

F6 Stream Reach Summary

Study Reach: F6, Fraser River - Consolidated Wastewater Treatment Plant downstream to the confluence with Ranch Creek.

Reach Description: Approximate channel length: 4 ¼ miles, approximate channel slope 0.7%.

In this reach the river corridor is wide, flat and sinuous. There are few trees present in this reach. However, the overbanks are heavily vegetated with grasses and wetlands-type vegetation, including willows. Grazing is evident on some portions of the overbanks, primarily near the Consolidated Wastewater Treatment Plant. Outside of the river corridor the vegetation is typically sage brush and sparse grass cover. Fraser River crosses under County Road 83 in the downstream portion of this reach. Below County Road 8, the Fraser confluences with Ranch Creek in an extensive and well vegetated wetlands area.



Fraser River Downstream of the Consolidated Treatment Plant



Fraser River downstream of WWTP



Downstream Portion of F6 near County Road 83. Note wide, shallow channel



Fraser River at Ranch Creek Confluence. Note lack of vegetative overstory and shading

Flow Recommendations:

Environmental Flow Methodology: A PHABSIM site was established within this reach during summer 2007. See Appendix A for methodology and Appendix E for PHABSIM survey information. In addition, CWCB instream flows have been developed.

Water Users:

- Irrigators, municipalities and industry flow-related issues: Low flows create difficulty for the Consolidated Wastewater Treatment plant to discharge within permitted flow conditions to protect acute stream standards.
- Recreational flows: Angling is the predominant recreational use. Float boating is possible in F6, however, not common due to low flows and limited accessibility.

Summary of Flows:

Environmental, recommended target flow ranges

- 40 to 60 cfs, April through September
- 40 to 50 cfs, October through March
- Flushing flow of at least 200 cfs for a 3-day duration with a frequency of 1 in 2 years during the late May to late June period.

CWCB flows

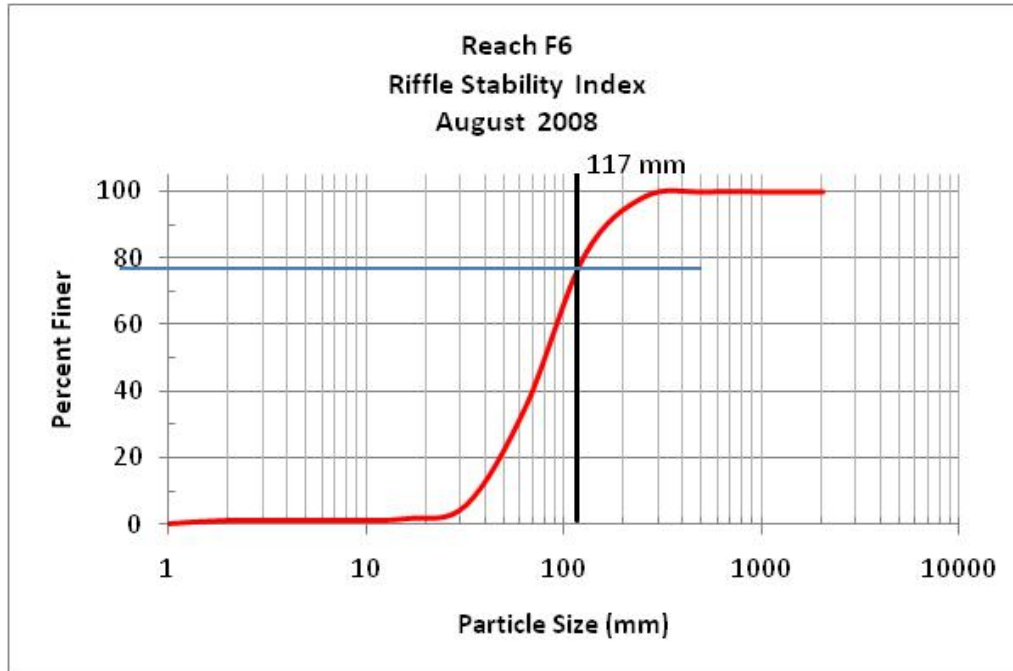
- 17 cfs summer (05/15 – 09/15)
- 11 cfs for winter (09/16 – 5/14)

Water Users

- Irrigators, municipalities and industry: No diversions are present in this reach.
- Recreation: Angling: 60 -200 cfs

Stream Assessments: In August 2008 Tetra Tech conducted three stream assessments in F6. 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 'good' category and the EPA HQA evaluation scored in the 'suboptimal' range. The RSI of 76 indicates riffle substrate is moderately unstable with up to 76 % of the particles mobilized during recent high flow events. Relevant issues revealed in the stream assessments include some bank degradation from grazing and lack of shading. Results of all three assessments are summarized in the following table and plot. Details and methodology are presented in Appendix A.

