Stream Monitoring

The Elm Creek watershed contains several large depressions and drainageways. Water is generally directed from the south and west to the northeast via four main drainageways – Rush Creek, North Fork Rush Creek, Diamond Creek, and Elm Creek. These drainageways converge in the Elm Creek Park Reserve and enter Hayden Lake. Water is eventually discharged to the Mississippi River near the Mill Pond in Champlin.

The monitoring station in Champlin, located at the Elm Creek Road crossing in the Elm Creek Park Reserve, is operated in cooperation with the United States Geological Survey (USGS). The Commission shares the costs of operating the station, which collects continuous flow data and periodic event and base water quality data. The watershed area above the gauging station is 86 square miles, or 81% of the hydrologic watershed.

Both grab samples and storm runoff samples are collected and analyzed for various parameters. Analyses of the streamflow and water quality monitoring data for Elm Creek and its tributaries are summarized below. Real time data from the monitoring station in Champlin may be viewed on the Internet at http://waterdata.usgs.gov/mn/nwis/uv/?site_no=05287890&PARAmeter_cd=00065,00060.

Flow Monitoring

Storm event samples are collected using an automatic sampler. Routine manual sampling occurs approximately monthly. The average daily discharge for the 2009 WY, October 1, 2008 through September 30, 2009, was 10.4 cubic feet per second (cfs) or 1.65 inches. During the same period, the minimum and maximum observed average daily discharge values were 0.50 cfs and 111 cfs, respectively. The long-term average daily discharge at the station is 37.8 cfs or 5.96 inches (years 1979-2009). A spreadsheet of the data received in 2009 water year (WY), including daily discharge and summary information, long-term flow volumes (calendar and water years), the flow hydrograph and the annual instantaneous peak discharge values at the gauging station for the period of record are also found in this appendix.

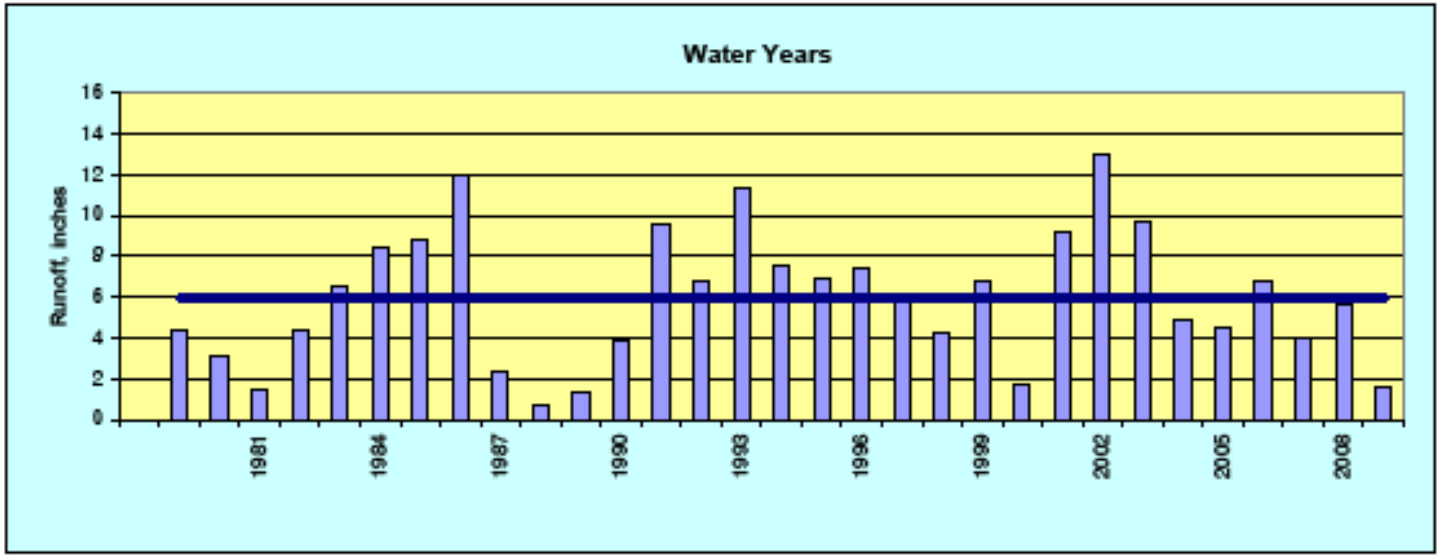
Elm Creek Annual Instantaneous Peak Discharge Rates

