

Index to High-Chloride Spring Data

DOUBLE CLICK MOUSE ON SAMPLE LOCATION TO VIEW DATA

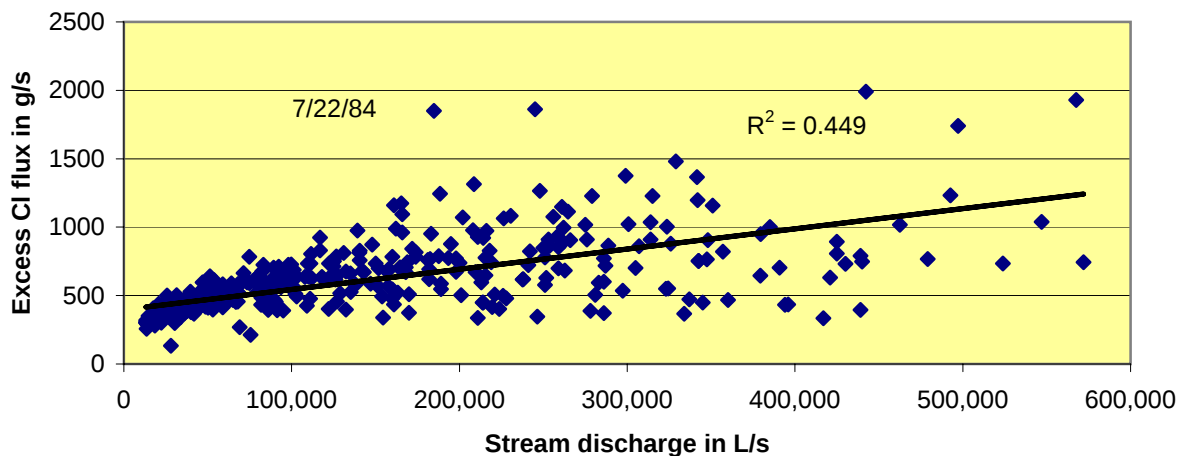
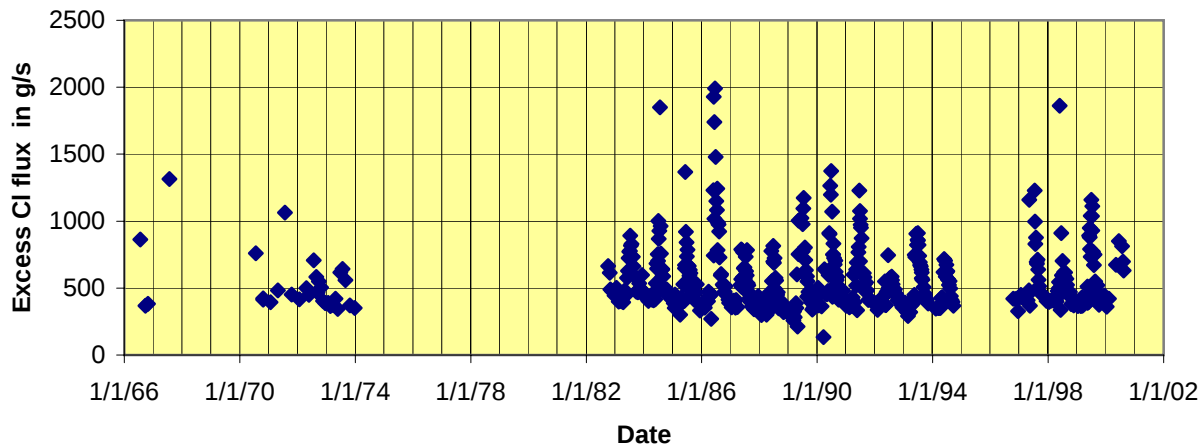
Description	Dates	Number of measurements
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Gardner River near Mammoth, WY	1966-1998	447
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DOUBLE CLICK MOUSE ON SAMPLE LOCATION TO VIEW DATA

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YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

Yellowstone River at Corwin Springs, MT, about 6 km north of the Yellowstone National Park Boundary; captures thermal discharge from the vicinity of Yellowstone Lake and other areas such as Mud Volcano along the upper Yellowstone River, in addition to the Roaring Mountain and Mammoth Hot Springs regions along the Gardner River. Sampled and gaged at lat. 45 deg. 06 min. 43 sec. N, long. 110 deg. 47 min. 37 sec. W, USGS streamgaging station 06191500. Most water samples were "grab" samples collected at a single point near the stream bank. A few samples collected after 9/89 were "integrated" samples collected across the width of the stream. Most chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. Some of the earliest determinations (through 1972) were by titration with a silver-nitrate solution and some of the more recent (9/89 on) by a colorimetric method. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Because this site captures thermal waters from diverse sources, it is not appropriate to convert the Cl flux to a hot-spring discharge. Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" might be assigned to the thermal waters in the Yellowstone River above its confluence with the Gardner River; the Cl concentration from Mammoth Hot Springs is much lower, about 170 mg/L (Sorey and others, 1991). The Yellowstone River and Gardner River (Mammoth Hot Springs) contributions can be separated -- for a few dates -- by using the data from Gardner River near Mammoth, which is displayed on the next sheet of this spreadsheet. The data compiled here are from Fournier and others (1975), Norton and Friedman (1991), Sorey and others (1991), Sorey and Colvard (1997), Friedman and Norton (2000), and the USGS archives in Helena, Montana, and Menlo Park, California.



YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/24/66		253,600	0.7	4.1	862	
9/27/66		41,810	0.7	9.5	368	
10/26/66		31,150	0.7	13.0	383	
7/24/67		208,700	0.7	7.0	1315	
7/24/70	1330	181,200	0.7	4.9	761	
10/22/70	830	45,900	0.7	9.9	422	
10/23/70	1330	44,500	0.7	10	414	
1/26/71	830	32,000	0.7	13	394	
4/27/71	1550	42,800	0.7	12	484	
7/26/71	1800	226,300	0.7	5.4	1064	
10/21/71	1415	50,690	0.7	9.6	451	
1/25/72	820	24,070	0.7	18.0	416	
4/24/72	1530	44,170	0.7	12.0	499	
5/25/72		213,800	0.7	2.8	449	
7/25/72	1530	164,500	0.7	5.0	707	
8/24/72	1530	92,590	0.7	7.0	583	
9/12/72		89,760	0.7	5.9	467	
9/26/72	1300	64,560	0.7	9.2	549	
10/26/72	1030	65,400	0.7	8.4	504	
11/21/72	800	43,900	0.7	9.9	404	
12/19/72	1100	37,700	0.7	11	388	
1/23/73	1400	31,700	0.7	13	390	
2/21/73	1100	29,700	0.7	13	365	
3/27/73	1100	30,300	0.7	13	373	
4/25/73	1130	31,700	0.7	14	422	
5/23/73	1300	246,400	0.7	2.1	345	
6/26/73	1445	237,600	0.7	3.3	618	
7/25/73	1145	102,200	0.7	7.0	644	
8/28/73	800	54,400	0.7	11	560	
10/25/73	1200	36,000	0.7	11	371	
12/26/73	1245	24,600	0.7	15	352	
10/5/82	1715	71,400	0.7	10.0	664	
10/26/82	1645	53,800	0.7	12.1	613	
11/4/82	1640	47,600	0.7	11.0	490	
11/24/82	1444	36,500	0.7	13.8	478	
12/24/82	1327	33,700	0.7	13.9	445	
1/19/83	1100	31,400	0.7	16.7	502	
2/17/83	1225	30,300	0.7	13.9	400	
3/10/83	1645	29,700	0.7	15.7	446	
3/22/83	1645	27,200	0.7	15.5	403	
3/31/83	1230	29,700	0.7	15.0	425	
4/14/83	900	26,800	0.7	15.4	394	
5/4/83	1615	44,200	0.7	11.6	482	
5/12/83	1710	43,300	0.7	11.2	455	
5/17/83	1645	41,600	0.7	11.4	445	
6/1/83	1400	250,900	0.7	3.0	577	
6/15/83	1535	251,700	0.7	3.2	629	
6/21/83	1430	241,000	0.7	3.7	723	
6/28/83	1545	286,000	0.7	3.4	772	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/6/83	1215	250,900	0.7	3.8	778	
7/11/83	1845	261,900	0.7	4.1	890	
7/21/83	1710	173,900	0.7	5.4	817	
7/29/83	1503	140,500	0.7	6.6	829	
8/5/83	1127	122,300	0.7	6.7	734	
8/11/83	1810	109,600	0.7	7.4	734	
8/19/83	1630	93,400	0.7	7.8	663	
9/1/83	1330	74,800	0.7	8.6	591	
9/27/83	1700	51,500	0.7	9.9	474	
10/18/83	1200	63,400	0.7	8.1	469	
11/1/83	1200	56,400	0.7	10.2	536	
11/15/83	1100	57,200	0.7	9.4	498	
12/8/83	1200	47,000	0.7	13.4	597	
1/3/84	1625	38,500	0.7	12.9	470	
2/7/84	915	32,600	0.7	13.6	421	
2/27/84	1645	30,300	0.7	14.0	403	
3/13/84	1630	30,900	0.7	14.6	430	
4/3/84	1145	29,400	0.7	15.1	423	
4/10/84	920	32,000	0.7	13.8	419	
4/11/84	1200	33,700	0.7	13	415	
4/26/84	1645	43,600	0.7	11.1	453	
5/2/84	1515	41,600	0.7	10.5	408	
5/9/84	1035	43,300	0.7	11.0	446	
5/16/84	820	337,000	0.7	2.1	472	
5/22/84	1515	219,500	0.7	2.6	417	
5/23/84	1730	214,100	0.7	2.8	450	
5/30/84	1624	297,300	0.7	2.5	535	
6/6/84	2043	262,800	0.7	3.3	683	
6/16/84	700	379,400	0.7	2.4	645	
6/22/84	2145	342,600	0.7	2.9	754	
6/27/84	1345	390,800	0.7	2.5	703	
6/30/84	2150	385,100	0.7	3.3	1001	
7/7/84	1050	288,800	0.7	3.7	866	
7/14/84	2000	211,000	0.7	5.1	928	
7/22/84	930	184,900	0.7	10.7	1849	
7/28/84	2030	165,900	0.7	6.5	962	
8/4/84	2001	140,500	0.7	6.1	759	
8/18/84	2120	102,800	0.7	6.9	637	
8/21/84	1630	100,300	0.7	7.1	642	
8/25/84	2010	92,000	0.7	7.1	589	
8/31/84	2015	80,700	0.7	8.0	589	
9/13/84	1730	64,300	0.7	8.4	495	
10/1/84	1930	56,600	0.7	9.0	470	
10/2/84	1600	55,900	0.7	9.4	486	
10/13/84	1205	49,000	0.7	10.7	490	
10/27/84	1530	42,800	0.7	11.1	445	
11/12/84	1655	41,900	0.7	11.4	448	
11/14/84	1200	41,700	0.7	11.7	459	
12/14/84	1530	33,700	0.7	13.4	428	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
1/12/85	1730	28,900	0.7	14.1	387	
1/24/85	1435	27,400	0.7	13.5	351	
1/30/85	1630	26,900	0.7	17.5	452	
2/17/85	845	29,700	0.7	13.5	380	
3/3/85	1800	28,300	0.7	14.6	393	
3/12/85	1430	28,300	0.7	13.6	365	
3/17/85	1130	29,200	0.7	13.5	374	
4/1/85	1630	30,300	0.7	10.6	300	
4/14/85	1630	51,000	0.7	9.1	428	
4/15/85	1530	59,000	0.7	7.7	413	
4/28/85	2045	50,200	0.7	8.9	412	
5/14/85	2200	135,200	0.7	4.6	527	
5/24/85	2100	223,800	0.7	2.5	403	
6/1/85	1430	215,600	0.7	3.7	647	
6/3/85	1445	209,600	0.7	3.9	671	
6/8/85	1750	341,500	0.7	4.7	1366	
6/15/85	1920	214,100	0.7	5.0	921	
6/22/85	1930	171,900	0.7	5.6	842	
6/29/85	2000	150,100	0.7	5.6	735	
7/5/85	1230	132,300	0.7	5.8	675	
7/7/85	2130	126,700	0.7	6.9	786	
7/8/85	1135	125,000	0.7	6.0	663	
7/20/85	2030	100,700	0.7	7.3	665	
7/28/85	2030	88,600	0.7	7.4	594	
8/4/85	1900	89,600	0.7	7.8	636	
8/10/85	2020	71,900	0.7	9.2	611	
8/17/85	1920	64,100	0.7	9.4	558	
8/19/85	1130	63,000	0.7	8.4	485	
8/24/85	1720	56,200	0.7	9.2	478	
8/31/85	1920	51,500	0.7	9.8	469	
9/19/85	1820	53,900	0.7	9.3	464	
10/1/85	1700	45,200	0.7	11.1	470	
10/3/85	1725	43,700	0.7	11.4	468	
10/4/85	845	43,300	0.7	10.2	411	
10/17/85	1450	40,000	0.7	12.3	464	
10/31/85	1400	39,700	0.7	14.0	528	
12/10/85	1030	23,900	0.7	14.6	332	
2/6/86	845	29,200	0.7	14.2	394	
2/9/86	900	24,100	0.7	15.4	354	
3/6/86	1630	36,200	0.7	12.3	420	
3/20/86	1000	34,600	0.7	12.3	401	
3/30/86	1130	52,500	0.7	9.7	473	
4/15/86	1630	56,600	0.7	8.5	441	
4/29/86	1400	69,100	0.7	4.6	269	
5/1/86	840	67,900	0.7	7.4	455	
5/30/86	1000	492,700	0.7	3.2	1232	
6/1/86	1030	572,000	0.7	2.0	744	
6/4/86	1030	567,500	0.7	4.1	1930	
6/10/86	1730	462,400	0.7	2.9	1017	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/12/86	1030	497,200	0.7	4.2	1740	
6/19/86	1630	442,300	0.7	5.2	1990	
6/26/86	1730	329,000	0.7	5.2	1481	
7/3/86	1630	261,100	0.7	5.1	1149	
7/11/86	1630	230,500	0.7	5.4	1083	
7/17/86	1850	188,400	0.7	7.3	1243	
7/22/86	1530	160,100	0.7	5.6	784	
7/25/86	1720	162,100	0.7	6.8	989	
7/31/86	1630	139,200	0.7	7.7	974	
8/8/86	1030	116,900	0.7	8.6	924	
8/15/86	1920	99,700	0.7	8.0	728	
8/30/86	1420	81,400	0.7	8.0	594	
9/4/86	1020	77,400	0.7	8.5	604	
9/23/86	1105	62,700	0.7	9.1	527	
10/7/86	1300	54,900	0.7	10.1	516	
10/16/86	1400	47,700	0.7	10.6	472	
10/22/86	1110	45,800	0.7	10.7	458	
10/31/86	1230	44,300	0.7	12.3	514	
12/4/86	1200	32,300	0.7	13.5	413	
12/12/86	1030	28,300	0.7	14.5	391	
1/14/87	1420	26,800	0.7	14.0	356	
2/11/87	1330	29,700	0.7	14.4	407	
3/3/87	1700	25,500	0.7	14.6	354	
3/13/87	1630	28,300	0.7	15.2	410	
3/27/87	1015	24,900	0.7	15.1	359	
5/8/87	1145	163,300	0.7	3.9	523	
5/15/87	1430	157,600	0.7	4.3	567	
5/17/87	1000	187,700	0.7	4.9	788	
5/20/87	1210	169,900	0.7	3.7	510	
5/28/87	1115	173,900	0.7	5.2	783	
6/5/87	1735	138,000	0.7	4.9	580	
6/9/87	805	182,600	0.7	4.9	767	
6/17/87	1030	127,200	0.7	5.8	649	
6/26/87	1030	100,700	0.7	7.2	655	
6/30/87	1100	91,900	0.7	6.9	570	
7/11/87	1030	111,100	0.7	7.3	733	
7/17/87	1930	80,200	0.7	8.5	626	
7/25/87	1030	73,500	0.7	8.8	595	
7/30/87	1630	74,700	0.7	11.2	784	
8/7/87	930	57,600	0.7	10.0	536	
8/11/87	1420	53,500	0.7	9.6	476	
8/14/87	1920	49,600	0.7	11.2	521	
8/22/87	2030	43,400	0.7	11.2	456	
9/4/87	1130	39,700	0.7	11.5	429	
9/11/87	1430	35,100	0.7	12.0	397	
9/26/87	1030	29,200	0.7	14.8	412	
9/30/87	1440	28,100	0.7	13.7	365	
10/10/87	1200	24,700	0.7	15.1	356	
10/24/87	1300	22,100	0.7	16.2	343	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
11/4/87	1420	23,100	0.7	15.9	351	
11/6/87	1650	21,500	0.7	16.8	346	
12/7/87	1240	21,200	0.7	19.6	401	
12/15/87	1000	20,800	0.7	21.8	439	
1/4/88	1430	17,500	0.7	23.9	406	
1/27/88	1010	13,500	0.7	22.9	300	
1/29/88	1620	13,500	0.7	23.1	302	
2/29/88	900	17,900	0.7	19.5	337	
3/18/88	1620	19,900	0.7	18.3	350	
3/31/88	1015	22,300	0.7	14.2	301	
4/13/88	1230	37,800	0.7	12.4	442	
4/29/88	1520	54,200	0.7	9.2	461	
5/4/88	1410	48,600	0.7	9.3	418	
5/12/88	1020	132,300	0.7	3.7	397	
5/20/88	1620	154,400	0.7	2.9	340	
6/1/88	1620	215,600	0.7	4.3	776	
6/7/88	900	324,500	0.7	2.4	552	
6/24/88	1030	151,900	0.7	5.3	699	
6/26/88	1420	140,400	0.7	6.5	814	
7/4/88	1200	101,200	0.7	7.5	688	
7/11/88	1400	83,200	0.7	9.4	724	
7/20/88	1100	66,400	0.7	8.1	491	
7/22/88	1020	64,100	0.7	9.7	577	
7/29/88	2020	58,000	0.7	10.3	557	
8/11/88	1625	44,900	0.7	10.7	449	
8/19/88	820	37,800	0.7	13.1	469	
8/31/88	940	30,600	0.7	12.1	349	
9/1/88	1620	29,700	0.7	12.7	356	
9/10/88	1200	27,000	0.7	14.1	362	
9/25/88	1750	24,500	0.7	17.2	404	
10/4/88	1230	23,300	0.7	15.5	345	
10/13/88	1420	22,100	0.7	16.4	347	
10/24/88	1225	21,400	0.7	18.4	379	
10/31/88	1500	19,900	0.7	16.8	320	
11/16/88	1600	19,400	0.7	17.5	326	
12/18/88	1130	19,200	0.7	17.9	330	
12/11/88	1530	19,400	0.7	18.8	351	
1/9/89	1700	15,100	0.7	22.7	332	
1/24/89	1630	13,200	0.7	23.5	301	
2/10/89	1230	13,300	0.7	24.1	311	
2/13/89	1545	14,700	0.7	24.6	351	
3/7/89	1315	13,300	0.7	24.8	321	
3/7/89	1630	13,600	0.7	19.6	257	
3/8/89	1330	13,700	0.7	22	292	
3/15/89	1400	17,200	0.7	19.7	327	
3/22/89	1730	18,500	0.7	15.9	281	
4/9/89	1030	30,000	0.7	13.6	387	
4/10/89	1400	26,400	0.7	14.0	351	
4/20/89	930	97,100	0.7	6.9	602	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
4/29/89	1430	75,600	0.7	3.5	212	
5/10/89	1200	342,600	0.7	2.9	754	
5/11/89	1920	323,700	0.7	3.8	1003	
6/9/89	1000	347,400	0.7	2.9	764	
6/14/89	1625	300,700	0.7	4.1	1022	
6/30/89	1710	208,100	0.7	5.4	978	
7/3/89	1530	193,400	0.7	4.7	774	
7/11/89	900	165,900	0.7	7.3	1095	
7/13/89	1000	165,400	0.7	7.8	1174	
7/28/89	2200	111,600	0.7	7.9	804	
8/3/89	1445	92,300	0.7	8.4	711	
8/10/89	1410	79,300	0.7	8.7	634	
8/18/89	1600	68,000	0.7	9.3	585	
8/25/89	1515	64,000	0.7	9.9	589	
8/28/89	1630	41,100	0.7	11.3	436	
8/31/89	1245	56,600	0.7	10.4	549	
9/12/89	1430	46,200	0.7	10.9	471	
9/12/89		46,600	0.7	10.2	443	
10/5/89	1130	45,300	0.7	11.4	485	
10/16/89	1045	37,100	0.7	11.3	393	
10/29/89	1245	33,700	0.7	10.8	340	
11/12/89	1300	34,500	0.7	12.3	400	
11/15/89	1630	30,300	0.7	12.4	355	
12/3/89	1300	27,400	0.7	16.8	441	
1/3/90	1230	23,900	0.7	16.5	378	
1/10/90	1145	25,700	0.7	20.2	501	
1/18/90	1720	21,700	0.7	17.8	371	
2/12/90	1730	25,100	0.7	19.2	464	
2/27/90		24,100	0.7	15.8	364	
3/20/90	1240	28,000	0.7	5.5	134	
4/3/90	1545	51,300	0.7	13.2	641	
4/19/90	1205	127,000	0.7	4.3	457	
5/4/90	1740	90,600	0.7	5.7	453	
5/7/00	1500	198,000	0.7	4.1	673	
5/16/90		111,000	0.7	5.0	477	
5/25/90	1100	213,000	0.7	3.5	596	
6/1/90	1315	253,000	0.7	4.3	911	
6/6/90	1240	266,000	0.7	4.1	904	
6/11/90	1215	421,000	0.7	2.2	632	
6/14/90	1430	248,000	0.7	5.8	1265	
6/15/00	1630	250,000	0.7	4.1	850	
6/22/90	900	342,000	0.7	4.2	1197	
6/28/90	1620	299,000	0.7	5.3	1375	
7/7/90	1900	202,000	0.7	6.0	1071	
7/14/90	1230	161,000	0.7	3.4	435	
7/23/90	1345	125,000	0.7	6.7	750	
7/23/90	2105	125,000	0.7	6.7	750	
7/27/90	1420	117,000	0.7	7.8	831	
8/3/90	1200	98,000	0.7	8.1	725	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/10/90	1950	82,400	0.7	8.9	676	
8/17/90	1230	89,200	0.7	8.6	705	
8/24/90	1800	72,200	0.7	9.3	621	
9/1/90	2110	58,900	0.7	9.7	530	
9/5/90	1430	59,500	0.7	10.1	559	
9/10/90	1100	58,900	0.7	10.6	583	
9/28/90		43,600	0.7	10.2	414	
9/30/90	1000	42,200	0.7	11.6	460	
10/12/90	1430	39,900	0.7	12.3	463	
10/22/90	1210	39,900	0.7	12.9	487	
11/15/90	1545	34,300	0.7	13.1	425	
11/23/90	1530	32,000	0.7	15.7	480	
12/17/90	1530	22,600	0.7	19.2	418	
1/2/91	1145	19,800	0.7	19.3	368	
1/17/91	1130	19,200	0.7	20.5	380	
2/11/91	1545	17,600	0.7	20.9	356	
3/18/91	1515	23,300	0.7	16.4	366	
3/26/91	1615	28,900	0.7	15.6	431	
4/6/91	1630	48,400	0.7	13.1	600	
4/18/91	1615	34,500	0.7	12.1	393	
5/8/91	1445	68,200	0.7	8.3	518	
5/9/91	1231	110,000	0.7	6.5	638	
5/16/91	950	182,000	0.7	4.5	692	
5/22/91	1255	417,000	0.7	1.5	334	
6/5/91	1250	479,000	0.7	2.3	766	
6/11/91	1648	425,000	0.7	2.6	808	
6/19/91	1409	315,000	0.7	4.6	1229	
6/25/91	1045	275,000	0.7	4.4	1018	
6/26/91	2112	259,000	0.7	3.4	699	
6/27/91	800	256,000	0.7	4.9	1075	
7/5/91	1038	216,000	0.7	5.2	972	
7/10/91	1003	183,000	0.7	5.9	952	
7/17/91	1200	148,000	0.7	6.6	873	
7/24/00	1615	131,000	0.7	6.9	812	
8/6/00	1513	98,300	0.7	7.8	698	
8/13/00	1227	81,800	0.7	8.4	630	
8/15/91	2000	77,600	0.7	8.6	613	
8/22/91	1420	69,100	0.7	9.1	580	
8/30/91	1807	58,600	0.7	9.8	533	
9/5/91		52,700	0.7	9.7	474	
9/12/91	1420	56,400	0.7	10.3	541	
9/23/91	1927	46,800	0.7	11.0	482	
10/9/91	1345	39,600	0.7	11.1	412	
11/15/91	1810	30,300	0.7	14.2	409	
12/31/91	1215	25,300	0.7	16.1	390	
1/16/92	1353	23,700	0.7	16.3	370	
2/4/92	1610	22,900	0.7	15.4	337	
2/13/92	1313	24,700	0.7	16.1	380	
3/11/92	1133	25,500	0.7	15.2	370	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/26/92	1525	27,400	0.7	14.4	375	
4/10/92	1715	46,400	0.7	10.0	432	
4/23/92	1300	87,800	0.7	5.7	439	
5/7/92	1428	323,000	0.7	2.4	549	
5/13/92	946	170,000	0.7	2.9	374	
5/19/92	1137	286,000	0.7	2.0	372	
5/27/92	1000	360,000	0.7	2.0	468	
6/9/92	1455	160,000	0.7	3.7	480	
6/17/92	1255	219,000	0.7	4.1	745	
6/24/92	1333	201,000	0.7	3.2	503	
6/30/92	1050	189,000	0.7	3.6	548	
7/7/92	1550	151,000	0.7	4.5	574	
7/15/92	1620	129,000	0.7	4.7	516	
7/21/92	1455	154,000	0.7	3.9	493	
7/30/92	1542	90,000	0.7	7.2	585	
8/4/92	1240	82,400	0.7	7.5	560	
8/12/92	1045	66,000	0.7	8.7	528	
8/19/92	1116	58,600	0.7	9.1	492	
8/26/92	1228	51,300	0.7	9.8	467	
9/9/92	1200	56,400	0.7	9.4	491	
9/27/92	1510	41,100	0.7	11.8	456	
10/17/92		37,100	0.7	11.7	408	
10/22/92	1333	36,000	0.7	12.4	421	
11/18/92	1655	32,600	0.7	13.4	414	
12/4/92	1655	25,500	0.7	15.3	372	
12/15/92	1500	26,600	0.7	14.1	356	
1/11/93	1405	22,300	0.7	18.3	392	
1/14/93	1400	21,400	0.7	17.8	366	
2/8/93	1455	17,300	0.7	19.4	324	
2/23/93	1440	15,300	0.7	19.8	292	
3/11/93	1135	17,000	0.7	19.5	320	
3/23/93	1225	18,700	0.7	17.8	320	
4/6/93	1342	34,100	0.7	11.6	372	
4/9/93	710	37,200	0.7	11.3	394	
4/20/93	1525	37,100	0.7	11.1	386	
5/5/93	1014	91,300	0.7	5.0	393	
5/13/93	851	345,000	0.7	2.0	449	
5/19/93	1030	440,000	0.7	2.4	748	
5/19/93	1455	394,000	0.7	1.8	433	
5/28/93	1605	430,000	0.7	2.4	731	
6/8/93	1620	348,000	0.7	3.3	905	
6/16/93	1120	357,000	0.7	3.0	821	
6/23/93	1530	307,000	0.7	3.5	860	
6/28/93	1110	276,000	0.7	4.0	911	
6/29/93	1629	259,000	0.7	4.0	855	
7/6/93	1624	242,000	0.7	4.1	823	
7/13/93	840	200,000	0.7	4.4	740	
7/21/93	1254	165,000	0.7	4.9	693	
7/27/93	1015	168,000	0.7	4.7	672	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

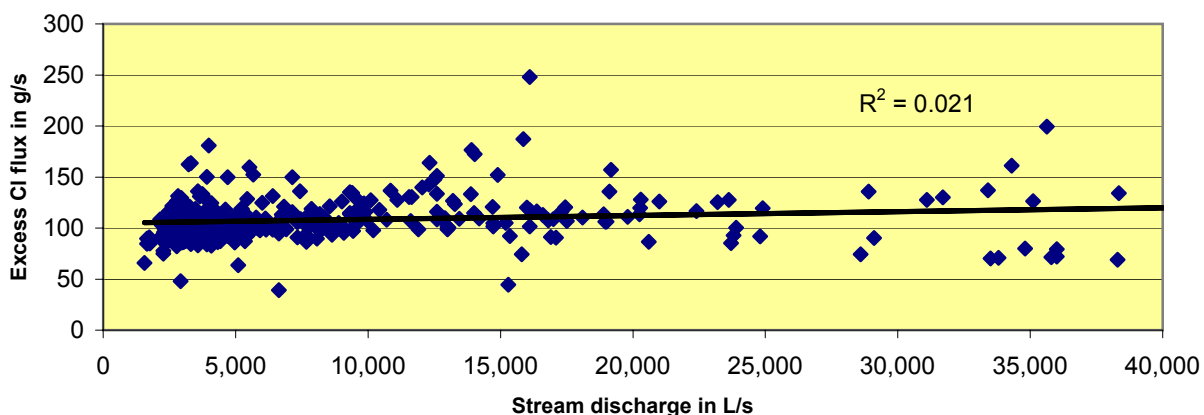
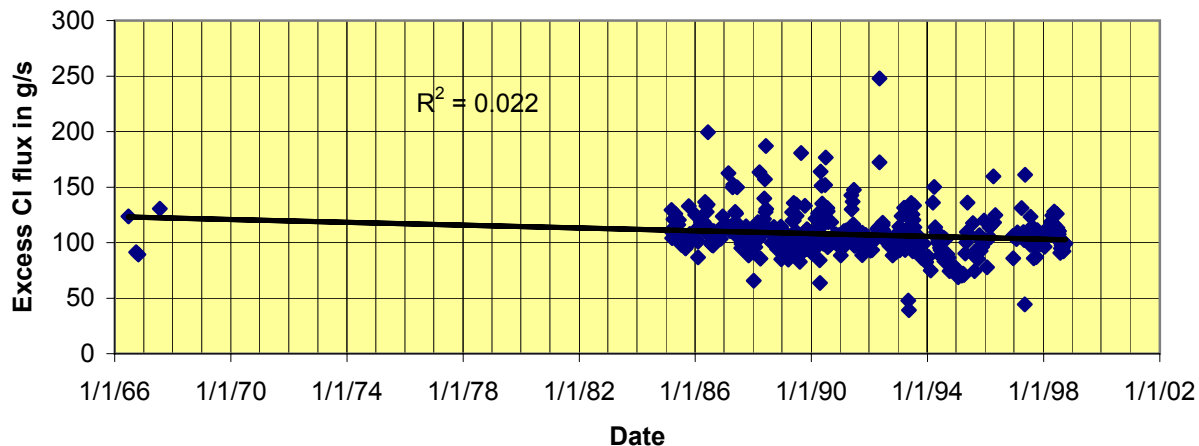
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/5/93	1423	135,000	0.7	5.6	662	
8/11/93	1550	118,000	0.7	6.1	637	
8/17/93	2000	101,000	0.7	6.8	616	
8/16/93	1429	98,800	0.7	6.5	573	
8/25/93	1047	86,400	0.7	7.2	562	
9/8/93	1215	64,100	0.7	8.6	506	
9/22/93	1432	51,700	0.7	9.3	445	
9/22/93	1815	51,500	0.7	9.6	458	
10/5/93	1120	43,600	0.7	10.5	427	
10/20/93	940	42,300	0.7	10.5	415	
11/4/93	1705	34,000	0.7	12.0	384	
2/11/94	1429	21,500	0.7	16.8	346	
3/9/94	1604	23,700	0.7	15.5	351	
3/24/94	1454	24,000	0.7	15.3	350	
4/8/94	1059	27,200	0.7	13.6	351	
4/20/94	1403	109,000	0.7	4.6	425	
5/3/94	1000	81,800	0.7	6.0	434	
5/10/94	1428	278,000	0.7	2.1	389	
5/19/94	1425	238,000	0.7	3.3	619	
5/25/94	515	287,000	0.7	3.2	718	
6/8/94	1815	168,000	0.7	4.9	706	
6/16/94	940	189,000	0.7	3.8	586	
6/22/94	820	157,000	0.7	5.0	675	
6/29/94	1150	119,000	0.7	5.9	619	
7/6/94	1420	112,000	0.7	6.3	627	
7/12/94	2025	87,200	0.7	7.2	567	
7/13/94	1430	85,500	0.7	7.3	564	
7/26/94	955	68,000	0.7	8.4	524	
8/3/94	1340	57,600	0.7	10.3	553	
8/10/94	1352	52,400	0.7	10.2	498	
8/17/94	1454	44,500	0.7	10.6	441	
8/25/94	1600	38,800	0.7	11.3	411	
9/8/94	1130	32,000	0.7	13.1	397	
9/22/94	1600	28,900	0.7	13.4	367	
10/15/96	1535	43,300	0.7	10.4	420	
11/12/96	1350	37,400	0.7	11.9	419	
12/9/96	1255	36,800	0.7	12.0	416	
12/16/96	1520	31,000	0.7	11.3	329	
1/22/97	1200	41,300	0.7	11.6	450	
2/4/97	1242	39,100	0.7	11.7	430	
4/7/97	1600	40,500	0.7	11.8	450	
4/16/97	1620	38,500	0.7	11.3	408	
4/23/97	1525	66,800	0.7	7.5	454	
5/1/97	1445	87,900	0.7	6.2	483	
5/7/97	745	161,000	0.7	7.9	1159	
5/14/97		334,000	0.7	1.8	367	
7/14/97	1030	279,000	0.7	5.1	1228	
7/18/97	1645	262,000	0.7	4.5	996	
7/23/97	1515	218,000	0.7	4.5	828	

YELLOWSTONE RIVER AT CORWIN SPRINGS, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/31/97	1151	195,000	0.7	5.2	878	
8/7/97	1155	158,000	0.7	5.1	695	
8/13/97	1245	142,000	0.7	5.5	682	
8/20/97	1745	125,000	0.7	6.4	713	
8/27/97	1355	108,000	0.7	6.6	637	
9/2/97	1630	93,700	0.7	6.7	562	
9/10/97	1730	81,700	0.7	7.0	515	
10/7/97	1720	60,000	0.7	8.3	456	
10/20/97	1500	60,600	0.7	8.1	448	
11/17/97	1625	42,500	0.7	11.0	438	
12/10/97	1050	38,200	0.7	11.3	405	
1/12/98	1730	35,400	0.7	11.9	396	
2/11/98	1437	35,100	0.7	12.3	407	
3/12/98	1045	32,800	0.7	13.1	407	
3/24/98	1426	38,500	0.7	11.8	427	
4/7/98	1425	37,900	0.7	11.4	406	
4/14/98	1448	39,600	0.7	10.8	400	
4/21/98	1154	42,200	0.7	10.8	426	
5/4/98	1150	228,000	0.7	2.8	479	
5/13/98	1428	226,000	0.7	2.9	497	
5/19/98	1426	160,000	0.7	4.1	544	
5/26/98	1431	245,000	0.7	8.3	1862	
6/2/98	1105	281,000	0.7	2.5	506	
6/9/98	735	211,000	0.7	2.3	338	
6/16/98	950	314,000	0.7	3.6	911	
6/22/98	1505	283,000	0.7	2.8	594	
6/30/98	1120	305,000	0.7	3.0	702	
7/8/98	800	286,000	0.7	2.8	601	
7/14/98	1434	221,000	0.7	3.0	508	
7/20/98	1350	182,000	0.7	4.1	619	
7/28/98	1440	147,000	0.7	4.7	588	
8/4/98	1620	126,000	0.7	5.6	617	
8/12/98	957	103,000	0.7	5.5	494	
8/18/98	1530	99,700	0.7	6.4	568	
8/26/98	1312	79,300	0.7	7.3	523	
9/15/98	1452	59,500	0.7	8.2	446	
10/1/98	1140	50,000	0.7	10.1	470	
10/21/98	1229	40,000	0.7	10.2	380	
11/20/98	1400	35,000	0.7	11.3	371	
12/10/98	1755	31,000	0.7	13.0	381	
1/11/99	1711	32,000	0.7	12.1	365	
1/21/99	1730	33,100	0.7	12	374	
2/10/99	1000	33,600	0.7	13	413	
2/16/99	829	31,000	0.7	12.5	366	
3/4/99	930	32,300	0.7	14	430	
3/11/99	1924	31,000	0.7	12.6	369	
3/25/99	1711	36,000	0.7	11.2	378	
4/6/99	930	34,300	0.7	13	422	
4/14/99	1642	36,000	0.7	11.9	403	

GARDNER RIVER NEAR MAMMOTH, WY

Gardner River near Mammoth, WY, about 4.4 km upstream of its confluence with the Yellowstone River; captures thermal discharge from the Mammoth Hot Springs area, with a relatively minor contribution from the Roaring Mountain region. Gaged at lat. 44 deg. 59 min. 33 sec. N, long. 110 deg. 41 min. 26 sec. W, USGS streamgaging station 06191000. Sampled at gaging station (1966-7 and 8/1988 -) and at McMinn Bench, 0.7 km downstream from the gaging station. Most water samples were "grab" samples collected at a single point near the stream bank. Some samples collected between 8/1988 9/1993 were "integrated" samples collected across the width of the stream. Most chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. The earliest determinations (through 1967) were by titration with a silver-nitrate solution and some of the more recent (approx. 8/1988-9/1993) by a colorimetric method or ion chromatography at the USGS labs in Menlo Park. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). The chloride flux is converted to a hot-spring discharge by assuming a Cl value of 170 mg/L -- the approximate Mammoth Hot Springs value -- for the thermal water. Some excess Cl flux actually comes from the Roaring Mountain region, via Obsidian Creek, an upstream tributary. The Obsidian Creek contribution can be separated -- for a few dates -- by using the Obsidian Creek data displayed on the fourth sheet of this spreadsheet. The data compiled here are from Fournier and others (1975), Norton and others (1989), Sorey and others (1991), Friedman and Norton (2000), and the USGS archives in Menlo Park, California.



GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/24/66		13,280	0.7	10.0	124	726
9/28/66		3,230	0.7	29.0	91	538
10/26/66		2,605	0.7	35.0	89	526
7/23/67		11,550	0.7	12.0	131	768
2/22/85		2,950	0.7	38.2	111	651
3/8/85		2,950	0.7	44.6	130	762
3/14/85		2,610	0.7	40.6	104	613
4/2/85		3,260	0.7	37.8	121	711
4/18/85		6,830	0.7	18.4	121	711
4/26/85		3,960	0.7	32.5	126	741
5/5/85		9,630	0.7	12.3	112	657
5/14/85		9,370	0.7	12.5	111	650
5/24/85		18,950	0.7	6.3	106	624
5/30/85		16,370	0.7	7.8	116	684
6/5/85		12,770	0.7	9.3	110	646
6/6/85		17,450	0.7	7.6	120	708
6/13/85		11,610	0.7	9.9	107	628
6/21/85		8,890	0.7	12.5	105	617
6/27/85		7,330	0.7	15.1	106	621
7/5/85		5,860	0.7	17.9	101	593
7/11/85		5,350	0.7	19.0	98	576
7/30/85		4,790	0.7	21.7	101	592
8/3/85		4,840	0.7	21.5	101	592
8/15/85		4,020	0.7	26.0	102	598
8/19/85		3,880	0.7	26.8	101	596
8/22/85		3,820	0.7	27.1	101	593
8/30/85		3,540	0.7	29.0	100	589
9/2/85		4,020	0.7	24.3	95	558
9/11/85		3,880	0.7	27.9	106	621
9/27/85		3,740	0.7	28.8	105	618
10/11/85		3,740	0.7	36.2	133	781
10/22/85		3,910	0.7	28.3	108	635
11/5/85		3,650	0.7	29.7	106	623
11/7/85		3,030	0.7	33.9	101	592
12/30/85		2,920	0.7	43.5	125	735
1/14/86		2,920	0.7	39.1	112	660
2/5/86		2,380	0.7	37.1	87	510
2/6/86		2,550	0.7	40.2	101	593
3/13/86		3,120	0.7	38.7	119	697
3/18/86		2,920	0.7	40.8	117	689
3/19/86		3,030	0.7	39.0	116	683
4/2/86		4,250	0.7	28.1	116	685
4/15/86		5,210	0.7	23.5	119	699
4/30/86		5,410	0.7	21.0	110	646
5/3/86		10,850	0.7	13.3	137	804
5/21/86		13,880	0.7	10.3	133	784
5/25/86		23,620	0.7	6.1	128	750

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/4/86		38,350	0.7	4.2	134	790
6/9/86		35,630	0.7	6.3	200	1174
6/20/86		20,250	0.7	6.3	113	667
6/27/86		13,450	0.7	8.8	109	641
7/3/86		9,710	0.7	11.8	108	634
7/9/86		9,970	0.7	11.5	108	633
7/17/86		7,560	0.7	14.6	105	618
7/22/86		6,340	0.7	16.5	100	589
7/22/86		6,150	0.7	16.7	98	579
7/27/86		6,540	0.7	16.7	105	616
8/5/86		5,040	0.7	20.1	98	575
8/13/86		4,700	0.7	21.4	97	572
8/21/86		5,780	0.7	19.8	110	649
8/29/86		4,250	0.7	24.3	100	590
9/2/86		4,530	0.7	24.3	107	629
9/15/86		4,330	0.7	25.1	106	621
10/1/86		4,330	0.7	25.2	106	624
10/16/86		3,740	0.7	30.2	110	649
10/22/86		3,740	0.7	29.1	106	625
10/30/86		3,820	0.7	29.3	109	643
11/18/86		3,570	0.7	29.7	104	609
12/4/86		2,630	0.7	44.2	114	673
12/12/86		3,120	0.7	40.3	124	727
1/14/87		3,120	0.7	37.4	115	674
2/20/87		3,230	0.7	51.0	162	956
2/25/87		2,830	0.7	41.1	114	673
3/13/87		2,830	0.7	39.7	110	649
4/10/87		2,920	0.7	39.9	114	673
4/17/87		4,700	0.7	32.6	150	882
4/23/87		5,660	0.7	27.6	152	896
5/5/87		7,140	0.7	16.9	116	680
5/18/87		9,600	0.7	14.0	128	751
5/20/87		9,490	0.7	12.9	116	681
5/21/87		7,870	0.7	15.8	119	699
5/28/87		9,010	0.7	14.7	126	742
6/5/87		6,740	0.7	17.5	113	666
6/11/87		7,140	0.7	21.7	150	882
6/25/87		4,620	0.7	23.3	104	614
6/30/87		4,330	0.7	25.9	109	642
7/3/87		4,080	0.7	26.6	106	622
7/9/87		4,960	0.7	23.1	111	654
7/15/87		3,910	0.7	28.1	107	630
7/24/87		4,160	0.7	26.7	108	636
7/31/87		3,480	0.7	28.0	95	559
8/4/87		3,480	0.7	29.1	99	581
8/11/87		3,400	0.7	32.3	107	632
8/12/87		3,480	0.7	30.9	105	618

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/21/87		3,230	0.7	32.6	103	606
8/27/87		3,480	0.7	32.3	110	647
9/2/87		3,120	0.7	34.2	105	615
9/3/87		3,230	0.7	35.2	111	656
9/11/87		3,120	0.7	34.9	107	628
9/18/87		2,920	0.7	35.3	101	594
9/25/87		2,920	0.7	37.5	107	632
9/30/87		2,920	0.7	40.0	115	675
10/9/87		2,830	0.7	35.8	99	584
10/23/87		2,210	0.7	42.4	92	542
11/4/87		2,380	0.7	37.9	89	521
12/4/87		2,380	0.7	38.9	91	535
12/15/87		2,210	0.7	47.3	103	606
1/6/88		1,560	0.7	42.8	66	386
1/27/88		2,290	0.7	42.6	96	564
2/5/88		2,630	0.7	43.0	111	654
2/26/88		2,630	0.7	45.7	118	696
3/8/88		2,210	0.7	47.4	103	607
3/18/88		3,310	0.7	50.1	164	962
4/1/88		2,380	0.7	36.7	86	504
4/15/88		3,480	0.7	34.8	119	698
4/29/88		4,330	0.7	27.2	115	675
5/4/88		3,990	0.7	28.7	112	657
5/13/88		8,550	0.7	14.9	121	714
5/19/88		12,040	0.7	12.3	140	822
5/27/88		19,170	0.7	8.9	157	925
6/3/88		11,100	0.7	12.2	128	751
6/7/88		15,860	0.7	12.5	187	1101
6/10/88		11,640	0.7	11.9	130	767
6/17/88		8,330	0.7	14.0	111	652
6/24/88		7,020	0.7	16.8	113	665
8/4/88	1315	3,170	0.7	36.0	112	658
8/11/88	1045	3,115	0.7	36.0	110	647
8/18/88	840	2,830	0.7	36.0	100	588
32380	1300	2,890	0.7	39.0	111	651
9/1/88	900	2,830	0.7	39.0	108	638
9/8/88	1035	2,830	0.7	39.0	108	638
9/14/88	1430	2,830	0.7	36.0	100	588
9/15/88	1410	2,830	0.7	41.0	114	671
9/22/88	930	2,755	0.7	39.0	106	621
9/29/88	1000	2,755	0.7	40.0	108	637
10/4/88	1700	2,830	0.7	38.0	106	621
10/6/88	1300	2,680	0.7	38.0	100	588
10/13/88		2,680	0.7	38.0	100	588
10/20/88	1900	2,610	0.7	38.0	97	573
10/27/88	1040	2,460	0.7	39.0	94	554
11/1/88	1130	2,605	0.7	40.0	102	602

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
11/1/88	1130	2,605	0.7	40.0	102	602
11/18/88	1550	2,610	0.7	43.4	111	656
12/5/88	1700	2,460	0.7	43.0	104	612
12/12/88	1700	2,460	0.7	47.2	114	673
12/16/88	1253	1,760	0.7	49.0	85	500
1/11/89	1650	2,460	0.7	41.0	99	583
1/11/89	1650	2,460	0.7	41.0	99	583
1/27/89	1458	2,460	0.7	41.0	99	583
2/14/89	1321	2,150	0.7	51.1	108	637
3/6/89	1220	2,325	0.7	41.0	94	551
3/8/89	930	2,460	0.7	43.0	104	612
3/15/89	1120	1,650	0.7	52.0	85	498
3/15/89	930	1,650	0.7	55.0	90	527
3/30/89	1540	2,460	0.7	42.0	102	598
4/11/89	1530	2,530	0.7	39.0	97	570
5/5/89	1645	10,100	0.7	13.3	127	749
5/9/89	1730	20,275	0.7	6.6	120	704
5/22/89	845	16,000	0.7	8.2	120	706
5/24/89	1120	19,110	0.7	7.8	136	798
6/6/89	1715	16,100	0.7	7.0	101	597
6/15/89	1313	18,100	0.7	6.8	110	649
6/22/89	1635	12,600	0.7	9.3	108	637
6/26/89	1610	9,400	0.7	15.0	134	791
6/30/89	1540	9,850	0.7	13.3	124	730
7/5/89	1715	7,670	0.7	12.0	87	510
7/14/89	1125	6,880	0.7	15.3	100	591
7/15/89	1715	8,300	0.7	12.7	100	586
7/20/89	1005	5,520	0.7	18.0	95	562
7/20/89	1205	5,350	0.7	18.3	94	554
7/28/89	1250	5,100	0.7	21.2	105	615
8/3/89	1107	4,130	0.7	23.4	94	551
8/8/89	1745	4,080	0.7	21.0	83	487
8/17/89	1308	3,680	0.7	26.0	93	548
8/23/89	1300	3,990	0.7	46.0	181	1063
8/23/89	1300	3,990	0.7	26.0	101	594
8/23/89	1330	3,680	0.7	27.1	97	571
8/31/89	1445	3,450	0.7	28.2	95	558
9/8/89	1015	3,310	0.7	29.9	97	569
9/8/89		3,455	0.7	30.9	104	614
9/11/89	1530	3,625	0.7	26.0	92	539
9/22/89	1340	3,110	0.7	31.1	95	556
9/22/89	1345	3,110	0.7	33.2	101	595
9/28/89	1450	3,400	0.7	32.0	106	626
9/8/89	1550	3,260	0.7	31.8	101	596
10/3/89	1515	3,740	0.7	28.0	102	601
10/12/89	1442	3,740	0.7	36.3	133	783
10/12/89	1643	3,260	0.7	34.0	109	639

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/18/89	1442	2,780	0.7	39.0	106	626
11/1/89		2,400	0.7	40.0	94	555
11/3/89	1600	3,310	0.7	34.6	112	660
11/11/89		2,610	0.7	40.0	103	603
11/15/89	1440	3,260	0.7	33.0	105	619
11/15/89	1500	3,260	0.7	34.8	111	654
12/13/89	1135	2,830	0.7	36.0	100	588
1/3/90	1310	1,740	0.7	53.0	91	535
1/17/90	1450	2,150	0.7	42.6	90	530
1/30/90	1440	2,260	0.7	42.0	93	549
2/16/90	1130	2,660	0.7	39.0	102	599
2/19/90	1310	2,610	0.7	47.3	122	715
3/7/90	1140	2,310	0.7	46.0	105	616
3/27/90	1315	2,780	0.7	46.1	126	742
4/4/90	1715	3,910	0.7	30.0	115	674
4/13/90	1120	3,910	0.7	22.2	84	495
4/18/90	1030	5,100	0.7	13.2	64	375
4/25/90	1600	12,320	0.7	14.0	164	964
5/7/90	1300	12,600	0.7	12.7	151	889
5/9/90	1830	9,320	0.7	13.0	115	674
5/17/90	1430	9,320	0.7	15.2	135	795
5/22/90	1201	7,870	0.7	13.9	104	611
5/29/90	1115	8,860	0.7	11.9	99	584
6/6/90	1330	13,030	0.7	8.4	100	590
6/6/90	1435	13,200	0.7	10.3	127	745
6/12/90	1730	13,000	0.7	8.3	99	581
6/13/90	1730	14,725	0.7	7.8	105	615
6/13/90	1730	14,725	0.7	7.6	102	598
6/22/90	1315	14,900	0.7	10.9	152	894
6/29/90	1130	13,900	0.7	13.4	177	1038
7/6/90	1030	8,520	0.7	12.5	101	591
7/19/90	1515	6,400	0.7	21.2	131	772
7/24/90	1450	5,440	0.7	24.3	128	755
7/25/90	1415	5,240	0.7	19.0	96	564
8/2/90	1440	5,240	0.7	23.3	118	697
8/17/90	1100	4,700	0.7	21.5	98	575
9/6/90	1330	3,910	0.7	31.0	118	697
9/28/90		3,290	0.7	31.2	100	590
10/4/90	1100	3,260	0.7	32.0	102	600
10/19/90	1423	3,480	0.7	31.5	107	630
11/6/90	1354	2,830	0.7	38.7	108	633
11/15/90	1245	2,970	0.7	34.0	99	582
12/11/90	1535	3,030	0.7	35.9	107	627
1/4/91	1345	2,370	0.7	38.0	88	520
1/16/91	1611	2,380	0.7	40.4	94	556
2/11/91	1630	2,780	0.7	38.0	104	610
2/13/91	1109	2,610	0.7	43.0	110	649

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/13/91	1328	2,550	0.7	44.2	111	653
3/27/91	1630	2,380	0.7	43.0	101	592
3/27/91	1700	2,380	0.7	43.4	102	598
4/1/91	1046	2,380	0.7	43.1	101	594
4/17/91	1325	2,610	0.7	40.3	103	608
5/8/91	1245	5,350	0.7	22.0	114	670
5/16/91	1040	12,300	0.7	12.3	143	839
5/22/91	1155	31,700	0.7	4.8	130	765
6/5/91	1145	33,400	0.7	4.8	137	806
6/11/91	1616	22,400	0.7	5.9	116	685
6/19/91	1443	12,500	0.7	12.5	148	868
6/26/91	1500	9,430	0.7	11.0	97	571
6/26/91	2040	9,680	0.7	12.2	111	655
7/5/91	1130	7,650	0.7	15.1	110	648
7/10/91	1032	7,140	0.7	16.5	113	664
7/17/91	1122	5,520	0.7	20.2	108	633
7/24/91	1536	5,070	0.7	22.0	108	635
8/6/91	1444	4,420	0.7	24.2	104	611
8/15/91	1700	3,840	0.7	26.0	97	571
8/15/91	1715	3,910	0.7	26.4	100	591
8/22/91	1348	3,820	0.7	28.2	105	618
8/30/91	1733	3,570	0.7	30.0	105	615
9/23/91	1810	3,480	0.7	31.1	106	622
9/30/91	1830	3,480	0.7	32.0	109	641
9/30/91	1840	3,030	0.7	30.0	89	522
10/9/91	1707	3,310	0.7	32.5	105	619
11/15/91	1440	3,310	0.7	33.0	107	629
12/11/91	1650	2,320	0.7	43.4	99	583
12/16/91	1645	2,830	0.7	36.0	100	588
1/16/92	1428	2,610	0.7	36.2	93	545
2/5/92	1550	2,720	0.7	35.0	93	549
2/13/92	1645	2,550	0.7	40.3	101	594
3/10/92	1210	2,490	0.7	43.2	106	623
3/24/92	1808	2,660	0.7	40.0	105	615
3/26/92	1600	2,780	0.7	38.0	104	610
4/10/92	1644	4,330	0.7	26.6	112	660
4/23/92	1330	8,180	0.7	14.6	114	669
5/5/92	1615	14,020	0.7	13.0	172	1014
5/7/92	1456	16,100	0.7	16.1	248	1458
5/13/93	1235	10,700	0.7	10.8	108	636
5/19/93	1111	14,000	0.7	8.9	115	675
5/27/92	1028	17,500	0.7	6.8	107	628
6/7/92	1423	7,760	0.7	15.2	113	662
6/16/92	1740	10,420	0.7	12.0	118	693
6/17/92	1325	9,910	0.7	12.4	116	682
6/24/92	1408	7,760	0.7	15.0	111	653
6/30/92	1221	7,450	0.7	15.3	109	640

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/7/92	1606	6,200	0.7	17.9	107	627
7/15/92	1639	5,440	0.7	20.3	107	627
7/21/92	1512	5,240	0.7	20.7	105	616
7/29/92	1645	3,990	0.7	26.0	101	594
7/30/92	1526	4,250	0.7	24.8	102	603
8/4/92	1257	4,250	0.7	24.9	103	605
8/8/92	1135	3,820	0.7	27.7	103	607
8/12/92	1201	3,740	0.7	27.9	102	598
8/19/92	1037	3,650	0.7	28.2	100	590
8/26/92	1206	3,570	0.7	29.0	101	594
9/9/92	1110	3,310	0.7	30.0	97	570
9/27/92	1455	3,260	0.7	31.2	99	585
10/20/92	1620	2,830	0.7	32.0	89	521
10/22/92	1400	3,110	0.7	33.9	103	607
11/18/92	1636	3,030	0.7	35.8	106	626
12/2/92	1650	2,660	0.7	35.0	91	537
12/15/92	1439	2,970	0.7	34.9	102	597
1/12/93	1600	3,110	0.7	37.5	114	673
1/12/93	1615	2,660	0.7	37.0	97	568
1/14/93	1342	2,780	0.7	34.2	93	548
2/8/93	1545	2,970	0.7	42.4	124	729
2/23/93	1350	2,430	0.7	43.0	103	605
3/11/93	1115	2,830	0.7	47.1	131	772
3/23/93	1211	2,320	0.7	40.9	93	549
4/6/93	1150	2,660	0.7	38.1	99	585
4/8/93	1750	2,780	0.7	36.0	98	577
4/20/93	1446	2,970	0.7	37.1	108	636
5/5/93	1042	2,920	0.7	17.1	48	282
5/13/93	1029	6,630	0.7	6.6	39	230
5/19/93	1505	35,110	0.7	4.3	126	744
5/28/93	1548	31,100	0.7	4.8	128	750
6/8/93	1605	28,900	0.7	5.4	136	799
6/16/93	1107	24,900	0.7	5.5	120	703
6/23/93	1615	23,200	0.7	6.1	125	737
6/28/93	1645	15,350	0.7	6.7	92	542
6/29/93	1604	15,200	0.7	7.6	105	617
7/6/93	1608	14,700	0.7	8.9	121	709
7/13/93	820	12,600	0.7	11.3	134	786
7/21/93	1155	9,320	0.7	12.9	114	669
7/27/93	1158	7,650	0.7	12.9	93	549
8/5/93	1405	7,650	0.7	14.7	107	630
8/11/93	1705	6,400	0.7	16.1	99	580
8/18/93	1518	5,830	0.7	17.8	100	586
8/19/93	1400	5,635	0.7	18.0	97	573
8/25/93	1126	5,150	0.7	19.0	94	554
9/8/93	1157	4,870	0.7	22.4	106	622
9/22/93	1710	4,420	0.7	23.0	99	580

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/5/93	1406	3,740	0.7	25.0	91	535
10/20/93	1036	3,030	0.7	29.1	86	506
11/15/93	1244	2,830	0.7	35.7	99	583
12/16/93	1100	2,780	0.7	30.3	82	484
1/14/94	1530	2,720	0.7	32.8	87	514
2/11/94	1500	2,270	0.7	33.7	75	441
3/9/94	1538	3,570	0.7	38.8	136	800
3/24/94	1522	3,910	0.7	39.1	150	883
4/8/94	1136	2,970	0.7	39.0	114	669
4/20/94	1345	7,650	0.7	15.0	109	644
5/3/94	940	6,710	0.7	16.2	104	612
5/10/94	1407	17,000	0.7	7.1	109	640
5/19/94	1350	13,000	0.7	8.5	101	596
5/25/94	1655	11,900	0.7	9.0	99	581
6/8/94	1750	9,090	0.7	11.2	95	561
6/16/94	910	8,640	0.7	11.5	93	549
6/22/94	750	8,070	0.7	11.8	90	527
6/29/94	1545	5,350	0.7	17.0	87	513
7/6/94	1400	5,440	0.7	17.7	92	544
7/13/94	1405	4,330	0.7	20.6	86	507
7/26/94	1121	3,740	0.7	28.6	104	614
8/3/94	1555	3,570	0.7	24.0	83	489
8/10/94	1620	3,310	0.7	26.2	84	497
8/17/94	1726	3,170	0.7	33.2	103	606
8/25/94	1546	3,110	0.7	28.7	87	512
9/8/94	1150	3,030	0.7	30.3	90	528
9/22/94	1715	2,920	0.7	30.3	86	508
10/3/94	1400	28,600	0.7	3.3	74	437
10/19/94	1338	34,800	0.7	3.0	80	471
11/17/94	1338	36,000	0.7	2.9	79	466
12/19/94	1330	40,600	0.7	2.6	77	454
1/22/95	1450	38,300	0.7	2.5	69	406
2/17/95	1434	35,800	0.7	2.7	72	421
3/8/95	1605	33,500	0.7	2.8	70	414
3/22/95	1116	36,000	0.7	2.7	72	424
4/5/95	1416	33,800	0.7	2.8	71	418
4/19/95	1421	29,100	0.7	3.8	90	531
5/4/95	1335	23,900	0.7	4.9	100	590
5/10/95	1550	12,900	0.7	9.2	110	645
5/17/95	1600	7,430	0.7	19.0	136	800
7/27/95	1510	16,100	0.7	8.0	118	691
8/9/95	1700	16,900	0.7	6.1	91	537
8/16/95	1510	15,800	0.7	5.4	74	437
8/23/95	1430	17,100	0.7	6.0	91	533
9/6/95	1628	20,600	0.7	4.9	87	509
9/13/95	1039	23,800	0.7	4.6	93	546
9/21/95	1546	24,800	0.7	4.4	92	540

GARDNER RIVER NEAR MAMMOTH, WY

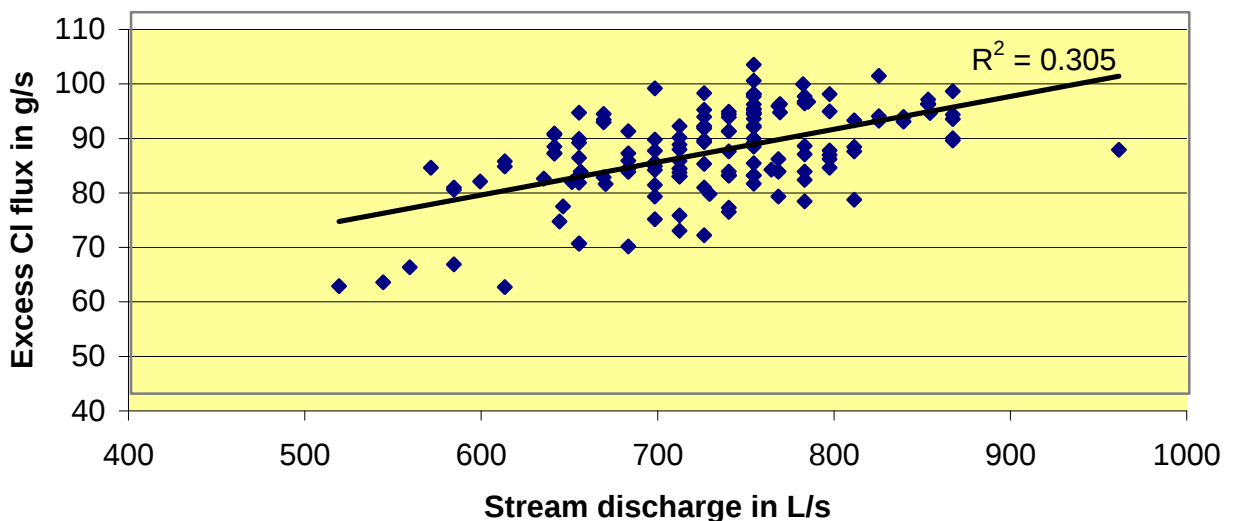
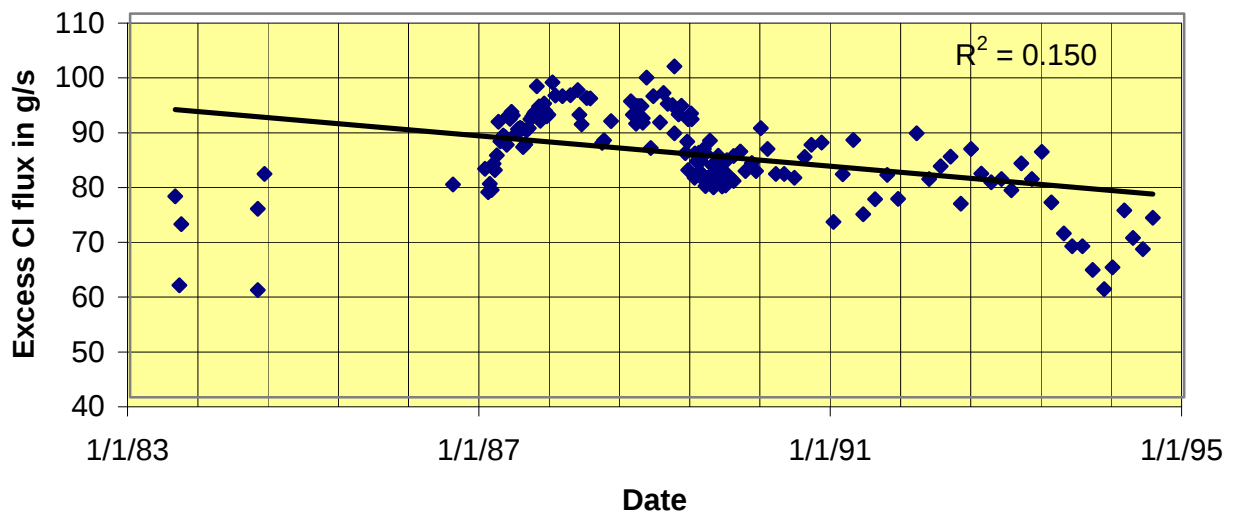
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
9/28/95	925	23,700	0.7	4.3	85	502
10/4/95	1512	4,800	0.7	22.5	105	616
10/11/95	1412	4,250	0.7	25.7	106	625
10/18/95	1253	4,620	0.7	23.8	107	628
11/1/95	1011	2,660	0.7	35.5	93	545
11/8/95	1527	3,820	0.7	26.3	98	575
11/20/95	1550	3,570	0.7	27.7	96	567
12/13/95	1135	4,020	0.7	30.5	120	705
1/6/96	1329	3,260	0.7	31.8	101	596
1/18/96	1420	2,270	0.7	35.0	78	458
2/20/96	1403	3,310	0.7	35.1	114	670
3/1/96	1231	2,720	0.7	39.2	105	616
3/19/96	1141	2,460	0.7	47.9	116	683
4/8/96	1710	5,520	0.7	29.6	160	938
4/15/96	1148	4,620	0.7	26.3	118	696
5/1/96	1305	6,000	0.7	21.5	125	734
12/10/96	1645	3,910	0.7	27.8	106	623
12/16/96	1300	2,970	0.7	29.6	86	505
1/22/97	1300	3,570	0.7	29.6	103	607
2/4/97	1450	2,610	0.7	42.6	109	643
2/18/97	1222	3,110	0.7	34.5	105	618
3/28/97	800	3,650	0.7	36.6	131	771
4/15/97	1330	3,170	0.7	35.0	109	640
4/23/97	1645	6,120	0.7	18.6	110	644
5/1/97	1600	7,990	0.7	13.5	102	602
5/7/97	1500	15,300	0.7	3.6	44	261
5/13/97	1930	34,300	0.7	5.4	161	948
7/14/97	1540	10,200	0.7	10.3	98	576
7/18/97	915	9,800	0.7	13.3	123	726
7/23/97	1624	8,980	0.7	12.2	103	607
7/31/97	1444	7,870	0.7	13.8	103	606
8/7/97	1125	7,020	0.7	17.0	114	673
8/13/97	1105	6,910	0.7	15.0	99	581
8/20/97	1210	5,240	0.7	19.5	99	579
8/27/97	1700	4,960	0.7	18.0	86	505
9/2/97	1415	5,520	0.7	18.4	98	575
9/4/97	1000	5,520	0.7	20.6	110	646
9/10/97	1640	4,870	0.7	22.7	107	630
9/18/97	1717	4,700	0.7	23.4	107	628
10/1/97	755	4,420	0.7	20.4	87	512
10/14/97	1700	4,960	0.7	23.1	111	654
11/17/97	1540	4,420	0.7	23.0	99	580
12/17/97	1347	3,910	0.7	26.3	100	589
1/12/98	1710	3,570	0.7	27.7	96	567
2/11/98	1342	3,650	0.7	31.5	112	661
3/12/98	1105	3,170	0.7	34.8	108	636
3/24/98	1408	4,280	0.7	27.3	114	670

GARDNER RIVER NEAR MAMMOTH, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/31/98	1630	3,740	0.7	31.0	113	667
4/7/98	1500	4,080	0.7	29.9	119	701
4/14/98	1458	3,910	0.7	29.6	113	665
4/21/98	1137	4,080	0.7	31.2	124	732
5/4/98	1405	17,300	0.7	7.4	116	682
5/13/98	1520	20,300	0.7	7.0	128	752
5/19/98	1455	12,600	0.7	9.9	116	682
5/26/98	1522	16,600	0.7	7.5	113	664
6/2/98	1150	19,000	0.7	6.3	106	626
6/9/98	800	14,200	0.7	8.4	109	643
6/16/98	1125	21,000	0.7	6.7	126	741
6/22/98	1545	18,900	0.7	6.7	113	667
6/30/98	1200	19,800	0.7	6.3	111	652
7/8/98	830	16,800	0.7	7.1	108	632
7/14/98	1510	12,700	0.7	9.4	110	650
7/20/98	1515	9,430	0.7	11.4	101	594
7/28/98	1410	7,330	0.7	13.1	91	535
8/4/98	1632	6,630	0.7	15.0	95	558
8/12/98	1030	5,920	0.7	17.2	98	575
8/18/98	1631	6,120	0.7	17.1	100	590
8/26/98	1447	5,070	0.7	19.5	95	561
9/9/98	1623	4,700	0.7	20.3	92	542
9/15/98	1508	4,790	0.7	21.6	100	589
9/30/98	1508	4,420	0.7	23.1	99	582
		7432 7392		24.8	107 19 447	Mean Std. Deviation No. Samples

Hot River near Mammoth, WY

Hot River near Mammoth, WY, a large hot spring near the left bank of the Gardner River; accounts for most of the thermal discharge from the Mammoth Hot Springs area. Gaged and sampled at lat. 44 deg. 59 min. 08 sec. N, long. 110 deg. 41 min. 16 sec W, USGS streamgaging station 06190540. Most water samples were "grab" samples collected at a single point near the stream bank. Chloride (Cl) determinations were made at several labs by a variety of methods, as described by Sorey and others (1991). It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). The chloride flux is converted to a hot-spring discharge by assuming a Cl value of 170 mg/L -- the approximate Mammoth Hot Springs value -- for the thermal water. Observations quoted by Allen and Day (1935) indicate that the discharge and chemistry of Hot River have not changed dramatically since 1883. The data compiled here are from Allen and Day (1935), Norton and others (1989), Sorey and others (1991), Sorey and Colvard (1997), and the USGS archives in Menlo Park, California. Many of the streamflow values reported here differ from those reported by Norton and others (1989) because they are based on a revised rating curve developed in 1988.