Reach F6 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	17
2	Mass wasting hazard	3	2	Aquatic Structure as Cover	11
3	Debris Jam Potential	3	3	Velocity/ Depth Regimes	16
4	Vegetation Cover	6	4	Channel Flow Status	15
Upper Bank Score:		14	5	Channel Alteration	16
Lower Banks			6	Frequency of Riffles	18
5	Channel Capacity	3	7	Channel Sinuosity	8
6	Bank Rock Content	5	Channel Score		101
7	Flow obstructors & Deflectors	4	Bank Score		
8	Cutting	10	8	Bank Stability	10
9	Deposition	6	9	Riparian Vegetation Cover and Disturbance	12
Lower Bank Score:		28	10	Riparian Vegetation zone width	14
Channel Bottom			Bank Score		36
10	Rock Angularity	2	Total Score		137
11	Brightness	2	Notes		
12	Consolidation/Particle Packing	4			
13	Bottom size distribution	8			
14	Bed Scour and Deposition	9			
15	Clinging Aquatic Veg	2			
Channel Bottom Score:		27			
Total Score:		69			



Spawning Observations: A spawning survey of Reach F6 was conducted on 28 October 2008, with two likely brown trout redds identified and measured.

Hydrologic Records: No streamflow records are available for this reach.

Water Temperature: F6 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 for reach F6 are generally below standards. However, some exceedences have occurred and resulted in placement of F6 on the 303 (d) list of impaired waters for temperature, with a low priority.

Water Quality: Available data through 2007 shows pH exceeding 9.0 approximately 15% of the time consistently since 1995. Grab samples taken at County Road 83 for 2007-2008 also indicate high pH levels, again exceeding 9.0 in 6 of 22 readings (27%). Generally, pH values exceeding 9.0 are considered unsuitable for trout based on the US Fish and Wildlife Service Habitat Suitability Index manuals for rainbow and brown trout (Raleigh et al 1984a; Raleigh et al 1984b). Findings include 1) physiological effects begin at pH \geq 9.0, 2) can be lethal at pH \geq 10.0 for hatchery rainbows, 3) can be lethal at pH \geq 9.8 for brook trout, and 4) can be lethal at pH $>$ 9.0 for trout eggs and early life stages. In addition, as of April 2010 this reach of the Fraser River has been placed by the State of Colorado on the 303(D) list for monitoring and evaluation for copper.

Water Supply Issues (UPCO): UPCO reports that flows in this reach are generally adequate under current conditions, with occasional shortages under future conditions.

Summary of Results and Additional Remarks:

1. No streamflow records are available for this reach. However, limited records available for Reach F7, immediately downstream, indicate that streamflows within the recommended target flow ranges have likely been common in F6 and the recommended flushing flow has been met or exceeded with regularity.
2. Temperatures appear supportive of a cold-water fishery, although some exceedences of temperature standards have been observed.
3. High pH readings are of concern.
4. Flows for water uses including recreation are generally adequate.
5. 2007 electrofishing data collected by GEI Consultants indicate brown, brook and rainbow trout occur within this reach, comprising 93, 6, and 1 percent of the game fish catch, respectively (GEI 2007).
6. Some habitat restoration efforts have been observed on the downstream portion of F6 near County Road 83. As of May 2010 the details of this restoration are unknown.
7. 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, may be occasionally lower than target ranges in this reach.

Restoration Opportunities: The flow recommendations and enhancement measures proposed for the upstream Fraser River reaches will provide benefits in F6 as well. Additional opportunities include the following:

- ✓ Follow-up on the ongoing restoration efforts and explore opportunities to expand such efforts. Specific restoration practices could include bank stabilization, tree plantings, channel narrowing with pool-cover features and elevated bar construction and spawning gravel trapping or placement.
- ✓ Explore livestock grazing practices and implement BMPs for reducing impacts such as fencing and isolated crossings.
- ✓ Consider site-specific bank restoration where grazing impacts have de-stabilized existing banks.

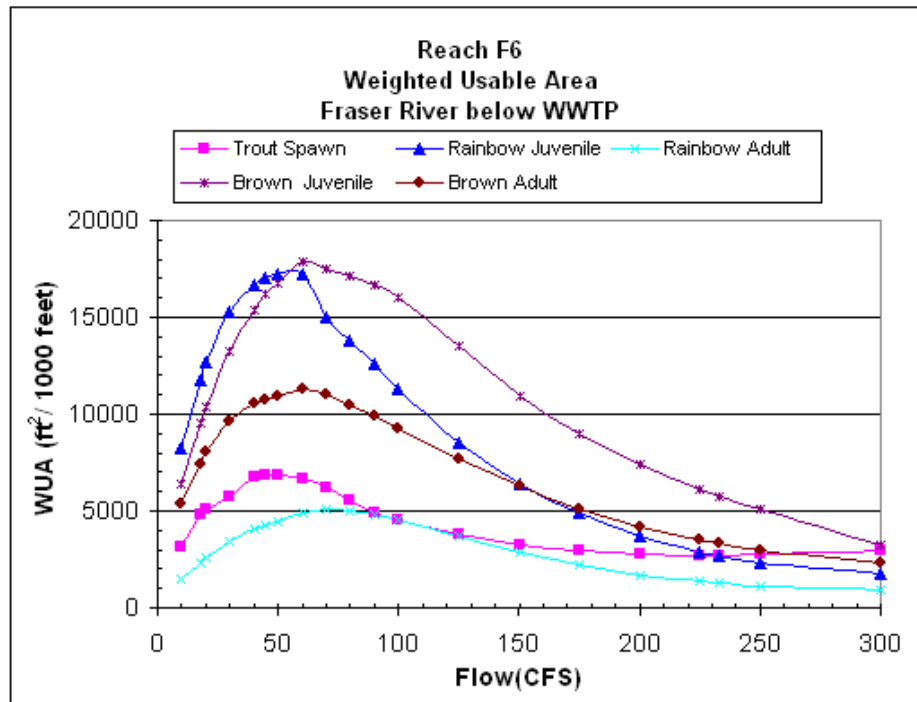
Monitoring: Establish and implement a monitoring program. Parameters should include pH monitoring to identify the source of the high readings observed at the downstream end of this reach. Once the source is identified, appropriate remediation measures should be taken. Surface water temperature monitoring should also be continued. Consider the addition of air temperature monitoring.

