RESULTS OF HYDROLOGIC INVESTIGATIONS

WHITEROCKS STATE FISH HATCHERY, WHITEROCKS, UTAH

July 2003 through February 2005

The U.S. Geological Survey

in cooperation with

The Utah Division of Wildlife Resources

Summary of Investigations at the Whiterocks State Fish Hatchery

From July 2003 to March 2005, hydrologic and water-quality data were collected from springs, wells, and surface-water sites at and in the vicinity of the Whiterocks State Fish Hatchery. These sites included several springs that supply water to the hatchery, a shallow observation well drilled on the hatchery property, springs on the adjacent Ridley property, sites on the Uinta and Whiterocks Rivers, and sites on Farm Creek and Farm Creek canal. Data include results of analysis for major-ion chemistry including dissolved-solids concentrations, and isotopic analyses for oxygen-deuterium, sulfur-35, and tritium. Isotope analyses were used to help determine possible sources and age of the water from the hatchery springs. On the basis of results of major-ion analysis of the spring waters, water from all of the springs is a calcium-magnesium bicarbonate type. Water from the hatchery springs is very similar chemically, and likely originates from the same source(s). However, measurable but slight variations in specific conductance (a surrogate for dissolved-solids concentration) were noted from spring to spring, indicating variations in ground-water chemistry or along flowpaths prior to discharging.

Field measurements of water temperature and specific conductance also were made to help determine the relation (response) between flow of the hatchery springs and water that is used for irrigation north of the hatchery. Specific conductance of water from the hatchery springs generally ranged between 360 and 440 microsiemens/cm and temperature of water ranged between 10 and 12 degrees Celsius. Specific conductance of water used for irrigation however, is very low because it originates from the Whiterocks River. Values of specific conductance of the spring water show a weak inverse relation to discharge. The gradual increase in specific conductance with a decrease in discharge probably reflects an increasing component of older ground water to the springs. Likewise, a decrease in specific conductance with an increase in discharge suggests an input of lower dissolved-solids concentration water, such as that used for irrigation from Farm Creek canal.

Daily measurements of springflow at Whiterocks hatchery were obtained from records at the Division of Wildlife Resources. Stage measurements are taken at the large flume installed just below the outflow from the hatchery and converted to units of flow in cubic feet per second. Daily measurements of flow in Farm Creek canal were obtained from the Bureau of Indian Affairs in Ft. Duchesne. These values are obtained from stage measurements at a flume located a short distance downstream from where water is diverted into the canal from the Whiterocks River. Periodic measurements of flow using a pygmy meter also were taken at Farm Creek spring, Ridley spring, Farm Creek bridge (Elkhorn), and Farm Creek canal at the highway. These measurements were taken to determine the relations, if any, between flow and irrigation north of the hatchery and variations in springflow in the Whiterocks hatchery area.

A comparison also was made between flow in Farm Creek canal and variations in springflow at the hatchery during the 2003 and 2004 irrigation seasons. Water is lost through the bottom of the canal and is also parceled out to various water users immediately north of the hatchery for irrigation. The exact distribution of water from the canal to various parcels of land (in terms of time and location) in relation to effects on springflow is difficult to determine with accuracy. Nonetheless, there appears to be a delay or lag between flow in the canal (and hence, the amount used for irrigation) and changes in springflow at the hatchery. The response of the spring with respect to the period of peak flow, to the period of peak flow in the canal does not appear to be immediate and may be in the range of 1 to 2 months. A plot of springflow for the period January 2003 through May 2005 also indicates that peak springflow at the hatchery occurred in October 2003 and September 2004, substantially later than the snowmelt runoff period.

A dye-tracer study was conducted in 2004-2005 to determine the relation between water in a ditch immediately northwest of the hatchery and springs at the hatchery. All of the water in ditches north of the hatchery originates from the Whiterocks River via Farm Creek canal. Fluorescein dye was injected on August 13, 2004 about 3,000 feet north of the hatchery in a ditch that runs along the west side of the

hatchery. Streamflow in the ditch began to noticeably lose into the streambed just above the northern boundary of the hatchery and near an old log cabin that is located by the ditch. During the tracer test, two autosamplers were installed at the hatchery - one above the culvert (intake) to the hatchery in the stream just north of the monitoring wells, and one just above the large flume at the outflow from the hatchery. Samples also were collected manually from the outflow from the adjacent wetlands (Ridley spring) and from springs rising in the streambed of Farm Creek, farther to the west. In addition, activated charcoal samples for passive adsorption of the dye were placed in all of the springs.

Results of the tracer test indicate that no dye was recovered from any of the water samples from either of the autosamplers at the hatchery. In addition, none of the charcoal samples from the hatchery showed any indication of dye. Water and charcoal samples collected from Farm Creek spring also did not show any indication of dye. However, water samples and all of the charcoal samples collected from Ridley spring were positive. Dye was recovered on charcoal samples collected on 8/21, 8/29, 9/12 (peaked), and was still recovered on samples collected on February 28, 2005, although by this time, the spring had stopped flowing.

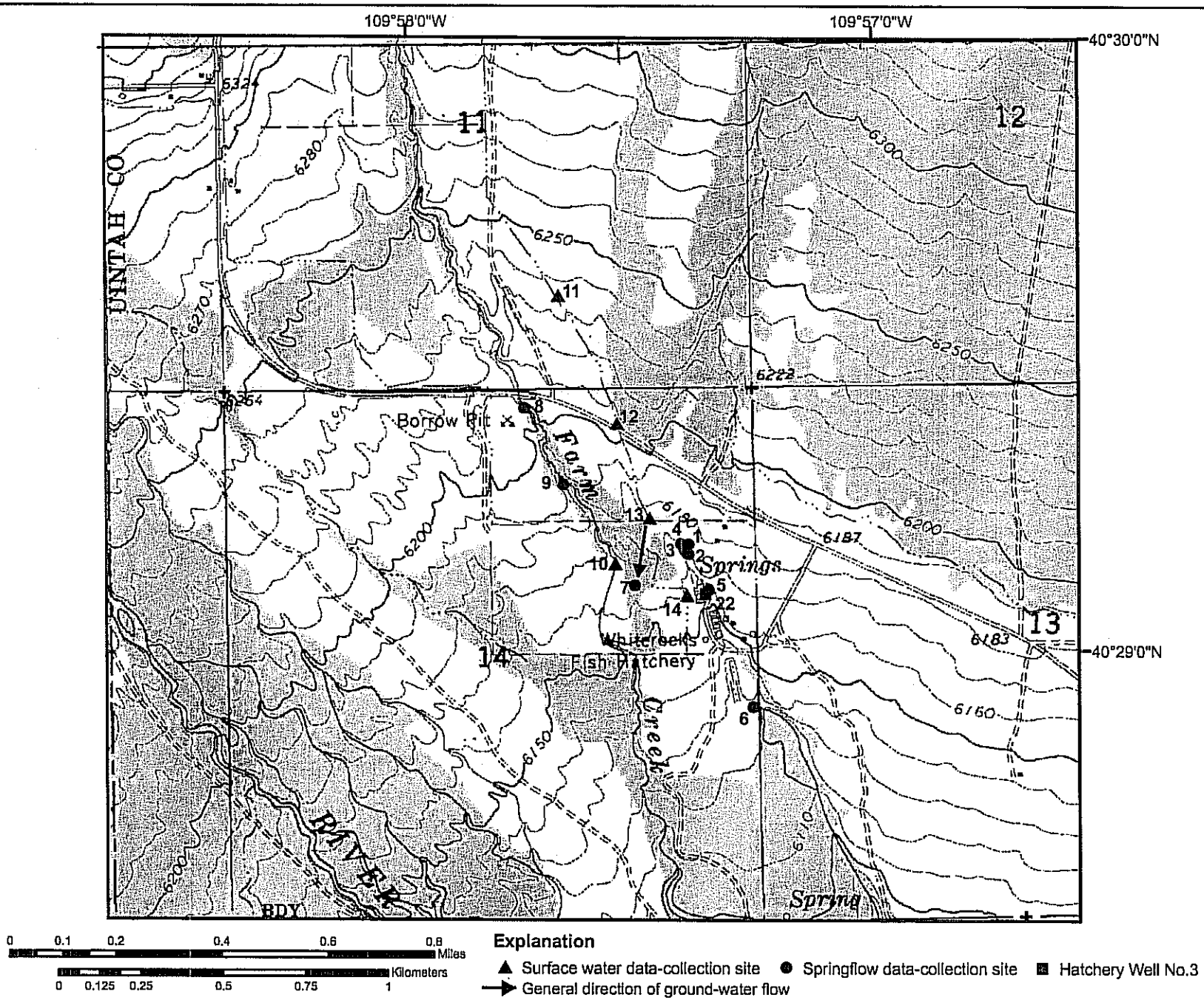
On the basis of the dye tracer study, it appears that water losing in the ditch just north of the hatchery moves underground for only a short distance before coming back to the surface in the wetland area just west of where the springs that supply the hatchery are located. Water that is moving through this wetland area eventually merges together just west of the hatchery, on the Ridley property. Although the dye initially arrived within about 8 days, it appears that it took several months to work its way through the underground-overland flow system. It doesn't appear that the ditch loses much, if any, water as it runs past the hatchery on the west side, because no dye was detected in water at the hatchery outflow. Also, this is probably a gaining (not losing) area for ground water. A tracer test was not conducted from the diversion ditch that runs onto the hatchery property from the northeast (north of the residences). At the time of the study, water was not diverted into this ditch because of construction on the well by the house. Water that is diverted into this ditch for irrigation above the hatchery springs may discharge from the springs. About 4 miles north of the hatchery near Elkhorn, Farm Creek also was noted to completely lose into its streambed, and during the study, the channel was generally dry between this area and where Farm Creek spring rises in the channel west of the hatchery. Although this stream may be a possible source of recharge to the hatchery springs, it was not feasible to conduct a tracer study from Farm Creek due to the long distance and potentially long ground-water travel times involved. In addition, delta deuterium/delta oxygen-18 ratios in water from Farm Creek are substantially different from those in water from the hatchery springs, suggesting that this creek may not be a source of water to the springs.

Other evidence indicating that at least some of the water from the hatchery springs may be relatively young (geologically) is provided by age-dating isotopes. Sulfur-35 occurs in precipitation such as snowmelt and has a radioactive half-life of about 87 days. Consequently, any detectable concentration of this isotope in ground water indicates that residence time is relatively short (several months to less than 1 year). Samples from the hatchery spring (composite) generally had concentrations of sulfur-35 that indicate water older than the last couple of years. Only one sample had a detectable concentration of sulfur-35, indicating an influx of water less than 1 year old and presumably from the preceding snowmelt runoff cycle. Interestingly, this sample was collected in November, further suggesting a lag between springflow and recharge to the ground-water system. In addition, a tritium (half-life of 12.3 years since atmospheric nuclear testing during the 1960s) sample collected from the hatchery (main spring) also indicates that a component of water to the spring is younger than about 40 years. Several samples also were collected for chlorofluorocarbons (CFCs), a common component of refrigerants until the 1990s, at which time substantial reductions in discharge to the atmosphere (and hence, to ground-water systems) occurred. Detectable concentrations of these compounds in water from two of the hatchery springs indicate that water discharging from these springs at the end of 2004 may have entered the ground-water system since the mid 1980s.

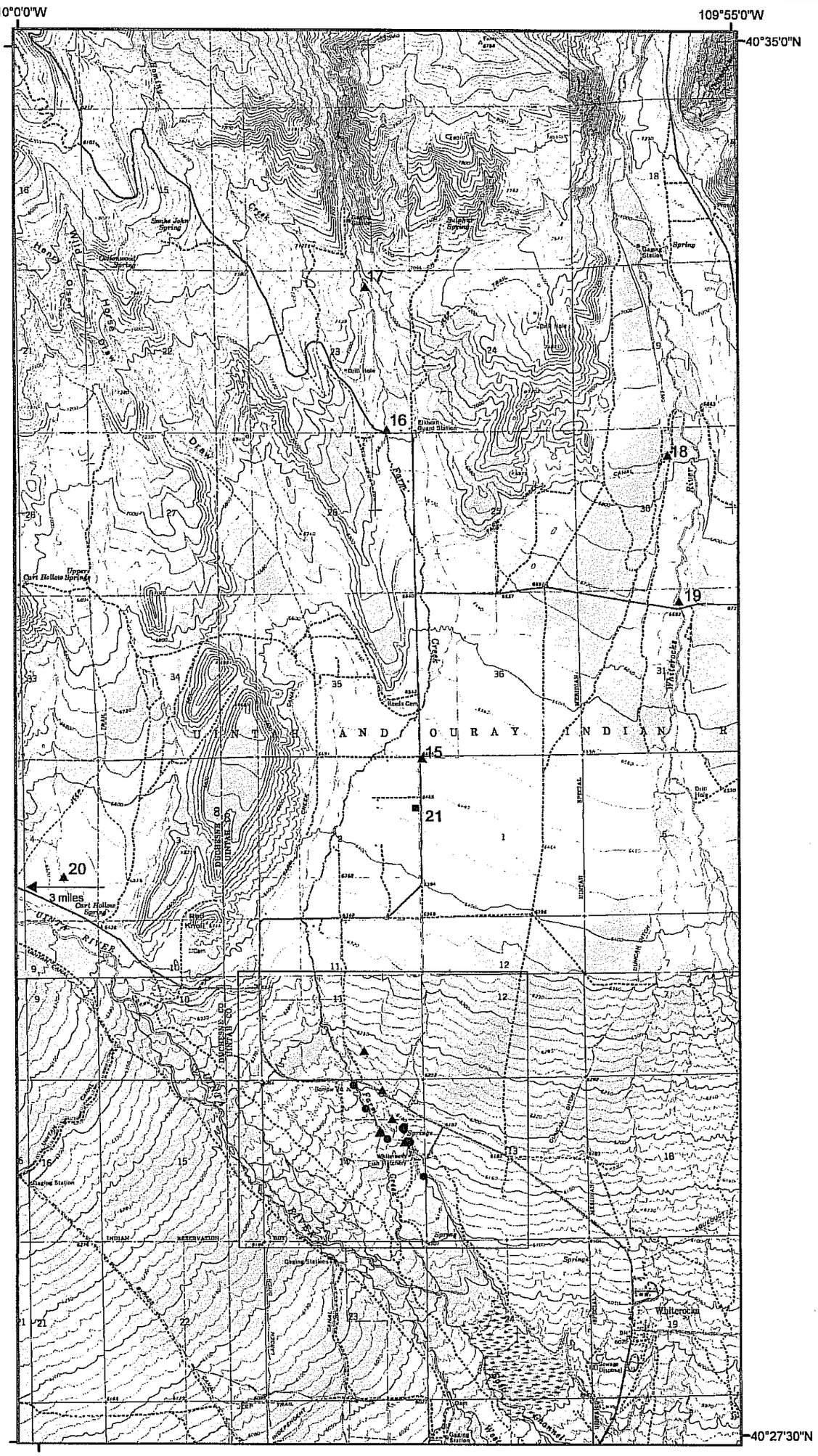
Location of Monitoring Sites

Location of monitoring sites in the Whiterocks Hatchery area

Map No.	Site Name	Latitude (deg-min-sec)	Longitude (deg-min-sec)	Township-Range-Section (Uintah Meridian)
1	Whiterocks spring (main)	40 29 11	109 57 22	U(B-1N-1W)14adb-S1
2	Whiterocks spring (east pipe)	40 29 10	109 57 22	U(B-1N-1W)14adb-S2
3	Whiterocks spring (west pipe)	40 29 10.5	109 57 22.5	U(B-1N-1W)14adb-S3
4	Whiterocks spring (left branch)	40 29 11	109 57 25.5	U(B-1N-1W)14adb-S4
5	Whiterocks spring (composite)	40 29 06.5	109 57 19.5	U(B-1N-1W)14add-S1
6	Whiterocks spring outflow (flume)	40 28 55	109 57 14	U(B-1N-1W)14daa-S1
7	Ridley spring (outflow)	40 29 07	109 57 29	U(B-1N-1W)14adc-S1
8	Farm Creek spring (source)	40 29 24.5	109 57 43	U(B-1N-1W)14abb-S1
9	Farm Creek spring (monitoring site)	40 29 17	109 57 38	U(B-1N-1W)14abd-S1
10	Farm Creek at flume	40 29 09	109 57 31.5	U(B-1N-1W)14aca
11	West ditch at flume (injection site)	40 29 35.5	109 57 38.5	U(B-1N-1W)11dca
12	West ditch at highway	40 29 23	109 57 31	U(B-1N-1W)14aba
13	West ditch at fenceline (losing reach)	40 29 13.5	109 57 27	U(B-1N-1W)14aac
14	West ditch by hatchery	40 29 06.5	109 57 22.5	U(B-1N-1W)14adc
15	Farm Creek canal at highway	40 31 10	109 57 12	U(B-1N-1W)1bbb
16	Farm Creek bridge (Elkhorn)	40 32 56	109 57 25	U(B-2N-1W)23ddc
17	Farm Creek below stream gage	40 33 41.5	109 57 33	U(B-2N-1W)23aba
18	Farm Creek canal flume (lower)	40 32 47	109 55 27	U(A-2N-1E)30abc
19	Whiterocks River at bridge	40 32 00	109 55 23	U(A-2N-1E)31aba
20	Uinta River at bridge	40 31 45	110 03 03	U(B-2N-2W)36adb
21	Symonds well	40 30 54	109 57 15	U(B-1N-1W)2ada-1
22	Hatchery monitoring well #3	40 29 06	109 57 20	U(B-1N-1W)14add-1



Location of monitoring, sampling, and discharge measurement sites in the Whiterocks Fish Hatchery study area.



0 0.25 0.5 1 1.5 2 Miles

0 0.5 1 2 3 Kilometers

Explanation

- ▲ Surface water data-collection site
- ● Springflow data-collection site
- ■ Well
- Losing stream reach
- Refer to enlarged map

Location of monitoring, sampling, and discharge measurement sites in the Whiterocks Fish Hatchery study area.

Field Water Quality Measurements

Field water-quality parameters and discharge for monitored sites in the Whiterocks Hatchery area

Site Date-time	Map No.	Specific conductance (microsiemens/cm)	Water temperature (degrees C)	pH	Discharge (cubic feet/sec)
Whiterocks spring (main)	1				
7/10/2003 1800		423	10.9	7.3	1
8/21/2004 ----		395	11.6	7.3	1-1.5
8/29/2004 ----		390	11.7		
2/28/2005 1630		419	10.1		
Whiterocks spring (east pipe)	2				
7/10/2003 2015		419	10.9	7.2	
9/12/2004 1730		403	11.2		
2/28/2005 1650		410	10.4		10-15 gal/min
2/28/2005 1715		416	10.2		10-15 gal/min
Whiterocks spring (west pipe)	3				
7/10/2003 2000		413	10.8	7	
Whiterocks spring (left branch)	4				
8/21/2004 ----		387	12.2	7.4	0.25
Whiterocks spring (composite)	5				
11/26/2003 1230		386	10.4	7.5	
12/03/2003 1310		367	10.1	7.5	
4/29/2004 1030		428	9.9	7.5	
6/29/2004 2000		428	11.2	7.4	
8/13/2004 2130		409	11.9	7.5	
8/29/2004 1700		397	12.1		
9/12/2004 1600		395	12.1		
2/28/2005 1600		427	10		
Whiterocks spring outflow (flume)	6				Total springflow (see table)
Ridley spring (outflow)	7				
6/30/2004 1115		426	14	7.9	<1
8/13/2004 1415		384	20.7	7.9	0.5
8/29/2004 1900		385	18.2		
9/12/2004 1940		394	16.2		0.71
2/28/2005 1750					No flow

Field water-quality parameters and discharge for monitored sites in the Whiterocks Hatchery area

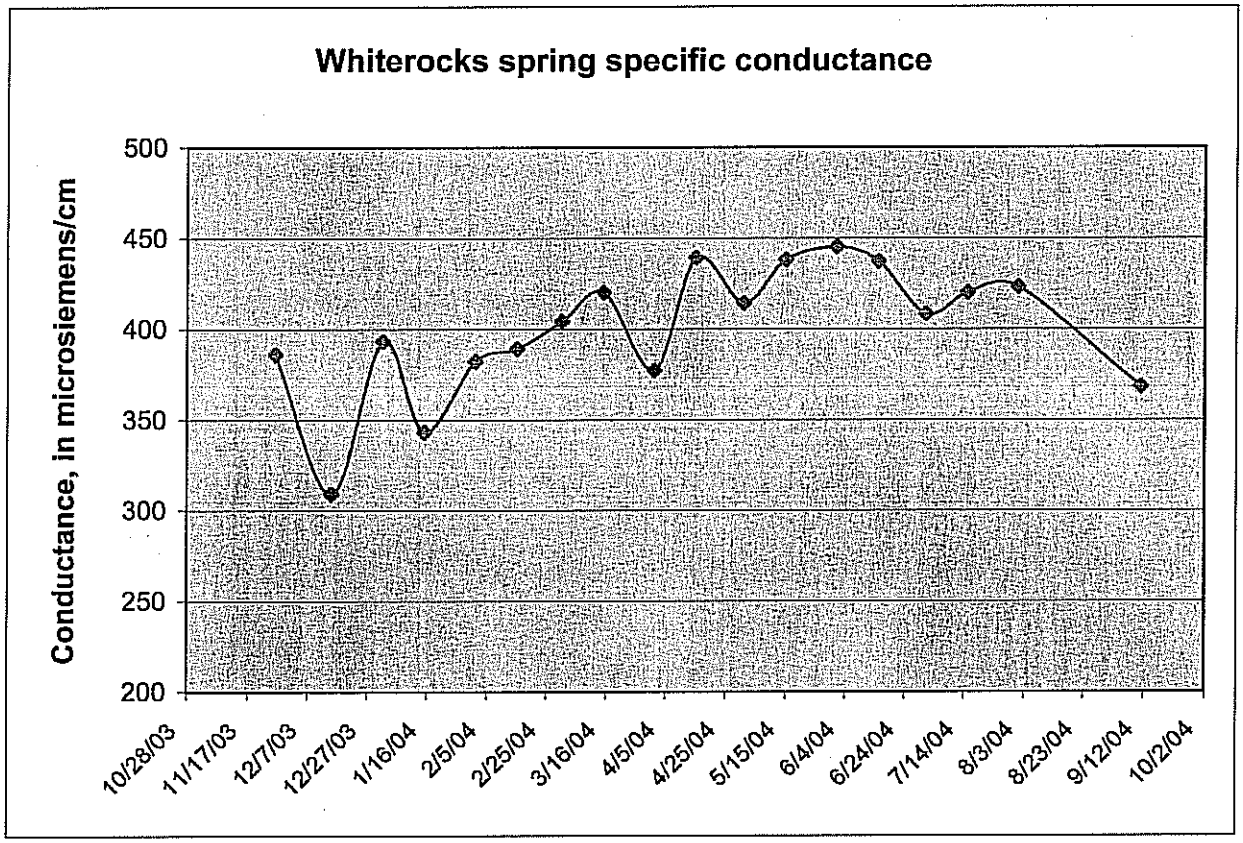
Site Date-time	Map No.	Specific conductance (microsiemens/cm)	Water temperature (degrees C)	pH	Discharge (cubic feet/sec)
Farm Creek spring	9				
12/03/2003 1450		540	9.1	7.6	<1
4/29/2004 1315		591	8.3		0.25
6/30/2004 1145		561	10.3	7.4	1.5-2
8/13/2004 1910		561	11.2		
8/29/2004 1920		565	11.7		
9/12/2004 1920		564	11.4		
2/28/2005 ----		569	8.6		1.2
Farm Creek at flume	10				
4/29/2004 ----		456	10.5		
9/12/2004 1915					2.04
2/28/2005 ----		445	9.8		1.5
West ditch at flume	11				
(injection site)					
8/13/2004 1530					0.5
8/14/2004 0730					1
West ditch at highway	12				
8/13/2004 1530					No flow
8/29/2004 2100		51			1
9/12/2004 2100					1.04
West ditch at fenceline	13				
(losing reach)					
8/13/2004 2030					<5 gal/min
8/21/2004 ----		430 (?)	14.8	7.5	0.25
West ditch by hatchery	14				
8/21/2004 1440					0.25
8/29/2004 1740					0.5
9/12/2004 2030		60	15.3		0.5
Farm Creek canal at highway	15				
4/29/2004 1515					5.77
6/30/2004 1345		37	14.1		
9/12/2004 1445					5

