

South Fork Jump River at Prentice 2004 Monitoring Results

The South Fork of the Jump River was monitored above and below the Prentice wastewater treatment plant (WWTP) in 2004. The monitoring was done in response to the massive algae growths that appeared in the river in the late summer of 2003.

In September of 2003 thick floating mats of filamentous green algae (mostly *Hydrodictyon*) completely covered the river at the Old Hwy 8W bridge, about 0.7 miles downstream of the Prentice WWTP (see photos in figure 1). A sample of WWTP effluent on September 23rd, 2003 had an unusually high total phosphorus (TP) concentration of 9.1 milligrams per liter (mg/l). An upstream river sample on that date had a TP concentration of 0.026 mg/l and a downstream sample had a TP concentration of 0.339 mg/l. River flow at the time of sample collection was estimated at 4.4 cubic feet per second (cfs). Drought conditions and very low stream flows occurred prior to this, during the summer of 2003 which provided minimal dilution of WWTP effluent and probably maintained higher downstream TP concentrations than were found on September 23rd.

Sampling conducted by the Prentice WWTP during 2004 determined that unusually high influent wastewater TP concentrations were due to wastewater contributions from two businesses where phosphatizing of metal surfaces was being done. The high phosphorus loads entering the WWTP coupled with low streamflows resulted in the massive algae growth in the river in 2003.

The South Fork of the Jump River was monitored above and below the Prentice WWTP on a monthly frequency during April through October of 2004. Monitoring sites are shown in Figure 2. Monitoring results are listed in Table 1.

The TP concentration of WWTP effluent during the monitoring period ranged from 3.3 to 11 mg/l with a mean of 6.8 mg/l. TP concentrations in the river upstream (site SFJ-1) were consistently low, ranging from 0.028 to 0.044 mg/l. On dates with high flows (April-June), TP concentrations in the river downstream (site SFJ-5) were only slightly elevated at 0.051 to 0.061 mg/l. On dates with lower, base flows (July-October), TP concentrations in the river downstream were 4 to 5 times higher than upstream at 0.119 to 0.195 mg/l. Higher stream flows in 2004 helped maintain lower downstream TP concentrations than probably occurred in 2003.

TP concentrations at the downstream site (SFJ-5) can be estimated with mixing calculations that combine upstream flow and TP concentration with WWTP effluent flow and TP concentration. Comparisons of calculated downstream TP concentrations with measured downstream TP concentrations is shown below. The fairly close agreement between the two values indicates that downstream TP concentrations are controlled by effluent releases, and there are no other significant gains or losses of TP between the outfall and the downstream monitoring site.

<u>Date</u>	<u>TP concentration (ug/l) at downstream site</u>	
	<u>by sample measurement</u>	<u>by mixing calculation</u>
05/11/04	59	47
06/15/04	61	55
09/22/04	168	166
10/19/04	152	156

Conductivity increases in downstream samples were less than 8% on all dates. Differences in dissolved oxygen concentrations and pH between the upstream and downstream site are fairly minor and are probably due mostly to photosynthetic activity by in-stream periphyton.

Two additional stream sites were monitored on April 13th, 2004. Site SFJ-3 is on the South Fork of the Jump River at the railroad bridge, about 0.16 miles downstream of the WWTP outfall. Monitoring results on that date were similar to those from site SFJ-5, further downstream. Site TRI-4 is at the mouth of a small unnamed tributary stream. Monitoring results from that site indicate the tributary is not a significant source of TP or flow for the South Fork of the Jump River.

Algae growth in the river downstream of the WWTP in 2004 was much less than in 2003. Attached filamentous algae (*Cladophora*) and other periphyton on rocks were similar in abundance both upstream and downstream of the WWTP (see photos in figure 3). There was a noticeable increase in duckweed and floating mats of filamentous algae downstream of the WWTP. These mats were restricted to patches along the shoreline (figure 3) and did not cover large areas of the channel as in 2003. Algae mat samples near site SFJ-5 from September 3rd, 2004 were dominated by *Hydrodictyon* as in 2003. Samples from September 22nd, 2004 were dominated by *Spirogyra* with remnants of *Hydrodictyon* and some *Microspora*. Algae mat samples from immediately below the WWTP outfall on September 22nd, 2004 were dominated by *Microspora*, with some *Spirogyra*.

