Big Creek Research and Extension Team

University of Arkansas System Division of Agriculture

Quarterly Report – July 1 to September 30, 2016

MONITORING THE SUSTAINABLE MANAGEMENT OF NUTRIENTS ON C&H FARM IN BIG CREEK WATERSHED

Mission of the University of Arkansas System Division of Agriculture

The mission of the **Division of Agriculture** is to advance the stewardship of natural resources and the environment, cultivate the improvement of agriculture and agribusiness, develop leadership skills and productive citizenship among youth and adults, enhance economic security and financial responsibility among the citizens of the state, ensure a safe, nutritious food supply, improve the quality of life in communities across Arkansas, and strengthen Arkansas families.

Dr. Mark J. Cochran
Vice President for Agriculture

Executive Summary

This is the third Quarterly Report of 2016 for the Big Creek Research and Extension Team that details activities and progress made from July 1 through September 30, 2016.

1. We continue to collect weekly base flow and periodic storm flow water samples from Big Creek above and below the C&H Farm, along with water from a spring, ephemeral stream, surface runoff sites on Fields 1, 5a, and 12, two interceptor trenches below the slurry holding ponds, and house well for chemical and bacterial analysis. Equipment to monitor flow from the interceptor trenches was installed, along with automatic water sampling equipment.

2. Between July 6th and August 16th, the upstream site on Big Creek was not flowing and samples were collected only at the downstream site on Big Creek.

3. Concentrations of P, N, Cl (a conservative and effective tracer), and electrical conductivity continue to show no upward or downward trends for water samples collected during this quarter. We will continue to monitor these sites.

Big Creek Science Team

Andrew Sharpley, Ph.D., TEAM LEADER – Distinguished Professor - Soil science, water quality, soil phosphorus chemistry, agricultural management

Brian Breaker, M.Sc., Surface-Water Specialist, stream flow and constituent collection, analysis, and statistical evaluation of trends.

Kris Brye, Ph.D., Professor - Effects of land application of poultry litter on in-situ nutrient leaching, effects of land use and management practices on soil physical, chemical, and biological properties related to soil quality and sustainability

Mike Daniels, Ph.D., Professor – Extension water quality and nutrient management specialist

Ed Gbur, Ph.D., Professor and Director, Agricultural Statistics Laboratory - Experimental design, linear and generalized linear mixed models, regression, agricultural applications of statistics.

Brian Haggard, Ph.D., Professor - Ecological engineering, environmental soil and water sciences, water quality chemistry, water quality monitoring and modeling, algal nutrient limitation, pollutant transport in aquatic systems

Phil Hays, Ph.D. Ground Water Specialist, U.S. Geological Survey and Research Professor with Geosciences Dept., University of Arkansas, application of stable isotopes and other geochemical indicators in delineating movement and behavior of contaminants in ground-water systems

Tim Kresse, M.Sc., Water Quality Specialist, U.S. Geological Survey, natural geochemical evolution of groundwater and separating these processes from anthropogenic sources of contamination

Mary Savin, Ph.D. - Structure and function of microbial communities in natural and managed ecosystems, microorganisms in nutrient cycling, contaminant degradation

Karl VanDevender, Ph.D. and P.E., Professor - Extension Engineer, Livestock and poultry manure and mortality management, nutrient management planning

Jun Zhu, PhD., Professor - Biological and agricultural engineering, agricultural sustainability, manure treatment technologies

Adam Willis, M.Sc., Newton County Extension Agent - Agriculture

Field Technicians - The Big Creek Research and Extension Team are ably supported by several outstanding and dedicated Program Technicians based in Fayetteville and Little Rock.

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Site 3. Edge-of-field monitoring on Field 12 permitted to receive slurry.

Site 4. Ephemeral stream flow draining a subwatershed containing the production facilities.

Site 5. Spring below Field 1.

Site 6. Big Creek upstream of the C&H Farm operation.

Site 7. Big Creak downstream of the C&H Farm operation.

Site 8. Left Fork downstream of the C&H Farm operation.

Site 9. North interceptor trench below the manure holding ponds.

Site 10. South interceptor trench below the manure holding ponds.

Site 11. House well at animal facility.

Table 1. Location of sampling sites on the Big Creek Research and Extension Team project.