Field water-quality parameters and discharge for monitored sites in the Whiterocks Hatchery area

Site Date-time	Map No.	Specific conductance (microsiemens/cm)	Water temperature (degrees C)	pH	Discharge (cubic feet/sec)
Farm Creek bridge (Elkhorn)	16				
7/11/2003 1400					1
11/26/2003 1010		480		8.1	1.39
12/02/2003 1600		455	3.7	8.1	
6/29/2004 1715		610	15.4	8.2	0.5
Farm Creek below stream gage	17				
4/28/2004 1930		320	8.9	8.3	3-3.5
Farm Creek canal flume (lower)	18				
4/28/2004 ----		57	9.2		7.6
4/29/2004 ----					7.79
Whiterocks River at bridge	19				
11/25/2003 1720		77	4	7.4	
12/2/2003 1530		68	0.3	7.4	
4/28/2004 1600		59	9.9	7.8	
6/29/2004 1810		34	13.8	7.6	
Uinta River at bridge	20				
(below powerplant)					
11/25/2003 1645		75	4	7.5	
12/02/2003 1500		66	2.2	7.5	
4/28/04 1440		78	10.8	7.5	
6/29/2004 1930		38	13.7	7.8	
Symonds well	21				
6/30/2004 1530		475	11.2	7.3	2 gal/min
Hatchery monitoring well #3	22				
7/11/2003 1150		432	10.4	7.3	1 gal/min
					(artesian flow)
Concrete vault	----				
(near Hatchery well #1)					
4/29/2004 ----		435	9.9	7.5	

Specific-conductance values for the Uinta and Whiterocks Rivers and Whiterocks Spring

Date	Time	Specific conductance (microsiemens/cm)	Location	Collector
Uinta River				
1/8/2004	1045	33.5	USGS gage	R. Eacret
3/4/2004	1307	38.5	USGS gage	R. Eacret
4/23/2004	1050	45.4	USGS gage	R. Eacret
6/10/2004	1140	23	USGS gage	R. Eacret
7/12/2004	1130	25.2	USGS gage	R. Eacret
8/25/2004	1320	28.5	USGS gage	R. Eacret
Whiterocks River				
1/8/2004	1330	46.5	USGS gage	R. Eacret
3/4/2004	1050	54.7	USGS gage	R. Eacret
4/23/2004	945	52.9	USGS gage	R. Eacret
6/10/2004	830	29.3	USGS gage	R. Eacret
7/14/2004	1330	30.9	USGS gage	R. Eacret
8/26/2004	855	34.8	USGS gage	R. Eacret
Whiterocks spring (composite)				
12/15/2003	845	309	Hatchery	R. Morrill
1/1/2004	1140	393	Hatchery	R. Morrill
1/15/2004	900	343	Hatchery	R. Morrill
2/1/2004	930	382	Hatchery	R. Morrill
2/15/2004	935	389	Hatchery	R. Morrill
3/1/2004	913	404	Hatchery	R. Morrill
3/15/2004	1302	420	Hatchery	R. Morrill
4/1/2004	1430	377	Hatchery	R. Morrill
4/15/2004	1100	439	Hatchery	R. Morrill
5/1/2004	1320	414	Hatchery	R. Morrill
5/15/2004	910	438	Hatchery	R. Morrill
6/1/2004	820	445	Hatchery	R. Morrill
6/15/2004	1600	437	Hatchery	R. Morrill
7/1/2004	1048	408	Hatchery	R. Morrill
7/15/2004	1002	420	Hatchery	R. Morrill
8/1/2004	945	423	Hatchery	R. Morrill
9/6/2004	2000	362	Hatchery	R. Morrill
9/11/2004	800	368	Hatchery	R. Morrill


Whiterocks spring specific conductance
Conductance, in microsiemens/cm
500
450
400
350
300
250
200
10/28/03
11/17/03
12/7/03
12/27/03
1/16/04
2/5/04
2/25/04
3/16/04
4/5/04
4/25/04
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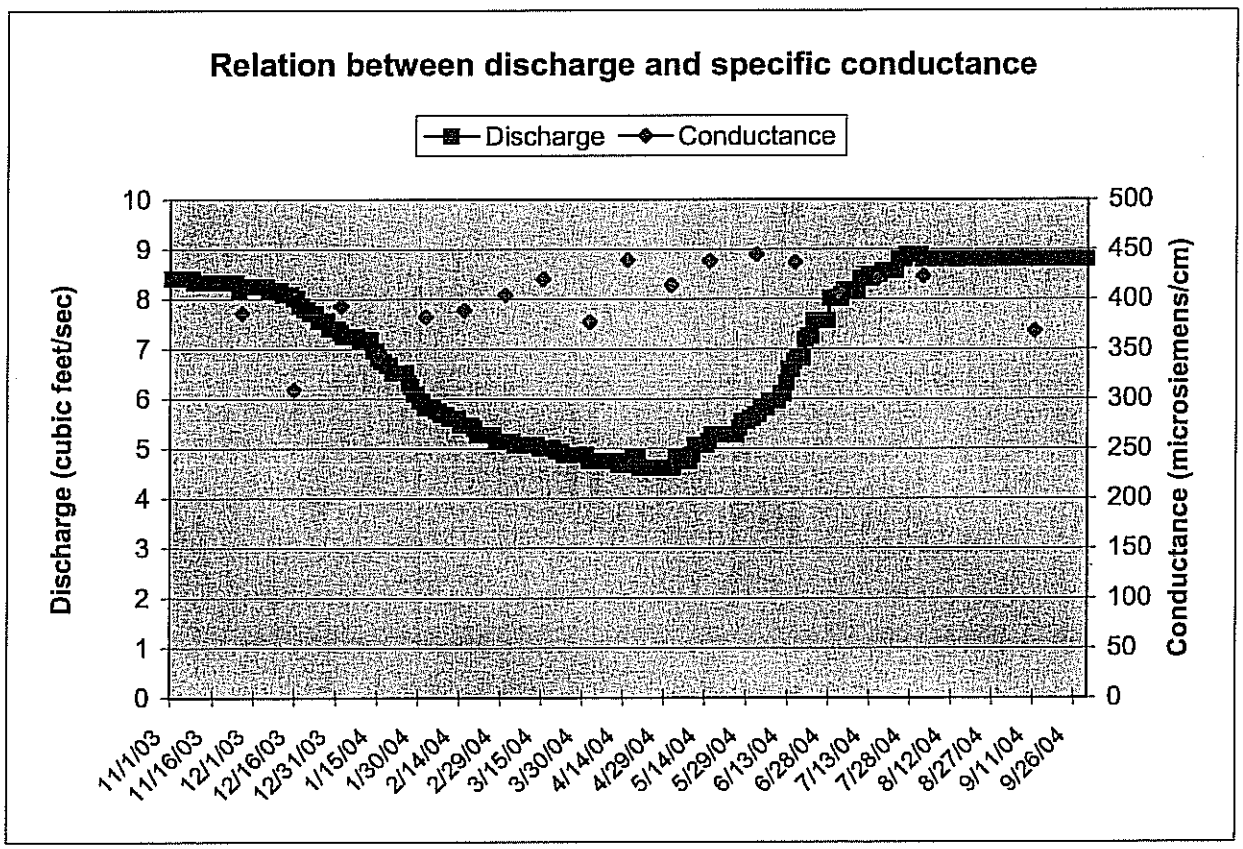
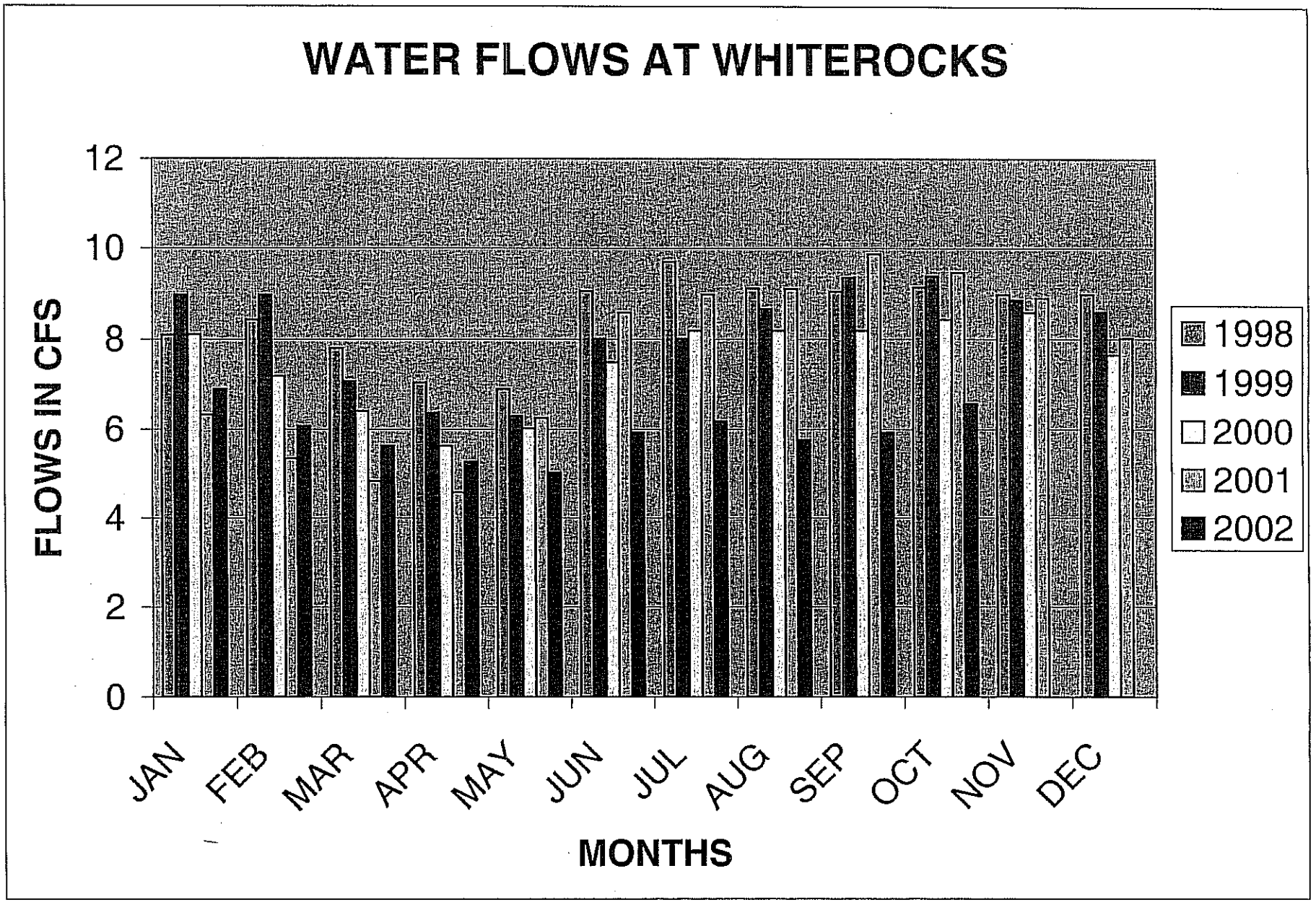
8/23/04
9/12/04
10/2/04


Relation between discharge and specific conductance
Discharge
Conductance
Discharge (cubic feet/sec)
10
9
8
7
6
5
4
3
2
1
0
Conductance (microsiemens/cm)
500
450
400
350
300
250
200
150
100
50
0
11/1/03
11/16/03
12/1/03
12/16/03
12/31/03
1/15/04
1/30/04
2/14/04
2/29/04
3/15/04
3/30/04
4/14/04
4/29/04
5/14/04
5/29/04
6/13/04
6/28/04
7/13/04
7/28/04
8/12/04
8/27/04
9/11/04
9/26/04

Discharge Measurements

				MONTHLY WATER MEASUREMENTS										UDWR/2000
				HATCHERY:		WHITEROCKS								
				TOTAL FLOW AT HATCHERY IN CFS FOR EACH MONTH										YEARLY
														AVG FLOWS
YEAR	HATID	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	IN CFS
1961	WR	3.92	3.78	4.12	4.47	4.47	4.5	4.88	4.9	5.07	5.46	6.23	5.32	4.760
1962	WR	4.96	5.25	5.54	6.01	8.18	5.25	8.25	8.31	8.05	7.47	6.1	5.81	6.598
1963	WR	5.78	5.81	5.21	4.63	4.87	5.53	6.01	6.37	6.09	6.24	5.7	4.75	5.583
1964	WR	4.43	4	3.42	3.12	4.26	5.55	6.1	6.25	5.95	6.23	5.95	6.5	5.147
1965	WR	3.88	3.64	3.74	3.74	4.13	6.61	7.25	7.89	7.8	7.25	7.44	7.14	5.876
1966	WR	6.95	7.01	5.93	5.5	6.09	6.4	6.7	6.81	7.45	7.45	6.81	5.55	6.554
1967	WR	5.39	5.12	5.26	5.22	5.26	6.36	7.14	6.89	6.81	7.43	7.07	6.4	6.196
1968	WR	5.8	5.39	4.66	4.19	4.86	6.12	7.44	7.64	6.81	7.1	7.1	6.4	6.126
1969	WR	5.85	4.94	4.43	4.19	5.04	7.4	8.74	8.74	8.53	7.92	7.44	6.91	6.678
1970	WR	6.05	5.68	5.44	5.12	4.9	5.36	6.54	7.59	7.45	7.07	6.81	6.11	6.177
1971	WR	5.7	5.75	5.81	5.86	6.01	6.66	7.54	7.75	7.64	7.64	6.87	6.35	6.632
1972	WR	5.66	4.98	4.86	4.86	4.95	6.88	7.64	7.64	7.64	7.28	6.66	5.9	6.246
1973	WR	5.140	4.950	5.170	4.950	5.810	8.050	8.990	8.990	8.420	7.860	7.430	6.910	6.889
1974	WR	6.310	5.300	4.890	4.470	4.470	4.850	5.520	5.960	5.280	5.000	4.000	4.250	5.025
1975	WR	4.450	4.180	3.820	3.760	4.550	6.420	8.460	8.970	8.890	8.690	8.390	7.420	6.500
1976	WR	6.250	5.080	5.360	5.230	5.970	7.670	8.490	8.490	8.490	7.990	7.260	6.680	6.913
1977	WR	6.390	5.770	4.880	4.550	4.620	5.040	5.960	5.960	5.890	5.900	5.780	5.410	5.513
1978	WR	5.040	5.040	5.390	5.720	6.470	8.100	9.130	8.360	8.680	8.090	7.970	6.480	7.038
1979	WR	5.890	5.430	5.280	5.320	6.360	8.340	10.400	9.950	9.620	8.810	7.250	6.570	7.435
1980	WR	6.390	5.410	5.120	4.950	6.610	8.810	8.970	8.740	9.620	9.490	8.810	8.330	7.604
1981	WR	7.470	6.570	6.940	6.560	7.190	8.260	9.460	9.790	9.260	8.410	7.940	7.540	7.949
1982	WR	7.090	6.390	5.840	5.820	6.080	7.420	9.240	10.300	10.300	10.300	9.400	8.200	8.032
1983	WR	6.290	5.330	5.040	5.040	5.120	5.880	9.790	9.790	9.790	9.790	9.790	9.790	7.628
1984	WR	9.790	9.490	8.580	7.900	8.020	8.380	9.590	10.300	10.300	10.300	10.300	10.200	9.429
1985	WR	9.500	8.220	7.460	6.480	7.400	9.270	9.620	9.620	9.850	9.950	9.880	10.400	8.971
1986	WR	9.870	9.790	9.580	9.140	8.810	9.920	9.920	9.920	9.920	10.250	9.240	8.500	9.572
1987	WR	8.340	8.260	7.550	7.400	7.970	8.940	9.790	9.790	9.790	9.560	9.240	8.340	8.748
1988	WR	7.840	6.760	6.510	6.260	6.530	8.340	8.670	7.880	7.330	6.780	6.240	5.550	7.041
1989	WR	5.08	5.15	5.44	5.84	6	6.26	6.68	6.92	6.75	6.46	5.79	5.49	5.988
1990	WR	5.18	4.81	4.51	4.23	4.71	6.43	8.84	9.87	9.62	9.21	9.13	8.37	7.076
1991	WR	7.12	6.21	5.89	5.48	5.41	7.49	8.73	8.81	9.05	8.49	8.81	7.72	7.434
1992	WR	7.13	6.53	6.18	5.41	6.03	7.41	8.4	8.73	8.34	8.1	8.02	7.26	7.295
1993	WR	6.64	6.53	6.6	6.82	6.95	8.94	9	9.38	8.81	9.05	8.81	8.1	7.969
1994	WR	7.91	7.38	6.1	5.41	6.1	7.12	7.95	7.8	6.75	7.95	7.41	6.97	7.071
1995	WR	6.39	6.14	6.18	6.25	6.89	8.73	9.95	9.78	9.95	10.4	10	9.54	8.350
1996	WR	8.73	8.1	7.87	7.64	8.04	8.49	8.73	9.05	8.89	8.81	8.57	7.87	8.399
1997	WR	7.12	6.68	6.39	6.39	7.49	9.29	9.05	8.97	9.13	8.81	8.26	8.02	7.967
1998	WR	8.1	8.42	7.8	7.04	6.89	9.05	9.7	9.106	9.04	9.13	8.97	8.97	8.518
1999	WR	8.97	8.97	7.07	6.36	6.29	8.02	8.02	8.66	9.35	9.38	8.85	8.58	8.210
2000	WR	8.11	7.18	6.4	5.62	6.02	7.49	8.18	8.18	8.18	8.42	8.57	7.84	7.499
2001	WR	6.32	5.34	4.82	4.56	6.25	8.57	8.97	9.1	9.87	9.46	8.89	8.02	7.514
2002	WR	6.89	6.073	5.62	5.28	5.01	5.93	6.18	5.76	5.93	6.57	5.70		5.922
2003	WR													#DIV/0!
2004	WR													#DIV/0!
2005	WR													#DIV/0!
2006	WR													#DIV/0!
2007	WR													#DIV/0!
2008	WR													#DIV/0!
Average Flow (cfs):		6.569	6.115	5.779	5.542	6.026	7.277	8.205	8.326	8.247	8.142	7.785	7.225	
Maximum Flow (cfs):		9.870	9.790	9.580	9.140	8.810	9.920	10.400	10.300	10.300	10.400	10.300	10.400	
Minimum Flow (cfs):		3.880	3.640	3.420	3.120	4.130	4.500	4.880	4.900	5.070	5.000	4.000	4.250	


WATER FLOWS AT WHITEROCKS
FLOWS IN CFS
12
10
8
6
4
2
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTHS
1998
1999
2000
2001
2002

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)
1/1/03	5.15		2/16/03	4.43		4/3/03	4.18
1/2/03	5.15		2/17/03	4.37		4/4/03	4.18
1/3/03	5.08		2/18/03	4.37		4/5/03	4.18
1/4/03	5.01		2/19/03	4.37		4/6/03	4.18
1/5/03	5.01		2/20/03	4.37		4/7/03	4.18
1/6/03	5.01		2/21/03	4.37		4/8/03	4.18
1/7/03	5.01		2/22/03	4.43		4/9/03	4.18
1/8/03	5.01		2/23/03	4.43		4/10/03	4.18
1/9/03	5.01		2/24/03	4.43		4/11/03	4.18
1/10/03	4.94		2/25/03	4.31		4/12/03	4.18
1/11/03	4.94		2/26/03	4.31		4/13/03	4.18
1/12/03	4.94		2/27/03	4.31		4/14/03	4.18
1/13/03	4.94		2/28/03	4.31		4/15/03	4.18
1/14/03	4.88		3/1/03	4.31		4/16/03	4.18
1/15/03	4.88		3/2/03	4.31		4/17/03	4.18
1/16/03	4.88		3/3/03	4.31		4/18/03	4.18
1/17/03	4.88		3/4/03	4.31		4/19/03	4.25
1/18/03	4.88		3/5/03	4.31		4/20/03	4.25
1/19/03	4.88		3/6/03	4.31		4/21/03	4.12
1/20/03	4.82		3/7/03	4.31		4/22/03	4.12
1/21/03	4.82		3/8/03	4.31		4/23/03	4.12
1/22/03	4.82		3/9/03	4.31		4/24/03	4.12
1/23/03	4.82		3/10/03	4.31		4/25/03	4.12
1/24/03	4.75		3/11/03	4.31		4/26/03	4.12
1/25/03	4.75		3/12/03	4.25		4/27/03	4.12
1/26/03	4.75		3/13/03	4.25		4/28/03	4.12
1/27/03	4.75		3/14/03	4.25		4/29/03	4.12
1/28/03	4.68		3/15/03	4.25		4/30/03	4.12
1/29/03	4.68		3/16/03	4.25		5/1/03	4.12
1/30/03	4.68		3/17/03	4.25		5/2/03	4.12
1/31/03	4.68		3/18/03	4.25		5/3/03	4.12
2/1/03	4.68		3/19/03	4.25		5/4/03	4.12
2/2/03	4.68		3/20/03	4.18		5/5/03	4.12
2/3/03	4.68		3/21/03	4.18		5/6/03	4.12
2/4/03	4.68		3/22/03	4.18		5/7/03	4.12
2/5/03	4.62		3/23/03	4.18		5/8/03	4.31
2/6/03	4.62		3/24/03	4.18		5/9/03	4.31
2/7/03	4.62		3/25/03	4.18		5/10/03	4.37
2/8/03	4.62		3/26/03	4.18		5/11/03	4.43
2/9/03	4.62		3/27/03	4.18		5/12/03	4.43
2/10/03	4.62		3/28/03	4.18		5/13/03	4.43
2/11/03	4.62		3/29/03	4.18		5/14/03	4.43
2/12/03	4.62		3/30/03	4.18		5/15/03	4.43
2/13/03	4.62		3/31/03	4.18		5/16/03	4.43
2/14/03	4.43		4/1/03	4.18		5/17/03	4.62
2/15/03	4.43		4/2/03	4.18		5/18/03	4.62

