

Data Verification Report

Water Quality Monitoring
Greater Yellowstone Inventory and Monitoring Network

Data Collected: January – December 2008

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DATA VERIFICATION

Introduction

Data verification is a systematic process that evaluates data collection performance for completeness, correctness and consistency. This report provides an evaluation and summary of the success and/or failures of field data collection and various QA/QC techniques and procedures used during the 2008 water quality field season in Yellowstone National Park for the stations listed below.

Sampler Training

Field training for the Yellowstone National Park water quality crew took place during May and June 2008. Training for data entry into NPSTORET took place during June and July 2008

Sample Collection

During 2008 nineteen stations were sampled throughout Yellowstone National Park for a total of 168 site visits, 453 activities, and 5,309 results. An additional 12 site visits, 12 activities, and 186 results were recorded for trip blank and quality control analysis. Results include field observations, multiprobe measurements, and laboratory analysis. The summation for each water quality station is listed as follows (the trip blank table was omitted):

Madison River Drainage:

Station ID: YELL_FH001.8C

Station Name: Firehole River - 100 meters downstream from USGS Gage

Visit Start			
Date	Time (MST)	# Activities	# Results
January 14, 2008	11:25	1	26
February 7, 2008	12:58	1	27
March 18, 2008	12:10	1	26
April 16, 2008	13:26	1	26
May 15, 2008	10:25	4	73
June 9, 2008	12:47	1	26
July 7, 2008	15:52	1	26
August 4, 2008	14:41	1	26
September 4, 2008	11:45	1	26
September 29, 2008	11:01	1	26
November 17, 2008	11:52	1	26
December 10, 2008	11:31	1	26

Totals For YELL_FH001.8C: 12 Visits; 15 Activities; 360 Results

Station ID: YELL_GB000.2M

Station Name: Gibbon River at Bridge .5m south of Madison Junction

Visit Start			
Date	Time (MST)	# Activities	# Results
January 14, 2008	12:31	1	26
February 7, 2008	14:05	1	26
March 18, 2008	10:58	1	26
April 16, 2008	12:20	1	26
May 15, 2008	11:27	1	26
June 9, 2008	11:49	1	26
July 7, 2008	15:25	1	26
August 4, 2008	14:01	1	26
September 4, 2008	10:33	1	26
September 29, 2008	10:13	1	26
November 17, 2008	11:13	1	26
December 10, 2008	10:46	1	26

Totals For YELL_GB000.2M: 12 Visits; 12 Activities; 312 Results

Station ID YELL_MD133.2T

Station Name Madison River 1.21km West of MT/WY State Boundary

Visit Start			
Date	Time (MST)	# Activities	# Results
January 14, 2008 14:24	12:31	1	26
February 7, 2008 16:05	14:05	1	26
March 18, 2008 13:52	10:58	1	26
April 16, 2008 10:55	12:20	1	26
May 15, 2008 09:12	11:27	1	26
June 9, 2008 14:35	11:49	1	26
July 7, 2008 14:33	15:25	1	26
August 4, 2008 13:14	14:01	1	26
September 4, 2008 09:55	10:33	1	25
September 29, 2008 09:10	10:13	1	26
November 17, 2008 10:02	11:13	1	25
December 10, 2008 13:35	10:46	4	73

Totals For YELL_MD133.2T: 12 Visits; 15 Activities; 358 Results

Yellowstone River Drainage- River and Stream Sites:

Station ID: YELL_GN002.9M

Station Name: Gardner River at Rescue Creek Trail Footbridge

Visit Start			
Date	Time (MST)	# Activities	# Results
January 17, 2008	11:05	4	71
February 14, 2008	17:38	1	26
March 20, 2008	09:49	4	64
April 17, 2008	11:48	1	26
May 13, 2008	14:04	1	26
June 10, 2008	16:47	1	26
July 7, 2008	12:25	1	26
August 4, 2008	11:15	1	26
September 2, 2008	16:42	1	25
October 1, 2008	10:53	4	73
November 10, 2008	14:29	1	26
December 8, 2008	13:07	1	26