Site description	Latitude	Longitude	Elevation, ft
Field 1	35 55’ 06.42”	93 03’ 38.34”	984
Field 5a	35 56’03.01”	93 04’ 25.85”	778
Field 12	35 54’ 13.57”	93 04’ 04.76”	838
Ephemeral stream	35 55’ 25.89”	93 04’ 14.94”	824
Spring	35 54’ 57.06”	93 03’ 34.64”	977
Big Creek upstream of farm	35 53’ 32.28”	93 04’ 06.38”	857
Big Creek downstream of farm	35 56’ 18.98”	93 04’ 21.81”	769
Left Fork	35 5’”48.04”	93 04” 02.02”	760
Trench 1 (south)	35 55’ 19.24”	93 04’ 23.04”	896
Trench 2 (north)	35 55’ 21.39”	93 04’ 19.93”	883
House well	35 55’ 27.02”	93 04’ 22.71”	915

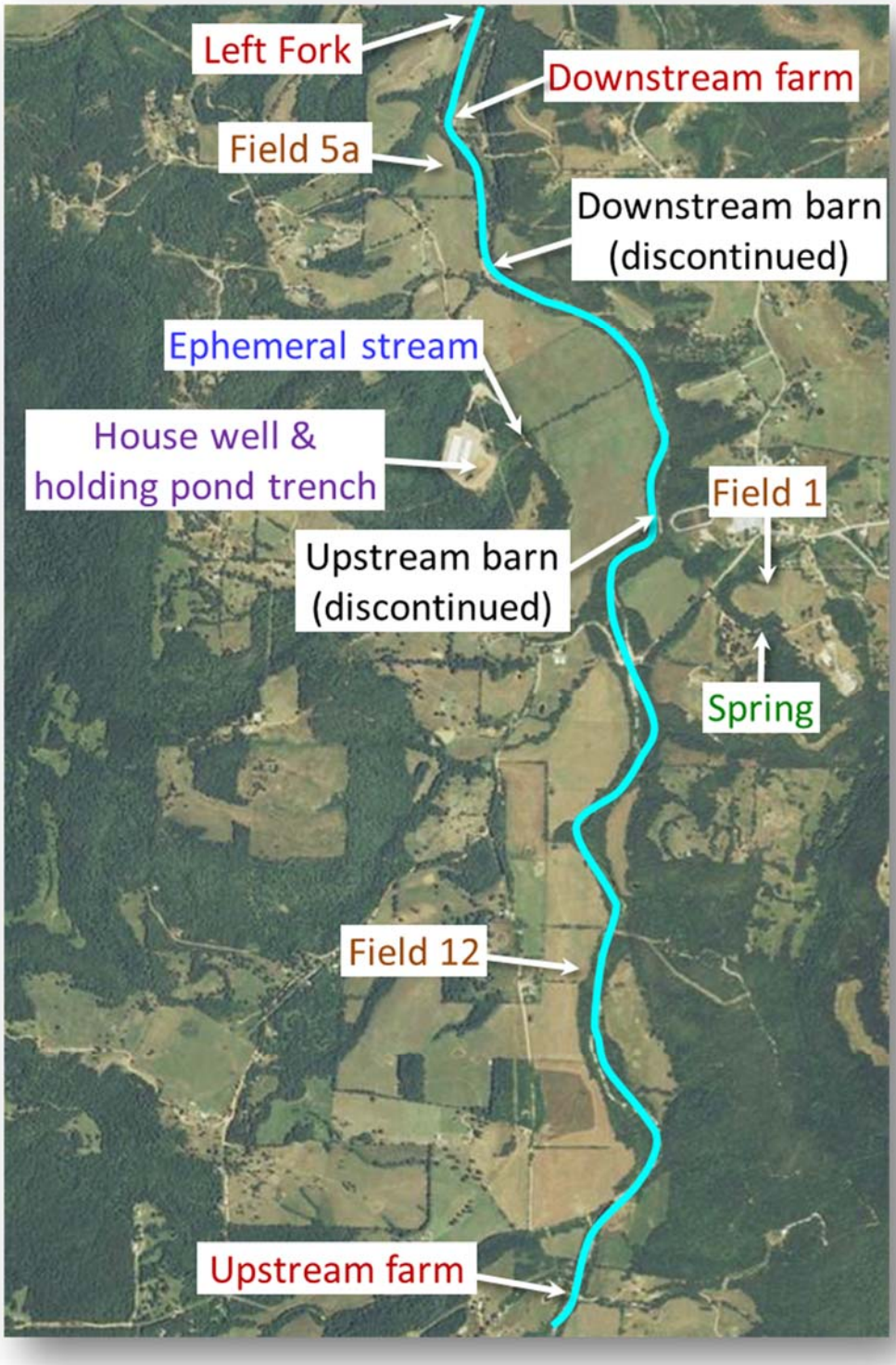

Figure 1. Location of sampling sites for the Big Creek Research and Extension Team project.

Sampling Protocols and Analyses

The following protocols were used to collect, prepare, and analyze all water samples:

1. One-liter acid-washed bottles were used to collect the stream samples for nutrient analyses.
2. Water was collected from just beneath the surface, where the stream was actively moving and well-mixed.
3. The bottle was rinsed with stream water before collecting the sample.
4. Sterilized specimen cups were used to collect samples for bacterial evaluation.
5. Time of collection was noted, and samples placed in a cooler on ice to preserve them until processed and were submitted to the Arkansas Water Resources Center Water Quality Lab on the day of collection for analyses.
6. Analyses included Alkalinity (APHA 2320-B), Ammonia (EPA 351.2), Chloride (EPA 300.0), Dissolved Phosphorus (EPA 365.2), E. coli (APHA 9223-B), Electrical Conductivity (EPA 120.1), Nitrate (EPA 300.0), pH (EPA 150.1), Total Coliforms (APHA 9223-B), Total Dissolved Solids (EPA 160.1), Total Nitrogen (APHA 4500-P J), Total Phosphorus (APHA 4500-P J), and Total Suspended Solids (EPA 160.2). APHA is American Public Health Association from the Wadeable Streams Assessment, Water Chemistry Laboratory Manual http://www.epa.gov/owow/monitoring/wsa/WRS_lab_manual.pdf
