

Table 1.BA. Battle Creek Monitoring Station Information



Station Address: Battle Creek near U.S. Highway 61, St. Paul, MN
County: Ramsey
Major Basin: Mississippi River Basin
Watershed: Battle Creek
Drainage Area: 11.40 square miles

Station Operator: Ramsey-Washington-Metro Watershed District

Metropolitan Council Environmental Services Contact Information:

Contact Person: Casandra Champion
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St. Paul, MN 55106
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Watershed District or Watershed Management Organization:

Ramsey-Washington-Metro Watershed District

Station Overview: MCES has supported water quality monitoring of Battle Creek since 1996. The monitoring station is located in St. Paul, Minnesota, 2.2 miles upstream from the creek confluence with the Mississippi River. MCES partners with the Ramsey-Washington-Metro Watershed District to operate the Battle Creek monitoring station. There is no rain gauge at this station; however, precipitation data are obtained from the Minnesota Climatology Working Group, St. Paul Airport Station Number 217386.

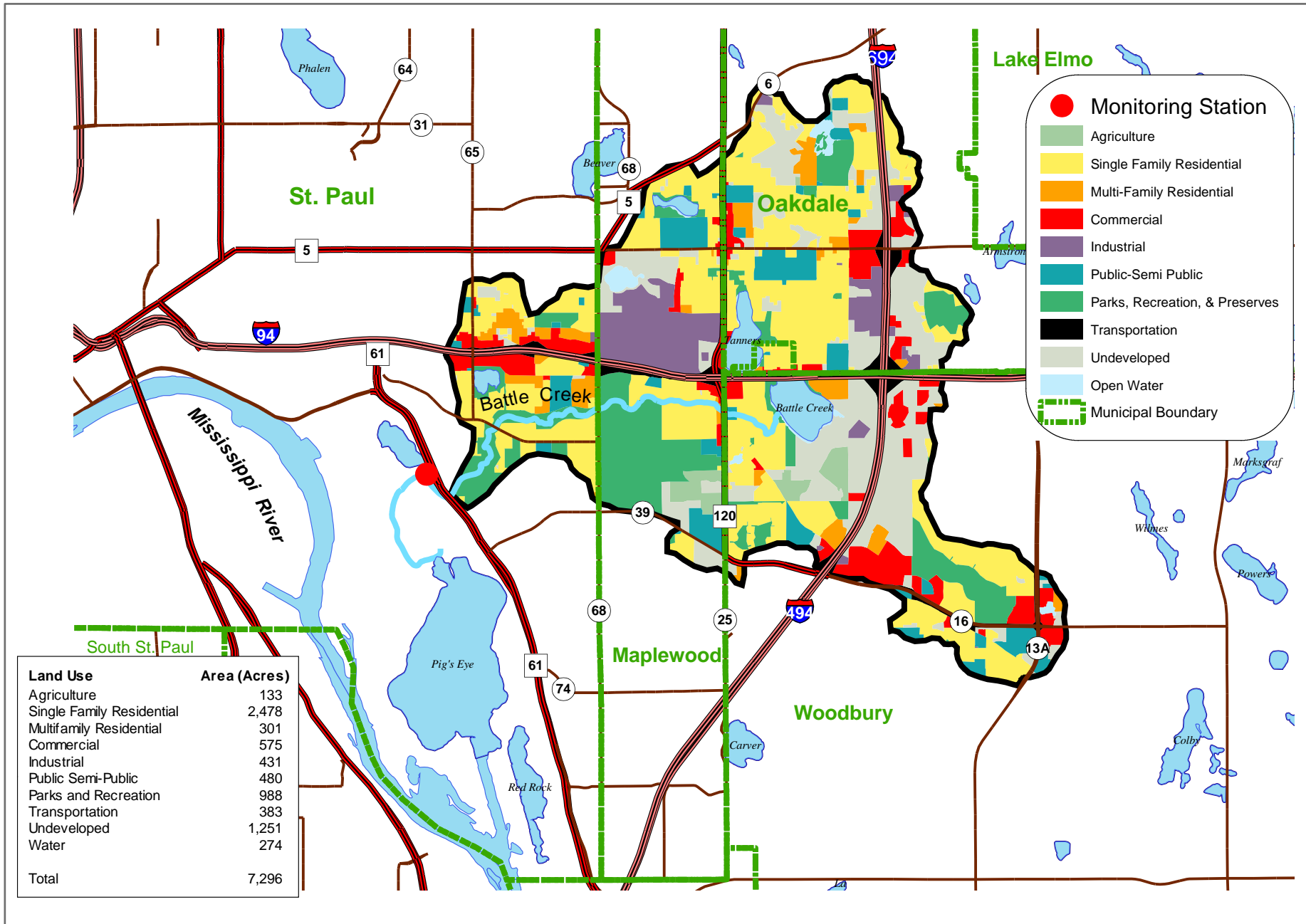
2003 Monitoring Year: Monitoring equipment was installed on March 13, 2003 and removed on December 10, 2003. Daily average flows were estimated prior to March 13 and after December 10. Snowmelt began during the last week of March 2003. The peak daily average flow of 71 cfs occurred on May 11, 2003.