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge		Date	Discharge		Date	Discharge
	(ft^3/sec)			(ft^3/sec)			(ft^3/sec)
5/19/03	4.75		7/4/03	6.68		8/19/03	7.87
5/20/03	4.75		7/5/03	6.68		8/20/03	7.87
5/21/03	4.75		7/6/03	6.68		8/21/03	7.87
5/22/03	4.75		7/7/03	6.68		8/22/03	7.87
5/23/03	4.75		7/8/03	6.68		8/23/03	7.87
5/24/03	4.75		7/9/03	7.26		8/24/03	7.87
5/25/03	4.75		7/10/03	7.26		8/25/03	7.87
5/26/03	4.82		7/11/03	7.26		8/26/03	7.87
5/27/03	5.28		7/12/03	7.26		8/27/03	7.87
5/28/03	5.28		7/13/03	7.26		8/28/03	7.87
5/29/03	5.28		7/14/03	7.41		8/29/03	7.87
5/30/03	5.34		7/15/03	7.41		8/30/03	7.87
5/31/03	5.41		7/16/03	7.41		8/31/03	7.87
6/1/03	5.41		7/17/03	7.49		9/1/03	7.87
6/2/03	5.48		7/18/03	7.95		9/2/03	7.87
6/3/03	5.62		7/19/03	7.95		9/3/03	7.87
6/4/03	5.62		7/20/03	7.8		9/4/03	7.87
6/5/03	5.69		7/21/03	7.8		9/5/03	8.02
6/6/03	5.82		7/22/03	7.8		9/6/03	8.02
6/7/03	5.96		7/23/03	7.8		9/7/03	8.02
6/8/03	6.18		7/24/03	7.8		9/8/03	8.02
6/9/03	5.96		7/25/03	7.72		9/9/03	8.02
6/10/03	5.96		7/26/03	7.72		9/10/03	8.02
6/11/03	5.96		7/27/03	7.72		9/11/03	8.02
6/12/03	5.96		7/28/03	7.87		9/12/03	8.02
6/13/03	5.96		7/29/03	7.8		9/13/03	8.02
6/14/03	6.1		7/30/03	7.8		9/14/03	8.02
6/15/03	6.1		7/31/03	7.8		9/15/03	8.02
6/16/03	6.1		8/1/03	7.8		9/16/03	8.02
6/17/03	6.1		8/2/03	7.8		9/17/03	8.02
6/18/03	6.18		8/3/03	7.8		9/18/03	8.02
6/19/03	6.25		8/4/03	7.8		9/19/03	8.18
6/20/03	6.32		8/5/03	7.8		9/20/03	8.18
6/21/03	6.46		8/6/03	7.8		9/21/03	8.18
6/22/03	6.53		8/7/03	7.87		9/22/03	8.18
6/23/03	6.53		8/8/03	7.87		9/23/03	8.18
6/24/03	6.53		8/9/03	7.87		9/24/03	8.18
6/25/03	6.68		8/10/03	7.87		9/25/03	8.18
6/26/03	6.68		8/11/03	7.87		9/26/03	8.18
6/27/03	6.68		8/12/03	7.87		9/27/03	8.18
6/28/03	6.89		8/13/03	7.87		9/28/03	8.18
6/29/03	6.68		8/14/03	7.87		9/29/03	8.18
6/30/03	6.68		8/15/03	7.87		9/30/03	8.18
7/1/03	6.68		8/16/03	7.87		10/1/03	8.18
7/2/03	6.68		8/17/03	7.87		10/2/03	8.18
7/3/03	6.68		8/18/03	7.87		10/3/03	8.18

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)
10/4/03	8.18		11/19/03	8.34		1/4/04	7.26
10/5/03	8.18		11/20/03	8.34		1/5/04	7.26
10/6/03	8.18		11/21/03	8.34		1/6/04	7.26
10/7/03	8.18		11/22/03	8.34		1/7/04	7.26
10/8/03	8.18		11/23/03	8.34		1/8/04	7.19
10/9/03	8.18		11/24/03	8.34		1/9/04	7.19
10/10/03	8.18		11/25/03	8.18		1/10/04	7.19
10/11/03	8.18		11/26/03	8.26		1/11/04	7.19
10/12/03	8.02		11/27/03	8.26		1/12/04	7.19
10/13/03	8.02		11/28/03	8.26		1/13/04	6.97
10/14/03	8.02		11/29/03	8.26		1/14/04	6.97
10/15/03	8.02		11/30/03	8.26		1/15/04	6.82
10/16/03	8.02		12/1/03	8.26		1/16/04	6.75
10/17/03	8.02		12/2/03	8.26		1/17/04	6.75
10/18/03	8.02		12/3/03	8.26		1/18/04	6.68
10/19/03	8.02		12/4/03	8.26		1/19/04	6.68
10/20/03	8.02		12/5/03	8.26		1/20/04	6.53
10/21/03	8.02		12/6/03	8.18		1/21/04	6.53
10/22/03	8.02		12/7/03	8.18		1/22/04	6.53
10/23/03	8.02		12/8/03	8.18		1/23/04	6.53
10/24/03	8.02		12/9/03	8.18		1/24/04	6.53
10/25/03	8.02		12/10/03	8.18		1/25/04	6.53
10/26/03	8.02		12/11/03	8.1		1/26/04	6.32
10/27/03	8.02		12/12/03	8.1		1/27/04	6.25
10/28/03	8.42		12/13/03	8.1		1/28/04	6.1
10/29/03	8.42		12/14/03	8.1		1/29/04	6.1
10/30/03	8.42		12/15/03	8.02		1/30/04	5.96
10/31/03	8.42		12/16/03	8.02		1/31/04	5.96
11/1/03	8.42		12/17/03	7.87		2/1/04	5.82
11/2/03	8.42		12/18/03	7.87		2/2/04	5.82
11/3/03	8.42		12/19/03	7.8		2/3/04	5.82
11/4/03	8.42		12/20/03	7.8		2/4/04	5.82
11/5/03	8.42		12/21/03	7.72		2/5/04	5.76
11/6/03	8.42		12/22/03	7.72		2/6/04	5.76
11/7/03	8.42		12/23/03	7.72		2/7/04	5.69
11/8/03	8.42		12/24/03	7.57		2/8/04	5.69
11/9/03	8.34		12/25/03	7.57		2/9/04	5.69
11/10/03	8.34		12/26/03	7.57		2/10/04	5.62
11/11/03	8.34		12/27/03	7.57		2/11/04	5.62
11/12/03	8.34		12/28/03	7.41		2/12/04	5.62
11/13/03	8.34		12/29/03	7.41		2/13/04	5.62
11/14/03	8.34		12/30/03	7.41		2/14/04	5.48
11/15/03	8.34		12/31/03	7.41		2/15/04	5.48
11/16/03	8.34		1/1/04	7.34		2/16/04	5.48
11/17/03	8.34		1/2/04	7.26		2/17/04	5.48
11/18/03	8.34		1/3/04	7.26		2/18/04	5.48

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)
2/19/04	5.41		4/5/04	4.75		5/21/04	5.28
2/20/04	5.28		4/6/04	4.75		5/22/04	5.28
2/21/04	5.28		4/7/04	4.75		5/23/04	5.28
2/22/04	5.28		4/8/04	4.75		5/24/04	5.28
2/23/04	5.28		4/9/04	4.75		5/25/04	5.28
2/24/04	5.28		4/10/04	4.75		5/26/04	5.41
2/25/04	5.28		4/11/04	4.75		5/27/04	5.55
2/26/04	5.28		4/12/04	4.68		5/28/04	5.55
2/27/04	5.15		4/13/04	4.68		5/29/04	5.55
2/28/04	5.15		4/14/04	4.68		5/30/04	5.62
2/29/04	5.15		4/15/04	4.68		5/31/04	5.62
3/1/04	5.15		4/16/04	4.68		6/1/04	5.69
3/2/04	5.15		4/17/04	4.82		6/2/04	5.69
3/3/04	5.15		4/18/04	4.82		6/3/04	5.82
3/4/04	5.15		4/19/04	4.82		6/4/04	5.82
3/5/04	5.08		4/20/04	4.62		6/5/04	5.82
3/6/04	5.08		4/21/04	4.62		6/6/04	5.96
3/7/04	5.08		4/22/04	4.62		6/7/04	5.96
3/8/04	5.08		4/23/04	4.62		6/8/04	5.96
3/9/04	5.08		4/24/04	4.62		6/9/04	5.96
3/10/04	5.08		4/25/04	4.62		6/10/04	6.1
3/11/04	5.08		4/26/04	4.62		6/11/04	6.1
3/12/04	5.08		4/27/04	4.62		6/12/04	6.32
3/13/04	5.08		4/28/04	4.62		6/13/04	6.6
3/14/04	5.01		4/29/04	4.62		6/14/04	6.6
3/15/04	5.01		4/30/04	4.62		6/15/04	6.75
3/16/04	5.01		5/1/04	4.62		6/16/04	6.82
3/17/04	5.01		5/2/04	4.62		6/17/04	6.82
3/18/04	5.01		5/3/04	4.82		6/18/04	6.82
3/19/04	5.01		5/4/04	4.82		6/19/04	7.19
3/20/04	4.94		5/5/04	4.75		6/20/04	7.26
3/21/04	4.94		5/6/04	4.75		6/21/04	7.26
3/22/04	4.94		5/7/04	4.75		6/22/04	7.57
3/23/04	4.88		5/8/04	4.75		6/23/04	7.57
3/24/04	4.88		5/9/04	4.88		6/24/04	7.57
3/25/04	4.88		5/10/04	5.08		6/25/04	7.57
3/26/04	4.88		5/11/04	5.08		6/26/04	7.57
3/27/04	4.88		5/12/04	5.08		6/27/04	7.57
3/28/04	4.88		5/13/04	5.08		6/28/04	8.02
3/29/04	4.88		5/14/04	5.08		6/29/04	8.02
3/30/04	4.88		5/15/04	5.15		6/30/04	8.02
3/31/04	4.88		5/16/04	5.28		7/1/04	8.02
4/1/04	4.75		5/17/04	5.28		7/2/04	8.02
4/2/04	4.75		5/18/04	5.28		7/3/04	8.18
4/3/04	4.75		5/19/04	5.28		7/4/04	8.18
4/4/04	4.75		5/20/04	5.28		7/5/04	8.18

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge		Date	Discharge		Date	Discharge
	(ft^3/sec)			(ft^3/sec)			(ft^3/sec)
7/6/04	8.18		8/21/04	8.81		10/6/04	8.81
7/7/04	8.18		8/22/04	8.81		10/7/04	8.81
7/8/04	8.18		8/23/04	8.81		10/8/04	8.81
7/9/04	8.42		8/24/04	8.81		10/9/04	8.65
7/10/04	8.42		8/25/04	8.81		10/10/04	8.65
7/11/04	8.42		8/26/04	8.81		10/11/04	8.65
7/12/04	8.49		8/27/04	8.81		10/12/04	8.65
7/13/04	8.49		8/28/04	8.81		10/13/04	8.65
7/14/04	8.49		8/29/04	8.81		10/14/04	8.65
7/15/04	8.49		8/30/04	8.81		10/15/04	8.65
7/16/04	8.49		8/31/04	8.81		10/16/04	8.65
7/17/04	8.57		9/1/04	8.81		10/17/04	8.65
7/18/04	8.57		9/2/04	8.81		10/18/04	8.49
7/19/04	8.57		9/3/04	8.81		10/19/04	8.49
7/20/04	8.57		9/4/04	8.81		10/20/04	8.49
7/21/04	8.57		9/5/04	8.81		10/21/04	8.49
7/22/04	8.57		9/6/04	8.81		10/22/04	8.49
7/23/04	8.81		9/7/04	8.81		10/23/04	8.49
7/24/04	8.81		9/8/04	8.81		10/24/04	8.49
7/25/04	8.81		9/9/04	8.81		10/25/04	8.49
7/26/04	8.89		9/10/04	8.81		10/26/04	8.34
7/27/04	8.89		9/11/04	8.81		10/27/04	8.34
7/28/04	8.89		9/12/04	8.81		10/28/04	8.34
7/29/04	8.89		9/13/04	8.81		10/29/04	8.34
7/30/04	8.89		9/14/04	8.81		10/30/04	8.34
7/31/04	8.89		9/15/04	8.81		10/31/04	8.34
8/1/04	8.81		9/16/04	8.81		11/1/04	8.18
8/2/04	8.81		9/17/04	8.81		11/2/04	8.18
8/3/04	8.81		9/18/04	8.81		11/3/04	8.18
8/4/04	8.81		9/19/04	8.81		11/4/04	8.02
8/5/04	8.81		9/20/04	8.81		11/5/04	8.02
8/6/04	8.81		9/21/04	8.81		11/6/04	7.87
8/7/04	8.81		9/22/04	8.81		11/7/04	7.87
8/8/04	8.81		9/23/04	8.81		11/8/04	7.87
8/9/04	8.81		9/24/04	8.81		11/9/04	7.87
8/10/04	8.81		9/25/04	8.81		11/10/04	7.72
8/11/04	8.81		9/26/04	8.81		11/11/04	7.72
8/12/04	8.81		9/27/04	8.81		11/12/04	7.72
8/13/04	8.81		9/28/04	8.81		11/13/04	7.72
8/14/04	8.81		9/29/04	8.81		11/14/04	7.57
8/15/04	8.81		9/30/04	8.81		11/15/04	7.57
8/16/04	8.81		10/1/04	8.81		11/16/04	7.57
8/17/04	8.81		10/2/04	8.81		11/17/04	7.26
8/18/04	8.81		10/3/04	8.81		11/18/04	7.26
8/19/04	8.81		10/4/04	8.81		11/19/04	7.26
8/20/04	8.81		10/5/04	8.81		11/20/04	7.26

Whiterocks hatchery springflow - January 2003 to October 2005

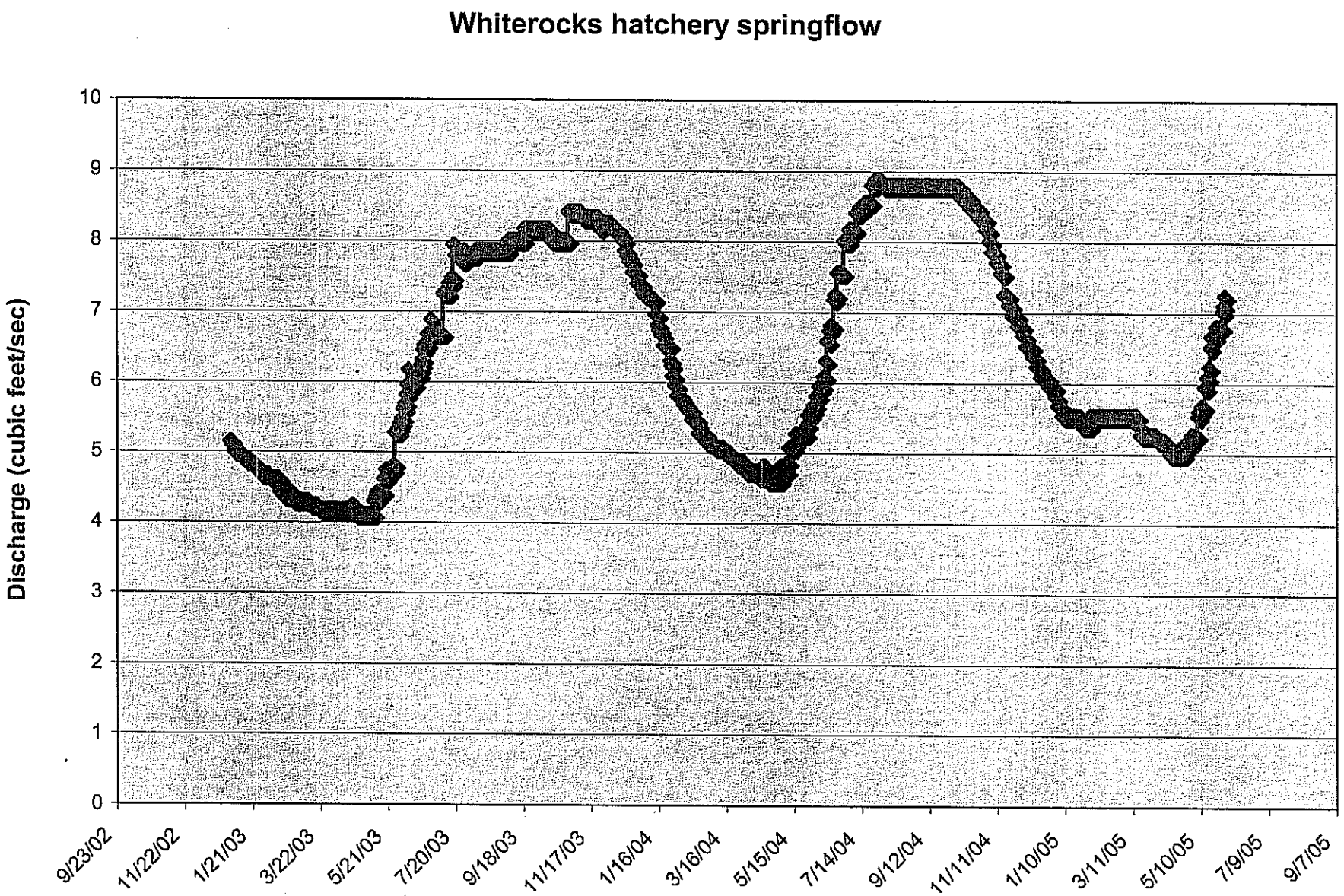
Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)
11/21/04	7.12		1/6/05	5.69		2/21/05	5.55
11/22/04	7.12		1/7/05	5.55		2/22/05	5.55
11/23/04	7.12		1/8/05	5.55		2/23/05	5.55
11/24/04	6.97		1/9/05	5.55		2/24/05	5.55
11/25/04	6.97		1/10/05	5.55		2/25/05	5.55
11/26/04	6.97		1/11/05	5.55		2/26/05	5.55
11/27/04	6.97		1/12/05	5.55		2/27/05	5.55
11/28/04	6.97		1/13/05	5.55		2/28/05	5.55
11/29/04	6.82		1/14/05	5.55		3/1/05	5.55
11/30/04	6.82		1/15/05	5.55		3/2/05	5.55
12/1/04	6.82		1/16/05	5.55		3/3/05	5.55
12/2/04	6.82		1/17/05	5.55		3/4/05	5.55
12/3/04	6.82		1/18/05	5.55		3/5/05	5.55
12/4/04	6.68		1/19/05	5.55		3/6/05	5.55
12/5/04	6.68		1/20/05	5.55		3/7/05	5.55
12/6/04	6.53		1/21/05	5.55		3/8/05	5.55
12/7/04	6.53		1/22/05	5.55		3/9/05	5.55
12/8/04	6.53		1/23/05	5.55		3/10/05	5.55
12/9/04	6.53		1/24/05	5.41		3/11/05	5.55
12/10/04	6.53		1/25/05	5.41		3/12/05	5.55
12/11/04	6.53		1/26/05	5.41		3/13/05	5.55
12/12/04	6.39		1/27/05	5.41		3/14/05	5.55
12/13/04	6.39		1/28/05	5.41		3/15/05	5.41
12/14/04	6.39		1/29/05	5.41		3/16/05	5.41
12/15/04	6.25		1/30/05	5.41		3/17/05	5.28
12/16/04	6.25		1/31/05	5.41		3/18/05	5.28
12/17/04	6.25		2/1/05	5.55		3/19/05	5.28
12/18/04	6.25		2/2/05	5.55		3/20/05	5.28
12/19/04	6.1		2/3/05	5.55		3/21/05	5.28
12/20/04	6.1		2/4/05	5.55		3/22/05	5.28
12/21/04	6.1		2/5/05	5.55		3/23/05	5.28
12/22/04	6.1		2/6/05	5.55		3/24/05	5.28
12/23/04	6.1		2/7/05	5.55		3/25/05	5.28
12/24/04	6.1		2/8/05	5.55		3/26/05	5.28
12/25/04	6.1		2/9/05	5.55		3/27/05	5.28
12/26/04	5.96		2/10/05	5.55		3/28/05	5.28
12/27/04	5.96		2/11/05	5.55		3/29/05	5.28
12/28/04	5.96		2/12/05	5.55		3/30/05	5.28
12/29/04	5.96		2/13/05	5.55		3/31/05	5.28
12/30/04	5.96		2/14/05	5.55		4/1/05	5.21
12/31/04	5.96		2/15/05	5.55		4/2/05	5.21
1/1/05	5.82		2/16/05	5.55		4/3/05	5.21
1/2/05	5.82		2/17/05	5.55		4/4/05	5.21
1/3/05	5.69		2/18/05	5.55		4/5/05	5.21
1/4/05	5.69		2/19/05	5.55		4/6/05	5.21
1/5/05	5.69		2/20/05	5.55		4/7/05	5.21

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)		Date	Discharge (ft^3/sec)
4/8/05	5.15		5/24/05	6.82		7/9/05	9.95
4/9/05	5.15		5/25/05	6.82		7/10/05	9.95
4/10/05	5.15		5/26/05	6.82		7/11/05	9.95
4/11/05	5.15		5/27/05	6.82		7/12/05	9.95
4/12/05	5.01		5/28/05	6.82		7/13/05	9.95
4/13/05	5.01		5/29/05	7.04		7/14/05	9.95
4/14/05	5.01		5/30/05	7.12		7/15/05	9.95
4/15/05	5.01		5/31/05	7.26		7/16/05	9.95
4/16/05	5.01		6/1/05	8.18		7/17/05	9.95
4/17/05	5.01		6/2/05	8.18		7/18/05	9.95
4/18/05	5.01		6/3/05	8.18		7/19/05	9.95
4/19/05	5.01		6/4/05	8.34		7/20/05	10
4/20/05	5.01		6/5/05	8.34		7/21/05	10
4/21/05	5.01		6/6/05	8.81		7/22/05	10
4/22/05	5.01		6/7/05	8.81		7/23/05	10
4/23/05	5.01		6/8/05	8.81		7/24/05	10
4/24/05	5.01		6/9/05	8.81		7/25/05	10
4/25/05	5.15		6/10/05	8.81		7/26/05	10
4/26/05	5.15		6/11/05	8.81		7/27/05	10
4/27/05	5.15		6/12/05	8.81		7/28/05	10
4/28/05	5.15		6/13/05	8.81		7/29/05	10
4/29/05	5.15		6/14/05	8.97		7/30/05	10
4/30/05	5.15		6/15/05	8.97		7/31/05	10
5/1/05	5.28		6/16/05	8.97		8/1/05	10.2
5/2/05	5.28		6/17/05	8.97		8/2/05	10.2
5/3/05	5.28		6/18/05	8.97		8/3/05	10.2
5/4/05	5.28		6/19/05	8.97		8/4/05	10.2
5/5/05	5.28		6/20/05	8.97		8/5/05	10.2
5/6/05	5.28		6/21/05	9.62		8/6/05	10.2
5/7/05	5.55		6/22/05	9.62		8/7/05	10.2
5/8/05	5.62		6/23/05	9.62		8/8/05	10.2
5/9/05	5.62		6/24/05	9.62		8/9/05	10.2
5/10/05	5.69		6/25/05	9.62		8/10/05	10.2
5/11/05	5.69		6/26/05	9.62		8/11/05	10.3
5/12/05	5.69		6/27/05	9.62		8/12/05	10.3
5/13/05	5.96		6/28/05	9.62		8/13/05	10.3
5/14/05	5.96		6/29/05	9.62		8/14/05	10.3
5/15/05	6.1		6/30/05	9.62		8/15/05	10.3
5/16/05	6.1		7/1/05	9.79		8/16/05	10.3
5/17/05	6.25		7/2/05	9.79		8/17/05	10.3
5/18/05	6.53		7/3/05	9.79		8/18/05	10.3
5/19/05	6.68		7/4/05	9.79		8/19/05	10.3
5/20/05	6.68		7/5/05	9.79		8/20/05	10.3
5/21/05	6.68		7/6/05	9.95		8/21/05	10.3
5/22/05	6.68		7/7/05	9.95		8/22/05	10.3
5/23/05	6.82		7/8/05	9.95		8/23/05	10.3