7. Prior to collection of a house well water sample, the well is purged and water temperature, pH, and electrical conductivity measured on-site every 30 seconds until all values stabilize (primarily water temperature). At that point a sample of water is collected in a 1-L acid-washed bottle. This method is taken from USGS and EPA well-water sampling protocols. See USGS methods for sampling at https://water.usgs.gov/owq/FieldManual/chapter4/pdf/Chap4_v2.pdf. Specific and detailed guidance on the collected of water quality data can be found in the USGS National Field Manual at file:///U:/Words/C&H%20Farm/Publications/Planning/USGS%20National%20Field%20Mannual_complete%202015.pdf

   The U.S. EPA also recommend that selected water quality parameters can be monitored during low-rate purging, with stabilization of these parameters indicating when the discharge water represents aquifer water or source well water. See: http://www.csus.edu/indiv/h/hornert/Geol_210_Summer_2012/Week%202%20readings/Puls%20and%20Barcelona%201996%20Low%20flow%20sampling.pdf and https://in-situ.com/wp-content/uploads/2015/01/Low-Flow-Groundwater-Sampling-Techniques-Improve-Sample-Quality-and-Reduce-Monitoring-Program-Costs-Case-Study.pdf
8. Minimum detection limits (MDLs) for each chemical and biological constituent are listed in Table 1. Some constituent concentrations were reported by the laboratory as less than the MDL but greater than zero. Those values are given in subsequent tables but have less confidence in their accuracy than concentrations above the MDL.
9. Chemical and biological analyses of samples collected from the beginning of 2015 to March 31, 2016 are given in Tables 2, 3, and 4.

Table 2. Minimum detection limits (MDLs) for each chemical and biological constituent.