Totals For YELL_GN002.9M: 12 Visits; 21 Activities; 441 Results

Station ID: YELL_LM000.5M

Station Name: Lamar River at USGS Gage near Ranger Station

Visit Start			
Date	Time (MST)	# Activities	# Results
January 17, 2008	13:36	1	31
February 14, 2008	12:14	1	30
March 20, 2008	13:01	1	31
April 15, 2008	13:46	1	26
May 15, 2008	13:59	1	26
June 10, 2008	12:10	1	26
July 8, 2008	11:12	1	26
August 6, 2008	10:13	1	25
September 2, 2008	09:47	1	25
October 1, 2008	13:20	1	26
November 13, 2008	14:23	1	26
December 11, 2008	13:47	1	30

Totals For YELL_LM000.5M: 12 Visits; 12 Activities; 328 Results

Station ID: YELL_PC000.4M

Station Name: Pelican Creek at Bridge 4km East of Lake Junction

Visit Start			
Date	Time (MST)	# Activities	# Results
January 15, 2008	12:14	1	31
February 11, 2008	14:35	1	31
April 14, 2008	11:20	1	4
May 12, 2008	13:02	1	26
June 12, 2008	14:27	1	26
July 10, 2008	11:11	4	73
August 6, 2008	13:00	1	40
September 4, 2008	14:52	1	26
September 29, 2008	14:40	1	26
November 12, 2008	11:55	1	26
December 9, 2008	11:54	1	31

Totals for YELL_PC000.4M: 11 Visits; 14 Activities; 326 Results

Station ID: YELL_SB001.5M

Station Name: Soda Butte Creek (lower)

Visit Start			
Date	Time (MST)	# Activities	# Results
January 16, 2008	15:24	1	321
February 13, 2008	14:45	1	28
March 19, 2008	13:00	1	26
April 15, 2008	10:40	1	26
May 13, 2008	10:06	1	26
June 12, 2008	10:21	1	26
July 8, 2008	15:10	1	26
August 7, 2008	12:33	1	25
September 2, 2008	12:30	1	25
October 1, 2008	16:03	1	26
November 13, 2008	11:28	1	26
December 11, 2008	10:40	1	26

Totals For YELL_SB001.5M: 12 Visits; 12 Activities; 317 Results

Station ID: YELL_SB015.7A

Station Name Soda Butte Creek (upper)

Visit Start			
Date	Time (MST)	# Activities	# Results
January 16, 2008	12:50	1	31
February 13, 2008	12:27	1	29
March 19, 2008	11:39	1	29
April 15, 2008	09:11	1	26
May 13, 2008	11:25	1	26
June 10, 2008	09:13	4	107
June 10, 2008	18:51	1	23
June 16, 2008	12:25	2	28
July 8, 2008	14:18	1	26
August 7, 2008	14:12	4	69
September 2, 2008	10:40	1	25
September 16, 2008	09:16	4	81
September 16, 2008	18:40	1	26
October 1, 2008	15:05	1	26
November 13, 2008	12:15	4	73
December 11, 2008	11:46	1	27

Totals For YELL_SB015.7A: 16 Visits; 29 Activities; 649 Results

Station ID YELL_YS600.5M

Station Name: Yellowstone River at Canyon

Visit Start			
Date	Time (MST)	# Activities	# Results
January 15, 2008	14:55	1	17
February 11, 2008	12:18	1	15
April 14, 2008	13:00	1	1
May 12, 2008	14:28	1	12
June 12, 2008	12:17	1	12
July 10, 2008	10:15	1	12
August 6, 2008	11:57	1	9
September 4, 2008	08:21	1	11
September 29, 2008	15:41	1	12
November 12, 2008	14:28	1	12
December 9, 2008	16:23	1	12

Totals for YELL_YS600.5M: 11 Visits; 11 Activities; 125 Results

Station ID: YELL_YS549.7M

Station Name: Yellowstone River at Corwin Springs

Visit Start			
Date	Time (MST)	# Activities	# Results
January 7, 2008	13:11	1	26
February 14, 2008	16:15	1	26
March 20, 2008	08:53	1	26
April 17, 2008	10:13	4	73
May 14, 2008	12:07	1	26
June 10, 2008	15:50	1	26
July 7, 2008	11:00	1	26
August 4, 2008	09:52	1	26
September 2, 2008	15:34	4	72
October 1, 2008	10:02	1	26
November 10, 2008	13:42	1	25
December 8, 2008	11:37	1	25