Support Data

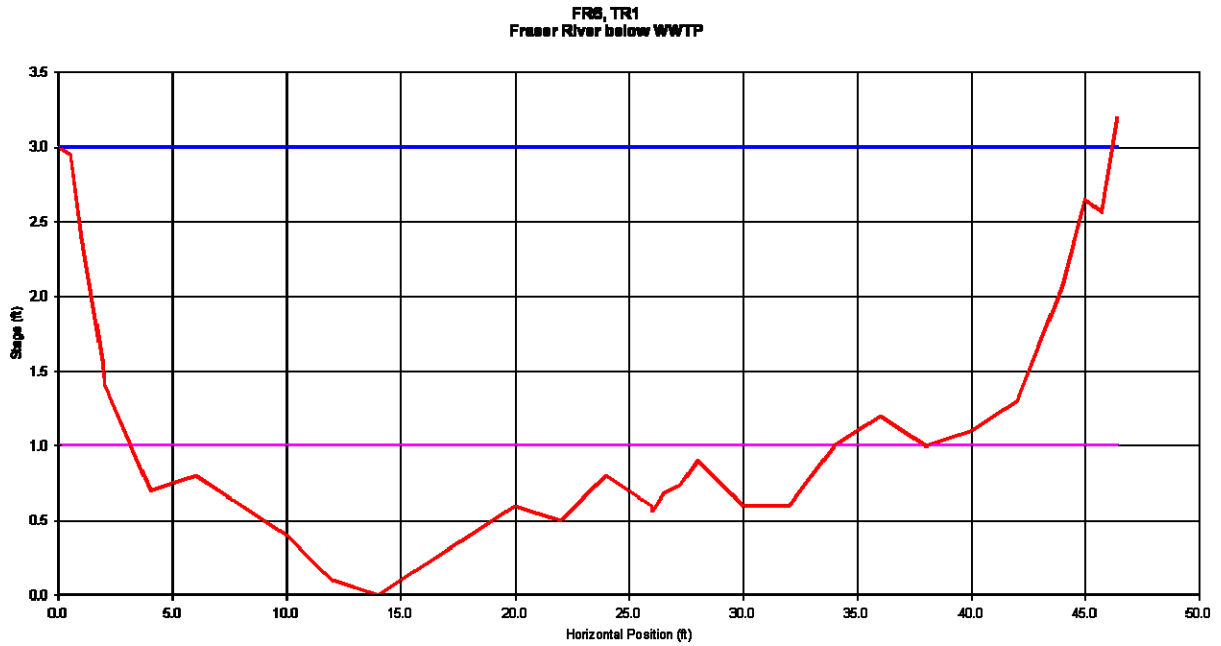
Weighted Useable Area Plots and Tables

Habitat-flow relations for the target species and life stages for Reach F6, Tetra Tech site.

Reach F6						
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)				
10.00	51254.7	3131.5	8229.8	1457.6	6359.5	5382.9
18.00	59637.3	4776.9	11789.2	2313.5	9518.1	7396.5
20.00	62496.4	5098.9	12693.2	2553.6	10351.1	8039.9
30.00	67603.7	5696.1	15288.3	3434.1	13277.5	9631.1
40.00	70117.2	6713.0	16701.3	4067.3	15381.4	10519.7
45.00	70897.2	6824.4	17062.0	4299.6	16173.3	10777.6
50.00	71474.1	6852.7	17261.0	4489.8	16791.2	10948.6
60.00	72192.5	6627.9	17226.8	4892.1	17824.2	11287.9
70.00	72808.8	6226.0	14957.7	5124.2	17528.8	10975.2
80.00	73386.8	5554.3	13785.8	5013.7	17170.6	10469.5
90.00	73914.6	4878.4	12558.1	4796.2	16624.7	9865.7
100.00	74392.9	4541.8	11313.4	4502.7	15978.5	9237.4
125.00	75899.6	3801.1	8519.6	3659.8	13505.3	7658.6
150.00	76848.8	3272.2	6417.5	2837.6	10933.9	6257.2
175.00	78693.0	2941.7	4881.7	2180.0	8936.6	5076.3
200.00	79951.4	2747.4	3744.4	1692.4	7385.5	4184.0
225.00	80999.5	2693.4	2894.8	1363.9	6154.3	3505.6
233.00	81328.4	2704.6	2697.9	1286.2	5759.9	3315.9
250.00	84518.2	2763.1	2359.9	1142.3	5050.2	2988.3
300.00	86216.4	2950.4	1748.1	929.2	3223.9	2337.0