Runoff event-based composite sampling began in mid-May 2003 and continued through mid-November. A composite sample collected during a small runoff event in mid-October had the highest total suspended solids (TSS) concentration (389 mg/L) of all 2003 samples.

Twenty samples were collected for water quality analysis during 2003, including 11 composite samples and 9 grab samples. The MCES annual water quality monitoring plan includes 12 monthly baseflow (“non-event”) grab samples and approximately 10 to 15 flow-weighted composite samples collected during all runoff events in the open-water season (March-November). The 2003 sampling scheme did not meet the goals of the MCES monitoring work plan. January and February baseflow conditions were not characterized with grab samples, and the mid-April to mid-May snowmelt and spring runoff period was not sampled. Necessary adjustments to the sampling scheme will be made prior to the 2004 monitoring year.

For additional stream monitoring information and monitoring methods regarding this site, see www.metrocouncil.org/environment/RiversLakes.

Figure 1.BA. Battle Creek Monitoring Station Location and Watershed Characteristics



0 0.25 0.5 1 Miles



Figure 2.BA. Battle Creek 2003 Hydrograph, Precipitation and Sampling Information

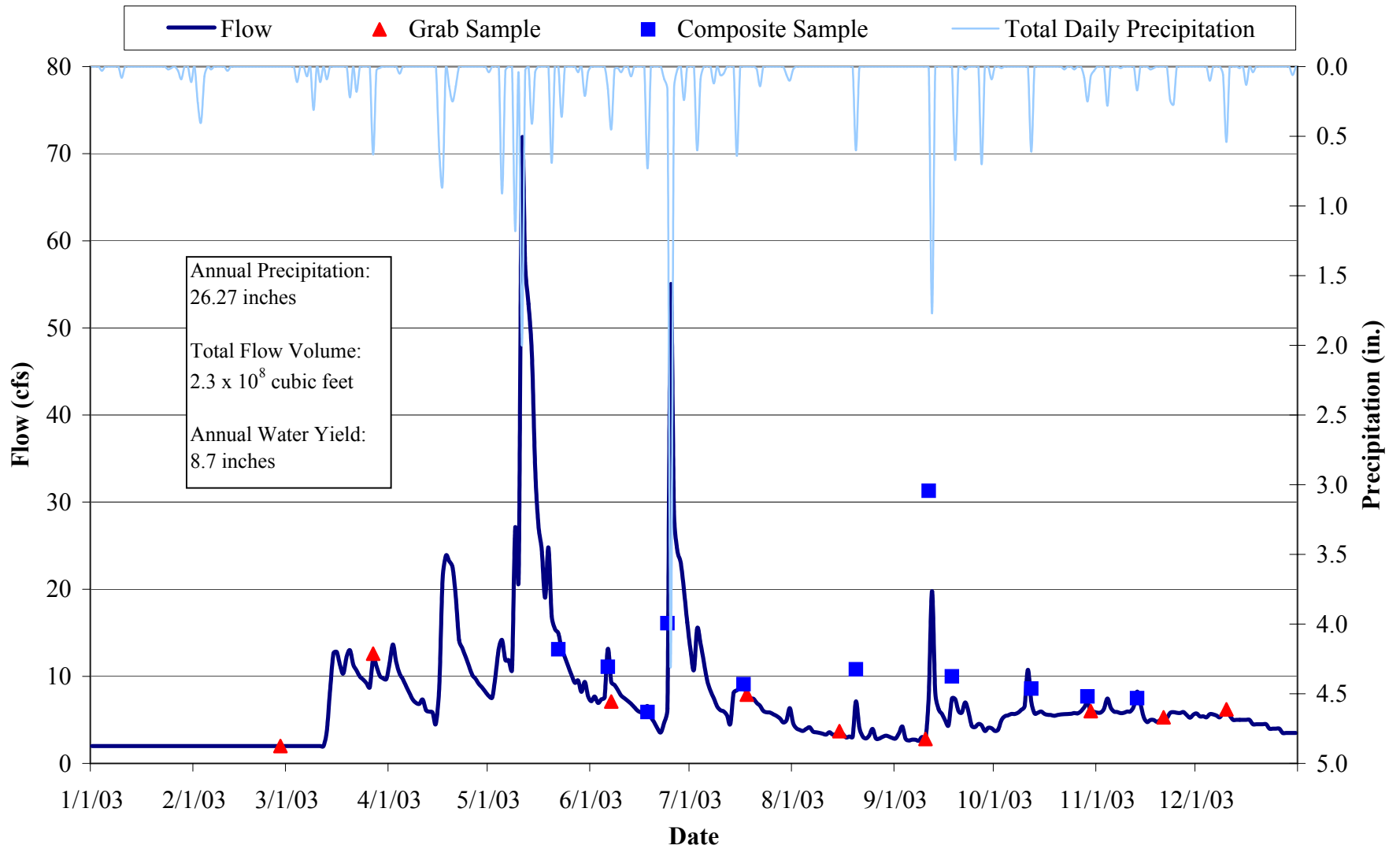


Table 2.BA. Battle Creek 2003 Water Chemistry Information

Variable	N	Mean	Median	Minimum	Maximum	25%	75%	STD
Chloride, mg/L	19	160	117	53	659	102	129	158
Hardness, mg/L	1	na	na	na	na	na	na	na
Cadmium, ug/L	1	na	na	na	na	na	na	na
Chromium, ug/L	1	na	na	na	na	na	na	na
Copper, ug/L	1	na	na	na	na	na	na	na
Lead, ug/L	1	na	na	na	na	na	na	na
Nickel, ug/L	1	na	na	na	na	na	na	na
Zinc, ug/L	1	na	na	na	na	na	na	na
Total Kjeldahl Nitrogen, mg/L	20	1.07	0.97	0.43	2.00	0.64	1.48	0.51
Total Nitrate Nitrogen, mg/L	20	0.48	0.46	0.08	0.90	0.28	0.67	0.24
Total Phosphorus, mg/L	20	0.21	0.17	0.04	0.53	0.07	0.36	0.17
Total Dissolved Phosphorus, mg/L	20	0.05	0.04	0.02	0.15	0.03	0.06	0.03
Total Suspended Solids, mg/L	20	86	20	1	389	5	154	118
Volatile Suspended Solids, mg/L	20	15	6	1	45	2	33	17
Turbidity, NTU	20	9	5	2	26	3	14	8

na: Data are insufficient to calculate these statistics.

