F4 Stream Reach Summary

Study Reach: F4, Fraser River - Town of Winter Park at Idlewild Road downstream to Town of Fraser at Meadow Ridge Road.

Reach Description: Approximate channel length: 3 miles, approximate channel slope 1.2%.

As the Fraser River leaves Winter Park, the river corridor begins to widen and flatten in slope. Sinuosity increases and the overbank vegetation transitions from pine forest to wetland meadows. Areas between Winter Park and Fraser are developing rapidly including residential, commercial and potentially a golf course. Sand deposition is visible and algae were observed along the banks of the Fraser River immediately south of Fraser. The floodplain along the Fraser near the Town of Fraser contains a series of wells that serve as water supply for the Winter Park West, Water and Sanitation District. In 2003, a consortium of municipalities, agencies and organizations implemented the Fraser River Enhancement Project along F4 immediately upstream of the Town of Fraser.

Fraser River downstream of Winter Park at the Rendezvous Bridge

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Fraser River immediately upstream of Fraser near well fields (Note algae on rock bar)

Flow Recommendations:

***Environmental Flow Methodology*:** CWCB flow recommendations are available for this reach. In addition environmental flow recommendations were developed using a PHABSIM study reported by Chadwick (1985) using the relationships between brook trout habitat and flow. A new study site was not established in this reach. See Appendix A for methodology.

Water Users:

- Irrigators, municipalities and industry flow-related issues: The Town of Fraser and the Winter Park West Water and Sanitation District obtain water from a series of groundwater wells along the Fraser River. The wells are located in the Fraser River alluvium and the Troublesome Formation. Recharge is from the Fraser River. In 2003 a study was completed which estimated the minimum flows required in the Fraser River to recharge and replace water being pumped from the well fields. The study concluded that an annual average, minimum flow in the Fraser River must be 4.6 cfs or greater for well recharge (Brown and Caldwell, 2003). Note that the minimum CWCB ISF in this reach is 11.0 and 5.0 cfs (summer and winter respectively). The study concludes that, although the range of CWCB flows is probably sufficient to recharge the aquifer, flows in excess of CWCB instream flows will be required to meet the Town's recharge needs while meeting CWCB instream flows at the downstream of the Town of Fraser.
- Recreational flows: Angling is the predominant recreational use. Float boating is possible in F4, however, not common due to low flows and limited accessibility.

Summary of Flows:

Environmental, recommended target flow range (based on Chadwick 1985)

- 20 to 30 cfs for April through September
- 10 to 30 cfs for October through March
- No flushing flow recommendation possible. Assume flushing flow from upstream will be adequate.

CWCB flows

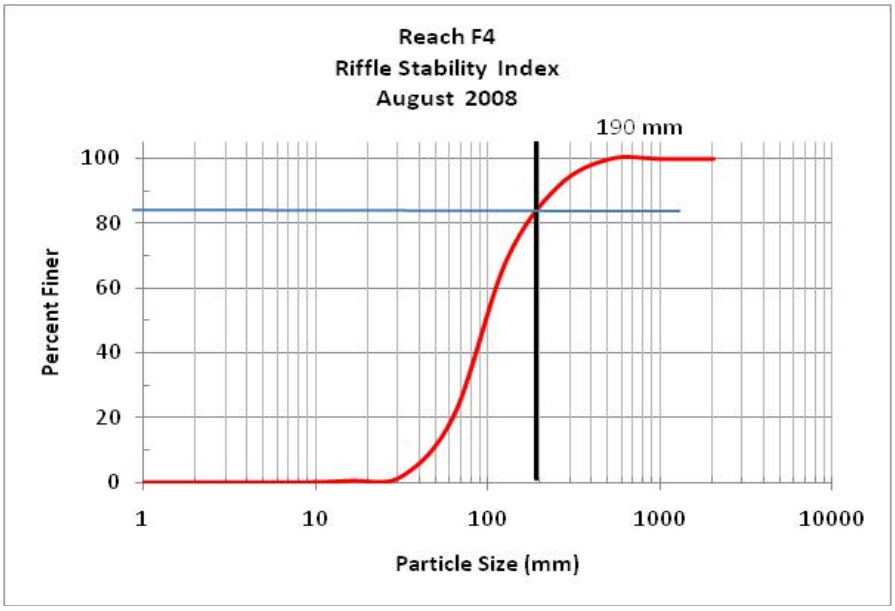
- 11 cfs summer (05/15 – 09/15)
- 5 cfs for winter (09/16 – 05/14)

Water Users

- Irrigators, municipalities and industry: The local diversions in this reach could potentially divert up to approximately 18 cfs during the summer seasons and 15 cfs in the winter. Most of the summer diversions are for irrigation and will likely have some return flows.
- Recreational flows: Angling: 60-200 cfs

Stream Assessments: In August 2008 Tetra Tech conducted three stream assessments in F4. 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 84 indicates riffle substrate is moderately unstable with up to 84% of particles mobilized by recent high flow events. Overall, the stream assessments did not reveal any issues of significant concern. Results of all three assessments are summarized in the following table and plot. Details and methodology are presented in Appendix A.