Constituent	Minimum detection limit [1]
Alkalinity, mg/L as $CaCO_3$	2
Chloride, mg/L	0.093
Dissolved P, mg/L	0.002
Conductivity, uS/cm	1
Ammonia-N, mg/L	0.03
Dissolved organic carbon, mg/L	0.18
E. coli, MPN/100 mL	1
Nitrate-N, mg/L	0.004
pH	0.1
Total coliform, MPN/100 mL	1
Total dissolved solids, mg/L	15.22
Total N, mg/L	0.006
Total P, mg/L	0.012
Total suspended solids, mg/L	6.58

[1] MDL the Minimum Detection Limit of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Further information is available at http://water.usgs.gov/owq/OFR_99-193/detection.html

Flow Measurement and Auto-sampling of Interceptor Trenches Drainage

In mid-July installation of a 0.5-foot H flume, tipping bucket water meter, and ISCO automated water sampler was installed at the end of each interceptor trench pipe, below the slurry holding ponds. This equipment was encased in a locked shed. This equipment design allows interceptor trench flow to be recorded and samples of high trench flow collected, in addition to the routine weekly grab samples when flow was present. This also ensured that samples collected were not contaminated by external sources, such as wildlife. Figures 2, 3, and 4 show site configuration.

Flow from the trench pipe was directed into the 0.5' H-flume, which was able to measure flows in excess of 10 mL/second. For smaller flows trench-water exited the flume into a tipping bucket rain gage, which was able to accurately measure low interceptor trench flow (i.e., <~12 mL/second). The ISCO automated water sampler was power by a solar battery and deep-cycle marine battery. This secure location allowed collection of samples of water from the interceptor trenches, which had not been affected by external sources, such as wildlife.

