

CR 3 Stream Reach Summary

Study Reach: CR3, Colorado River - Granby Reservoir outlet downstream to Windy Gap Reservoir.

Reach Description: Approximate channel length: 8.75 miles, approximate channel slope 0.8%.

This reach of the Colorado River spans from Granby Reservoir outlet to Windy Gap outlet, truncated by crossings under U.S. Highway 34 and 40. It begins relatively confined and steep near the outlet of Granby Reservoir. As the river flows downstream, the valley slopes flatten, the valley and channel open and sinuosity increases. Land use along this reach has traditionally been agriculture, however in recent years residential development has occurred near and along the riverbanks. Recreational fishing is popular in this reach and is also influencing land use changes including the Orvis and Shorefox LLC Development, located upstream of U.S. Highway 40, spanning over a mile of the Colorado River. As of 2008 construction of the project, including infrastructure, a golf course and river improvements, was halted. As of May 2010, it is unknown if construction will continue and if other restoration improvements are planned.

Several sections of CR 3 have undergone physical restoration to enhance trout habitat under low flow conditions. Channel modifications were observed in areas immediately downstream of Granby Reservoir, within the Orvis and Shorefox site and in several areas downstream of the Highway 34 crossing.



Colorado River at Highway 34 near the Ouray Ranch and County Road 623



Colorado River between Miller, Orvis and Shorefox, LLC property

Flow Recommendations:

Environmental Flow Methodology: A PHABSIM study site was established within this reach below Willow Creek confluence in summer 2007. See Appendix A for methodology and Appendix E for PHABSIM survey information. CWCB instream flows have been set within CR3 and the U. S. Fish and Wildlife Service (USFWS 1951) developed minimum flow recommendations for the Colorado River both upstream and downstream of Willow Creek. In addition, in 1961 the U.S. Department of the Interior developed “Principles to govern the Release of Water at Granby Dam to provide Fishery Flows immediately Downstream in the Colorado River” (Department of the Interior 1961).

Water Users:

- Irrigators, municipalities and industry flow-related issues: None reported.
- Recreational flows: Angling is the predominant recreational use in this reach. Due to abundance of private land most of the fishing is guided or by members of fishing clubs.

Summary of Flows:

Environmental, recommended target flow ranges

- 90 to 160 cfs, April through September
- 40 to 100 cfs, October through March
- Flushing flow, at least 200 cfs for 3-day duration with a frequency of 1 in 2 years during the late-May to late-June period.

CWCB flows

- 40 cfs summer (05/1 – 09/30)
- 20 cfs winter (010/1 – 04/30)

USFWS Flows (above Willow Ck) (USFWS 1951)

- 50 to 100 cfs, April through September
- 35 to 85 cfs, October through March

USFWS Flows (below Willow Ck) (USFWS 1951)

- 65 to 130 cfs, April through September
- 42 to 100 cfs, October through March

1961 Principles (U.S. Department of the Interior 1961)

- 75 cfs May through July
- 40 cfs August
- 20 cfs September
- 20 cfs October through April

Water Users:

- Irrigators, municipalities and industry: The local diversions in this reach could potentially divert up to approximately 75 cfs. Most of the diversions are made in the summer for irrigation and will likely have some return flows.
- Recreation:
 - Angling: none reported.

Stream Assessments: In August 2008 Tetra Tech conducted two stream assessments in two locations along CR3. These included a Stream Reach Inventory /Channel Stability Evaluation (SRI/CSE) and an EPA Habitat Quality Assessment (HQA). One site was at the PHABSIM site established in 2007, and the second, referred to as the Upper site, at County Road 623 bridge. The SRI/CSE scored in the ‘good’ category at the Upper site and ‘fair’ at the PHABSIM site, while the EPA HQA scored ‘marginal’ at the Upper site and ‘suboptimal’ at the PHABSIM site. An RSI was conducted in CR3 but the results are not reported here as the 2008 antecedent high flow of 92cfs in this highly regulated reach was likely not of sufficient magnitude and stage to deposit large sediment particles on the adjacent point bar.

Relevant issues revealed in the stream assessments at the Upper site include the presence of fish passage barriers, lack of flows in the late summer and fall, lack of aquatic habitat structure and cover, and marginal riparian vegetation cover and width. At the PHABSIM site, aquatic habitat structure and cover were also lacking and the stream bed was heavily embedded with finer sediments in locations having moderate to low water velocities. Results of the assessments are summarized in the following tables and plot. Details and methodology are presented in Appendix A.

Reach CR3-U Stream Assessments					
Stream Reach Inventory/Channel Stability Evaluation		EPA Habitat Quality Assessment			
Attribute		Attribute	Score		
Upper Banks		Channel			
1	Landform Slope	4	1 Aquatic Habitat Barriers/ Diversion	2	
2	Mass wasting hazard	6	2 Aquatic Structure as Cover	6	
3	Debris Jam Potential	4	3 Velocity/ Depth Regimes	11	
4	Vegetation Cover	9	4 Channel Flow Status	10	
Upper Bank Score: 23		5	Channel Alteration	12	
Lower Banks		6	Frequency of Riffles	11	
5	Channel Capacity	4	7 Channel Sinuosity	8	
6	Bank Rock Content	4	Channel Score	60	
7	Flow obstructors & Deflectors	3	Banks		
8	Cutting	4	8 Bank Stability	18	
9	Deposition	4	9 Riparian Vegetation Cover and Disturbance	10	
Lower Bank Score: 19		10	Riparian Vegetation zone width	10	
Channel Bottom		Bank Score		38	
10	Rock Angularity	2	Total Score		
11	Brightness	2	98		
12	Consolidation/Particle Packing	5	Notes		
13	Bottom size distribution	6			
14	Bed Scour and Deposition	12			
15	Clinging Aquatic Veg	1			
Channel Bottom Score: 28					
Total Score: 70					

Reach CR3-L Stream Assessments			
Stream Reach Inventory/Channel Stability Evaluation		EPA Habitat Quality Assessment	
Attribute		Attribute	Score
Upper Banks		Channel	
1	Landform Slope	2	1 Aquatic Habitat Barriers/ Diversion
2	Mass wasting hazard	3	2 Aquatic Structure as Cover
3	Debris Jam Potential	4	3 Velocity/ Depth Regimes
4	Vegetation Cover	6	4 Channel Flow Status
Upper Bank Score: 15		5	Channel Alteration
Lower Banks		6	Frequency of Riffles
5	Channel Capacity	3	7 Channel Sinuosity
6	Bank Rock Content	8	Channel Score 86
7	Flow obstructors & Deflectors	5	Banks
8	Cutting	4	8 Bank Stability
9	Deposition	6	9 Riparian Vegetation Cover and Disturbance
Lower Bank Score: 26		10	Riparian Vegetation zone width
Channel Bottom			Bank Score 50
10	Rock Angularity	3	Total Score 136
11	Brightness	2	Notes
12	Consolidation/Particle Packing	6	
13	Bottom size distribution	10	
14	Bed Scour and Deposition	18	
15	Clinging Aquatic Veg	3	
Channel Bottom Score: 42			
Total Score: 83			

Spawning Observations: A trout spawning survey was conducted in the vicinity of the PHABSIM site on 29 October 2008. Eight likely brown trout redds were identified and measured.