Reach F4 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	18
2	Mass wasting hazard	6	2	Aquatic Structure as Cover	14
3	Debris Jam Potential	4	3	Velocity/ Depth Regimes	16
4	Vegetation Cover	5	4	Channel Flow Status	14
	Upper Bank Score:	**17**	5	Channel Alteration	15
Lower Banks			6	Frequency of Riffles	18
5	Channel Capacity	2	7	Channel Sinuosity	10
6	Bank Rock Content	5		**Channel Score**	**105**
7	Flow obstructors & Deflectors	3			
8	Cutting	6	8	Bank Stability	16
9	Deposition	6	9	Riparian Vegetation Cover and Disturbance	18
	Lower Bank Score:	**22**	10	Riparian Vegetation zone width	16
Channel Bottom				**Bank Score**	50
10	Rock Angularity	2		**Total Score**	**155**
11	Brightness	2	**Notes**		
12	Consolidation/Particle Packing	4			
13	Bottom size distribution	6			
14	Bed Scour and Deposition	9			
15	Clinging Aquatic Veg	2			
	Channel Bottom Score:	**25**			
	Total Score:	**64**			



Spawning Observations: A spawning survey was conducted in F4 on 27 October 2008 but no likely trout redds were identified. The coarse substrate throughout the reach in potential spawning locations and the influence of numerous beaver dams on fine sediment deposition may be responsible for curtailing trout spawning activity in this reach.

Hydrologic Records: No streamflow records are available for this reach. The most applicable records are those for reach F3, immediately upstream.

Water Temperature: Two temperature standards exist in reach F4, as defined by CDPHE. Upstream of the Rendezvous Bridge is Tier I; downstream of the Rendezvous Bridge is Tier II. Available temperature data upstream of the Rendezvous Bridge was reviewed and compared to Tier I standards, which includes a chronic standard of 17^{o}C MWAT and an acute temperature standard of 21.2^{o}C DM. Temperature data reviewed in reach F4 indicate stream temperatures for the Fraser River in this area are generally well below the MWAT and DM standards.

Water Quality: Some algae was observed in summer of 2007, otherwise, there are no indications from existing data that constituents are regularly exceeding criteria. Sanding operations along the highway and side roads could be contributing to the sediment and aggradation observed in the river.

Water Supply Issues (UPCO): Water supply is generally considered adequate with occasional shortages under existing conditions. Under future conditions, water shortages are predicted to be increased significantly.

Summary of Results and Additional Remarks:

1. No streamflow records are available for this reach. However, daily streamflow exceedence plots for F3 indicate the flow recommendations have been commonly equaled or exceeded throughout the entire period-of-record. Thus, it is likely that recommended flows in F4 are commonly met.
2. Temperatures and water quality appear supportive of a cold-water fishery.
3. Flows for water uses including recreation are generally adequate.
4. 2007 electrofishing data collected by GEI Consultants indicate brook, rainbow and brown trout occur within this reach, comprising 61, 38, and 1 percent of the game fish catch, respectively (GEI 2007). DOW fish sampling indicates that the F4 reach has had an increase in adult trout population, likely the result of the Stream Enhancement Project. However, there appears to be an absence of spawning sites in the reach.
5. The stream enhancement project was recently completed which re-configured approximately 3 miles of the Fraser River channel near the Town of Fraser. Improvements included the construction of pools and scour structures with the intent of addressing elevated temperatures. However, little information or project details were available for inclusion in this report.
6. Volumetric flow rates in this reach could be impacted by a proposed pump-back plan, which is contemplated to recapture Fraser River return flows below the Towns of Fraser and Winter Park. A reconnaissance-level study was completed by GEI in June 2005 addressing several alternatives and associated costs. Preliminary indications are that the pump-back plan could compensate for flow shortages, but the environmental impacts are yet unknown (GEI 2005).
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, will be typically lower than target ranges in this reach.