Totals For YELL_YS549.7M: 12 Visits; 18 Activities; 404 Results

Station ID YELL_YS616.4M

Station Name: Yellowstone River at Fishing Bridge

Visit Start			
Date	Time (MST)	# Activities	# Results
January 15, 2008	-	1	1
April 14, 2008	10:18	1	26
May 12, 2008	12:26	1	26
June 12, 2008	13:59	1	26
July 10, 2008	12:41	1	26
August 6, 2008	13:26	1	11
September 4, 2008	15:19	1	26
September 30, 2008	14:56	1	26
November 12, 2008	12:30	1	26
December 9, 2008	11:22	1	26

Totals For YELL_YS616.4M: 10 Visits; 10 Activities; 220 Results

Yellowstone River Drainage- Yellowstone Lake Sites:

Station ID: YELL_YL001.0M

Station Name: Yellowstone Lake near Signal Pt

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008	15:04	1	13
August 5, 2008	15:15	1	13
September 3, 2008	13:48	1	13
September 30, 2008	12:15	1	13

Totals For YELL_YL001.0M: 4 Visits; 4 Activities; 52 Results

Station ID: YELL_YL002.0M

Station Name: Yellowstone Lake near Dot Island

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008	09:47	1	13
August 5, 2008	15:31	1	13
September 3, 2008	10:07	4	34
September 30, 2008	09:46	4	35

Totals For YELL_YL002.0M: 4 Visits; 10 Activities; 91 Results

Station ID: YELL_YL003.0M

Station Name: West Thumb, Yellowstone Lake

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008	08:20	30	125
August 5, 2008	08:36	38	161
September 3, 2008	09:52	29	125
September 30, 2008	08:36	34	145

Totals For YELL_YL003.0M: 4 Visits; 131 Activities; 556 Results

Station ID: YELL_YL004.0M

Station Name: Yellowstone Lake @ east side of Stevenson Island

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008	15:27	1	13
August 5, 2008	15:48	4	32
September 3, 2008	11:54	1	13
September 30, 2008	12:37	1	13

Totals For YELL_YL004.0M: 4 Visits; 7 Activities; 71 Results

Station ID: YELL_YL005.0M

Station Name: Yellowstone Lake at Mary Bay

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008	15:42	1	13
August 5, 2008	16:12	1	13
September 3, 2008	14:31	1	13
September 30, 2008	12:55	1	13

Totals For YELL_YL005.0M: 4 Visits; 4 Activities; 52 Results

Station ID: YELL_YL006.0M

Station Name: Yellowstone Lake at southeast arm

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008	14:02	1	13
August 5, 2008	14:21	1	13
September 3, 2008	13:08	1	13
September 30, 2008	11:49	1	13

Totals For YELL_YL006.0M: 4 Visits; 4 Activities; 52 Results

Station ID: YELL_YL007.0M

Station Name: Yellowstone Lake in south arm

Visit Start			
Date	Time (MST)	# Activities	# Results
July 9, 2008 11:11	14:02	29	125
August 5, 2008 11:24	14:21	29	125
September 3, 2008 11:54	13:08	29	125
September 30, 2008 10:49	11:49	29	125

Totals For YELL_YL007.0M: 4 Visits; 116 Activities; 500 Results

Snake River Drainage:

Station ID: YELL_SN999.9M

Station Name: Snake River at Bridge South of Flagg Ranch near USGS Gage

Visit Start			
Date	Time (MST)	# Activities	# Results
May 12, 2008	10:34	1	12
June 12, 2008	16:28	1	12
July 10, 2008	14:29	1	12
August 6, 2008	15:12	1	11
September 4, 2008	13:27	1	12
September 29, 2008	13:01	1	12
November 17, 2008	14:01	1	12
December 9, 2008	14:12	1	12