Hydrologic Records: USGS Gage Station 09019500 has been operated seasonally within CR3 from 1962 to the present, and year around from 1908 to 1911 and 1934 to 1953. The daily streamflow exceedence plots describe the unusual flow regime in this reach over the past 45 years, with low stable flows predominating and infrequent (11) high flow events (greater than 1000 cfs) occurring when water is likely being spilled from Granby Dam. The IHA analysis comparing this recent period with the early record documents the dramatic flow alteration that has occurred. For example, the June median flow has declined from 1090 to 75 cfs, while the September median flow has been reduced from 92 to 19 cfs.

Water Temperature: CR3 is a Tier II stream reach as designated by CDPHE with a chronic temperature standard of 18.2°C MWAT and an acute temperature standard of 23.8°C DM. Temperature data reviewed in reach CR3 indicate stream temperatures for the Colorado River in this area are generally well below the MWAT and DM standards.

Water Quality: Increased pumping of water from the Colorado River at Windy Gap would result in an increase in nutrient loading to Granby Reservoir (HRC 2003); however, it is not clear if this potential change would affect the river immediately below. No other water quality concerns were noted from the available water quality data.

Water Supply Issues (UPCO): There are no reported water supply issues noted in the UPCO report.

Summary of Results and Additional Remarks:

1. There has been an unusual flow regime in this reach over the past 45 years, with low stable flows predominating and infrequent high flow events (greater than 1000 cfs) occurring when water is likely being spilled from Granby Dam.
2. The recommended target flow ranges often exceed the late summer and fall flows Reach CR3 has experienced. Although no winter flow records are available, it is likely the recommended winter targets as well as the CWCB instream flows also exceed the flows experienced.
3. Aquatic habitat quality within CR3 is limited by a lack of flow and habitat structure, the presence of fish passage barriers, heavily embedded moderate and low velocity habitats, and a riparian zone in less than optimum condition.
4. Temperatures and water quality are supportive of a cold-water fishery.
5. There is little float boating in CR3 due to limited access and low flows.
6. The '1961 Principles' developed by the Department of the Interior for flow releases from Granby Reservoir, were established to "provide the water to preserve at all times that section of the Colorado River...as a live stream, and also to insure an adequate supply for irrigation, for sanitary purposes, for the preservation of scenic attractions and for the preservation of fish life." These flows, however, are not consistent with the flows recommended by the USFWS in 1951, developed in support of the 1961 Principles.
7. The 1951 USFWS report (USFWS 1951) and our recommended target flow ranges are relatively similar. This is likely due to the 2007 study site being located within a fairly natural, unaltered channel section whose dimensions have been maintained by the occasional high flow events that still occur below Granby Reservoir Dam. Recommendations may have varied had the site been located within one of the several sections within the reach which have been reconstructed to maximize trout habitat under low flow conditions.
8. There have been antidotal accounts of pools freezing to the stream bed in the winter in areas along the upper reaches of CR3 behind or upstream of control structures. It is not clear at this time if these structures are associated with diversions or if they were constructed as part of an effort to improve habitat.
9. In 2007 Orvis and Shorefox LLC were developing a 1,500-acre fly-fishing and golf course resort immediately upstream of Windy Gap. The project included habitat restoration along the Colorado River and a system of lakes and ponds within the property. Indications are that the river restoration was geared toward cutthroat trout, although actual design parameters, including flow regime is unavailable for inclusion in this report. It is also unknown at this time how the change from agricultural land use to recreational land use will effect flow quantities, temperature and water quality. Monitoring of the river and coordination with the landowners is recommended as future phases of the Stream Management Plan progress. Of special interest is how the reduction in irrigation and return flows will affect flows above and below Windy Gap. This project was halted mid-way through construction and as of April 2010 still not progressed. Surface erosion from incomplete construction has and could continue to result in heavy loading of fine sediments into the Colorado River system.
10. This reach of the Colorado River is highly regulated and typically has very low flows. However this reach is also subject to extreme high flows when spills occur out of Granby Reservoir. This reach may also undergo flow regime changes as a result of operational changes. Ongoing and future restoration efforts should accommodate spill conditions as well as the lower flow scenarios and other pending operational changes such as release of flow enhancements.
11. Review of future flow conditions as depicted by Denver Water's PACSM model indicate that the late summer flows, flushing flows and winter base flows, without flow enhancements or restoration, will be typically lower than target ranges recommended for this reach.

Restoration Opportunities: Recommendations presented here are aimed at reducing the impacts of frequent low flows in late summer, reducing the frequency and extent of freezing in the winter, lack of flushing flows, and lack of aquatic structure and cover in the downstream sections of this reach. Specific restoration opportunities include:

- ✓ Apply enhancement flows to increase low flows, typically in August and September and/or to increase flushing flows during spring runoff. Alternate application of enhancement flows and flushing flows as needed.
- ✓ Increase aquatic cover with ‘cover and pool’ structures and construct channel bar enhancements to narrow the low flow channel. See Appendix F for details.
- ✓ Investigate some of the river improvements that have occurred along this portion of the reach. Determine if the frozen ponds are associated with restoration efforts. Also, determine the target flow regime for these improvements and compare to recommended flows herein.
- ✓ Inspect headgates at irrigation diversions and replace as needed where stream bed manipulation is currently required to maintain adequate headwater.
- ✓ Implement BMPs on the Orvis and Shorefox property to control erosion and fine sediment loading into the Colorado River system.
- ✓ Further analysis should be conducted to evaluate minimum flows and ramping rates of releases from Granby Reservoir.