Transect and Bedload Threshold Plots and Tables

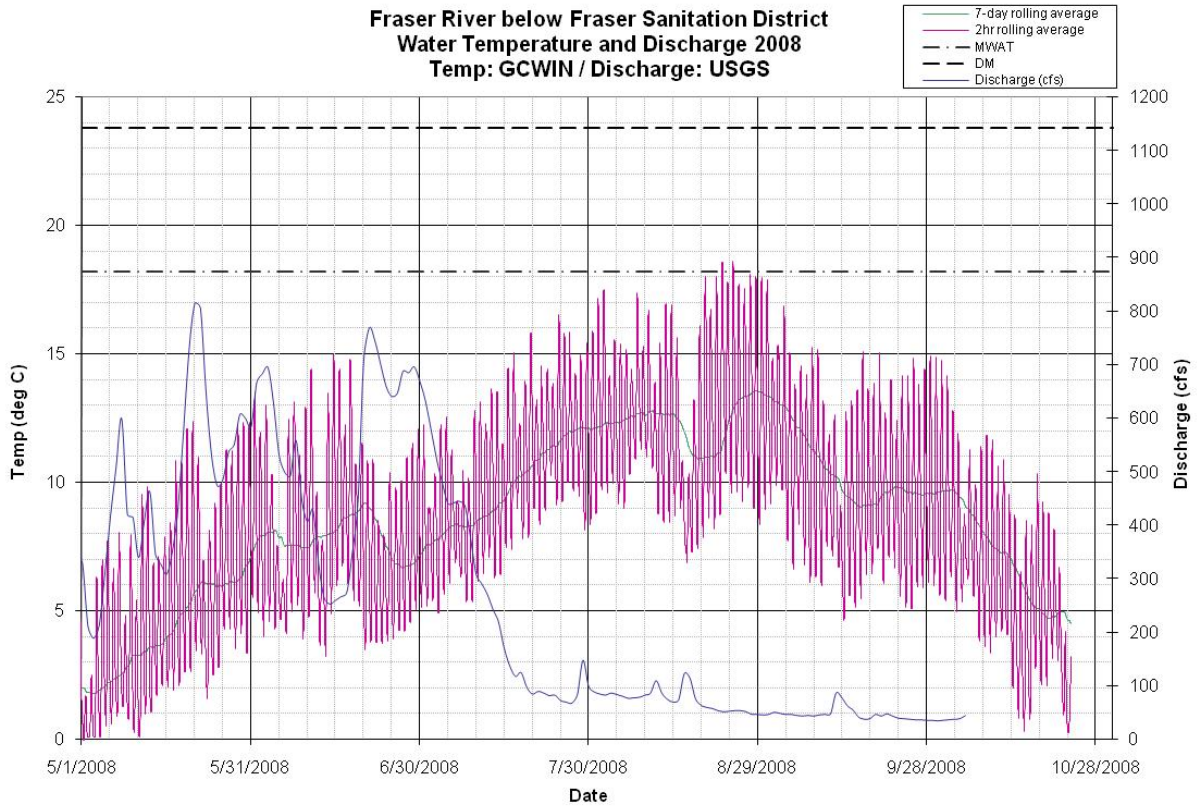
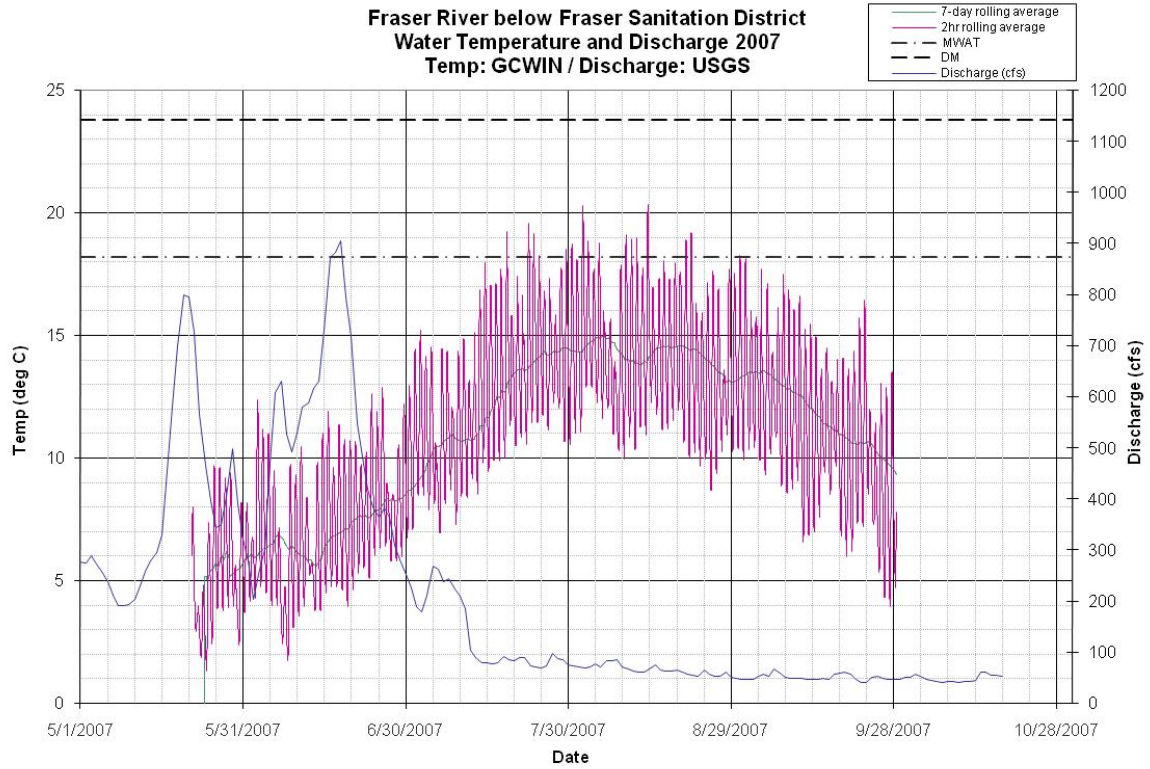