Hot River near Mammoth, WY

DATE mo/d/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/5/1884		611	0.7	160	97	573
7/7/83		728	0.7	106	77	451
7/25/83		543	0.7	112	60	356
8/2/83		643	0.7	112	72	421
6/15/84		612	0.7	98	60	350
7/13/84		655	0.7	124	81	475
6/15/84		645	0.7	116	74	437
9/4/86		650	0.7	122	79	464
1/15/87	1230	612	0.7	134	82	481
1/29/87		583	0.7	134	77	455
2/4/87		598	0.7	133	79	464
2/12/87		583	0.7	134	78	458
2/20/87		612	0.7	136	83	486
2/26/87	915	570	0.7	144	81	479
3/6/87	830	640	0.7	132	84	495
3/13/87		668	0.7	136	90	531
3/21/87	1810	654	0.7	133	87	510
4/1/87		640	0.7	138	88	516
4/10/87		640	0.7	137	87	515
4/16/87		654	0.7	132	86	506
4/21/87		668	0.7	137	91	537
4/29/87		725	0.7	126	91	534
5/6/87	2030	725	0.7	128	92	542
5/12/87	630	753	0.7	122	91	538
5/27/87		739	0.7	120	88	519
6/2/87		753	0.7	119	89	523
6/11/87		753	0.7	119	89	524
6/19/87		725	0.7	123	89	523
6/23/87		711	0.7	121	86	504
7/2/87		725	0.7	120	86	507
7/8/87		725	0.7	123	89	522
7/17/87	1130	725	0.7	124	89	524
7/23/87	1045	739	0.7	124	91	534
7/31/87	1030	739	0.7	124	91	537
8/7/87	1030	739	0.7	125	92	539
8/12/87	930	753	0.7	123	92	542
8/19/87	1415	781	0.7	125	97	569
8/28/87	1500	753	0.7	124	93	547
9/3/87	1330	753	0.7	121	90	532
9/9/87	830	767	0.7	122	93	546
9/19/87		782	0.7	120	94	551
9/23/87	930	753	0.7	123	92	543
9/30/87	1000	753	0.7	122	91	537
10/6/87	1020	753	0.7	122	92	539
10/23/87	1900	753	0.7	130	97	573
11/5/87		753	0.7	127	95	559

Hot River near Mammoth, WY

DATE mo/d/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
12/3/87		753	0.7	127	95	559
1/6/88	1610	725	0.7	132	95	560
2/5/88		697	0.7	139	96	565
2/12/88		654	0.7	141	92	539
2/21/88		668	0.7	135	90	528
3/14/88		753	0.7	126	95	556
3/28/88		782	0.7	122	95	556
5/16/88		866	0.7	101	86	508
5/24/88		866	0.7	101	87	511
6/23/88	1000	866	0.7	105	90	532
9/14/88	1300	852	0.7	111	94	553
9/22/88	1000	853	0.7	108	92	538
10/5/88	1538	838	0.7	108	90	529
10/6/88	1200	852	0.7	110	93	548
10/13/88	930	852	0.7	110	93	548
10/20/88	846	852	0.7	110	93	548
10/27/88	915	852	0.7	110	93	548
11/1/88	845	824	0.7	110	90	530
11/1/88	1000	824	0.7	111	91	535
11/18/88	1100	824	0.7	120	98	578
12/5/88	1345	782	0.7	110	85	503
12/16/88	1220	796	0.7	120	95	559
1/13/89	1600	810	0.7	112	90	530
1/27/89	1715	866	0.7	111	96	562
2/14/89	925	784	0.7	120	94	550
3/6/89	1153	782	0.7	120	93	549
3/13/89	1530	739	0.7	120	88	519
3/13/89	1630	753	0.7	134	100	590
3/30/89	1120	768	0.7	120	92	539
4/11/89	1245	768	0.7	122	93	548
4/27/89	1345	697	0.7	122	85	497
5/5/89	1620	697	0.7	125	87	510
5/9/89	1030	796	0.7	103	81	479
5/9/89	1030	838	0.7	109	91	534
5/12/89	1100	866	0.7	106	91	536
5/22/89	905	796	0.7	116	92	540
5/24/89	1420	838	0.7	109	91	534
6/5/89	1600	753	0.7	107	80	471
6/6/89	1415	810	0.7	105	84	497
6/15/89	1327	796	0.7	105	83	488
6/22/89	1550	796	0.7	107	85	498
6/26/89	1420	763	0.7	107	81	477
6/30/89	1605	767	0.7	109	83	489
7/5/89	1430	739	0.7	109	80	471
7/5/89	1515	739	0.7	110	81	475
7/14/89	825	753	0.7	114	85	502

Hot River near Mammoth, WY

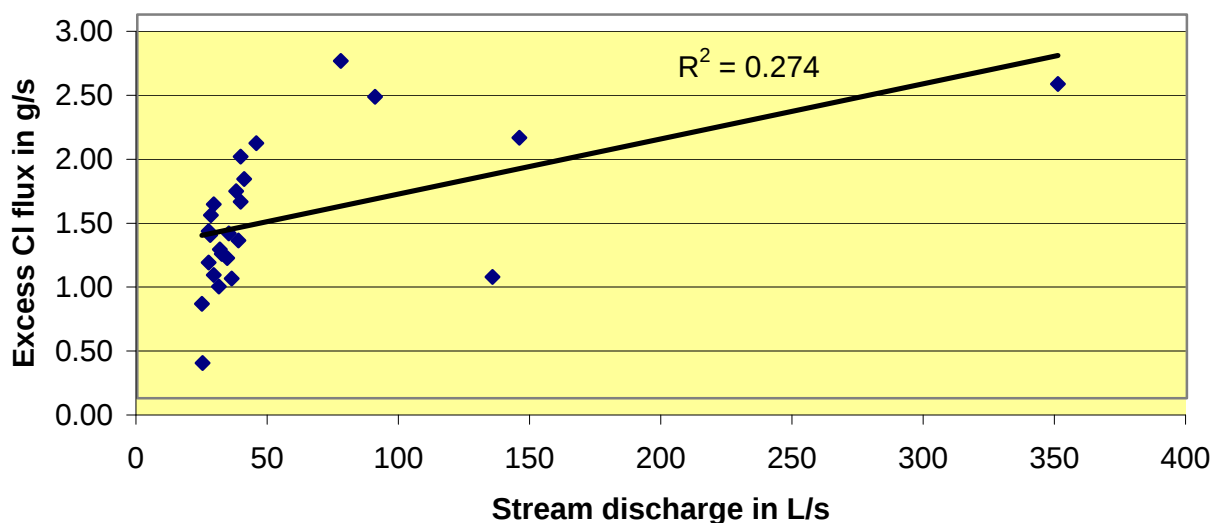
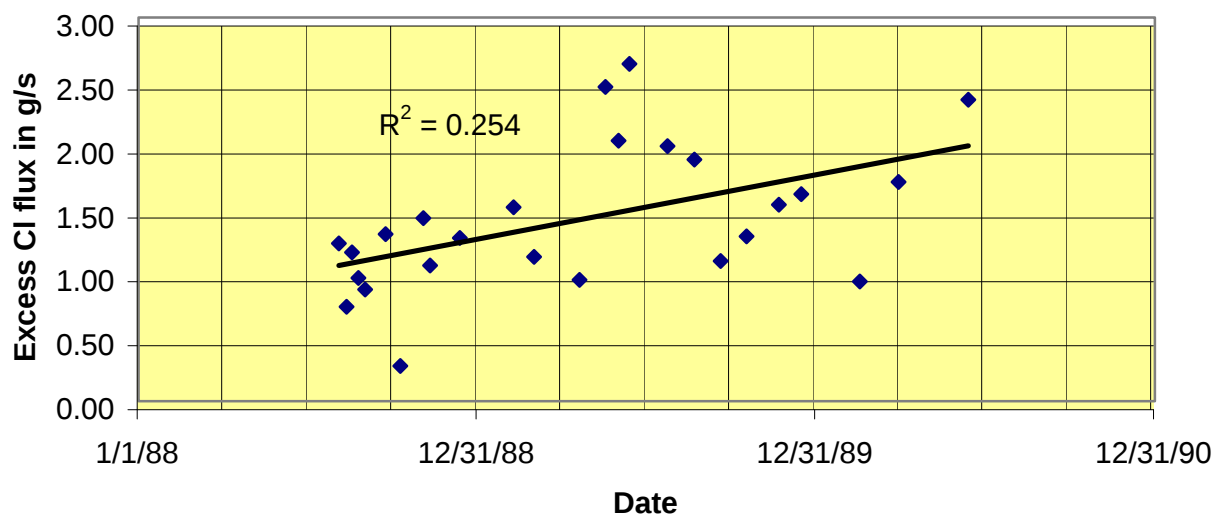
DATE mo/d/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/20/89	827	739	0.7	115	84	497
7/20/89	840	753	0.7	105	79	462
7/28/89	1315	739	0.7	109	80	471
8/3/89	1053	739	0.7	109	80	471
8/8/89	1500	753	0.7	116	87	511
8/17/89	1210	753	0.7	110	82	484
8/23/89	1000	697	0.7	113	78	460
8/31/89	1400	697	0.7	117	81	477
9/8/89	1050	682	0.7	120	81	479
9/11/89	1500	682	0.7	124	84	495
9/11/89	1515	668	0.7	120	80	469
9/15/89	1410	697	0.7	119	82	485
9/22/89	1410	697	0.7	118	82	481
9/28/89	940	669	0.7	118	78	462
10/3/89	1400	682	0.7	120	81	479
10/12/89	1340	654	0.7	121	79	463
10/18/89	1355	654	0.7	128	83	490
11/3/89	1530	654	0.7	123	80	470
11/15/89	1239	640	0.7	132	84	494
11/15/89	1300	634	0.7	126	79	467
12/13/89	1500	711	0.7	120	85	499
1/3/90	1400	711	0.7	115	81	478
1/30/90	1150	682	0.7	122	83	487
2/16/90	1030	711	0.7	115	81	478
3/7/90	1309	711	0.7	126	89	524
4/4/90	1445	640	0.7	134	85	502
5/9/90	1730	767	0.7	106	81	475
6/13/90	1400	767	0.7	106	81	475
7/25/90	1200	753	0.7	107	80	471
9/6/90	1240	796	0.7	106	84	493
10/4/90	1030	753	0.7	115	86	506
11/15/90	1150	725	0.7	120	86	509
1/4/91	1200	697	0.7	104	72	424
2/11/91	1430	682	0.7	119	81	475
3/27/91	1300	711	0.7	123	87	512
5/8/91	1215	739	0.7	100	73	432
6/26/91	1445	767	0.7	100	76	448
8/15/91	1120	711	0.7	114	81	474
9/30/91	1630	697	0.7	110	76	448
12/16/91	1555	682	0.7	130	88	519
2/5/92	1415	711	0.7	113	80	470
3/24/92	1315	725	0.7	114	82	483
5/5/92	1345	782	0.7	108	84	494
6/16/92	1430	782	0.7	97	75	443
7/29/92	1315	810	0.7	106	85	502
9/9/92	1035	782	0.7	104	81	475

Hot River near Mammoth, WY

DATE mo/d/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/20/92	1450	782	0.7	102	79	466
12/2/92	1335	711	0.7	113	80	470
1/12/93	1515	725	0.7	108	78	458
2/23/93	1225	711	0.7	117	83	486
4/8/93	1700	711	0.7	113	80	470
5/19/93	1350	960	0.7	89	85	499
6/28/93	1405	810	0.7	94	76	445
8/19/93	1130	711	0.7	99	70	411
9/22/93	1500	654	0.7	104	68	397
11/4/93	1350	654	0.7	104	68	397
12/16/93	905	558	0.7	114	63	372
2/2/94	1020	518	0.7	116	60	351
3/9/94	1240	583	0.7	110	64	375
4/27/94	1215	739	0.7	101	74	436
6/2/94	1015	725	0.7	96	69	406
7/14/94	1305	682	0.7	99	67	394
8/24/94	1245	711	0.7	103	73	428
		729.9 73.7		117	84.4 8.0 154	Mean Std. Deviation No. Samples

Obsidian Creek near Clearwater Springs, Yellowstone Natl. Park, WY

Obsidian Creek near Clearwater Springs, Yellowstone National Park, WY; captures the thermal discharge from Clearwater Springs. Upstream site gaged and sampled at lat. 44 deg. 47 min. 11 sec. E, long. 110 deg. 44 min. 20 sec. W prior to 9/25/88; at lat. 44 deg. 47 min. 8 sec. N, long. 110 deg. 44 min., 21 sec. W from 9/25/88 on. Downstream site gaged and sampled at lat. 44 deg. 47 min. 30 sec. N, long. 110 deg. 44 min. 16 sec. W. Water samples were "integrated" samples collected across the width of the stream. Chloride (Cl) determinations were made at the University of Utah Research Institute labs by colorimetric titration. The chloride flux is converted to a hot-spring discharge by assuming a Cl value of 470 mg/L -- the approximate value at Clearwater Springs -- for the thermal water. The data compiled here are from Sorey and others (1991) and the USGS archives in Menlo Park, California.

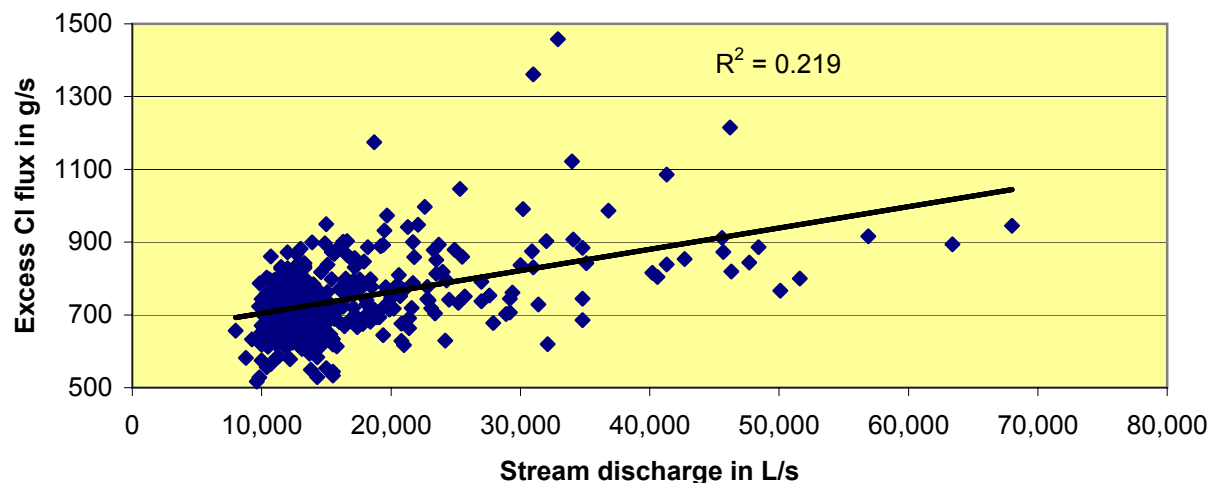
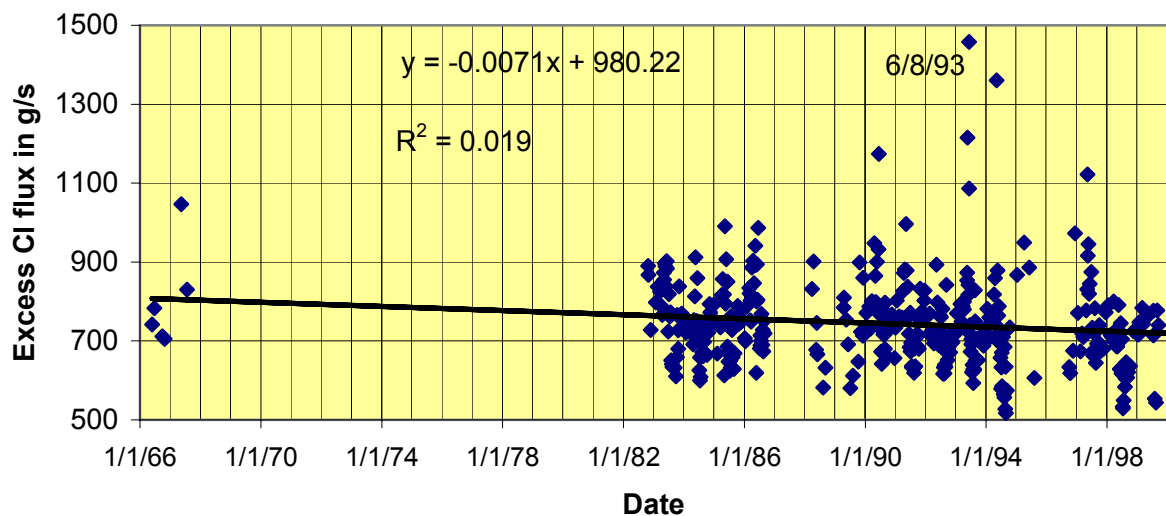


Obsidian Creek near Clearwater Springs, Yellowstone Natl. Park, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/4/88	1100	38.52	236	268	1.23	2.62
8/12/88	1340	24.64	243	273	0.74	1.57
8/18/88	1515	31.44	245	282	1.16	2.48
8/25/88	1020	29.17	252	285	0.96	2.05
9/1/88	1323	31.15	259	287	0.87	1.86
9/23/88	1230	27.19	246	294	1.31	2.78
10/9/88	1410	24.92	259	270	0.27	0.58
11/3/88	1027	28.04	263	314	1.43	3.04
11/10/88	910	27.19	275	314	1.06	2.26
12/12/88	1230	27.75	270	316	1.28	2.72
2/8/89	1350	29.17	230	282	1.52	3.23
3/2/89	1310	32.23	230	265	1.13	2.40
4/20/89	1135	135.4	71	78	0.95	2.02
5/18/89	1145	350.9	28	35	2.46	5.23
6/1/89	1045	145.6	54	68	2.04	4.34
6/13/89	1300	77.60	83	117	2.64	5.61
7/24/89	1550	45.31	153	197	1.99	0.83
8/22/89	1545	39.36	174	222	1.89	0.79
9/19/89	1430	34.27	204	236	1.10	0.46
10/17/89	1410	34.83	202	239	1.29	0.54
11/21/89	1300	39.36	197	236	1.54	0.64
12/15/89	1115	37.67	200	243	1.62	0.67
2/16/90	1310	35.96	218	244	0.93	0.39
3/30/90	1235	40.78	190	232	1.71	0.71
6/13/90	1420	90.61	67	93	2.36	0.98
		58.4 68.9		228	1.42 0.57 25	Mean Std. Deviation No. Samples

Madison River near West Yellowstone, MT

Madison River near West Yellowstone, MT; captures thermal discharge from Upper and Lower Geyser Basins via the Firehole River and the Norris and Gibbon Basins via the Gibbon River. Sampled and gaged at lat. 44 deg. 39 min. 25 sec. N, long. 111 deg. 04 min. 03 sec. W, USGS streamgaging station 06037500. Most water samples were "grab" samples collected at a single point near the stream bank. Most chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979), through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. The earliest determinations (through 1967) were by titration with a silver-nitrate solution. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. Firehole River (Upper and Lower Geyser Basin) and Gibbon River (Norris and Gibbon Basins) contributions can be distinguished -- for many dates -- by using the data displayed on the next two sheets of this spreadsheet. The data compiled here are from Fournier and others (1975), Norton and Friedman (1991), Friedman and Norton (2000), and the USGS archives <<http://water.usgs.gov/nwis>>.



Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/27/66		24,490	0.7	31	742	1855
6/24/66		17,670	0.7	45	783	1957
9/28/66		11,610	0.7	62	712	1779
10/26/66		11,500	0.7	62	705	1762
5/14/67		25,340	0.7	42	1047	2616
7/23/67		17,190	0.7	49	830	2076
10/27/82	1035	16,100	0.7	56.0	890	2226
10/31/82	1330	15,600	0.7	56.3	867	2168
11/26/82	1035	12,600	0.7	58.5	728	1821
1/26/83	1000	12,600	0.7	64.0	798	1994
2/19/83	1230	13,100	0.7	64.6	837	2093
3/17/83	945	13,100	0.7	63.7	825	2063
3/31/83	1000	12,600	0.7	63.3	789	1972
4/13/83	730	11,700	0.7	66.2	766	1916
5/1/83	930	15,400	0.7	57.4	873	2183
5/8/83	1000	16,900	0.7	51.3	855	2138
5/15/83	1000	14,900	0.7	60.9	897	2242
5/22/83	1000	19,200	0.7	47.0	889	2222
5/29/83	1000	41,300	0.7	21.0	838	2096
6/5/83	1000	32,000	0.7	28.9	902	2256
6/12/83	1000	34,800	0.7	26.1	884	2210
6/26/83	1000	19,500	0.7	37.8	723	1809
7/3/83	1000	24,000	0.7	34.8	818	2046
7/17/83	1000	16,900	0.7	45.8	762	1905
7/24/83	1000	16,400	0.7	47.8	772	1931
7/31/83	1000	13,100	0.7	50.4	651	1628
8/7/83	1000	12,800	0.7	50.8	641	1603
8/14/83	1000	12,300	0.7	52.2	633	1584
9/11/83	1000	11,900	0.7	53.8	632	1580
9/25/83	1000	11,900	0.7	52.0	610	1526
10/9/83	1000	13,100	0.7	51.0	659	1647
10/12/83	1015	14,400	0.7	53.9	766	1915
10/23/83	1000	13,100	0.7	56.2	727	1818
10/25/83	1450	13,100	0.7	52.6	680	1700
11/6/83	1000	15,100	0.7	56.2	838	2095
12/4/83	1000	13,500	0.7	57.7	770	1924
12/14/83	1000	12,800	0.7	59.5	753	1882
12/31/83	1000	12,800	0.7	58.5	740	1850
1/25/84	1000	12,100	0.7	60.3	721	1803
1/29/84	1000	12,100	0.7	61.5	736	1839
3/6/84	1410	11,500	0.7	63.7	725	1811
3/11/86	1500	11,700	0.7	65.0	752	1881
3/25/86	1000	11,700	0.7	64.7	749	1872
4/8/84	1000	11,700	0.7	64.3	744	1860
4/17/84	1120	13,600	0.7	53.2	714	1785
4/22/84	1900	13,300	0.7	52.7	692	1729
4/30/84	1000	12,400	0.7	61.4	753	1882

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/7/84	1000	12,400	0.7	61.1	749	1872
5/13/84	1000	23,500	0.7	35.3	813	2033
5/21/84	1000	45,600	0.7	20.7	912	2280
5/30/84	1615	34,800	0.7	22.1	745	1862
6/6/84	820	25,700	0.7	29.9	750	1876
6/10/84	630	25,500	0.7	34.4	859	2148
6/22/84	1000	22,800	0.7	33.3	743	1858
7/6/84	1000	14,900	0.7	42.7	626	1565
7/11/84	1215	14,500	0.7	46.1	658	1646
7/14/84	1000	13,700	0.7	44.5	600	1500
7/20/84	1000	13,700	0.7	45.1	608	1521
7/27/84	1500	14,900	0.7	47.5	697	1743
8/10/84	1000	13,700	0.7	49.7	671	1678
8/17/84	1000	15,100	0.7	49.2	732	1831
8/21/84	1410	13,800	0.7	48.6	661	1653
8/24/84	1000	14,400	0.7	52.3	743	1858
8/31/84	1000	13,500	0.7	52.4	698	1745
9/6/84	1000	13,700	0.7	53.1	718	1795
9/14/84	1000	12,800	0.7	52.9	668	1670
10/3/84	1200	13,300	0.7	55.9	734	1835
10/7/84	1600	12,800	0.7	52.6	664	1661
10/21/84	1000	13,000	0.7	56.2	722	1804
11/4/84	1000	13,500	0.7	59.5	794	1985
11/14/84	1330	13,600	0.7	57.5	772	1931
12/2/84	1200	12,800	0.7	60.1	760	1901
12/18/84	915	12,600	0.7	59.8	745	1862
12/30/84	1500	13,500	0.7	59.4	792	1981
1/22/84	1200	12,100	0.7	63.2	756	1891
2/6/85	1200	10,700	0.7	63.1	668	1669
3/13/85	1000	12,100	0.7	61.7	738	1845
3/17/85	1000	12,100	0.7	61.8	739	1848
3/19/85	1540	11,700	0.7	63.5	735	1837
3/31/85	1000	12,400	0.7	66.5	816	2040
4/14/85	1000	17,200	0.7	50.5	857	2141
4/28/85	1100	14,600	0.7	56.7	818	2044
5/1/85	1645	15,800	0.7	39.5	613	1533
5/12/85	1000	30,200	0.7	33.5	991	2476
5/18/85	2000	24,300	0.7	33.4	795	1987
5/26/85	1000	34,100	0.7	27.3	907	2268
6/3/85	1000	20,700	0.7	37.0	751	1879
6/9/85	1000	23,500	0.7	36.9	851	2127
6/12/85	1000	17,900	0.7	39.0	686	1714
6/16/85	1000	16,400	0.7	41.5	669	1673
6/23/85	1000	13,900	0.7	47.3	648	1619
7/7/85	1000	12,400	0.7	51.0	624	1559
7/14/85	1000	12,800	0.7	51.5	650	1626
7/21/85	1000	11,900	0.7	53.8	632	1580

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/24/85	830	15,100	0.7	51.2	763	1906
7/28/85	1000	11,700	0.7	57.6	666	1664
8/4/85	1000	13,500	0.7	54.6	728	1819
8/11/85	1000	11,900	0.7	56.1	659	1648
8/25/85	1430	11,500	0.7	55.4	629	1573
9/5/85	850	11,900	0.7	56.9	669	1672
10/13/85	1000	13,300	0.7	60.0	789	1972
10/16/85	1735	13,000	0.7	59.0	758	1895
10/20/85	1100	13,000	0.7	57.8	742	1856
11/21/85	900	12,400	0.7	61.0	748	1869
12/1/85	1330	12,800	0.7	61.3	776	1939
1/7/86	1000	11,900	0.7	60.1	707	1767
1/12/86	1000	11,700	0.7	60.5	700	1749
2/3/86	1000	12,400	0.7	64.3	789	1972
3/2/86	1000	13,300	0.7	63.4	834	2085
3/5/86	900	12,800	0.7	64.8	820	2051
3/16/86	1000	12,600	0.7	64.4	803	2007
3/30/86	900	18,200	0.7	49.4	886	2216
4/17/86	815	16,600	0.7	55.1	903	2258
4/27/86	1000	17,900	0.7	48.0	847	2117
5/11/86	1000	21,300	0.7	44.9	941	2354
5/18/86	1000	19,400	0.7	46.7	892	2231
5/25/86	1130	32,100	0.7	20.0	620	1549
5/28/86	1425	51,600	0.7	16.2	800	2000
6/1/86	1000	63,400	0.7	14.8	894	2235
6/8/86	1000	40,600	0.7	20.5	804	2010
6/15/86	1000	36,800	0.7	27.5	986	2466
7/6/86	1300	18,400	0.7	37.7	681	1702
7/13/86	1345	18,700	0.7	38.9	714	1786
7/15/86	1530	17,400	0.7	40.3	689	1723
7/20/86	1300	17,200	0.7	41.4	700	1750
7/27/86	1100	21,000	0.7	37.3	769	1922
8/5/86	1400	15,600	0.7	44.9	690	1724
8/10/86	1330	16,100	0.7	45.9	728	1819
8/17/86	1200	14,900	0.7	45.9	673	1684
8/24/86	1000	16,600	0.7	45.9	750	1876
9/3/86	1125	15,900	0.7	45.9	719	1797
3/29/88	1430	11,500	0.7	73	831	2079
4/14/88	1030	16,300	0.7	56	901	2253
5/17/88	1300	27,900	0.7	25	678	1695
5/24/88	915	20,000	0.7	38	746	1865
6/1/88	915	17,400	0.7	39	666	1666
8/9/88	1400	8,780	0.7	67	582	1455
9/7/88	2000	9,260	0.7	69	632	1581
4/14/89	1500	12,400	0.7	64	785	1962
4/20/89	1930	20,600	0.7	40	810	2024
5/17/89	1645	27,600	0.7	28	753	1884

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/8/89	930	21,400	0.7	33	691	1728
7/6/89	945	11,100	0.7	53	581	1451
8/4/89	915	10,500	0.7	59	612	1530
10/10/89	1627	10,900	0.7	60.1	647	1619
10/26/89	1128	13,900	0.7	65.4	899	2248
11/9/89	1028	11,000	0.7	66.4	723	1807
12/3/89	1600	10,500	0.7	68.6	713	1782
12/8/89	900	10,700	0.7	81.1	860	2151
1/3/90	1630	9,800	0.7	74.5	723	1808
1/15/90	1422	10,900	0.7	71.4	771	1927
1/24/90	1330	10,300	0.7	71.1	725	1813
2/19/90	1356	9,850	0.7	80.6	787	1968
3/6/90	1715	10,200	0.7	72.4	731	1828
3/21/90	1144	11,300	0.7	71.6	801	2003
4/13/90	1430	15,400	0.7	52.5	798	1994
4/20/90	955	22,100	0.7	43.6	948	2370
5/2/90	945	16,600	0.7	52.8	865	2162
5/9/90	1228	18,400	0.7	44.1	799	1996
5/16/90	1341	17,100	0.7	47.1	793	1984
5/23/90	1117	21,700	0.7	42.2	901	2251
6/6/90	1445	17,600	0.7	44.5	771	1927
6/11/90	954	19,500	0.7	48.5	932	2330
6/14/90	1802	18,700	0.7	63.5	1174	2936
6/20/90	849	15,200	0.7	49.0	734	1835
6/27/00	757	13,100	0.7	60.7	786	1965
7/4/90	847	11,900	0.7	62.8	739	1847
7/11/90	2015	11,500	0.7	59.2	673	1682
7/18/90	720	10,900	0.7	59.6	642	1605
7/25/90	724	12,400	0.7	63.6	780	1950
8/1/90	1635	11,300	0.7	69.3	775	1938
8/8/90	735	10,700	0.7	67.7	717	1792
8/15/90	719	10,800	0.7	70.0	748	1871
8/22/90	716	11,000	0.7	73.1	796	1991
8/24/90	1710	11,500	0.7	63	716	1791
8/25/90	810	11,100	0.7	62	680	1701
8/29/90	1644	10,600	0.7	75.9	797	1993
9/12/90	743	10,000	0.7	75.1	744	1860
9/26/90	1035	10,200	0.7	65.3	659	1647
10/8/91	1615	11,300	0.7	64	715	1788
10/11/91	1250	11,400	0.7	67.0	756	1890
10/23/90	1600	11,600	0.7	66.6	764	1911
10/24/90	1630	11,100	0.7	66.6	731	1829
11/21/90	831	11,100	0.7	69.8	767	1918
12/20/90	1426	7,990	0.7	82.9	657	1642
1/2/91	1200	10,800	0.7	68.6	733	1833
1/18/91	1550	10,400	0.7	77.9	803	2007
2/13/91	1545	10,700	0.7	71.9	762	1905

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
2/15/91	1445	10,600	0.7	71.4	749	1874
3/19/91	1509	10,400	0.7	73.7	759	1898
4/4/91	1621	11,500	0.7	72.6	827	2067
4/11/91	900	12,000	0.7	73.4	872	2181
4/22/91	1801	13,000	0.7	68.5	881	2204
5/9/91	1555	22,600	0.7	44.8	997	2492
5/16/91	1855	24,900	0.7	36.0	879	2197
5/29/91	1815	30,000	0.7	28.6	837	2093
6/6/91	1730	29,400	0.7	26.6	761	1904
6/13/91	722	23,100	0.7	31.8	718	1796
6/20/91	1143	16,800	0.7	41.4	684	1709
6/28/91	1635	16,600	0.7	47.2	772	1930
7/3/91	1627	14,400	0.7	47.5	674	1685
7/11/91	1745	14,000	0.7	50.4	696	1740
7/16/91	1330	12,400	0.7	52.0	636	1590
7/18/91	1833	12,200	0.7	52.6	633	1583
7/25/91	1739	12,700	0.7	54.1	678	1695
8/8/91	846	11,500	0.7	55.6	631	1578
8/15/91	1952	11,100	0.7	56.5	619	1548
8/21/91	815	11,100	0.7	63.0	692	1729
8/22/91	1719	11,000	0.7	62.6	681	1702
8/30/91	1927	10,800	0.7	59.5	635	1588
9/12/91	1540	12,000	0.7	60.4	716	1791
9/26/91	1730	11,100	0.7	62.5	686	1715
10/9/91	1805	11,100	0.7	62.0	680	1701
10/25/91	1554	12,600	0.7	66.8	833	2082
11/16/91	1415	11,800	0.7	66.4	775	1938
11/19/91	1545	11,900	0.7	64	753	1883
12/13/91	1305	12,200	0.7	66.5	803	2007
12/19/91	1445	12,000	0.7	69.7	828	2070
1/17/92	1415	11,100	0.7	69.4	763	1906
2/11/92	1500	10,900	0.7	66.6	718	1796
2/19/92	1430	11,100	0.7	70	769	1923
3/29/92	1555	10,900	0.7	67.2	725	1812
4/7/92	1430	11,500	0.7	61	693	1734
5/9/92	1740	23,700	0.7	38.4	893	2234
5/13/92	1805	17,100	0.7	42.8	720	1800
5/20/92	1430	17,600	0.7	46	797	1993
5/22/92	1255	15,900	0.7	45.6	714	1785
5/28/92	1656	15,600	0.7	46.7	718	1794
6/11/92	942	12,200	0.7	57.2	689	1723
6/20/92	1006	14,200	0.7	51.8	726	1814
6/25/92	1400	14,200	0.7	54.5	764	1910
7/1/92	1332	12,800	0.7	54.5	689	1722
7/1/92	1530	14,000	0.7	55	760	1901
7/9/92	2124	11,700	0.7	59.3	686	1714
7/13/92	1322	12,800	0.7	55.8	705	1763

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/21/92	830	13,200	0.7	59.9	781	1954
7/30/92	1200	10,400	0.7	60.0	617	1542
8/6/92	831	10,000	0.7	64.0	633	1583
8/13/92	1000	10,000	0.7	62.5	618	1545
8/19/92	1410	10,100	0.7	64	639	1598
8/26/92	915	10,000	0.7	64.1	634	1585
9/7/92	830	13,300	0.7	64.0	842	2105
9/12/92	1000	10,400	0.7	65.2	671	1677
9/23/92	1632	10,000	0.7	65.9	652	1630
10/7/92	1020	10,900	0.7	66	712	1779
10/7/92	1400	10,400	0.7	66.7	686	1716
10/24/92	1230	10,000	0.7	67.8	671	1678
11/16/92	1530	10,700	0.7	66	699	1747
11/21/92	1457	10,200	0.7	69.0	697	1742
12/19/92	1445	10,400	0.7	69.7	718	1794
1/5/93	1545	10,500	0.7	70	728	1819
1/13/93	1500	10,700	0.7	72.7	770	1926
2/11/93	1300	10,400	0.7	70.9	730	1825
2/24/93	1430	10,900	0.7	73.5	794	1984
3/7/93	1410	10,400	0.7	72.7	749	1872
3/24/93	1500	11,500	0.7	69.2	788	1969
4/7/93	1445	11,700	0.7	69	799	1998
4/8/93	945	12,200	0.7	64.6	780	1949
5/15/93	1740	42,700	0.7	20.7	854	2135
5/17/93	1530	45,700	0.7	19.8	873	2182
5/18/93	1440	46,200	0.7	27	1215	3038
5/26/93	1100	40,200	0.7	21	816	2040
5/30/93	1015	35,100	0.7	24.7	842	2106
6/7/93	910	41,300	0.7	27.0	1086	2715
6/8/93	1700	32,900	0.7	45	1457	3644
6/17/93	815	22,900	0.7	33.0	740	1849
6/22/93	850	20,200	0.7	36.2	717	1793
6/28/93	850	16,400	0.7	41.7	672	1681
7/4/93	1646	18,200	0.7	39.4	704	1761
7/7/93	1145	18,200	0.7	38.7	692	1729
7/14/93	1540	13,700	0.7	46.0	621	1552
7/22/93	1712	13,700	0.7	47.4	640	1599
7/28/93	1020	13,700	0.7	44	593	1483
7/28/93	1530	13,500	0.7	47.2	628	1569
8/4/93	845	12,400	0.7	51.1	625	1562
8/11/93	1200	12,800	0.7	49.8	628	1571
8/17/93	945	13,300	0.7	63	829	2071
8/21/93	1500	14,700	0.7	51.7	750	1874
8/24/93	830	12,800	0.7	51.5	650	1626
9/5/93	1350	13,000	0.7	55.0	706	1765
9/25/93	1700	12,200	0.7	54.1	651	1629
10/17/93	1350	13,100	0.7	54.9	710	1775

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
11/30/93	1300	11,800	0.7	59	688	1720
12/18/93	1145	11,800	0.7	62.7	732	1829
1/13/94	1400	12,000	0.7	65.8	781	1953
2/8/94	1410	12,000	0.7	64.0	760	1899
2/15/94	1045	11,200	0.7	64	709	1772
3/7/94	1330	11,600	0.7	65.6	753	1882
3/20/94	1510	11,500	0.7	65.6	746	1866
4/5/94	830	12,400	0.7	63	773	1931
4/6/94	1440	12,300	0.7	67.2	818	2045
4/19/94	1025	21,800	0.7	40.1	859	2147
5/8/94	1230	31,000	0.7	44.6	1361	3402
5/9/94	1330	28,900	0.7	25	702	1756
5/16/94	1330	27,000	0.7	28	737	1843
5/20/94	950	23,300	0.7	38.4	878	2196
5/26/94	802	19,700	0.7	39.5	764	1911
6/2/94	1030	21,700	0.7	37	788	1969
6/9/94	2011	16,300	0.7	45.0	722	1805
6/17/94	737	15,300	0.7	46.1	695	1737
6/24/94	550	14,100	0.7	47.3	657	1643
6/30/94	1100	12,200	0.7	48.1	578	1446
7/5/94	1930	12,100	0.7	53	633	1582
7/9/94	1045	11,800	0.7	57.5	670	1676
7/13/94	2130	11,300	0.7	52.5	585	1463
7/23/94	1735	11,200	0.7	64.1	710	1775
7/30/94	1415	10,700	0.7	53.5	565	1412
8/6/94	1415	10,400	0.7	54.2	556	1391
8/13/94	900	10,900	0.7	63.5	685	1711
8/20/94	1800	9,830	0.7	54.4	528	1320
8/22/94	1810	10,700	0.7	60	635	1586
8/26/94	1740	9,630	0.7	54	517	1293
9/7/94	1540	10,000	0.7	58	575	1438
10/13/94	1000	11,600	0.7	64	734	1836
1/10/95	1330	12,700	0.7	69	867	2169
4/5/95	1230	15,000	0.7	64	950	2374
6/6/95	900	48,400	0.7	19	886	2214
8/8/95	1645	13,100	0.7	47	607	1516
10/1/96	925	15,500	0.7	41.6	634	1585
10/14/96	1500	15,500	0.7	40.6	618	1546
11/18/96	1200	16,500	0.7	41.6	675	1687
12/10/96	1200	19,700	0.7	50.1	973	2433
1/14/97	1425	16,000	0.7	48.9	771	1928
2/12/97	830	13,800	0.7	49.5	673	1684
3/4/97	900	14,100	0.7	51.7	719	1798
3/18/97	1130	13,900	0.7	51.8	710	1776
4/25/97	1200	22,800	0.7	34.8	777	1944
5/7/97	922	31,000	0.7	27.5	831	2077
5/8/97	1200	34,000	0.7	33.7	1122	2805