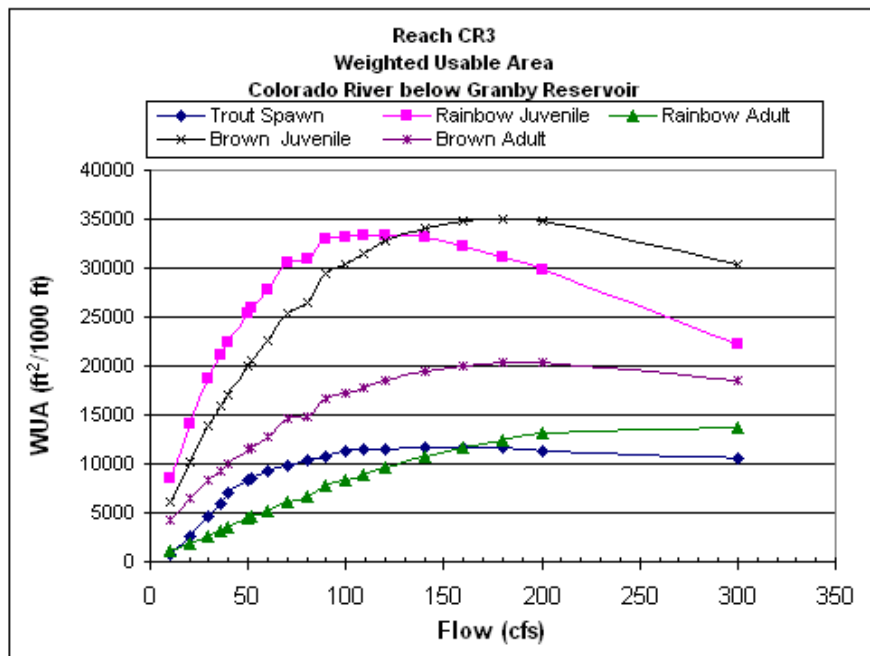
Monitoring: Establish and implement a monitoring program. Parameters should include winter streamflows and summer air temperature. Continue to monitor surface water temperatures and summer flows. Additional recommendations may be forthcoming following review of previous river improvements as outlined above.

Support Data

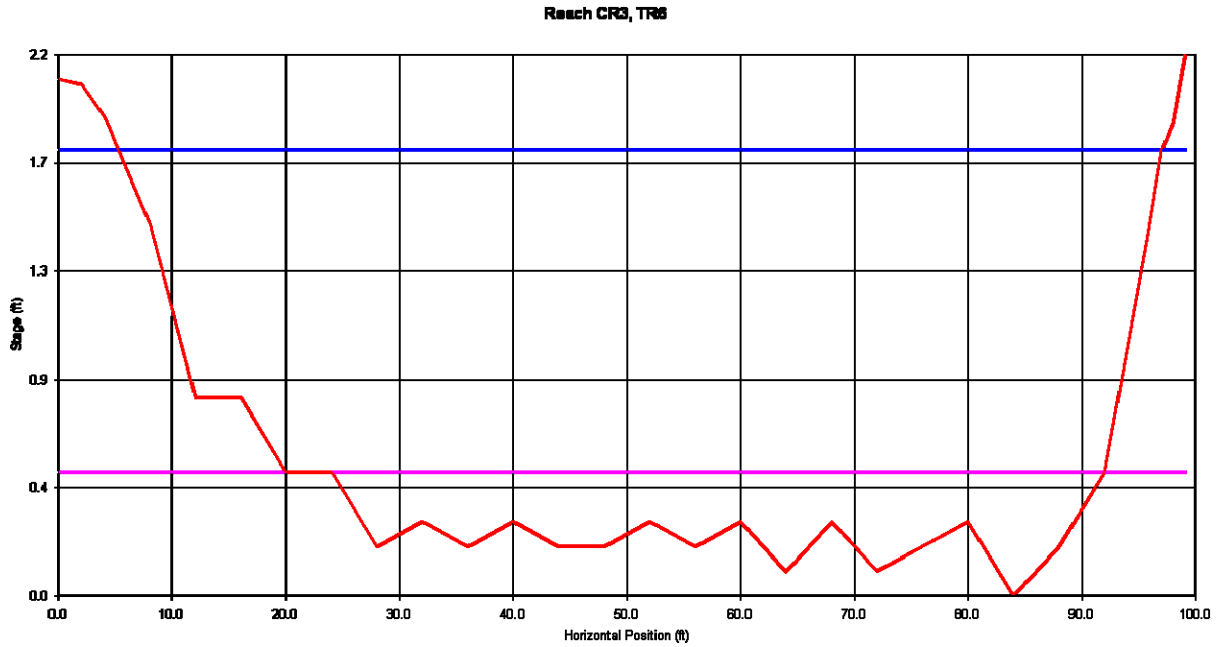
Weighted Useable Area Plots and Tables

Habitat-flow relations for the target species and life stages for Reach C3, Tetra Tech site.

Reach C3						
Discharge	Total Area	Trout Spawn	Rainbow Juvenile	Rainbow Adult	Brown Juvenile	Brown Adult
(cfs)	(ft ²)	Weighted Useable Area (ft ² /1000 ft stream length)				
10.0	54436.8	689.9	8441.9	1150.5	6093.3	4325.4
20.0	30617.1	2506.6	14019.6	1912.8	10147.7	6505.2
30.0	59742.0	4672.9	18721.9	2664.2	13801.7	8306.5
36.0	62980.4	5902.8	21072.4	3156.4	15838.0	9293.5
40.0	65479.9	7021.8	22424.6	3527.2	17103.9	9979.4
50.0	36789.8	8370.9	25394.3	4374.9	19998.4	11440.1
52.0	67144.3	8546.5	25920.3	4541.8	20535.1	11719.9
60.0	68146.0	9207.6	27818.9	5192.1	22523.6	12767.5
70.0	69107.7	9792.7	30502.6	6147.7	25376.6	14539.7
80.0	69986.2	10285.3	30952.4	6687.5	26554.0	14904.0
90.0	70850.8	10670.7	33055.6	7742.6	29356.3	16726.1
100.0	71607.8	11237.0	33055.6	8299.6	30425.3	17147.6
109.0	37706.8	11396.0	33320.4	8897.7	31551.4	17805.4
120.0	38417.5	11551.5	33420.3	9585.7	32702.8	18496.5
140.0	40042.9	11691.0	33111.5	10698.8	34143.6	19419.3
160.0	76067.3	11723.3	32311.7	11695.8	34769.4	20008.7
180.0	41794.7	11594.1	31160.2	12496.9	34919.3	20312.9
200.0	42021.9	11366.9	29858.0	13103.8	34724.4	20357.8
300.0	45126.3	10519.5	22254.6	13628.3	30367.9	18467.9