N: Sample Count

25%, 75%: 25th and 75th Percentiles

STD: Standard Deviation

Table 3.BA. Battle Creek 2003 Annual Loading Information* for Suspended Solids and Nutrients

Variable	Annual Load (tons)	Annual Yield (lbs/acre)	Annual Normalized Yield (lbs/acre/in of water)	Flow Weighted Mean Concentration (mg/L)
Total Suspended Solids	790	217	25	110
Total Phosphorus	1.74	0.48	0.06	0.24
Total Dissolved Phosphorus	0.32	0.09	0.01	0.04
Total Nitrate Nitrogen	3.18	0.87	0.10	0.45

* 2003 Annual Loading Information is provisional and may be subject to minor revisions.

Figure 3.BA. Battle Creek 2003 Hydrograph with Total Suspended Solids and Nitrate Nitrogen Concentrations

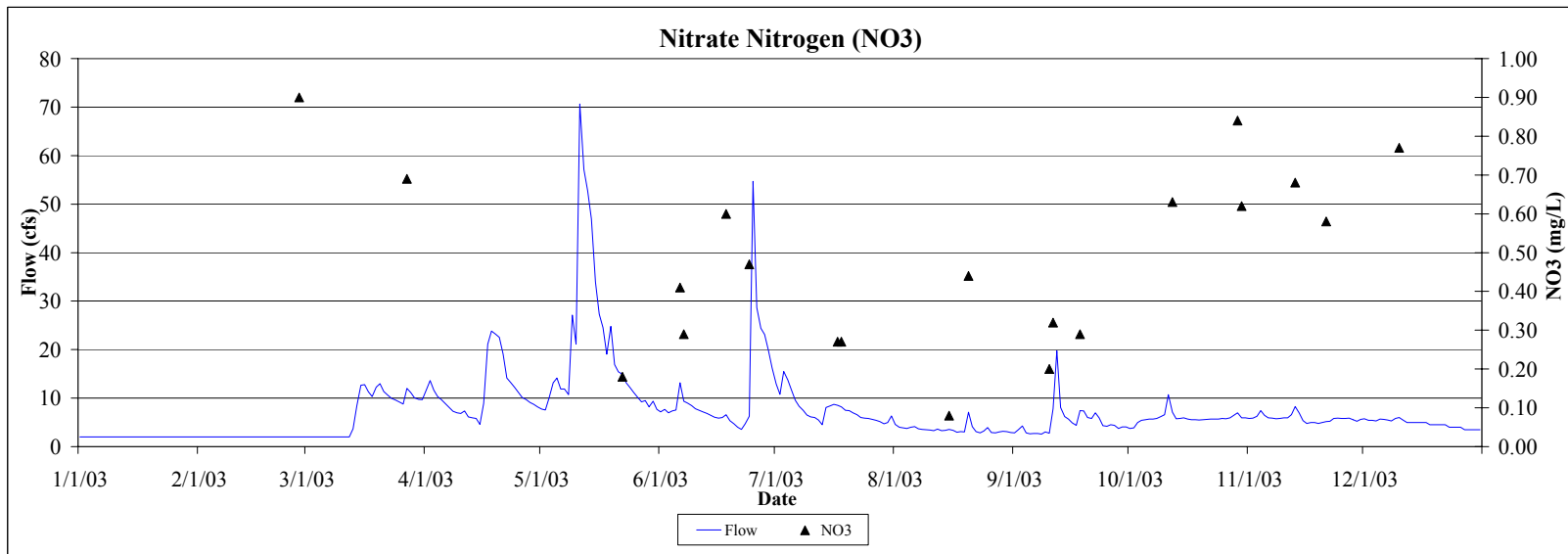
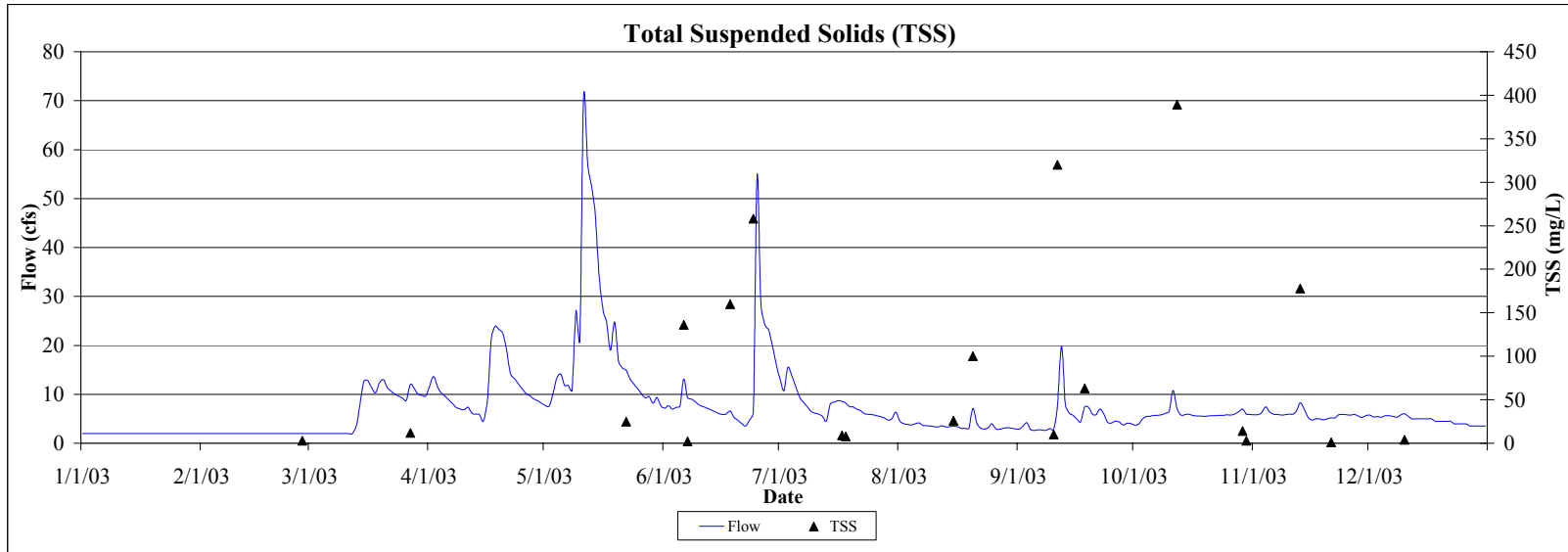