Totals For YELL_SN999.9M: 8 Visits; 8 Activities; 95 Results

Field Observations and Measurements

Characteristic	SOPs followed (If NO, must explain)	Recommendations/Comments
Air Temperature	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Air temperature was recorded for most station visits at the time of sampling.
Flow Severity	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Flow severity was recorded for most station visits at the time of sampling.
Time Since Last PPT	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	This characteristic is almost impossible to determine on a site-by-site basis. Precipitation events in one area of the park are often very different in other areas of the park.
Water Appearance	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Water appearances that are not reported will be affected by phytoplankton and suspended sediments which are interpreted in turbidity, and total, volatile, and fixed suspended solid readings. Factors other than this will be recorded in the site comment section.
Weather	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Weather comments were omitted from many of the field data sheets. Care should be taken by the field technician to record weather comments during each site visit.
Water Temperature	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Water temperature was recorded from each site unless otherwise noted.
DO field	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	DO was collected during each station visit unless otherwise noted.
pH field	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	pH was collected during each station visit unless otherwise noted.
Raw conductivity	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Multiparameter probe not capable of recording both raw conductivity and specific conductance. This core parameter was removed from the data sheet.
Specific Conductance	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Specific conductance was collected during each station visit
Turbidity - Field	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Turbidity measurements were collected during each station visit using a HACH 2100P turbidity meter. Turbidity was collected during each visit unless otherwise noted.
Discharge	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Discharge measurements were not collected from the stations that had USGS gage stations. Discharge measurements were not collected from Pelican Creek during winter months and high flow conditions. Discharge measurements were collected from YELL_SB015.7A during metal collection.

QA/QC	SOPs followed (If NO, must explain)	Recommendations/Comments
Split Sample	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Calibration and Calibration log	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	2-point calibrations were conducted for all pH calibrations; 1-point calibrations were conducted on all specific conductance calibrations; DO was calibrated at each site and adjusted for elevation.
Instrument inspection and maintenance	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

Sample Collection and QA/QC

Characteristic(s)	SOPs followed (If NO, must explain)	Recommendations/Comments
Cations (Calcium, Potassium, Magnesium, Sodium)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Anions (Chloride, Nitrate-N, Nitrate-N, Orthophosphate-P, Sulfate)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Samples for anions were field filtered using a 0.45 micron filter
Alkalinity (Bicarbonate, Carbonate, Total Alkalinity)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Ammonia	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Samples for ammonia were preserved in the field using pre-measured sulfuric acid provided by the analytical laboratory.
Total Phosphorus	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Samples for total phosphorus were preserved in the field using pre-measured sulfuric acid provided by the analytical laboratory.
Total Solids (Suspended, Fixed, Volatile)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Dissolved Metals (Arsenic, Copper, Iron, Selenium)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Total Metals (Arsenic, Copper, Iron, Selenium)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Metals in Sediment (Arsenic, Copper, Iron, Selenium)	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

QA/QC	SOPs followed (If NO, must explain)	Recommendations/Comments
Trip Blank	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Trip blanks were established for all of the sample weeks.
Equipment Blank	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	Equipment blank was not performed at the beginning of the field season. All equipment is acid washed and rinsed after each sample event. Trip blanks should serve as equipment blanks.
Field Equipment Blank	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Field equipment blanks are conducted along with the regular QA/QC sample. Some contamination of blank water was noted (primarily alkalinity). Calcium was also detected in a few of the blank samples. More effort and maintenance needs to go into maintaining sample blank water for analysis. Water filter apparatus at Yellowstone could possibly be defective. Might need to get certified deionized water from the analytical laboratory
Duplicate/Split	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A split sample was conduct once each sample episode as part of the QA/QC process.
Preservation	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	The cooler for the July samples of YELL_GB000.2M, YELL_FH001.8C, YELL_MD133.2T, YELL_YS549.7M, and YELL_GN002.9M were delayed 2 extra days by FedEx resulting in exceedance of water temperature to 12 degrees Celsius. Samples were analyzed and results were reported in NPSTORET noting the unacceptable temperature holding time.
Holding Time	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	For alkalinity, bicarbonate, and carbonate the holding time was exceeded in July for sites YELL_GN002.9M, YELL_YS549.7M, YELL_FH001.8C, YELL_GB000.2M, and YELL_MD133.2T due to delayed shipment by Fed Ex. For chloride, nitrate, nitrite, Ortho-Phosphate, and sulfate the holding time was exceeded in August for sites YELL_SB015.7A, YELL_SB001.5M, YELL_LM000.5M , YELL_GN002.9M, YELL_YS549.7M, YELL_YS616.4M, YELL_GB000.2M, YELL_MD133.2T, and YELL_FH001.8C. The August samples may be within allowed holding times. YELL park staff are checking with the analytical laboratory to see if these values are within the acceptable holding times and reported as a lab error.
Chain of custody documentation	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	All chain of custody forms are complete and compiled with lab data sheets.