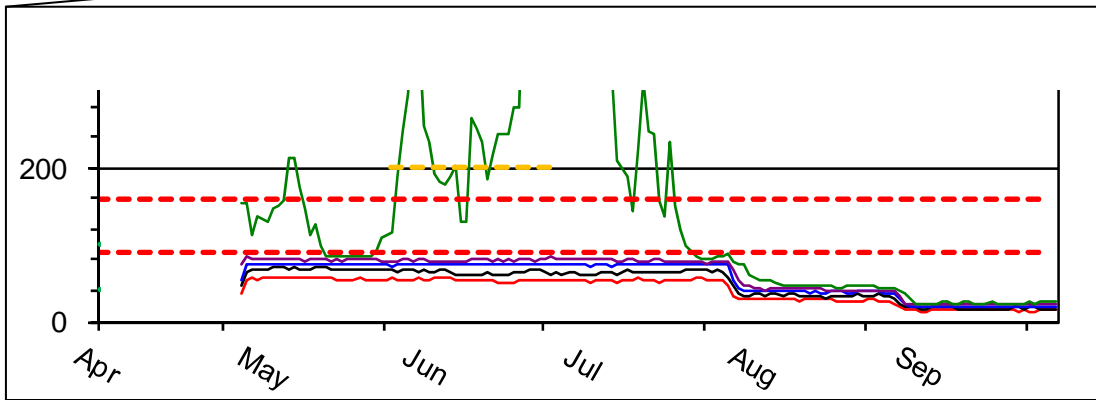
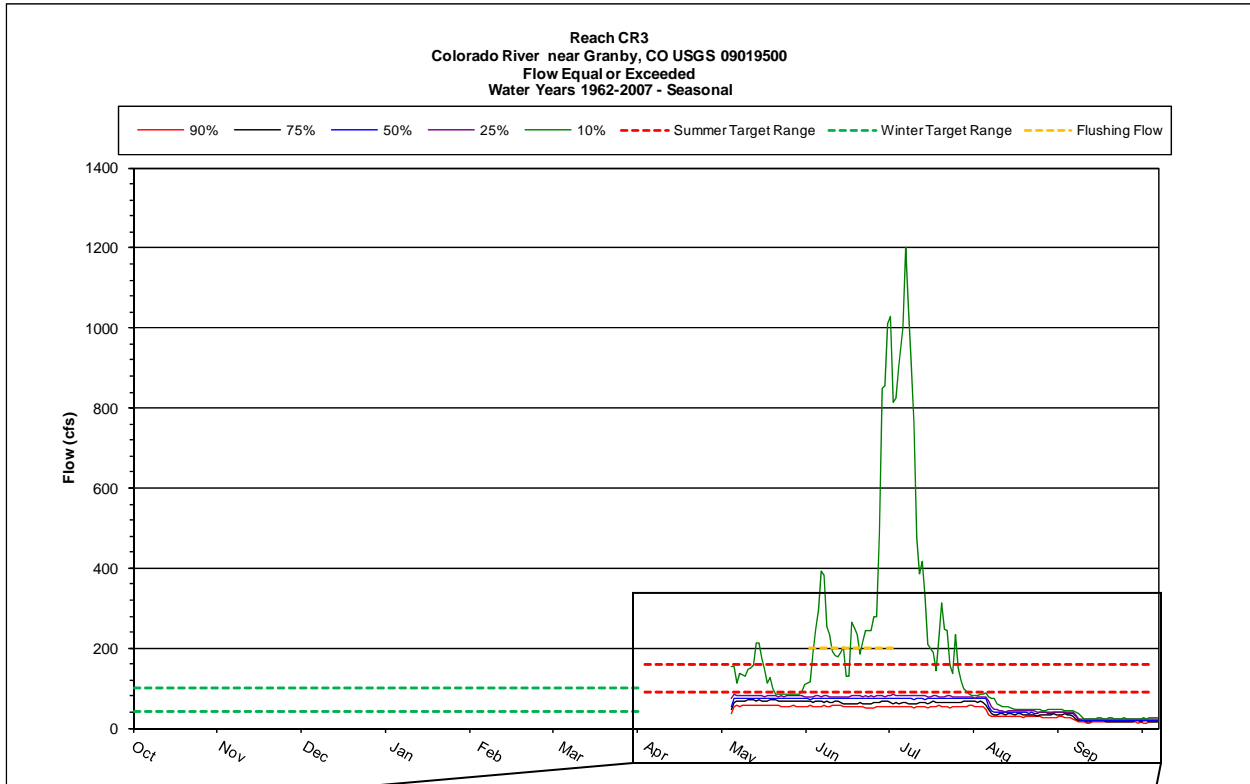
Transect and Bedload Threshold Plots and Tables