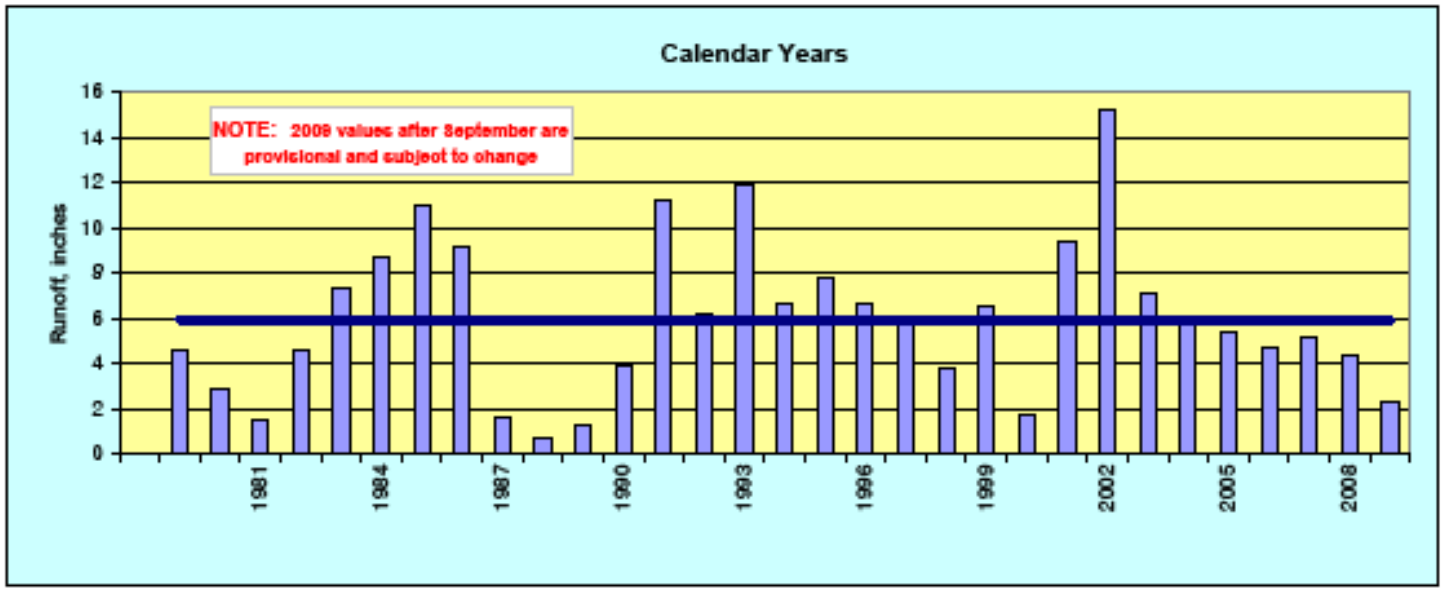
Date	Peak Flow (cfs)	Date	Peak Flow (cfs)	Date	Peak Flow (cfs)
4/4/79	307	8/1/90	225	4/25/01	875**
3/25/80	199	6/1/91	371	5/11/02	554
6/15/81	44	3/8/92	380	6/28/03	695
4/3/82	471*	6/22/93	315	6/03/04	350
3/9/83	408	4/30/94	669*	10/30/04	118
2/25/84	341	3/17/95	237	10/09/05	295
3/18/85	579*	3/19/96	407	3/17/07	223
3/27/86	812*	4/1/97	511*	5/4/08	205
8/1/87	185	4/5/98	306	3/27/09	119
3/27/88	39	5/15/99	538*		
3/31/89	159	7/13/00	112		

*These values have been revised based on the 2001 rating curve.