Madison River near West Yellowstone, MT

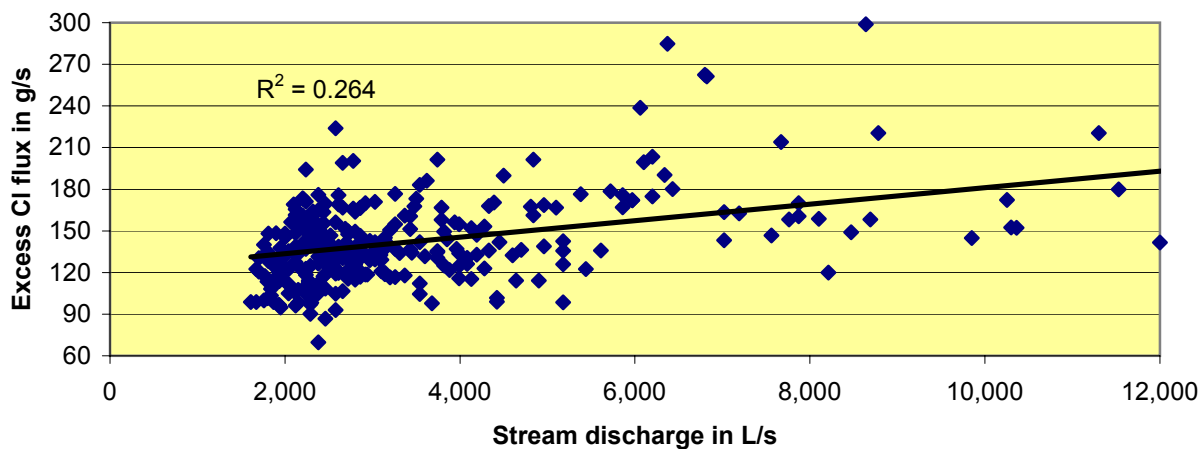
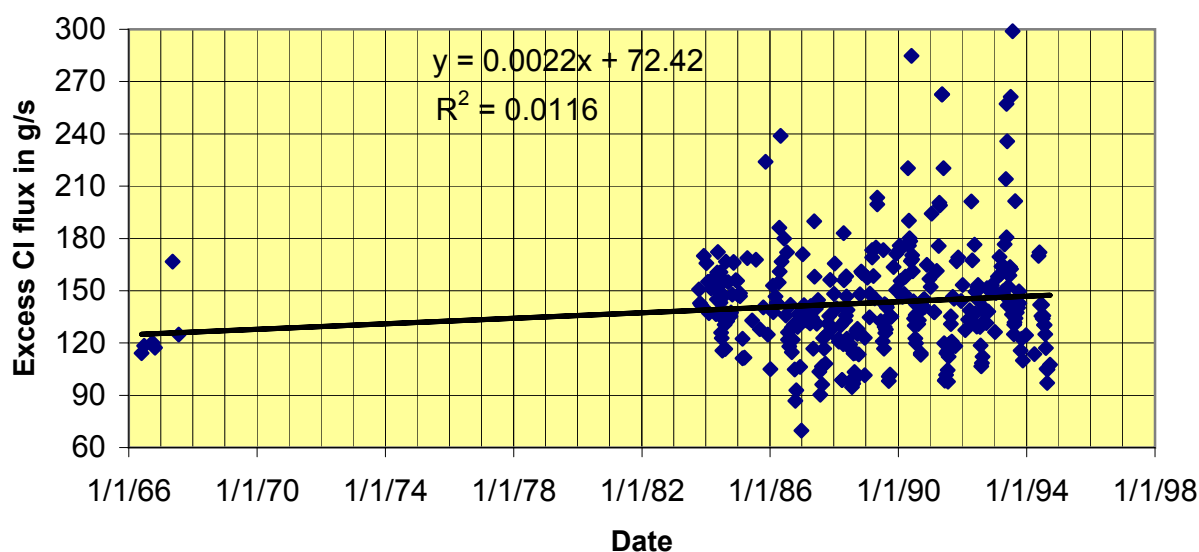
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/14/97	1538	56,900	0.7	16.8	916	2290
5/21/97	1515	68,000	0.7	14.6	945	2363
5/28/97	1650	46,300	0.7	18.4	820	2049
6/4/97	1615	47,700	0.7	18.4	844	2111
6/24/97	1200	30,900	0.7	29.0	874	2186
7/7/97	1200	25,200	0.7	29.8	733	1833
7/17/97	1200	21,400	0.7	31.7	663	1659
7/22/97	1200	20,800	0.7	33.2	676	1690
7/29/97	1200	21,600	0.7	34.0	719	1798
8/8/97	1200	20,500	0.7	38.9	783	1958
8/19/97	1200	19,400	0.7	33.9	644	1610
9/2/97	1200	19,100	0.7	37.0	693	1733
9/16/97	1200	18,900	0.7	37.4	694	1734
9/30/97	1200	18,400	0.7	38.4	694	1734
10/1/97	1200	18,100	0.7	41.6	740	1851
10/16/97	1200	17,800	0.7	38.6	675	1687
11/20/97	1420	16,000	0.7	43.2	680	1700
12/17/97	1535	16,800	0.7	46.7	773	1932
1/15/98	1405	16,500	0.7	48.6	790	1976
2/12/98	1405	14,300	0.7	50.7	715	1788
3/3/98	1311	13,800	0.7	52.1	709	1773
3/24/98	1030	16,500	0.7	49.2	800	2001
3/31/98	1600	13,800	0.7	51.3	698	1746
4/7/98	1340	14,200	0.7	50.7	710	1775
4/15/98	1153	14,600	0.7	48.5	698	1745
4/21/98	1345	13,800	0.7	50.5	687	1718
4/28/98	740	18,100	0.7	41.0	729	1824
5/5/98	1210	34,800	0.7	20.4	686	1714
5/12/98	1623	31,400	0.7	23.9	728	1821
5/19/98	1530	27,000	0.7	30.0	791	1978
5/26/98	1730	29,200	0.7	24.9	707	1767
6/2/98	1730	24,200	0.7	26.7	629	1573
6/8/98	1750	20,800	0.7	30.9	628	1570
6/16/98	1745	29,200	0.7	26.2	745	1862
6/23/98	1720	21,000	0.7	30.1	617	1544
6/30/98	1715	23,400	0.7	30.8	704	1761
7/7/98	1716	15,500	0.7	35.1	533	1333
7/14/98	1555	14,300	0.7	37.7	529	1323
7/21/98	1715	13,800	0.7	40.5	549	1373
7/28/98	1500	15,300	0.7	42.5	640	1599
8/5/98	1800	14,300	0.7	41.5	583	1459
8/12/98	1420	14,300	0.7	43.0	605	1512
8/19/98	1435	15,300	0.7	42.9	646	1614
9/1/98	1720	13,900	0.7	44.4	607	1519
9/14/98	1655	14,600	0.7	43.2	621	1551
10/7/98	1740	14,200	0.7	45.5	636	1590
11/18/98	900	14,500	0.7	50.7	725	1813

Madison River near West Yellowstone, MT

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
1/6/99	1000	13,700	0.7	53.0	717	1791
1/17/99	1300	13,700	0.7	53.0	717	1791
1/25/99	1200	14,000	0.7	54.1	748	1869
3/1/99	954	14,000	0.7	56.7	784	1960
3/3/99	830	13,700	0.7	55.3	748	1870
3/13/99	1000	13,500	0.7	55.7	743	1856
4/14/99	910	14,000	0.7	56.0	774	1936
5/26/99	1820	50,100	0.7	16.0	767	1916
7/14/99	1200	19,600	0.7	40.3	776	1940
7/15/99	1213	19,900	0.7	36.6	714	1786
8/1/99	1530	15,000	0.7	37.6	554	1384
8/15/99	1715	15,500	0.7	35.8	544	1360
8/31/99	1130	18,500	0.7	42.7	777	1943
9/15/99	1418	14,200	0.7	52.8	740	1850
		16777 8673		51.1	744 109 390	Mean Std. Deviation No. Samples

Gibbon River upstream from Madison Junction, WY

Gibbon River upstream from Madison Junction, WY; captures thermal discharge from Norris and Gibbon Basins. In the 1960s, sampled and gaged at approx. lat. 44 deg. 43 min. 10 sec. N, long. 110 deg. 43 min. 20 sec. W; in the 1980s, sampled and gaged at lat. 44 deg. 38 min. 58 sec. N, long. 111 deg. 47 min. 02 sec. W, USGS streamgaging station 06037000. Water samples were "grab" samples collected at a single point near the stream bank. Most chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. The earliest determinations (through 1967) were by titration with a silver-nitrate solution. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. For the 1966-7 dates the Norris and Gibbon contributions can be separated using the data reported by Fournier and others (1975). The data compiled here are from Fournier and others (1975), Norton and Friedman (1991), and Friedman and Norton (2000).



Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/27/66		4,900	0.7	24	114	285
6/24/66		2,940	0.7	41	118	296
9/28/66		1,930	0.7	63	120	301
10/26/66		1,770	0.7	67	117	293
5/14/67		2,860	0.7	59	167	417
7/23/67		3,990	0.7	32	125	312
10/15/83	1750	3,200	0.7	47.8	151	377
10/26/83	1045	2,970	0.7	48.8	143	357
11/9/83	1305	3,030	0.7	47.5	142	355
12/6/83	1215	2,920	0.7	58.9	170	425
1/6/84	1430	2,780	0.7	60.3	166	414
1/25/84	1715	2,440	0.7	64.3	155	388
2/2/84	1200	2,240	0.7	61.9	137	343
2/29/84	1230	2,320	0.7	65.9	151	378
3/14/84	1140	2,240	0.7	70.6	157	391
3/29/84	1315	2,320	0.7	68.2	157	392
4/10/84	1420	2,350	0.7	66.3	154	385
4/25/84	1130	3,430	0.7	40.5	137	341
5/3/84	1440	3,140	0.7	46.9	145	363
5/9/84	1100	3,430	0.7	47.5	161	401
5/17/84	1245	10,250	0.7	17.5	172	431
5/23/84	920	10,360	0.7	15.4	152	381
5/29/84	1300	8,470	0.7	18.3	149	373
6/6/84	1245	7,760	0.7	21.1	158	396
6/12/84	620	7,870	0.7	21.1	161	401
6/12/84	1740	7,020	0.7	21.1	143	358
6/20/84	1235	5,180	0.7	25.0	126	315
6/28/84	1940	4,280	0.7	29.4	123	307
7/5/84	1100	3,990	0.7	29.7	116	289
7/11/84	1030	4,330	0.7	32.1	136	340
7/19/84	1600	3,990	0.7	34.2	134	334
7/25/84	1300	4,190	0.7	35.8	147	368
8/1/84	1230	4,080	0.7	32.7	131	326
8/9/84	900	3,200	0.7	37.1	116	291
8/16/84	1500	3,790	0.7	44.7	167	417
8/22/84	1345	3,260	0.7	42.7	137	342
8/30/84	1450	3,090	0.7	43.6	133	331
9/11/84	1545	3,260	0.7	48.2	155	387
10/3/84	840	2,800	0.7	49.0	135	338
10/12/84	1220	2,660	0.7	52.4	138	344
10/26/84	1410	2,720	0.7	55.0	148	369
11/9/84	1100	2,780	0.7	60.4	166	415
11/9/84	1330	2,860	0.7	58.9	166	416
12/7/84	1550	2,580	0.7	61.2	156	390
12/20/84	1130	2,440	0.7	64.5	156	389
1/2/85	1315	2,440	0.7	61.2	148	369
1/23/85	1505	2,320	0.7	64.0	147	367

Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
1/23/85	1520	2,320	0.7	64.7	148	371
2/21/85	815	2,040	0.7	60.7	122	306
2/21/85	1850	2,040	0.7	55.2	111	278
3/14/85	800	2,040	0.7	55.4	112	279
4/17/85	1200	4,960	0.7	34.7	169	422
6/11/85	1915	4,190	0.7	32.4	133	332
7/23/85	1840	3,480	0.7	48.9	168	419
9/4/85	900	2,440	0.7	53.1	128	320
10/16/85	1300	2,520	0.7	56.4	140	351
11/8/85	900	2,580	0.7	87.5	224	560
12/5/85	1600	2,290	0.7	55.2	125	312
1/3/86	1420	2,040	0.7	52.2	105	263
2/3/86	1420	2,240	0.7	69.0	153	382
2/5/86	1000	2,210	0.7	63.0	138	344
3/2/86	935	2,520	0.7	58.9	147	367
3/16/86	1448	2,240	0.7	64.5	143	357
3/18/86	1800	2,240	0.7	64.5	143	357
4/8/86	933	3,990	0.7	39.5	155	387
4/17/86	1345	3,620	0.7	52.1	186	465
4/18/86	1655	3,370	0.7	48.5	161	403
5/1/86	1637	6,060	0.7	40.1	239	597
5/11/86	730	5,100	0.7	33.4	167	417
6/8/86	710	11,530	0.7	16.3	180	450
6/26/86	1615	5,610	0.7	24.9	136	339
7/10/86	825	5,970	0.7	29.5	172	430
7/23/86	730	3,880	0.7	32.1	122	305
7/24/86	1717	4,080	0.7	31.6	126	315
8/6/86	820	3,370	0.7	35.7	118	295
8/20/86	805	3,140	0.7	45.9	142	355
9/3/86	1239	2,970	0.7	44.1	129	322
9/4/86	710	2,800	0.7	41.7	115	287
9/17/86	845	2,720	0.7	45.5	122	305
10/1/86	743	2,800	0.7	47.4	131	327
10/8/86	900	2,580	0.7	41.3	105	262
10/15/86	1153	2,460	0.7	36.0	87	217
10/25/86	1729	2,580	0.7	36.7	93	232
11/9/86	1442	2,720	0.7	48.2	129	323
11/18/86	900	2,720	0.7	50.9	137	341
11/27/86	1125	2,660	0.7	50.5	132	331
12/10/86	1215	2,320	0.7	46.5	106	266
12/24/86	1133	2,380	0.7	30.0	70	174
1/7/87	1345	3,030	0.7	57.1	171	427
1/21/87	1215	2,320	0.7	61.8	142	354
2/4/87	1527	2,240	0.7	62.6	139	347
2/18/87	900	2,120	0.7	63.4	133	332
2/18/87	915	2,120	0.7	63.6	133	333
3/25/87	1615	1,950	0.7	68.4	132	330

Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
4/2/87	1545	1,950	0.7	68.0	131	328
4/8/87	1325	2,460	0.7	58.1	141	353
4/23/87	1650	3,740	0.7	36.7	135	337
5/6/87	840	3,260	0.7	36.5	117	292
5/19/87	800	4,500	0.7	42.9	190	475
5/20/87	907	3,790	0.7	42.4	158	395
6/4/87	1515	3,140	0.7	45.2	140	349
6/17/87	1727	2,610	0.7	50.9	131	328
7/1/87	1715	2,440	0.7	60.0	145	362
7/15/87	1521	2,320	0.7	45.3	103	259
7/26/87	1530	2,290	0.7	40.1	90	226
8/12/87	1700	2,100	0.7	51.4	106	266
8/18/87	900	2,120	0.7	46.1	96	241
8/26/87	1708	2,240	0.7	55.5	123	307
9/9/87	1450	1,950	0.7	60.6	117	292
9/23/87	1655	1,840	0.7	59.5	108	270
10/7/87	1711	2,070	0.7	61.0	125	312
10/21/87	1600	1,980	0.7	66.9	131	328
11/4/87	1010	2,040	0.7	67.1	135	339
11/17/87	845	2,070	0.7	76.2	156	391
12/1/87	850	1,810	0.7	71.5	128	320
12/30/87	1510	1,810	0.7	82.5	148	370
1/5/88	1025	2,120	0.7	78.8	166	414
1/28/88	1237	1,760	0.7	80.2	140	350
2/17/88	1100	1,670	0.7	74.0	122	306
2/24/88	1303	1,700	0.7	71.7	121	302
3/16/88	836	1,700	0.7	77.3	130	326
3/29/88	910	1,670	0.7	59.8	99	247
3/31/88	1130	1,610	0.7	62.0	99	247
4/13/88	1658	2,780	0.7	43.6	119	298
4/17/88	1645	3,540	0.7	52.4	183	458
4/21/88	1716	3,940	0.7	40.3	156	390
5/4/88	1645	2,920	0.7	46.2	133	332
5/12/88	1614	5,180	0.7	26.9	136	339
5/17/88	815	8,690	0.7	18.9	158	395
5/18/88	1648	7,560	0.7	20.1	147	367
5/25/88	1650	5,440	0.7	23.2	122	306
6/1/88	1600	4,960	0.7	28.7	139	347
6/8/88	1827	3,140	0.7	38.5	119	297
6/15/88	1654	2,800	0.7	42.8	118	295
6/22/88	845	2,580	0.7	46.9	119	298
6/29/88	656	2,460	0.7	49.1	119	298
7/6/88	17	2,150	0.7	46.4	98	246
7/20/88	725	1,950	0.7	49.3	95	237
7/27/88	723	1,930	0.7	50.7	97	241
8/3/88	707	1,930	0.7	50.8	97	242
8/9/88	911	1,870	0.7	53.5	99	247

Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/9/88	1743	1,930	0.7	59.8	114	285
8/17/88	941	1,840	0.7	56.9	103	259
8/24/88	934	1,760	0.7	57.5	100	250
8/31/88	1643	1,870	0.7	61.9	114	286
9/7/88	1810	1,870	0.7	68.5	127	317
9/20/88	915	1,870	0.7	67.6	125	313
9/21/88	1654	1,930	0.7	67.1	128	320
10/6/88	930	1,800	0.7	63.7	113	284
10/19/88	1738	2,000	0.7	74.7	148	370
11/3/88	850	2,200	0.7	73.9	161	403
11/16/88	835	2,200	0.7	73.5	160	400
12/13/88	945	2,000	0.7	62.2	123	308
12/15/88	1448	1,800	0.7	57.1	102	254
1/10/89	1200	2,200	0.7	72.3	158	394
2/7/89	1530	1,800	0.7	75.6	135	337
2/9/89	1100	1,900	0.7	78.8	148	371
3/7/89	1330	2,200	0.7	79.5	173	433
3/8/89	1400	2,100	0.7	81.2	169	423
3/23/89	925	2,200	0.7	72.7	158	396
4/4/89	1151	2,000	0.7	73.5	146	364
4/19/89	1815	6,200	0.7	28.9	175	437
5/3/89	1430	6,100	0.7	33.4	199	499
5/3/89	1828	6,200	0.7	33.5	203	508
6/13/89	1615	4,600	0.7	29.5	132	331
7/5/89	1945	3,100	0.7	39.7	121	302
7/13/89	1210	3,500	0.7	50.2	173	433
7/21/89	940	2,800	0.7	42.4	117	292
7/26/89	1400	3,100	0.7	42.4	129	323
7/27/89	1800	3,100	0.7	46.6	142	356
8/4/89	1540	2,800	0.7	45.6	126	314
8/12/89	1445	2,800	0.7	46.3	128	319
8/16/89	1200	2,700	0.7	53.1	141	354
8/21/89	1030	2,700	0.7	52.7	140	351
8/27/89	900	2,600	0.7	52.2	134	335
9/12/89	1245	2,300	0.7	43.4	98	246
9/12/89	1426	2,300	0.7	44.5	101	252
9/26/89	1251	2,300	0.7	45.0	102	255
10/10/89	1738	2,570	0.7	53.3	135	338
10/11/89	1456	2,440	0.7	56.1	135	338
11/7/89	1705	2,440	0.7	67.7	163	409
12/4/89	1457	2,240	0.7	77.1	171	428
12/5/89	1200	2,330	0.7	65.2	150	376
1/6/90	846	2,210	0.7	79.0	173	433
1/16/90	900	2,380	0.7	74.6	176	440
1/25/90	1030	2,210	0.7	71.1	156	389
2/15/90	1141	2,010	0.7	73.6	147	366
3/7/90	1400	2,120	0.7	70.6	148	370

Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/22/90	1846	2,270	0.7	70.3	158	395
4/18/90	1138	8,780	0.7	25.8	220	551
5/2/90	311	6,340	0.7	30.7	190	476
5/2/90	900	5,860	0.7	30.7	176	440
5/9/90	1503	6,430	0.7	28.7	180	450
5/16/90	924	5,720	0.7	31.9	178	446
5/23/90	1025	5,860	0.7	29.2	167	418
5/30/90	1018	6,370	0.7	45.4	285	712
6/6/90	1130	4,390	0.7	39.5	170	426
6/6/90	1816	4,330	0.7	39.5	168	420
6/13/90	1809	4,840	0.7	34.0	161	403
6/20/90	1813	3,850	0.7	38.1	144	360
6/27/90	1803	3,310	0.7	41.2	134	335
7/4/90	1316	3,030	0.7	43.6	130	325
7/11/90	2045	2,830	0.7	44.0	123	306
7/15/90	1833	2,760	0.7	50.0	136	340
7/18/90	1747	2,610	0.7	46.6	120	299
7/25/90	1130	2,860	0.7	50.4	142	355
8/1/90	1748	2,660	0.7	52.1	137	342
8/8/90	1748	2,520	0.7	53.4	133	332
8/15/90	1749	2,470	0.7	53.7	131	327
8/22/90	1746	2,520	0.7	53.5	133	333
9/12/90	1300	2,270	0.7	50.6	113	283
9/12/90	1743	2,270	0.7	51.0	114	285
10/10/90	839	2,410	0.7	60.7	145	362
10/23/90	1245	2,380	0.7	61.7	145	363
10/24/90	1325	2,290	0.7	62.0	140	351
11/20/90	1005	2,380	0.7	70.0	165	412
12/19/90	1442	2,180	0.7	72.6	157	392
1/3/91	1330	2,150	0.7	71.5	152	381
1/15/91	1421	2,240	0.7	87.4	194	486
2/13/91	1250	1,950	0.7	71.3	138	344
2/13/91	1300	1,950	0.7	71.3	138	344
3/12/91	1231	2,120	0.7	76.8	161	403
4/3/91	15	2,610	0.7	68.0	176	439
4/10/91	1215	2,780	0.7	72.8	200	501
4/18/91	1439	2,660	0.7	75.5	199	497
5/9/91	1735	6,800	0.7	39.3	262	656
5/16/91	2054	14,200	0.7	19.2	263	657
5/30/91	1145	11,300	0.7	20.2	220	551
6/6/91	1748	8,210	0.7	15.3	120	300
6/12/91	1814	5,180	0.7	19.7	98	246
6/20/91	1356	4,420	0.7	23.1	99	248
6/27/91	1825	4,420	0.7	23.7	102	254
7/1/91	1817	4,640	0.7	25.3	114	285
7/11/91	1736	4,130	0.7	28.6	115	288
7/16/91	1130	3,540	0.7	30.2	104	261

Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/18/91	2038	3,680	0.7	27.3	98	245
7/26/91	1233	3,540	0.7	32.4	112	281
8/8/91	1901	3,140	0.7	38.8	120	299
8/15/91	2052	2,860	0.7	41.6	117	292
8/20/91	1645	2,860	0.7	48.0	135	338
8/22/91	1745	2,780	0.7	47.8	131	327
8/30/91	2035	2,610	0.7	47.0	121	302
9/12/91	1640	2,860	0.7	51.9	146	366
9/26/91	846	2,410	0.7	61.0	145	363
10/9/91	958	2,240	0.7	53.5	118	296
10/25/91	1651	2,660	0.7	63.4	167	417
11/14/91	1904	2,610	0.7	65.5	169	423
12/14/91	1139	2,410	0.7	60.5	144	360
1/1/92	1114	2,210	0.7	70.1	153	383
2/2/92	1235	2,120	0.7	60.8	127	319
3/3/92	1217	2,150	0.7	62.8	134	334
3/23/92	1040	2,120	0.7	66.2	139	347
4/10/92	1659	3,740	0.7	54.5	201	503
4/20/92	1414	4,810	0.7	35.5	167	418
5/15/92	1301	5,380	0.7	33.5	176	441
5/22/92	1551	3,960	0.7	35.3	137	343
5/29/92	1334	3,820	0.7	39.8	149	373
6/11/92	1152	3,030	0.7	43.4	129	323
6/20/92	1613	4,130	0.7	37.5	152	380
6/27/92	1605	4,280	0.7	36.5	153	383
7/4/92	1543	3,850	0.7	38.2	144	361
7/10/92	1602	3,430	0.7	44.8	151	378
7/18/92	1559	3,090	0.7	42.5	129	323
7/24/92	1641	2,920	0.7	41.3	119	296
8/1/92	1701	2,660	0.7	40.8	107	267
8/8/92	1809	2,460	0.7	44.8	108	271
8/15/92	1606	2,380	0.7	47.8	112	280
8/21/92	1726	2,610	0.7	53.8	139	346
8/28/92	1741	2,440	0.7	54.8	132	330
9/12/92	1145	2,520	0.7	56.0	139	348
9/29/92	941	2,380	0.7	55.9	131	328
10/4/92	1631	2,690	0.7	57.0	151	379
10/20/92	1222	2,380	0.7	58.7	138	345
11/28/92	947	2,210	0.7	70.0	153	383
12/13/92	1540	2,240	0.7	67.6	150	375
1/6/93	1200	2,380	0.7	53.8	126	316
1/16/93	1143	2,380	0.7	63.2	149	372
2/8/93	1443	2,320	0.7	68.8	158	395
2/24/93	1200	2,460	0.7	69.6	169	424
3/7/93	1212	2,290	0.7	70.4	160	399
3/20/93	1421	2,320	0.7	71.4	164	410
4/7/93	930	2,720	0.7	55.7	150	374

Gibbon River upstream from Madison Junction, WY

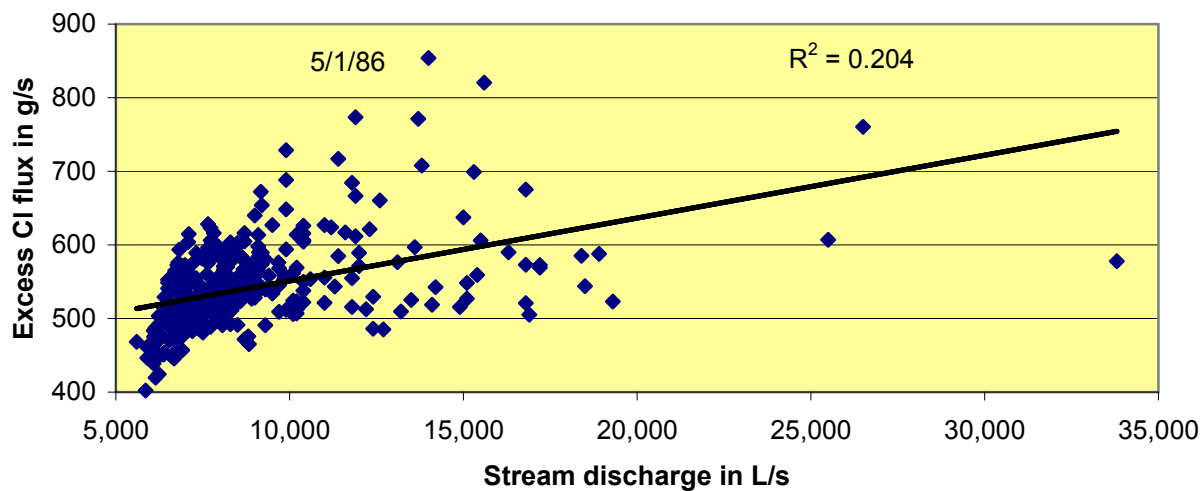
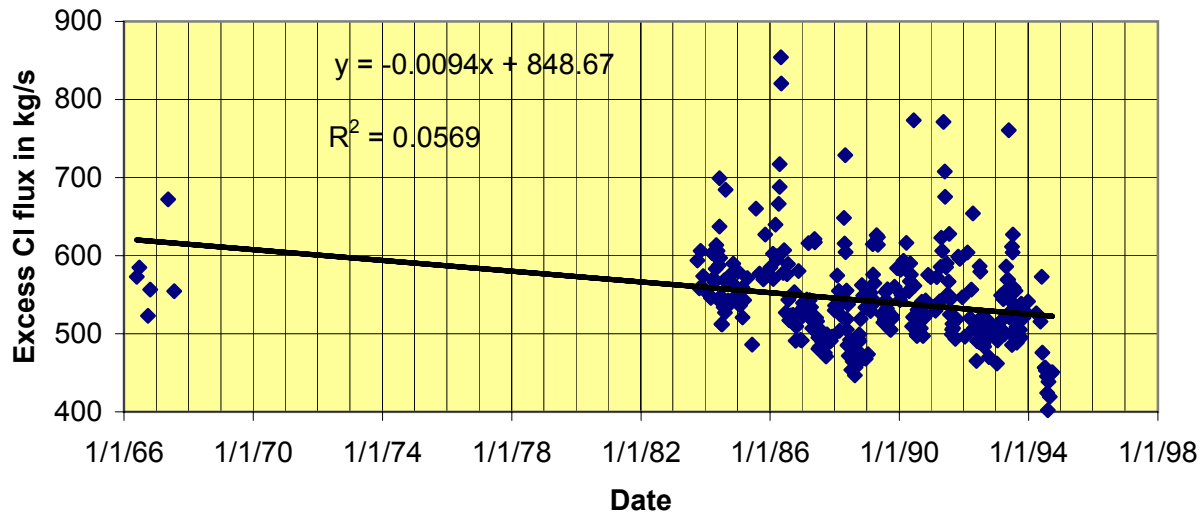
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
4/17/93	1439	2,800	0.7	59.2	164	410
4/24/93	1135	3,260	0.7	54.9	177	442
5/8/93	1649	7,670	0.7	28.6	214	535
5/15/93	1551	24,500	0.7	11.2	257	643
5/17/93	1845	17,200	0.7	11.2	181	452
5/22/93	2205	27,400	0.7	9.3	236	589
5/29/93	1807	12,000	0.7	12.5	142	354
6/4/93	2035	10,300	0.7	15.5	152	381
6/12/93	1644	9,850	0.7	15.4	145	362
6/19/93	1818	8,100	0.7	20.3	159	397
6/26/93	1653	7,020	0.7	24.0	164	409
7/3/93	1621	6,820	0.7	39.0	261	653
7/7/93	915	7,190	0.7	23.3	162	406
7/10/93	1854	5,180	0.7	28.2	142	356
7/16/93	1553	4,700	0.7	29.7	136	341
7/24/93	1836	8,640	0.7	35.3	299	747
8/7/93	1742	3,820	0.7	33.4	125	312
8/13/93	1917	3,740	0.7	35.6	131	326
8/16/93	1730	3,600	0.7	37.3	132	329
8/21/93	1842	4,840	0.7	42.3	201	503
8/27/93	1912	3,450	0.7	39.6	134	336
9/10/93	1750	3,140	0.7	44.5	138	344
9/24/93	1649	3,030	0.7	47.0	140	351
10/5/93	1615	2,800	0.7	54.1	150	374
10/8/93	1814	3,140	0.7	46.2	143	357
10/22/93	1655	2,720	0.7	43.2	116	289
11/5/93	1240	2,520	0.7	49.3	122	306
11/17/93	1320	2,240	0.7	49.8	110	275
12/25/93	1537	2,150	0.7	58.6	124	311
3/29/94	1410	1,930	0.7	59.6	114	284
5/16/94	1045	7,870	0.7	22.3	170	425
5/28/94	1617	5,970	0.7	29.5	172	430
6/4/94	1850	4,450	0.7	32.6	142	355
6/18/94	1704	3,740	0.7	36.9	135	338
6/25/94	1801	3,540	0.7	40.8	142	355
7/2/94	1600	3,030	0.7	44.9	134	335
7/9/94	1907	3,030	0.7	44.8	136	339
7/16/94	1729	2,860	0.7	45.6	130	326
7/25/94	1443	2,660	0.7	49.0	130	326
7/30/94	1640	2,550	0.7	49.0	125	312
8/6/94	1804	2,440	0.7	48.0	117	293
8/14/94	1232	2,380	0.7	44.2	105	263
8/20/94	1353	2,290	0.7	42.4	97	243
8/27/94	1854	2,240	0.7	46.8	105	262
9/25/94	1046	2,150	0.7	50.7	108	269

Gibbon River upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
		3577 2721		49.0	143 32 327	Mean Std. Deviation No. Samples

Firehole River 4.2 km upstream from Madison Junction, WY

Firehole River 4.2 km upstream from Madison Junction, WY; captures thermal discharge from Upper and Lower Geyser Basins. Sampled and gaged at approx. lat. 44 deg. 35 min. 50 sec. N, long. 110 deg. 49 min. 55 sec. W, USGS streamgaging station 06036905. Water samples were "grab" samples collected at a single point near the stream bank. Most chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. The earliest determinations (through 1967) were by titration with a silver-nitrate solution. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. Upper and Lower Geyser Basin contributions can be separated -- for the 1966-67 dates -- by using the data for Upper Geyser Basin reported by Fournier and others (1975). The data compiled here are from Fournier and others (1975), Norton and Friedman (1991), and Friedman and Norton (2000).



Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/27/66		17,200	0.7	34	573	1432
6/24/66		11,400	0.7	52	585	1462
9/28/66		8,010	0.7	66	523	1308
10/26/66		8,270	0.7	68	557	1391
5/14/67		9,170	0.7	74	672	1680
7/23/67		9,850	0.7	57	555	1386
10/3/83	1730	9,900	0.7	60.7	594	1485
10/23/83	1105	9,400	0.7	60.1	558	1396
11/6/83	1230	10,400	0.7	59.0	606	1516
12/4/83	1215	8,800	0.7	65.9	574	1434
1/1/84	1330	8,500	0.7	66.1	556	1390
1/29/84	1130	8,200	0.7	67.9	551	1378
2/29/84	1145	7,800	0.7	70.7	546	1365
3/16/84	1130	8,300	0.7	73.4	603	1509
3/29/84	1340	8,100	0.7	71.2	571	1428
4/10/84	1400	8,100	0.7	70.6	566	1415
4/25/84	1100	9,100	0.7	64.8	583	1458
5/3/84	1420	9,100	0.7	68.1	613	1533
5/9/84	1045	9,100	0.7	66.4	598	1495
5/17/84	1230	15,500	0.7	39.8	606	1515
5/23/84	900	18,500	0.7	30.1	544	1360
5/30/84	1540	18,900	0.7	31.8	588	1469
6/6/84	620	15,300	0.7	46.4	699	1748
6/6/84	1820	15,000	0.7	43.2	638	1594
6/13/84	1450	13,600	0.7	44.6	597	1493
6/20/84	1250	15,100	0.7	37.0	548	1370
6/28/84	2000	12,200	0.7	42.7	512	1281
7/5/84	1940	10,200	0.7	50.9	512	1280
7/11/84	1010	9,700	0.7	56.9	545	1363
7/19/84	1540	9,300	0.7	58.7	539	1349
7/25/84	1240	9,500	0.7	56.9	534	1335
8/1/84	1210	9,700	0.7	59.3	568	1421
8/9/84	845	8,900	0.7	59.9	527	1317
8/16/84	1445	11,800	0.7	58.7	684	1711
8/22/84	1413	9,100	0.7	59.7	537	1342
8/30/84	1430	9,000	0.7	60.5	538	1346
9/11/84	1530	9,200	0.7	59.7	543	1357
9/26/84	1120	9,200	0.7	63.1	574	1435
10/12/84	1200	8,900	0.7	61.3	539	1348
10/26/84	1436	9,100	0.7	62.8	565	1413
11/9/84	1400	9,200	0.7	64.8	590	1474
12/7/84	1520	8,500	0.7	65.2	548	1371
1/2/85	1240	8,700	0.7	67.3	579	1449
1/23/85	1450	8,100	0.7	66.9	536	1341
2/21/85	745	7,800	0.7	67.5	521	1303
2/21/85	1820	8,000	0.7	70.6	559	1398
3/14/85	630	7,800	0.7	70.3	543	1357

Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
4/17/85	1000	12,000	0.7	48.3	571	1428
6/11/85	1630	12,400	0.7	39.9	486	1215
7/23/85	1450	12,600	0.7	53.1	660	1651
9/4/85	1700	8,300	0.7	70.2	577	1442
10/16/85	1500	8,900	0.7	64.7	570	1424
11/8/85	925	9,500	0.7	66.7	627	1568
12/5/85	1630	8,700	0.7	67.1	578	1444
1/3/86	1450	8,600	0.7	68.7	585	1462
2/3/86	1435	8,500	0.7	71.6	603	1507
2/5/86	1120	8,200	0.7	70.2	570	1425
3/2/86	1010	9,000	0.7	71.8	640	1600
3/16/86	920	8,300	0.7	72.4	595	1488
3/18/86	1600	8,500	0.7	71.2	599	1498
4/8/86	900	11,900	0.7	56.7	666	1666
4/17/86	1030	11,400	0.7	63.6	717	1793
4/18/86	1730	9,900	0.7	70.2	688	1720
5/1/86	1620	14,000	0.7	61.7	854	2135
5/5/86	811	15,600	0.7	53.3	821	2051
5/29/86	830	33,800	0.7	17.8	578	1445
6/8/86	735	25,500	0.7	24.5	607	1517
6/26/86	1640	15,100	0.7	35.6	527	1317
7/10/86	848	13,100	0.7	44.7	576	1441
7/23/86	740	12,000	0.7	49.8	589	1473
7/24/86	1150	11,300	0.7	48.8	544	1359
8/6/86	845	10,100	0.7	51.9	517	1293
8/20/86	830	10,200	0.7	52.0	523	1308
9/3/86	830	10,400	0.7	50.9	522	1305
9/4/86	735	10,200	0.7	52.0	523	1308
9/17/86	1745	10,100	0.7	52.6	524	1310
10/1/86	804	10,600	0.7	52.9	553	1383
10/8/86	1100	9,900	0.7	52.4	512	1280
10/15/86	1135	9,300	0.7	53.5	491	1228
10/25/86	1605	9,700	0.7	53.2	509	1273
11/18/86	1100	9,300	0.7	63.1	580	1451
11/27/86	1112	9,000	0.7	59.4	528	1321
12/10/86	1200	8,300	0.7	60.0	492	1230
12/24/86	1150	8,500	0.7	58.5	491	1228
1/6/87	1300	8,600	0.7	63.4	539	1348
1/7/87	1437	8,500	0.7	62.2	523	1307
1/21/87	1230	8,100	0.7	66.8	535	1339
2/4/87	1555	8,500	0.7	64.0	538	1345
2/18/87	937	8,200	0.7	67.0	544	1359
2/18/87	1100	8,200	0.7	66.1	536	1341
3/11/87	1000	8,700	0.7	71.5	616	1540
3/25/87	1545	8,000	0.7	68.6	543	1358
4/3/87	900	7,800	0.7	67.4	520	1301
4/8/87	1347	8,700	0.7	62.1	534	1335

Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
4/23/87	1712	10,200	0.7	50.4	507	1267
5/6/87	902	11,800	0.7	44.4	516	1289
5/19/87	930	12,300	0.7	51.2	621	1553
5/20/87	928	11,600	0.7	53.9	617	1543
6/4/87	1727	8,300	0.7	63.4	520	1301
6/17/87	1725	7,600	0.7	68.6	516	1290
6/30/87	1145	7,500	0.7	64.8	481	1202
7/1/87	1727	7,400	0.7	67.6	495	1238
7/15/87	1229	7,200	0.7	67.8	483	1208
6/26/87	1800	7,500	0.7	68.4	508	1269
8/12/87	1725	7,100	0.7	69.7	490	1225
8/18/87	1220	7,200	0.7	69.6	496	1240
8/26/87	1645	7,200	0.7	67.8	483	1208
9/9/87	1510	6,900	0.7	69.6	475	1189
9/23/87	1729	6,700	0.7	71.0	471	1178
10/6/87	1205	6,900	0.7	71.2	486	1216
10/7/87	1734	7,000	0.7	72.0	499	1248
10/21/87	1530	6,800	0.7	73.1	492	1231
11/4/87	1030	6,900	0.7	72.2	493	1233
11/17/87	1130	6,800	0.7	72.9	491	1227
12/1/87	837	6,700	0.7	74.8	496	1241
12/30/87	1445	6,900	0.7	77.5	530	1325
1/5/88	1120	7,000	0.7	77.3	536	1341
1/28/88	1303	7,200	0.7	80.5	575	1436
2/17/88	1210	6,900	0.7	81.1	555	1387
2/24/88	1328	6,900	0.7	73.7	504	1259
3/16/88	856	6,800	0.7	79.9	539	1346
3/29/88	1130	7,200	0.7	73.1	521	1303
3/31/88	1201	6,900	0.7	80.5	551	1377
4/13/88	1726	9,900	0.7	66.2	648	1621
4/21/88	1740	10,400	0.7	59.9	616	1539
4/27/88	1709	9,900	0.7	74.3	729	1822
5/4/88	1705	8,700	0.7	70.2	605	1512
5/12/88	1544	11,000	0.7	51.2	556	1389
5/17/88	1130	16,900	0.7	30.6	505	1263
5/18/88	1709	14,100	0.7	37.5	519	1297
5/25/88	1709	12,700	0.7	38.9	485	1213
6/1/88	1714	10,400	0.7	52.4	538	1344
6/8/88	1846	8,700	0.7	54.9	472	1179
6/15/88	1713	7,400	0.7	66.5	487	1217
6/22/88	1049	7,100	0.7	70.0	492	1230
6/22/88	1210	7,100	0.7	69.0	485	1212
6/29/88	715	6,700	0.7	72.8	483	1208
7/6/88	734	6,400	0.7	71.6	454	1134
7/13/88	845	6,300	0.7	76.0	474	1186
7/20/88	748	6,100	0.7	76.9	465	1162
7/27/88	741	6,200	0.7	77.5	476	1190

Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/3/88	726	6,100	0.7	76.7	464	1159
8/9/88	1215	6,100	0.7	78.6	475	1188
8/9/88	1715	6,100	0.7	77.6	469	1173
8/17/88	917	5,900	0.7	76.4	447	1117
8/24/88	915	6,100	0.7	75.6	457	1142
8/31/88	1659	6,000	0.7	78.4	466	1166
9/7/88	1827	5,900	0.7	78.8	461	1152
9/20/88	1215	6,300	0.7	79.1	494	1235
9/21/88	1712	6,300	0.7	76.5	478	1194
10/5/88	1702	6,500	0.7	76.2	491	1227
10/6/88	1230	6,500	0.7	77.5	499	1248
10/19/88	1754	6,600	0.7	79.3	519	1297
11/3/88	1145	7,100	0.7	79.9	562	1406
11/16/88	901	6,500	0.7	85.1	549	1372
12/13/88	1515	6,500	0.7	82.8	534	1334
12/15/88	1508	5,600	0.7	84.3	468	1170
1/10/89	1615	6,300	0.7	75.9	474	1184
2/7/89	1515	6,500	0.7	85.7	553	1381
2/9/89	1015	6,400	0.7	83.4	529	1323
3/7/89	945	7,100	0.7	87.3	615	1537
3/8/89	1330	6,800	0.7	85.4	576	1440
3/23/89	910	6,700	0.7	85.0	565	1412
4/4/89	1125	6,500	0.7	83.9	541	1352
4/19/89	1750	10,400	0.7	60.9	626	1565
5/3/89	1015	11,200	0.7	56.4	624	1560
5/3/89	1752	10,200	0.7	60.9	614	1535
6/14/89	1115	13,500	0.7	39.6	525	1313
7/5/89	850	8,000	0.7	65.0	514	1286
7/13/89	1140	8,900	0.7	61.5	541	1353
7/21/89	1000	7,600	0.7	68.9	518	1296
7/26/89	1000	7,600	0.7	68.3	514	1284
7/28/89	1100	8,300	0.7	67.4	554	1384
8/4/89	1630	7,600	0.7	68.7	517	1292
8/10/89	1645	7,700	0.7	71.1	542	1355
8/12/89	1515	7,900	0.7	68.1	532	1331
8/21/89	1000	8,000	0.7	70.3	557	1392
8/27/89	930	7,600	0.7	70.2	528	1321
9/12/89	1100	7,200	0.7	71.0	506	1265
9/26/89	1308	7,100	0.7	71.8	505	1262
10/10/89	1754	7,420	0.7	71.2	523	1308
10/11/89	1305	7,360	0.7	71.3	520	1299
11/7/89	1646	7,620	0.7	74.2	560	1400
12/5/89	1230	7,480	0.7	78.8	584	1460
1/6/90	944	7,050	0.7	77.7	543	1357
1/16/90	918	7,480	0.7	78.5	582	1455
1/25/90	915	7,110	0.7	78.0	550	1374
2/15/90	1204	6,820	0.7	87.7	593	1483

Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/7/90	930	7,310	0.7	81.3	589	1473
3/22/90	1822	7,820	0.7	79.5	616	1541
4/18/90	1118	11,800	0.7	47.7	555	1387
5/1/90	1430	8,670	0.7	66.1	567	1418
5/2/90	1238	9,120	0.7	65.4	590	1475
5/9/90	1447	9,680	0.7	60.2	576	1440
5/16/90	944	9,850	0.7	57.4	558	1396
5/23/90	1007	13,200	0.7	39.3	510	1274
5/30/90	1118	12,500	0.7	30.2	369	922
6/6/90	1832	11,000	0.7	48.1	521	1304
6/13/90	1824	11,900	0.7	65.7	774	1934
6/20/90	1829	10,100	0.7	56.3	562	1404
6/27/90	1820	8,330	0.7	62.1	511	1279
7/4/90	1257	7,650	0.7	67.3	509	1274
7/11/90	2104	7,220	0.7	69.9	500	1249
7/18/90	1808	7,080	0.7	70.9	497	1243
7/25/90	845	7,650	0.7	70.1	531	1327
7/25/90	1851	7,310	0.7	70.1	507	1268
8/1/90	1806	7,190	0.7	72.4	516	1289
8/8/90	1809	7,160	0.7	72.8	516	1291
8/15/90	1805	7,390	0.7	73.0	534	1336
8/22/90	1802	7,110	0.7	73.2	515	1289
8/29/90	1837	7,050	0.7	72.6	507	1267
9/12/90	930	6,970	0.7	78.3	541	1352
9/12/90	1758	6,910	0.7	78.3	536	1341
9/26/90	1806	7,110	0.7	70.6	497	1242
10/10/90	858	7,280	0.7	72.2	521	1301
10/23/90	900	7,390	0.7	74.1	542	1356
10/24/90	1344	7,160	0.7	73.8	523	1308
11/20/90	946	7,650	0.7	75.9	575	1438
12/19/90	1424	6,990	0.7	82.6	572	1431
2/13/91	930	6,910	0.7	77.3	529	1323
2/13/91	1315	6,770	0.7	79.8	536	1339
2/28/91	915	6,770	0.7	85.3	573	1432
3/31/91	1312	6,820	0.7	80.1	542	1354
4/10/91	1439	7,820	0.7	75.6	586	1464
4/18/91	1415	7,730	0.7	81.3	623	1558
4/30/91	1410	7,730	0.7	79.1	606	1515
5/16/91	1703	13,700	0.7	57.0	771	1928
5/30/91	2016	13,800	0.7	52.0	708	1770
5/31/91	815	16,800	0.7	40.9	675	1688
6/13/91	1101	18,400	0.7	32.5	585	1463
6/20/91	806	16,300	0.7	36.9	590	1475
6/27/91	1333	10,400	0.7	53.6	550	1375
6/30/91	1649	9,030	0.7	61.5	549	1373
7/11/91	1513	8,750	0.7	65.5	567	1418
7/16/91	1626	8,410	0.7	66.0	549	1373

Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/18/91	915	7,650	0.7	82.8	628	1570
7/26/91	1946	7,560	0.7	70.1	525	1312
7/31/91	1128	7,900	0.7	69.6	544	1361
8/15/91	1836	7,160	0.7	70.4	499	1248
8/21/91	2034	7,220	0.7	70.7	505	1264
8/22/91	1220	7,280	0.7	71.1	513	1281
8/30/91	1509	7,190	0.7	71.2	507	1267
9/26/91	1708	7,080	0.7	70.4	493	1234
9/30/91	1241	7,360	0.7	71.3	520	1299
10/9/91	1647	7,140	0.7	73.3	518	1296
10/26/91	1108	7,930	0.7	76.2	599	1497
11/13/91	1647	7,650	0.7	78.6	596	1490
12/14/91	1212	7,360	0.7	75.0	547	1367
1/13/92	1148	6,800	0.7	73.7	496	1241
2/10/92	1205	7,080	0.7	86.0	604	1510
3/9/92	1050	6,540	0.7	80.2	520	1300
3/23/92	1051	6,990	0.7	80.3	556	1391
4/10/92	1635	9,200	0.7	71.8	654	1635
4/20/92	1423	8,210	0.7	62.4	507	1266
5/15/92	1322	10,100	0.7	50.8	506	1265
5/22/92	1607	8,830	0.7	53.4	465	1163
5/29/92	1353	8,070	0.7	61.5	491	1227
6/11/92	1212	6,990	0.7	74.2	514	1284
6/20/92	1705	7,480	0.7	66.1	489	1223
6/27/92	1624	8,330	0.7	71.1	586	1466
7/4/92	1639	8,070	0.7	72.5	579	1449
7/10/92	1622	7,160	0.7	73.2	519	1298
7/17/92	1736	6,990	0.7	73.0	505	1263
7/24/92	1717	6,770	0.7	77.8	522	1305
7/31/92	2055	6,310	0.7	79.1	495	1237
8/8/92	1831	6,140	0.7	80.1	488	1219
8/14/92	1922	6,090	0.7	80.1	484	1209
8/21/92	1747	6,460	0.7	77.8	498	1245
8/28/92	1802	6,230	0.7	81.5	503	1258
9/12/92	1215	6,820	0.7	74.9	506	1265
9/28/92	1006	6,820	0.7	76.5	517	1292
10/10/92	1703	6,540	0.7	72.6	470	1176
10/20/92	1202	6,540	0.7	77.1	500	1249
11/20/92	1011	6,460	0.7	79.6	510	1274
1/6/93	1015	5,950	0.7	78.3	462	1154
1/16/93	1214	6,230	0.7	79.6	492	1229
2/8/93	1420	6,370	0.7	81.5	515	1287
2/24/93	955	6,680	0.7	82.9	549	1373
3/7/93	1145	6,430	0.7	79.2	505	1262
3/21/93	1448	6,820	0.7	80.5	544	1361
4/1/93	1200	6,820	0.7	73.9	499	1248
4/17/93	1522	7,310	0.7	76.6	555	1387

Firehole River 4.2 km upstream from Madison Junction, WY

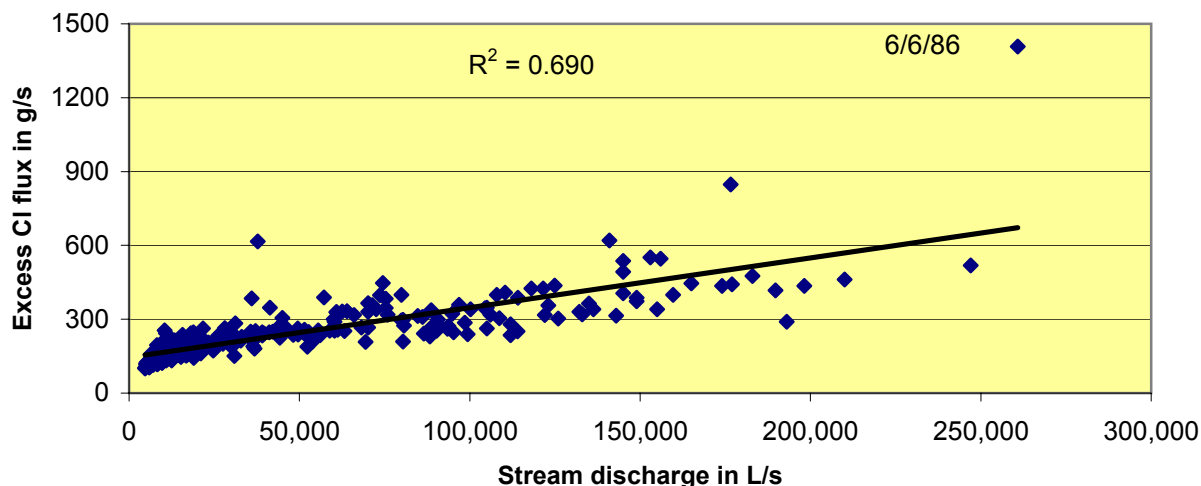
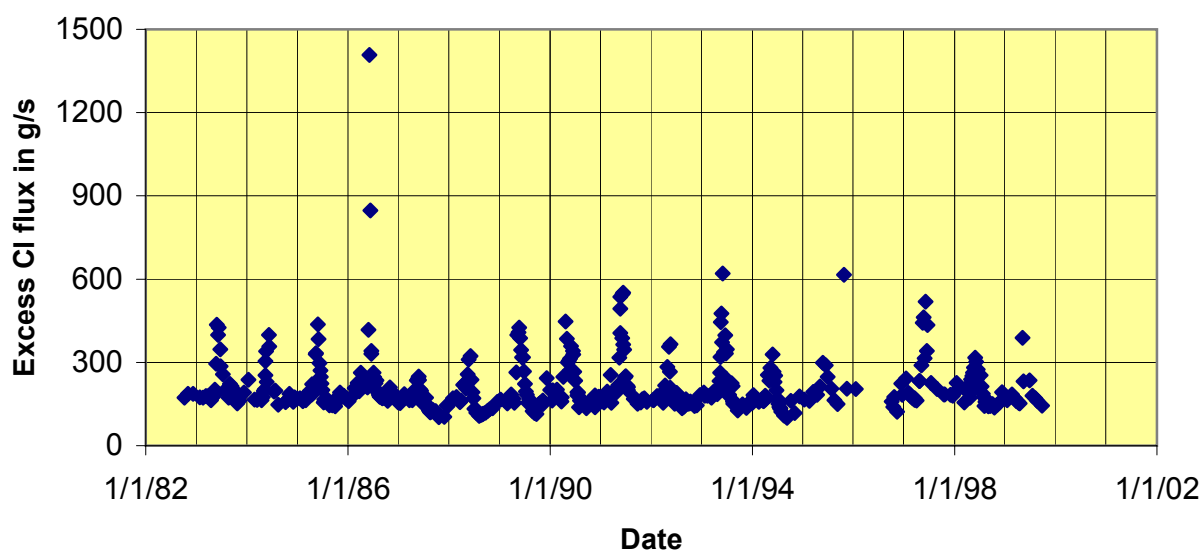
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
4/24/93	1158	8,070	0.7	73.3	586	1465
5/8/93	1627	10,200	0.7	56.5	569	1423
5/15/93	1200	17,200	0.7	33.8	569	1423
5/18/93	930	19,300	0.7	27.8	523	1308
5/22/93	2026	26,500	0.7	29.4	761	1901
5/29/93	1636	16,800	0.7	31.7	521	1302
6/4/93	2008	14,200	0.7	38.9	542	1356
6/12/93	1612	15,400	0.7	37.0	559	1398
6/19/93	1741	12,400	0.7	43.4	529	1324
6/26/93	1623	11,900	0.7	52.1	612	1529
7/3/93	1559	10,400	0.7	58.8	604	1511
7/6/93	1800	11,000	0.7	57.7	627	1568
7/10/93	1913	9,030	0.7	62.5	558	1395
7/16/93	1517	9,030	0.7	62.6	559	1397
7/23/93	1853	8,580	0.7	61.7	523	1308
7/31/93	2100	8,410	0.7	63.4	527	1318
8/7/93	1715	8,750	0.7	64.1	555	1387
8/13/93	1852	8,330	0.7	64.2	529	1322
8/16/93	1615	8,070	0.7	63.7	508	1271
8/20/93	1901	7,730	0.7	63.9	489	1221
8/27/93	1751	7,590	0.7	65.4	491	1228
9/10/93	1726	7,760	0.7	66.0	507	1267
9/24/93	1629	7,990	0.7	63.9	505	1262
10/5/93	1500	7,480	0.7	66.9	495	1238
10/9/93	1715	7,990	0.7	68.1	539	1346
10/22/93	1639	8,130	0.7	66.2	533	1331
11/5/93	1200	8,070	0.7	65.2	521	1301
11/17/93	1310	7,730	0.7	69.1	529	1322
12/25/93	1516	7,500	0.7	72.9	542	1354
3/29/94	1200	7,080	0.7	75.0	526	1315
5/16/94	1215	14,900	0.7	35.3	516	1289
5/28/94	1549	16,800	0.7	34.8	573	1432
6/5/94	1824	8,810	0.7	54.7	476	1189
6/18/93	1639	7,930	0.7	63.7	500	1249
6/25/93	1735	7,390	0.7	66.4	486	1214
7/2/94	1600	6,910	0.7	66.8	457	1142
7/9/94	1805	6,910	0.7	66.8	457	1142
7/16/94	1707	6,680	0.7	68.5	453	1132
7/25/94	1401	6,680	0.7	67.4	446	1114
7/30/94	1705	6,230	0.7	68.8	424	1061
8/6/94	1917	5,860	0.7	69.3	402	1005
8/14/94	1135	6,090	0.7	72.7	438	1096
8/20/94	1332	6,230	0.7	72.7	449	1121
8/27/94	1834	6,140	0.7	69.0	419	1048
9/11/94	1919	6,600	0.7	68.7	449	1122
9/25/94	1007	6,370	0.7	71.5	451	1127

Firehole River 4.2 km upstream from Madison Junction, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
		8943 3265		65.5	542 62 328	Mean Std. Deviation No. Samples

Snake River above Jackson Lake at Flag Ranch, WY

Snake River above Jackson Lake at Flag Ranch, WY; captures thermal discharge from Shoshone and Heart Lake Geyser Basin and the Snake River Hot Springs. Sampled and gaged at lat. 44 deg. 05 min. 21 sec. N, long. 110 deg. 41 sec. 38 min. W, USGS streamgaging station 13010065. Water samples were "grab" samples collected at a single point near the stream bank. Chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. The data compiled here are from Norton and Friedman (1991), Friedman and Norton (2000), and the USGS archives <<http://water.usgs.gov/nwis>>.



Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/8/82	850	14,300	0.7	12.8	173	433
11/1/82	840	13,900	0.7	14.1	186	466
12/10/82	1245	12,500	0.7	15.6	186	466
1/26/83	1315	11,000	0.7	16.5	174	435
2/18/83	1245	11,000	0.7	16.4	173	432
3/11/83	1545	11,000	0.7	16.9	178	446
3/23/83	910	10,800	0.7	17.1	177	443
4/18/83	1515	10,200	0.7	16.8	164	411
5/13/83	850	15,900	0.7	12.1	181	453
5/16/83	1520	16,100	0.7	13.2	201	503
5/25/83	1230	79,900	0.7	4.4	296	739
5/30/83	1010	198,200	0.7	2.9	436	1090
6/7/83	1020	159,700	0.7	3.2	399	998
6/13/83	1120	118,100	0.7	4.3	425	1063
6/23/83	1530	105,000	0.7	4.0	347	866
6/27/83	1305	98,500	0.7	3.6	286	714
7/11/83	1140	51,500	0.7	5.7	258	644
7/28/83	1310	21,000	0.7	10.2	200	499
8/22/83	1605	17,800	0.7	10.4	173	432
9/2/83	945	18,100	0.7	13.0	223	557
9/12/83	1030	17,000	0.7	13.3	214	536
10/7/83	1145	19,500	0.7	10.8	197	492
10/24/83	515	16,700	0.7	9.8	152	380
11/7/83	1223	21,000	0.7	8.4	162	404
12/12/83	1215	16,800	0.7	12.1	192	479
1/12/84	1410	15,700	0.7	15.8	237	593
2/27/84	1515	10,900	0.7	15.9	166	414
3/15/84	1505	10,600	0.7	16.2	164	411
4/2/84	1130	10,000	0.7	18.0	173	433
4/16/84	1145	11,400	0.7	15.1	164	410
4/27/84	835	13,200	0.7	14.0	176	439
5/3/84	1330	14,400	0.7	14.4	197	493
5/11/84	930	18,800	0.7	11.5	203	508
5/14/84	1330	60,300	0.7	4.9	253	633
5/15/84	1820	108,700	0.7	3.5	304	761
5/20/84	1330	100,200	0.7	4.1	341	852
5/24/84	1410	88,300	0.7	3.3	230	574
6/9/84	1210	79,900	0.7	5.7	400	999
6/12/84	1603	71,400	0.7	5.7	357	893
7/17/84	1810	24,700	0.7	8.6	195	488
7/26/84	1525	21,800	0.7	9.8	198	496
8/14/84	1303	15,200	0.7	10.4	147	369
10/7/84	1745	11,400	0.7	14.5	157	393
10/21/84	1715	11,000	0.7	15.7	165	413
10/23/84	1723	11,800	0.7	14.8	166	416
11/4/84	1630	13,000	0.7	15.1	187	468
12/2/84	1320	11,100	0.7	14.9	158	394

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
12/11/84	1500	11,800	0.7	15.5	175	437
12/30/84	1600	11,700	0.7	15.2	170	424
1/20/85	1500	11,000	0.7	16.2	171	426
2/9/85	1345	10,800	0.7	15.5	160	400
2/17/85	730	9,400	0.7	19.2	174	435
3/3/85	1600	9,500	0.7	17.9	163	409
3/18/85	1130	9,500	0.7	19.7	181	451
3/31/85	850	9,700	0.7	21.0	197	492
4/15/85	1445	16,900	0.7	11.6	184	461
4/16/85	1350	19,800	0.7	11.9	222	554
4/28/85	1610	16,400	0.7	12.4	192	480
5/12/85	1745	70,200	0.7	5.4	330	825
5/14/85	1850	64,000	0.7	5.9	333	832
5/29/85	1730	124,900	0.7	4.2	437	1093
6/2/85	1800	75,300	0.7	5.8	384	960
6/10/85	1800	80,400	0.7	4.4	297	744
6/16/85	1740	60,300	0.7	5.2	271	678
6/18/85	2000	52,700	0.7	5.4	248	619
6/23/85	1750	36,000	0.7	6.9	223	558
6/30/85	1635	27,500	0.7	8.0	201	502
7/10/85	1645	18,300	0.7	9.2	156	389
7/14/85	1715	16,400	0.7	10.8	166	414
7/16/85	1850	15,200	0.7	11.2	160	399
7/21/85	1645	14,700	0.7	11.9	165	412
7/28/85	1200	14,300	0.7	12.1	163	408
8/5/85	1645	14,200	0.7	12.4	166	415
8/13/85	1700	12,100	0.7	13.5	155	387
8/18/85	1645	11,200	0.7	14.4	153	384
8/20/85	1639	10,500	0.7	14.5	145	362
8/29/85	1745	10,100	0.7	15.7	152	379
9/9/85	1639	10,500	0.7	14.5	145	362
9/25/85	1900	11,100	0.7	15.4	163	408
10/1/85	1100	9,600	0.7	15.5	142	355
10/13/85	1630	10,100	0.7	16.8	163	407
10/22/85	1630	10,700	0.7	15.9	163	407
11/5/85	1300	13,600	0.7	14.8	192	479
12/2/85	1500	11,600	0.7	16.2	180	450
12/17/85	815	10,500	0.7	16.8	169	423
1/5/86	1530	9,600	0.7	17.4	160	401
2/3/86	1630	10,700	0.7	17.4	179	447
2/19/86	1445	14,900	0.7	14.6	207	518
3/11/86	830	15,100	0.7	15.7	227	566
3/22/86	1600	12,500	0.7	16.4	196	491
4/4/86	800	21,700	0.7	12.8	263	656
5/2/86	1500	27,200	0.7	8.6	215	537
5/13/86	1015	26,100	0.7	9.6	232	581
5/23/86	1045	53,800	0.7	4.6	210	525

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/30/86	900	189,700	0.7	2.9	417	1043
6/6/86	900	260,800	0.7	6.1	1408	3521
6/12/86	900	176,600	0.7	5.5	848	2119
6/18/86	1,815	136,300	0.7	3.2	341	852
6/19/86	1900	132,200	0.7	3.2	331	826
7/5/86	1100	49,500	0.7	6.0	262	656
7/9/86	1810	41,100	0.7	6.7	247	617
7/15/86	1530	33,100	0.7	7.6	228	571
7/19/86	1315	31,200	0.7	7.9	225	562
7/26/86	1300	36,700	0.7	7.1	235	587
8/2/86	1430	23,400	0.7	9.1	197	491
8/9/86	815	19,700	0.7	10.3	189	473
8/13/86	1905	18,000	0.7	10.8	182	455
8/19/86	1630	15,900	0.7	11.8	176	441
8/23/86	1215	16,800	0.7	11.2	176	441
8/27/86	1800	17,600	0.7	11.2	185	462
9/6/86	1150	14,500	0.7	12.5	171	428
9/20/86	1100	14,700	0.7	12.4	172	430
10/4/86	1000	13,800	0.7	13.1	171	428
10/15/86	1200	12,300	0.7	13.8	161	403
10/21/86	1420	12,900	0.7	13.7	168	419
10/30/86	1345	14,000	0.7	15.7	210	525
11/10/86	1030	12,100	0.7	15.5	179	448
12/17/86	930	10,500	0.7	17.7	179	446
12/31/86	850	10,100	0.7	16.1	156	389
1/12/87	1030	8,600	0.7	18.5	153	383
2/10/87	930	10,600	0.7	17.3	176	440
2/13/87	1215	10,900	0.7	17.7	185	463
3/15/87	1100	10,200	0.7	17.6	172	431
3/20/87	915	9,700	0.7	17.6	164	410
4/10/87	1100	10,600	0.7	16.1	163	408
4/21/87	1310	19,200	0.7	10.9	196	490
5/6/87	1000	52,300	0.7	4.3	188	471
5/14/87	715	56,100	0.7	4.9	236	589
5/23/87	1100	39,600	0.7	6.8	242	604
5/27/87	1538	42,200	0.7	6.6	249	622
5/29/87	1435	48,200	0.7	5.6	236	590
6/6/87	1135	31,300	0.7	7.2	203	509
6/9/87	1335	29,800	0.7	7.3	197	492
6/13/87	1130	26,100	0.7	8.3	198	496
6/19/87	830	19,000	0.7	10.2	181	451
6/27/87	1130	13,700	0.7	11.8	152	380
7/3/87	745	12,900	0.7	12.4	151	377
7/11/87	950	15,600	0.7	10.6	154	386
7/14/87	1315	10,900	0.7	14.2	147	368
7/18/87	1300	17,600	0.7	10.5	172	431
7/25/87	1030	11,100	0.7	13.5	142	355

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/31/87	900	10,600	0.7	13.9	140	350
8/8/87	1050	8,100	0.7	16.4	127	318
8/15/87	1320	7,500	0.7	17.1	123	308
8/19/87	1645	7,000	0.7	17.9	120	301
8/22/87	830	6,700	0.7	19.0	123	307
8/28/87	1045	6,900	0.7	18.9	126	314
9/5/87	1530	6,900	0.7	19.4	129	323
9/11/87	1230	6,300	0.7	20.2	123	307
9/27/87	1430	5,700	0.7	22.5	124	311
10/9/87	1500	5,200	0.7	23.1	116	291
10/20/87	1630	4,700	0.7	22.6	103	257
11/28/87	1520	5,900	0.7	18.3	104	260
12/16/87	1200	7,100	0.7	21.2	146	364
12/20/87	1315	7,200	0.7	20.4	142	355
1/29/88	1510	8,800	0.7	20.1	171	427
2/23/88	1500	8,000	0.7	22.6	175	438
2/24/88	1535	8,600	0.7	20.6	171	428
3/19/88	1630	7,500	0.7	21.6	157	392
3/30/88	900	7,800	0.7	21.6	163	408
4/13/88	930	14,600	0.7	15.7	219	548
4/26/88	1000	17,400	0.7	13.6	224	561
5/3/88	1050	18,400	0.7	11.9	206	515
5/9/88	1130	20,600	0.7	11.0	212	530
5/15/88	1410	61,200	0.7	4.9	257	643
5/22/88	1245	86,100	0.7	4.3	310	775
5/29/88	645	86,500	0.7	3.5	242	606
6/5/88	1220	94,900	0.7	4.1	323	807
6/12/88	1605	49,600	0.7	5.5	238	595
6/19/88	930	29,700	0.7	7.2	193	483
6/26/88	745	18,700	0.7	9.8	170	425
7/3/88	830	12,500	0.7	11.3	133	331
7/10/88	1015	10,900	0.7	12.9	133	332
7/17/88	1000	8,300	0.7	15.0	119	297
8/5/88	900	6,100	0.7	18.3	107	268
8/11/88	915	5,800	0.7	19.8	111	277
8/14/88	945	5,800	0.7	19.7	110	276
8/22/88	1000	5,200	0.7	22.3	112	281
8/28/88	1330	5,200	0.7	22.5	113	283
9/4/88	945	5,100	0.7	23.3	115	288
9/20/88	1145	5,000	0.7	24.5	119	298
10/7/88	1520	5,200	0.7	24.8	125	313
10/20/88	1120	5,700	0.7	23.7	131	328
11/10/88	1030	6,000	0.7	23.1	134	336
12/16/88	1150	6,300	0.7	25.7	158	394
1/8/89	1400	7,800	0.7	22.0	166	415
2/12/89	1000	7,900	0.7	21.1	161	403
2/26/89	1150	7,400	0.7	21.3	152	381

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/5/89	1700	8,400	0.7	19.8	160	401
3/26/89	1630	10,000	0.7	19.2	185	463
4/10/89	1630	10,100	0.7	17.5	170	424
4/18/89	1625	17,000	0.7	9.8	155	387
4/30/89	1300	28,100	0.7	10.1	264	660
5/7/89	1200	107,900	0.7	4.4	399	998
5/17/89	757	110,400	0.7	4.4	408	1021
5/21/89	1430	121,500	0.7	4.2	425	1063
5/29/89	1230	114,100	0.7	4.1	388	970
6/4/89	930	104,400	0.7	4.0	345	861
6/11/89	750	106,000	0.7	3.7	318	795
6/18/89	1725	75,900	0.7	4.9	319	797
6/25/89	900	43,900	0.7	6.8	268	669
7/2/89	730	35,400	0.7	7.0	223	558
7/9/89	1700	22,900	0.7	9.2	195	487
7/16/89	950	19,100	0.7	10.3	183	458
7/23/89	730	14,600	0.7	11.3	155	387
8/2/89	1525	14,600	0.7	12.2	168	420
8/6/89	720	12,000	0.7	13.5	154	384
8/13/89	830	12,000	0.7	13.4	152	381
8/20/89	745	11,400	0.7	13.4	145	362
8/27/89	1000	8,800	0.7	14.9	125	312
9/10/89	1930	8,300	0.7	14.8	117	293
9/14/89	1100	9,300	0.7	15	133	332
9/24/89	1800	7,000	0.7	17.0	114	285
10/11/89	1045	10,100	0.7	15.5	149	374
10/24/89	1730	10,400	0.7	15.6	155	387
11/8/89	1400	8,950	0.7	17.4	149	374
11/9/89	1030	10,600	0.7	16	162	405
12/6/89	1615	10,800	0.7	23.2	243	608
1/1/90	1130	9,340	0.7	22.2	201	502
1/16/90	1700	10,000	0.7	17	163	408
1/20/90	1315	10,000	0.7	20.6	199	498
2/18/90	1430	11,100	0.7	18.9	202	505
3/22/90	1050	8,700	0.7	19	159	398
3/26/90	1500	9,340	0.7	19.3	174	434
4/6/90	1420	18,900	0.7	13.8	248	619
4/21/90	1630	74,500	0.7	6.7	447	1118
5/2/90	1330	36,000	0.7	11.4	385	963
5/8/90	1900	60,000	0.7	5.7	300	750
5/16/90	1730	45,000	0.7	7.5	306	765
5/24/90	840	93,700	0.7	3.6	272	679
5/24/90	1425	84,700	0.7	4.4	313	783
5/31/90	920	96,800	0.7	4.4	358	895
6/6/90	1015	88,600	0.7	3.7	266	665
6/13/90	810	72,500	0.7	5.4	341	852
6/17/90	1030	60,900	0.7	6.1	329	822