Figure 4.BA. Battle Creek 2003 Hydrograph with Total and Dissolved Phosphorus Concentrations

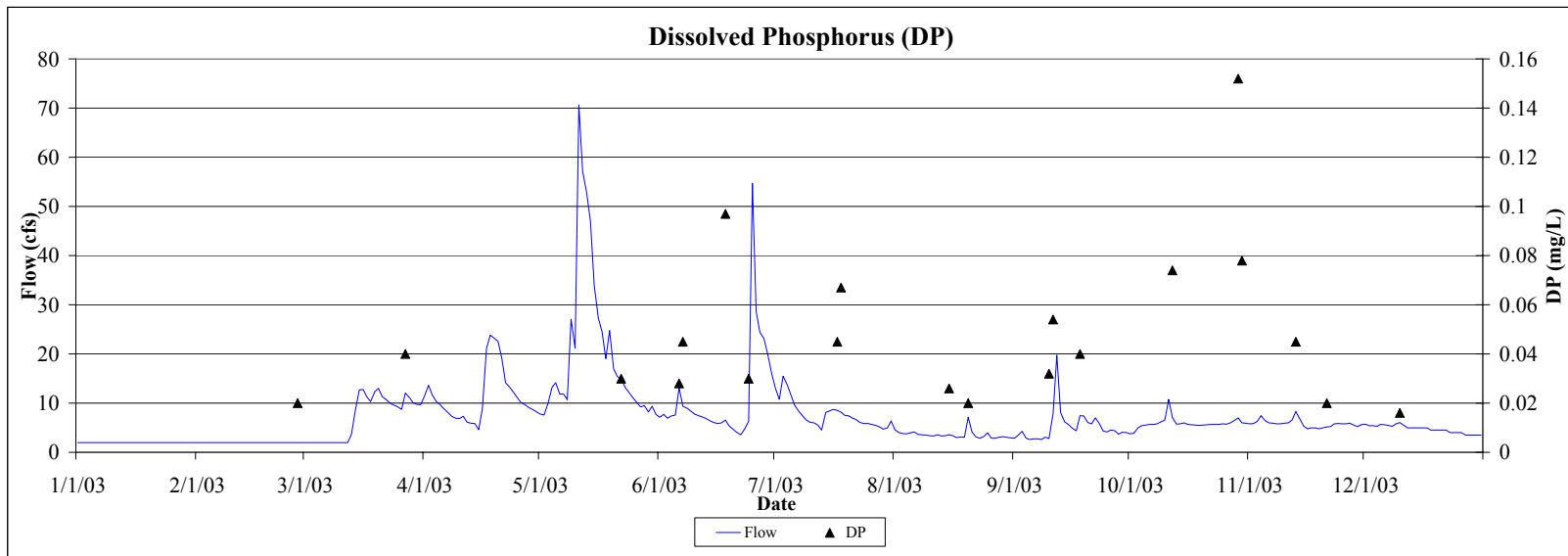
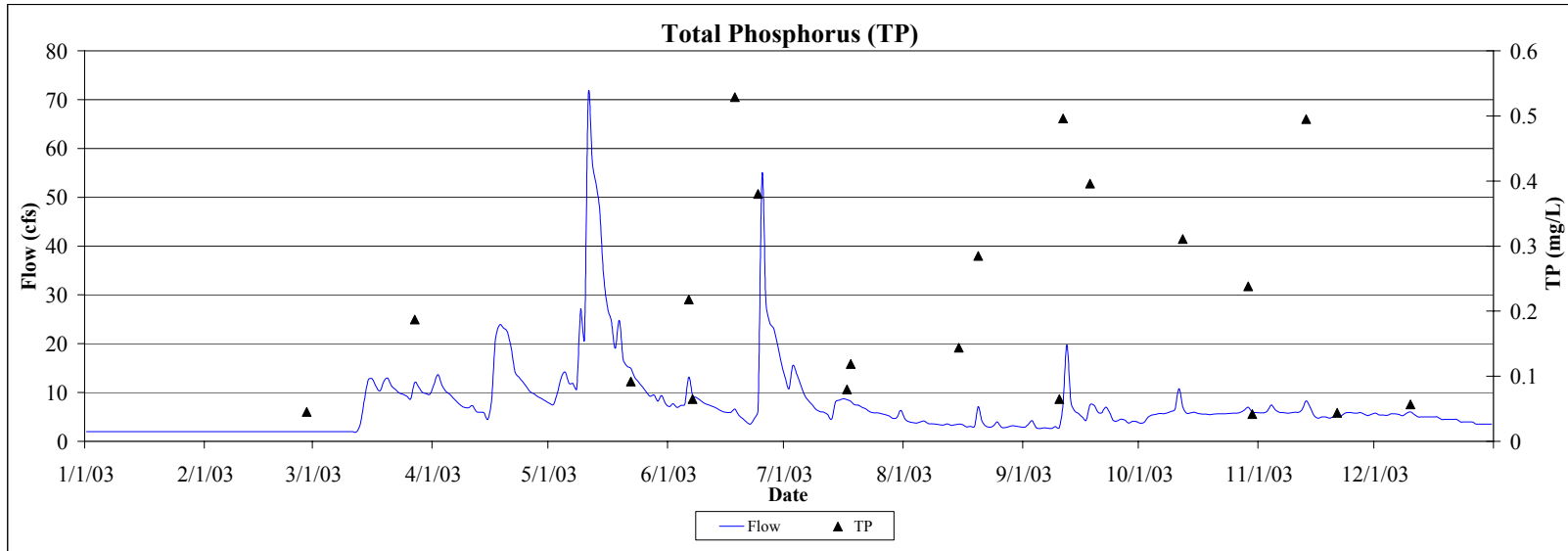