Quality Control Results

Duplicate and Relative Percent Difference (RPD)

Analytical results of duplicate (split) samples will, in theory, be the same. Realistically, results may differ due to the non-homogeneity of the sample source, sampling, and analytical errors. Duplicate samples also document the technique and ability of the technician and analyst to produce representative water quality data. Relative percent difference was calculated for each characteristic group (i.e. field parameters, and ETC) sampled in Yellowstone National Park.

The acceptable range for duplicate samples is as follows:

Type of Duplicate	Frequency	Acceptable Range for Precision	Corrective Action	
Field Duplicates (multiparameter probes and HACH turbidity meter)	Minimum of 1 per trip per parameter or 10% of all samples	Temperature (thermistor thermometer): + 0.2 °C	Re-calibrate instrument; replace batteries; perform instrument field check with different standards; repair or replace instrument; notify management; audit and train field personnel; project manager determines whether associated data is usable.	
		Temperature (liquid in glass thermometer): + 0.5 °C		
		Dissolved Oxygen: + 0.3 mg/L		
		pH: + 0.1 unit		
		Specific conductance < 100 µS/cm: + 5%		
		Specific conductance > 100 µS/cm: + 5%		
		Turbidity + 15%		
Field Duplicates for water samples	Minimum of 1 per trip per parameter or 10% of all samples per parameter per day	Anions, cations, metals, nutrients, TSS, VSS, and FSS	RPD + 15%	Audit field personnel and verify sample collection procedures; resample; reanalyze; revise SOP; audit and train field personnel; project manager determines whether associated data is usable.

Duplicate Results for Required Field Parameters

All duplicate results for required field parameters were within acceptable range for both the stream and lake water quality stations.

Duplicate Results for Regulatory Parameters (metals on Soda Butte Creek-YELL_SB015.7A)

Regulatory monitoring on Soda Butte Creek near Silver Gate, MT include the measurements of total and dissolved metals (arsenic, copper, iron, selenium) in the water column and total metals in stream bed sediments. For regulatory monitoring this site is visited 4 times per year on 2 days during a high and low flow period. All duplicates for metals in water were within the 15% RPD except the following:

Dissolved Iron

Split samples that exceeded relative percent differences (15%) for dissolved iron (1 sample)

Date	Time (MST)	RPD	Actual Difference (mg/l)	Comment
16-Sep-08	9:16	108.2	0.545-1.83	Data recorded as final

Duplicate samples for metals in sediments are technically collected as separate samples and therefore no RPD is reported for these parameters.

Duplicate Results - all other sites and parameters

Not all duplicate results for parameters for field measurement and those analyzed by the laboratory were within acceptable range. The following data exceeded the RPD for the given parameters and stations.

Turbidity and Suspended Solids analyzed by Yellowstone Park Staff

Turbidity

Split samples that exceeded relative percent differences (15%) for turbidity (2 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
16-Sep-08	YELL_SB015.7A	20.84	0.8-1.0	Data recorded as final
5-Aug-08	YELL_YL0004.0M	40.00	0.6-0.9	Data recorded as final