Restoration Opportunities: The proposed sediment basin(s), flushing flow recommendations and application of flow enhancements made for F2 and F3 will provide direct benefits in F4 as well. Additional opportunities include the following:

- ✓ Practice and enforce effective Best Management Practices (BMPs) associated with local construction for the control of sediment runoff.

- ✓ Install log or rock vanes to improve gravel trapping to provide additional trout spawning habitat in the reach. Spawning gravel placement in suitable locations could also be beneficial.

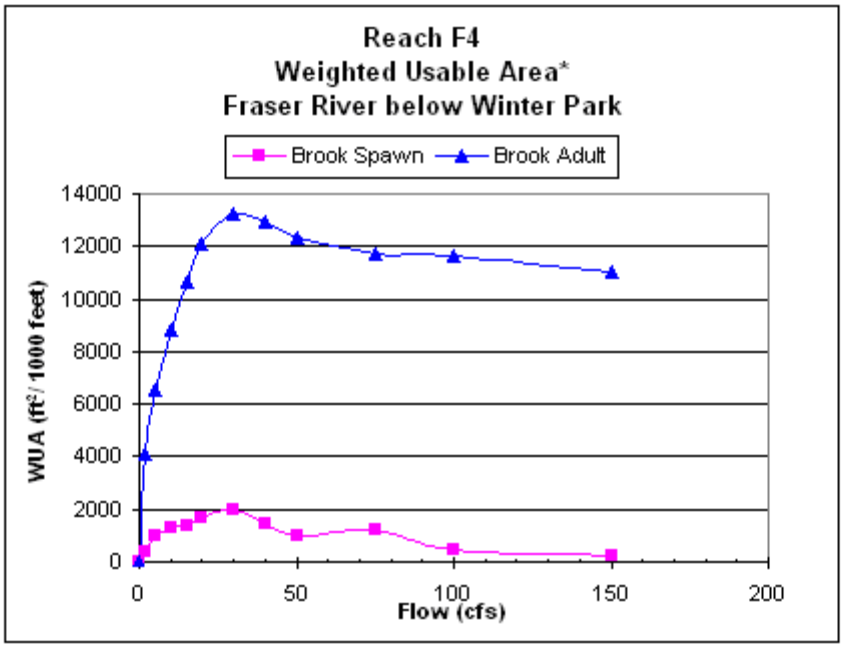
Monitoring: Establish and implement a monitoring program. Parameters should include monitoring of fish population, benthic macro invertebrates and river cross sections to track the success of the Fraser River Enhancement improvements recently constructed near the Town of Fraser.

Support Data

Weighted Useable Area Plots and Tables

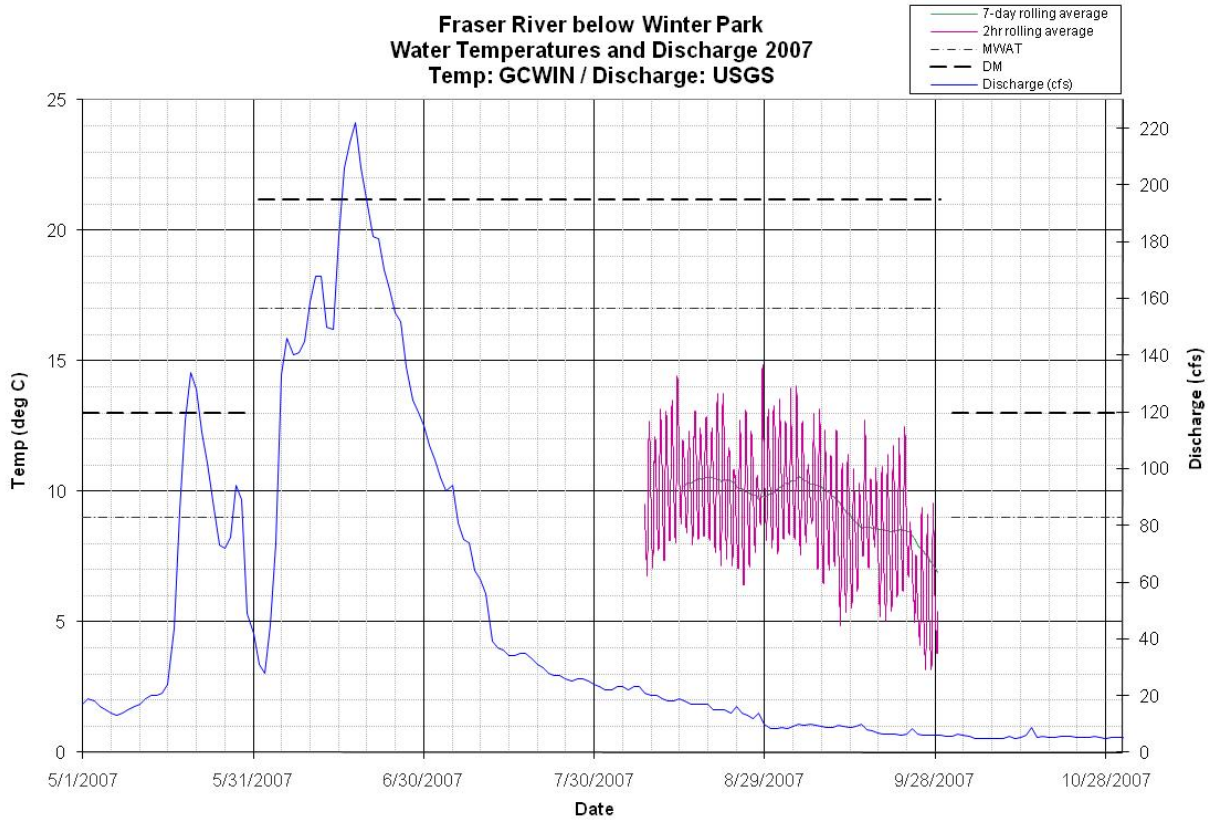
Habitat-flow relations for the target species and life stages for Reach F4 developed by Chadwick and Associates, 1986.