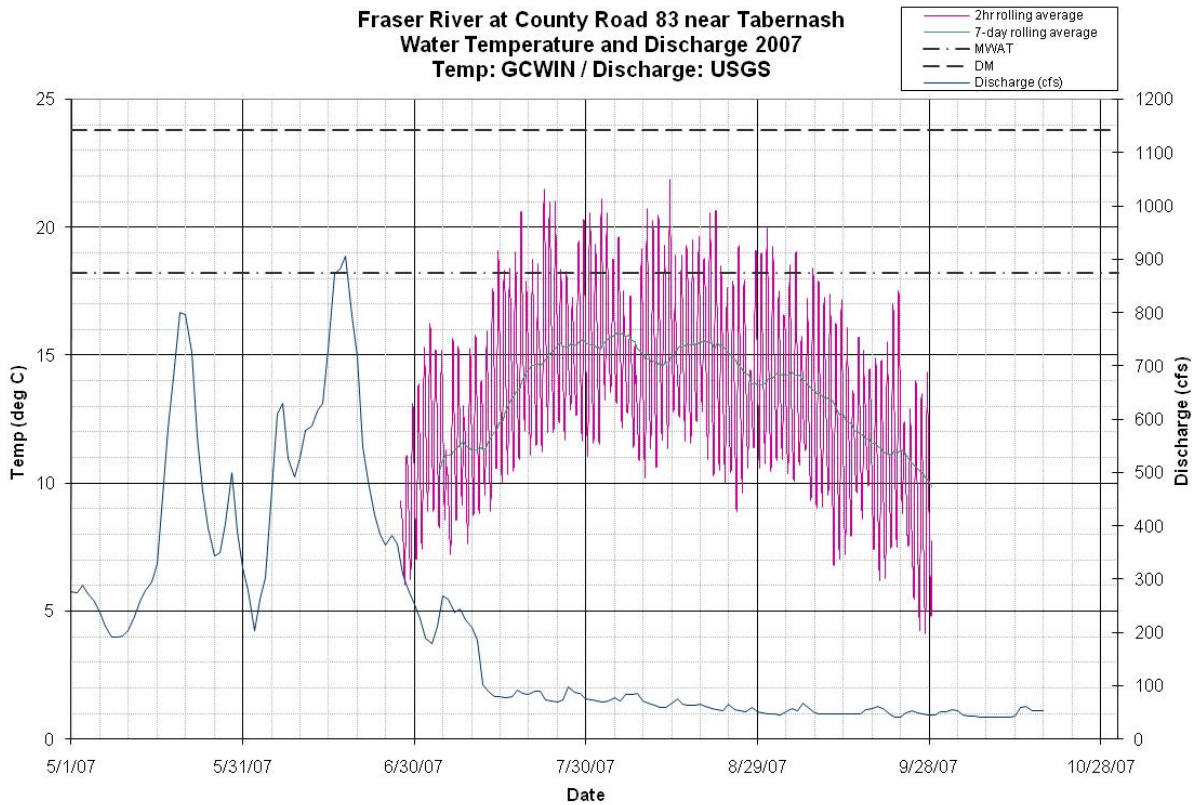
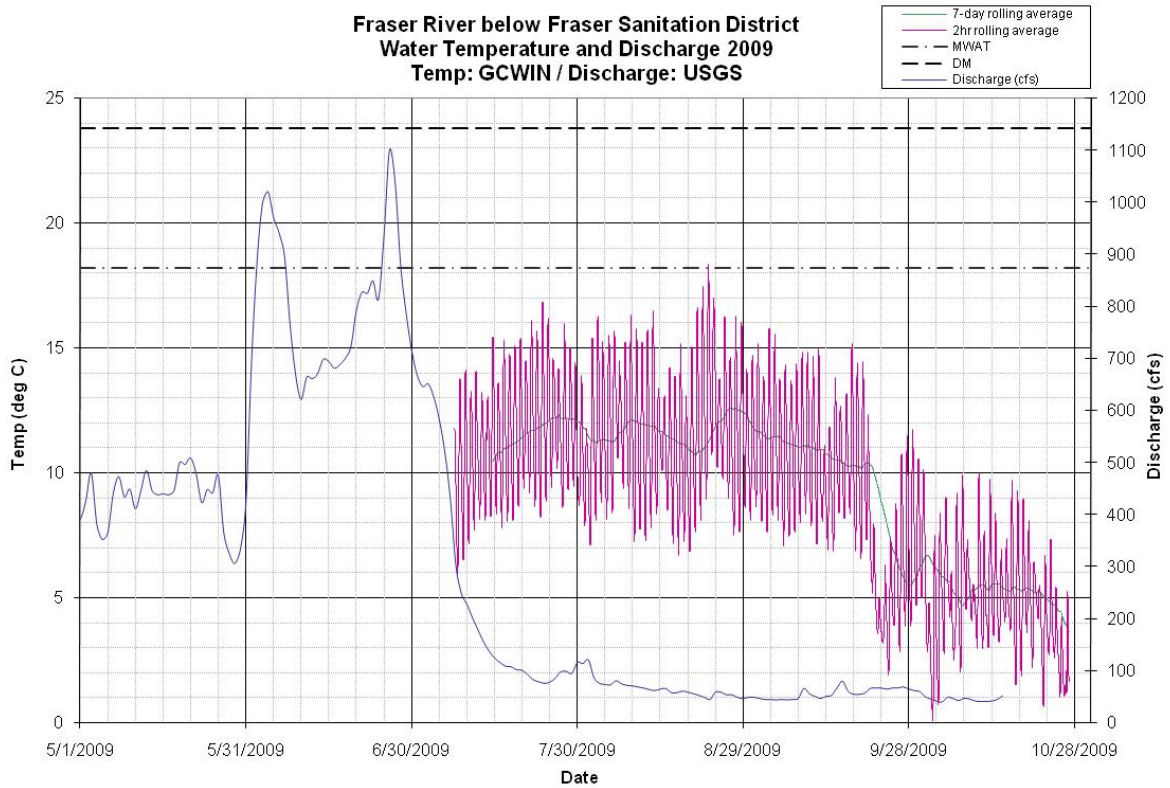
FR6, TR1
TT2007 site