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/24/90	730	70,200	0.7	4.5	267	667
7/1/90	830	37,700	0.7	6.9	234	584
7/17/90	1200	15,700	0.7	12.2	181	451
7/17/90	1230	15,700	0.7	13	193	483
7/22/90	740	14,200	0.7	14.2	192	479
7/29/90	745	10,600	0.7	13.8	139	347
8/5/90	1000	11,400	0.7	15.0	163	408
8/17/90	1800	11,000	0.7	15.8	166	415
8/20/90	900	10,000	0.7	16.9	162	405
9/9/90	1545	8,440	0.7	18.4	149	373
9/19/90	1000	7,800	0.7	18	135	337
9/26/90	900	7,790	0.7	19.2	144	360
10/10/90	1230	8,440	0.7	19.4	158	395
10/24/90	1130	8,440	0.7	20.2	165	411
11/20/90	1200	9,710	0.7	19.4	182	454
11/20/90	1530	9,700	0.7	15	139	347
12/19/90	1630	8,920	0.7	20.5	177	442
1/18/91	1630	8,830	0.7	20.6	176	439
1/24/91	1540	9,000	0.7	18	156	389
2/16/91	1600	8,160	0.7	24.6	195	488
3/13/91	1425	10,400	0.7	25.2	255	637
3/18/91	1710	10,100	0.7	16	155	386
3/28/91	945	9,510	0.7	21.1	194	485
4/16/91	900	11,000	0.7	17.8	188	470
5/9/91	1559	30,300	0.7	7.9	218	545
5/16/91	1330	66,000	0.7	5.5	317	792
5/22/91	1330	145,000	0.7	3.5	406	1015
5/22/91	1530	145,000	0.7	4.1	493	1233
5/22/91	1700	145,000	0.7	4.4	537	1341
6/6/91	1300	149,000	0.7	3.3	387	969
6/7/91	1145	156,000	0.7	4.2	546	1365
6/11/91	900	135,000	0.7	3.4	365	911
6/12/91	1751	153,000	0.7	4.3	551	1377
6/19/91	1820	75,300	0.7	5.3	346	866
6/27/91	1300	39,100	0.7	7.0	246	616
6/30/91	1717	35,700	0.7	7.7	250	625
7/11/91	1300	22,000	0.7	10.5	216	539
7/17/91	1200	17,200	0.7	12.3	200	499
7/17/91	1245	17,200	0.7	13	212	529
8/28/91	1405	10,800	0.7	16.3	168	421
9/11/91	1550	12,600	0.7	14.1	169	422
9/24/91	1515	8,700	0.7	18	151	376
9/28/91	1830	9,120	0.7	17.9	157	392
10/18/91	1155	7,900	0.7	20.4	156	389
10/29/91	955	9,370	0.7	18.6	168	419
11/12/91	1200	9,060	0.7	19.5	170	426
12/1/91	1330	7,930	0.7	20.6	158	395

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
1/15/92	1458	7,650	0.7	22.1	164	409
1/21/92	1500	7,400	0.7	23	165	413
2/11/92	1102	8,690	0.7	21.3	179	448
3/9/92	1330	9,000	0.7	21	183	457
3/10/92	1310	9,120	0.7	20.9	184	461
3/27/92	1205	9,370	0.7	17.2	155	387
4/11/92	1020	16,300	0.7	14.0	217	542
4/25/92	1700	31,200	0.7	9.8	284	710
5/8/92	1237	123,000	0.7	3.6	357	892
5/15/92	1115	68,200	0.7	4.6	266	665
5/18/92	1320	69,400	0.7	3.7	208	521
5/19/92	1145	70,200	0.7	5.9	365	913
5/29/92	1037	36,400	0.7	5.9	189	473
6/5/92	1321	24,700	0.7	7.7	173	432
6/12/92	1301	19,100	0.7	9.3	164	411
6/19/92	935	30,900	0.7	5.6	151	379
6/26/92	1100	20,800	0.7	8.7	166	416
7/3/92	1420	18,700	0.7	10.9	191	477
7/10/92	1430	14,000	0.7	13.1	174	434
7/11/92	1200	14,800	0.7	13.0	182	455
7/14/92	1220	16,000	0.7	12	181	452
7/22/92	1445	12,900	0.7	13.7	168	419
7/28/92	1440	10,300	0.7	16.0	158	394
8/5/92	1115	8,690	0.7	17.2	143	358
8/11/92	817	7,530	0.7	18.6	135	337
8/18/92	1415	8,830	0.7	17.5	148	371
8/25/92	1630	7,160	0.7	20.4	141	353
9/7/92	1050	11,300	0.7	15.5	167	418
9/15/92	1600	7,800	0.7	21	158	396
9/23/92	1400	7,420	0.7	21.1	151	378
10/6/92	1200	8,240	0.7	19.1	152	379
10/9/92	1200	8,040	0.7	20.5	159	398
10/24/92	1530	6,940	0.7	22.6	152	380
11/9/92	1500	7,400	0.7	20	143	357
11/25/92	1700	6,510	0.7	23.0	145	363
12/18/92	1330	8,690	0.7	21.6	182	454
1/14/93	1500	9,400	0.7	21.1	192	479
1/21/93	1800	9,300	0.7	20	179	449
2/8/93	1545	8,350	0.7	22.3	180	451
3/7/93	1640	8,160	0.7	22.3	176	441
3/10/93	1320	8,100	0.7	22	173	431
3/24/93	1930	8,950	0.7	22.3	193	483
4/10/93	1630	11,300	0.7	18.0	195	489
4/15/93	1145	10,600	0.7	19	194	485
4/22/93	1015	12,700	0.7	15.3	185	464
4/29/93	1010	16,900	0.7	12	191	477
5/7/93	1345	30,300	0.7	8.4	233	583

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/13/93	1530	90,600	0.7	3.6	263	657
5/14/93	1040	133,000	0.7	3.1	319	798
5/18/93	1045	165,000	0.7	3.4	446	1114
5/22/93	1500	183,000	0.7	3.3	476	1190
5/27/93	1645	149,000	0.7	3.2	373	931
5/31/93	1600	141,000	0.7	5.1	620	1551
6/10/93	1130	88,700	0.7	4.5	337	843
6/18/93	1200	73,600	0.7	6.1	397	994
6/23/93	1500	62,600	0.7	6.0	332	829
6/24/93	1315	51,500	0.7	5.4	242	605
6/30/93	915	41,300	0.7	9.1	347	867
7/10/93	1030	30,900	0.7	7.4	207	518
7/15/93	1430	24,300	0.7	8.1	180	450
7/17/93	845	22,100	0.7	9.0	183	459
7/23/93	1545	19,300	0.7	11.9	216	540
7/28/93	1045	19,100	0.7	12.0	216	540
8/3/93	800	15,000	0.7	15.7	225	563
8/10/93	945	13,300	0.7	16.8	214	535
8/12/93	1415	15,500	0.7	11	160	399
8/16/93	1030	12,200	0.7	13.1	151	378
8/28/93	1420	10,700	0.7	15.2	155	388
9/10/93	1030	9,230	0.7	15.9	140	351
9/16/93	1205	8,900	0.7	15	127	318
10/21/93	1300	9,100	0.7	17	148	371
11/18/93	1200	6,700	0.7	21	136	340
12/16/93	1245	8,700	0.7	19	159	398
1/1/94	1630	9,230	0.7	17.5	155	388
1/9/94	1750	9,940	0.7	19.0	182	455
1/13/94	1200	9,500	0.7	19	174	435
2/17/94	1210	8,600	0.7	19	157	393
3/11/94	1555	9,090	0.7	19.1	167	418
3/17/94	1230	8,900	0.7	19	163	407
3/23/94	1350	8,440	0.7	19.7	160	401
4/4/94	1150	11,000	0.7	17	179	448
4/4/94	1350	9,510	0.7	18.2	166	416
4/22/94	1640	55,500	0.7	5.3	255	638
5/3/94	1115	39,100	0.7	6.7	235	587
5/11/94	1545	112,000	0.7	3.2	280	700
5/23/94	1100	63,200	0.7	4.7	253	632
5/27/94	1500	60,900	0.7	6.1	329	822
6/3/94	1503	45,900	0.7	6.5	266	666
6/10/94	1245	29,400	0.7	8.5	229	573
6/14/94	1325	37,100	0.7	7.5	252	631
6/24/94	1620	18,100	0.7	11.7	199	498
6/30/94	1230	13,800	0.7	13	170	424
7/1/94	1245	13,300	0.7	13.1	165	412
7/8/94	1609	11,400	0.7	13.9	150	376

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/15/94	1100	9,660	0.7	15.1	139	348
7/21/94	1320	8,700	0.7	16	133	333
7/22/94	1415	8,040	0.7	17.5	135	338
7/29/94	1556	7,790	0.7	16.4	122	306
8/18/94	1445	5,700	0.7	20	110	275
8/18/94	1450	5,800	0.7	19.3	108	270
9/8/94	1140	4,700	0.7	22	100	250
10/5/94	1740	7,600	0.7	22	162	405
11/3/94	1120	6,100	0.7	20	118	294
12/7/94	1240	9,700	0.7	19	178	444
1/11/95	1110	9,100	0.7	19	167	416
2/16/95	1235	8,800	0.7	19	161	403
3/16/95	1050	11,900	0.7	17	194	485
4/12/95	1320	12,000	0.7	16	184	459
5/3/95	1130	18,900	0.7	12	214	534
5/24/95	1330	90,600	0.7	4.0	299	747
6/14/95	1910	193,000	0.7	2.2	290	724
6/28/95	915	95,200	0.7	3.3	248	619
7/27/95	1300	23,300	0.7	9.5	205	513
8/16/95	1500	13,300	0.7	13	164	409
9/7/95	1200	11,300	0.7	14	150	376
10/24/95	1550	37,800	0.7	17	616	1540
11/13/95	1122	13,400	0.7	16	205	513
1/18/96	1330	11,800	0.7	18	204	510
10/2/96	1810	12,200	0.7	13.7	159	397
10/15/96	1235	11,400	0.7	12.9	139	348
10/22/96	1335	12,200	0.7	15.1	176	439
11/11/96	1115	9,660	0.7	13.4	123	307
12/10/96	1635	16,100	0.7	14.6	224	559
12/17/96	1345	15,000	0.7	12.9	183	458
1/15/97	1625	18,100	0.7	14.1	243	606
1/30/97	1306	15,200	0.7	13.2	190	475
2/12/97	1445	12,900	0.7	15.0	184	461
2/19/97	1245	11,800	0.7	15.7	177	443
3/4/97	1145	11,800	0.7	15.2	171	428
3/18/97	1445	11,400	0.7	15.2	165	413
3/19/97	1635	11,600	0.7	15.4	171	426
4/2/97	955	11,400	0.7	15.0	163	408
4/21/97	1720	31,100	0.7	8.2	233	583
4/22/97	1705	30,600	0.7	8.3	233	581
5/6/97	1335	60,300	0.7	5.5	289	724
5/14/97	1110	177,000	0.7	3.2	443	1106
5/21/97	1225	210,000	0.7	2.9	462	1155
5/28/97	1020	143,000	0.7	2.9	315	787
6/4/97	1000	247,000	0.7	2.8	519	1297
6/13/97	900	155,000	0.7	2.9	341	853
6/18/97	1430	174,000	0.7	3.2	435	1088

Snake River above Jackson Lake at Flag Ranch, WY

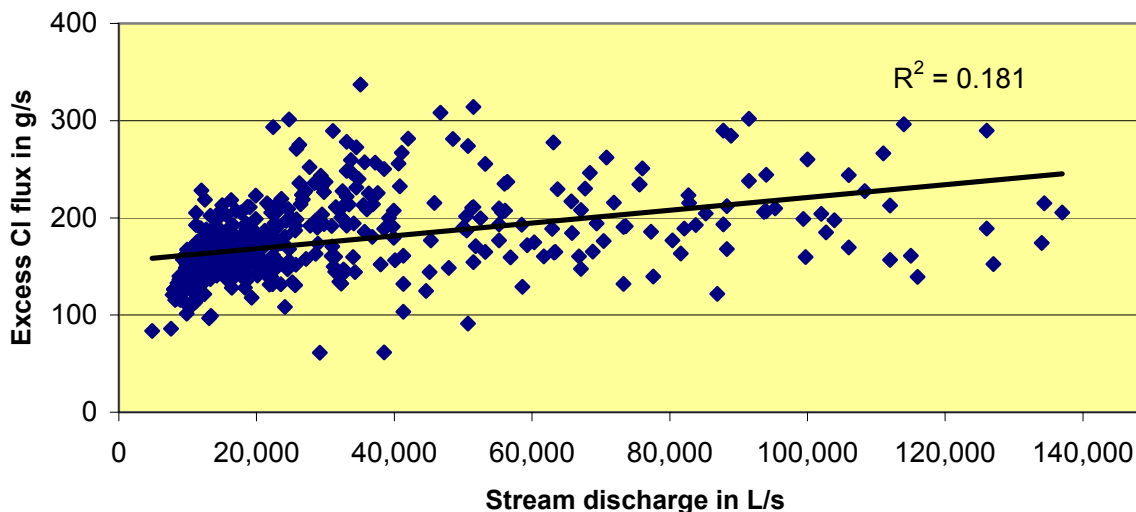
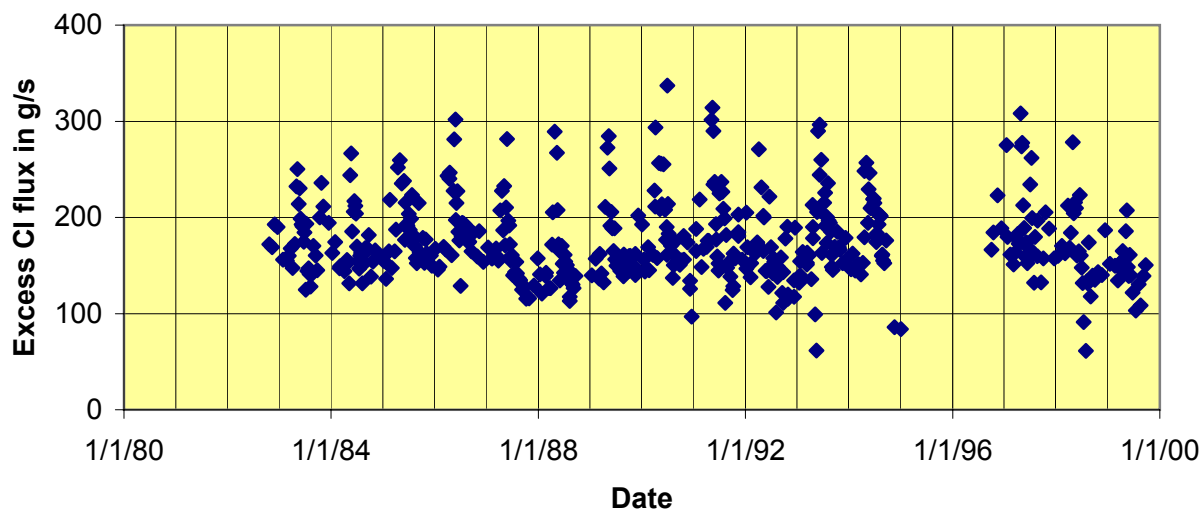
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/15/97	1130	44,200	0.7	5.8	225	564
8/26/97	1055	21,500	0.7	10.2	204	511
10/15/97	1200	17,200	0.7	11.4	184	460
10/22/97	930	15,400	0.7	12.7	185	462
12/2/97	1100	13,800	0.7	14.0	184	459
12/17/97	1000	13,300	0.7	14.5	184	459
12/18/97	1630	13,500	0.7	14.0	180	449
1/14/98	1330	15,700	0.7	15.1	226	565
2/2/98	1115	13,300	0.7	16.2	206	515
3/11/98	1140	11,400	0.7	14.4	156	390
3/24/98	1400	14,700	0.7	14.8	207	518
4/8/98	1115	13,200	0.7	15.3	193	482
4/15/98	1730	13,600	0.7	14.6	189	473
4/22/98	1200	14,100	0.7	13.0	173	434
4/29/98	805	37,100	0.7	6.7	223	557
4/29/98	1530	35,100	0.7	7.5	239	597
5/7/98	900	114,000	0.7	2.9	251	627
5/13/98	1200	105,000	0.7	3.2	263	656
5/20/98	1200	90,600	0.7	3.8	281	702
5/28/98	1200	122,000	0.7	3.3	317	793
6/4/98	1200	126,000	0.7	3.1	302	756
6/5/98	1000	93,500	0.7	3.5	262	655
6/10/98	1106	99,400	0.7	3.1	239	596
6/17/98	1400	80,700	0.7	4.1	274	686
6/25/98	1500	90,300	0.7	3.5	253	632
7/1/98	1430	80,400	0.7	3.3	209	523
7/7/98	830	58,900	0.7	5.0	253	633
7/15/98	1200	32,800	0.7	7.2	213	533
7/23/98	1530	22,000	0.7	9.2	187	468
7/30/98	1000	21,600	0.7	8.8	175	437
8/4/98	1000	19,000	0.7	8.2	143	356
8/11/98	1430	15,300	0.7	11.0	158	394
8/18/98	1500	17,600	0.7	10.1	165	414
9/1/98	1000	12,300	0.7	12.2	141	354
9/15/98	2000	12,400	0.7	12.2	143	357
10/1/98	1117	11,200	0.7	14.1	150	375
10/15/98	1310	10,200	0.7	14.1	137	342
11/4/98	1100	10,500	0.7	14.8	148	370
11/19/98	1300	10,400	0.7	15.6	155	387
12/10/98	1050	12,900	0.7	15.6	192	481
1/15/99	1430	11,500	0.7	14.9	163	408
2/18/99	1315	13,400	0.7	14.5	185	462
3/12/99	1700	11,600	0.7	15.4	171	426
3/24/99	1515	10,900	0.7	15.4	160	401
4/1/99	1445	11,000	0.7	15.2	160	399
4/9/99	1730	10,800	0.7	15.0	154	386
4/16/99	1801	10,500	0.7	15.2	152	381

Snake River above Jackson Lake at Flag Ranch, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/7/99	2000	57,200	0.7	7.5	389	972
5/13/99	1440	35,100	0.7	7.3	232	579
6/26/99	1530	112,000	0.7	2.8	235	588
7/16/99	815	36,800	0.7	5.6	180	451
8/6/99	945	19,800	0.7	9.3	170	426
8/21/99	1000	15,700	0.7	11.0	162	404
9/24/99	1100	12,000	0.7	12.7	144	360
		33541 42768		12.7	213 104 477	Mean Std. Deviation No. Samples

Fall River near Squirrel, ID

Fall River near Squirrel, ID; captures thermal discharge from Boundary Creek, Bechler River, Mountain Ash Creek, and Upper Falls River thermal areas. Sampled and gaged at lat. 44 deg. 04 min. 07 sec. N, long. 111 deg. 14 sec. 25 min. W, USGS streamgaging station 13047500. Water samples were "grab" samples collected at a single point near the stream bank. Chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) through water year 1989 and by an ion chromatography method (Fishman and Friedman, 1989) thereafter. It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. Data for Boundary Creek are displayed on the next sheet of this spreadsheet. The data compiled here are from Norton and Friedman (1991), Friedman and Norton (2000), and the USGS archives <<http://water.usgs.gov/nwis>>.



Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/21/82	1630	18,700	0.7	9.9	172	430
11/10/82	1025	19,000	0.7	9.6	169	423
11/30/82	1030	18,700	0.7	11.0	193	482
12/19/82	1235	16,100	0.7	12.5	190	475
1/26/83	1020	13,700	0.7	12.1	156	390
2/23/83	1010	12,600	0.7	13.0	155	387
3/8/83	1010	12,800	0.7	13.2	160	400
3/21/83	1730	12,800	0.7	13.8	168	419
4/5/83	1535	11,600	0.7	13.4	147	368
4/19/83	1430	16,100	0.7	11.4	172	431
5/2/83	1350	29,400	0.7	8.6	232	581
5/9/83	1745	38,500	0.7	7.2	250	626
5/17/83	1000	26,400	0.7	8.8	214	535
5/23/83	950	67,700	0.7	4.1	230	575
5/31/83	1035	99,400	0.7	2.7	199	497
6/7/83	925	83,800	0.7	3.0	193	482
6/14/83	955	73,300	0.7	3.3	191	476
6/22/83	1300	60,300	0.7	3.6	175	437
6/27/83	910	65,800	0.7	3.5	184	461
7/6/83	830	44,600	0.7	3.5	125	312
7/11/83	840	55,200	0.7	4.2	193	483
7/18/83	910	31,400	0.7	5.3	144	361
7/26/83	1000	24,500	0.7	6.7	147	368
8/1/83	1030	21,400	0.7	7.3	141	353
8/9/83	915	18,300	0.7	7.7	128	320
8/16/83	905	20,100	0.7	7.7	141	352
8/29/83	900	22,700	0.7	8.2	170	426
9/13/83	945	20,300	0.7	8.6	160	401
9/26/83	1230	16,300	0.7	9.6	145	363
10/12/83	920	25,000	0.7	8.7	200	500
10/25/83	1100	26,200	0.7	9.7	236	590
11/8/83	1335	32,500	0.7	7.2	211	528
12/15/83	1530	18,500	0.7	11.2	194	486
1/8/84	1056	17,000	0.7	10.3	163	408
1/30/84	1435	15,700	0.7	11.8	174	436
2/29/84	1440	13,500	0.7	11.6	147	368
3/3/84	1345	13,300	0.7	11.9	149	372
3/26/84	1520	13,700	0.7	11.6	149	373
4/4/84	1400	13,100	0.7	11.7	144	360
4/22/84	1930	24,700	0.7	7.0	156	389
4/30/84	1035	21,900	0.7	7.7	153	383
5/8/84	950	21,900	0.7	6.7	131	329
5/15/84	1004	106,000	0.7	3.0	244	610
5/21/84	1025	111,000	0.7	3.1	266	666
5/29/84	1740	77,300	0.7	3.1	186	464
6/8/84	645	93,700	0.7	2.9	206	515
6/13/84	1955	65,700	0.7	4.0	217	542

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/19/84	1915	88,300	0.7	3.1	212	530
6/25/84	2030	102,000	0.7	2.7	204	510
6/30/84	1030	106,000	0.7	2.3	170	424
7/9/84	1100	51,500	0.7	3.7	155	386
7/17/84	1005	32,600	0.7	5.2	147	367
7/24/84	908	31,400	0.7	5.8	160	400
7/30/84	2050	28,600	0.7	6.4	163	408
8/9/84	757	23,500	0.7	6.3	132	329
8/15/84	710	22,400	0.7	7.9	161	403
8/23/84	1030	23,500	0.7	7.2	153	382
8/29/84	1005	24,700	0.7	7.5	168	420
9/9/84	1855	20,800	0.7	8.8	168	421
9/23/84	1855	21,900	0.7	9.0	182	454
10/9/84	1543	16,100	0.7	9.3	138	346
10/22/84	1619	15,900	0.7	10.4	154	386
11/7/84	924	16,100	0.7	11.0	166	415
12/4/84	1410	14,600	0.7	11.7	161	402
1/7/85	930	14,200	0.7	11.6	155	387
1/22/85	1342	12,500	0.7	11.6	136	341
2/12/85	1645	14,700	0.7	11.9	165	412
2/19/85	650	16,300	0.7	14.1	218	546
3/5/85	1545	12,500	0.7	12.5	148	369
3/25/85	755	13,500	0.7	12.9	165	412
4/3/85	955	14,200	0.7	13.9	187	469
4/15/85	1445	27,700	0.7	9.8	252	630
4/29/85	1844	33,700	0.7	8.4	259	649
5/13/85	1230	56,000	0.7	4.9	235	588
5/28/85	1940	91,500	0.7	3.3	238	595
6/4/85	1005	55,200	0.7	3.9	177	442
6/9/85	1930	82,800	0.7	3.3	215	538
6/18/85	922	58,500	0.7	4.0	193	483
6/23/85	2035	39,800	0.7	5.5	191	478
6/25/85	930	38,500	0.7	5.6	189	472
7/1/85	750	29,500	0.7	7.6	204	509
7/9/85	800	25,600	0.7	8.0	187	467
7/17/85	955	25,800	0.7	8.4	199	497
7/23/85	945	26,600	0.7	9.1	223	559
7/29/85	939	21,000	0.7	9.1	176	441
8/6/85	849	20,300	0.7	9.6	181	452
8/13/85	1002	18,700	0.7	9.8	170	425
8/20/85	1902	16,600	0.7	10.2	158	394
8/27/85	900	15,700	0.7	10.4	152	381
9/9/85	958	21,500	0.7	10.7	215	538
9/17/85	958	16,200	0.7	10.8	164	409
9/23/85	1511	16,200	0.7	10.4	157	393
10/8/85	1652	16,400	0.7	11.6	179	447
10/21/85	944	14,700	0.7	11.1	153	382

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/30/85	900	16,100	0.7	11.7	177	443
11/4/85	1043	15,200	0.7	11.4	163	407
12/4/85	1010	13,700	0.7	12.4	160	401
12/11/85	1030	11,600	0.7	13.6	150	374
1/4/86	1010	13,500	0.7	13.1	167	419
1/23/86	1000	11,400	0.7	13.5	146	365
2/3/86	1525	12,000	0.7	13.1	149	372
3/4/86	904	14,000	0.7	12.8	169	424
3/19/86	925	14,000	0.7	12.6	167	417
3/31/86	1030	29,300	0.7	9.0	243	608
4/14/86	1650	34,800	0.7	7.6	240	600
4/16/86	945	33,800	0.7	8.0	247	617
4/30/86	948	30,900	0.7	5.9	161	402
5/14/86	955	32,500	0.7	7.7	228	569
5/19/86	1053	48,500	0.7	6.5	281	703
5/26/86	2025	91,500	0.7	4.0	302	755
5/29/86	930	103,900	0.7	2.6	197	494
6/2/86	1053	134,400	0.7	2.3	215	538
6/9/86	1017	108,300	0.7	2.8	227	569
6/17/86	922	102,700	0.7	2.5	185	462
6/24/86	845	70,400	0.7	3.2	176	440
7/1/86	1100	58,600	0.7	2.9	129	322
7/8/86	910	36,800	0.7	5.6	180	451
7/13/86	2035	34,100	0.7	6.4	194	486
7/16/86	930	33,100	0.7	6.5	192	480
7/23/86	815	29,800	0.7	7.2	194	484
7/30/86	920	27,800	0.7	7.6	192	480
8/5/86	839	25,600	0.7	8.2	192	480
8/12/86	848	24,100	0.7	8.2	181	452
8/18/86	927	23,000	0.7	8.4	177	443
8/27/86	840	21,500	0.7	8.8	174	435
9/2/86	932	23,600	0.7	8.1	175	437
9/16/86	1030	18,700	0.7	9.5	165	411
9/29/86	944	18,400	0.7	10.7	184	460
10/28/86	1430	16,100	0.7	10.6	159	398
11/10/86	1710	16,300	0.7	12.1	186	465
12/9/86	1540	12,500	0.7	13.0	154	384
1/13/87	1047	13,500	0.7	13.2	169	422
2/9/87	1307	12,300	0.7	13.5	157	394
2/9/87	1718	12,300	0.7	13.5	157	394
3/10/87	1015	12,900	0.7	13.7	168	419
3/24/87	1612	11,400	0.7	14.6	158	396
3/26/87	1620	11,400	0.7	14.3	155	388
4/8/87	1032	17,000	0.7	12.9	207	519
4/20/87	1022	27,100	0.7	9.1	228	569
4/29/87	1223	50,500	0.7	4.4	187	467
5/4/87	1944	40,800	0.7	6.4	233	581

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/11/87	945	51,800	0.7	4.0	171	427
5/19/87	845	51,300	0.7	4.8	210	526
5/26/87	920	42,000	0.7	7.4	281	704
6/3/87	1001	28,500	0.7	7.6	197	492
6/9/87	1907	23,100	0.7	9.0	192	479
6/15/87	1032	18,500	0.7	10.0	172	430
6/18/87	1300	16,200	0.7	10.3	156	389
6/23/87	1007	15,500	0.7	10.8	157	391
6/29/87	911	18,700	0.7	9.3	161	402
7/8/87	906	15,900	0.7	9.5	140	350
7/14/87	918	14,200	0.7	10.6	141	351
7/21/87	1023	12,900	0.7	11.8	143	358
7/30/87	920	14,500	0.7	11.3	154	384
8/4/87	1050	12,900	0.7	11.7	142	355
8/13/87	900	11,100	0.7	12.9	135	339
8/17/87	950	11,000	0.7	13.1	136	341
8/26/87	1021	10,600	0.7	13.4	135	337
8/31/87	934	10,300	0.7	13.5	132	330
9/8/87	910	9,600	0.7	13.7	125	312
10/8/87	955	8,200	0.7	14.8	116	289
10/20/87	1045	8,500	0.7	14.5	117	293
10/29/87	1100	8,900	0.7	13.7	116	289
11/30/87	1310	8,500	0.7	15.9	129	323
12/28/87	1655	10,100	0.7	16.3	158	394
1/12/88	1130	9,500	0.7	15.5	141	352
1/26/88	1722	7,800	0.7	16.2	121	302
2/22/88	1745	9,100	0.7	16.0	139	348
2/24/88	1145	9,300	0.7	16.0	142	356
3/15/88	1150	8,000	0.7	16.5	126	316
3/28/88	1010	8,000	0.7	16.5	126	316
4/8/88	1100	12,900	0.7	14.0	172	429
4/13/88	1110	17,700	0.7	12.3	205	513
4/25/88	1645	31,100	0.7	10.0	289	723
5/11/88	1017	41,100	0.7	7.2	267	668
5/16/88	1035	56,100	0.7	4.4	208	519
5/23/88	904	59,300	0.7	3.6	172	430
6/1/88	835	32,000	0.7	4.9	134	336
6/6/88	925	63,200	0.7	3.3	164	411
6/14/88	935	31,000	0.7	6.2	171	426
6/20/88	953	25,700	0.7	6.6	152	379
6/27/88	905	16,800	0.7	9.8	153	382
6/29/88	1200	16,200	0.7	9.5	143	356
7/5/88	900	18,100	0.7	9.6	161	403
7/10/88	2040	19,500	0.7	8.6	154	385
7/20/88	1055	17,700	0.7	9.2	150	376
7/27/88	2002	16,800	0.7	9.4	146	365
8/1/88	1110	15,500	0.7	9.6	138	345

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/9/88	1140	11,100	0.7	10.9	113	283
8/10/88	718	11,400	0.7	11.0	117	294
8/17/88	748	12,500	0.7	11.5	135	338
8/22/88	950	12,100	0.7	11.6	132	330
8/30/88	730	11,400	0.7	12.1	130	325
9/6/88	1009	10,800	0.7	12.4	126	316
9/20/88	1015	11,800	0.7	12.5	139	348
1/13/89	1030	8,800	0.7	16.6	140	350
2/8/89	1535	9,300	0.7	17.6	157	393
3/6/89	1430	8,800	0.7	16.2	136	341
3/9/89	917	10,800	0.7	15.7	162	405
3/21/89	1645	9,200	0.7	16.1	142	354
4/6/89	955	8,500	0.7	16.3	133	332
4/18/89	1020	19,000	0.7	11.8	211	527
5/2/89	1410	34,500	0.7	8.6	273	681
5/12/89	1043	88,900	0.7	3.9	284	711
5/17/89	1038	76,000	0.7	4.0	251	627
5/23/89	918	73,600	0.7	3.3	191	478
5/31/89	1022	55,600	0.7	4.4	206	514
6/6/89	1327	82,100	0.7	3.0	189	472
6/14/89	917	68,800	0.7	3.1	165	413
6/21/89	840	62,900	0.7	3.7	189	472
6/27/89	850	40,100	0.7	4.6	156	391
7/4/89	1040	31,200	0.7	5.5	150	374
7/11/89	907	21,500	0.7	7.9	155	387
7/12/89	1000	20,800	0.7	7.9	150	374
7/18/89	845	20,800	0.7	8.0	152	380
7/27/89	954	20,200	0.7	8.1	149	374
8/1/89	841	18,500	0.7	8.5	144	361
8/8/89	1000	17,000	0.7	9.2	145	361
8/17/89	940	16,700	0.7	9.6	149	372
8/23/89	905	16,700	0.7	9.0	139	347
8/27/89	935	17,000	0.7	10.2	162	404
9/11/89	930	15,700	0.7	10.5	154	385
9/27/89	914	14,400	0.7	10.7	144	360
10/2/89	1225	15,500	0.7	11	160	399
10/10/89	938	15,100	0.7	11.3	160	400
10/24/89	1145	14,000	0.7	11.2	147	368
11/6/89	1715	14,200	0.7	11.2	149	373
11/15/89	845	12,400	0.7	12	140	350
11/15/89	1255	13,500	0.7	12.7	162	405
12/5/89	1043	13,300	0.7	15.9	202	505
1/2/90	1010	11,200	0.7	17.9	193	482
1/16/90	1140	11,300	0.7	14.5	156	390
1/23/90	1155	11,700	0.7	13	144	360
2/14/90	1620	11,200	0.7	15.8	169	423
2/21/90	1030	10,900	0.7	14	145	362

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
3/20/90	953	10,400	0.7	16.2	161	403
3/31/90	1700	12,000	0.7	19.7	228	570
4/4/90	1700	18,700	0.7	12	211	528
4/6/90	1010	22,400	0.7	13.8	293	734
4/17/90	1010	27,200	0.7	6.5	158	394
5/1/90	1039	37,200	0.7	7.6	257	642
5/9/90	953	36,000	0.7	6.5	209	522
5/14/90	1935	40,600	0.7	7.0	256	639
5/21/90	1012	35,500	0.7	6.7	213	533
5/21/90	1530	33,400	0.7	7.1	214	534
6/1/90	948	53,200	0.7	5.5	255	638
6/6/90	918	51,500	0.7	4.8	211	528
6/12/90	935	67,100	0.7	3.8	208	520
6/19/90	1020	45,300	0.7	4.6	177	442
6/25/90	839	50,000	0.7	4.5	190	475
6/26/90	1210	41,300	0.7	4.6	161	403
6/30/90	833	35,100	0.7	10.3	337	842
7/3/90	930	36,900	0.7	6.5	214	535
7/9/90	850	20,800	0.7	9.5	183	458
7/17/90	800	21,200	0.7	8.9	174	435
7/24/90	830	20,800	0.7	8.9	171	426
8/7/90	1435	13,300	0.7	11	137	342
8/14/90	800	15,200	0.7	10.6	150	376
8/21/90	745	16,500	0.7	11.3	175	437
8/28/90	837	15,200	0.7	11.2	160	399
9/11/90	1000	14,400	0.7	11.5	156	389
9/26/90	937	13,000	0.7	12.3	151	377
10/10/90	820	14,000	0.7	11.8	155	389
10/23/90	930	14,800	0.7	12.9	181	451
10/24/90	1315	13,800	0.7	12	156	390
11/19/90	1635	12,900	0.7	14.2	174	435
12/6/90	750	9,460	0.7	14	126	315
12/6/90	1220	9,500	0.7	14.8	134	335
12/17/90	1055	13,100	0.7	8	97	242
1/17/91	1055	12,400	0.7	14	165	412
1/18/91	1006	12,700	0.7	15.5	188	470
2/12/91	1020	12,500	0.7	18.2	219	547
2/26/91	1445	9,700	0.7	16	148	371
3/11/91	822	9,900	0.7	17.6	167	418
4/2/91	1215	11,000	0.7	16.1	169	424
4/9/91	1350	13,200	0.7	14	176	439
4/16/91	1307	11,400	0.7	16.1	176	439
5/6/91	1015	24,700	0.7	12.9	301	753
5/13/91	1045	51,500	0.7	6.8	314	785
5/20/91	1023	87,800	0.7	4.0	290	724
5/21/91	1615	75,600	0.7	3.8	234	586
5/28/91	1020	56,400	0.7	4.9	237	592

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
6/6/91	1038	87,800	0.7	2.9	193	483
6/10/91	1030	80,400	0.7	2.9	177	442
6/17/91	904	56,900	0.7	3.5	159	398
6/24/91	855	38,000	0.7	4.7	152	380
6/25/91	1250	32,900	0.7	5.1	145	362
7/1/91	935	36,300	0.7	6.9	225	563
7/8/91	845	26,900	0.7	9.1	226	565
7/16/91	1037	30,000	0.7	8.6	237	593
7/23/91	835	29,800	0.7	8.3	226	566
7/29/91	843	24,600	0.7	9.2	209	523
8/7/91	1000	19,900	0.7	10.7	199	498
8/12/91	1700	10,800	0.7	11	111	278
8/18/91	1710	17,800	0.7	10.9	182	454
8/25/91	1619	15,900	0.7	10.0	148	370
9/13/91	1705	13,400	0.7	12.2	154	385
9/17/91	930	13,300	0.7	11.1	138	346
10/3/91	1200	11,000	0.7	12.0	124	311
10/7/91	1200	10,800	0.7	12.6	129	321
10/9/91	1000	13,300	0.7	12.9	162	406
10/21/91	1010	12,200	0.7	13.6	157	393
11/12/91	1035	12,900	0.7	14.7	181	452
11/13/91	945	14,200	0.7	15	203	508
11/13/91	1200	14,200	0.7	13.7	185	462
12/10/91	1420	11,300	0.7	14.5	156	390
1/7/92	1200	10,800	0.7	14.3	147	367
1/7/92	1440	11,200	0.7	19	205	512
1/15/92	1605	10,500	0.7	16.8	169	423
2/5/92	810	9,630	0.7	15	138	344
2/10/92	1031	10,100	0.7	15.8	153	381
3/11/92	1830	10,700	0.7	15.9	163	407
3/25/92	730	11,300	0.7	16	173	432
3/25/92	1613	11,300	0.7	16.1	174	435
4/5/92	1630	25,800	0.7	11.2	271	677
4/23/92	1934	34,500	0.7	7.4	231	578
5/6/92	825	50,400	0.7	4.7	202	504
5/7/92	725	53,200	0.7	3.8	165	412
5/11/92	753	39,200	0.7	5.8	200	500
5/22/92	925	45,100	0.7	3.9	144	361
5/29/92	847	34,300	0.7	4.9	144	360
6/10/92	808	16,400	0.7	8.5	128	320
6/17/92	915	33,100	0.7	7.4	222	554
6/20/92	1107	22,700	0.7	7.2	148	369
6/24/92	938	17,600	0.7	9.0	146	365
6/29/92	938	17,800	0.7	10.2	169	423
7/11/92	1012	15,100	0.7	10.1	142	355
7/16/92	1012	14,600	0.7	11.5	158	394
7/21/92	912	13,500	0.7	12.1	154	385