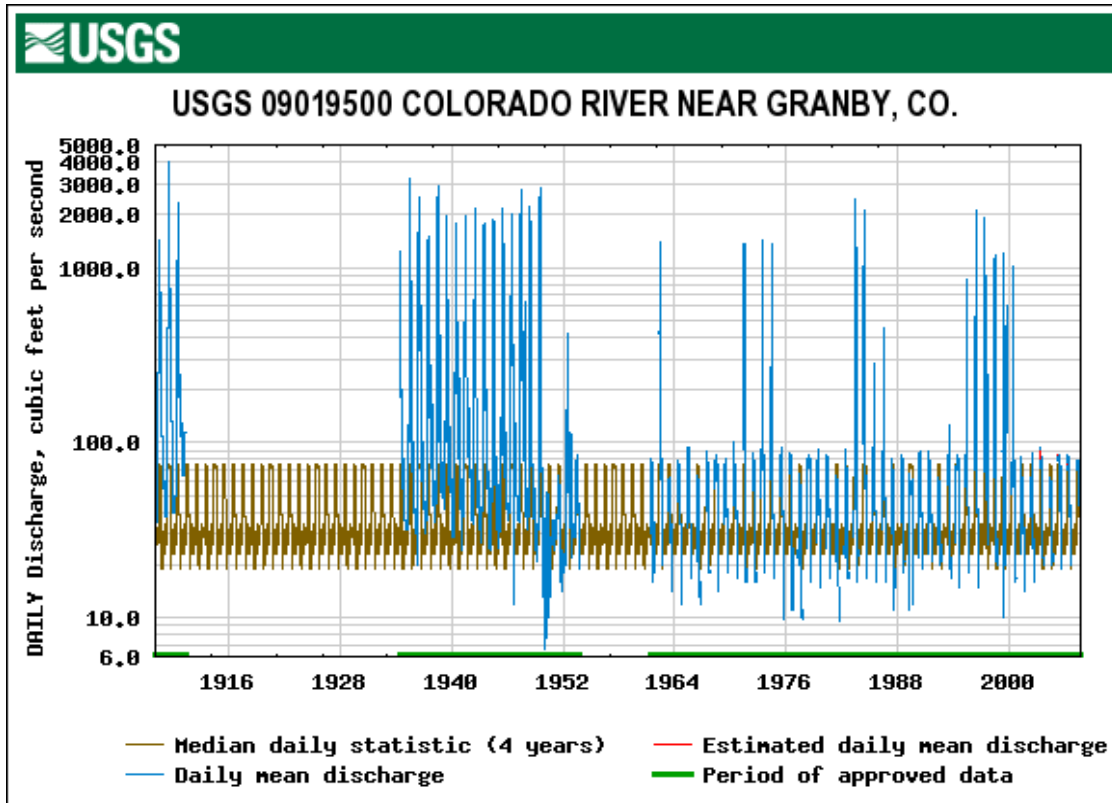


Reach CR3, TR 6
 Colorado River below Granby Reservoir
 TT2007 site
 Resistance Method: Jarrett's Equation

STAGE (ft)	AREA (sq ft)	PERIM (ft)	WIDTH (ft)	R (ft)	DHYD (ft)	SLOPE (ft/ft)	n	VAVG (ft/s)	Q (cfs)	SHEAR (psf)
0.5	18.40	68.06	68.00	0.27	0.27	0.002	0.045	0.61	11.2	0.03
0.6	25.69	73.81	73.73	0.35	0.35	0.002	0.044	0.75	19.3	0.04
0.7	33.14	75.56	75.46	0.44	0.44	0.002	0.042	0.91	30.2	0.05
0.8	40.78	77.30	77.19	0.53	0.53	0.002	0.041	1.06	43.3	0.07
0.9	48.94	82.29	82.15	0.59	0.60	0.002	0.04	1.17	57.5	0.07
1.0	57.21	83.28	83.12	0.69	0.69	0.002	0.039	1.32	75.7	0.09
1.1	65.57	84.26	84.09	0.78	0.78	0.002	0.038	1.47	96.2	0.10
1.2	74.02	85.25	85.05	0.87	0.87	0.002	0.038	1.61	119.0	0.11
1.3	82.58	86.23	86.02	0.96	0.96	0.002	0.037	1.74	144.0	0.12
1.4	91.23	87.22	86.98	1.05	1.05	0.002	0.036	1.88	171.1	0.13
1.5	99.97	88.19	87.93	1.13	1.14	0.002	0.036	2.01	200.5	0.14
1.6	108.83	89.47	89.19	1.22	1.22	0.002	0.036	2.13	231.4	0.15
1.7	117.81	90.77	90.47	1.30	1.30	0.002	0.035	2.24	264.4	0.16
1.8	126.92	92.10	91.78	1.38	1.38	0.002	0.035	2.36	299.4	0.17
1.9	136.19	93.95	93.62	1.45	1.45	0.002	0.035	2.46	335.0	0.18
2.0	145.64	95.71	95.37	1.52	1.53	0.002	0.034	2.56	372.9	0.19

Hydrographs and Exceedence Plots and Tables





Return Period T (year)	Probability P (percent)	Flood Discharge Q (ft ³ /sec)
1.05	95.2	45
1.11	90.1	58
1.25	80	83
2	50	199
5	20	610
10	10	1220
25	4	2784

Flood frequency analysis for USGS 09019500 Colorado River near Granby, CO, for 45 years of record (Water years 1961-2006).