Total Suspended Solids

Split samples that exceeded relative percent differences of (15%) for total suspended solids (9 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
15-May-08	YELL_FH001.8C	33.06	6.0-8.4	Data recorded as final
17-Jan-08	YELL_GN002.9M	60.00	3.1-5.8	Leave data as preliminary
01-Oct-08	YELL_GN002.9M	96.02	2.6-7.3	Leave data as preliminary
10-Jul-08	YELL_PC000.4M	38.05	3.3-4.8	Leave data as preliminary
10-Jun-08	YELL_SB015.7A	20.84	9.6-11.9	Data recorded as final
16-Sep-08	YELL-SB015.7A	17.0	0.9-1.1	Data recorded as final
30-Sep-08	YELL_YL002.0M	22.86	0.6-0.7	Data recorded as final
05-Aug-08	YELL_YL004.0M	16.67	0.3-0.4	Data recorded as final
02-Sep-08	YELL_YS549.7M	20.15	3.0-3.7	Data recorded as final

Volatile Suspended Solids

Split samples that exceeded relative percent differences of (15%) for volatile suspended solids (4 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
15-May-08	YELL_FH001.8C	19.17	2.2-2.6	Data recorded as final
17-Jan-08	YELL_GN002.9M	38.46	1.0-1.5	Leave data as preliminary
01-Oct-08	YELL_GN002.9M	59.44	0.6-1.2	Leave data as preliminary
05-Aug-08	YELL_YL004.0M	18.33	0.2-0.3	Data recorded as final

Fixed Suspended Solids

Split samples that exceeded relative percent differences of (15%) for fixed suspended solids (8 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
15-May-08	YELL_FH001.8C	40.00	3.9-5.8	Leave data as preliminary
17-Jan-08	YELL_GN002.9M	68.75	2.1-4.3	Leave data as preliminary
01-Oct-08	YELL_GN002.9M	104.2	1.9-6.1	Leave data as preliminary
10-Jul-08	YELL_PC000.4M	74.29	1.3-2.8	Leave data as preliminary
10-Jun-08	YELL_SB015.7A	21.49	8.3-10.4	Data recorded as final
16-Sep-08	YELL_SB015.7A	22.50	0.6-0.7	Data recorded as final
30-Sep-08	YELL_YL002.0M	45.00	0.2-0.3	Data recorded as final
2-Sep-08	YELL_YS549.7M	23.4	2.2-2.8	Data recorded as final

Chemical parameters analyzed by Environmental Testing and Consulting

Total Phosphorus

Split samples that exceeded relative percent difference (15%) for total phosphorus (9 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
15-May-08	YELL_FH001.8C	15.31	0.187-0.218	Data recorded as final
20-Mar-08	YELL_GN002.9M	20.54	0.083-0.102	Data recorded as final
01-Oct-08	YELL_GN002.9M	97.56	0.063-0.183	Leave data as preliminary
10-Dec-08	YELL_MD133.2T	19.32	0.187-0.227	Data recorded as final
10-Jul-08	YELL_PC000.4M	44.78	0.078-0.123	Leave data as preliminary
10-Jun-08	YELL_SB015.7A	19.51	0.037-0.045	Data recorded as final
7-Aug-08	YELL-SB015.7A	40.94	0.068-0.103	Leave data as preliminary
17-Apr-08	YELL_YS549.7M	38.99	0.064-0.095	Leave data as preliminary
2-Sep-08	YELL_YS549.7M	18.52	0.049-0.059	Data recorded as final

Chloride

Split samples that exceeded relative percent difference (15%) for chloride (1 sample)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
20-Mar-08	YELL_GN002.9M	22.4	32.9-41.2	Data recorded as final

Potassium

Split samples that exceeded relative percent difference (15%) for potassium (2 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
17-Jan-08	YELL_GN002.9M	58.4	15.9-29	Leave data as preliminary
7-Aug-08	YELL-SB015.7A	16.45	0.318-0.375	Data recorded as final

Sodium

Split samples that exceeded relative percent difference (15%) for sodium (1 sample)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
17-Jan-08	YELL_GN002.9M	52.5	42.7-73.1	Leave data as preliminary

Sulfate

Split samples that exceeded relative percent difference (15%) for sulfate (1 sample)

20-Mar-08	YELL_GN002.9M	19.14	137-166	Data recorded as final
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Calcium

Split samples that exceeded relative percent difference (15%) for calcium (1 sample)

7-Aug-08	YELL_SB015.7a	17.42	13.1-15.6	Data recorded as final
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Magnesium