Reduced algae growth downstream of the WWTP in 2004 resulted from several factors:

- Higher sustained streamflow which provided more dilution of WWTP effluent TP
- Possibly lower WWTP effluent TP concentrations due to efforts to reduce influent TP concentrations (data was not available for 2003 to allow a comparison)
- Cooler summer temperatures that reduced algae growth; August that year was one of the coolest on record

The TP concentrations measured in the WWTP effluent in 2004 are probably adequate to cause massive algae growth in the future when very low flows and warm summer temperatures occur. Phosphorus is the limiting nutrient for algae and duckweed growth in streams and lakes. Increased inputs of phosphorus result in increased growth of algae and duckweed. Minimizing phosphorus inputs is desirable to maintain high quality in the South Fork of the Jump River and downstream water bodies.

Figure 1. South Fork Jump River above and below the Old Hwy 8W bridge near Prentice in mid-September, 2003



**Fig. 2 South Fork Jump River at
Prentice 2004 Monitoring Sites**

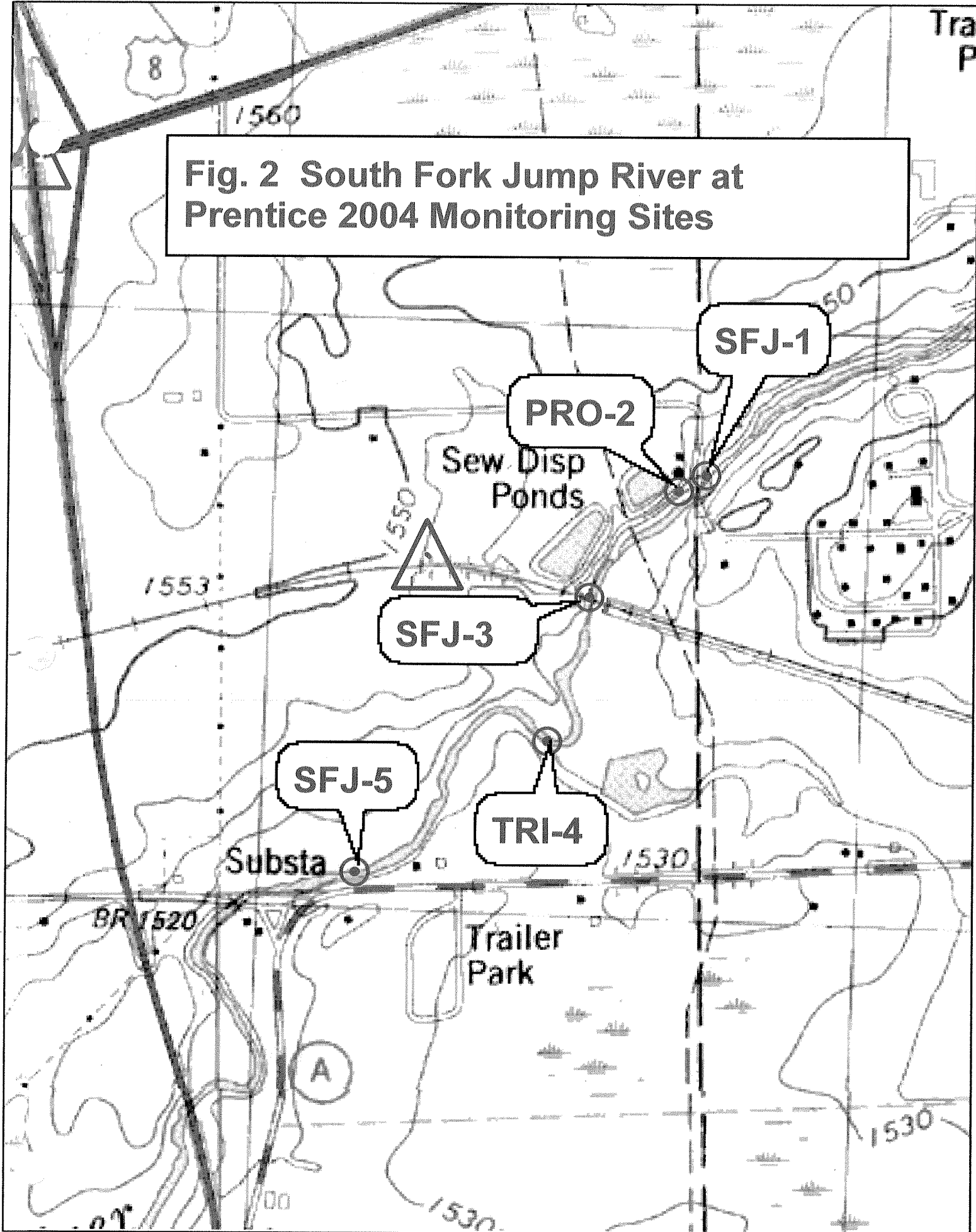


**TABLE 1. MONITORING RESULTS FOR THE SOUTH FORK JUMP RIVER AT PRENTICE
ABOVE AND BELOW WWTP, APRIL - OCTOBER 2004**

TP = total phosphorus (ug/l); Cond. = conductivity (uS); D.O. = dissolved oxygen (mg/l)
Temp = temperature (degrees Centigrade) ; cfs = cubic feet per second; mgd = million gallons per day

SFJ-1 (200 ft upstream of WWTP outfall)							SFJ-5 (Along CTH A, 0.6 mi. downstream of outfall)				