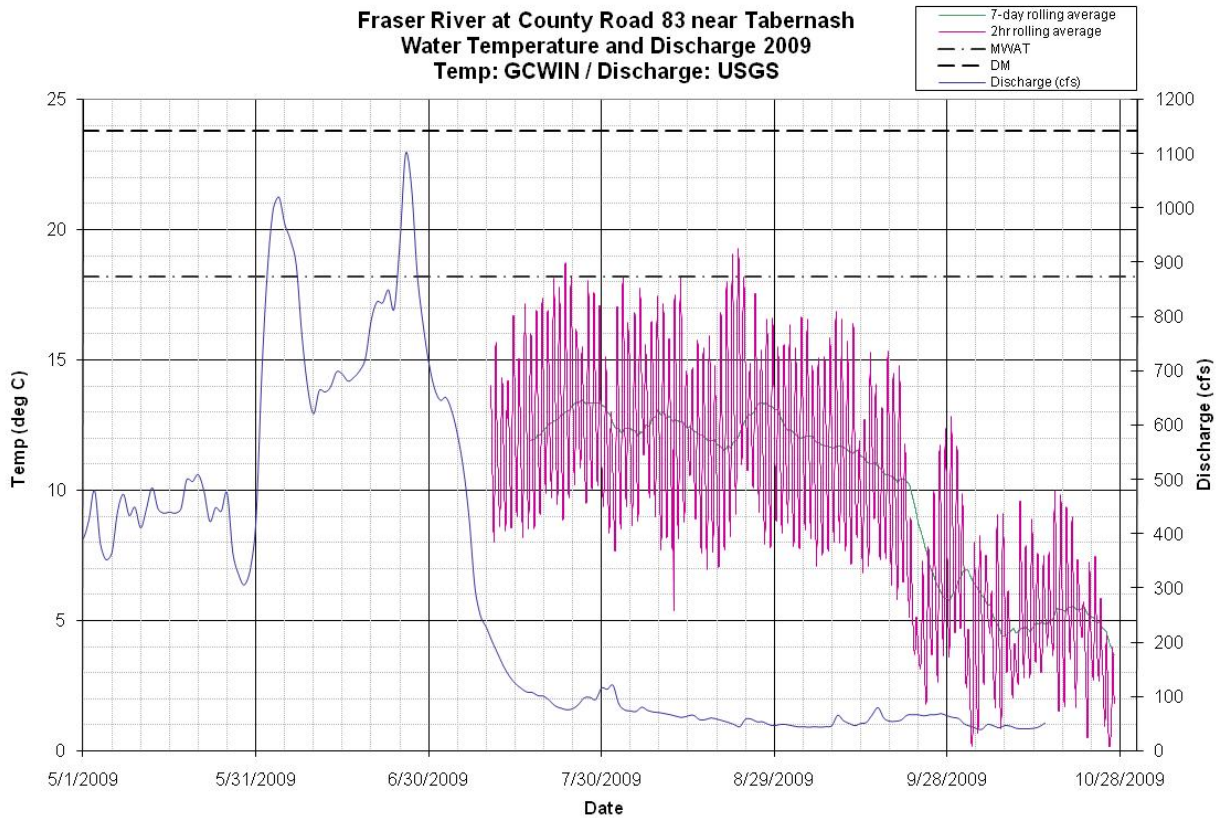
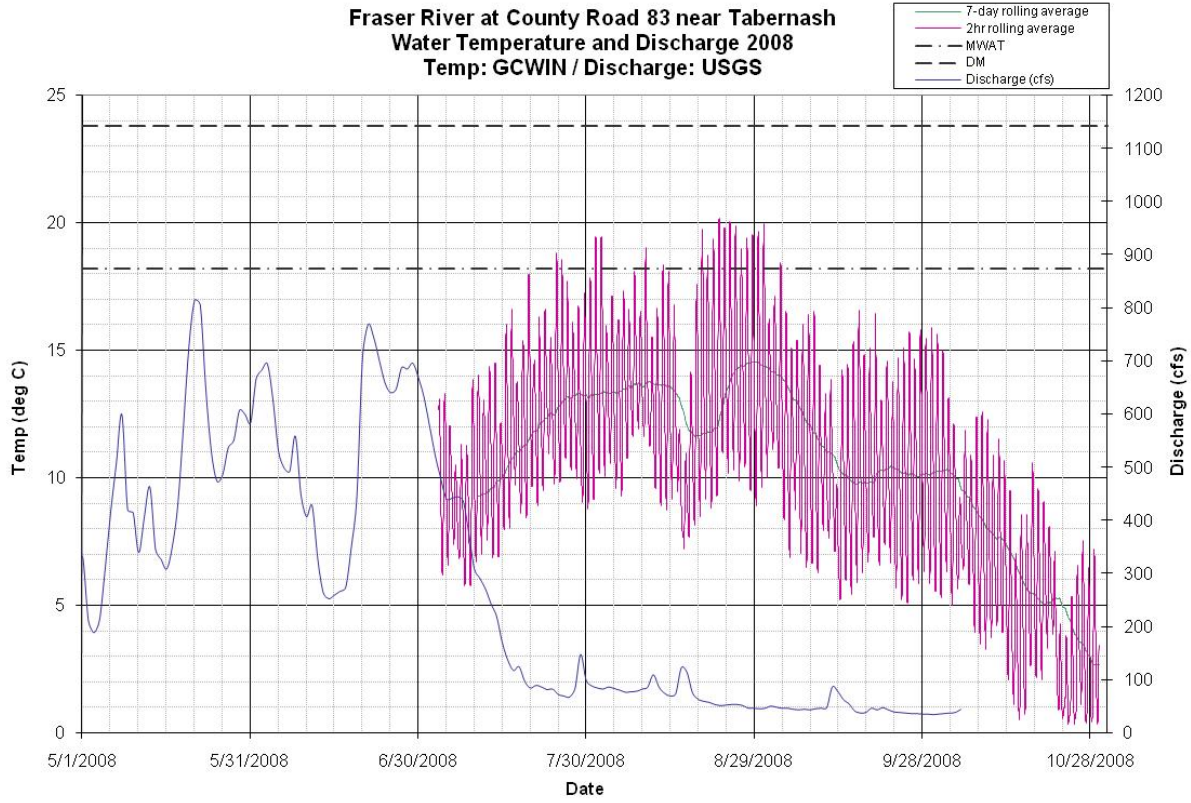
Resistance Method: Jarrett's Equation