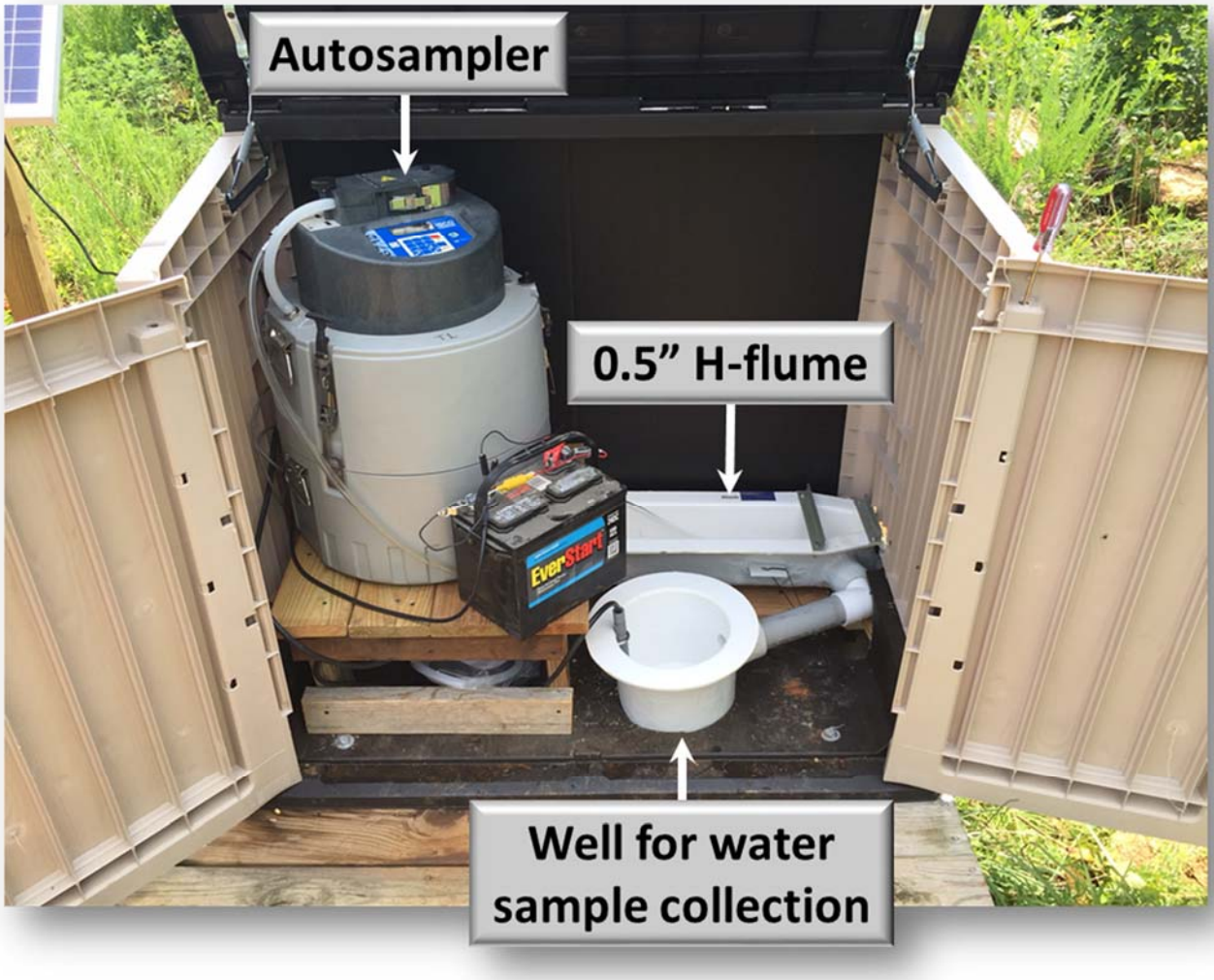

Figure 2. Sampling equipment installed on interceptor trenches.

Figure 3. Tipping bucket rain gage to measure low interceptor trench flow (i.e., <~12 mL/second).

Figure 4. External view of interceptor trench flow monitoring equipment.

Big Creek Research and Extension Team Monitoring Data

Nutrients, Sediment, and Bacteria by Date of Sampling

Table 3. Water quality analyses at each sample site since 2016, with those collected since the last report noted. Coliform units are Most Probable Number (MPN) per 100 mL of water.

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
			---------- mg/L ----------							-- MPN/100 mL --	
1/5/2016	**1/25/2016**	**Grab sample**									
11:52	15:29	Spring	0.007	0.024	<0.03	0.584	0.63	0.7	1.39	16.0	816.4
13:00	15:29	Upstream	0.008	0.026	<0.03	0.158	0.20	0.5	0.95	67.7	648.8
11:40	15:29	Downstream	0.011	0.026	<0.03	0.419	0.46	0.1	1.13	40.8	648.8
11:30	15:29	Left Fork	0.013	0.028	<0.03	0.427	0.48	0.7	1.51	34.1	686.7
12:02	15:29	Ephemeral	0.007	0.018	<0.03	0.883	1.00	1.2	2.15	32.7	686.7
12:13	15:29	Trench 1	0.003	0.016	<0.03	0.243	0.29	0.9	1.11	1.0	209.8
12:44	15:29	House well	0.008	0.020	<0.03	0.528	0.57	0.9	1.08	<1.0	1.0
1/25/2016	**1/25/2016**	**Grab sample**									
11:16	15:25	Spring	0.010	0.022	<0.03	0.565	0.60	0.3	1.27	34.5	1732.9
12:10	15:25	Upstream	0.010	0.022	<0.03	0.068	0.09	1.1	1.52	16.9	290.9
11:00	15:25	Downstream	0.011	0.022	<0.03	0.213	0.24	0.7	1.29	8.6	365.4
10:48	15:25	Left Fork	0.010	0.024	<0.03	0.198	0.25	1.0	1.30	21.1	435.2