**All-time instantaneous peak discharge. 100-year flood discharge at this site is 2290 cfs.

2009 USGS Annual Runoff Summary





2009 USGS Daily Stream Flow with Statistics

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
Station No 05287890 Elm Creek Nr Champlin, MN Source Agency USGS State 27 County 053
WATER YEAR OCTOBER 2008 TO SEPTEMBER 2009
Daily Mean Values Discharge, cubic feet per second [e, estimated]

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e2.4	1.6	1.5	e1.1	e0.75	e9.3	74	15	0.67	6.9	0.91	14
2	e2.4	1.7	1.7	e1.1	e0.70	e9.4	72	14	0.65	6.4	0.79	9.9
3	e2.4	1.6	1.6	e1.1	e0.70	e10	67	13	0.63	6.5	0.79	7.1
4	e2.4	1.5	e1.5	e1.0	e0.75	e11	62	12	0.65	6.3	0.61	5.6
5	e2.4	1.6	e1.5	e1.0	e0.90	e12	59	12	0.63	6.5	0.52	4.4
6	e2.4	3.0	e1.4	e1.1	e1.0	e10	53	11	0.70	5.9	0.52	3.7
7	e2.4	3.4	e1.5	e1.1	e1.1	e9.7	48	10	0.70	4.7	0.74	3.0
8	e2.4	3.5	e1.5	e1.1	e1.0	e10	44	9.9	0.99	3.9	0.92	2.7
9	e2.4	3.3	e1.4	e1.1	e1.0	e11	40	7.0	0.79	2.7	3.9	1.9
10	e2.3	3.0	e1.4	e1.1	e9.4	e9.9	37	5.8	0.80	1.8	6.9	2.0
11	e2.3	2.8	e1.4	e1.1	e18	e9.6	34	5.1	0.69	1.5	7.2	1.7
12	e2.3	2.9	e1.5	e1.1	e17	e9.3	33	4.6	0.57	1.3	7.0	1.6
13	e2.3	3.3	e1.6	e1.0	e17	e10	31	4.5	0.53	1.2	6.1	1.5
14	e2.3	3.1	e1.4	e0.99	e16	e18	29	4.8	0.51	1.1	5.6	1.5
15	e2.3	2.9	e1.2	e0.79	e16	e26	26	4.3	0.50	1.0	4.9	1.3
16	e2.2	2.7	e1.1	e0.94	e17	48	24	4.1	0.59	0.91	6.2	1.2
17	2.1	2.7	e1.0	e0.94	e16	44	23	3.9	0.69	0.79	7.7	1.2
18	2.1	3.1	e1.0	e0.94	e15	52	21	2.9	0.99	0.90	6.9	0.97
19	2.3	2.7	e1.1	e0.94	e15	58	20	2.5	0.95	0.76	9.3	0.99
20	2.1	2.3	e1.1	e0.69	e14	70	19	2.1	0.74	0.70	18	0.79
21	2.0	2.3	e1.0	e0.79	e13	84	17	1.9	0.63	1.2	39	0.77
22	1.9	2.3	e1.0	e0.79	e13	91	16	1.5	0.60	1.3	48	0.76
23	2.3	2.2	e1.0	e0.79	e12	94	15	1.2	0.63	0.99	50	0.91
24	2.3	2.0	e1.1	e0.59	e11	96	14	0.99	0.51	0.91	48	0.64
25	2.2	2.3	e1.1	e0.53	e10	107	13	0.93	0.56	0.96	49	0.69
26	2.5	2.1	e1.2	e0.59	e9.9	111	14	0.91	0.54	0.79	47	0.92
27	2.3	2.0	e1.1	e0.60	e9.6	103	16	0.95	2.1	0.79	43	0.71
28	1.9	1.6	e1.2	e0.65	e9.4	100	14	0.79	6.4	0.71	40	0.63
29	1.7	2.1	e1.3	e0.63	---	91	14	0.76	7.7	0.69	34	0.54
30	1.7	1.4	e1.1	e0.63	---	80	16	0.74	7.2	0.71	27	0.52
31	1.7	---	e1.0	e0.90	---	73	---	0.69	---	0.75	20	---