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/28/92	852	13,300	0.7	12.0	150	376
8/4/92	843	12,500	0.7	12.5	148	369
8/5/92	750	9,830	0.7	11	101	253
8/13/92	900	11,600	0.7	12.6	138	345
8/16/92	910	12,400	0.7	12.7	149	372
8/26/92	942	11,900	0.7	12.9	145	363
9/8/92	953	13,100	0.7	12.8	159	396
9/17/92	930	12,400	0.7	10.5	122	304
9/22/92	1035	9,830	0.7	12	111	278
9/23/92	855	11,000	0.7	13.7	143	358
10/8/92	953	13,000	0.7	14.4	178	445
10/22/92	1037	13,800	0.7	14.5	190	476
10/27/92	700	11,200	0.7	11	115	288
10/27/92	1200	11,300	0.7	11.3	120	299
12/8/92	815	11,900	0.7	12	134	336
12/8/92	1200	11,200	0.7	11.2	118	294
12/16/92	1346	11,900	0.7	16.6	189	473
1/13/93	1005	11,700	0.7	12.0	132	331
1/20/93	1200	10,200	0.7	14.4	140	349
1/20/93	1225	10,800	0.7	15	154	386
2/8/93	1055	10,800	0.7	15.9	164	410
3/9/93	1200	9,800	0.7	16.3	153	382
3/9/93	1325	9,880	0.7	16	151	378
3/10/93	1325	9,900	0.7	17.2	163	408
3/22/93	1640	9,500	0.7	17.6	161	401
4/9/93	1515	9,700	0.7	14.7	136	340
4/19/93	1437	15,000	0.7	14.9	213	533
4/20/93	1200	14,400	0.7	13.9	190	475
4/20/93	1422	13,400	0.7	14	178	446
5/7/93	1315	13,400	0.7	8.1	99	248
5/15/93	1015	38,500	0.7	2.3	62	154
5/20/93	1517	137,000	0.7	2.2	206	514
5/26/93	745	126,000	0.7	3.0	290	725
6/8/93	1200	114,000	0.7	3.3	296	741
6/8/93	1630	94,000	0.7	3.3	244	611
6/12/93	1625	94,000	0.7	2.9	207	517
6/19/93	716	100,000	0.7	3.3	260	650
6/23/93	1052	81,600	0.7	2.7	163	408
7/9/93	1057	45,800	0.7	5.4	215	538
7/15/93	842	37,600	0.7	6.7	226	564
7/21/93	800	30,900	0.7	6.9	192	479
7/27/93	1200	28,800	0.7	7.3	190	475
7/27/93	1500	28,900	0.7	6.7	173	434
7/30/93	1130	32,300	0.7	6.9	200	501
8/5/93	913	28,400	0.7	9.0	236	589
8/10/93	822	24,300	0.7	8.8	197	492
8/19/93	918	22,600	0.7	9.3	194	486

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/25/93	850	21,300	0.7	9.4	185	463
8/31/93	1708	19,400	0.7	9.0	161	403
9/1/93	1200	17,900	0.7	9.0	149	371
9/8/93	855	16,900	0.7	9.3	145	363
9/21/93	718	17,100	0.7	10.6	169	423
10/9/93	1343	19,900	0.7	10.0	185	463
10/20/93	1047	16,400	0.7	11.0	169	422
10/27/93	1200	16,300	0.7	10.9	166	416
11/16/93	1612	12,700	0.7	12.7	152	381
12/8/93	1500	14,300	0.7	13.2	179	447
12/13/93	1555	12,200	0.7	13.5	156	390
1/15/94	1015	11,600	0.7	13.3	146	365
1/25/94	1300	12,300	0.7	13.9	162	406
2/12/94	1355	10,200	0.7	14.9	145	362
3/8/94	1640	11,300	0.7	14.1	151	379
3/26/94	1547	10,200	0.7	14.5	141	352
4/8/94	1510	11,000	0.7	14.6	153	382
4/18/94	1915	18,700	0.7	10.3	180	449
4/20/94	730	33,100	0.7	8.2	248	621
5/2/94	1615	35,700	0.7	7.9	257	643
5/13/94	1946	69,400	0.7	3.5	194	486
5/18/94	1351	63,700	0.7	4.3	229	573
5/25/94	949	68,400	0.7	4.3	246	616
6/1/94	955	95,300	0.7	2.9	210	524
6/10/94	918	31,500	0.7	7.4	211	528
6/18/94	840	26,700	0.7	8.9	219	547
6/24/94	848	23,600	0.7	10.0	219	549
6/29/94	905	23,100	0.7	10.0	215	537
7/9/94	1905	22,100	0.7	10.0	206	514
7/12/94	1105	19,800	0.7	9.5	174	436
7/16/94	1140	19,300	0.7	10.2	183	458
7/21/94	840	18,300	0.7	10.5	179	448
7/28/94	900	16,600	0.7	12.3	193	481
8/5/94	915	15,600	0.7	13.7	203	507
8/12/94	915	14,700	0.7	14.4	201	503
8/20/94	1025	13,800	0.7	12.3	160	400
8/24/94	1200	11,700	0.7	14.5	161	404
8/27/94	857	11,000	0.7	14.8	155	388
9/6/94	948	11,200	0.7	14.3	152	381
9/20/94	958	11,900	0.7	15.5	176	440
11/17/94	1200	7,590	0.7	12	86	214
1/2/95	1230	4,840	0.7	18	84	209
10/1/96	1420	18,300	0.7	9.8	167	416
10/15/96	1300	19,000	0.7	10.4	184	461
11/12/96	1325	19,900	0.7	11.9	223	557
12/10/96	1040	18,500	0.7	10.9	189	472
1/15/97	1455	26,200	0.7	11.2	275	688

Fall River near Squirrel, ID

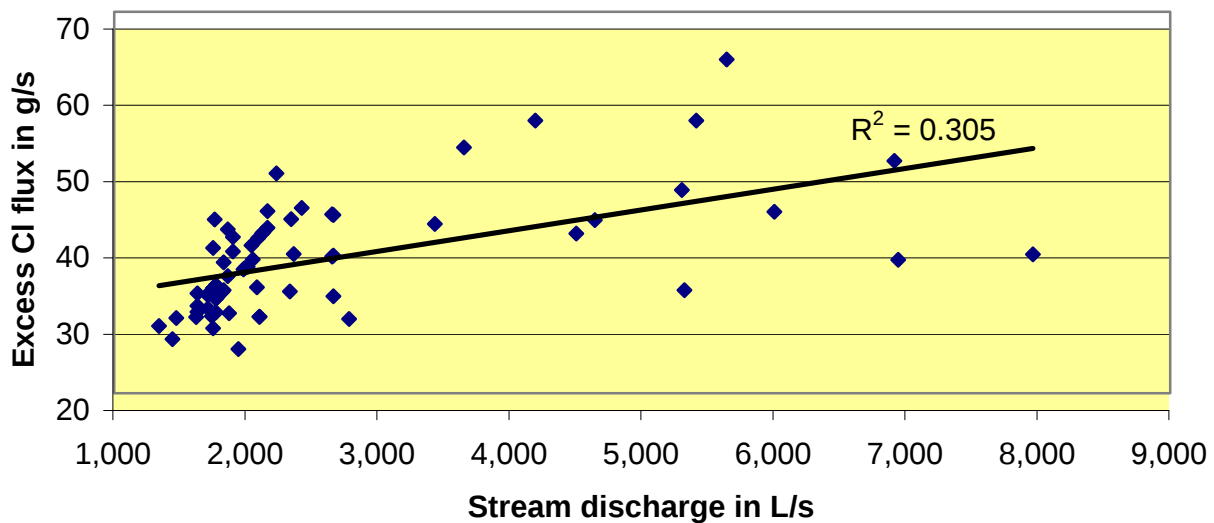
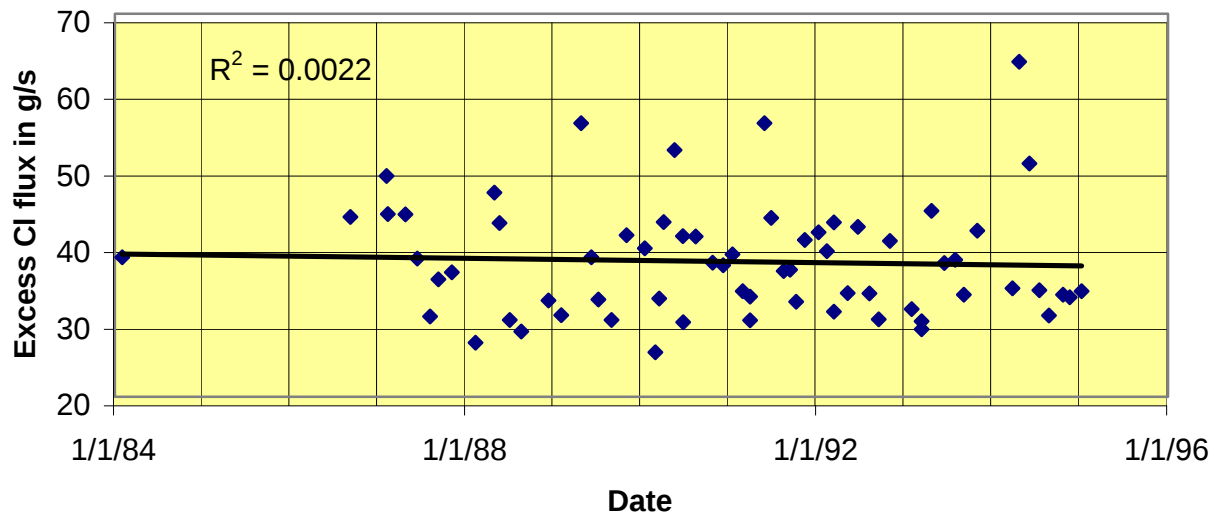
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
1/22/97	1300	15,500	0.7	12.3	180	450
2/11/97	1402	12,900	0.7	13.2	161	403
3/5/97	1640	11,800	0.7	13.5	151	378
3/19/97	1531	13,200	0.7	13.1	164	409
4/4/97	1115	15,900	0.7	12.2	183	457
4/8/97	1745	15,200	0.7	12.3	176	441
4/11/97	1030	14,400	0.7	12.7	173	432
4/15/97	1620	15,700	0.7	11.7	173	432
4/24/97	1040	46,700	0.7	7.3	308	771
5/1/97	1200	50,700	0.7	6.1	274	684
5/6/97	816	63,100	0.7	5.1	278	694
5/13/97	2003	112,000	0.7	2.6	213	532
5/20/97	1000	126,000	0.7	2.2	189	473
5/27/97	845	99,700	0.7	2.3	160	399
6/3/97	1654	134,000	0.7	2.0	174	436
6/10/97	820	127,000	0.7	1.9	152	381
6/17/97	1130	112,000	0.7	2.1	157	392
6/24/97	1633	88,300	0.7	2.6	168	419
7/1/97	1315	75,600	0.7	3.8	234	586
7/9/97	1610	70,800	0.7	4.4	262	655
7/15/97	1605	52,500	0.7	4.5	200	499
7/29/97	1453	41,300	0.7	3.9	132	330
8/5/97	1106	39,900	0.7	5.2	180	449
8/19/97	1336	34,000	0.7	5.4	160	400
8/22/97	1230	32,800	0.7	6.7	197	492
9/16/97	830	32,300	0.7	4.8	132	331
10/1/97	1200	22,500	0.7	7.7	158	394
10/17/97	1735	22,800	0.7	9.7	205	513
11/12/97	745	22,700	0.7	9.0	188	471
12/17/97	1655	15,600	0.7	10.8	158	394
1/14/98	1615	15,400	0.7	11.1	160	400
2/10/98	825	14,700	0.7	12.3	171	426
3/3/98	830	13,900	0.7	12.4	163	407
3/24/98	910	21,900	0.7	10.4	212	531
4/4/98	1810	17,000	0.7	10.6	168	421
4/14/98	1815	16,300	0.7	12.0	184	460
4/28/98	820	33,100	0.7	9.1	278	695
5/5/98	2030	85,200	0.7	3.1	204	511
5/13/98	845	71,900	0.7	3.7	216	539
5/19/98	745	55,200	0.7	4.5	210	524
5/26/98	1140	66,800	0.7	3.1	160	401
6/9/98	850	63,400	0.7	3.3	165	412
6/16/98	620	82,700	0.7	3.4	223	558
6/23/98	906	61,700	0.7	3.3	160	401
6/30/98	1025	67,100	0.7	2.9	148	369
7/7/98	1040	73,300	0.7	2.5	132	330
7/14/98	835	50,700	0.7	2.5	91	228

Fall River near Squirrel, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/28/98	725	29,200	0.7	2.8	61	153
8/4/98	1227	25,200	0.7	6.0	134	334
8/11/98	738	22,300	0.7	6.6	132	329
8/18/98	755	23,500	0.7	8.1	174	435
9/1/98	710	19,300	0.7	6.8	118	294
9/15/98	1850	18,100	0.7	8.4	139	348
10/1/98	1515	18,500	0.7	8.0	135	338
10/22/98	940	15,900	0.7	9.7	143	358
11/19/98	1650	16,300	0.7	9.3	140	350
12/10/98	750	21,200	0.7	9.5	187	466
1/14/99	1030	13,300	0.7	12.1	152	379
2/18/99	920	12,700	0.7	12.5	150	375
3/11/99	1705	11,900	0.7	12.0	134	336
3/25/99	810	14,200	0.7	11.4	152	380
4/1/99	535	13,300	0.7	11.7	146	366
4/15/99	1040	14,000	0.7	12.5	165	413
4/22/99	1810	19,300	0.7	8.8	156	391
5/6/99	1555	35,700	0.7	5.9	186	464
5/13/99	805	39,900	0.7	5.9	207	519
5/20/99	745	47,900	0.7	3.8	148	371
5/27/99	745	116,000	0.7	1.9	139	348
6/3/99	1830	115,000	0.7	2.1	161	403
6/10/99	1650	77,600	0.7	2.5	140	349
6/24/99	1530	86,900	0.7	2.1	122	304
7/15/99	910	41,300	0.7	3.2	103	258
8/5/99	910	25,600	0.7	5.8	131	326
8/19/99	1850	24,100	0.7	5.2	108	271
9/9/99	745	22,100	0.7	7.0	139	348
9/23/99	745	22,100	0.7	7.5	150	376
		30176 26543		9.4	175 41 499	Mean Std. Deviation No. Samples

Boundary Creek near Bechler Ranger Station, WY

Boundary Creek near Bechler Ranger Station, WY; captures the discharge from Upper and Middle Boundary Creek, Silver Scarf, and Three Rivers thermal areas. Sampled and gaged near lat. 44 deg. 11 min. 09 sec. N, long. 111 deg. 00 min. 19 sec. W, USGS streamgaging station 13046680. Most water samples were "integrated" samples collected across the width of the stream. Most chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979). It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. The data compiled here are from Friedman and others (1993) and the USGS archives <<http://water.usgs.gov/nwis>>.



Boundary Creek near Bechler Ranger Station, WY

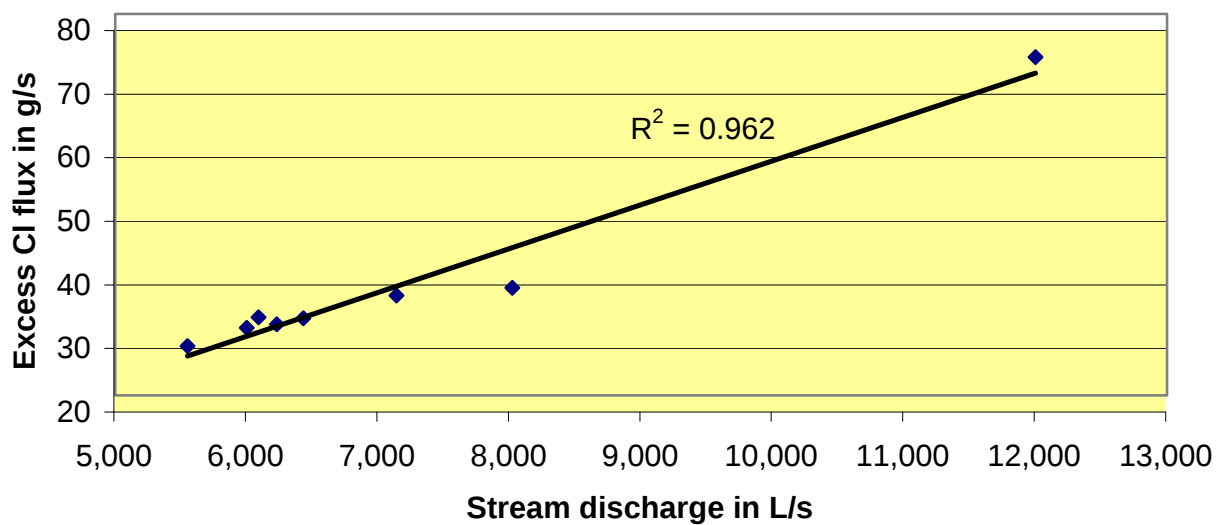
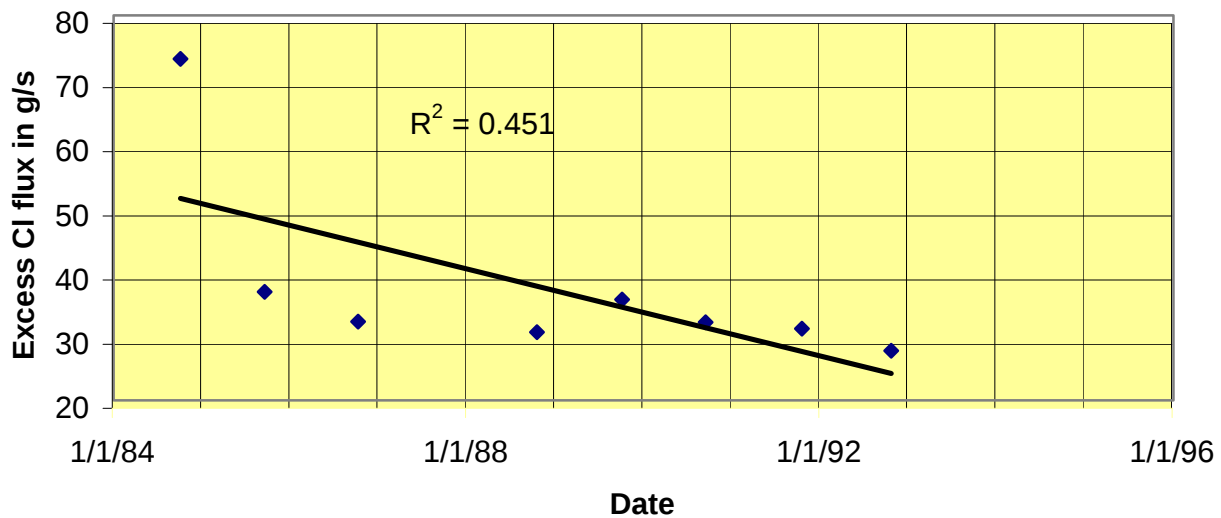
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
1/31/84		2,360	0.7	16.9	38.2	96
9/7/86		2,650	0.7	17.1	43.5	109
2/5/87		2,230	0.7	22.6	48.8	122
2/10/87	1150	2,160	0.7	21	43.8	110
4/24/87	1403	6,000	0.7	8	43.8	110
6/12/87	1141	2,660	0.7	15	38.0	95
8/5/87	1326	1,870	0.7	17	30.5	76
9/9/87		1,860	0.7	19.7	35.3	88
11/3/87	1150	1,980	0.7	19	36.2	91
2/10/88		1,440	0.7	19.5	27.1	68
4/29/88	1202	5,300	0.7	9.5	46.6	117
5/20/88	1102	4,640	0.7	9.9	42.7	107
7/1/88	1200	2,100	0.7	15	30.0	75
8/18/88	1200	1,750	0.7	17	28.5	71
12/9/88	1255	1,780	0.7	19	32.6	81
2/1/89		1,630	0.7	19.5	30.6	77
4/25/89	1235	4,190	0.7	14	55.7	139
6/6/89	1150	7,960	0.7	5.5	38.2	96
7/6/89	1205	2,660	0.7	13	32.7	82
8/29/89	1345	2,100	0.7	15	30.0	75
10/30/89	1235	2,130	0.7	20	41.1	103
1/15/90	1250	2,040	0.7	20	39.4	98
2/27/90	1155	1,940	0.7	14	25.8	65
3/15/90		1,710	0.7	19.9	32.8	82
4/3/90	1100	2,340	0.7	19	42.8	107
5/18/90	1400	3,650	0.7	15	52.2	130
6/22/90	1005	4,500	0.7	9.8	41.0	102
6/23/90		2,780	0.7	11.4	29.7	74
8/14/90	1155	2,120	0.7	20	40.9	102
10/24/90	905	2,050	0.7	19	37.5	94
12/7/90	1205	1,830	0.7	21	37.1	93
1/15/91	1450	1,900	0.7	21	38.6	96
2/26/91	1050	1,750	0.7	20	33.8	84
3/28/91	945	1,630	0.7	21	33.1	83
3/28/91		1,620	0.7	19.2	30.0	75
5/28/91	1205	5,410	0.7	11	55.7	139
6/25/91	1010	2,660	0.7	17	43.4	108
8/16/91	1125	1,990	0.7	19	36.4	91
9/11/91		2,010	0.7	18.9	36.6	91
10/7/91	1140	1,770	0.7	19	32.4	81
11/12/91	1220	1,900	0.7	22	40.5	101
1/7/92	1055	1,860	0.7	23	41.5	104
2/11/92	1240	1,750	0.7	23	39.0	98
3/12/92	1500	1,760	0.7	25	42.8	107
3/12/92		1,710	0.7	18.9	31.1	78
5/8/92	1125	5,320	0.7	7	33.5	84
6/19/92	1030	3,430	0.7	13	42.2	105

Boundary Creek near Bechler Ranger Station, WY

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/7/92	1050	1,830	0.7	19	33.5	84
9/14/92	1230	1,740	0.7	18	30.1	75
10/30/92	955	2,090	0.7	20	40.3	101
1/29/93		1,630	0.7	20	31.5	79
3/12/93	1430	1,470	0.7	21	29.8	75
3/12/93		1,340	0.7	22.2	28.8	72
4/22/93	1245	2,420	0.7	19	44.3	111
6/14/93	1121	6,940	0.7	6.1	37.5	94
7/30/93	1145	2,650	0.7	15	37.9	95
9/3/93	1200	2,330	0.7	15	33.3	83
10/29/93	1140	2,160	0.7	20	41.7	104
3/25/94	1010	1,770	0.7	20	34.2	85
4/22/94	926	5,640	0.7	12	63.7	159
6/3/94	1101	6,910	0.7	8	50.4	126
7/15/94	1245	2,080	0.7	17	33.9	85
8/24/94	1135	1,770	0.7	18	30.6	77
10/21/94	1208	1,820	0.7	19	33.3	83
11/18/94	1330	1,710	0.7	20	33.0	83
1/6/95	1200	1,750	0.7	20	33.8	84
		2650 1508		17.1	37.7 7.4 66	Mean Std. Deviation No. Samples

Warm River, ID

Warm River, ID; captures discharge from the Crescent Ridge thermal area. Gaged and sampled at lat. 44 deg. 06 min. 52 sec. N, long. 111 deg. 19 min. 26 sec. W, USGS streamgaging station 13044500. Water samples were "grab" samples collected at a single point near the stream bank. Chloride (Cl) determinations were made at the USGS National Water-Quality Laboratory with a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979). It seems reasonable to assume a "background" Cl value of about 0.7 mg/L, independent of thermal sources, due to rock weathering (~0.5 mg/L) and precipitation (~0.2 mg/L) (Norton and Friedman, 1991). Fournier's (1989) value of 400 mg/L for an "end-member deep thermal water" is used to convert the Cl flux to a hot-spring discharge. The data compiled here are from Friedman and others (1993).

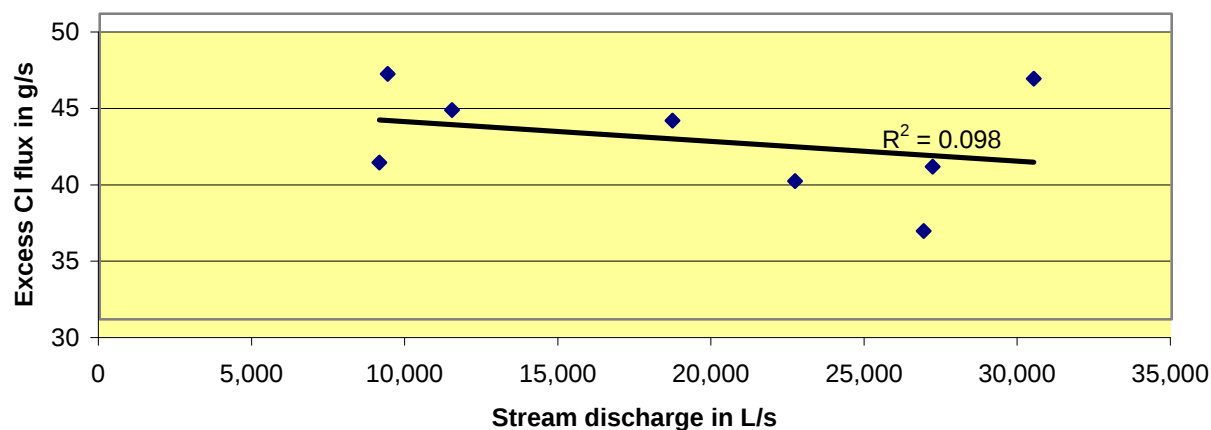
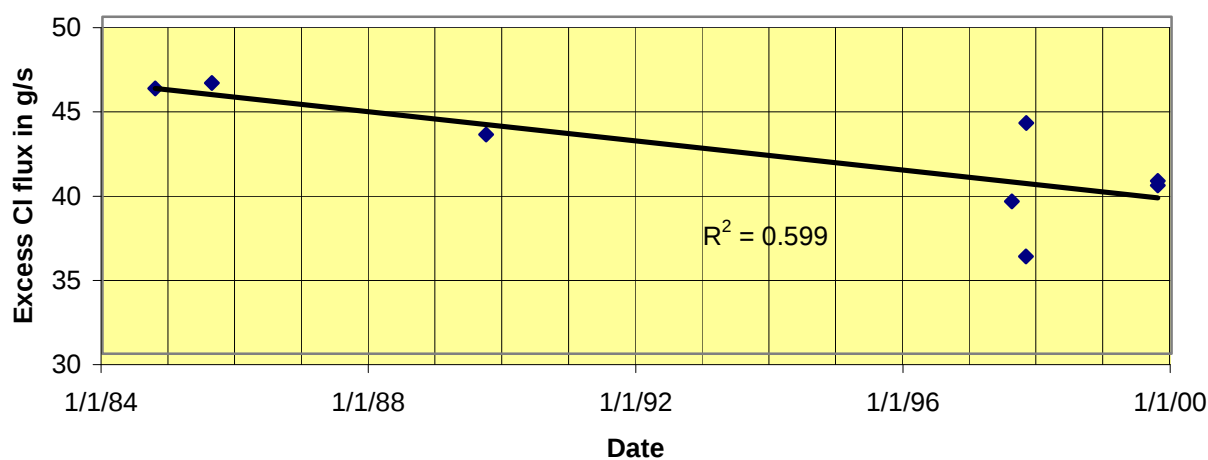


Warm River, ID

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/3/84		12,000	0.7	6.8	73.2	183
9/17/85		8,020	0.7	5.3	36.9	92
10/8/86		6,090	0.7	6.0	32.3	81
10/17/88		6,000	0.7	5.8	30.6	77
10/4/89		7,140	0.7	5.7	35.7	89
9/14/90		6,430	0.7	5.7	32.2	80
10/17/91		6,230	0.7	5.7	31.2	78
10/21/92		5,550	0.7	5.7	27.8	69
		7183 2092		5.8	37.5 14.7 8	Mean Std. Deviation No. Samples

Clackamas River near Three Lynx, OR

Clackamas River near Three Lynx, OR; captures the discharge from Austin Hot Springs, the largest high-chloride hot spring in the Cascade Range. Gaged and sampled at two sites: (1) above Three Lynx Creek, lat. 45 deg. 07 min. 30 sec. N, long. 122 deg. 04 min. 20 sec. W, USGS streamgaging station 14209500 and (2) near the confluence with the Collawash River, approx. lat. 45 deg. 01 min. 55 sec. N, long. 122 deg. 03 min. 25 sec. W. Water samples were "grab" samples collected at a single point near the stream bank. Chloride values at the Collawash are probably more reliable, because the Three Lynx site is just below a significant power-plant inflow and the River may not be thoroughly mixed. In the 1980s Cl determinations were made by a modified thiocyanate-spectrophotometric method (Skoustad and others, 1979) at the USGS National Water-Quality Laboratory and with a colorimetric method at the USGS labs in Menlo Park, California; in the 1990s, Cl determinations were made by ion chromatography at the USGS labs in Menlo Park. Because both "background" and "downstream" Cl concentrations are low in the Cascade Range, the accuracy of the Cl determinations is critical. Most of the "background" values are grab samples made near Big Bottom, lat. 45 deg. 01 min. 00 sec. N, long. 121 deg. 55 min. 10 sec. W, USGS streamgaging station 14208000. The background values for 1985 and 1989 are estimates. The Cl flux is converted to a hot-spring discharge by assuming a Cl value of 390 mg/L -- the approximate value at Austin Hot Springs -- for the thermal water. The data compiled here are from Ingebritsen and others (1994) and the USGS archives in Menlo Park, California.

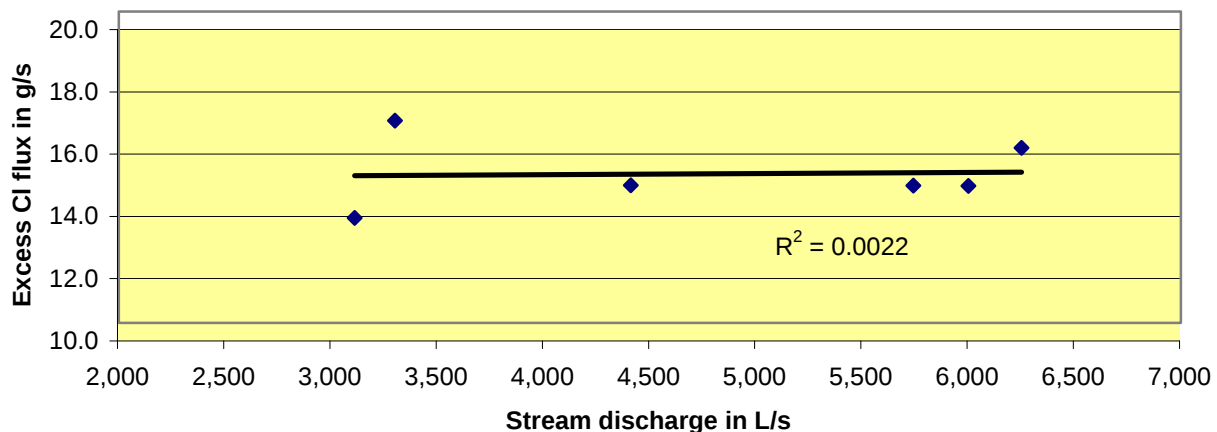
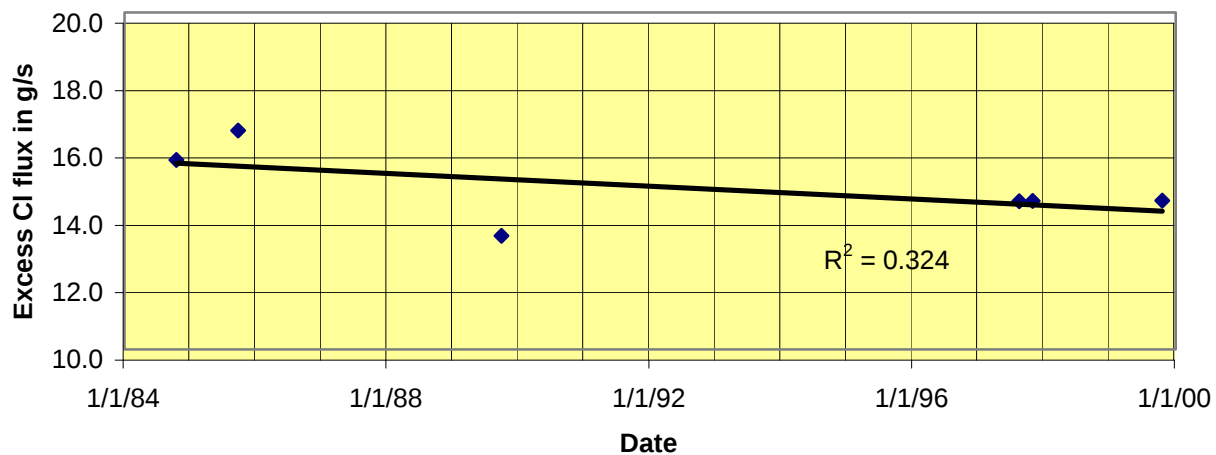


Clackamas River near Three Lynx, OR

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s	
10/16/84		30,500	0.7	2.2	46	117	3 Lynx
8/15/85		9,400	0.6	5.5	46	118	Collawash
9/28/89		18,700	0.6	2.9	43	110	Collawash
8/12/97	1120	22,700	0.58	2.30	39	100	3 Lynx
10/27/97	1625	26,900	0.60	1.93	36	92	3 Lynx
10/28/97	1040	11,500	0.60	4.40	44	112	Collawash
10/18/99	1445	27,200	0.59	2.06	40	103	3 Lynx
10/18/99	1555	9,130	0.59	5.00	40	103	Collawash
		19504 8615		3.29	42 3.6 8	Mean Std. Deviation No. Samples	

Breitenbush River above French Creek near Detroit, OR

Breitenbush River above French Creek near Detroit, OR; captures the discharge from Breitenbush Hot Springs. Sampled at several sites during the 1980s (see Ingebritsen and others, 1994) and at lat. 44 deg. 45 min. 10 sec. N, long. 122 deg. 07 min. 40 sec. W, USGS streamgaging station 14179000 during the 1990s. Gaged at station 14179000 during both 1980s and 1990s. Water samples were "grab" samples collected at a single point near the stream bank. In the 1980s chloride determinations were made by a modified thiocyanate-spectrophotometric method at the USGS National Water-Quality Laboratory and with a colorimetric method at the USGS labs in Menlo Park, California; in the 1990s, Cl determinations were made by ion chromatography at the USGS labs in Menlo Park. Because both "background" and "downstream" Cl concentrations are low in the Cascade Range, the accuracy of the Cl determinations is critical. Most of the "background" values are grab samples made near the Breitenbush Guard Station, approx. lat. 44 deg. 46 min. 52 sec. N, long. 121 deg. 57 min. 59 sec. W. The background values for 1985 and 1989 are estimates. The Cl flux is converted to a hot-spring discharge by assuming a Cl value of 1,150 mg/L -- the approximate value at Breitenbush Hot Springs -- for the thermal water. The data compiled here are from Ingebritsen and others (1994) and the USGS archives in Menlo Park, California.