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:28	15:25	Ephemeral	0.011	0.030	<0.03	0.762	0.87	9.8	3.10	1.0	816.4
11:42	15:25	House well	0.012	0.020	<0.03	0.602	0.55	0.5	2.36	<1.0	<1
2/10/2016	**2/10/2016**	**Grab sample**									
12:25	15:26	Spring	0.007	0.040	<0.03	0.634	0.80	17.7	2.70	1.0	325.5
11:15	15:26	Upstream	0.005	0.016	<0.03	0.048	0.11	0.5	1.11	14.5	178.5
11:04	15:26	Downstream	0.005	0.016	<0.03	0.198	0.24	0.9	0.99	4.1	218.7
11:29	15:26	Left Fork	0.003	0.012	<0.03	0.175	0.24	0.8	1.15	7.4	209.8
12:03	15:26	House well	0.007	0.014	<0.03	0.542	0.56	0.1	0.63	<1.0	<1.0
2/24/2016	**2/24/2016**	**Grab sample**									
11:05	14:45	Spring	0.010	0.052	<0.03	1.102	1.46	2.8	N.S.	209.8	3930.0
12:16	14:45	Upstream	0.014	0.052	<0.03	0.099	0.28	6.1	N.S.	1203.3	7330.0
10:52	14:45	Downstream	0.015	0.058	<0.03	0.142	0.37	8.3	N.S.	1986.3	6500.0
10:38	14:45	Left Fork	0.015	0.088	<0.03	0.249	0.63	15.6	N.S.	2780.0	14390.0
11:15	14:45	Ephemeral	0.010	0.056	<0.03	0.195	0.40	12.8	N.S.	387.3	4870.0
11:36	14:45	Trench 1	0.005	0.014	<0.03	0.345	0.39	2.1	N.S.	<1.0	9070.0
11:53	14:45	House well	0.010	0.010	<0.03	0.582	0.55	1.3	N.S.	<1.0	<1.0
3/10/2016	**3/10/2016**	**Grab sample**									
11:04	15:45	Spring	0.012	0.064	0.11	0.104	0.34	9.5	5.38	285.1	3230.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
13:13	15:45	Upstream	0.012	0.048	0.13	0.082	0.20	8.6	2.66	770.1	>2419.2
10:51	15:45	Downstream	0.010	0.044	0.11	0.118	0.25	6.2	2.28	298.7	>2419.2
11:32	15:45	Ephemeral stream	0.006	0.050	0.13	0.918	1.22	26.7	3.12	648.8	8840.0
10:38	15:45	Left Fork	0.013	0.046	0.01	0.154	0.38	8.7	2.64	367.3	2750.0
12:03	15:45	House well	0.011	0.020	0.02	0.562	0.59	0.9	1.19	<1.0	<1.0
11:50	15:45	Trench 1	0.005	0.036	0.10	0.264	0.45	3.5	2.87	2419.2	16690.0
11:46	15:45	Trench 2	0.005	0.054	0.14	1.716	2.35	6.8	6.77	613.1	34480.0
12:41	15:45	Field 12	0.411	0.522	1.17	0.852	4.49	621.5	12.58	410.6	>241920
3/16/2016	**3/16/2016**	**Grab sample**									
11:35	15:05	Spring	0.009	0.036	0.01	0.340	0.44	5.7	3.36	75.4	461.1
12:35	15:05	Upstream	0.008	0.034	<0.03	0.060	0.13	0.4	1.10	52.9	579.4
11:23	15:05	Downstream	0.006	0.028	0.01	0.170	0.24	0.9	1.17	81.3	>2419.2
11:50	15:05	Ephemeral stream	0.006	0.022	0.01	0.520	0.54	0.0	1.75	88.0	461.1
11:13	15:05	Left Fork	0.009	0.032	<0.03	0.190	0.26	0.3	1.45	35.9	980.4
12:22	15:05	House well	0.009	0.022	<0.03	0.550	0.55	0.0	1.55	<1.0	<1
12:01	15:05	Trench 1	0.003	0.032	0.02	0.331	0.37	0.0	1.23	101.7	290.9
3/24/2016	**3/24/2016**	**Storm sample**									

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:50	15:10	Spring	0.015	0.046	0.06	0.172	0.42	13.1	4.95	N.S.	N.S.
12:50	15:10	Upstream	0.011	0.032	0.06	0.040	0.14	4.5	1.60	N.S.	N.S.
11:35	15:10	Downstream	0.011	0.024	<0.03	0.106	0.20	3.9	1.29	N.S.	N.S.
12:10	15:10	Ephemeral stream	0.010	0.012	<0.03	0.531	0.64	1.3	1.44	N.S.	N.S.
11:25	15:10	Left Fork	0.013	0.048	0.09	0.186	0.39	10.7	2.65	N.S.	N.S.
12:34	15:10	House well	0.012	0.014	<0.03	0.565	0.65	0.2	2.72	N.S.	N.S.
12:20	15:10	Trench 1	0.008	0.016	<0.03	0.208	0.20	2.8	1.33	N.S.	N.S.
3/31/2016	**3/31/3016**	**Grab sample**									
11:06	15:10	Spring	0.011	0.034	<0.03	0.319	0.52	7.4	25.32	71.7	1553.1
12:45	15:10	Upstream	0.008	0.042	0.08	0.100	0.22	6.1	2.49	186.0	>2419.2
10:45	15:10	Downstream	0.011	0.056	0.08	0.156	0.33	12.4	2.67	365.0	>2419.2
11:16	15:10	Ephemeral stream	0.013	0.656	0.68	1.211	3.05	375.0	12.14	16160.0	198630.0
10:33	15:10	Left Fork	0.013	0.056	0.09	0.199	0.40	11.9	2.59	172.0	3640.0
11:49	15:10	House well	0.010	0.018	<0.03	0.556	0.62	0.2	3.93	1.0	26.2
11:40	15:10	Trench 1	0.004	0.018	<0.03	0.347	0.49	5.5	4.76	4.1	2419.2
11:35	15:10	Trench 2	0.006	0.040	0.06	2.800	3.54	20.9	9.29	7.4	10810.0
12:02	15:10	Field 5a	1.154	1.352	0.27	0.302	1.67	26.5	32.74	24890.0	>241920