IHA Results

Reach CR3

Non-Parametric IHA Scorecard

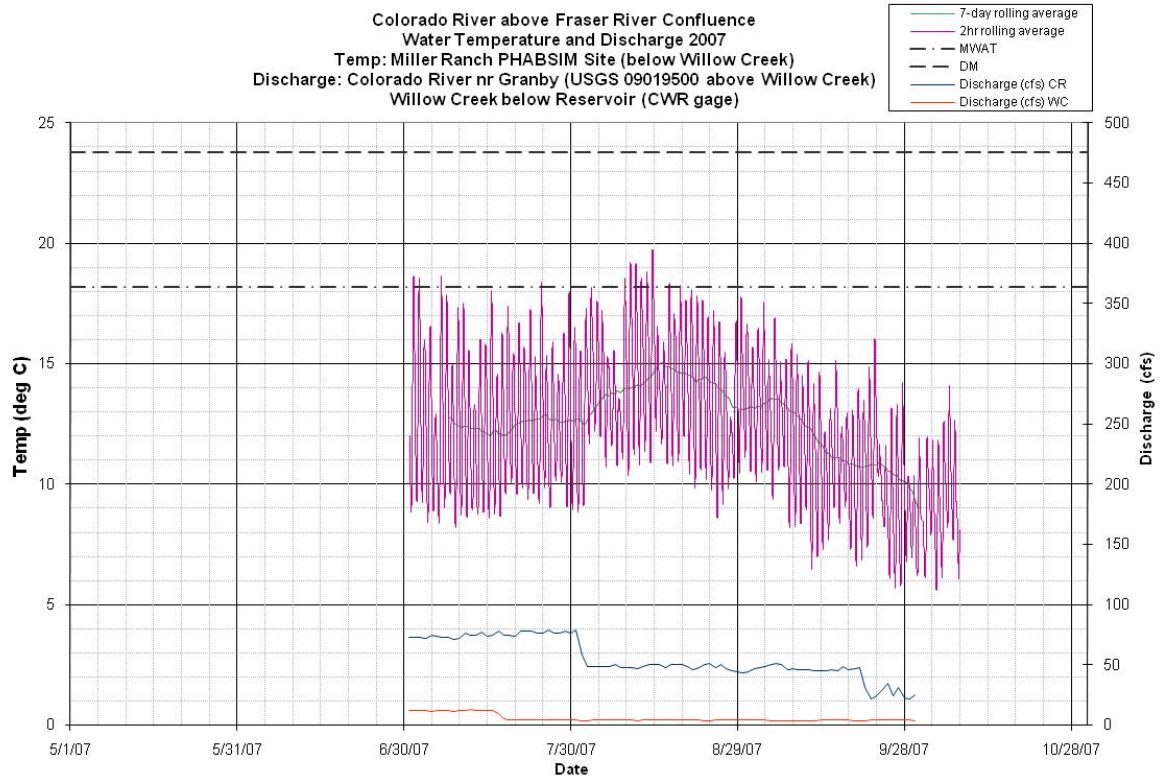
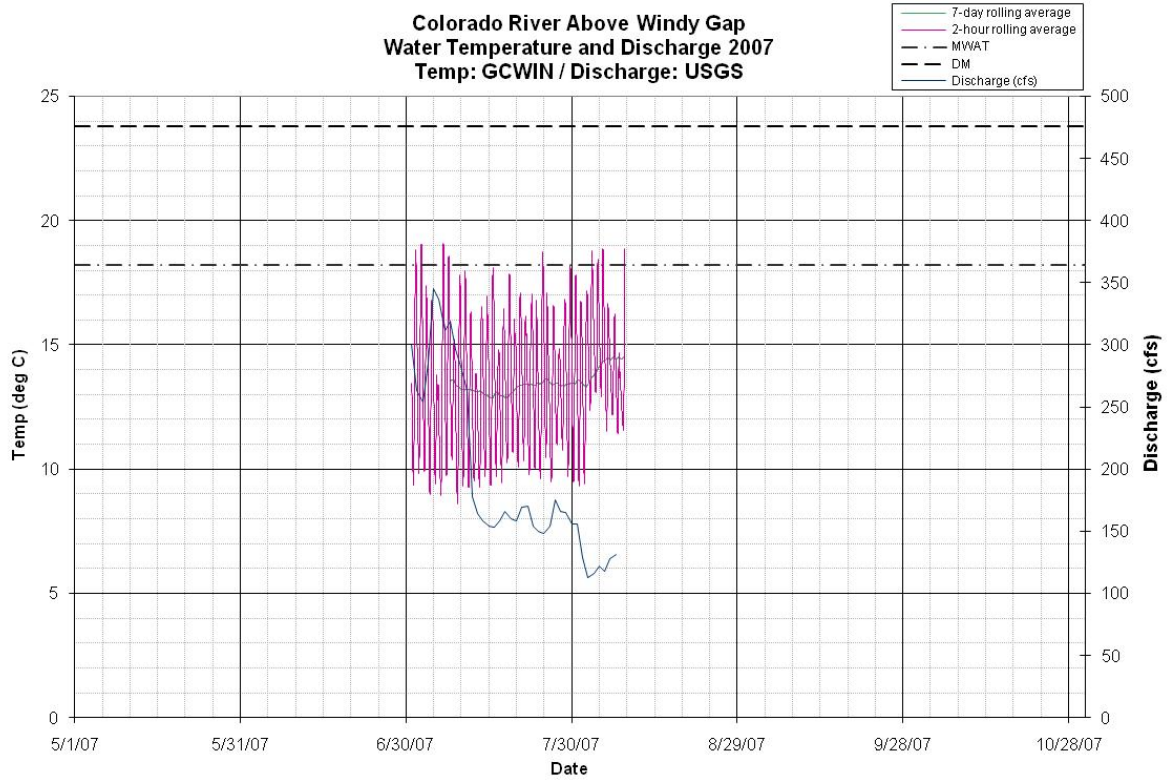
Colorado River near Granby, CO USGS 09019500 (Seasonal)
Season from Julian date 122 to 274. May 1 through Sept 30)