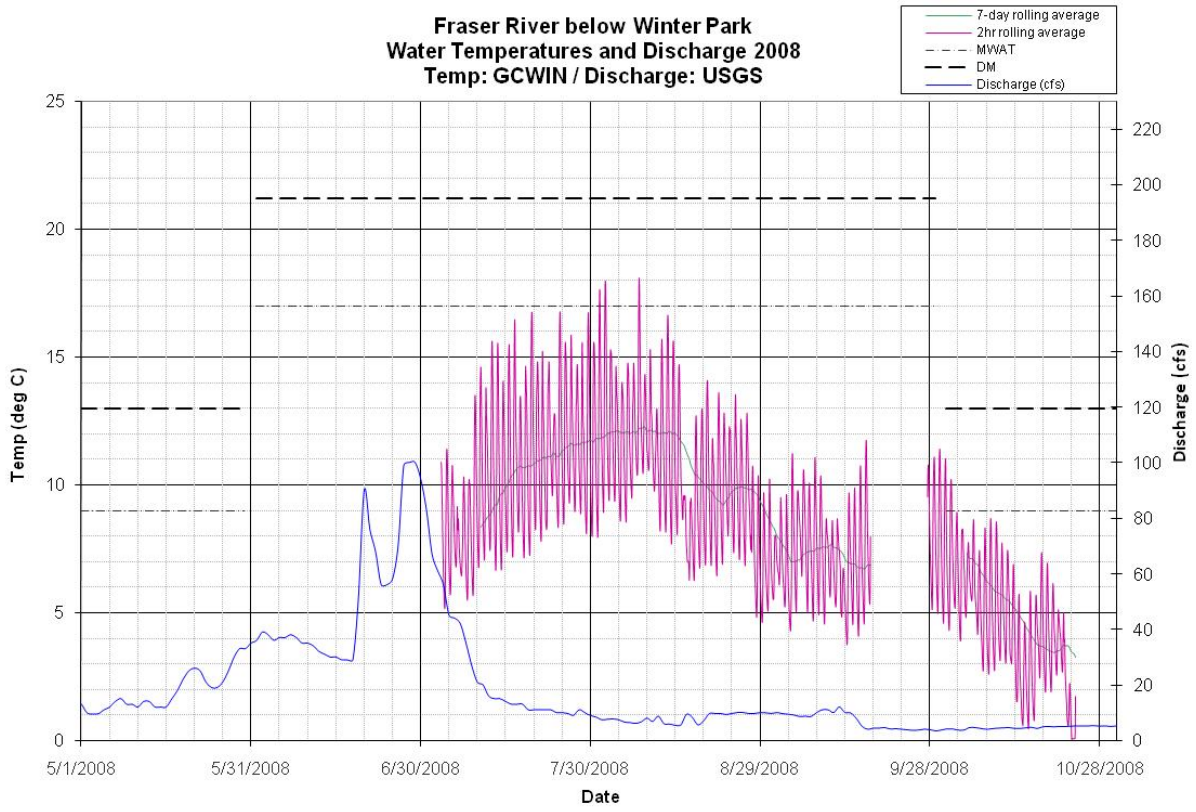
Reach F4			
Flow	Total Area	Brook Spawn	Brook Adult
(cfs)	(ft^2)	Weighted Usable Area (ft^2/1000 ft stream length)	
0	0	0	0
2	15468	392	4121
5	20253	1004	6534
10	24448	1292	8836
15	27198	1395	10683
20	29287	1705	12089
30	31669	2014	13219
40	33531	1443	12904
50	35038	995	12305
75	41242	1184	11696
100	43049	453	11637
150	44428	258	11051
10000	0	0	0