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
4/4/2016	**4/4/2016**	**Grab sample**									
11:58	15:20	Spring	0.009	0.028	<0.03	0.324	0.42	7.5	1.57	104.7	866.4
12:50	15:20	Upstream	0.008	0.026	<0.03	0.065	0.08	1.7	0.71	8.3	648.8
11:48	15:20	Downstream	0.010	0.026	<0.03	0.176	0.20	1.9	0.98	77.6	1046.2
12:08	15:20	Ephemeral stream	0.008	0.018	<0.03	0.462	0.48	1.3	1.79	12.0	727.0
11:38	15:20	Left Fork	0.009	0.022	<0.03	0.131	0.17	1.5	0.87	44.8	1119.9
12:35	15:20	House well	0.011	0.018	<0.03	0.466	0.48	0.0	0.94	<1.0	1.0
12:26	15:20	Trench 2	0.004	0.012	<0.03	0.236	0.25	0.0	0.85	1.0	>2419.2
4/20/2016	**4/20/2016**	**Grab sample**									
12:02	15:52	Spring	0.005	0.042	<0.03	0.410	0.55	22.4	1.04	3.1	195.6
13:20	15:52	Upstream	0.003	0.020	<0.03	0.047	0.06	1.9	0.61	185.0	1299.7
11:42	15:52	Downstream	0.004	0.018	<0.03	0.152	0.20	1.2	0.74	38.4	2920.0
12:11	15:52	Ephemeral stream	0.008	0.020	<0.03	0.517	0.66	4.1	0.68	44.3	21430.0
11:30	15:52	Left Fork	0.005	0.020	<0.03	0.157	0.21	2.1	0.84	35.0	6160.0
12:52	15:52	House well	0.005	0.014	<0.03	0.598	0.50	0.5	0.47	1.0	1.0
4/28/2016	**4/28/2016**	**Grab sample**									
11:55	15:17	Spring	0.010	0.024	<0.03	0.455	0.63	12.0	N.S.	25.6	>2419.2

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
13:00	15:17	Upstream	0.009	0.012	<0.03	0.035	0.12	1.2	N.S.	58.6	648.8
11:30	15:17	Downstream	0.010	0.012	<0.03	0.154	0.27	1.5	N.S.	36.4	2149.2
12:31	15:17	House well	0.011	0.008	<0.03	0.481	0.57	0.3	N.S.	<1.0	<1.0
11:25	15:17	Dry Creek	0.010	0.012	<0.03	0.152	0.27	1.0	N.S.	14.8	3050.0
5/2/2016	**5/3/2016**	**Grab sample**									
12:25	08:55	Spring	0.008	0.012	<0.03	0.338	0.36	2.2	5.08	88.2	>2419.2
14:29	08:55	Upstream	0.006	0.018	<0.03	0.039	0.10	6.7	1.76	185.0	2419.2
11:43	08:55	Downstream	0.008	0.016	<0.03	0.075	0.16	2.0	1.50	178.9	4720.0
12:38	08:55	Ephemeral stream	0.007	0.016	<0.03	0.468	0.59	1.7	2.56	118.7	5380.0
12:38	08:55	Ephemeral stream	0.008	0.112	0.15	1.794	2.62	61.8	4.07	1046.2	23590.0
11:24	08:55	Left Fork	0.009	0.020	<0.03	0.095	0.20	1.9	2.30	172.6	3640.0
13:27	08:55	House well	0.009	0.016	<0.03	0.551	0.56	0.1	1.94	<1.0	<1
5/10/2016	**5/10/2016**	**Grab sample**									
11:15	15:40	Spring	0.008	0.026	<0.03	0.281	0.45	2.9	7.58	410.6	2780.0
12:50	15:40	Upstream	0.007	0.044	0.01	0.070	0.20	6.1	3.10	613.1	4480.0
10:58	15:40	Downstream	0.011	0.060	0.01	0.101	0.31	11.6	2.95	1203.3	7490.0
11:28	15:40	Ephemeral stream	0.195	0.560	0.32	0.649	4.01	1346.7	11.94	579.4	>2419.2