Whiterocks hatchery springflow - January 2003 to October 2005

Date	Discharge		Date	Discharge		Date	Discharge
	(ft^3/sec)			(ft^3/sec)			(ft^3/sec)
8/24/05	10.3						
8/25/05	10.3						
8/26/05	10.3						
8/27/05	10.3						
8/28/05	10.3						
8/29/05	10.3						
8/30/05	10.3						
8/31/05	10.3						
9/1/05	10.1						
9/2/05	10.1						
9/3/05	10.1						
9/4/05	10.1						
9/5/05	10.1						
9/6/05	10.1						
9/7/05	10.1						
9/8/05	10.1						
9/9/05	10.1						
9/10/05	10.1						
9/11/05	5.41						
9/12/05	5.48						
9/13/05	5.34						
9/14/05	5.69						
9/15/05	5.69						
9/16/05	5.69						
9/17/05	5.76						
9/18/05	5.82						
9/19/05	5.82						
9/20/05	5.96						
9/21/05	5.96						
9/22/05	5.96						
9/23/05	5.96						
9/24/05	5.96						
9/25/05	5.96						
9/26/05	5.96						
9/27/05	5.96						
9/28/05	5.96						
9/29/05	5.96						
9/30/05	5.41						


Whiterocks hatchery springflow
Discharge (cubic feet/sec)
10
9
8
7
6
5
4
3
2
1
0
9/23/02
11/22/02
1/21/03
3/22/03
5/21/03
7/20/03
9/18/03
11/17/03
1/16/04
3/16/04
5/15/04
7/14/04
9/12/04
11/11/04
1/10/05
3/11/05
5/10/05
7/9/05
9/7/05

DAILY FLOW RECORD

U. S. FARMCREEK
PROJECT
2003

	APRIL SEC. FT.	MAY SEC. FT.	JUNE SEC. FT. 1 TO 70	JUNE SEC. FT.	JUNE SEC. FT. 1 TO 70	JULY SEC. FT.	AUGUST SEC. FT.	SEPTEM. SEC. FT.	OCTOB. SEC. FT.
1	1.37	4.72	*4.72*	20.50	*20.50*	24.50	9.95	8.91	8.91
2	1.37	4.72	*4.72*	19.40	*19.40*	24.79	9.74	8.91	8.51
3	1.37	4.72	*4.72*	22.18	*22.18*	24.79	11.92	8.91	8.51
4	1.37	4.72	*4.72*	24.20	*24.20*	23.33	9.74	8.91	8.51
5	1.37	4.72	*4.72*	22.75	*22.75*	22.18	*7.72	8.91	8.31
6	1.37	4.07	*4.07*	22.47	*22.47*	20.22	8.51	8.91	8.11
7	1.37	4.07	*4.07*	21.05	*21.05*	17.80	8.51	10.38	7.91
8	1.37	4.07	*4.07*	16.51	*16.51*	16.76	8.31	11.47	7.91
9	1.37	4.86	*4.86*	15.75	*15.75*	16.25	8.51	11.03	7.91
10	1.37	5.19	*5.19*	15.75	*15.75*	14.27	8.31	11.03	7.91
11	1.37	5.19	*5.19*	14.51	*14.51*	13.31	8.31	10.38	7.91
12	1.37	5.19	*5.19*	15.50	*15.50*	13.31	8.51	9.74	8.11
13	1.37	5.19	*5.19*	18.86	*18.86*	13.08	8.51	9.32	7.91
14	3.37	5.53	*5.53*	22.18	*22.18*	12.61	8.51	8.51	6.59
15	4.34	7.72	*7.72*	23.91	*23.80*	12.84	8.51	8.51	5.53
16	4.00	14.51	*14.51*	23.62	*23.62*	12.84	8.51	8.51	5.70
17	4.00	23.04	*23.04*	23.33	*23.33*	11.70	8.71	8.51	5.70
18	4.00	25.09	*23.80*	18.07	*18.07*	10.81	8.51	7.72	5.70
19	4.00	25.09	*23.80*	16.25	*16.25*	10.81	8.51	7.72	5.53
20	4.00	25.09	*23.80*	18.07	*18.07*	10.81	8.71	7.72	5.03
21	4.00	25.09	*23.80*	18.07	*18.07*	10.38	8.71	7.72	4.54
22	5.36	25.09	*23.80*	23.33	*23.33*	11.92	8.71	7.53	4.38
23	5.36	30.98	*23.80*	25.39	*23.80*	13.08	8.71	7.53	4.22
24	5.36	30.98	*23.80*	25.09	*23.80*	12.84	9.32	7.53	4.38
25	5.36	30.34	*23.80*	22.75	*22.75*	12.84	9.53	7.34	4.54
26	5.36	23.33	*23.80*	22.18	*22.18*	13.31	9.53	7.34	4.54
27	5.36	26.90	*23.80*	22.18	*22.18*	13.08	9.32	7.15	4.54
28	5.36	29.07	*23.80*	24.20	*24.20*	13.08	8.91	7.15	2.78
29	4.72	26.29	*23.80*	23.62	*23.62*	12.84	8.91	7.15	1.57
30	4.72	23.91	*23.80*	23.33	*23.33*	10.81	8.91	8.51	1.47
31		21.90	*21.90*			9.95	8.91		1.47
AMOUNT DIVERTED									
SEC. FT. DAYS	96.48	481.38	*443.53*	625.00	*622.01*	461.14	275.99	258.96	184.64
AC. FT.	191.37	934.41	*879.74*	1,239.69	*1,233.76*	914.67	547.43	513.65	366.23

TOTAL
AREA SERVED 1,666.00
AMOUNT DIVERTED 4,707.45
AMOUNT PER ACRE 2.8256

CHARGED
AREA SERVED 1,666.00
AMOUNT DIVERTED 4,646.85
AMOUNT PER ACRE 2.7892

acres ÷ duty = cfs
500 ÷ 1:100 = 5 cfs
500 ÷ 1:70 = 7.15 cfs

* AS LOW AS I COULD GET HEADGATE—MUST HAVE "TRASH" IN HEADGATE.

Shane Handlin (435) 724-0114 Farm Creek canal flows
*all readings taken at second flume

DAILY FLOW RECORD

* ATTENTION: LARRY SPANGLER

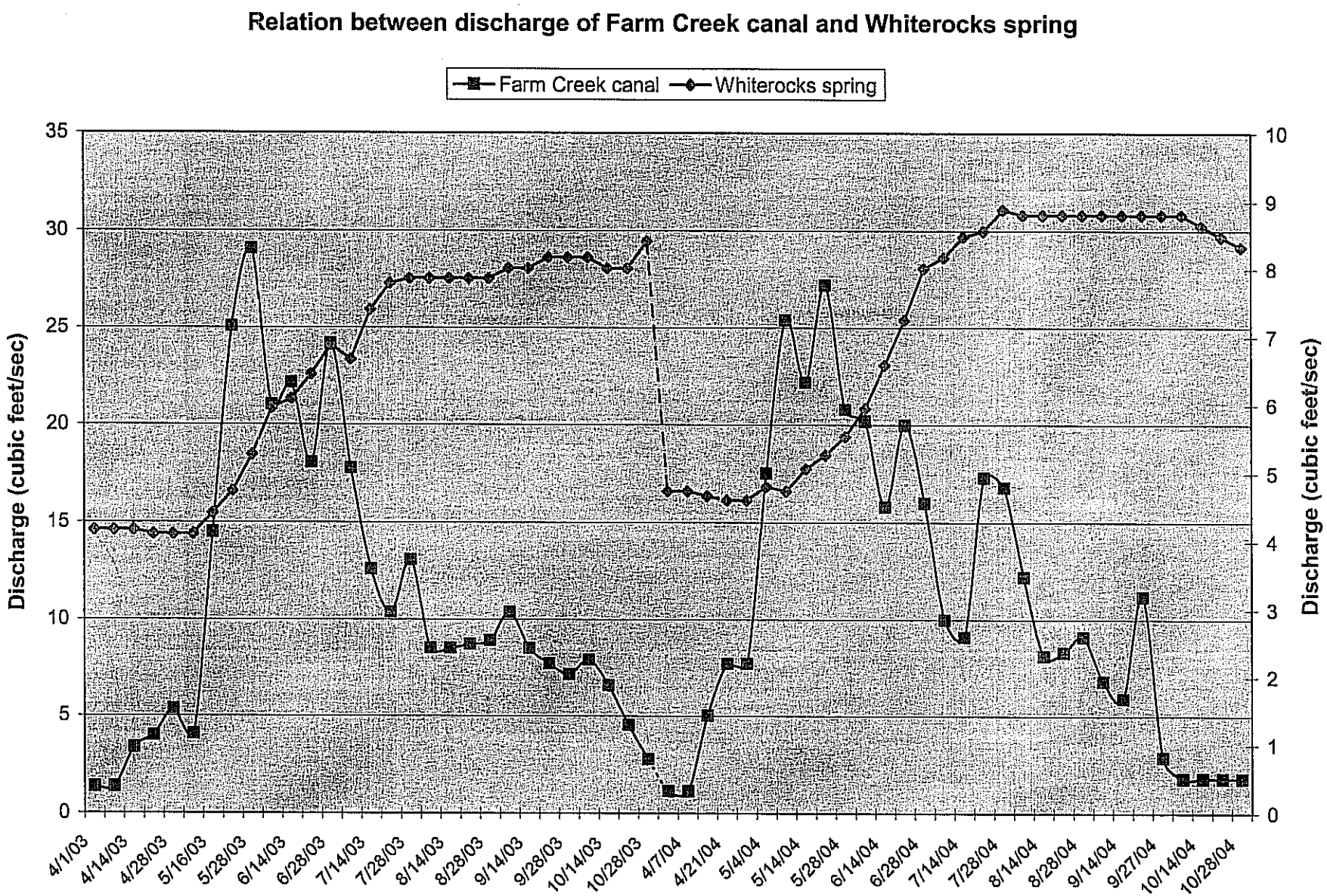
U. S. FARMCREEK
PROJECT
2004

	APRIL SEC. FT.	MAY SEC. FT.	JUNE SEC. FT.	JULY SEC. FT.	AUGUST SEC. FT.	SEPTEM. SEC. FT.	OCTOB. SEC. FT.
1	1.15	8.11	19.13	14.51	13.79	6.96	1.59
2	1.15	8.31	17.02	14.03	13.79	6.59	1.80
3	1.15	10.59	18.07	12.61	13.55	6.59	1.80
4	1.15	17.54	18.07	11.47	12.61	7.53	1.80
5	1.15	23.91	17.80	10.81	11.94	7.72	1.80
6	1.15	25.69	19.40	10.81	12.38	7.15	1.80
7	1.15	25.39	20.22	9.95	12.15	6.77	1.80
8	1.15	26.90	19.95	11.03	11.25	6.59	1.80
9	1.15	28.13	19.67	11.92	10.38	6.05	1.80
10	1.15	27.82	19.40	11.92	9.95	5.70	1.80
11	1.15	26.60	19.13	11.92	9.74	5.70	1.80
12	3.25	24.50	18.60	10.16	8.91	5.88	1.80
13	5.03	21.90	17.80	9.11	8.51	6.05	1.80
14	5.03	22.18	15.75	9.11	8.11	5.88	1.80
15	5.03	24.79	15.00	9.11	8.11	5.70	1.80
16	5.03	26.90	14.76	11.70	7.72	5.53	1.80
17	5.03	27.51	14.03	12.84	7.91	5.53	1.80
18	5.03	29.70	15.75	15.75	8.11	5.53	1.80
19	5.03	30.98	17.80	17.28	8.11	6.41	1.80
20	5.03	30.66	17.28	16.76	8.11	11.25	1.80
21	7.72	27.21	19.95	17.28	8.31	11.25	1.80
22	6.36	22.75	19.95	18.33	9.74	11.25	1.80
23	5.03	22.18	19.95	18.60	10.38	8.91	1.80
24	5.03	21.33	16.76	18.60	10.16	8.91	1.80
25	5.03	21.61	15.75	17.54	9.95	8.31	1.80
26	5.53	20.17	16.00	16.00	9.53	8.31	1.80
27	6.77	18.86	16.00	17.02	9.53	2.88	1.80
28	7.72	20.77	16.00	16.76	9.11	1.26	1.80
29	8.11	22.75	15.75	16.00	8.91	1.26	1.80
30	8.11	21.33	15.25	15.25	8.11	1.26	1.80
31		20.22		14.03	7.72		1.80
AMOUNT DIVERTED							
SEC. FT. DAYS	121.57	707.29	525.99	428.21	306.58	194.71	55.59
AC. FT.	241.13	1,402.91	1,043.30	849.35	608.10	386.21	110.26

TOTAL
AREA SERVED 1,666.00
AMOUNT DIVERTED 4,641.26
AMOUNT PER ACRE 2.7859

CHARGED
AREA SERVED 1,666.00
AMOUNT DIVERTED 4,641.26
AMOUNT PER ACRE 2.7859

* AS LOW AS I COULD GET HEADGATE—MUST HAVE "TRASH" IN HEADGATE.


Relation between discharge of Farm Creek canal and Whiterocks spring
Farm Creek canal
Whiterocks spring
Discharge (cubic feet/sec)
Discharge (cubic feet/sec)
35
30
25
20
15
10
5
0
10
9
8
7
6
5
4
3
2
1
0
4/1/03
4/14/03
4/28/03
5/16/03
5/28/03
6/14/03
6/28/03
7/14/03
7/28/03
8/14/03
8/28/03
9/14/03
9/28/03
10/14/03
10/28/03
4/7/04
4/21/04
5/4/04
5/14/04
5/28/04
6/14/04
6/28/04
7/14/04
7/28/04
8/14/04
8/28/04
9/14/04
9/27/04
10/14/04
10/28/04

Results of Tracer Study

Summary of results of West ditch tracer study in the Whiterocks Hatchery area

Injection site	Date-time of tracer injection	Injection site discharge (gpm)	Type of tracer	Amount of tracer	Monitored sites	Map No.
West ditch at flume (above)	8-13-04 1530 to 1550	225 - 450	Fluorescein dye	1.0 lb	Whiterocks spring	5
West ditch at flume (below)	8-13-04 2030 to 2100			1.0 lb	(composite)	
					Whiterocks spring	6
					(outflow)	
					Whiterocks spring	3
					(west pipe)	
					Farm Creek spring	9
					Ridley spring	7
					(outflow)	

Recovery site(s)	Date-time of tracer recovery	Recovery site discharge (gpm)	Method of detection	[1]Maximum travel time (days)	[2]Linear distance (ft)
Ridley spring (outflow)	8-21-04 1725	225 - 350	Activated charcoal	8	700

[1]Maximum travel time - Based on cumulative adsorption of dye; actual travel time may be considerably less.

[2]Linear distance - Distance from point of total stream loss in channel, not from injection site.

Ron opened headgate to ditch @ 11:00 AM on 8/13/2004 and let out about 200 gal/min.

Flow in ditch had not quite reached highway at time of injection.

At time of second injection, water had moved down channel to just above hatchery boundary.

Ron opened gate @ 11:00 PM on 8/13/2004 to increase flow in channel to about 1 cfs.

Next morning @ 7:30 AM, flow had moved down channel and past hatchery.

Results of analysis of activated charcoal samples from West ditch tracer study

Site	Detector In Date-time	Detector Out Date-time	Results	Comments
Whiterocks spring (composite)	6/30/2004 1110	8/13/2004 1345	Negative	
Whiterocks spring (composite)	8/13/2004 1345	8/29/2004 1655	Negative	
Whiterocks spring (composite)	8/29/2004 1655	9/12/2004 1600	Negative	
Whiterocks spring (composite)	8/29/2004 1655	9/12/2004 1600	Negative	Duplicate
Whiterocks spring (composite)	9/12/2004 1600	2/28/2005 1600	-----	No recovery
Whiterocks spring (outflow)	8/13/2004 1455	8/21/2004 1600	Negative	
Whiterocks spring (outflow)	8/21/2004 1600	8/29/2004 1630	Negative	
Whiterocks spring (outflow)	8/29/2004 1630	9/12/2004 1535	Negative	
Whiterocks spring (outflow)	8/29/2004 1630	9/12/2004 1535	Negative	Duplicate
Whiterocks spring (outflow)	9/12/2004 1535	2/28/2005 1530	-----	No recovery
Whiterocks spring (west pipe)	8/13/2004 1450	8/21/2004 1850	Negative	
Whiterocks spring (west pipe)	8/21/2004 1850	8/29/2004 1750	Negative	
Whiterocks spring (west pipe)	8/29/2004 1750	9/12/2004 1800	Negative	
Whiterocks spring (west pipe)	8/29/2004 1750	9/12/2004 1800	Negative	Duplicate
Whiterocks spring (west pipe)	9/12/2004 1800	2/28/2005 1630	Negative	
Farm Creek spring	6/30/2004 1145	8/13/2004 1910	Negative	
Farm Creek spring	8/13/2004 1910	8/21/2004 1745	Negative	
Farm Creek spring	8/21/2004 1745	8/29/2004 1920	Negative	
Farm Creek spring	8/29/2004 1920	9/12/2004 1920	Negative	
Ridley spring	6/30/2004 1115	8/13/2004 1825	Negative	
Ridley spring	8/13/2004 1825	8/21/2004 1725	Very weak +	Light beam
Ridley spring	8/21/2004 1725	8/29/2004 1900	Very weak +	Light beam
Ridley spring	8/29/2004 1900	9/12/2004 1940	Weak +	Visual
Ridley spring	9/12/2004 1940	2/28/2005 1750	Weak +	Light beam

Results of analysis of water from Whiterocks Hatchery spring composite (upper) for fluorescein dye

Dye Injection: August 13, 2004 1530 and 2030				
Location: West ditch at flume				
				Background
			Relative	Corrected
Sample ID	Date	Time	Fluorescence	Fluorescence
Background samples prior to tracer test				
DI Water			0	
WRU1	11/26/2003	1530	0.01	0.01
WRU2	11/26/2003	2330	0.02	0.02
WRU3	11/27/2003	730	0.02	0.02
WRU4	11/27/2003	1530	0.03	0.03
WRU5	11/27/2003	2330	0.01	0.01
WRU6	11/28/2003	730	0.02	0.02
DI Water			0	
WRU7	11/28/2003	1530	0.03	0.03
WRU8	11/28/2003	2330	0.01	0.01
WRU9	11/29/2003	730	0.02	0.02
WRU10	11/29/2003	1530	0.02	0.02
WRU11	11/29/2003	2330	0.02	0.02
WRU12	11/30/2003	730	0.03	0.03
DI Water			0	
WRU13	11/30/2003	1530	0.02	0.02
WRU14	11/30/2003	2330	0.02	0.02
WRU15	12/1/2003	730	0.02	0.02
WRU16	12/1/2003	1530	0.03	0.03
WRU17	12/1/2003	2330	0.03	0.03
WRU18	12/2/2003	730	0.03	0.03
DI Water			0.01	
WRU19	12/2/2003	1530	0.03	0.02
WRU20	12/2/2003	2330	0.03	0.02
WRU21	12/3/2003	730	0.41	0.4
DI Water			0.01	
Samples collected during tracer test				
DI Water			0	
WRU1	8/13/2004	1300	0.04	0.04
WRU2	8/13/2004	2100	0.07	0.07
WRU3	8/14/2004	500	0.07	0.07
WRU4	8/14/2004	1300	0.06	0.06
WRU5	8/14/2004	2100	0.08	0.08
WRU6	8/15/2004	500	0.06	0.06
DI Water			0.01	
WRU3R	8/14/2004	500	0	
WRU7	8/15/2004	1300	0.08	0.08
WRU8	8/15/2004	2100	0.08	0.08
WRU9	8/16/2004	500	0.08	0.08
WRU10	8/16/2004	1300	0.08	0.08
WRU11	8/16/2004	2100	0.08	0.08
WRU12	8/17/2004	500	0.09	0.09
DI Water			0	
WRU11R	8/16/2004	2100	0.02	0.02
WRU (MAN)	8/13/2004	1145	0.06	0.06

Results of analysis of water from Whiterocks Hatchery spring composite (upper) for fluorescein dye

Sample ID	Date	Time	Relative Fluorescence	Background Corrected Fluorescence
WRU13	8/17/2004	1300	0.09	0.09
WRU14	8/17/2004	2100	0.09	0.09
WRU15	8/18/2004	500	0.09	0.09
WRU16	8/18/2004	1300	0.09	0.09
WRU17	8/18/2004	2100	0.1	0.1
WRU18	8/19/2004	500	0.08	0.08
DI Water			0.01	
WRU19R	8/19/2004	1300	0.02	0.01
WRU19	8/19/2004	1300	0.1	0.09
WRU20	8/19/2004	2100	0.1	0.09
WRU21	8/20/2004	500	0.09	0.08
WRU22	8/20/2004	1300	0.09	0.08
WRU23	8/20/2004	2100	0.1	0.09
WRU24	8/21/2004	500	0.09	0.08
DI Water			0.02	
WRU (MAN)	8/13/2004	1440	0.09	0.07
WRU (MAN)	8/13/2004	1930	0.08	0.06
DI Water			0.02	
DI Water			0	
WRU1	8/21/2004	2000	0.07	0.07
WRU2	8/22/2004	400	0.09	0.09
WRU3	8/22/2004	1200	0.07	0.07
WRU4	8/22/2004	2000	0.09	0.09
WRU4R	8/22/2004	2000	0.01	0.01
WRU5	8/23/2004	400	0.09	0.09
WRU6	8/23/2004	1200	0.08	0.08
DI Water			0	
WRU7	8/23/2004	2000	0.08	0.08
WRU8	8/24/2004	400	0.08	0.08
WRU9	8/24/2004	1200	0.09	0.09
WRU10	8/24/2004	2000	0.08	0.08
WRU11	8/25/2004	400	0.07	0.07
WRU12	8/25/2004	1200	0.07	0.07
WRU12R	8/25/2004	1200	0	0
WRU1	8/13/2004	1300	0.05	0.05
DI Water			0.01	
WRU13	8/25/2004	2000	0.07	0.06
WRU14	8/26/2004	400	0.08	0.07
WRU15	8/26/2004	1200	0.07	0.06
WRU16	8/26/2004	2000	0.08	0.07
WRU17	8/27/2004	400	0.05	0.04
WRU18	8/27/2004	1200	0.05	0.04
DI Water			0.01	
WRU19	8/27/2004	2000	0.07	0.06
WRU20	8/28/2004	400	0.08	0.07
WRU20R	8/28/2004	400	0.01	0
WRU21	8/28/2004	1200	0.08	0.07
WRU22	8/28/2004	2000	0.09	0.08