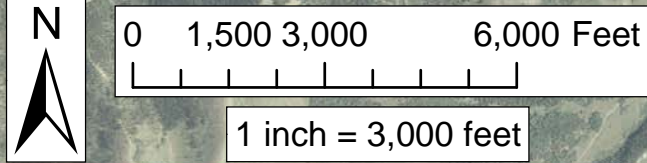
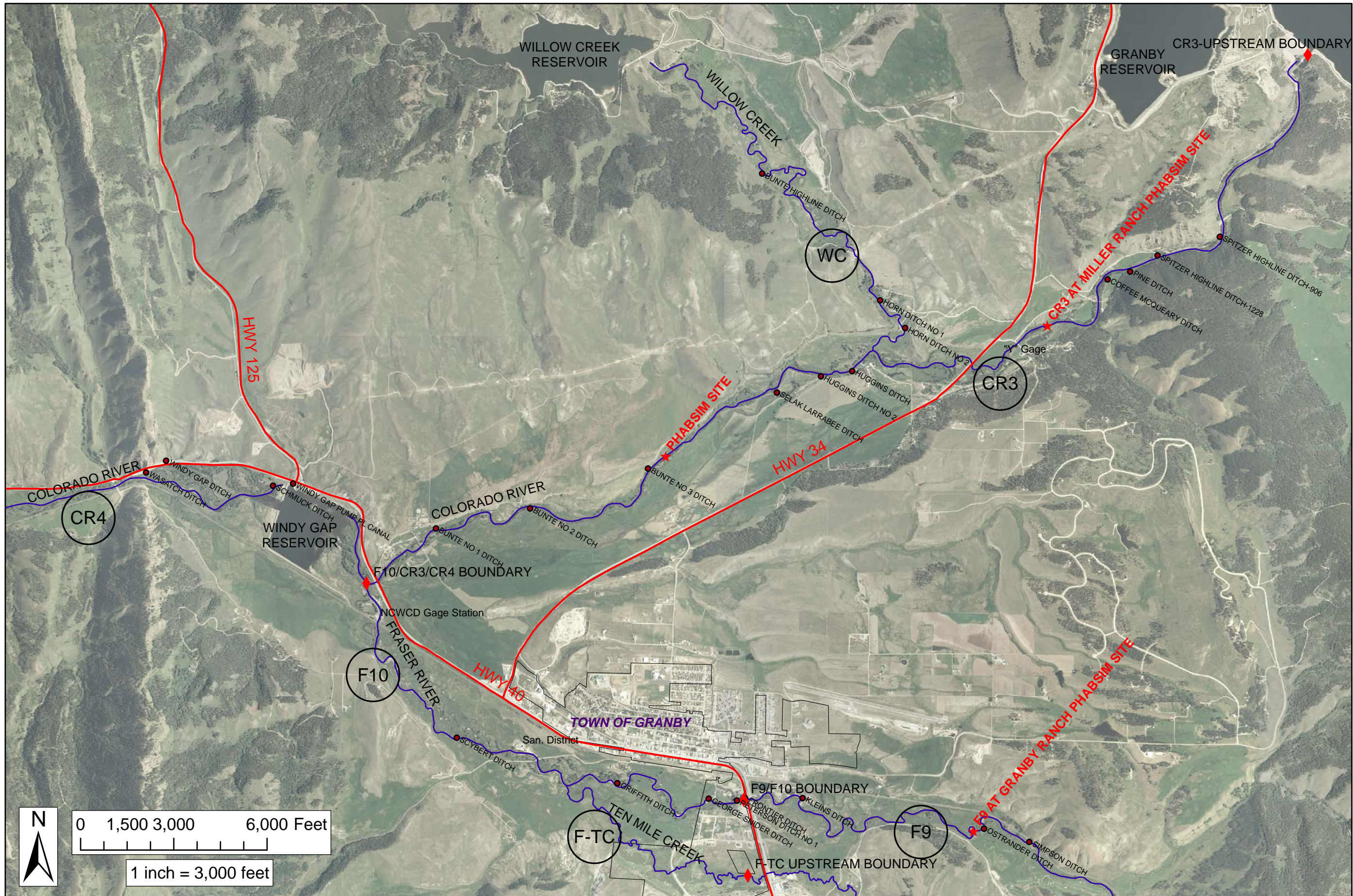
	Pre-impact period: 1908-1953 (24 years)		Post-impact period: 1961-2007 (47 years)					
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Mean annual flow	509.6			89.97				
Mean flow/area	509.6			89.97				
Annual C. V.	1.18			1.99				
Flow predictability	0.39			0.53				
Constancy/predictability	0.51			0.68				
% of floods in 60d period	0.83			0.77				
Flood-free season	1			121				
		MEDIANS		COEFF. of DISP.		DEVIATION FACTOR		SIGNIFICANCE COUNT
	Pre	Post	Pre	Post	Medians	C.D.	Medians	C.D.
Parameter Group #1								
October (cfs)								
November (cfs)								
December (cfs)								
January (cfs)								
February (cfs)								
March (cfs)								
April (cfs)								
May (cfs)	604	75	1.142	0.12	0.8758	0.8949	0.00	0.3013
June (cfs)	1090	75	1.067	0.2133	0.9312	0.8001	0.00	0.3383
July (cfs)	365	74	1.49	0.1757	0.7973	0.8821	0.00	0.2543
August (cfs)	155	39	0.5565	0.2051	0.7484	0.6314	0.00	0.4094
September (cfs)	92	19	0.7541	0.1579	0.7935	0.7906	0.00	0.3173
Parameter Group #2								
1-day minimum (cfs)	60	17	0.8208	0.2353	0.7167	0.7133	0.00	0.5345
3-day minimum (cfs)	61.67	17.33	0.7959	0.25	0.7189	0.6859	0.00	0.5275
7-day minimum (cfs)	67.71	18	0.7991	0.2063	0.7342	0.7418	0.00	0.4885
30-day minimum (cfs)	93.73	20.2	0.7813	0.1705	0.7845	0.7818	0.00	0.2933
90-day minimum (cfs)	222.1	44.82	1.092	0.3267	0.7982	0.7008	0.007007	0.1612
1-day maximum (cfs)	1975	89	0.6063	8.73	0.9549	13.4	0.3333	0.003003
3-day maximum (cfs)	1820	84.33	0.6497	8.664	0.9537	12.33	0.3333	0.01401
7-day maximum (cfs)	1716	81.14	0.5996	5.048	0.9527	7.418	0.3333	0.1011
30-day maximum (cfs)	1402	77.7	0.5606	1.993	0.9446	2.555	0.2212	0.07708
90-day maximum (cfs)	852.7	75.41	0.5508	0.7877	0.9116	0.4301	0.01401	0.4875
Number of zero days (count)	0	0	0	0				
Base flow index (7day minimum in cfs/median in cfs)	0.1397	0.2971	0.6982	0.4825	1.126	0.309	0.001001	0.3934
Parameter Group #3								
Date of minimum (Julian day)	263	257	0.09221	0.04645	0.03279	0.4963	0.3303	0.009009
Date of maximum (Julian day)	162.5	164	0.05396	0.1148	0.008197	1.127	0.7988	0.002002
Parameter Group #4								
Low pulse count (#)	1	0	2	0	1	1	0.00	0.00
Low pulse duration (days)	7.5	207.5	4.467	3.846	26.67	0.139	0.003003	0.9329
High pulse count (#)	2	0	0.875	0	1	1	0.00	0.00
High pulse duration (days)	22	6.5	1	1.154	0.7045	0.1538	0.08308	0.7337
The low pulse threshold is (cfs)	90							
The high pulse threshold is (cfs)	762.3							
Parameter Group #5								
Rise rate (cfs difference between consecutive days)	45	2	1	0	0.9556	1	0.00	0.3103
Fall rate (cfs difference between consecutive days)	-20	-2	-1.1	-0.5	0.9	0.5455	0.00	0.4755
Number of reversals	37	51	0.2703	0.1765	0.3784	0.3471	0.00	0.1361

Reach CR3
IHA Percentile Data
 Colorado River near Granby, CO USGS 09019500 Seasonal
 Season from Julian date 122 to 274. (May 1 through Sept 30)