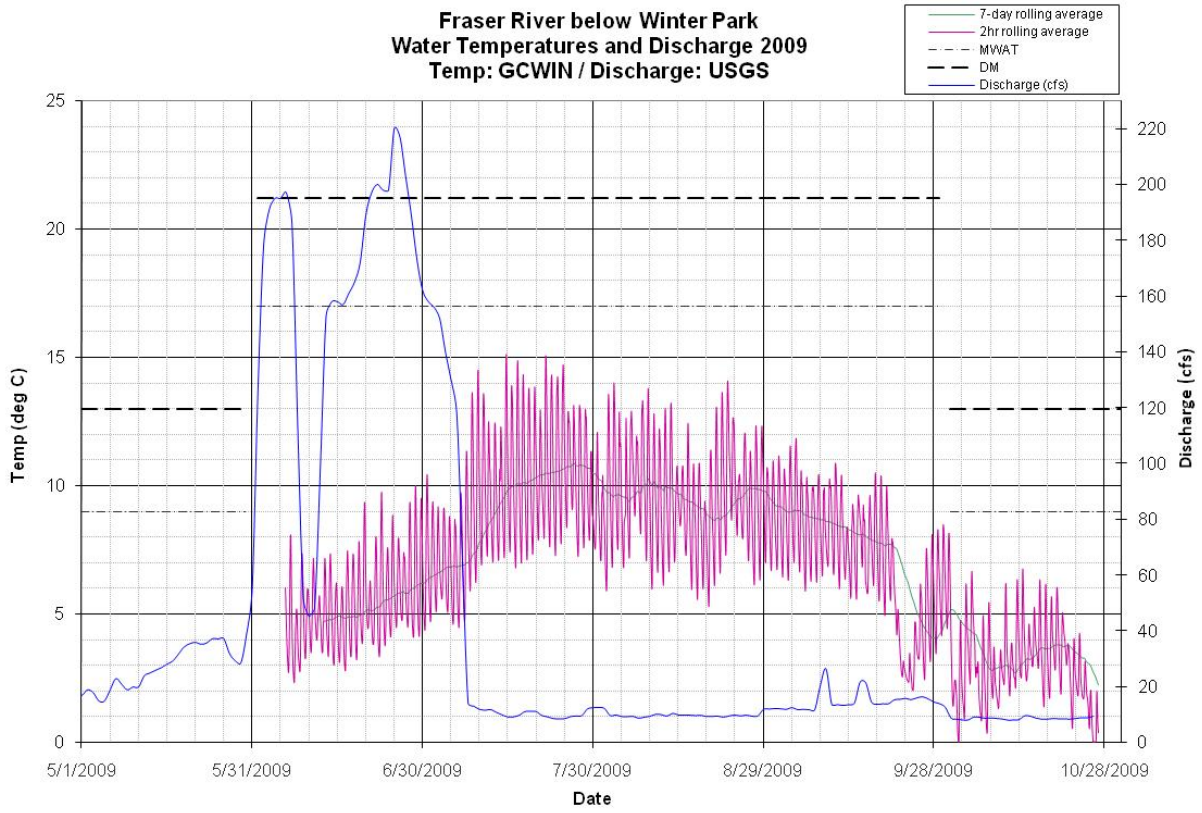


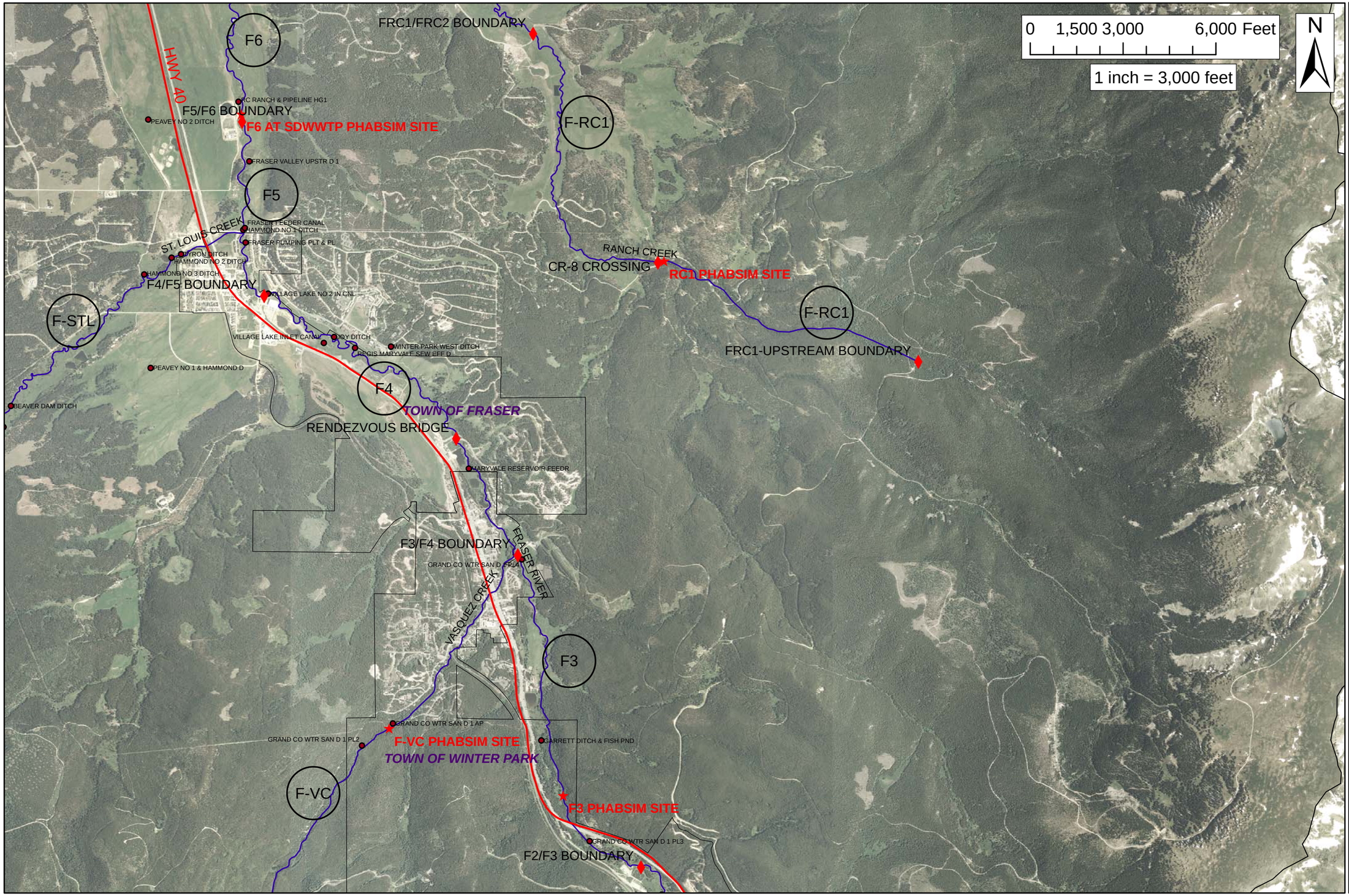
*Fraser River Segment 1, 1978-1985 data collected by Chadwick and Associates

Surface Water Temperature Plots






Fraser River below Winter Park
Water Temperatures and Discharge 2009
Temp: GCWIN / Discharge: USGS
7-day rolling average
2hr rolling average
MWAT
DM
Discharge (cfs)
Temp (deg C)
Discharge (cfs)
Date
0
5
10
15
20
25
0
20
40
60
80
100
120
140
160
180
200
220
5/1/2009
5/31/2009
6/30/2009
7/30/2009
8/29/2009
9/28/2009
10/28/2009



GRAND COUNTY STREAM MANAGEMENT PLAN REACHES

Legend

- REACH BOUNDARY
- PHABSIM SITES
- DIVERSIONS

REACH: F4

SHEET # :
1 OF 1

GRAND COUNTY Colorado · Est 1874

TETRA TECH