Table 4.BA. Battle Creek: Comparison of 2001-2003 Hydrology and Water Chemistry

	2001	2002	2003
Hydrology			
Total Precipitation (inches)	31.55	41.22	26.27
Water Yield (inches)	7.2	11.7	8.7
Total Volume (cubic feet)	1.9×10^8	3.1×10^8	2.3×10^8
Annual Load (tons)			
Total Suspended Solids	177	634	790
Total Phosphorus	0.80	1.37	1.74
Total Dissolved Phosphorus	0.31	0.45	0.32
Total Nitrate Nitrogen	2.38	3.90	3.18
Annual Yield (lbs/acre)			
Total Suspended Solids	49	174	217
Total Phosphorus	0.22	0.38	0.48
Total Dissolved Phosphorus	0.08	0.12	0.09
Total Nitrate Nitrogen	0.65	1.07	0.87
Annual Normalized Yield (lbs/acre/inch of water)			
Total Suspended Solids	7	15	25
Total Phosphorus	0.03	0.03	0.06
Total Dissolved Phosphorus	0.01	0.01	0.01
Total Nitrate Nitrogen	0.09	0.09	0.10
Flow-Weighted Mean Concentration (mg/L)			
Total Suspended Solids	30	66	110
Total Phosphorus	0.14	0.14	0.24
Total Dissolved Phosphorus	0.05	0.05	0.04
Total Nitrate Nitrogen	0.40	0.40	0.45

Table 5.BA. Battle Creek 2003 Macroinvertebrate Monitoring Results and Metrics

Monitoring Date 9/30/2003

Class	Order	Family	Common Name	Organism Count
Arthropoda	Amphipoda		Scuds	312
Arthropoda	Isopoda		Sowbugs	7
Hirudinea			Leeches	1
Insecta	Coleoptera	Elmidae	Riffle Beetles	2
Insecta	Diptera	Chironomidae	Midges	40
Insecta	Hemiptera	Belostomatidae	Giant Water Bugs	1
Insecta	Hemiptera	Corixidae	Water Boatman	1
Insecta	Hemiptera	Gerridae	Water Striders	2
Insecta	Lepidoptera	Pyralidae	Aquatic Moths	9
Insecta	Odonata	Calopterygidae	Broadwinged Damselflies	6
Insecta	Odonata	Coenagrionidae	Narrowwinged Damselflies	13
Insecta	Trichoptera	Lepidostomatidae	Lepidostomatid Case Makers	1
Pelecypoda			Clams and Mussels	4
Turbellaria	Tricladida	Planariidae	Planarians	97

Macroinvertebrate Taxa Metrics

Total Taxa	14
EPT Taxa	1
% EPT Taxa	7
Diptera Taxa	1
% Diptera Taxa	7
Mean Tolerance Value	6.1

Macroinvertebrate Organism Metrics

Total Individuals	496
EPT Individuals	1
% EPT Individuals	0
Diptera Individuals	40
% Diptera Individuals	8
Chironomidae Individuals	40
% Chironomidae Individuals	8

Water Quality

Degree of Organic Pollution

Family-Level Biotic Index	6.1	Fair	Fairly Significant Organic Pollution
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