Statistics for Water Year October 2008 to September 2009

Total	69.5	73.0	39.5	27.11	266.10	1,497.2	964	159.05	40.90	71.02	539.19	79.67
Mean	2.21	2.43	1.27	0.97	9.50	48.0	32.1	5.10	1.36	2.29	17.4	2.46
Max	2.5	3.5	1.7	1.1	18	111	74	15	7.7	6.9	50	14
Min	1.7	1.4	1.0	0.53	0.70	9.3	13	0.69	0.50	0.69	0.52	0.52
Ac-ft	138	145	79	54	528	2,950	1,910	313	81	141	1,070	146
Cfsm	0.03	0.03	0.01	0.01	0.11	0.56	0.37	0.06	0.02	0.03	0.20	0.03
Inches	0.03	0.03	0.02	0.01	0.12	0.64	0.42	0.07	0.02	0.03	0.23	0.03

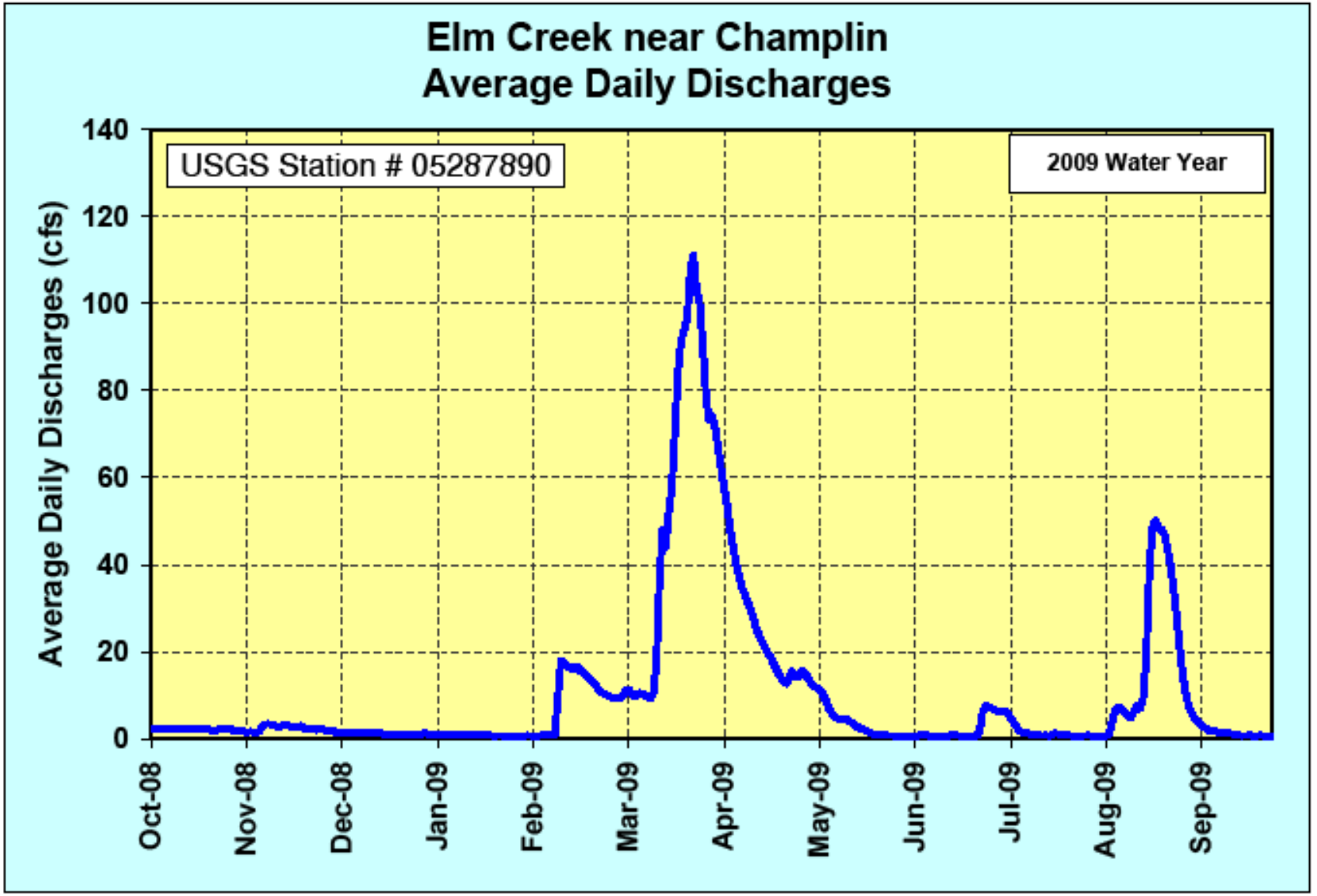
Statistics of monthly mean data for 1979 - 2009, by Water Year (WY)