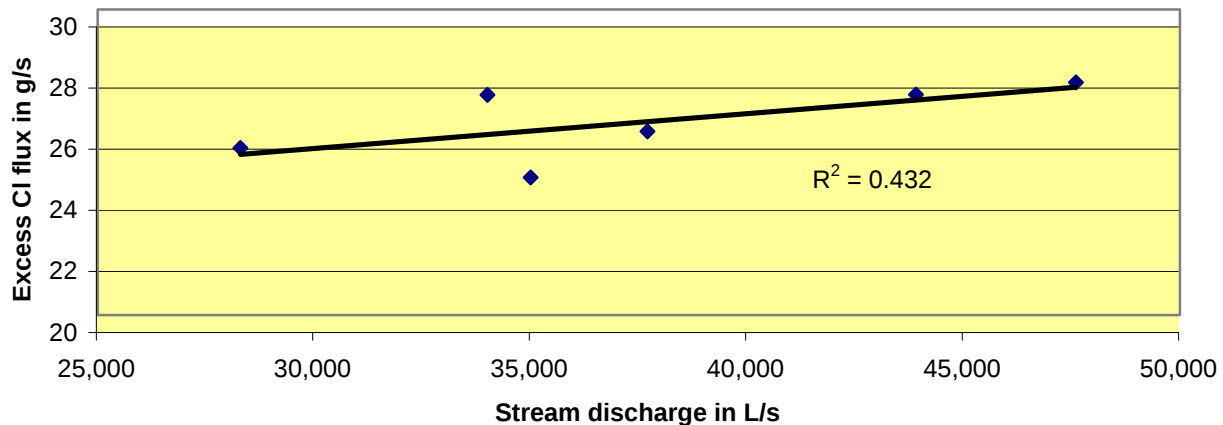
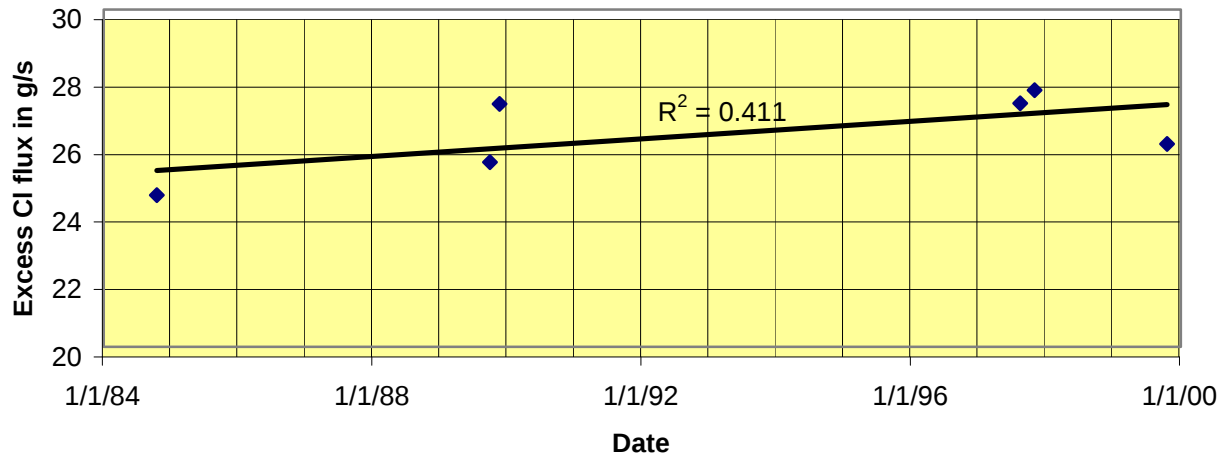


Breitenbush River above French Creek near Detroit, OR

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/16/84		6,250	0.4	2.9	15.6	13.6
9/24/85		3,300	0.4	5.4	16.5	14.3
9/27/89		3,110	0.4	4.7	13.4	11.6
8/14/97		6,000	0.40	2.80	14.4	12.5
10/28/97	1400	5,740	0.49	3.00	14.4	12.5
10/19/99	830	4,410	0.43	3.70	14.4	12.5
		4802 1392		3.75	14.8 1.1 6	Mean Std. Deviation No. Samples

McKenzie River at McKenzie Bridge, OR

McKenzie River at McKenzie Bridge, OR; captures the discharge from Bigelow and Belknap Hot Springs. Sampled and gaged at lat. 44 deg. 10 min. 45 sec. N, long. 122 deg. 07 min. 45 sec. W, USGS streamgaging station 14159000. Water samples were "grab" samples collected at a single point near the stream bank. In the 1980s chloride determinations were made by a modified thiocyanate-spectrophotometric method at the USGS National Water-Quality Laboratory and with a colorimetric method at the USGS labs in Menlo Park, California; in the 1990s, Cl determinations were made by ion chromatography at the USGS labs in Menlo Park. Because both "background" and "downstream" Cl concentrations are low in the Cascade Range, the accuracy of the Cl determinations is critical. Most of the "background" values are grab samples made below the confluence with Deer Creek, approx. lat. 44 deg. 14 min. 21 sec. N, long. 122 deg. 03 min. 25 sec. W. The background value for 9/26/89 is an estimate. The Cl flux is converted to a hot-spring discharge by assuming a Cl value of 1,200 mg/L -- the approximate value at Bigelow and Belknap Hot Springs -- for the thermal water. The data compiled here are from Ingebritsen and others (1994) and the USGS archives in Menlo Park, California.

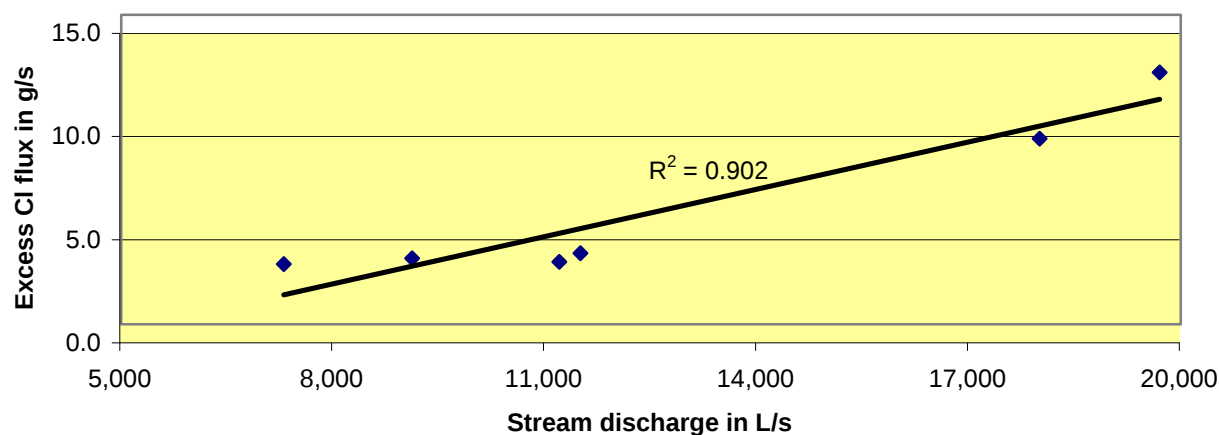
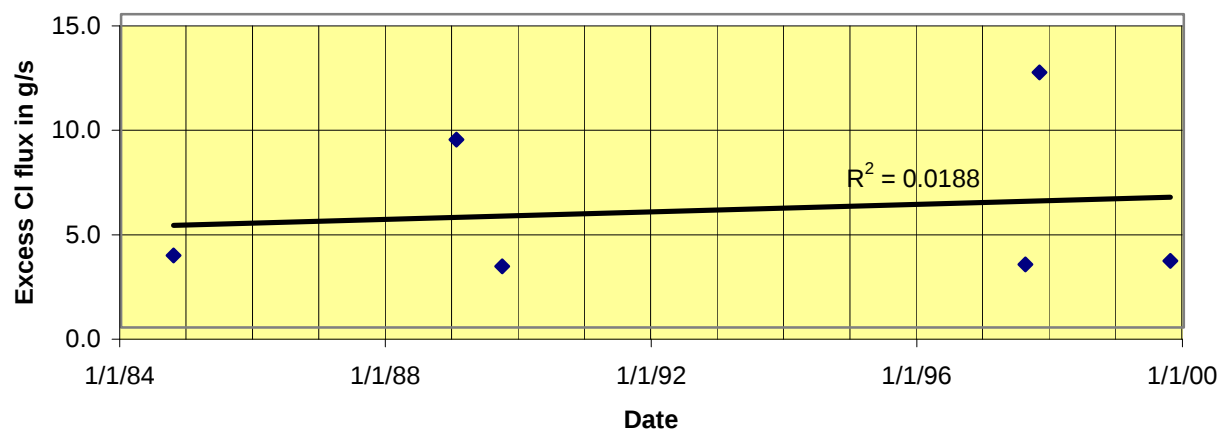


McKenzie River at McKenzie Bridge, OR

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/15/84		35,000	0.7	1.4	25	20
9/26/89		28,300	0.7	1.6	25	22
11/17/89		34,000	0.8	1.6	27	24
8/13/97	1120	43,900	0.70	1.32	27.2	23.7
10/29/97	1240	47,600	0.71	1.29	27.6	24.0
10/19/99	1330	37,700	0.72	1.41	26.0	22.6
		37750 7011		1.44	26.3 1.2 6	Mean Std. Deviation No. Samples

Horse Creek near McKenzie Bridge, OR

Horse Creek near McKenzie Bridge, OR; captures the discharge from Foley Hot Springs. Sampled and gaged at lat. 44 deg. 09 min. 48 sec. N, long. 122 deg. 03 min. 32 sec. W, USGS streamgaging station 14159100. Water samples were "grab" samples collected at a single point near the stream bank. In the 1980s chloride (Cl) determinations were made by a modified thiocyanate-spectrophotometric method at the USGS National Water-Quality Laboratory and by a colorimetric method at the USGS labs in Menlo Park, California; in the 1990s, Cl determinations were made by ion chromatography at the USGS labs in Menlo Park. Because both "background" and "downstream" Cl concentrations are low in the Cascade Range, the accuracy of the Cl determinations is critical. Most of the "background" values are grab samples made below the confluence with Separation Creek -- itself a significant Cl source -- at approx. lat. 44 deg. 09 min. 07 sec. N, long. 122 deg. 04 min. 33 sec. W. The background value for 1984 is an estimate. The Cl flux is converted to a hot-spring discharge by assuming a Cl value of 1,330 mg/L -- the approximate value at Foley Hot Springs -- for the thermal water. Foley Hot Springs is located on a hillside about 0.5 km south of Horse Creek. The unusually large variability in the excess Cl flux is probably due in part to the large distance between the Hot Spring and the gaged stream, and in part to the relatively small difference between the background and downstream Cl values. The data compiled here are from Ingebritsen and others (1994) and the USGS archives in Menlo Park, California.

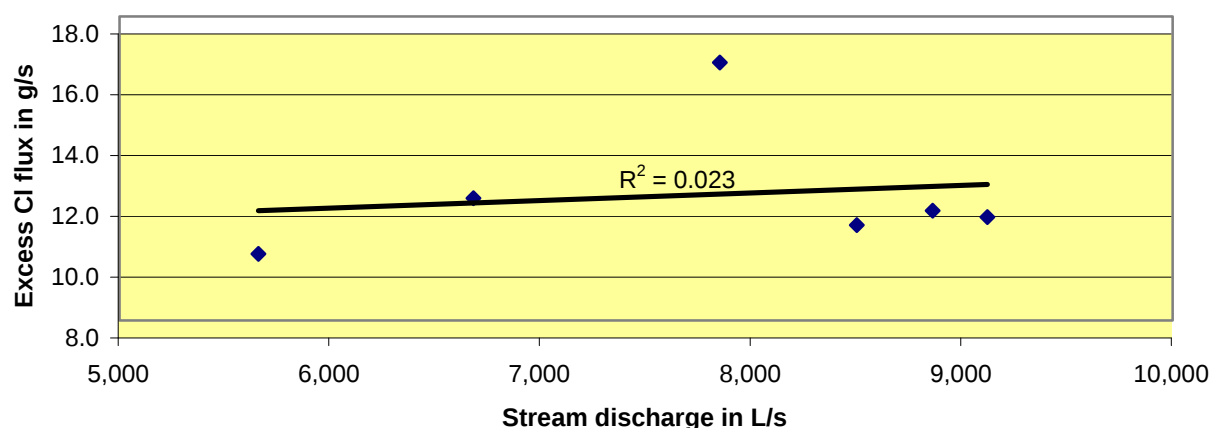
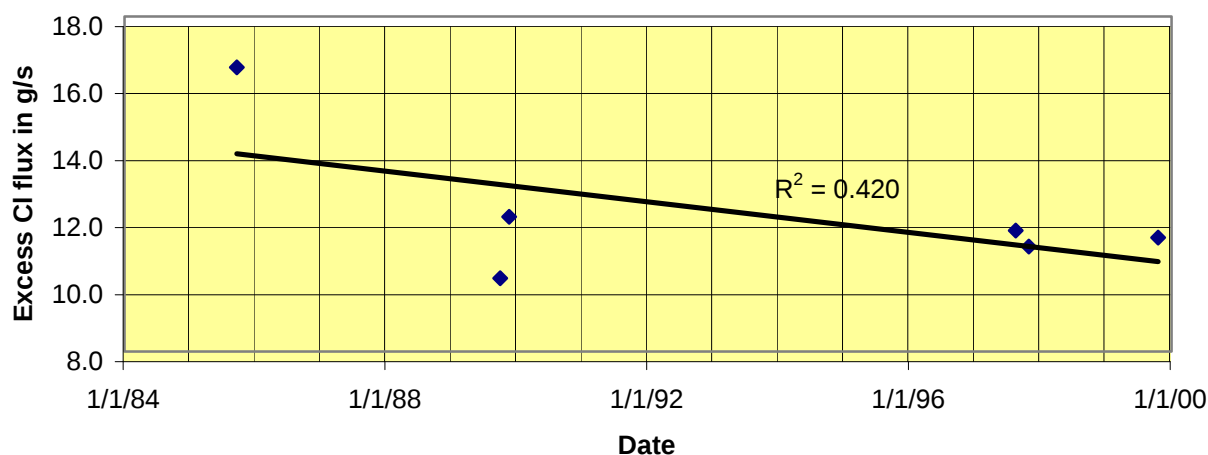


Horse Creek near McKenzie Bridge, OR

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/15/84		11,500	1.6	1.9	3.5	2.6
1/19/89		18,000	1.4	1.9	9.0	6.8
9/26/89		7,300	1.9	2.3	2.9	2.2
8/13/97	1415	11,200	1.59	1.86	3.0	2.3
10/29/97	1450	19,700	1.38	2.00	12.2	9.2
10/19/99	1610	9,120	1.65	2.00	3.2	2.4
		12803 4954		2.0	5.6 4.0 6	Mean Std. Deviation No. Samples

Warm Springs River near Kahneeta Hot Springs, OR

Warm Springs River near Kahneeta Hot Springs, OR; captures the discharge from Kahneeta Hot Springs. Sampled and gaged at lat. 44 deg. 51 min. 24 sec. N, long. 121 deg. 08 min. 55 sec. W, USGS streamgaging station 14097100. Water samples were "grab" samples collected at a single point near the stream bank. In the 1980s chloride (Cl) determinations were made by a modified thiocyanate-spectrophotometric method at the USGS National Water-Quality Laboratory and by a colorimetric method at the USGS labs in Menlo Park, California; in the 1990s, Cl determinations were made by ion chromatography at the USGS labs in Menlo Park. Because both "background" and "downstream" Cl concentrations are low in the Cascade Range, the accuracy of the Cl determinations is critical. Most of the "background" values are grab samples made near the fish hatchery at approx. lat. 44 deg. 51 min. 35 sec. N, long. 121 deg. 14 min. 50 sec. W. The background value for 9/27/89 is an estimate. The Cl flux is converted to a hot-spring discharge by assuming a Cl value of 232 mg/L -- the approximate value at Kahneeta Hot Springs -- for the thermal water. The data compiled here are from Ingebritsen and others (1994) and the USGS archives in Menlo Park, California.

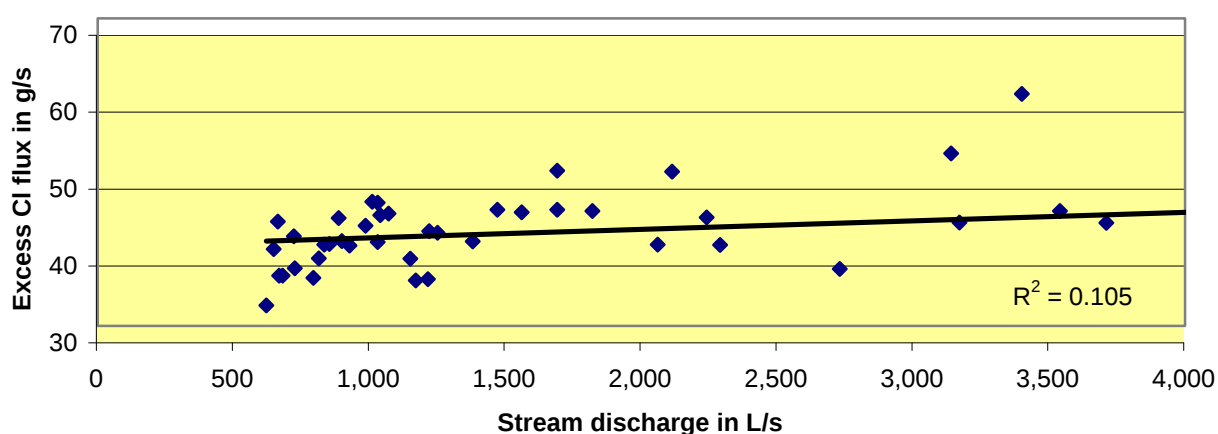
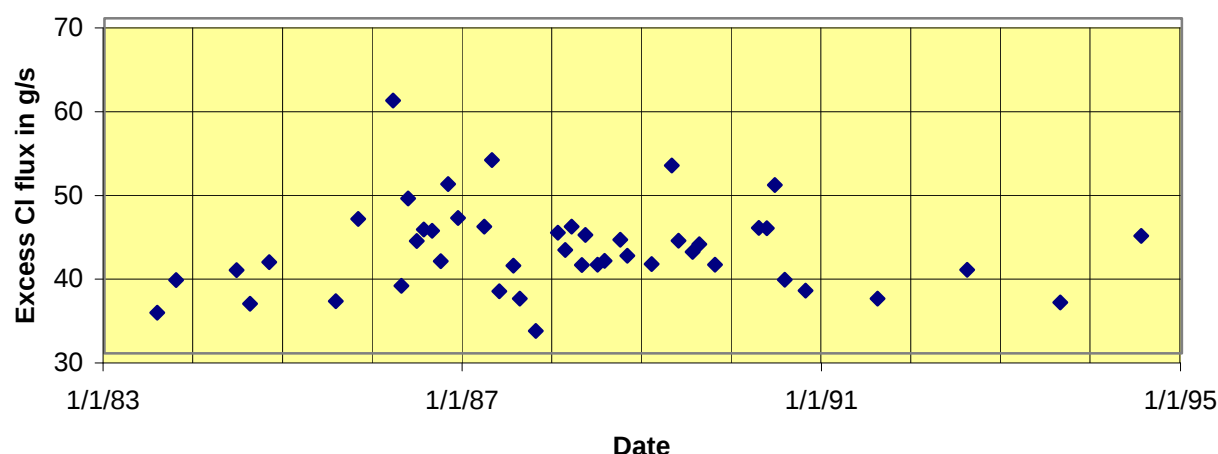


Warm Springs River near Kahneeta Hot Springs, OR

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
9/19/85		7,850	0.5	2.6	16.5	71.1
9/27/89		5,660	0.8	2.6	10.2	43.9
11/17/89		6,680	0.9	2.7	12.0	51.8
8/14/97	1715	8,860	0.79	2.10	11.6	50.0
10/27/97	920	8,500	0.84	2.15	11.1	48.0
10/18/99	1130	9,120	0.85	2.10	11.4	49.1
		7778 1356		2.38	12.1 2.2 6	Mean Std. Deviation No. Samples

Mill Creek near Mineral, CA

Mill Creek near Mineral, CA, at Highway 36, about 6.5 km south of the Lassen National Park boundary; captures most of the identified thermal-liquid discharge from the Lassen hydrothermal system. Gaged and sampled at lat. 40 deg. 21 min. 33 sec. N, long. 121 deg. 30 min. 10 sec. W, USGS streamgaging station 11381000. Water samples were "integrated" samples collected across the width of the stream. Chloride (Cl) determinations were made at several labs by colorimetric methods, with intercomparison of results, as described by Sorey and others (1994). It seems reasonable to assume a "background" Cl value of about 0.3 mg/L, independent of thermal sources, based on the data reported by Paulson and Ingebritsen (1991). The chloride flux is converted to a hot-spring discharge by assuming a Cl value of 2,400 mg/L -- the approximate value at Growler and Morgan Hot Springs -- for the thermal water. Some thermal water from the Morgan Hot Springs area bypasses the gaging/sampling site via a tributary of Mill Creek (Sorey and others, 1994). The data compiled here are from Sorey and others (1994) and the USGS archives in Menlo Park, California.



Mill Creek near Mineral, CA

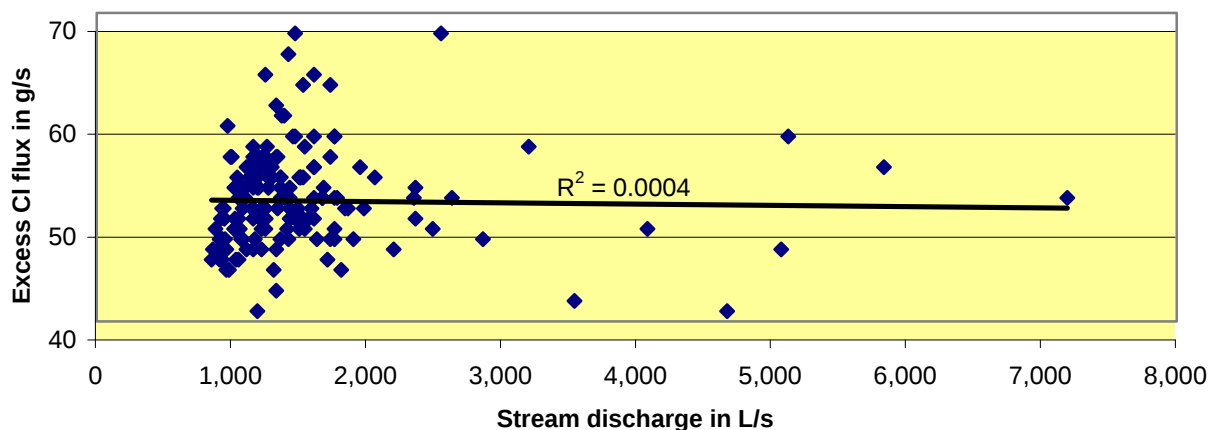
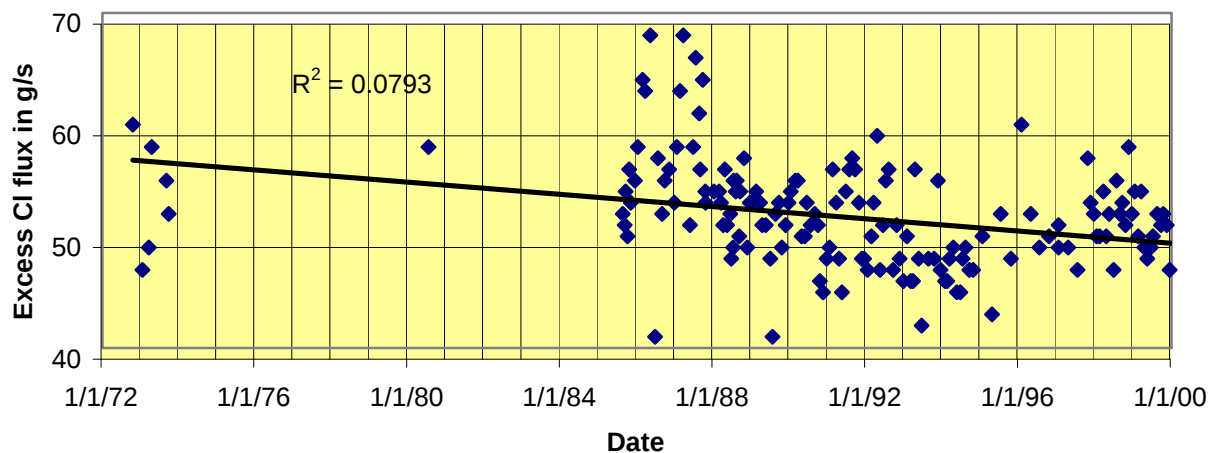
DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
8/4/83		4,840	0.3	7.5	35	15
10/20/83		1,150	0.3	34	39	16
6/21/84		4,870	0.3	8.5	40	17
8/15/84		1,170	0.3	31	36	15
11/1/84		1,030	0.3	40	41	17
7/30/85		793	0.3	46	36	15
10/29/85		1,030	0.3	45	46	19
3/20/86		3,400	0.3	18	60	25
4/23/86		5,440	0.3	7.3	38	16
5/21/86		6,830	0.3	7.4	48	20
6/25/86		3,710	0.3	12	43	18
7/23/86		1,560	0.3	29	45	19
8/26/86		1,070	0.3	42	45	19
9/30/86		1,380	0.3	30	41	17
10/30/86		1,690	0.3	30	50	21
12/10/86		1,010	0.3	46	46	19
3/26/87		1,470	0.3	31	45	19
4/27/87		5,470	0.3	10	53	22
5/27/87		2,730	0.3	14	37	16
7/22/87		926	0.3	44	40	17
8/18/87		668	0.3	55	37	15
10/22/87		620	0.3	53	33	14
1/20/88		1,040	0.3	43	44	19
2/18/88		1,220	0.3	35	42	18
3/15/88		1,690	0.3	27	45	19
4/26/88		2,290	0.3	18	41	17
5/10/88		2,240	0.3	20	44	18
6/29/88		2,060	0.3	20	41	17
7/27/88		898	0.3	46	41	17
9/29/88		663	0.3	66	44	18
10/28/88		722	0.3	58	42	17
2/4/89		852	0.3	48	41	17
4/27/89		3,140	0.3	17	52	22
5/24/89		3,170	0.3	14	43	18
7/20/89		1,250	0.3	34	42	18
8/17/89		985	0.3	44	43	18
10/20/89		833	0.3	49	41	17
4/16/90		3,540	0.3	13	45	19
5/18/90		1,820	0.3	25	45	19
6/20/90		2,113	0.3	24	50	21
7/30/90		813	0.3	48	39	16
10/23/90		725	0.3	52	37	16
8/12/91		680	0.3	54	37	15
8/10/92		648	0.3	62	40	17
8/24/93		1,215	0.3	30	36	15
7/20/94		886	0.3	50	44	18

Mill Creek near Mineral, CA

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
		2085 1529		31.4	42.8 5.2 46	Mean Std. Deviation No. Samples

Hot Creek at flume near Mammoth Lakes, CA

Hot Creek at flume near Mammoth Lakes, CA; captures thermal discharge from numerous hot springs in and adjacent to an approximately 1-km-long reach of Hot Creek. Gaged and sampled at lat. 37 deg. 40 min. 08 sec. N, long. 118 deg. 49 min. 00 sec. W, USGS streamgaging station 10265150. Earlier (pre-1987) water samples were "grab" samples collected at a single point in midstream; samples collected from 1987 on were "integrated" samples collected across the width of the stream. Chloride (Cl) determinations were made at the Los Angeles Department of Water and Power laboratories (1972-73), the USGS National Water-Quality Laboratory (1980-), and the USGS laboratories in Ocala, Florida, (1980-) and Menlo Park, California (1994-96) by a variety of methods. The "background" Cl values are from grab or integrated samples obtained at or near lat. 37 deg. 39 min. 27 sec. N., long. 118 deg. 49 min. 54 sec. W, USGS streamgaging station 10265147. At this site Cl values are already affected by input from thermal springs west of the Hot Creek Gorge. The Cl flux is converted to a hot-spring discharge by assuming a Cl value of 220 mg/L -- the approximate value in the Hot Creek Gorge hot springs -- for the thermal water. The data compiled here are from Eccles (1976), Sorey and Clark (1981), Farrar and others (1987, 1989), Howle and Farrar (1996), and the USGS archives in Carnelian Bay, California, and Menlo Park, California.



Hot Creek at flume near Mammoth Lakes, CA

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
10/17/72		1,390	3.9	47	60	272
1/17/73		1,220	7.3	46	47	215
3/21/73		1,220	4.6	45	49	224
4/17/73		1,760	13	46	58	264
9/5/73		1,610	4.1	38	55	248
9/25/73		1,610	3.6	36	52	237
7/17/80		5,122	2.6	14	58	265
8/16/85		1,362	5.9	44	52	236
9/4/85		1,340	7.6	46	51	234
9/13/85		1,362	7.0	47	54	248
10/3/85		1,252	7.9	48	50	228
10/19/85		1,252	6.5	51	56	253
11/1/85		1,274	6.3	48	53	241
12/13/85		1,297	7.8	50	55	249
1/9/86		1,453	7.1	47	58	264
2/24/86		1,610	3.1	43	64	292
3/20/86		1,730	9.6	46	63	286
5/8/86		2,550	7.3	34	68	309
6/23/86		4,670	4.2	13	41	187
7/20/86		3,200	5.1	23	57	260
8/28/86		2,350	6.0	28	52	235
9/23/86		1,950	6.6	35	55	252
11/5/86		1,730	5.8	38	56	253
12/22/86		1,360	6.1	45	53	240
1/16/87		1,470	5.8	45	58	262
2/17/87		1,530	7.7	49	63	287
3/20/87		1,470	5.5	52	68	311
5/22/87		1,980	6.2	32	51	232
6/22/87		1,610	6.0	42	58	263
7/17/87		1,420	6.3	53	66	301
8/20/87		1,330	6.0	52	61	278
8/27/87		1,160	7.0	55	56	253
9/21/87		1,250	6.5	58	64	293
10/17/87		1,190	5.9	51	54	244
10/20/87		1,190	6.4	51	53	241
1/8/88		1,300	7.4	49	54	246
2/26/88		1,360	8.3	48	54	245
3/15/88		1,270	7.0	49	53	242
4/5/88		1,250	7.5	48	51	230
4/20/88		1,330	8.0	50	56	254
5/10/88		1,220	7.4	49	51	231
6/10/88		1,670	6.8	38	52	237
6/20/88		1,760	7.6	35	48	219
7/7/88		1,500	6.2	39	49	224
7/12/88		1,610	6.1	40	55	248
8/3/88		1,270	7.4	50	54	246
8/10/88		1,220	7.1	52	55	249

Hot Creek at flume near Mammoth Lakes, CA

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
9/6/88		1,160	6.8	50	50	228
9/13/88		1,160	6.8	53	54	244
10/19/88		1,160	7.2	56	57	257
11/21/88		1,250	7.0	46	49	222
12/14/88		1,080	7.0	56	53	241
1/9/89		1,100	8.7	57	53	242
2/15/89		1,130	7.6	55	54	243
3/21/89		1,160	7.0	53	53	243
4/12/89		1,220	6.5	48	51	230
5/16/89		1,590	6.1	38	51	231
6/27/89		1,420	7.4	41	48	217
7/19/89		1,190	7.4	42	41	187
8/15/89		1,100	7.6	55	52	237
9/19/89	1120	1,200	6.6	51	53	242
10/17/89	1330	1,020	7.1	55	49	222
11/21/89	1210	1,160	6.9	51	51	233
12/20/89	1200	1,025	7.2	59	53	241
1/10/90	1135	1,040	6.7	59	54	247
2/21/90	1200	1,110	6.8	56	55	248
3/20/90	1205	1,120	7.7	57	55	251
4/24/90	1700	920	7.6	62	50	227
5/25/90	1040	1,210	9.7	51	50	227
6/11/90	1630	1,680	7.6	39	53	240
7/18/90		1,080	9.5	57	51	233
8/28/90	1245	1,050	7.1	57	52	238
9/26/90	1055	940	7.8	62	51	232
10/17/90		930	9.2	59	46	211
11/15/90		960	9.7	57	45	206
12/19/90		910	9.9	63	48	220
1/17/91	1625	880	9.5	65	49	222
2/15/91	1205	1,000	9.4	65	56	253
3/21/91	1310	1,045	8.0	59	53	242
4/17/91	1115	950	10	60	48	216
5/16/91	1500	980	9.0	55	45	205
6/21/91	1035	2,060	5.9	32	54	244
7/23/91	1450	1,230	9.5	55	56	254
8/22/91	1325	1,260	8.4	54	57	261
9/18/91	1200	1,200	6.6	53	56	253
10/23/91		1,020	8.0	60	53	241
11/21/91		1,080	6.4	51	48	219
12/12/91		930	8.9	61	48	220
1/14/92	1550	960	8.8	58	47	215
2/20/92	1510	1,025	10	59	50	228
3/12/92	1340	1,040	11	62	53	241
4/16/92	1105	970	10	71	59	269
5/13/92	1540	1,330	6.7	42	47	213
6/9/92	1715	1,150	7.6	52	51	232

Hot Creek at flume near Mammoth Lakes, CA

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
7/8/92		1,160	6.9	54	55	248
8/4/92	1635	990	7.8	64	56	253
9/15/92	1555	860	8.2	63	47	214
10/21/92		930	7.6	62	51	230
11/17/92		930	7.3	59	48	219
12/23/92		850	8.4	62	46	207
1/27/93	935	945	9.2	62	50	227
3/2/93		910	9.4	60	46	209
3/24/93	1630	1,710	15	42	46	210
4/13/93	1520	1,340	8.9	51	56	256
5/20/93		2,860	4.1	21	48	220
6/15/93		3,540	3.1	15	42	191
7/14/93	1015	3,140	3.3	15	37	167
8/19/93	1730	1,630	8.7	38	48	217
9/8/93	1410	1,590	23	36	21	94
10/14/93		1,360	5.9	41	48	217
11/18/93		1,250	5.3	49	55	248
12/14/93		1,160	5.9	46	47	211
1/24/94		1,050	6.6	50	46	207
2/15/94	1530	1,030	6.6	51	46	208
3/10/94	1210	1,070	7.7	53	48	220
4/13/94	1140	1,060	7.5	54	49	224
5/18/94	1445	1,810	4.0	29	45	206
6/21/94	1545	1,310	6.6	41	45	205
7/13/94	1010	1,170	5.7	47	48	220
8/9/94	1615	1,020	5.9	54	49	223
9/14/94	1240	920	6.7	58	47	215
10/20/94		910	6.9	59	47	216
1/18/95	1605	1,050	8.0	56	50	229
4/19/95	1220	1,330	9.4	42	43	197
7/12/95		7,190	1.7	8.9	52	235
10/17/95		1,900	4.7	30	48	219
1/25/96	1235	1,370	6.4	50	60	272
4/24/96		1,670	4.7	36	52	238
7/17/96		2,490	3.3	23	49	223
10/17/96	1330	1,435	5.4	40	50	226
1/15/97	945	1,760	4.3	32	49	222
1/16/97		1,840	4.3	32.0	51	232
4/16/97	1015	1,540	4.7	36.4	49	222
7/16/97	1200	2,200	3.3	24.8	47	215
10/22/97		1,540	4.4	41.7	57	261
11/19/97		1,430	4.7	42.1	53	243
12/18/97		1,430	5.0	41.3	52	236
1/16/98	1215	1,610	5.5	36.7	50	228
2/12/98		1,430	5.7	40.5	50	226
3/19/98		1,500	5.7	42	54	248
4/17/98		1,530	7.0	40	50	230

Hot Creek at flume near Mammoth Lakes, CA

DATE mo/da/yr	TIME	STREAM- FLOW L/s	BACKGRND CHLORIDE mg/L	CHLORIDE DOWNSTREAM mg/L	EXCESS CHLORIDE g/s	HOT-SPRING DISCHARGE L/s
5/13/98		1,780	4.7	34	52	237
6/25/98		5,070	1.8	11	47	212
7/22/98		5,830	1.5	11.0	55	252
8/25/98		2,630	3.5	23.4	52	238
9/16/98	1125	2,360	3.7	26.0	53	239
10/16/98		1,860	4.4	31.6	51	230
11/18/98		1,760	4.9	37.9	58	264
12/17/98		1,760	4.8	34.5	52	238
1/13/99	1130	1,510	4.4	40.3	54	246
2/18/99		1,570	5.6	37.7	50	229
3/17/99		1,510	5.3	40.8	54	244
4/15/99	1440	1,410	4.9	40.0	49	225
5/13/99	1110	1,730	3.7	31.7	48	220
6/16/99		4,080	2.5	14.4	49	221
7/8/99	1130	2,360	2.1	23.2	50	226
8/17/99	1050	1,670	4.9	35.8	52	235
9/23/99		1,490	5.2	39.7	51	234
10/14/99		1,390	5.2	42.9	52	238
11/17/99		1,430	5.1	41.1	51	234
12/15/99		1,110	5.6	47.7	47	212
1/19/00		1,470	6.8	41	50	229
2/16/00		1,530	5.8	41	54	245
		1554 887		45.2	51.7 5.4 163	Mean Std. Deviation No. Samples