Split samples that exceeded relative percent difference (15%) for magnesium (2 samples)

<u>Date</u>	<u>Station</u>	<u>RPD</u>	<u>Actual Difference (mg/L)</u>	<u>Comment</u>
17-Jan-08	YELL_GN002.9M	57.28	0.0019-0.0061	Leave data as preliminary
07-Aug-08	YELL_SB015.7A	19.57	2.95-3.59	Data recorded as final

Blank Results for Water Quality Parameters

All blank water samples include a combination of trip, equipment, and field equipment blanks. Analysis of all blanks was recorded as non-detectable, with the following exceptions:

Field Blank

Field blank samples that had detection of analyte during laboratory analysis.

<u>Date</u>	<u>Station</u>	<u>Characteristic</u>	<u>Actual Result (mg/L)</u>
17-Jan-08	YELL_GN002.9M	Alkalinity	1.0
		Bicarbonate	1.0
20-Mar008	YELL_GN002.9M	Alkalinity	2.0
		Bicarbonate	2.0
		Calcium	0.284
17-Apr-08	YELL_YS549.7M	Alkalinity	2.0
		Bicarbonate	2.0
		Calcium, dissolved	0.470
15-May-08	YELL_FH001.8C	Alkalinity	1.0
		Bicarbonate	1.0
10-Jun-08	YELL_SB015.7A	Alkalinity	1.0
		Bicarbonate	1.0
		Calcium, dissolved	0.191
10-Jul-08	YELL_PC000.4M	Alkalinity	1.5
		Bicarbonate	1.5
		Calcium, dissolved	0.248
		Potassium, dissolved	0.202
		Magnesium, dissolved	0.47
7-Aug-08	YELL_SB015.7A	Alkalinity	2.0
		Bicarbonate	2.0
		Calcium, dissolved	0.151
2-Sep-08	YELL_YS549.7M	Alkalinity	2.0
		Bicarbonate	2.0
16-Sep-08	YELL_SB015.7A	Calcium, dissolved	0.317
01-Oct-08	YELL_GN002.9M	Alkalinity	1.5
		Bicarbonate	1.5
		Calcium, dissolved	
13-Nov-08	YELL_SB015.7A	Alkalinity	2.0
		Bicarbonate	0.34
		Calcium, dissolved	0.114
10-Dec-08	YELL_MD133.2T	Calcium, dissolved	0.154

Trip Blank

Trip Blank samples that had detection of analyte during laboratory analysis

<u>Date</u>	<u>Station</u>	<u>Characteristic</u>	<u>Actual Result (mg/L)</u>
16-Jan-08	Trip Blank	Alkalinity	1.0
		Bicarbonate	1.0
18-Mar-08	Trip Blank	Alkalinity	2.0
		Bicarbonate	2.0
		Calcium, dissolved	0.281
17-Apr-08	Trip Blank	Alkalinity	2.0
		Bicarbonate	2.0
15-May-08	Trip Blank	Alkalinity	1.0
		Bicarbonate	1.0
		Calcium, dissolved	0.173
10-Jul-08	Trip Blank	Alkalinity	1.5
		Bicarbonate	1.5
		Calcium, dissolved	0.228
		Chloride	4.42
7-Aug-08	Trip Blank	Alkalinity	1.0
		Bicarbonate	1.0
4-Sep-08	Trip Blank	Alkalinity	1.0
		Bicarbonate	1.0
		Calcium, dissolved	0.498
1-Oct-08	Trip Blank	Alkalinity	2.0
		Bicarbonate	2.0
13-Nov-08	Trip Blank	Alkalinity	2.0
		Bicarbonate	2.0
11-Dec-08	Trip Blank	Calcium, dissolved	0.139

Detection of alkalinity, bicarbonate, and calcium were most likely contributed to water being contaminated at the filtration source. Detection of bicarbonate was minimal while dissolved calcium varied little from month to month. Contamination of other elements during the July sampling event was most likely attributed to poor handling procedures of the water. Both problems are in the process of being corrected by better training of seasonal field personnel and improved laboratory practices. A possible remedy to this situation would be to obtain deionized water from a certified laboratory before the samples are analyzed.