Mean	33.3	21.0	10.3	5.29	9.78	59.1	109	70.1	50.5	26.9	27.6	26.3
Max	240	67.4	41.3	22.0	99.1	183	414	203	196	157	151	170
(WY)	(1996)	(1994)	(1992)	(1992)	(1994)	(1995)	(2001)	(2002)	(2004)	(1999)	(2002)	(1991)
Min	1.13	1.03	0.92	0.74	0.91	3.96	5.31	3.54	1.34	0.76	1.97	1.09
(WY)	(1990)	(1990)	(1990)	(1991)	(1990)	(2001)	(1987)	(2000)	(1988)	(1989)	(2008)	(1988)

Summary Statistics	Calendar Year 2008		Water Year 2009		Water Years 1979 – 2009	
Annual total	10,005.04		3,907.13			
Annual mean	27.3		10.4		37.8	
Highest annual mean					82.2	2002
Lowest annual mean					4.54	1989
Highest daily mean	195	May 4	111	Mar 26	915	Apr 25, 2001
Lowest daily mean	0.71	Aug 26	0.50	Jun 15	0.91	Jun 30, 1989
Annual seven-day minimum	0.92	Aug 21	0.59	Jun 11	0.95	Jun 26, 1989
Maximum peak flow			119	Mar 27	975	Apr 25, 2001
Maximum peak stage			6.24	Mar 27	10.02	Apr 25, 2001
Instantaneous low flow			[a]0.45	Jun 15	0.29	Jul 9, 1999
Annual runoff (ac-ft)	19,840		7,550		27,350	
Annual runoff (cfsm)	0.319		0.121		0.439	
Annual runoff (inches)	4.33		1.65		5.96	
10 percent exceeds	119		34		106	
50 percent exceeds	2.4		2.2		11	
90 percent exceeds	1.0		0.70		1.6	

[a] Also occurred June 24th.

2009 USGS Flows and Hydrograph



Elm Creek Near Champlin (USGS Station 05287890)

Manual Water Quality Samples for Water Year 2009

(Selected Parameters)

USGS Parameter #		P00010	P00020	P00025	P00061	P00095	P00300	P00301	P00340	P00400
DATE	Sample Start Time	Water Temp. °C	Air Temp. °C	Barom Press mm Hg	Disch Inst cfs	Sp cond mS/cm	DO mg/L	DO % Satur	COD mg/L	pH
16-Oct-08	08:55	7.0		750	2.3	644	6.1	50	20	7.2
3-Nov-08	08:30	7.2		741	2.6	695	7.7	65	10	7.6
11-Dec-08	13:00	0.0	-7.7	741	1.4	740	10.4	71	20	7.2
12-Jan-09	12:25	0.0	-9.0	739	1.2	750	10.3	70	20	7.8
24-Feb-09	12:50	0.0	6.0	739	11.0	802	12.7	86	40	8.0
9-Mar-09	11:30	0.0	1.0	742	10.0	746	12.2	83	49.2	7.8
29-Apr-09	12:30	11.1	10.0	746	14.0	635	10.8	99	40	8.0
26-May-09	08:35	15.0	15.0	739	1.5	706	6.8	67	20	7.7
23-Jun-09	08:55	20.6	24.0	741	0.6	722	4.2	46	10	7.7
14-Jul-09	11:30	18.7	19.0	740	1.0	710	6.1	65	20	7.8
13-Aug-09	10:25	22.3	27.5	743	7.5	652	5.1	59	40	7.4
30-Sep-09	10:55	8.5	12.5	744	0.5	684	8.4	72	20	7.9