DATE	TP	Cond.	D.O.	pH	Temp (C)	Flow (cfs)	TP	Cond.	D.O.	pH	Temp (C)
04/13/2004	41	53	12.7	6.5	3.1	160	51	55	12.4	6.6	3.8
05/11/2004	31	76	9.2	7.3	16.5	50.7	59	80	9.8	7.4	17
06/15/2004	44	66	8.4	7.2	20.3	55	61	66	7.8	7.3	20.8
07/19/2004	35	209	8.8	7.9	25.2	2	195	219	12.6	8.7	26.5
09/03/2004	28	237	10.4	8	23.7	1.8	119	244	13.3	8.2	23.4
09/22/2004	37	178	9.1	nd	19.8	6	168	187	10.3	nd	20.3
10/19/2004	33	170	11.3	7.7	6.8	5.7	152	183	12.3	7.8	6.9

TRI-4 (unnamed trib mouth 0.3 mi. downstream of outfall)							SFJ-3 (At RR bridge 0.16 mi. downstream of outfall)				
DATE	TP	Cond.	D.O.	pH	Temp (C)	Flow (cfs)	TP	Cond.	D.O.	pH	Temp (C)
04/13/2004	53	132	10.2	6.5	6.4	1	47	54	12.8	6.7	3.2

PRO-2 (Prentice wwtp effluent outfall)(grab samples)			
DATE	TP (mg/l)(State lab)	TP (mg/l)(WWTP's lab)	
05/11/2004	7.6	7.4	
09/22/2004	8.9	8.7	
10/19/2004	Cond.	D.O.	pH Temp (C)
	1,055	9.1	7.4 14.5

Prentice WWTP effluent composite samples
taken during stream monitoring period

<u>DATE</u>	<u>TP (mg/l)</u>
04/05/2004	3.3
05/11/2004	6.4
06/15/2004	4.3
07/13/2004	6.3
08/04/2004	11
09/22/2004	7.9
10/19/2004	8.4

Prentice WWTP effluent flow rates on stream sampling dates

<u>DATE</u>	<u>FLOW (cfs)</u>	<u>FLOW (mgd)</u>
04/13/2004	0.18	0.117
05/11/2004	0.13	0.086
06/15/2004	0.14	0.092
07/19/2004	0.08	0.054
09/03/2004	0.11	0.068
09/22/2004	0.1	0.063
10/19/2004	0.085	0.055

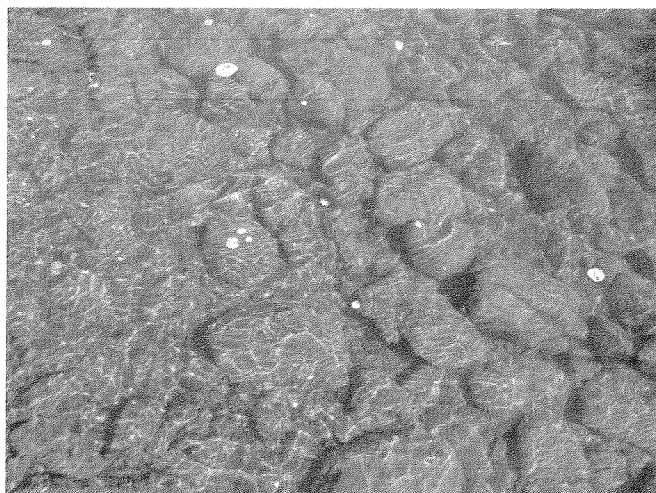
**Figure 3. South Fork Jump River at Prentice
09-22-2004 Photos**