Results of analysis of water from Whiterocks Hatchery spring composite (upper) for fluorescein dye

Sample ID	Date	Time	Relative Fluorescence	Background Corrected Fluorescence
WRU23	8/29/2004	400	0.07	0.06
WRU24	8/29/2004	1200	0.08	0.07
WRU (MAN)	8/13/2004	1440	0.09	0.08
WRU (MAN)	8/21/2004	1420	0.07	0.06
DI Water			0.01	
DI Water			0	
WRU1	8/29/2004	2045	0.04	0.04
WRU2	8/30/2004	445	0.05	0.05
WRU2R	8/30/2004	445	0	0
WRU3	8/30/2004	1245	0.08	0.08
WRU4	8/30/2004	2045	0.08	0.08
WRU5	8/31/2004	445	0.07	0.07
WRU6	8/31/2004	1245	0.07	0.07
DI Water			0	
WRU7	8/31/2004	2045	0.05	0.05
WRU8	9/1/2004	445	0.07	0.07
WRU9	9/1/2004	1245	0.07	0.07
WRU10	9/1/2004	2045	0.08	0.08
WRU10R	9/1/2004	2045	0	0
WRU11	9/2/2004	445	0.07	0.07
WRU12	9/2/2004	1245	0.08	0.08
DI Water			0	
WRU13	9/2/2004	2045	0.08	0.08
WRU14	9/3/2004	445	0.07	0.07
WRU15	9/3/2004	1245	0.05	0.05
WRU16	9/3/2004	2045	0.05	0.05
WRU17	9/4/2004	445	0.06	0.06
WRU2	8/13/2004	2100	0.08	0.08
WRU18	9/4/2004	1245	0.06	0.06
WRU18R	9/4/2004	1245	0.01	0.01
DI Water			0.01	
WRU19	9/4/2004	2045	0.06	0.06
WRU20	9/5/2004	445	0.05	0.05
WRU21	9/5/2004	1245	0.05	0.05
WRU22	9/5/2004	2045	0.07	0.07
WRU23	9/6/2004	445	0.03	0.03
WRU24	9/6/2004	1245	0.03	0.03
WRU (MAN)	8/13/2004	1930	0.05	0.05
WRU1	8/13/2004	1300	0.05	0.05
WRU (MAN)	9/12/2004	1600	0.08	0.08
WRU21	12/3/2003	730	0.42	0.42
WRU20	12/2/2003	2330	0.07	0.07
DI Water			0	
DI Water - Laboratory de-ionized water				
R - Rinsate sample from autosampler				
MAN - Sample collected manually				

Results of analysis of water from Whiterocks Hatchery spring outflow (lower) for fluorescein dye

Dye Injection: August 13, 2004 1530 and 2030				
Location: West ditch at flume				
				Background
			Relative	Corrected
Sample ID	Date	Time	Fluorescence	Fluorescence
DI Water			0	
WRL (MAN)	8/13/2004	1150	0.06	0.05
WRL (MAN)	8/13/2004	1500	0.07	0.06
WRL1	8/13/2004	1700	0.07	0.06
WRL (MAN)	8/13/2004	2115	0.08	0.07
WRL2	8/14/2004	100	0.08	0.07
WRL3	8/14/2004	900	0.08	0.07
WRL4	8/14/2004	1700	0.09	0.08
WRL5	8/15/2004	100	0.09	0.08
WRL6	8/15/2004	900	0.08	0.07
WRL6R	8/15/2004	900	0.02	0.01
DI Water			0.02	
WRL7	8/15/2004	1700	0.08	0.06
WRL8	8/16/2004	100	0.1	0.08
WRL9	8/16/2004	900	0.09	0.07
WRL10	8/16/2004	1700	0.08	0.06
WRK11	8/17/2004	100	0.08	0.06
WRL12	8/17/2004	900	0.09	0.07
DI Water			0.02	
WRL (MAN)	8/13/2004	1150	0.06	0.04
WRL13	8/17/2004	1700	0.07	0.05
WRL14	8/18/2004	100	0.08	0.06
WRL14R	8/18/2004	100	0.02	0
WRL15	8/18/2004	900	0.06	0.04
WRL16	8/18/2004	1700	0.09	0.07
WRL17	8/19/2004	100	0.05	0.03
WRL18	8/19/2004	900	0.06	0.04
DI Water			0.02	
WRL19	8/19/2004	1700	0.06	0.04
WRL20	8/20/2004	100	0.05	0.03
WRL21	8/20/2004	900	0.07	0.05
WRL22	8/20/2004	1700	0.06	0.04
WRL22R	8/20/2004	1700	0.02	0
WRL23	8/21/2004	100	0.09	0.07
WRL24	8/21/2004	900	0.08	0.06
DI Water			0.02	
WRL (MAN)	8/13/2004	1500	0.06	0.04
WRL (MAN)	8/13/2004	2115	0.07	0.05
WRL (MAN)	8/21/2004	1530	0.06	0.04
DI Water			0	
WRU (MAN)	8/13/2004	1145	0.04	0.04
WRU (MAN)	8/29/2004	1710	0.05	0.05
WRU (MAN)	8/21/2004	2030	0.06	0.06

Results of analysis of water from Whiterocks Hatchery spring outflow (lower) for fluorescein dye

Sample ID	Date	Time	Relative Fluorescence	Background Corrected Fluorescence
DI Water			0	
WRL1	8/21/2004	1600	0.05	0.05
WRL2	8/22/2004	0	0.05	0.05
WRL3	8/22/2004	800	0.06	0.06
WRL4	8/22/2004	1600	0.06	0.06
WRL4R	8/22/2004	1600	0.02	0.02
WRL5	8/23/2004	0	0.06	0.06
WRL6	8/23/2004	800	0.05	0.05
DI Water			0.01	
WRL7	8/23/2004	1600	0.06	0.05
WRL8	8/24/2004	0	0.06	0.05
WRL9	8/24/2004	800	0.06	0.05
WRL10	8/24/2004	1600	0.07	0.06
WRL11	8/25/2004	0	0.06	0.05
WRL12	8/25/2004	800	0.05	0.04
WRL12R	8/25/2004	800	0.03	0.02
DI Water			0.02	
WRL (MAN)	8/13/2004	1150	0.07	0.05
WRL13	8/25/2004	1600	0.07	0.05
WRL14	8/26/2004	0	0.07	0.05
WRL15	8/26/2004	800	0.06	0.04
WRL16	8/26/2004	1600	0.06	0.04
WRL17	8/27/2004	0	0.07	0.05
WRL18	8/27/2004	800	0.06	0.04
DI Water			0.01	
WRL19	8/27/2004	1600	0.04	0.03
WRL20	8/28/2004	0	0.05	0.04
WRL20R	8/28/2004	0	0.01	0
WRL21	8/28/2004	800	0.05	0.04
WRL22	8/28/2004	1600	0.06	0.05
WRL23	8/29/2004	0	0.05	0.04
WRL24	8/29/2004	800	0.04	0.03
DI Water			0.02	
WRL (MAN)	8/13/2004	1500	0.06	0.04
DI Water			0	
WRL1	8/29/2004	1615	0.02	0.02
WRL2	8/30/2004	15	0.04	0.04
WRL3	8/30/2004	815	0.05	0.05
WRL4	8/30/2004	1615	0.04	0.04
WRL5	8/31/2004	15	0.05	0.05
WRL6	8/31/2004	815	0.05	0.05
DI Water			0	
WRL7	8/31/2004	1615	0.05	0.05
WRL8	9/1/2004	15	0.05	0.05
WRL9	9/1/2004	815	0.05	0.05

Results of analysis of water from Whiterocks Hatchery spring outflow (lower) for fluorescein dye

Sample ID	Date	Time	Relative Fluorescence	Background Corrected Fluorescence
WRL10	9/1/2004	1615	0.05	0.05
WRL11	9/2/2004	15	0.04	0.04
WRL12	9/2/2004	815	0.05	0.05
DI Water			0.01	
WRL1	8/13/2004	1700	0.05	0.05
WRL13	9/2/2004	1615	0.04	0.04
WRL14	9/3/2004	15	0.04	0.04
WRL15	9/3/2004	815	0.04	0.04
WRL16	9/3/2004	1615	0.05	0.05
WRL17	9/4/2004	15	0.05	0.05
WRL18	9/4/2004	815	0.05	0.05
DI Water			0	
WRL19	9/4/2004	1615	0.04	0.04
WRL20	9/5/2004	15	0.04	0.04
WRL21	9/5/2004	815	0.04	0.04
WRL22	9/5/2004	1615	0.05	0.05
WRL23	9/6/2004	15	0.04	0.04
WRL24	9/6/2004	815	0.05	0.05
DI Water			0.01	
WRL (MAN)	8/13/2004	2115	0.06	0.05
WRL (MAN)	9/12/2004	1530	0.06	0.05
WRL (MAN)	9/12/2004	2100	0.06	0.05
WRU (MAN)	9/12/2004	800	0.04	0.03
DI Water - Laboratory de-ionized water				
R - Rinsate sample from autosampler				
WRU - Whiterocks spring composite (upper)				
WRL - Whiterocks spring outflow (lower)				
MAN - Sample collected manually				

Results of analysis of water from selected sites in the Whiterocks Hatchery area for fluorescein dye

Dye Injection: August 13, 2004 1530 and 2030					
Location: West ditch at flume					
					Background
	Map			Relative	Corrected
Sample ID	No.	Date	Time	Fluorescence	Fluorescence
DI Water				0.02	
West ditch at flume (injection site)	11	8/13/2004	1600	0.18	0.16
Ridley spring	7	8/13/2004	1415	0.13	0.11
DI Water				0.02	
DI Water				0.01	
Whiterocks spring (main)	1	8/21/2004	2030	0.05	0.05
West ditch by hatchery	14	8/21/2004	1440	0.21	0.21
West ditch by hatchery	14	8/21/2004	2100	0.18	0.18
Whiterocks spring (west pipe)	3	8/29/2004	1710	0.05	0.05
Ridley spring	7	8/29/2004	1900	0.3	0.3
Farm Creek spring	9	8/29/2004	1920	0.08	0.08
West ditch by hatchery	14	8/29/2004	1740	0.12	0.12
West ditch at highway	12	8/29/2004	2100	0.12	0.12
Whiterocks spring (main)	1	8/21/2004	2030	0.04	0.04
DI Water				0	
DI Water				0.02	
Whiterocks spring (main)	1	8/21/2004	2030	0.06	0.04
DI Water				0.01	
Farm Creek canal at highway	15	9/12/2004	1445	0.07	0.07
Farm Creek spring	9	9/12/2004	1925	0.05	0.05
Ridley spring	7	9/12/2004	1940	0.39	0.39
West ditch by hatchery	14	9/12/2004	2035	0.16	0.16
West ditch at flume (injection site)	11	8/13/2004	1600	0.16	0.16
West ditch at highway	12	8/29/2004	2100	0.1	0.1
DI Water				0	
West ditch by hatchery	14	8/21/2004	1440	0.19	0.19
West ditch by hatchery	14	8/21/2004	2100	0.17	0.17
West ditch by hatchery	14	8/29/2004	1740	0.1	0.1
Ridley spring	7	8/13/2004	1415	0.1	0.1
Ridley spring	7	8/29/2004	1900	0.26	0.26
Farm Creek spring	9	8/29/2004	1920	0.06	0.06
DI Water				0	
DI Water				0	
Farm Creek canal at highway	15	9/12/2004	1445	0.07	0.07
Farm Creek spring	9	9/12/2004	1925	0.05	0.05
Ridley spring	7	9/12/2004	1940	0.38	0.38
West ditch by hatchery	14	9/12/2004	2035	0.16	0.16
DI Water				0.01	

Laboratory Techniques for Analysis of Fluorescent Dyes in the Utah Water Science Center Laboratory, Salt Lake City

Instrumentation

The Utah Water Science Center Laboratory is equipped with Turner Designs Model 10 and Model 700 filter fluorometers. The Model 10 is a 1970s-era analog instrument; the Model 700 was purchased in 2005. The Model 10 can be used as either a field or laboratory instrument. However, the instrument is seldom used in the field and instead, is set up for manual analysis of discrete samples in the District Lab. The Model 700 is designed as a laboratory instrument and unlike the Model 10, it has more advanced functions including digital display, data manipulation, and data output capability to a printer or computer. Both of the instruments use glass filters to quantify the amount of fluorescence generated by a substance when exposed to a broad spectrum light source. Incoming light from an ultraviolet lamp (quartz halogen or mercury vapor) passes through an excitation filter which then narrows or focuses the spectrum of light that bombards the sample. Light is re-emitted from the sample at a longer wavelength, which then passes through an emission filter that further restricts the spectrum of light emitted by the sample. Every fluorescent substance is characterized by peak excitation and emission wavelengths that are specific to the substance being analyzed. Only one set of excitation and emission filters can be placed in the Model 10 at a time for each fluorescent substance being analyzed. The Model 700 employs a filter "cylinder" that can accommodate up to 4 sets of filters for sequential analysis of multiple dyes or other fluorescent substances. The Model 10 filter fluorometer is currently used for the detection of sodium fluorescein and rhodamine WT dyes and the procedures outlined in this guidance document pertain only to the analysis of these dyes on the Model 10 unit. Because each of these dyes fluoresces at different wavelengths, separate excitation and emission filters and light sources (lamps) are required. Specifications for analysis of each of these dyes are presented in table 1.

Table 1. Specifications for fluorometric analysis of fluorescein and rhodamine WT dyes (Turner Designs, 1996)

Dye/ Color Index Name	Excitation Filter (nanometers)	Emission Filters (nanometers)	Reference Filter (nanometers)	Peak Excitation/ Peak Emission (nanometers)	Source lamp
Sodium fluorescein (uranine) Acid Yellow 73	034-0486 (481 - 491)	2A-12 and 4-97 (510 - 700)	10-063 (#8) (> 485)	485/515	Daylight White 10-045
Rhodamine WT Acid Red 388	10-056 (546)	4-97 and 3-66 (570 - 700)	10-053 (#16) (> 535)	550/580	Clear Quartz 10-046

The Model 10 filter fluorometer has four relative sensitivity ranges – MINS (minimum sensitivity), x3.16, x10, and x31.6, where each range is 3.16 times the previous one. Thus, a value of 2.5 on the x3.16 scale is equivalent to 7.9 on the x10 scale. Each of these ranges can also be increased by x100 to further increase sensitivity to very low concentrations. The basic ranges can be selected manually or the instrument can be set to select the most applicable range automatically. Generally, the instrument is set on the most sensitive scale that will still accommodate samples with the highest fluorescence (concentration) values. Lower concentration samples are analyzed on higher sensitivity scales or ranges, to increase detectability and improve measurement accuracy. However, all sample readings are ultimately referenced to the same scale for plotting recovery curves. In addition, the instrument can be calibrated to read concentration directly when relative fluorescence readings are related to a set of known dye standards (see below).

Methodology - Water sample analysis

Initially, the instrument is calibrated to read zero or close to zero using laboratory grade deionized (DI) water. This adjustment is made using the "blank" control knob. Generally, DI water is analyzed after every six environmental samples to establish a baseline for monitoring instrument "drift". Over a period of several hours, values for DI water tend to increase slightly, presumably as the instrument warms up. The blank is then either periodically adjusted back to zero or the values are "subtracted" from the values of the environmental samples. Field process (rinsate) blanks are used to assess potential cross contamination between environmental samples collected in an automatic water sampler. These samples are processed in the field or lab to evaluate the effectiveness of the cleaning procedure of the sample bottles. The sample bottles are rinsed twice with DI water and selected bottles (every 8th bottle) are rinsed a third time. This third rinsate sample is analyzed after every six environmental samples.

Samples from all potential discharge points such as springs, are collected prior to a dye injection and are analyzed to determine the average natural (background) fluorescence, which is used to establish a baseline for a dye-recovery curve. This "background" fluorescence typically is due to organic material such as humic acids that can fluoresce in the same wavelength range as the dye. Background fluorescence is "subtracted" from the fluorescence of the samples to yield a value that is related only to the fluorescence of the dye. A sample of water from the injection point is also usually collected for comparison to the potential outlet samples. All of the baseline samples are analyzed prior to the environmental samples (collected after the dye injection) and selected baseline samples are also re-run after every 12 environmental samples.

Environmental samples are stored in the dark and/or refrigerated to minimize biological and photochemical (UV) degradation of the dyes. Prior to analysis, the samples are brought to room temperature to minimize potential temperature effects on fluorescence. Thirty-milliliter (ml) glass test tubes or vials are used as sample holders. The vials are rinsed with the sample water two times before a third aliquot is taken for analysis. The vial is placed into the sample compartment of the fluorometer and a reading is taken once the indicator (needle) stabilizes, generally a period of about 10 seconds. Each sample is analyzed twice (separate aliquots) unless the value varies by more than two scalar units, and is then analyzed a third time. Samples known to have concentrations beyond the linear range (see below) of the particular dye are diluted either 2 or 4 times, analyzed on the applicable scale, and then corrected using a multiplier based on the dilution factor. Dilutions are seldom necessary, however.

A dye-calibration curve can be prepared to convert the relative fluorescence of samples to actual concentrations. Standards ranging from 1 micrograms/L or less to 50 micrograms/L are prepared using a serial dilution technique described in Wilson (1986). This serial dilution technique uses the stock manufactured dye to create a range of concentration values that are within the expected range of concentrations in the environmental samples. Resulting concentrations are typically 1, 5, 10, 25, and 50 micrograms/L. The fluorescence of fluorescein and rhodamine WT dyes generally is linear to about 50 micrograms/L. Higher concentrations of the dye are typically "quenched" so that values of fluorescence above 50 micrograms/L, and particularly above 100 micrograms/L, are typically less than values of fluorescence would be if linearity were to be maintained. At very high concentrations, this fluorescence actually reverses and can be less than that at lower concentrations in the linear range. As a result, samples with high concentrations of dye are usually diluted into the linear range prior to analysis. Calibration standards up to 50 micrograms/L can be measured directly on the x31.6 range. Samples with higher concentrations (generally greater than 100 micrograms/L) are first diluted with laboratory DI water into the linear range for the dye and then the values are corrected by using the applicable

multiplier. Selected dye standards are usually analyzed for every 24 environmental samples to check linearity and instrument precision.

Methodology - Activated charcoal analysis

Fluorescein and rhodamine WT dyes can also be extracted from activated charcoal by using one of several eluent mixtures consisting of DI water, an alcohol (such as isopropyl), and a base (such as potassium hydroxide) (Aley and Fletcher, 1976; Mull and others, 1988). Although the individual chemicals have a shelf life of at least several years, the resulting eluents have a reported shelf life ranging from only several weeks to several months. Extraction of fluorescein dye is done by using a 5 percent solution of isopropyl alcohol (70 percent) and potassium hydroxide (KOH) (Mull and others, 1988). This is prepared by dissolving 6-7 grams of KOH in 100 ml of isopropyl alcohol. This results in a supersaturated mixture, as indicated by a heavier supernatant at the bottom of the container overlain by the eluent solution.

Activated charcoal is removed from pre-constructed nylon screen wire packets and placed into 100-ml glass beakers. The charcoal is then thoroughly rinsed with laboratory DI water until all of the sediment and organic debris are removed from the charcoal that could potentially interfere with the extraction, observation, and analysis of dye in the sample. After rinsing, the excess water is poured off and each sample is then eluted with about 20 ml of the alcohol-KOH eluent to extract the dye from the charcoal. Samples are then covered and allowed to stand overnight. Dye eluted from charcoal that has adsorbed substantial amounts of the dye generally is visible in the elutant within minutes of extraction while samples that have adsorbed lesser amounts may take several hours or more to become visually positive. Concentrations of dye extracted from activated charcoal generally are reported qualitatively based on the relative strength of the visible amount of dye in the elutant. This classification includes very weakly positive, weakly positive, positive, strongly positive, and very strongly positive. Concentrations of dye that are not obviously visible (less than very weakly positive) can often be enhanced for observation by using a directed beam of white light. In addition, very low concentrations of dye that cannot be discerned by visual methods or cannot be differentiated from the fluorescence of natural organic material often can be detected by analysis of the elutant on the fluorometer. Because dye is cumulatively adsorbed onto charcoal, however, measured dye concentrations are not representative of those present in the water at the time of collection.

Low concentrations of dye, particularly fluorescein, that are adsorbed by activated charcoal can be difficult to distinguish visually from the fluorescence of organic materials, which are also adsorbed over time. Consequently, detectors are placed in all potential discharge points at least 1 week prior to (and removed on the day of) the dye injection, to evaluate the amount of

natural fluorescence in the native water. Detectors also are collected and replaced after the dye test has been completed, to document a return to natural background conditions. Generally, all charcoal detectors collected prior to, during, and after the dye trace are processed at the same time (rather than after each one is collected) for comparison purposes. If elution of the charcoal is to take place within several days of collection, the detectors are kept moist until ready for processing. If analysis of the detectors is not planned for several weeks, the detectors are refrigerated to inhibit bacterial growth, which potentially could result in loss of dye. Charcoal detectors are stored dry for longer periods of time.

Additional samples that are typically processed along with the environmental samples include samples that were positive for dye in prior tests, a split or duplicate sample, and an unused charcoal sample. Processing of a sample from a previous dye trace that was positive for dye evaluates the effectiveness of the eluent mixture to extract dye. Environmental samples are often split for processing in order to provide additional sample for verification of results. Duplicate samples are typically employed and processed to provide additional verification of a result, to serve as backup detectors should the primary detector become lost or tampered with, or to be processed at a later date for comparison with samples from other dye tests. In addition, processing a charcoal detector that has not been used in the field allows for comparison with natural background fluorescence in environmental samples and for evaluating the presence of other fluorescent substances that may be inherent to the charcoal.

References

Aley, T., and Fletcher, M.W., 1976, The water tracers cookbook: Missouri Speleology, v. 16, no. 3, p. 1-32.

Jones, W.K., 1984, Dye tracer tests in karst areas: The NSS Bulletin, Water Tracing Special Issue, vol. 46, no. 2, p. 3-9.

Mull, D.S., Liebermann, T.D., Smoot, J.L., and Woosley, L.H., Jr., 1988, Application of dye-tracing techniques for determining solute-transport characteristics of ground water in karst terranes: U.S. Environmental Protection Agency, Region 4, EPA 904/6-88-001, 103 p.

Turner Designs, 1996, Optical configuration guide, Model 10-AU-005 field fluorometer, 998-0005, July 23, 1996.

Wilson, J.F., Cobb, E.D., and Kilpatrick, F.A., 1986, Fluorometric procedures for dye tracing: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. A12, 34 p.