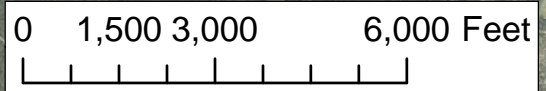
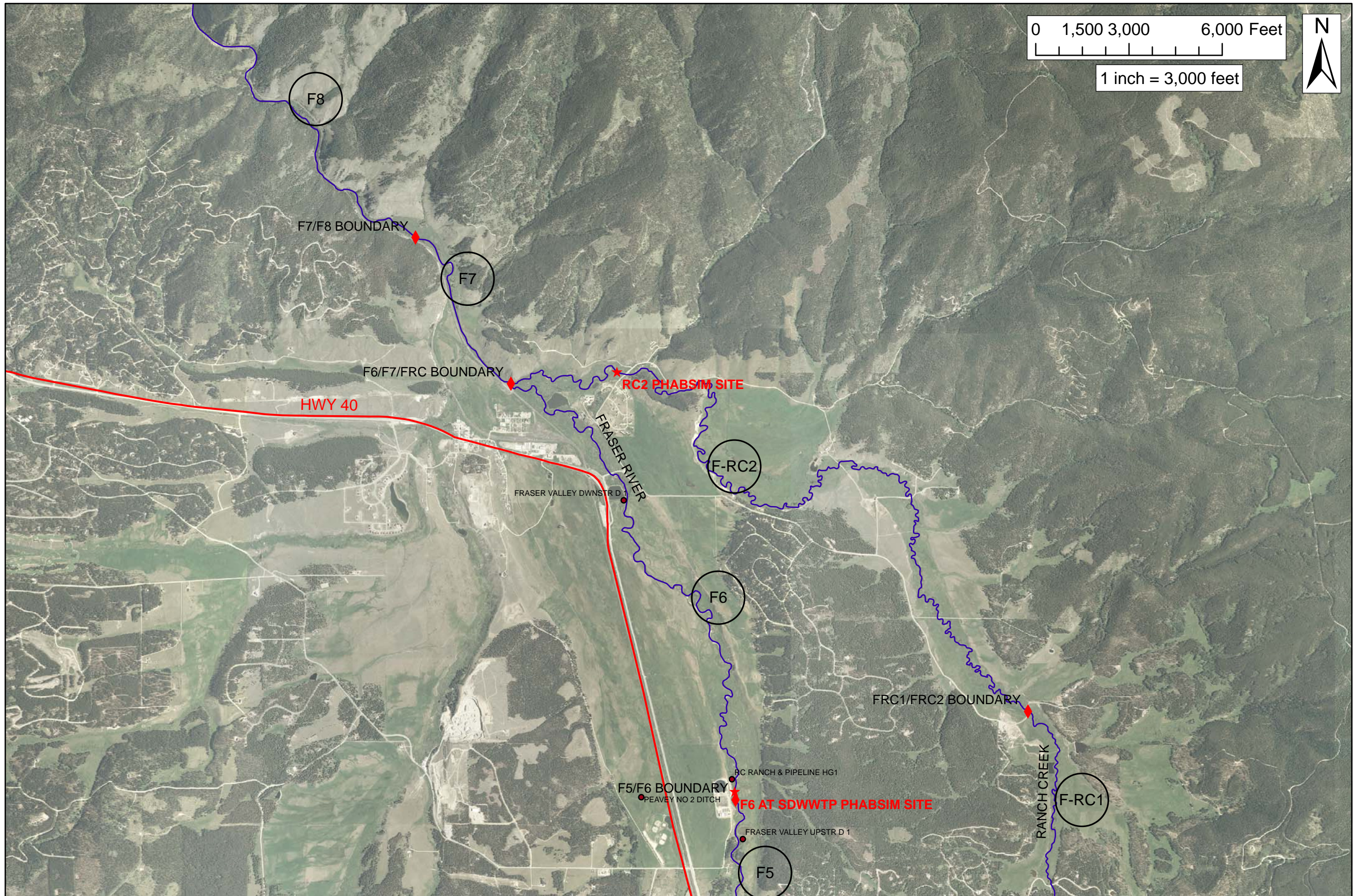
STAGE (ft)	AREA (sq ft)	PERIM (ft)	WIDTH (ft)	R (ft)	DHYD (ft)	SLOPE (ft/ft)	n	VAVG (ft/s)	Q (cfs)	SHEAR (psf)
1.0	14.27	31.15	30.85	0.46	0.46	0.005	0.059	1.06	15.1	0.14
1.1	17.57	35.46	35.13	0.50	0.50	0.005	0.058	1.13	19.8	0.15
1.2	21.25	38.78	38.42	0.55	0.55	0.005	0.057	1.22	26.0	0.17
1.3	25.15	40.09	39.70	0.63	0.63	0.005	0.056	1.37	34.5	0.20
1.4	29.15	40.67	40.25	0.72	0.72	0.005	0.055	1.53	44.6	0.22
1.5	33.19	41.06	40.57	0.81	0.82	0.005	0.054	1.69	56.1	0.25
1.6	37.26	41.46	40.89	0.90	0.91	0.005	0.053	1.85	68.8	0.28
1.7	41.37	41.89	41.26	0.99	1.00	0.005	0.052	2.00	82.6	0.31
1.8	45.52	42.32	41.63	1.08	1.09	0.005	0.051	2.14	97.6	0.34
1.9	49.70	42.74	42.00	1.16	1.18	0.005	0.051	2.29	113.6	0.36
2.0	53.92	43.17	42.37	1.25	1.27	0.005	0.050	2.43	130.8	0.39
