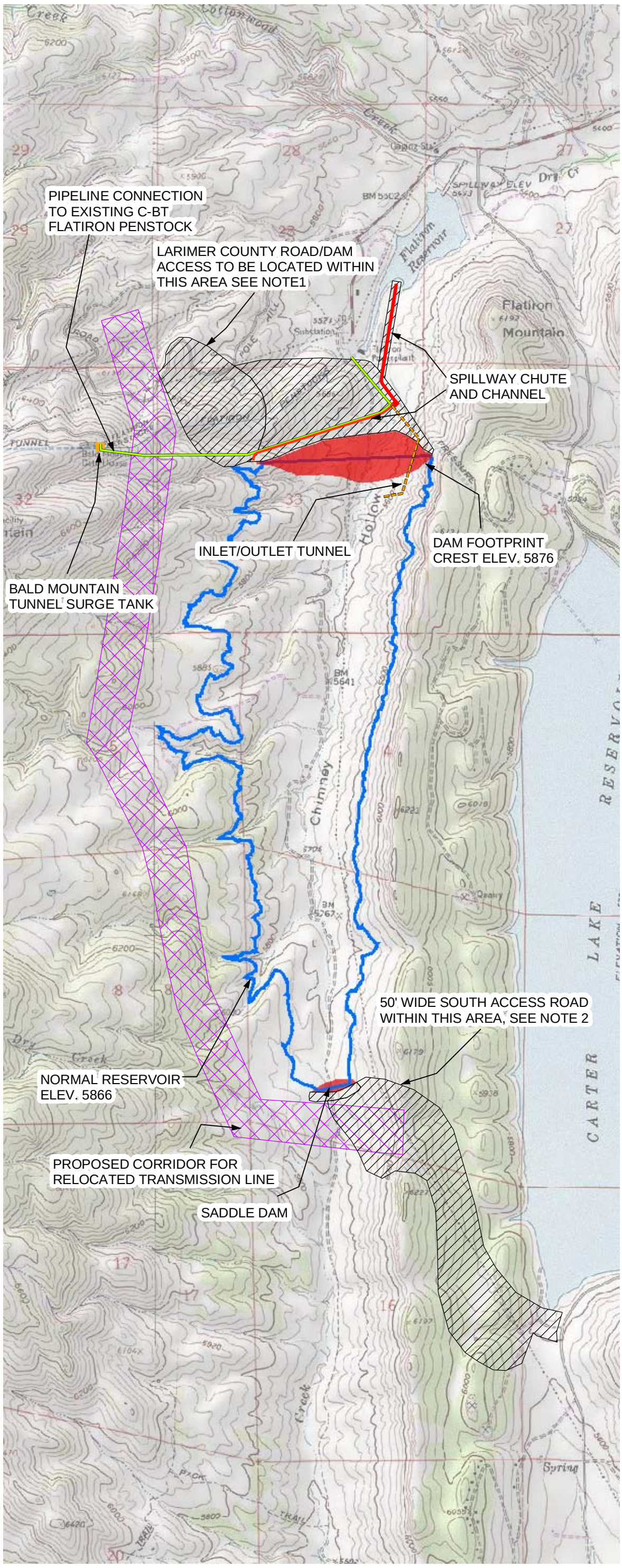
NOTES:

1. FINAL LOCATION OF DAM CREST ACCESS ROAD TO BE DETERMINED THROUGH LARIMER COUNTY PARK PLANNING PROCESS.
2. SOUTH ACCESS ROAD DURING CONSTRUCTION - GATED WITH NO PUBLIC ACCESS FOLLOWING CONSTRUCTION.

0 2,000 4,000 Feet

N

"USGS MAP OF THE CARTER LAKE RESERVOIR QUADRANGLE, BOULDER AND LARIMER COUNTIES, COLORADO"
SITE SPECIFIC TOPOGRAPHY BASED ON AERIAL SURVEY, APRIL 2003



WINDY GAP FIRMING PROJECT

Figure 3
Chimney Hollow Reservoir (90,000 AF)

Windy Gap Firming Project