Results of Chemical Analysis

===== Project: 9716AUG02 Site: USGS 402911109572201 Database: 01 =====

ONWIS QW Batch Enter -- Process Date: 10-09-2003 01:05 -- Transaction Number: 3

Record Number: 00300456 SINT: 858525 MDT Begin Date: 07-10-2003 18:00 End Date: Medium: 6
Site ID: USGS 402911109572201 Station Name: U(B- 1- 1)14adb- 1 State: 49 County: 047
Lab ID Number: 2230215 Project: 9716AUG02 Geologic Unit:. Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: X Sample Type: 9 Hydrologic Event: X
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 24
Sample Field Comment--
Sample Lab Comment-- Whiterocks spring (main)

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00010		--		Temperature, water	degrees C	10.9				S	I	3	--		
	00027		--		Collecting agency	code	1028				S	I	4	--		
U	00028		--		Analyzing agency	code	80020				S	I	4	--		
	00095		--		Specific cond at 25C	uS/cm @ 25C	425				S	I	3	--		
	00400		--		pH	standard units	7.3				S	I	2	--		
	00403	A	.1	MRL	pH, wu,lab	standard units	7.83				S	H	2	--		20030812
	00452	B	--		Carbonate,wf,icr,fld	mg/L	0				S	A	1	--		
	00453	B	--		Bicarbonate,wf,icr,f	mg/L	238				S	I	3	--		
C	00900		--		Hardness, wu	mg/L as CaCO3	220							--		
	00915	D	.011	IRL	Calcium, wf	mg/L	65.4200				S	H	3	--		20030820
	00925	C	.008	IRL	Magnesium, wf	mg/L	14.0111				S	H	3	--		20030820
	00930	C	.1	IRL	Sodium, wf	mg/L	2.5436				S	H	3	--		20030820
C	00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C	00932		--		Sodium, w	percent	3							--		
	00935	C	.16	IRL	Potassium, wf	mg/L	1.8349				S	H	2	--		20030820
	00940	J	.2	LRL	Chloride, wf	mg/L	3.07				S	H	3	--		20030819
	00945	G	.18	LRL	Sulfate, wf	mg/L	23.96				S	H	3	--		20030819
	00950	B	.17	MRL	Fluoride, wf	mg/L	.17	<			S	H	2	--		20030820
	00955	D	.02	IRL	Silica, wf	mg/L	10.8947				S	H	3	--		20030820
	01046	D	8	IRL	Iron, wf	ug/L	8	<			S	H	1	--		20030820
	01056	C	.4	IRL	Manganese, wf	ug/L	.4735				S	H	1	--		20030820
	39086	B	--		Alkalinity, wf,icr,f	mg/L as CaCO3	195				S	I	3	--		
	70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	247.27				S	H	3	--		20030820
C	70301		--		Residue, wf, sum	mg/L	239							--		
	71870	E	.016	LRL	Bromide, wf	mg/L	.0285				S	H	3	--		20030818
N	82082	B	--		H-2/H-1 ratio, wu	per mil	-109.8				S	H	4	--		20031005
N	82085	A	--		O-18/O-16 ratio, wu	per mil	-14.91				S	H	4	--		20031005
	90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	404.9				S	H	3	--		20030812

**** ERROR REPORT AND MESSAGES for Transaction Number 3 ****
Result integer: 858525 P00028 = 80020/ / /4/ from P00028 = 1028/ / /4/
LAB ID REPORTED BY LAB: 2529539DOES NOT MATCH STORED: 2230215
--Lab ID number not stored.

07000 Tritium, 25 picocuries/L (7.8 Tritium Units)
75985 Tritium, 2-sigma uncertainty 1.9 pCi/L

RECORD NUMBER: 00300456
STATION ID: USGS 402911109572201
STATION NAME: U(B- 1- 1)14adb- 1
COLLECTION DATE: 07-10-2003 1800 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	65.4	3.265	CHLORIDE, DISS. MG/L	3.07	0.087
MAGNESIUM, DISS. MG/L	14.0	1.153	SULFATE, DISS. MG/L	24.0	0.499
SODIUM, DISS. MG/L	2.54	0.111	BICARB., DIS, IT, FLD	238	3.901
POTASSIUM, DISS. MG/L	1.83	0.047	CARB., DIS, IT, FLD	.0	0.001
MANGANESE, DISS. UG/L	.5	0.001			
TOTAL		4.576	TOTAL		4.487

PERCENT DIFFERENCE = 0.98

WHITEROCKS SP MAIN

ALKALINITY

pH	Δ pH	Vol acid DC or mL	ΔVol acid DC or mL	Δ pH / Δ Vol acid
7.39		0		
7.06		100		
6.80		200		
6.46		400		
6.12		600		
5.68		800		
5.27	.41	900	100	.0041
4.95	.32	940	40	.008
4.83	.12	950	10	.012
4.76	.07	955	5	.014
4.67	.09	960	5	.018
4.60	.07	965	5	.014
4.55	.05	968	3	.017
4.49	.06	971	3	.020
4.43	.06	974	3	.020
4.38	.05	977	3	.017
4.33	.05	980	3	.017
4.25	.08	985	5	.016
4.17	.08	990	5	.016
4.10	.07	995	5	.014
4.04		1000		

Acid: 1.60 N (0.1600 N) 0.01639N OTHER _____

Acid Lot No.: _____

Sample Volume: 50 mL

☐ Filtered ☒ Unfiltered

Sample stirred: ☒ magnetically ☐ manually

pH: Start 7.39 End 4.04

DC (Digital Counts) or Vol. titrated at End Point near pH 8.3: 0

Digital Counts or Vol. titrated at End Point near pH 4.5: 974

☒ Incremental Equivalence ☐ Fixed End Point ☐ Gran Titration

Date 7/10/03 Time 1800

CALCULATIONS:

$$CO_3^{-2} = A \times \frac{F_1}{\text{mL sample}} \times CF^{*}$$

$$HCO_3^{-1} = [B - 2(A)] \times \frac{F_2}{\text{mL sample}} \times CF;^{*}$$

$$\text{ALKALINITY as } CaCO_3 = B \times \frac{F_3}{\text{mL sample}} \times CF^{*}$$

A = DC or mLs acid from initial pH to endpoint near 8.3 = 0

B = DC or mLs acid from initial pH to endpoint near 4.5 = 974

* APPLY CORRECTION FACTOR (CF) IF ACID USED FOR BURETTE TITRATION HAS NONSTANDARD NORMALITY– CF = corr. factor = H_2SO_4 normality/0.01639

FACTORS	DIGITAL COUNT TITRATION (DC) Using 0.1600 normal	Using 1.60 normal
F_1	12.0	120
F_2	12.2	122
F_3	10.0	100

FACTORS	BURETTE TITRATION (mL)* Using ml of 0.01639 normal H_2SO_4
F_1	983.5
F_2	1000
F_3	820.2

(IMPORTANT: CF NOT APPLICABLE FOR THE DIGITAL TITRATION FACTORS SHOWN; use only with nonstandard normality BURETTE titration)

ALKALINITY ( ) 195 mg/L as $CaCO_3$

BICARBONATE ( ) 238 mg/L as HCO_3^{-1}

CARBONATE ( ) 0 mg/L as CO_3^{-2}

NOTE: ATTACH OUTPUT COPY IF ALKALINITY VALUES ARE CALCULATED USING A COMPUTER PROGRAM

OBSERVATIONS/CALCULATIONS:

$HCO_3^- = 974 \cdot .244 = 238$

ALK = 974 · .2 = 195

===== Project: 9716AUG02 Site: USGS 402910109572201 Database: 01 =====

ONWIS QW Batch Enter -- Process Date: 10-09-2003 01:05 -- Transaction Number: 2

Record Number: 00300457 SINT: 858524 MDT Begin Date: 07-10-2003 20:15 End Date: Medium: 6
Site ID: USGS 402910109572201 Station Name: U(B- 1- 1)14adb-2 State: 49 County: 047
Lab ID Number: 2230214 Project: 9716AUG02 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: X Sample Type: 9 Hydrologic Event: X
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 22
Sample Field Comment--
Sample Lab Comment-- Whiterocks spring (east pipe)

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00010		--		Temperature, water	degrees C	10.9				S	I	3	--		
	00027		--		Collecting agency	code	1028				S	I	4	--		
U	00028		--		Analyzing agency	code	80020				S	I	4	--		
	00095		--		Specific cond at 25C	uS/cm @ 25C	420				S	I	3	--		
	00400		--		pH	standard units	7.2				S	I	2	--		
	00403	A	.1	MRL	pH, wu,lab	standard units	7.78				S	H	2	--		20030812
	00452	B	--		Carbonate,wf,icr,fld	mg/L	0				S	I	1	--		
	00453	B	--		Bicarbonate,wf,icr,f	mg/L	240				S	I	3	--		
C	00900		--		Hardness, wu	mg/L as CaCO3	220							--		
	00915	D	.011	IRL	Calcium, wf	mg/L	64.6682				S	H	3	--		20030820
	00925	C	.008	IRL	Magnesium, wf	mg/L	13.9144				S	H	3	--		20030820
	00930	C	.1	IRL	Sodium, wf	mg/L	2.5293				S	H	3	--		20030820
C	00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C	00932		--		Sodium, w	percent	3							--		
	00935	C	.16	IRL	Potassium, wf	mg/L	1.8051				S	H	2	--		20030820
	00940	J	.2	LRL	Chloride, wf	mg/L	2.6				S	H	3	--		20030819
	00945	G	.18	LRL	Sulfate, wf	mg/L	21.43				S	H	3	--		20030819
	00950	B	.17	MRL	Fluoride, wf	mg/L	.17	<			S	H	2	--		20030820
	00955	D	.02	IRL	Silica, wf	mg/L	11.3618				S	H	3	--		20030820
	01046	D	8	IRL	Iron, wf	ug/L	12.6688				S	H	3	--		20030820
	01056	C	.4	IRL	Manganese, wf	ug/L	2.7794				S	H	2	--		20030820
	39086	B	--		Alkalinity, wf,icr,f	mg/L as CaCO3	197				S	I	3	--		
	70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	245.98				S	H	3	--		20030820
C	70301		--		Residue, wf, sum	mg/L	236							--		
	71870	E	.016	LRL	Bromide, wf	mg/L	.0221				S	H	3	--		20030818
	90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	402.0				S	H	3	--		20030812

**** ERROR REPORT AND MESSAGES for Transaction Number 2 ****
Result integer: 858524 P00028 = 80020/ / /4/ from P00028 = 1028/ / /4/

RECORD NUMBER: 00300457
STATION ID: USGS 402910109572201
STATION NAME: U(B- 1- 1)14adb-2
COLLECTION DATE: 07-10-2003 2015 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	64.7	3.227	CHLORIDE, DISS. MG/L	2.60	0.074
MAGNESIUM, DISS. MG/L	13.9	1.146	SULFATE, DISS. MG/L	21.4	0.447
SODIUM, DISS. MG/L	2.53	0.111	BICARB., DIS, IT, FLD	240	3.934
POTASSIUM, DISS. MG/L	1.81	0.047	CARB., DIS, IT, FLD	.0	0.001
IRON, DISS. UG/L	13	0.001			
MANGANESE, DISS. UG/L	2.8	0.001			
TOTAL		4.529	TOTAL		4.454

PERCENT DIFFERENCE = 0.85

WHITEROCKS SP RISE (EAST PIPE)

ALKALINITY

pH	Δ pH	Vol acid DC or mL	ΔVol acid DC or mL	Δ pH / Δ Vol acid
7.28		0		
7.02		100		
6.80		200		
6.46		400		
6.14		600		
5.73		800		
5.37	.36	900	100	.0036
5.02	.35	950	50	.007
4.90	.12	960	10	.012
4.84	.06	965	5	.012
4.77	.07	970	5	.014
4.70	.07	975	5	.014
4.63	.07	980	5	.014
4.58	.05	983	3	.017
4.54	.04	986	3	.013
4.50	.04	989	3	.013
4.45	.05	992	3	.017
4.40	.05	995	3	.017
4.31	.09	1000	5	.018
4.23	.08	1005	5	.016
4.14	.09	1010	5	.018
4.06		1015		

Date 7/10/03 Time 2015

CALCULATIONS :

$$CO_3^{-2} = A \times \frac{F_1}{\text{mL sample}} \times CF \;*$$

$$HCO_3^{-1} = [B - 2(A)] \times \frac{F_2}{\text{mL sample}} \times CF \;*$$

$$\text{ALKALINITY as } CaCO_3 = B \times \frac{F_3}{\text{mL sample}} \times CF \;*$$

FACTORS	DIGITAL COUNT TITRATION (DC) Using 0.1600 normal	Using 1.60 normal
F_1	12.0	120
F_2	12.2	122
F_3	10.0	100

A = DC or mLs acid from initial pH to endpoint near 8.3 = 0

B = DC or mLs acid from initial pH to endpoint near 4.5 = 983

FACTORS	BURETTE TITRATION (mL) * Using ml of 0.01639 normal H_2SO_4
F_1	983.5
F_2	1000
F_3	820.2

* APPLY CORRECTION FACTOR (CF) IF ACID USED FOR BURETTE TITRATION HAS NONSTANDARD NORMALITY– CF = corr. factor = H_2SO_4 normality/0.01639

(IMPORTANT : CF NOT APPLICABLE FOR THE DIGITAL TITRATION FACTORS SHOWN; use only with nonstandard normality BURETTE titration)

ALKALINITY ( ) 197 mg/L as $CaCO_3$

BICARBONATE ( ) 240 mg/L as HCO_3^{-1}

CARBONATE ( ) 0 mg/L as CO_3^{-2}

NOTE: ATTACH OUTPUT COPY IF ALKALINITY VALUES ARE CALCULATED USING A COMPUTER PROGRAM

OBSERVATIONS/CALCULATIONS :

$HCO_3^- = 983 \cdot .244 = 240$

$ALK = 983 \cdot .2 = 197$

Acid: 1.60 N (0.1600 N) 0.01639N OTHER _____

Acid Lot No. : _____

Sample Volume : 50 mL

☐ Filtered ☒ Unfiltered

Sample stirred : ☒ magnetically ☐ manually

pH: Start 7.28 End 4.06

DC (Digital Counts) or Vol. titrated at End Point near pH 8.3 : 0

Digital Counts or Vol. titrated at End Point near pH 4.5 : 983

☒ Incremental Equivalence ☐ Fixed End Point ☐ Gran Titration

===== Project: 9716AUG05 Site: USGS 402906109572001 Database: 01 =====

ONWIS QW Batch Enter -- Process Date: 03-23-2004 01:05 -- Transaction Number: 21

Record Number: 00400051 SINT: 873401 MST Begin Date: 11-26-2003 12:30 End Date: Medium: 6
Site ID: USGS 402906109572001 Station Name: U(B- 1- 1)14add-S1 State: 49 County: 047
Lab ID Number: 3450094 Project: 9716AUG05 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: 9 Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 20
Sample Field Comment--
Sample Lab Comment-- Whiterocks spring (composite)

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00010		--		Temperature, water	degrees C	10.0				S	I	3	--		
	00027		--		Collecting agency	code	1028				S	I	4	--		
U	00028		--		Analyzing agency	code	80020				S	I	4	--		
	00095		--		Specific cond at 25C	uS/cm @ 25C	385				S	I	3	--		
	00400		--		pH	standard units	7.5				S	I	2	--		
N	00403	A	.1	MRL	pH, wu,lab	standard units	7.62				S	H	2	--		20031212
C	00900		--		Hardness, wu	mg/L as CaCO3	210							--		
N	00915	D	.01	IRL	Calcium, wf	mg/L	61.1000		c		S	H	3	--		20040224
N	00925	C	.008	IRL	Magnesium, wf	mg/L	13.9000		c		S	H	3	--		20040224
N	00930	C	.1	IRL	Sodium, wf	mg/L	2.3500		c		S	H	3	--		20040224
C	00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C	00932		--		Sodium, w	percent	3							--		
N	00935	C	.16	IRL	Potassium, wf	mg/L	2.0100		c		S	H	2	--		20040224
N	00940	J	.2	LRL	Chloride, wf	mg/L	1.81		c		S	H	3	--		20040221
N	00945	G	.18	LRL	Sulfate, wf	mg/L	16.64		c		S	H	3	--		20040224
N	00950	B	.17	MRL	Fluoride, wf	mg/L	.17	<			S	H	2	--		20031217
N	00955	D	.04	IRL	Silica, wf	mg/L	10.3000		c		S	H	3	--		20040224
N	01046	D	6.4	IRL	Iron, wf	ug/L	4.8200	E	n c		S	H	2	--		20040224
N	01056	C	.8	IRL	Manganese, wf	ug/L	2.5100		c		S	H	2	--		20040224
N	29801	A	2	MRL	Alkalinity,wf,fxEP,l	mg/L as CaCO3	142.23				S	H	3	--		20040218
N	70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	208.25				S	H	3	--		20040112
C	70301		--		Residue, wf, sum	mg/L	193							--		
N	71870	E	.016	LRL	Bromide, wf	mg/L	.0224				S	H	3	--		20031222
N	90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	373.0				S	H	3	--		20031212

**** ERROR REPORT AND MESSAGES for Transaction Number 21 ****
SUM OF CONSTITUENTS/SPECIFIC CONDUCTANCE RATIO OUTSIDE LIMITS .55 TO .81
RESIDUE AT 180 C/SPECIFIC CONDUCTANCE RATIO OUTSIDE LIMITS .55 TO .81
PERCENT DIFFERENCE GREATER THAN +/- 5.49 %

N82082 H-2/H-1 ratio, wu permil -110.1
N82085 O-18/O-16 ratio, wu permil - 14.59
wu - water, unfiltered

RECORD NUMBER: 00400051
STATION ID: USGS 402906109572001
STATION NAME: U(B- 1- 1)14add-S1
COLLECTION DATE: 11-26-2003 1230 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	61.1	3.049	CHLORIDE, DISS. MG/L	1.81	0.052
MAGNESIUM, DISS. MG/L	13.9	1.144	SULFATE, DISS. MG/L	16.6	0.347
SODIUM, DISS. MG/L	2.35	0.103	ALKALIN, DIS FET, LAB	142	2.842
POTASSIUM, DISS. MG/L	2.01	0.052	Alkalinity (in house)	183	3.657
MANGANESE, DISS. UG/L	2.5	0.001	$NO_3 + NO_2$	.26	.019
TOTAL		4.347	TOTAL		3.240

PERCENT DIFFERENCE = 14.60

(3.23) (4.075)

Record Number: 00400052 SINT: 873400 MST Begin Date: 12-03-2003 13:10
End Date: Medium: 6
Site ID: USGS 402906109572001 Sec. Township Range U(B- 1- 1)14add-S1
Station Name: **Whiterocks spring composite** State: 49 County: 047
Lab ID Number: 3450093 Project: 9716AUG05 Geologic Unit: Glacial outwash
Data Types: NU Sample Status: H Sample Source: 9 Hydrologic Condition: 9
Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 9

*	PCODE	T	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	M
	00010		--		Temperature, water	degrees C	10.0	
	00027		--		Collecting agency	code	1028	
U	00028		--		Analyzing agency	code	80020	
	00095		--		Specific conductance	uS/cm @ 25C	365	
	00400		--		pH	standard units	7.5	
N	00608	F	.04	LRL	Ammonia, wf	mg/L as N	.04	<
N	00613	F	.008	LRL	Nitrite, wf	mg/L as N	.008	<
N	00631	E	.06	LRL	NO2+NO3, wf	mg/L as N	.257	
N	00671	H	.018	LRL	Orthophosphate, wf	mg/L as P	.018	<

Wf - whole water sample, filtered

RECORD NUMBER: 00400052
SITE ID: USGS 402906109572001
STATION NAME: U(B- 1- 1)14add-S1
COLLECTION DATE: 12-03-2003 1310

PARTIAL BALANCE

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
			NO2 + NO3, DISS. AS N	.26	0.019
			TOTAL		0.019

PERCENT DIFFERENCE =-100.00

===== Project: 9716AUG02 Site: USGS 402907109572001 Database: 01 ==========

ONWIS QW Batch Enter -- Process Date: 10-09-2003 01:05 -- Transaction Number: 1

Record Number: 00300458 SINT: 858522 MDT Begin Date: 07-11-2003 11:50 End Date: Medium: 6
Site ID: USGS 402907109572001 Station Name: U(B- 1- 1)14add- 1 State: 49 County: 047
Lab ID Number: 2230212 Project: 9716AUG02 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: X Sample Type: 9 Hydrologic Event: X
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 23
Sample Field Comment--
Sample Lab Comment-- Whiterocks hatchery well #3

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00010		--		Temperature, water	degrees C	10.4				S	I	3	--		
	00027		--		Collecting agency	code	1028				S	I	4	--		
U	00028		--		Analyzing agency	code	80020				S	I	4	--		
	00059		--		Flow rate, instant.	gal/min	1				S	I	2	--		
	00095		--		Specific cond at 25C	uS/cm @ 25C	430				S	I	3	--		
	00400		--		pH	standard units	7.3				S	I	2	--		
	00403	A	.1	MRL	pH, wu,lab	standard units	7.99				S	H	2	--		20030812
	00452	B	--		Carbonate,wf,icr,fld	mg/L	0				S	I	1	--		
	00453	B	--		Bicarbonate,wf,icr,f	mg/L	251				S	I	3	--		
C	00900		--		Hardness, wu	mg/L as CaCO3	230							--		
	00915	D	.011	IRL	Calcium, wf	mg/L	68.1028				S	H	3	--		20030820
	00925	C	.008	IRL	Magnesium, wf	mg/L	14.9453				S	H	3	--		20030820
	00930	C	.1	IRL	Sodium, wf	mg/L	2.7693				S	H	3	--		20030820
C	00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C	00932		--		Sodium, w	percent	3							--		
	00935	C	.16	IRL	Potassium, wf	mg/L	1.8732				S	H	2	--		20030820
	00940	J	.2	LRL	Chloride, wf	mg/L	2.71				S	H	3	--		20030819
	00945	G	.18	LRL	Sulfate, wf	mg/L	27.73				S	H	3	--		20030819
	00950	B	.17	MRL	Fluoride, wf	mg/L	.17	<			S	H	2	--		20030820
	00955	D	.02	IRL	Silica, wf	mg/L	10.4597				S	H	3	--		20030820
	01046	D	8	IRL	Iron, wf	ug/L	8	<			S	H	1	--		20030820
	01056	C	.4	IRL	Manganese, wf	ug/L	.2859	E	n		S	H	1	--		20030820
	39086	B	--		Alkalinity, wf,icr,f	mg/L as CaCO3	205				S	I	3	--		
	70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	265.04				S	H	3	--		20030820
C	70301		--		Residue, wf, sum	mg/L	252							--		
	71870	E	.016	LRL	Bromide, wf	mg/L	.0282				S	H	3	--		20030818
	90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	424.5				S	H	3	--		20030812

**** ERROR REPORT AND MESSAGES for Transaction Number 1 ****
Result integer: 858522 P00028 = 80020/ / /4/ from P00028 = 1028/ / /4/

RECORD NUMBER: 00300458
STATION ID: USGS 402907109572001
STATION NAME: U(B- 1- 1)14add- 1
COLLECTION DATE: 07-11-2003 1150 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	68.1	3.399	CHLORIDE, DISS. MG/L	2.71	0.077
MAGNESIUM, DISS. MG/L	14.9	1.230	SULFATE, DISS. MG/L	27.7	0.578
SODIUM, DISS. MG/L	2.77	0.121	BICARB., DIS, IT, FLD	251	4.114
POTASSIUM, DISS. MG/L	1.87	0.048	CARB., DIS, IT, FLD	.0	0.001
TOTAL		4.797	TOTAL		4.768

