

F-RC2 Stream Reach Summary

Study Reach: F-RC2, Ranch Creek - A tributary to the Fraser River from F-RC2 at Devils Thumb downstream to the Fraser River at Tabernash, CO.

Reach Description: Approximate channel length: 10.25 miles, from the Fraser River to F-RC1, approximate channel slope 0.7%.

Within this reach, Ranch Creek meanders through a fairly broad, open valley with a floodplain covered in most areas with relatively dense wetland-type vegetation and a willow overstory. This creek is valued for fisheries and aesthetics, but heavily impacted by altered flows from upstream diversions. Much of the river and associated floodplain is on private property including the Devils Thumb Cross Country Ski Area.



Ranch Creek downstream of County Road 83



Ranch Creek upstream of Devils Thumb Lodge



Ranch Creek upstream of Devils Thumb Lodge

Flow Recommendations:

Environmental Flow Methodology: A study site was established within F-RC2 in 2008, located downstream of County Road 83. See Appendix A for methodology and Appendix E for PHABSIM survey information. CWCB instream flow recommendations are available for this reach.

Water Users:

- Irrigators, municipalities and industry flow-related issues: none reported
- Recreational flows: There are concerns about degraded conditions for angling due to low flows, especially over the past several years due (Pers. Comm., C. Klancke 2008).

Summary of Flows:

Environmental, recommended target flow ranges

- 30 to 50 cfs, April through September
- 20 to 30 cfs, October through March
- Flushing flow, at least 150 cfs for a 3-day duration with a frequency of 1 in 2 years during the late May to late June period.

CWCB flows

- 8 cfs summer (05/15 – 09/15)
- 5 cfs for winter (09/16 – 05/14)

Forest Service By-pass Flows

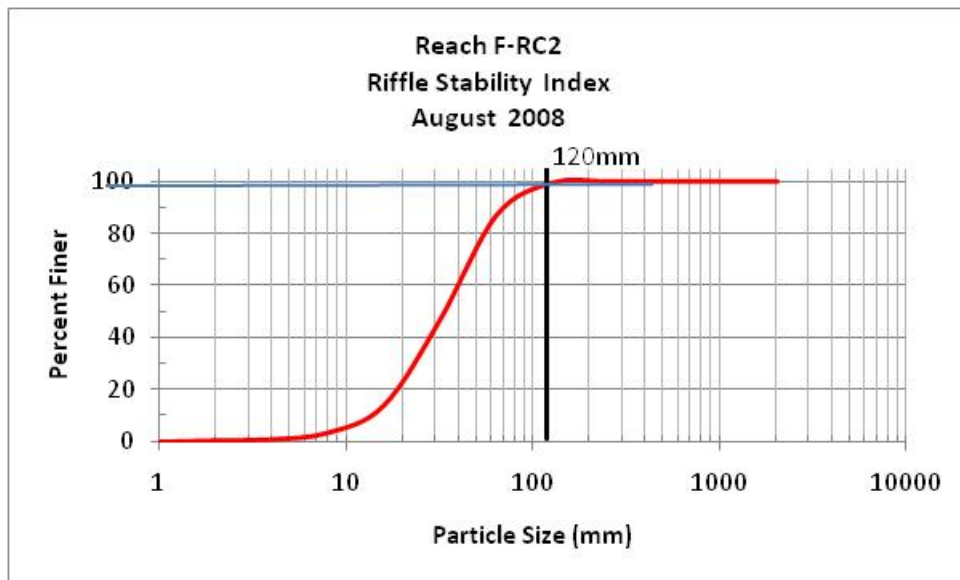
- 4 cfs summer
- 2 cfs winter

Water Users

- Irrigators, municipalities and industry: There are no local diversions in this reach.
- Recreation: none reported

Stream Assessments: In August 2008 Tetra Tech conducted three assessments in F-RC2. These included Stream Reach Inventory/Channel Stability Evaluation (SRI/CSE), EPA Habitat Quality Assessment (HQA) and a Riffle Stability Index (RSI) evaluation. The SRI/CSE evaluation scored in the ‘mid-fair’ range, the EPA HQA evaluation scored in the ‘suboptimal’ category and the RSI score of 98 indicates the riffle substrate is highly unstable with up to 98% of the particles mobilized during recent high water events. Relevant issues revealed in the stream assessments include substantial stream bank erosion, heavy fine sediment deposition in low to moderate velocity habitats, marginal aquatic habitat structure and cover, low flow conditions, and the presence of likely fish passage impediments. Results of the assessments are summarized in the following tables and plot. Details and methodology are presented in Appendix A.

Reach F-RC2 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	8
2	Mass wasting hazard	4	2	Aquatic Structure as Cover	9
3	Debris Jam Potential	4	3	Velocity/ Depth Regimes	13
4	Vegetation Cover	6	4	Channel Flow Status	13
		Upper Bank Score:	5	Channel Alteration	14
			6	Frequency of Riffles	16
Lower Banks			7	Channel Sinuosity	10
5	Channel Capacity	3	Channel Score		83
6	Bank Rock Content	6	Banks		
7	Flow obstructors & Deflectors	5	8	Bank Stability	10
8	Cutting	12	9	Riparian Vegetation Cover and Disturbance	16
9	Deposition	8	10	Riparian Vegetation zone width	16
		Lower Bank Score:	Bank Score		42
			Total Score		125
Channel Bottom			Notes		
10	Rock Angularity	3			
11	Brightness	2			
12	Consolidation/Particle Packing	5			
13	Bottom size distribution	12			
14	Bed Scour and Deposition	15			
15	Clinging Aquatic Veg	3			
		Channel Bottom Score:			40
		Total Score:			90



Spawning Observations: A trout spawning survey was conducted in F-RC2 on 28 October 2008. Numerous adult brown trout exhibiting spawning behavior were observed and 10 completed redds were field measured.