USGS Parameter #		P00530	P00535	P00608	P00613	P00625	P00631	P00665	P00666	P00940
DATE	Sample Start Time	TSS mg/L	Volatile Residue mg/L	Ammonia mg/L	Nitrite mg/L	Total Nitrogen mg/L	Dissolved NO2+NO3 mg/L	Total P mg/L	Dissolved P mg/L	Dissolved Chloride mg/L
16-Oct-08	08:55	<15	<10	E0.012	0.006	0.73	0.10	0.15	0.11	55.2
3-Nov-08	08:30	<15	<10	E0.019	0.004	0.50	0.07	0.07	E0.04	45.7
11-Dec-08	13:00	<15	<10	0.297	0.009	0.73	0.17	0.06	E0.03	39.4
12-Jan-09	12:25	<15	<10	0.299	0.004	0.72	0.20	0.07	E0.03	42.9
24-Feb-09	12:50	<30	<20	0.256	0.017	1.70	0.21	0.28	0.15	119.0
9-Mar-09	11:30	<30	<20	0.441	0.011	2.00	0.30	0.41	0.25	108.0
29-Apr-09	12:30	<15	<10	E0.013	0.007	0.99	0.08	0.16	0.13	83.2
26-May-09	08:35	<30	22	0.058	0.007	0.51	0.04	0.13	0.09	25.9
23-Jun-09	08:55	<15	<10	0.181	0.026	0.69	0.11	0.23	0.20	33.8
14-Jul-09	11:30	<15	<10	0.159	0.030	0.92	0.16	0.22	0.17	59.4
13-Aug-09	10:25	<15	<10	0.105	0.015	1.30	0.07	0.27	0.20	106.0
30-Sep-09	10:55	<15	<10	0.051	0.015	0.62	0.22	0.16	0.13	37.8

Data are provisional and are subject to change

E = Estimated

Automatic Event Samples for Water Year 2009

(Selected parameters)

USGS Parameter #			P00095	P00340	P00400	P00530	P00608	P00613	P00625	P00631	P00665	P00666	P00940
DATE & TIME			Sp Cond µS/cm	COD mg/L	pH	TSS mg/L	Ammonia mg/L	Nitrite mg/L	Total N mg/L	Dissolved NO2+NO3 mg/L	Total P mg/L	Dissolved P mg/L	Dissolved Chloride mg/L
7-Aug-09	11:12	to	641	30	7.7	< 15	0.062	0.012	0.82	0.07	0.20	0.11	67.4
10-Aug-09	08:13												
19-Aug-09	16:07	to	471	40	7.8	< 15	0.241	0.079	1.6	0.20	0.34	0.24	92.8
21-Aug-09	10:07												
21-Aug-09	13:07	to	636	50	7.9	< 15	0.493	0.083	2.0	0.17	0.40	0.29	103
23-Aug-09	04:09												

USGS Parameters

P00010 - Temperature, water, degrees Celsius
P00020 - Temperature, air, degrees Celsius
P00025 - Barometric pressure, millimeters of mercury
P00061 - Discharge, instantaneous, cubic feet per second
P00095 - Specific conductance, water, unfiltered, microsiemens per centimeter at 25 degrees Celsius
P00300 - Dissolved oxygen, water, unfiltered, milligrams per liter
P00301 - Dissolved oxygen, water, unfiltered, percent of saturation
P00340 - Chemical oxygen demand, high level, water, unfiltered, milligrams per liter
P00400 - pH, water, unfiltered, field, standard units
P00530 - Residue, total nonfilterable, milligrams per liter
P00535 - Loss on ignition, from nonfilterable residue, milligrams per liter
P00608 - Ammonia, water, filtered, milligrams per liter as nitrogen
P00613 - Nitrite, water, filtered, milligrams per liter as nitrogen
P00625 - Ammonia plus organic nitrogen, water, unfiltered, milligrams per liter as nitrogen
P00631 - Nitrate plus nitrite, water, filtered, milligrams per liter as nitrogen
P00665 - Phosphorus, water, unfiltered, milligrams per liter
P00666 - Phosphorus, water, filtered, milligrams per liter
P00940 - Chloride, water, filtered, milligrams per liter