PERCENT DIFFERENCE = 0.31

WHITEROCKS WELL 3

ALKALINITY

pH	Δ pH	Vol acid DC or mL	ΔVol acid DC or mL	Δ pH / Δ Vol acid
7.41		0		
7.13		100		
6.89		200		
6.52		400		
6.20		600		
5.81		800		
5.51	.30	900	100	.003
5.27	.24	950	50	.0048
5.10	.17	975	25	.0068
4.97	.13	990	15	.0087
4.85	.12	1000	10	.012
4.79	.06	1005	5	.012
4.71	.08	1010	5	.016
4.61	.10	1015	5	.020
4.56	.05	1018	3	.017
4.50	.06	1021	3	.020
4.44	.06	1024	3	.020
4.37	.07	1027	3	.023
4.32	.05	1030	3	.017
4.24	.08	1035	5	.016
4.16	.08	1040	5	.016
4.03		1050		

Acid: 1.60 N (0.1600 N) 0.01639N OTHER _____

Acid Lot No. : _____

Sample Volume : 50 mL

☐ Filtered ☒ Unfiltered

Sample stirred : ☒ magnetically ☐ manually

pH: Start 7.41 End 4.03

DC (Digital Counts) or Vol. titrated at End Point near pH 8.3 : 0

Digital Counts or Vol. titrated at End Point near pH 4.5 : 1027

☒ Incremental Equivalence ☐ Fixed End Point ☐ Gran Titration

Date 7/11/03 Time 1150

CALCULATIONS :

$$CO_3^{-2} = A \times \frac{F_1}{\text{mL sample}} \times CF \ *$$

$$HCO_3^{-1} = [B - 2(A)] \times \frac{F_2}{\text{mL sample}} \times CF; \ *$$

$$\text{ALKALINITY as } CaCO_3 = B \times \frac{F_3}{\text{mL sample}} \times CF \ *$$

A = DC or mLs acid from initial pH to endpoint near 8.3 = 0

B = DC or mLs acid from initial pH to endpoint near 4.5 = 1027

* APPLY CORRECTION FACTOR (CF) IF ACID USED FOR BURETTE TITRATION HAS NONSTANDARD NORMALITY– CF = corr. factor = H_2SO_4 normality/0.01639

FACTORS	DIGITAL COUNT TITRATION (DC) Using 0.1600 normal	Using 1.60 normal
F_1	12.0	120
F_2	12.2	122
F_3	10.0	100

FACTORS	BURETTE * TITRATION (mL) Using ml of 0.01639 normal H_2SO_4
F_1	983.5
F_2	1000
F_3	820.2

(IMPORTANT : CF NOT APPLICABLE FOR THE DIGITAL TITRATION FACTORS SHOWN; use only with nonstandard normality BURETTE titration)

ALKALINITY ( ) 205 mg/L as $CaCO_3$

BICARBONATE ( ) 251 mg/L as HCO_3^{-1}

CARBONATE ( ) 0 mg/L as CO_3^{-2}

NOTE: ATTACH OUTPUT COPY IF ALKALINITY VALUES ARE CALCULATED USING A COMPUTER PROGRAM

OBSERVATIONS/CALCULATIONS :

$HCO_3^- = 1027 \cdot .244 = 251$

$ALK = 1027 \cdot .2 = 205$

1===== Project: 9716AUG05 Site: USGS 402907109572901 Database: 01 ==========

ONWIS QW Batch Enter -- Process Date: 01-04-2005 01:05 -- Transaction Number: 2

Record Number: 00400536 SINT: 910836 MDT Begin Date: 08-13-2004 14:15 End Date: Medium: 6
Site ID: USGS 402907109572901 Station Name: U(B- 1- 1)14adc-S1 State: 49 County: 047
Lab ID Number: 2470313 Project: 9716AUG05 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: X Sample Type: 9 Hydrologic Event: X
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 22
Sample Field Comment--
Sample Lab Comment-- Ridley spring

* PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
00010		--		Temperature, water	degrees C	21				S	I	3	--		
00027		--		Collecting agency	code	1028				S	I	4	--		
U 00028		--		Analyzing agency	code	80020				S	I	4	--		
00059		--		Flow rate, instant.	gal/min	200				S	I	3	--		
00095		--		Specific cond at 25C	uS/cm @ 25C	385				S	I	3	--		
00400		--		pH	standard units	7.9				S	I	2	--		
N 00403	A	.1	MRL	pH, wu,lab	standard units	7.91				S	H	2	--		20040908
00452	B	--		Carbonate,wf,icr,fld	mg/L	0				S	I	1	--		
C 00900		--		Hardness, water	mg/L as CaCO3	210							--		
N 00915	D	.01	IRL	Calcium, wf	mg/L	61.3500				S	H	3	--		20041223
N 00925	C	.008	IRL	Magnesium, wf	mg/L	12.9000				S	H	3	--		20041223
N 00930	C	.1	IRL	Sodium, wf	mg/L	2.2960		c		S	H	3	--		20041223
C 00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C 00932		--		Sodium, w	percent	3							--		
N 00935	C	.16	IRL	Potassium, wf	mg/L	1.4280		c		S	H	2	--		20041207
N 00940	J	.2	LRL	Chloride, wf	mg/L	1.406				S	H	3	--		20041130
N 00945	G	.18	LRL	Sulfate, wf	mg/L	11.659				S	H	3	--		20041130
N 00950	B	.17	MRL	Fluoride, wf	mg/L	.208				S	H	2	--		20040917
N 00955	D	.04	IRL	Silica, wf	mg/L	12.2200		c		S	H	3	--		20041207
N 01046	D	6.4	IRL	Iron, wf	ug/L	16.4400		c		S	H	3	--		20041207
N 01056	C	.8	IRL	Manganese, wf	ug/L	3.6430		c		S	H	2	--		20041207
39086	B	--		Alkalinity, wf,icr,f	mg/L as CaCO3	195				S	I	3	--		
N 70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	225.48				S	H	3	--		20041028
C 70301		--		Residue, wf, sum	mg/L	220							--		
N 71870	E	.016	LRL	Bromide, wf	mg/L	.016	<			S	H	3	--		20040928
N 90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	372.8000				S	H	3	--		20040908

**** ERROR REPORT AND MESSAGES for Transaction Number 2 ****

RECORD NUMBER: 00400536
STATION ID: USGS 402907109572901
STATION NAME: U(B- 1- 1)14adc-S1
COLLECTION DATE: 08-13-2004 1415 - -

CATIONS		(MG/L)	(MEQ/L)	ANIONS		(MG/L)	(MEQ/L)
CALCIUM,	DISS. MG/L	61.3	3.062	CHLORIDE,	DISS. MG/L	1.41	0.040
MAGNESIUM,	DISS. MG/L	12.9	1.062	SULFATE,	DISS. MG/L	11.7	0.243
SODIUM,	DISS. MG/L	2.30	0.100	FLUORIDE,	DISS. MG/L	.2	0.011
POTASSIUM,	DISS. MG/L	1.43	0.037	ALKALIN.,	DIS,IT, FLD	195	3.897
IRON,	DISS. UG/L	16	0.001				
MANGANESE,	DISS. UG/L	3.6	0.001				
	TOTAL		4.261		TOTAL		4.190

PERCENT DIFFERENCE = 0.84

===== Project: 9716AUG05 Site: USGS 402917109573801 Database: 01 =====

ONWIS QW Batch Enter -- Process Date: 03-23-2004 01:05 -- Transaction Number: 26

Record Number: 00400056 SINT: 874016 MST Begin Date: 12-03-2003 14:50 End Date: Medium: 6
Site ID: USGS 402917109573801 Station Name: U(B- 1- 1)14abd-S1 State: 49 County: 047
Lab ID Number: 3510010 Project: 9716AUG05 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: 9 Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 22
Sample Field Comment--
Sample Lab Comment-- Farm Creek spring

* PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
00010		--		Temperature, water	degrees C	9.0				S	I	2	--		
00027		--		Collecting agency	code	1028				S	I	4	--		
00028		--		Analyzing agency	code	80020				S	I	4	--		
00095		--		Specific cond at 25C	uS/cm @ 25C	570				S	I	3	--		
00400		--		pH	standard units	7.6				S	I	2	--		
00403	A	.1	MRL	pH, wu,lab	standard units	7.46				S	H	2	--		20031218
C 00900		--		Hardness, wu	mg/L as CaCO3	330							--		
00915	D	.01	IRL	Calcium, wf	mg/L	84.3000		c		S	H	3	--		20040226
00925	C	.008	IRL	Magnesium, wf	mg/L	28.0000		c		S	H	3	--		20040226
00930	C	.1	IRL	Sodium, wf	mg/L	3.9500		c		S	H	3	--		20040226
C 00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C 00932		--		Sodium, w	percent	3							--		
00935	C	.16	IRL	Potassium, wf	mg/L	1.6800		c		S	H	2	--		20040226
00940	J	.2	LRL	Chloride, wf	mg/L	3.63		c		S	H	3	--		20040224
00945	G	.18	LRL	Sulfate, wf	mg/L	11.79		c		S	H	3	--		20040224
00950	B	.17	MRL	Fluoride, wf	mg/L	.463				S	H	2	--		20031222
00955	D	.04	IRL	Silica, wf	mg/L	18.0000		c		S	H	3	--		20040226
01046	D	6.4	IRL	Iron, wf	ug/L	6.4	<	c		S	H	2	--		20040226
01056	C	.8	IRL	Manganese, wf	ug/L	48.8000		c		S	H	3	--		20040226
29801	A	2	MRL	Alkalinity,wf,fxEP,1	mg/L as CaCO3	233.54				S	H	3	--		20040220
70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	284.21				S	H	3	--		20040203
C 70301		--		Residue, wf, sum	mg/L	292							--		
71870	E	.016	LRL	Bromide, wf	mg/L	.0578				S	H	3	--		20031222
82082	B	--		H-2/H-1 ratio, wu	per mil	-109.0				S	H	4	--		20040116
82085	A	--		O-18/O-16 ratio, wu	per mil	-14.71				S	H	4	--		20040116
90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	555.7				S	H	3	--		20031218

**** ERROR REPORT AND MESSAGES for Transaction Number 26 ****

SUM OF CONSTITUENTS/SPECIFIC CONDUCTANCE RATIO OUTSIDE LIMITS .55 TO .81
RESIDUE AT 180 C/SPECIFIC CONDUCTANCE RATIO OUTSIDE LIMITS .55 TO .81
PERCENT DIFFERENCE GREATER THAN +/- 5.49 %

RECORD NUMBER: 00400056
STATION ID: USGS 402917109573801
STATION NAME: U(B- 1- 1)14abd-S1
COLLECTION DATE: 12-03-2003 1450 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	84.3	4.207	CHLORIDE, DISS. MG/L	3.63	0.103
MAGNESIUM, DISS. MG/L	28.0	2.305	SULFATE, DISS. MG/L	11.8	0.246
SODIUM, DISS. MG/L	3.95	0.172	FLUORIDE, DISS. MG/L	.5	0.025
POTASSIUM, DISS. MG/L	1.68	0.043	ALKALIN, DIS FET, LAB	* 234	4.667
MANGANESE, DISS. UG/L	48.8	0.002			
TOTAL		6.728	TOTAL		5.039

* PERCENT DIFFERENCE = 14.36

* Note: Large imbalance due to error in alkalinity; should be at least 25% higher than stated val

===== Project: 9716AUG05 Site: USGS 403256109572500 Database: 01 =====

ONWIS QW Batch Enter -- Process Date: 03-23-2004 01:05 -- Transaction Number: 27

Record Number: 00400053 SINT: 874017 MST Begin Date: 11-26-2003 10:10 End Date: Medium: 9
Site ID: USGS 403256109572500 Station Name: FARM CREEK NEAR ELKHORN U(B-2-1)23ddc State: 49 County: 047
Lab ID Number: 3510011 Project: 9716AUG05 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: 9 Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 21
Sample Field Comment--
Sample Lab Comment-- Farm Creek bridge (Elkhorn)

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00010		--		Temperature, water	degrees C	.5				S	I	1	--		
	00027		--		Collecting agency	code	1028				S	I	4	--		
U	00028		--		Analyzing agency	code	80020				S	I	4	--		
	00061		--		Discharge, instant.	cfs	1.39				S	I	2	--		
	00095		--		Specific cond at 25C	uS/cm @ 25C	480				S	I	3	--		
	00400		--		pH	standard units	8.1				S	I	2	--		
N	00403	A	.1	MRL	pH, wu,lab	standard units	8.10				S	H	2	--		20031218
C	00900		--		Hardness, wu	mg/L as CaCO3	280							--		
N	00915	D	.01	IRL	Calcium, wf	mg/L	79.1000		c		S	H	3	--		20040226
N	00925	C	.008	IRL	Magnesium, wf	mg/L	18.9000				S	H	3	--		20040305
N	00930	C	.1	IRL	Sodium, wf	mg/L	4.2700		c		S	H	3	--		20040226
C	00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C	00932		--		Sodium, w	percent	4							--		
N	00935	C	.16	IRL	Potassium, wf	mg/L	2.2500		c		S	H	2	--		20040226
N	00940	J	.2	LRL	Chloride, wf	mg/L	2.96		c		S	H	3	--		20040224
N	00945	G	.18	LRL	Sulfate, wf	mg/L	51.7				S	H	3	--		20040224
N	00950	B	.17	MRL	Fluoride, wf	mg/L	.243				S	H	2	--		20031222
N	00955	D	.04	IRL	Silica, wf	mg/L	11.6000		c		S	H	3	--		20040226
N	01046	D	6.4	IRL	Iron, wf	ug/L	9.4900		c		S	H	2	--		20040226
N	01056	C	.8	IRL	Manganese, wf	ug/L	13.6000		c		S	H	3	--		20040226
N	29801	A	2	MRL	Alkalinity,wf,fxEP,l	mg/L as CaCO3	163.03				S	H	3	--		20040220
N	70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	269.16				S	H	3	--		20040203
C	70301		--		Residue, wf, sum	mg/L	269							--		
N	71870	E	.016	LRL	Bromide, wf	mg/L	.0251				S	H	3	--		20031222
N	90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	471.3				S	H	3	--		20031218

**** ERROR REPORT AND MESSAGES for Transaction Number 27 ****
PERCENT DIFFERENCE GREATER THAN +/- 5.49 %

N82082 H-2/H-1 ratio, wu permil - 113.8
N82085 O-18/O-16 ratio, wu permil - 15.35
WU - water, unfiltered

RECORD NUMBER: 00400053
STATION ID: USGS 403256109572500
STATION NAME: FARM CREEK NEAR ELKHORN
COLLECTION DATE: 11-26-2003 1010 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	79.1	3.948	CHLORIDE, DISS. MG/L	2.96	0.084
MAGNESIUM, DISS. MG/L	18.9	1.556	SULFATE, DISS. MG/L	51.7	1.077
SODIUM, DISS. MG/L	4.27	0.186	FLUORIDE, DISS. MG/L	.2	0.013
POTASSIUM, DISS. MG/L	2.25	0.058	ALKALIN, DIS FET, LAB	163	3.258
IRON, DISS. UG/L	9	0.001	Alkalinity (in house)	206	4.116
MANGANESE, DISS. UG/L	13.6	0.001			
TOTAL		5.747	TOTAL		4.431

PERCENT DIFFERENCE = 12.94

(4.14) (5.29)

===== Project: 9716AUG02 Site: USGS 403256109572500 Database: 01 ==========

ONWIS QW Batch Enter -- Process Date: 10-09-2003 01:05 -- Transaction Number: 11

Record Number: 00300506 SINT: 864459 MDT Begin Date: 07-11-2003 14:00 End Date: Medium: 9
Site ID: USGS 403256109572500 Station Name: CANAL OFF OF FARM CREEK State: 49 County: 047
Lab ID Number: 2529540 Project: 9716AUG02 Geologic Unit: Data Types: RA
Sample Status: H Sample Source: 9 Hydrologic Condition: 9 Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 4
Sample Field Comment--
Sample Lab Comment-- Farm Creek bridge (Elkhorn)

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00027		--		Collecting agency	code	1028				S	I	4	--		
U	00028		--		Analyzing agency	code	80020				S	I	4	--		
N	82082	B	--		H-2/H-1 ratio, wu	per mil	-113.6				S	H	4	--		20031005
N	82085	A	--		O-18/O-16 ratio, wu	per mil	-15.22				S	H	4	--		20031005

**** ERROR REPORT AND MESSAGES for Transaction Number 11 ****
Result integer: 864459 P00028 = 80020/ / /4/ from P00028 = 1028/ / /4/

RECORD NUMBER: 00300506
STATION ID: USGS 403256109572500
STATION NAME: CANAL OFF OF FARM CREEK
COLLECTION DATE: 07-11-2003 1400 - -

PARTIAL BALANCE

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
TOTAL		0.000	TOTAL		0.000

PERCENT DIFFERENCE = 0.00

===== Project: 9716AUG05 Site: USGS 403200109552300 Database: 01 =====

ONWIS QW Batch Enter -- Process Date: 03-23-2004 01:05 -- Transaction Number: 31

Record Number: 00400054 SINT: 874019 MST Begin Date: 11-25-2003 17:20 End Date: Medium: 9
Site ID: USGS 403200109552300 Station Name: WHITEROCKS RIVER BELOW FARM CK CANAL DIVERSION State: 49 County: 047
Lab ID Number: 3510013 Project: 9716AUG05 Geologic Unit: Data Types: CH U(A-2-1)31aba
Sample Status: H Sample Source: 9 Hydrologic Condition: 9 Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 20
Sample Field Comment--
Sample Lab Comment-- Whiterocks River at bridge

*	PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
	00010		--		Temperature, water	degrees C	.5				S	I	1	--		
	00027		--		Collecting agency	code	1028				S	I	4	--		
	00028		--		Analyzing agency	code	80020				S	I	4	--		
	00095		--		Specific cond at 25C	uS/cm @ 25C	77				S	I	2	--		
	00400		--		pH	standard units	7.4				S	I	2	--		
	00403	A	.1	MRL	pH, wu,lab	standard units	7.21				S	H	2	--		20031218
C	00900		--		Hardness, wu	mg/L as CaCO3	36							--		
	00915	D	.01	IRL	Calcium, wf	mg/L	9.5425				S	H	3	--		20031231
	00925	C	.008	IRL	Magnesium, wf	mg/L	2.9339				S	H	3	--		20031231
	00930	C	.1	IRL	Sodium, wf	mg/L	1.5058				S	H	3	--		20031231
C	00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C	00932		--		Sodium, w	percent	9							--		
	00935	C	.16	IRL	Potassium, wf	mg/L	.6196				S	H	2	--		20031231
	00940	J	.2	LRL	Chloride, wf	mg/L	1.02				S	H	3	--		20040116
	00945	G	.18	LRL	Sulfate, wf	mg/L	10.51				S	H	3	--		20040116
	00950	B	.17	MRL	Fluoride, wf	mg/L	.17	<			S	H	2	--		20031222
	00955	D	.04	IRL	Silica, wf	mg/L	5.0367				S	H	3	--		20031231
	01046	D	6.4	IRL	Iron, wf	ug/L	46.1592				S	H	3	--		20031231
	01056	C	.8	IRL	Manganese, wf	ug/L	12.3255				S	H	3	--		20031231
	29801	A	2	MRL	Alkalinity,wf,fxEP,1	mg/L as CaCO3	25.56				S	H	2	--		20040220
	70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	49.61				S	H	2	--		20040203
C	70301		--		Residue, wf, sum	mg/L	47							--		
	71870	E	.016	LRL	Bromide, wf	mg/L	.016	<			S	H	3	--		20031222
	90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	79.9				S	H	2	--		20031218

RECORD NUMBER: 00400054
STATION ID: USGS 403200109552300
STATION NAME: WHITEROCKS RIVER BELOW FARM CK CANAL DIVERSION
COLLECTION DATE: 11-25-2003 1720 - -

N82082 H-2/H-1 ratio, wu permil -107.8
N82085 O-18/O-16 ratio, wu permil -14.69
wu - water, unfiltered

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	9.54	0.477	CHLORIDE, DISS. MG/L	1.02	0.029
MAGNESIUM, DISS. MG/L	2.93	0.242	SULFATE, DISS. MG/L	10.5	0.219
SODIUM, DISS. MG/L	1.51	0.066	ALKALIN, DIS FET, LAB	26	0.511
POTASSIUM, DISS. MG/L	.62	0.016			
IRON, DISS. UG/L	46	0.003			
MANGANESE, DISS. UG/L	12.3	0.001			
TOTAL		0.802	TOTAL		0.759

PERCENT DIFFERENCE = 2.80

===== Project: 9716AUG05 Site: USGS 403145110030300 Database: 01 ==========

ONWIS QW Batch Enter -- Process Date: 03-23-2004 01:05 -- Transaction Number: 28

Record Number: 00400055 SINT: 874018 MST Begin Date: 11-25-2003 16:45 End Date: Medium: 9
Site ID: USGS 403145110030300 Station Name: UINTA RIVER BELOW POWERPLANT U(B-2-2)36adb State: 49 County: 013
Lab ID Number: 3510012 Project: 9716AUG05 Geologic Unit: Data Types: CH
Sample Status: H Sample Source: 9 Hydrologic Condition: 9 Sample Type: 9 Hydrologic Event: 9
Organism (ITIS): Body-part id: Processing Status: R Number Parameters: 20
Sample Field Comment--
Sample Lab Comment-- Uinta River at bridge

* PCODE	MET	RPLV	RLCOD	--PARAMETER NAME--	-----UNITS-----	--VALUE--	REM	QUAL CODES 1 2 3	NLQ	DQI	QA	PRC	LSDEV	PRP-DATE	ANL-DATE
00010		--		Temperature, water	degrees C	.5				S	I	1	--		
00027		--		Collecting agency	code	1028				S	I	4	--		
U 00028		--		Analyzing agency	code	80020				S	I	4	--		
00095		--		Specific cond at 25C	uS/cm @ 25C	75				S	I	2	--		
00400		--		pH	standard units	7.5				S	I	2	--		
N 00403	A	.1	MRL	pH, wu,lab	standard units	7.11				S	H	2	--		20031218
C 00900		--		Hardness, wu	mg/L as CaCO3	35							--		
N 00915	D	.01	IRL	Calcium, wf	mg/L	10.0257				S	H	3	--		20031231
N 00925	C	.008	IRL	Magnesium, wf	mg/L	2.4566				S	H	3	--		20031231
N 00930	C	.1	IRL	Sodium, wf	mg/L	1.1099				S	H	3	--		20031231
C 00931		--		Sodium Adsrptn Ratio	ratio	.1							--		
C 00932		--		Sodium, w	percent	7							--		
N 00935	C	.16	IRL	Potassium, wf	mg/L	.6686				S	H	2	--		20031231
N 00940	J	.2	LRL	Chloride, wf	mg/L	.73				S	H	2	--		20040116
N 00945	G	.18	LRL	Sulfate, wf	mg/L	6.06				S	H	3	--		20040116
N 00950	B	.17	MRL	Fluoride, wf	mg/L	.17	<			S	H	2	--		20031222
N 00955	D	.04	IRL	Silica, wf	mg/L	5.4149				S	H	3	--		20031231
N 01046	D	6.4	IRL	Iron, wf	ug/L	21.1669				S	H	3	--		20031231
N 01056	C	.8	IRL	Manganese, wf	ug/L	5.2786				S	H	2	--		20031231
N 29801	A	2	MRL	Alkalinity,wf,fxEP,1	mg/L as CaCO3	30.57				S	H	2	--		20040220
N 70300	A	10	MRL	Residue, ROE@180C,wf	mg/L	54.81				S	H	2	--		20040203
C 70301		--		Residue, wf, sum	mg/L	45							--		
N 71870	E	.016	LRL	Bromide, wf	mg/L	.080	<			S	H	3	--		20031222
N 90095	A	2.6	MRL	SpecCond,wu25degCLab	uS/cm @ 25C	77.7				S	H	2	--		20031218