Hydrologic Records: USGS Gage Station 09033100 was in operation on Ranch Creek below Meadow Creek near Tabernash from 1997 to 2005 (now discontinued). The daily streamflow exceedence plots indicate the CWCB flows are commonly available during both the summer and winter periods. The median (50-percentile) daily peak flow occurs in early June and approaches 200 cfs.

Water Temperature: F-RC2 is a Tier I stream reach as designated by CDPHE with a chronic temperature standard of 17°C MWAT and an acute temperature standard of 21.2°C DM. Temperature data reviewed in reach F-RC2 indicate stream temperatures for Ranch Creek in this reach are generally within the MWAT but often exceed DM standards, especially in late summer. This reach has been identified by the State of Colorado for having temperature impairment, with a high priority, as defined by the Clean Water Act, Section 303(d).

Water Quality: No water quality issues were noted from the available data, although algae were observed in abundance in August 2008, especially upstream of Devils Thumb Lodge.

Water Supply Issues (UPCO): Water supply issues in this reach were not presented in the UPCO report.

Summary of Results and Additional Remarks:

1. CWCB flows are commonly available during both the summer and winter periods but recommended environmental flow targets are higher and not a frequently available.
2. The stream assessments indicate substantial bank erosion and fine sediment deposition, marginal aquatic habitat structure and cover, a general lack of flow, and likely fish passage impediments.
3. Temperatures exceedences are common and RC2 is currently on the proposed 303(D) list.
4. Water quality is likely adequate for support of a cold-water fishery. Algae were observed in abundance at some locations.
5. CDOW electrofishing records from 1993 indicate brook, brown and rainbow trout were present within the reach.
6. 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 significantly lower than target ranges in this reach.

Restoration Opportunities: Restoration opportunities presented for F-RC2 are aimed at reducing the impacts from excessive sedimentation, high water temperatures and low flow conditions. Specific restoration opportunities include the following:

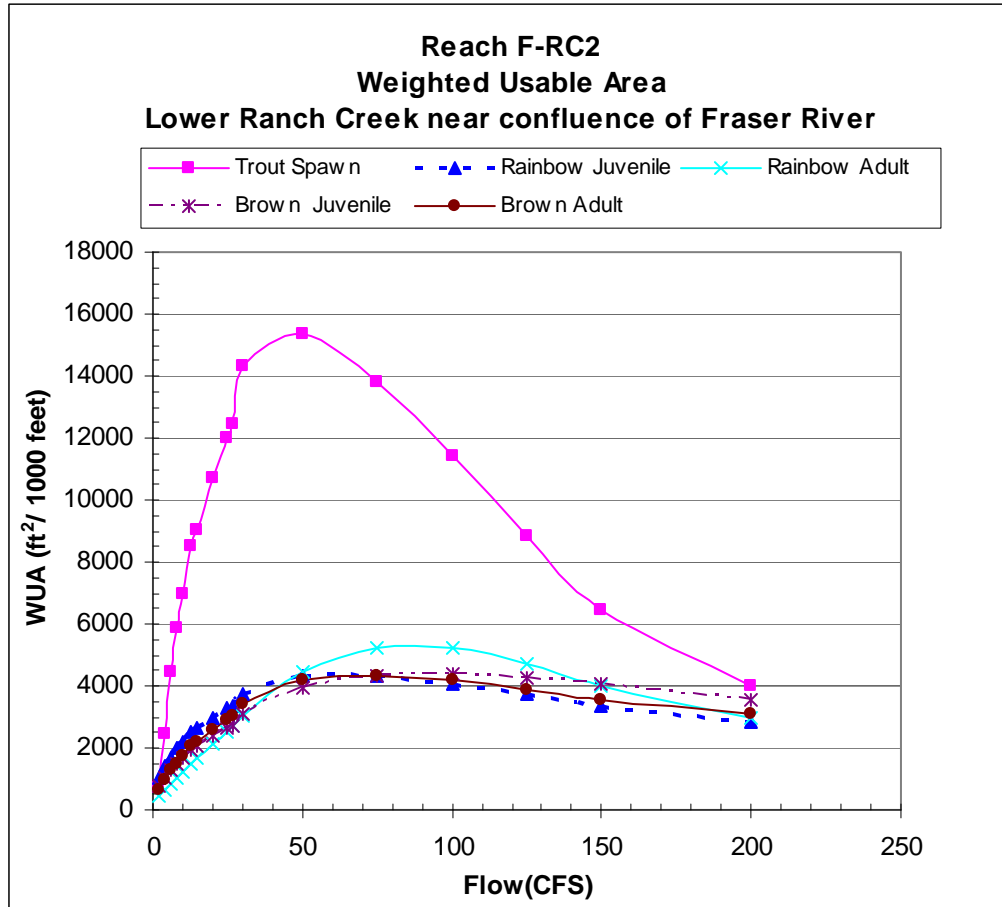
- ✓ Apply flow enhancements to supplement low flow conditions and/or generate flushing flows.
- ✓ Inventory downstream culverts, bridges and other stream crossings for capacity-related issues as they relate to flushing flow implementation.
- ✓ Explore river restoration and improved public access opportunities near the confluence of Ranch Creek with the Fraser River. This could potentially include the placement of private land into a conservation easement with public access. Specific restoration would be aimed at improving spawning conditions, stabilizing stream banks, developing a better riparian overstory to improve the temperature regime, and enhancing pool and cover habitats through structural methods.