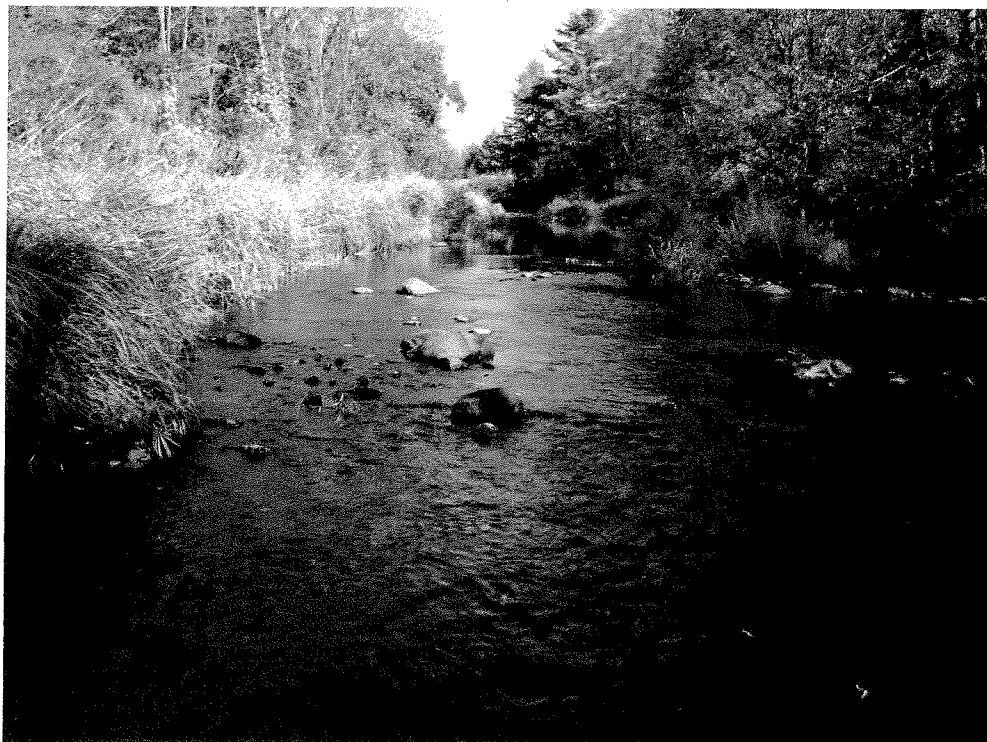
Site SFJ-1 (200 ft upstream of WWTP outfall)



Filamentous algae at SFJ-1



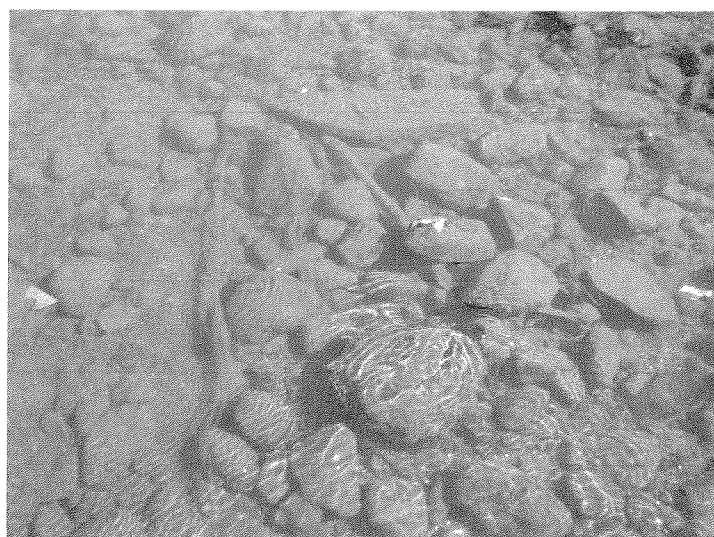
Periphyton at SFJ-1



Site SFJ-5 (along CTH A, 0.6 mi. downstream of WWTP outfall)



Filamentous algae at SFJ-5



Periphyton at SFJ-5



South Fork Jump River upstream of Old Hwy. 8W bridge



South Fork Jump River downstream of Old Hwy 8W bridge



Filamentous algae and duckweed near Old Hwy 8W bridge