**** ERROR REPORT AND MESSAGES for Transaction Number 28 ****
Result integer: 874018 P00028 = 80020/ / /4/ from P00028 = 1028/ / /4/
DISSOLVED SOLIDS/CALCULATED SOLIDS RATIO OUTSIDE LIMITS .9 TO 1.12

RECORD NUMBER: 00400055
STATION ID: USGS 403145110030300
STATION NAME: UINTA RIVER BELOW POWERPLANT
COLLECTION DATE: 11-25-2003 1645 - -

CATIONS	(MG/L)	(MEQ/L)	ANIONS	(MG/L)	(MEQ/L)
CALCIUM, DISS. MG/L	10.0	0.501	CHLORIDE, DISS. MG/L	.73	0.021
MAGNESIUM, DISS. MG/L	2.46	0.203	SULFATE, DISS. MG/L	6.1	0.127
SODIUM, DISS. MG/L	1.11	0.049	ALKALIN, DIS FET, LAB	31	0.611
POTASSIUM, DISS. MG/L	.67	0.018			
IRON, DISS. UG/L	21	0.002			
MANGANESE, DISS. UG/L	5.3	0.001			
TOTAL		0.770	TOTAL		0.758

PERCENT DIFFERENCE = 0.76

UTAH DIVISION OF WILDLIFE RESOURCES

Water Quality for State Fish Hatcheries

SV - SPRINGVILLE 1000 NORTH MAIN ST SPRINGVILLE

CA_LW	69	SO4_LW	37	PH_LW	7.4	TGAS_HI	
CA_HI	128	SO4_HI	231	PH_HI	7.8	FLOWCFS_LW	8.69
MG_LW	23	TDS_LW	296	TEMPF_LW	53	FLOWCFS_HI	76.7
MG_HI	37	TDS_HI	626	TEMPF_HI	64		
NA_LW	9	HARDNC_LW	269	CO2_LW	7		
NA_HI	28	HARDNC_HI	592	CO2_HI	18		
K_LW	0.7	HARD_LW	39	O2_LW	5.7		
K_HI	3.5	HARD_HI	355	O2_HI	11		
HCO3_LW	272	SPFCOND_LW	520	N2_LW			
HCO3_HI	289	SPFCOND_HI	1150	N2_HI			

WR - WHITEROCKS HCR 67 BOX 10 WHITEROCKS

CA_LW	64	SO4_LW	12	PH_LW	7.3	TGAS_HI	
CA_HI	70	SO4_HI	32	PH_HI	7.6	FLOWCFS_LW	3.12
MG_LW	14	TDS_LW	195	TEMPF_LW	50	FLOWCFS_HI	10.4
MG_HI	18	TDS_HI	260	TEMPF_HI	57		
NA_LW	2.9	HARDNC_LW	181	CO2_LW	9		
NA_HI	3.9	HARDNC_HI	236	CO2_HI	21		
K_LW	1.7	HARD_LW	12	O2_LW	5.2		
K_HI	2	HARD_HI	26	O2_HI	9		
HCO3_LW	206	SPFCOND_LW	351	N2_LW			
HCO3_HI	260	SPFCOND_HI	442	N2_HI			

"LW" = Low Value and "HI" = High Value

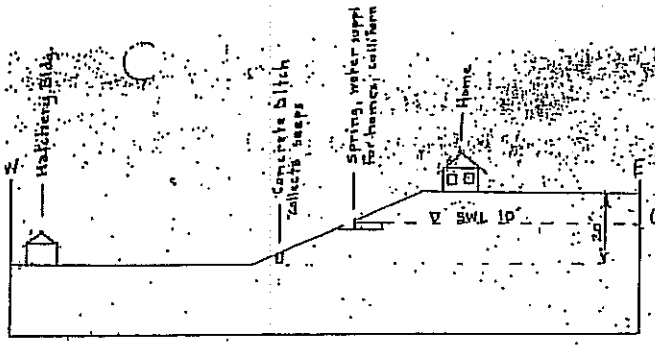
Results of isotopic analysis of water from selected sites in the Whiterocks Hatchery area

Site	Map No.	Date	Delta Deuterium (per mil)	Delta Oxygen-18 (per mil)	Sulfur-35 concentration (mBq/L)
Whiterocks spring (composite)	5	7/11/2003			0.0 +/- 0.7
Whiterocks spring (composite)	5	11/26/2003	-110.1	-14.59	1.7 +/- 0.6
Whiterocks spring (composite)	5	4/29/2004			(-)0.3 +/- 0.7
Whiterocks spring (composite)	5	6/29/2004			0.5 +/- 0.6
Whiterocks spring (composite)	5	8/13/2004			(-)1.0 +/- 0.7
Whiterocks spring (composite)	5	9/12/2004			0.3 +/- 0.5
Farm Creek bridge (Elkhorn)	16	4/28/2004			0.0 +/- 0.8
Farm Creek bridge (Elkhorn)	16	7/11/2003	-113.6	-15.22	
Farm Creek bridge (Elkhorn)	16	11/26/2003	-113.8	-15.35	
Farm Creek canal at highway	15	6/30/2004			1.7 +/- 0.5
Whiterocks spring (main)	1	7/10/2003	-109.8	-14.91	
Farm Creek spring	9	12/3/2003	-109	-14.71	
Whiterocks River at bridge	19	11/25/2003	-107.8	-14.69	
Uinta River at bridge	20	12/2/2003	-109	-14.89	
Oxygen/deuterium ratios expressed in units of per mil (per thousand)					
Sulfur-35 concentration expressed in units of mBq/L (millibequerels per liter)					

Results of analysis of water from Whiterocks spring for chlorofluorocarbons (CFCs)

SAMPLE ID	Sample date	CFC-11 (pmoles/kg)	CFC-12 (pmoles/kg)	CFC-113 (pmoles/kg)	Salinity (‰)	Recharge elevation (meters)	Recharge tempera-ture (^{0}C)	CFC-11 recharge year	CFC-12 recharge year	CFC-113 recharge year
Whiterocks spring (main)	8/29/2004	2.981800725	1.65541714	0.30269894	0.1	1950	9.5	1980.5	1984	1987
Whiterocks spring (main)	8/29/2004	3.094415416	1.739502342	0.213672989	0.1	1950	9.5	1981.5	1985.5	1984.5
Whiterocks spring (main)	8/29/2004	3.14252377	1.753733465	0.197088465	0.1	1950	9.5	1982	1985.5	1984
Whiterocks spring (east pipe)	9/12/2004	3.641028621	2.082901131	0.337062265	0.1	1950	9.5	1985	1989.5	1988
Whiterocks spring (east pipe)	9/12/2004	3.786370447	2.068783622	0.300120748	0.1	1950	9.5	1985.5	1989	1987
Whiterocks spring (main)	8/29/2004	2.981800725	1.65541714	0.30269894	0.1	1950	14.5	1986.5	1989.5	1990
Whiterocks spring (main)	8/29/2004	3.094415416	1.739502342	0.213672989	0.1	1950	14.5	1987	1991.5	1986.5
Whiterocks spring (main)	8/29/2004	3.14252377	1.753733465	0.197088465	0.1	1950	14.5	1987.5	1992	1986
Whiterocks spring (east pipe)	9/12/2004	3.641028621	2.082901131	0.337062265	0.1	1950	14.5	2001.5	2001.5	2001.5
Whiterocks spring (east pipe)	9/12/2004	3.786370447	2.068783622	0.300120748	0.1	1950	14.5	2001.5	2001.5	1990
Chlorofluorocarbon concentrations are expressed in units of picomoles/kilogram (pmoles/kg)										

Miscellaneous



- Depth to bedrock (alluvium thickness) is est. to be less than 100' (Montgomery, 1979)

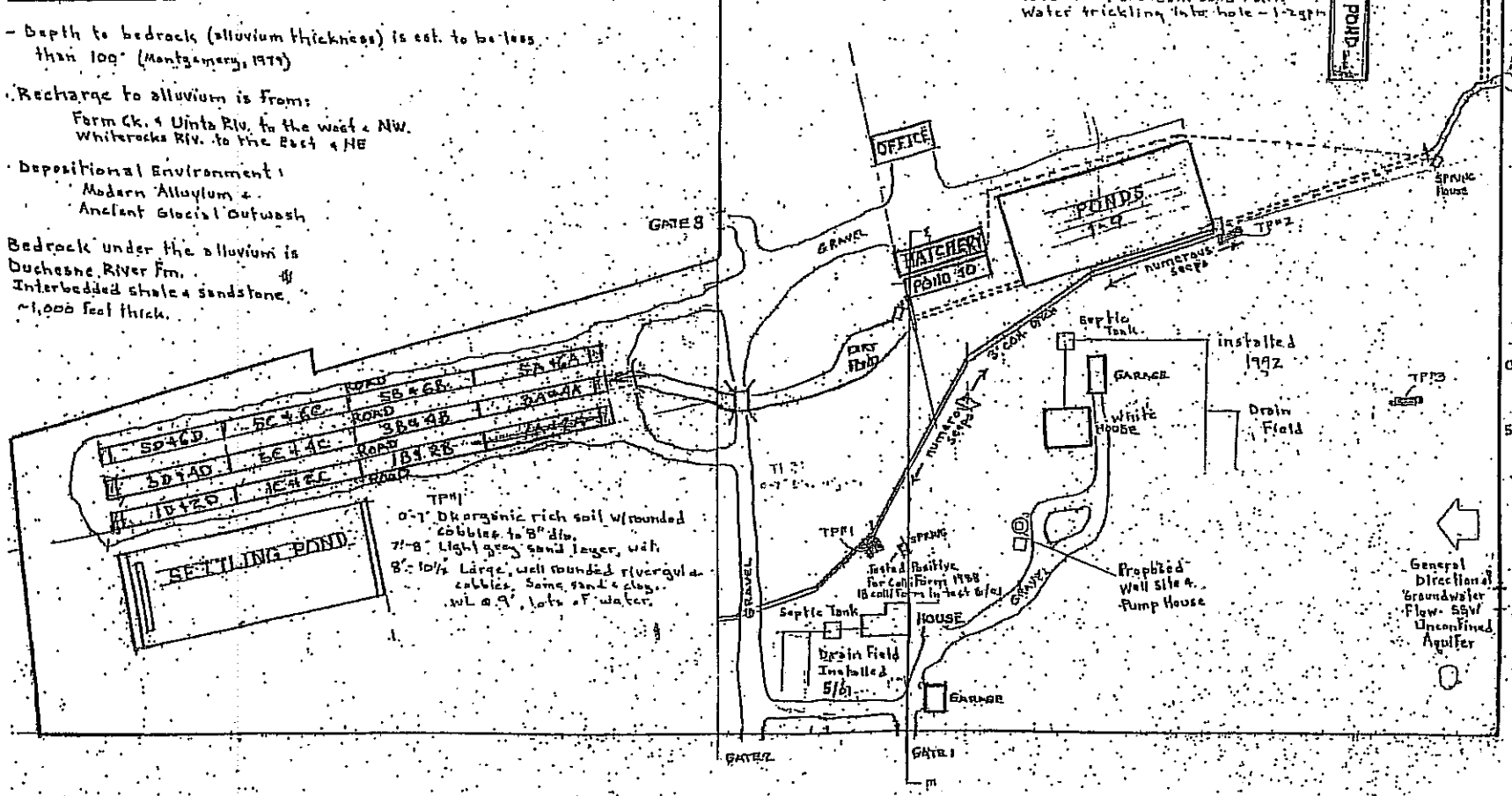
· Recharge to alluvium is from:

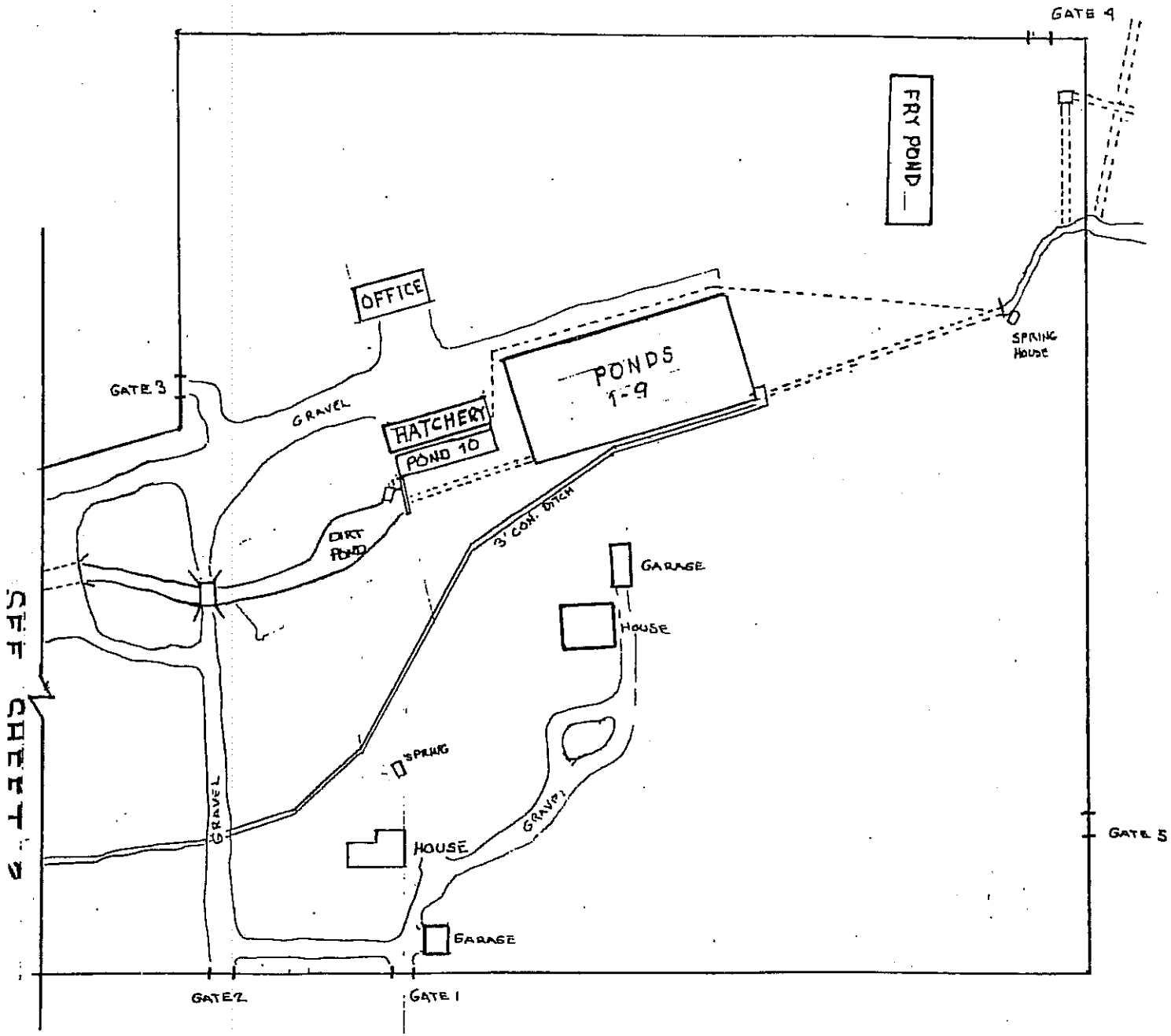
Farm Ck. & Uinta Riv. to the west & NW.
Whiterocks Riv. to the East & NE

· Depositional Environment:

Modern Alluvium &
Ancient Glacial Outwash

Bedrock under the alluvium is Duchesne River Fm.
Interbedded shale & sandstone
~1,000 feet thick.





LAYOUT
WHITEROCKS HATCHERY
5/30/01

SHEET 1 of 2
SCALE 3/32 = 10'

UNIZICKER & WELLS DRILLING MW #3

WELL DATA FORM

Sampled well

OWNER NAME White Rocks Monitor Hole# East of 3 Page ____ of ____

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	3			X	X	X								Top Soil
3	8			X	X									dark Brown Clay
8	10		X		X				X					clay & Cobbles mixed.
10	30	X	X					X	X	X				Extreme boulders & Gravel

2" sch 40 PVC was placed 0-30' with 40 perforations from 10-30'
Gravel packed from 10-30
1/4" pea gravel
7-10 Bentonite Chips 3/4"
0-7 Neat Cement 1.5 cuft.

Water Level 4" above Ground Level

steel cap placed over well

UNIZICKER & WELLS DRILLING

WELL DATA FORM

OWNER NAME White Rocks monitor Hole # Middle of 3 Page _____ of _____

Well Log DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	2			X	X									Top soil
2	10			X	X									Brown Clay
10	13		X		X				X					clay & Boulders mixed
13	30	X	X						X	X				Cobbles & Boulders

0 - 30 2" PVC sch 40
12 - 30 40 1/8" x 3" perforations
10 - 30 1/4 pea Gravel
7 - 10 3/4" Bentonite Chips
0 - 7 neat Cement 1.5 cu.ft

Water Level 3" below Ground Level

UNIZICKER & WELLS DRILLING

WELL DATA FORM

OWNER NAME White Rocks Monitor Hole # West of 3 Page _____ of _____

Well Log DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (include comments on *water quality* if known.)
0	3			X	X									Top soil
3'	15'			X	X									Dark brown Clay
15	30	X	X						X	X				Cobbles & Boulders
														0-30' 2" pvc sch 40
														15-30' 30 1/8" x 3 perforation
														13-30 1/4 pea Gravel
														7-13 3/4" Bentonite Chips
														0-7 neat Cemet 1.5 cuft
														12" below Ground level
														water level

Hatchery deepwell

WELL DRILLER'S REPORT

State of Utah
Division of Water Rights
For additional space, use "Additional Well Data Form" and attach

Well Identification WATER RIGHT APPLICATION: 43-10627 (A70167)

Owner *Note any changes*

State of Utah Division of Wildlife Resources
1594 West North Temple, Ste 2110
Salt Lake City, UT 84114-6301
Contact Person/Engineer:

Well Location *Note any changes*

COUNTY: Duchesne
NORTH 600 feet WEST 600 feet from the E4 Corner of SECTION 14, TOWNSHIP 1N, RANGE 1W, USB&M.

Location Description: (address, proximity to buildings, landmarks, ground elevation, local well #)

Drillers Activity Whiterocks Start Date: 3-27-02 Completion Date: 6-19-02

Check all that apply: ☑ New ☐ Repair ☐ Deepen ☐ Clean ☐ Replace ☐ Public Nature of Use: DOM, OTH

If a replacement well, provide the location of the new well ____ feet north/south and ____ feet east/west of the existing well.

DEPTH (feet) FROM	TO	BOREHOLE DIAMETER (in)	DRILLING METHOD	DRILLING FLUID
0	100	13	Mud Rotary	Bentonite
100	200	10	Mud Rotary	" "

Well Log

DEPTH (feet) FROM	TO	WATER	PERMEABLE high	PERMEABLE low	UNCONSOLIDATED CLAY	SILT	SAND	GRAVEL	COBBLES	BOULDER	OTHER	CONSOLIDATED ROCK TYPE	COLOR	DESCRIPTIONS AND REMARKS (e.g., relative %, grain size, sorting, angularity, bedding, grain composition, density, plasticity, shape, cementation, consistancy, water bearing, odor, fracturing, minerology, texture, degree of weathering, hardness, water quality, etc.)
0	2				X									Soil
2	6		X		X					X				
6	85	X	X					X	X	X		Sandstone	Boulders	Static Level 9'
85	105			X	X							Shale	Grey	
105	120	X	X								X	Sandstone	Grey	Loose broken
120	135			X							X	Shale	Red	
135	150	X	X								X	Sandstone	Grey	
150	175											Shale	Red	
175	180											Shale	Grey	
180	200											Shale	Red	

Static Water Level

Date 6-17-02 Water Level 18' feet Flowing? ☐ Yes ☑ No

Method of Water Level Measurement Tape If Flowing, Capped Pressure — PSI

Point to Which Water Level Measurement was Referenced Top Casing Ground Elevation (If known)

Height of Water Level reference point above ground surface 24" feet Temperature 48 ☐ °C ☑ °F

Construction Information

DEPTH (feet) FROM	TO	CASING: CASING TYPE AND MATERIAL/GRADE	WALL THICK (in)	NOMINAL DIAM. (in)	DEPTH (feet) FROM	TO	☐ SCREEN ☑ PERFORATIONS ☐ OPEN BOTTOM: SCREEN SLOT SIZE OR PERF SIZE (in)	SCREEN DIAM. OR PERF LENGTH (in)	SCREEN TYPE OR NUMBER PERF (per round/interval)
0	200	Steel A53-B	.250	6	105	200	1/8	2.5	6

Well Head Configuration: Cap Access Port Provided? ☑ Yes ☐ No

Casing Joint Type: Welded Perforator Used: Mill

Was a Surface Seal installed? ☑ Yes ☐ No Depth of Surface Seal: 102 feet Drive Shoe? ☐ Yes ☑ No

Surface Seal Material Placement Method: Tremie Pipe

Provide Seal Material description below:

DEPTH (feet) FROM	TO	SURFACE SEAL / INTERVAL SEAL / FILTER PACK / PACKER INFORMATION: SEAL MATERIAL, FILTER PACK and PACKER TYPE and DESCRIPTION	Quantity of Material Used (if applicable)	GROUT DENSITY (lbs./gal., # bag mix, gal./sack etc.)
0	100	Neat Cement	60 cu ft	15.4
100	200	1/4 Washed Gravel	35 cu ft.	

Well Development and Well Yield Test Information

Date	Method	Yield	Units Check One GPM	CFS	DRAWDOWN (ft)	TIME PUMPED (hrs & min)
6-17-02	Test Pump	15	✓		150'	48

Pump (Permanent)

Pump Description: _____ Horsepower: _____ Pump Intake Depth: _____ feet

Approximate maximum pumping rate: _____ Well disinfected upon completion? ☐ Yes ☐ No

Comments

Description of construction activity, additional materials used, problems encountered, extraordinary circumstances, abandonment procedures. *Use additional well data form for more space.*

grout was placed May 29-02 witnessed by William Burkes Department Environmental Quality

Well Driller Statement

This well was drilled and constructed under my supervision, according to applicable rules and regulations, and this report is complete and correct to the best of my knowledge and belief.

Name: Unzicker & Wells (Person, Firm, or Corporation—Print or Type) License No.: 398