Monitoring: Establish and implement a monitoring program. Parameters should include water quality; air temperature; intergravel fine sediments; cross sectional surveys and stream assessments; and fish population and diversity. Add a year round streamflow gage. Continue to monitor surface water temperatures. Monitor recreation use near Fraser River confluence.

Support Data

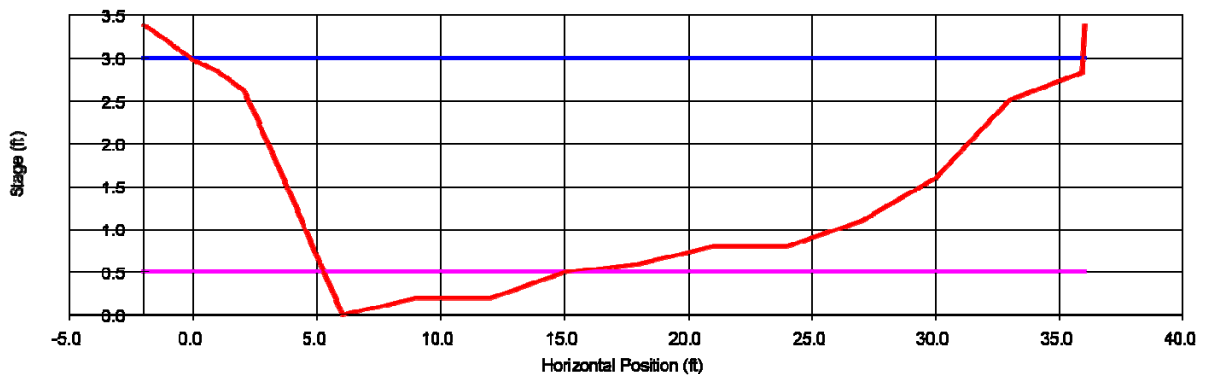
Weighted Useable Area Plots and Tables

Habitat-flow relations for the target species and life stages for Reach F-RC2, Tetra Tech site 2008.						
Reach F-RC2						
Discharge	Total Area	Trout Spawn	Rainbow Juvenile	Rainbow Adult	Brown Juvenile	Brown Adult
(cfs)	(ft ²)	Weighted Usable Area (ft ² /1000 ft stream length)				
2.0	14006.0	709.4	1046.2	435.5	778.8	674.7
4.0	16706.6	2482.1	1411.7	644.7	1047.0	996.7
6.0	18519.9	4436.1	1708.1	842.5	1274.0	1259.2
8.0	20129.9	5890.8	1968.5	1037.7	1484.3	1497.2
10.0	20938.9	6990.7	2209.6	1224.8	1673.4	1722.8
13.0	21816.0	8544.7	2512.9	1504.7	1938.7	2034.0
15.0	22324.9	9064.3	2656.0	1704.3	2071.7	2209.3
20.0	23361.6	10733.3	2991.0	2139.2	2393.6	2601.4
25.0	24306.9	12019.8	3266.4	2545.9	2654.5	2921.6
27.0	24580.4	12475.5	3357.8	2701.1	2741.5	3032.1
30.0	24965.3	14348.5	3764.8	3015.8	3117.8	3389.6
50.0	26894.7	15379.3	4320.5	4422.6	3911.0	4170.0
75.0	29223.8	13819.9	4350.9	5244.2	4292.0	4353.9
100.0	30835.3	11446.7	4073.5	5195.5	4412.3	4168.3
125.0	31891.3	8811.9	3717.9	4677.5	4238.7	3854.3
150.0	33202.7	6433.8	3373.5	4001.4	4062.8	3531.7
200.0	35877.4	3989.3	2839.9	2977.5	3525.3	3097.6



Transect and Bedload Threshold Plots and Tables:

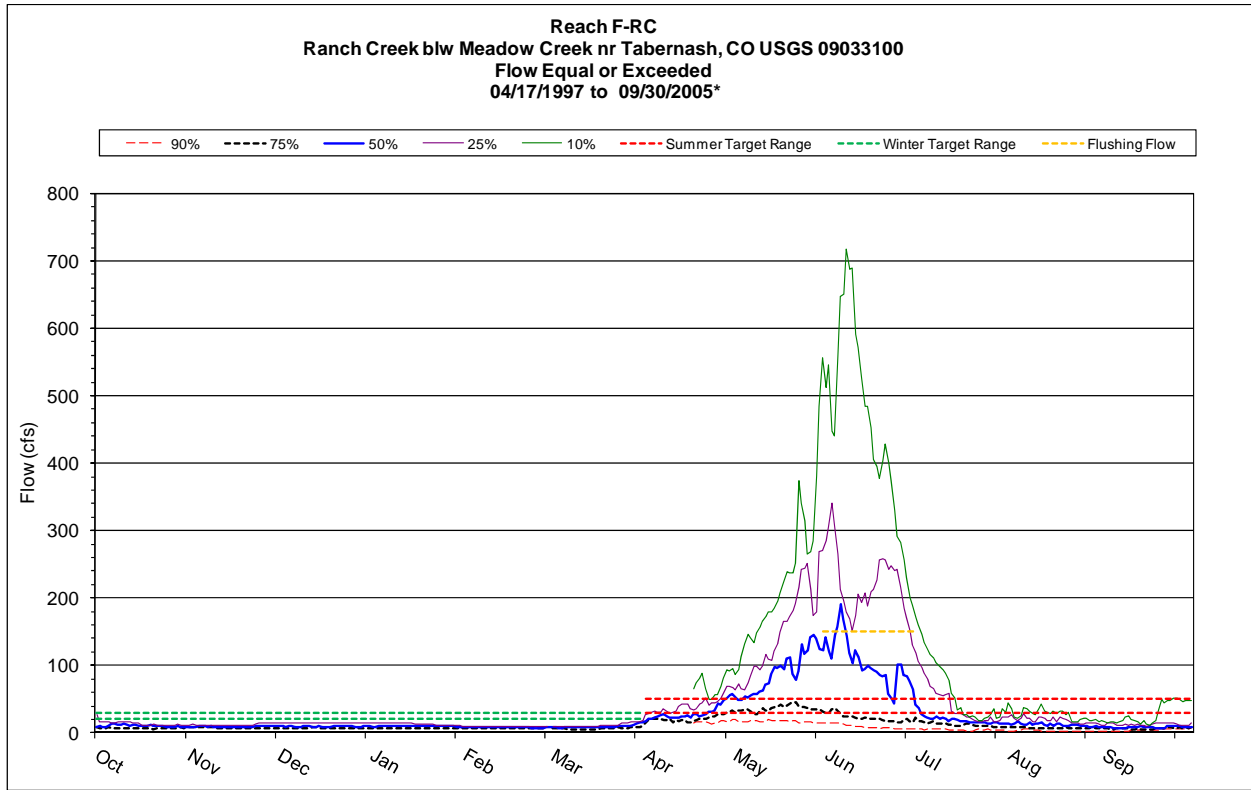
Reach F-RC2, TR7



Reach F-RC2 TR7
TT2008 site

Resistance	Method:	Jarrett's	Equation							
STAGE	AREA	PERIM	WIDTH	R	DHYD	SLOPE	n	VAVG	Q	SHEAR
(ft)	(sq ft)	(ft)	(ft)	(ft)	(ft)	(ft/ft)		(ft/s)	(cfs)	(psf)
0.50	2.74	9.92	9.75	0.28	0.28	0.002	0.045	0.62	1.70	0.03
0.60	3.87	13.10	12.90	0.30	0.30	0.002	0.046	0.66	2.56	0.04
0.70	5.24	14.78	14.54	0.35	0.36	0.002	0.045	0.77	4.06	0.05
0.80	6.78	16.47	16.19	0.41	0.42	0.002	0.045	0.88	5.98	0.06
0.90	8.75	20.65	20.34	0.42	0.43	0.002	0.046	0.91	7.96	0.07
1.00	10.85	21.84	21.49	0.50	0.50	0.003	0.045	1.04	11.32	0.08
1.10	13.05	23.02	22.64	0.57	0.58	0.003	0.045	1.17	15.28	0.10
1.20	15.35	23.81	23.39	0.64	0.66	0.003	0.045	1.31	20.11	0.11
1.30	17.73	24.60	24.14	0.72	0.73	0.003	0.045	1.44	25.60	0.13
1.40	20.18	25.39	24.89	0.80	0.81	0.003	0.045	1.57	31.76	0.15
1.50	22.71	26.17	25.64	0.87	0.89	0.003	0.045	1.70	38.60	0.17
1.60	25.31	26.96	26.39	0.94	0.96	0.003	0.045	1.82	46.13	0.19
1.70	27.97	27.48	26.87	1.02	1.04	0.003	0.045	1.96	54.75	0.22
1.80	30.68	28.01	27.35	1.10	1.12	0.004	0.045	2.09	64.11	0.24
1.90	33.44	28.53	27.82	1.17	1.20	0.004	0.045	2.22	74.20	0.27
2.00	36.25	29.05	28.30	1.25	1.28	0.004	0.045	2.35	85.03	0.30
2.10	39.10	29.58	28.79	1.32	1.36	0.004	0.045	2.47	96.58	0.32
2.20	42.01	30.12	29.28	1.39	1.43	0.004	0.046	2.59	108.88	0.35
2.30	44.96	30.65	29.76	1.47	1.51	0.004	0.046	2.71	121.94	0.38
2.40	47.96	31.18	30.25	1.54	1.59	0.004	0.046	2.83	135.77	0.41
2.50	51.01	31.71	30.74	1.61	1.66	0.004	0.046	2.95	150.36	0.44
2.60	54.13	32.75	31.74	1.65	1.71	0.005	0.046	3.02	163.72	0.47
2.70	57.37	34.10	33.08	1.68	1.73	0.005	0.047	3.08	176.63	0.49
2.80	60.75	35.53	34.49	1.71	1.76	0.005	0.047	3.13	190.15	0.51
2.90	64.24	36.48	35.37	1.76	1.82	0.005	0.047	3.22	206.72	0.54
3.00	67.82	37.25	36.04	1.82	1.88	0.005	0.047	3.32	224.98	0.57