	Pre-impact period: 1908-1953 (24 years)						Post-impact period: 1961-2007 (47 years)					
	10%	25%	Pre-impact 50%	75%	90%	(75-25)/50	10%	25%	Post-impact 50%	75%	90%	(75-25)/50
Parameter Group #1												
October (cfs)												
November (cfs)												
December (cfs)												
January (cfs)												
February (cfs)												
March (cfs)												
April (cfs)												
May (cfs)	63.5	283.5	604	973	1210	1.142	55.8	70	75	79	101.2	0.12
June (cfs)	62	478.3	1090	1641	1940	1.067	55	62.5	75	78.5	279.2	0.2133
July (cfs)	54.5	117.5	365	661.3	891.5	1.49	54.6	64	74	77	228.4	0.1757
August (cfs)	41.5	99.25	155	185.5	349.5	0.5565	28.8	33	39	41	47	0.2051
September (cfs)	25.75	49.75	92	119.1	199.3	0.7541	14	18	19	21	23.2	0.1579
Parameter Group #2												
1-day minimum (cfs)	13.5	32.25	60	81.5	111.5	0.8208	10.8	14	17	18	20.2	0.2353
3-day minimum (cfs)	17.33	35.58	61.67	84.67	111.5	0.7959	11.72	15	17.33	19.33	21	0.25
7-day minimum (cfs)	18.07	36.96	67.71	91.07	113.9	0.7991	13.74	16.43	18	20.14	21.17	0.2063
30-day minimum (cfs)	22.2	47.88	93.73	120.3	165.8	0.7813	15.34	17.96	20.2	21.4	24.11	0.1705
90-day minimum (cfs)	39.64	106.3	222.1	348.9	426	1.092	33.79	38.73	44.82	53.38	171.6	0.3267
1-day maximum (cfs)	75.5	1288	1975	2485	3060	0.6063	65	82	89	859	1534	8.73
3-day maximum (cfs)	70.5	1196	1820	2378	2930	0.6497	61.87	80.67	84.33	811.3	1524	8.664
7-day maximum (cfs)	70.21	1143	1716	2173	2705	0.5996	59.57	77.71	81.14	487.3	1385	5.048
30-day maximum (cfs)	66.47	1010	1402	1797	2079	0.5606	56.79	72.17	77.7	227	647.7	1.993
90-day maximum (cfs)	60.44	549.1	852.7	1019	1280	0.5508	54.7	65.79	75.41	125.2	305.7	0.7877
Number of zero days (count)	0	0	0	0	0	0	0	0	0	0	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.07001	0.1048	0.1397	0.2023	0.4804	0.6982	0.09706	0.2025	0.2971	0.3459	0.3978	0.4825
Parameter Group #3												
Date of minimum (Julian day)	183.5	237	263	270.8	273	0.09221	246	249	257	266	271	0.04645
Date of maximum (Julian day)	134	153	162.5	172.8	174.5	0.05396	124.8	142	164	184	199.4	0.1148
Parameter Group #4												
Low pulse count (#)	0	0	1	2	3	2	0	0	0	2	3	0
Low pulse duration (days)	2.6	4.5	7.5	38	368.4	4.467	3.7	18	207.5	816	1295	3.846
High pulse count (#)	0	1	2	2.75	4	0.875	0	0	0	1	1.2	0
High pulse duration (days)	5	7.5	22	29.5	50	1	1.3	3.25	6.5	10.75	15.85	1.154
Parameter Group #5												
Rise rate (cfs difference between consecutive days)	2	20	45	65	76.4	1	1	2	2	2	4	0
Fall rate (cfs difference between consecutive days)	-46	-31	-20	-9	-2	-1.1	-5	-3	-2	-2	-1.5	-0.5
Number of reversals	24	31	37	41	43	0.2703	39.8	47	51	56	62.4	0.1765
EFC Monthly Low Flows												
October Low Flow (cfs)												
November Low Flow (cfs)												
December Low Flow (cfs)												
January Low Flow (cfs)												
February Low Flow (cfs)												
March Low Flow (cfs)												
April Low Flow (cfs)												
May Low Flow (cfs)	32	57.75	139	187.3	240	0.9317	54.8	58	72	75.5	80.4	0.2431
June Low Flow (cfs)	31	44.5	65	144.3	212.5	1.535	54.6	61.75	73	76	80.4	0.1952
July Low Flow (cfs)	54.5	82.5	165.3	217.1	233.5	0.8147	54.6	63	73	76	81	0.1781
August Low Flow (cfs)	40.5	73.5	121.8	163.5	188.7	0.7392	31	35	40	41	47.75	0.15
September Low Flow (cfs)	32	64	90	115	149	0.5667	29	30	33.25	39.25	45.9	0.2782
EFC Parameters												
Extreme low peak (cfs)	12.4	20	24	27	27	0.2917	11	16	18	21	26.2	0.2778
Extreme low duration (days)	1	1	2.5	8	186.6	2.8	3.2	23	86	155.5	241.8	1.541
Extreme low timing (Julian date)	289.3	329	8	90	228.2	0.347	225.6	244	251.5	265	270.4	0.05738
Extreme low freq. (#/year)	0	0	0	1.75	9.5	0	1	1	1	2	3.2	1
High flow peak (cfs)	100.4	132.5	247	502	1028	1.496	76.4	85	90	411.5	790.4	3.628
High flow duration (days)	3.6	7	12.5	42	87.2	2.8	2.6	7	12.5	28	57.6	1.68
High flow timing (Julian date)	109.1	130	199.5	226.8	252.8	0.2643	123	127	145	171	183.8	0.1202
High flow frequency (#/year)	0	1.25	2	3.75	4.5	1.25	0	0	1	2	3.2	2
High flow rise rate (cfs difference between consecutive days)	13.04	17.38	26.09	45.14	56.5	1.064	1.65	2.322	21.5	57	99.95	2.543
High flow fall rate (cfs difference between consecutive days)	-29.39	-22.19	-12.47	-7.226	-2.271	-1.2	-83.4	-52.32	-11.71	-1.5	-0.7818	-4.338
Small Flood peak (cfs)	1984	2133	2275	2818	2888	0.3011	2110	2110	2110	2460	2460	0.1659
Small Flood duration (days)	86	88.25	101.5	114.3	125.2	0.2562	27	27	28	62	62	1.25
Small Flood timing (Julian date)	144	153	161	171	176.7	0.04918	174	174	184	194	194	0.05464
Small Flood freq. (#/year)	0	0	0	1	1	0	0	0	0	0	0	0
Small Flood riserate (cfs difference between consecutive days)	32.71	36.46	45.6	51.78	61.41	0.3361	47.63	47.63	198.3	204.4	204.4	0.7908
Small Flood fallrate (cfs difference between consecutive days)	-62.52	-54.45	-39.34	-35.36	-30.13	-0.4852	-139	-139	-107.6	-102.8	-102.8	-0.3365
Large flood peak (cfs)	3230	3230	3615	4000	4000	0.213						
Large flood duration (days)	84	84	110	136	136	0.4727						
Large flood timing (Julian date)	168	168	170	172	172	0.01093						
Large flood freq. (#/year)	0	0	0	0	0.5	0	0	0	0	0	0	0
Large flood riserate (cfs difference between consecutive days)	79.79	79.79	89.76	99.73	99.73	0.2222						
Large flood fallrate (cfs difference between consecutive days)	-54.4	-54.4	-48.38	-42.36	-42.36	-0.2489						

Surface Water Temperature Plots





GRAND COUNTY
 STREAM MANAGEMENT PLAN
 REACHES

- Legend**
- ◆ REACH BOUNDARY
 - ★ PHABSIM SITES
 - DIVERSIONS

REACH: CR3
 SHEET # :
 1 OF 1