2.1	58.17	43.58	42.72	1.33	1.36	0.005	0.050	2.56	149.2	0.42
2.2	62.46	43.92	43.00	1.42	1.45	0.005	0.049	2.70	168.8	0.44
2.3	66.77	44.27	43.29	1.51	1.54	0.005	0.049	2.84	189.5	0.47
2.4	71.12	44.62	43.57	1.59	1.63	0.005	0.048	2.97	211.2	0.50
2.5	75.49	44.95	43.83	1.68	1.72	0.005	0.048	3.10	234.2	0.52
2.6	79.89	45.60	44.39	1.75	1.80	0.005	0.048	3.21	256.7	0.55
2.7	84.37	46.42	45.11	1.82	1.87	0.005	0.047	3.31	279.5	0.57
2.8	88.90	46.71	45.32	1.90	1.96	0.005	0.047	3.44	306.0	0.59
2.9	93.44	46.99	45.52	1.99	2.05	0.005	0.047	3.57	333.5	0.62
3.0	98.01	47.71	46.17	2.05	2.12	0.005	0.046	3.67	359.4	0.64

Surface Water Temperature Plots









1 inch = 3,000 feet



GRAND COUNTY
STREAM MANAGEMENT PLAN
REACHES

Legend

- ◆ REACH BOUNDARY
- ★ PHABSIM SITES
- DIVERSIONS

REACH: F6
SHEET # :
1 OF 1