Hydrographs and Exceedence Plots and Tables

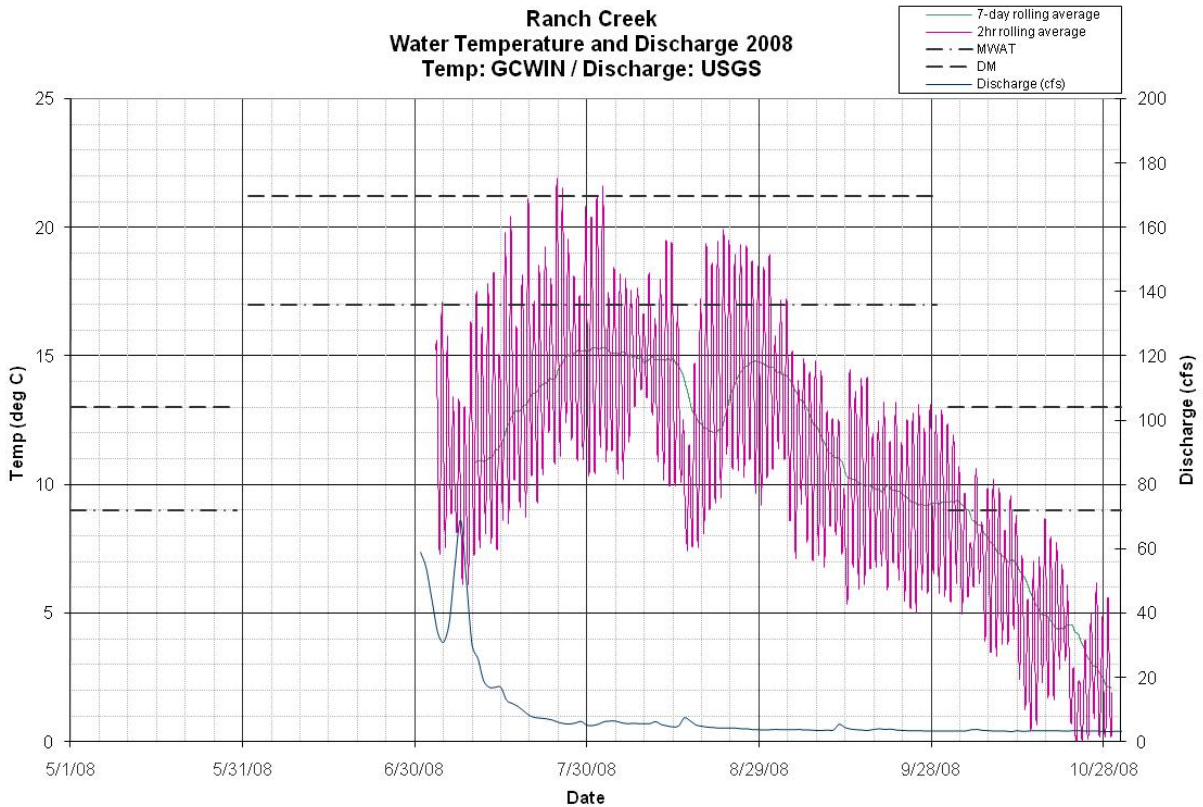
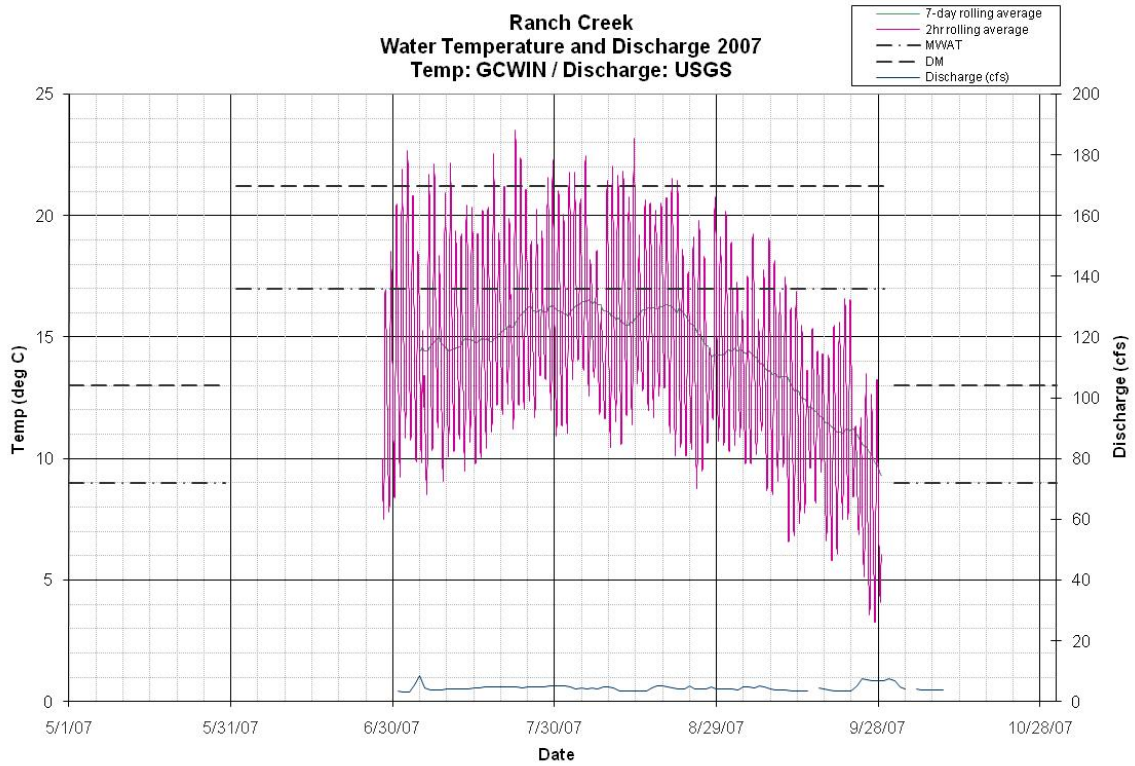


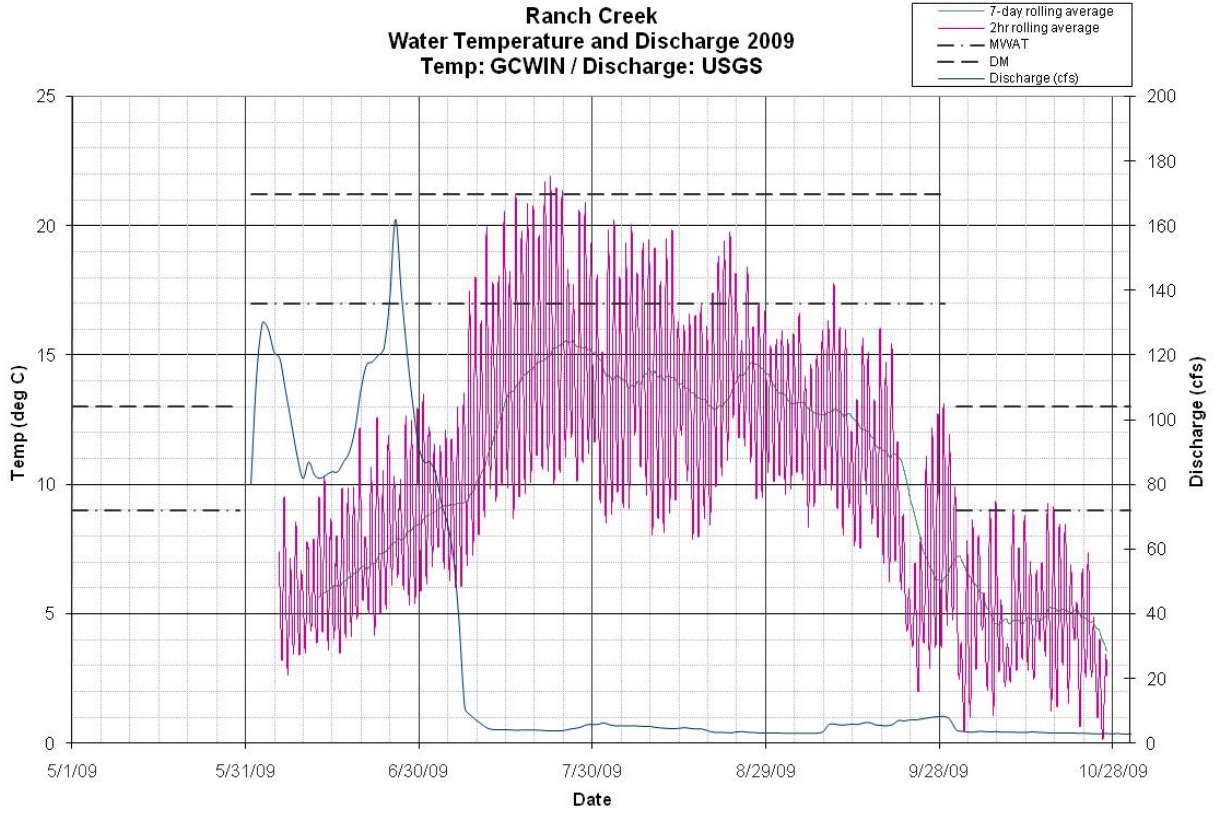
IHA Results

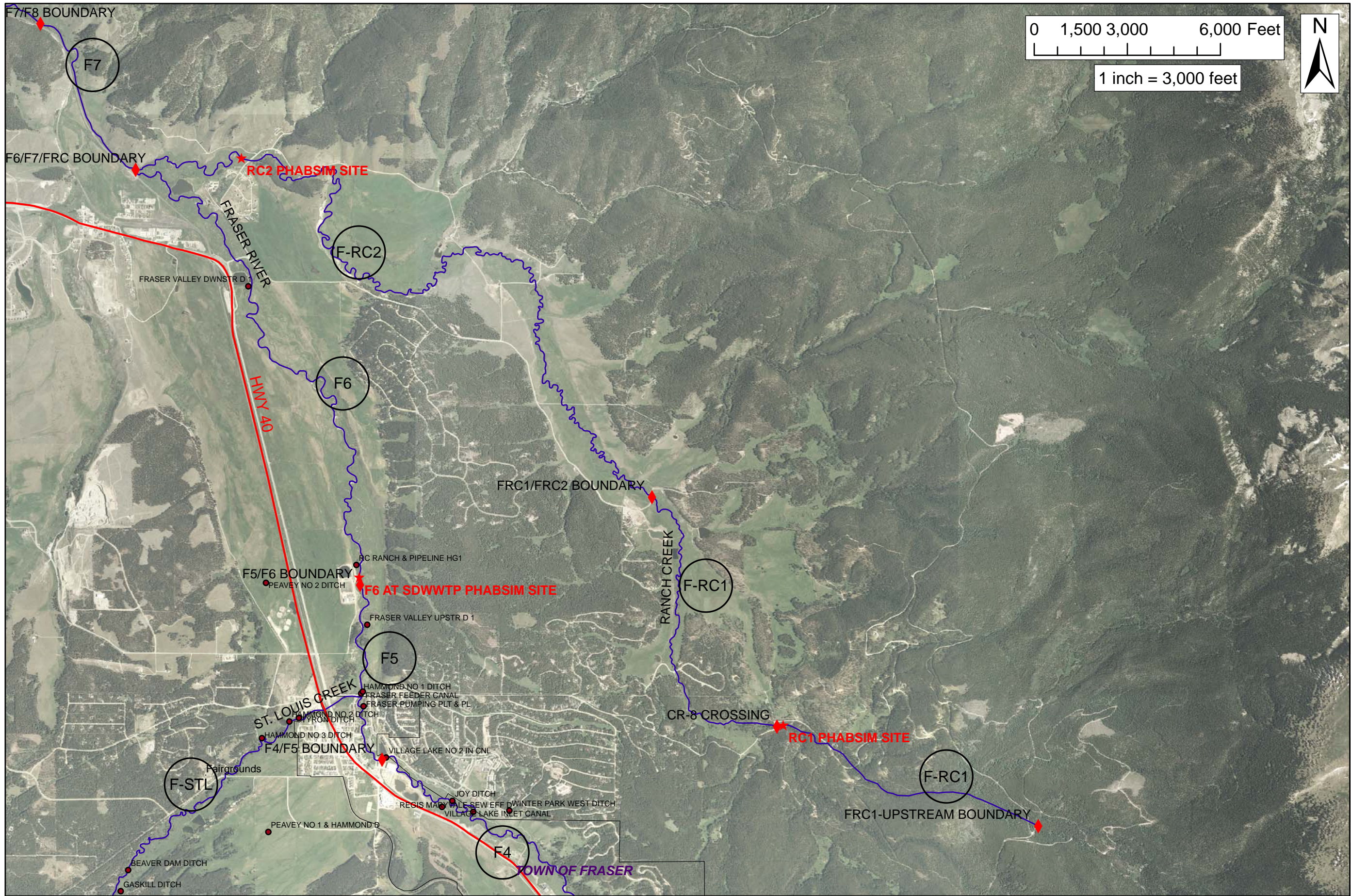
Non-Parametric IHA Scorecard		
Ranch Creek below Meadow Creek		
USGS 09033100		
Period of Analysis: 1997-2005 (9 years)		
NormalizationFactor	1	
Mean annual flow	34.34	
Non-Normalized Mean Flow	34.34	
Annual C. V.	1.87	
Flow predictability	0.55	
Constancy/predictability	0.61	
% of floods in 60d period	0.49	
Flood-free season	29	
	Medians	Coeff. of Disp.
Parameter Group #1		
October (cfs)	12	0.6
November (cfs)	12	0.7153
December (cfs)	14	0.8316
January (cfs)	13	1.185
February (cfs)	9.2	1.939
March (cfs)	10	2.082
April (cfs)	26	0.6442
May (cfs)	95	1.216
June (cfs)	92	1.766
July (cfs)	16	0.8125
August (cfs)	12	0.7542
September (cfs)	8.05	0.7919
Parameter Group #2		
1-day minimum (cfs)	5.3	0.3585
3-day minimum (cfs)	5.667	0.3412
7-day minimum (cfs)	5.971	0.4653
30-day minimum (cfs)	6.683	0.3815
90-day minimum (cfs)	8.75	0.7464
1-day maximum (cfs)	268	1.394
3-day maximum (cfs)	264.7	1.374
7-day maximum (cfs)	245.3	1.281
30-day maximum (cfs)	163.3	1.173
90-day maximum (cfs)	86.97	1.173
Number of zero days (count)	0	0
Base flow index (7day minimum in cfs/median in cfs)	0.1779	0.8033
Parameter Group #3		
Date of minimum (Julian day)	260	0.2992
Date of maximum (Julian day)	152	0.08743
Parameter Group #4		
Low pulse count (#)	4	1
Low pulse duration (days)	7	3.25
High pulse count (#)	4	0.875
High pulse duration (days)	3	9.125
The low pulse threshold is (cfs)	8.8	
The high pulse threshold is (cfs)	29	
Parameter Group #5		
Rise rate (cfs difference between consecutive days)	2	1.123
Fall rate (cfs difference between consecutive days)	-1.1	-0.9091
Number of reversals	69	0.3768

IHA Percentile Data						
Ranch Creek below Meadow Creek						
USGS 09033100						
Period of Analysis: 1997-2005 (9 years)						
	Period of Analysis					
	10%	25%	50%	75%	90%	(75-25)/50
Parameter Group #1						
October (cfs)	6.0	7.8	12.0	15.0	34.0	0.60
November (cfs)	7.0	7.9	12.0	16.4	34.0	0.72
December (cfs)	6.8	7.8	14.0	19.4	34.0	0.83
January (cfs)	6.0	7.1	13.0	22.5	34.0	1.19
February (cfs)	6.0	7.6	9.2	25.4	34.0	1.94
March (cfs)	4.0	7.6	10.0	28.4	34.0	2.08
April (cfs)	15.0	19.5	26.0	36.3	48.5	0.64
May (cfs)	18.0	38.0	95.0	153.5	185.0	1.22
June (cfs)	7.9	21.3	92.0	183.8	411.0	1.77
July (cfs)	4.5	12.0	16.0	25.0	27.0	0.81
August (cfs)	2.6	7.0	12.0	16.0	27.0	0.75
September (cfs)	5.4	6.1	8.1	12.5	15.0	0.79
Parameter Group #2						
1-day minimum (cfs)	2.0	4.2	5.3	6.1	8.1	0.4
3-day minimum (cfs)	2.1	4.2	5.7	6.1	8.8	0.3
7-day minimum (cfs)	2.2	4.3	6.0	7.1	9.7	0.5
30-day minimum (cfs)	2.5	5.3	6.7	7.9	11.3	0.4
90-day minimum (cfs)	4.1	6.6	8.8	13.1	26.7	0.7
1-day maximum (cfs)	26.0	68.5	268.0	442.0	718.0	1.4
3-day maximum (cfs)	24.7	66.0	264.7	429.7	698.0	1.4
7-day maximum (cfs)	22.9	64.0	245.3	378.1	651.0	1.3
30-day maximum (cfs)	18.9	49.7	163.3	241.2	432.6	1.2
90-day maximum (cfs)	15.8	35.0	87.0	137.0	231.2	1.2
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)	0.1	0.1	0.2	0.3	0.4	0.8
Parameter Group #3						
Date of minimum (Julian day)	71	166.5	260	276	294	0.2992
Date of maximum (Julian day)	106	132.5	152	164.5	172	0.08743
Parameter Group #4						
Low pulse count (#)	1	1	4	5	9	1
Low pulse duration (days)	4.5	5.25	7	28	147	3.25
High pulse count (#)	0	1.5	4	5	11	0.875
High pulse duration (days)	1	1.125	3	28.5	114	9.125
Parameter Group #5						
Rise rate (cfs difference between consecutive days)	0.08824	0.2545	2	2.5	8	1.123
Fall rate (cfs difference between consecutive days)	-5	-2	-1.1	-1	-0.2	-0.9091
Number of reversals	45	54.5	69	80.5	112	0.3768
EFC Monthly Low Flows						
October Low Flow (cfs)	7.0	7.7	12.0	13.6	16.0	0.5
November Low Flow (cfs)	7.0	7.8	11.5	14.8	17.9	0.6
December Low Flow (cfs)	6.8	7.8	12.5	17.8	20.6	0.8
January Low Flow (cfs)	6.8	8.0	13.0	21.7	23.3	1.1
February Low Flow (cfs)	7.3	8.0	9.2	24.9	25.9	1.8
March Low Flow (cfs)	7.0	8.5	9.7	23.6	28.1	1.6
April Low Flow (cfs)	12.0	18.5	22.0	24.5	26.0	0.3
May Low Flow (cfs)	18.0	18.0	18.3	18.5	18.5	0.0
June Low Flow (cfs)	9.2	10.7	17.0	25.0	27.0	0.8
July Low Flow (cfs)	11.0	13.5	16.0	20.8	22.0	0.5
August Low Flow (cfs)	6.7	8.4	12.0	15.5	18.0	0.6
September Low Flow (cfs)	7.2	7.6	8.4	11.0	15.0	0.4
EFC Parameters						
Extreme low peak (cfs)	4.6	4.9	5.5	6.2	6.5	0.2
Extreme low duration (days)	2.0	2.6	9.5	20.3	36.0	1.9
Extreme low timing (Julian date)	71.0	247.5	264.3	290.0	335.0	0.1
Extreme low freq. (#/year)	0.0	1.0	3.0	4.0	5.0	1.0
High flow peak (cfs)	31.0	34.0	36.0	42.0	57.0	0.2
High flow duration (days)	1.0	1.0	3.0	4.0	4.0	1.0
High flow timing (Julian date)	98.0	109.0	180.0	219.0	220.0	0.3
High flow frequency (#/year)	0.0	0.5	3.0	4.5	11.0	1.3
High flow rise rate (cfs difference between consecutive days)	4.8	5.5	9.8	13.0	15.0	0.8
High flow fall rate (cfs difference between consecutive days)	-12.3	-10.0	-7.0	-5.0	-4.5	-0.7
Small Flood peak (cfs)	268.0	276.0	313.5	499.5	557.0	0.7
Small Flood duration (days)	68.0	68.3	69.5	103.0	114.0	0.5
Small Flood timing (Julian date)	151.0	151.3	153.5	167.8	172.0	0.0
Small Flood freq. (#/year)	0.0	0.0	0.0	1.0	1.0	0.0
Small Flood riserate (cfs difference between consecutive days)	3.0	3.7	6.2	12.7	14.7	1.5
Small Flood fallrate (cfs difference between consecutive days)	-15.7	-14.9	-11.7	-8.9	-8.3	-0.5
Large flood peak (cfs)						
Large flood duration (days)						
Large flood timing (Julian date)						
Large flood freq. (#/year)	0.0	0.0	0.0	0.0	0.0	0.0
Large flood riserate (cfs difference between consecutive days)						
Large flood fallrate (cfs difference between consecutive days)						

Surface Water Temperature Plots







GRAND COUNTY
 STREAM MANAGEMENT PLAN
 REACHES

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

REACH: F-RC2
 SHEET # :
 1 OF 1