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
10:35	15:40	Left Fork	0.011	0.072	0.02	0.121	0.37	17.2	3.35	980.4	8230.0
12:08	15:40	House well	0.009	0.008	<0.03	0.533	0.56	0.5	4.39	<1.0	24.9
11:55	15:40	Trench 1	0.002	0.016	<0.03	0.228	0.30	3.9	2.91	13.9	>2419.2
11:45	15:40	Trench 2	0.002	0.038	<0.03	1.706	2.18	5.2	3.72	38.7	>2419.2
12:26	15:40	Field 5a	1.114	1.458	1.69	2.894	6.35	79.9	12.82	22820.0	>2419.2
13:08	15:40	Field 12	0.370	0.666	0.12	0.062	1.03	96.7	6.92	663.0	>2419.2
5/18/2016	**5/18/2016**	**Grab sample**									
11:29	15:20	Spring	0.009	0.024	0.01	0.320	0.51	8.7	2.20	45.7	1413.6
13:08	15:20	Upstream	0.007	0.016	<0.03	0.043	0.13	1.4	1.00	85.5	1299.7
11:10	15:20	Downstream	0.009	0.020	0.02	0.117	0.25	1.2	0.98	107.1	>2419.2
11:43	15:20	Ephemeral stream	0.008	0.014	<0.03	0.479	0.63	3.0	0.84	34.1	2419.2
10:57	15:20	Left Fork	0.010	0.016	0.01	0.139	0.27	1.4	1.54	60.1	2620.0
12:50	15:20	House well	0.009	0.010	<0.03	0.488	0.64	0.4	0.95	<1.0	<1.0
12:05	15:20	Trench 1	0.006	0.006	<0.03	0.169	0.22	0.1	0.54	2.0	5200.0
5/26/2016	**5/26/2016**	**Grab sample**									
11:45	15:30	Spring	0.008	0.020	<0.03	0.219	0.35	6.2	4.15	344.8	3730.0
13:08	15:30	Upstream	0.007	0.030	<0.03	0.056	0.12	4.2	1.56	238.2	5290.0
11:30	15:30	Downstream	0.009	0.036	<0.03	0.094	0.20	4.6	1.75	547.5	3640.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
12:05	15:30	Ephemeral stream	0.052	0.424	0.39	0.858	2.20	350.6	8.58	22470.0	>2419.2
11:20	15:30	Left Fork	0.010	0.048	0.02	0.123	0.24	10.6	2.66	461.1	6890.0
12:51	15:30	House well	0.009	0.012	<0.03	0.564	0.57	0.7	0.93	1.0	7.4
12:38	15:30	Trench 1	0.008	0.006	<0.03	0.217	0.23	1.4	1.29	1.0	4260.0
Samples analyzed since the last quarterly report											
6/2/2016	**6/2/2016**	**Grab sample**									
11:15	14:40	Spring	0.007	0.032	<0.03	0.330	0.47	10.8	2.38	64.1	1986.3
12:26	14:40	Upstream farm	0.007	0.018	<0.03	0.046	0.13	4.1	1.8	224.7	1986.3
11:04	14:40	Downstream farm	0.006	0.018	<0.03	0.106	0.20	1.4	1.8	104.6	3410
11:26	14:40	Ephemeral stream	0.008	0.022	<0.03	0.494	0.63	3.6	2.15	770.1	1986.3
10:52	14:40	Left Fork	0.007	0.022	<0.03	0.117	0.22	1.4	1.40	44.1	1986.3
12:06	14:40	House well	0.008	0.018	<0.03	0.597	0.62	0.7	0.99	<1.0	<1.0
11:35	14:40	Trench 1	0.002	0.018	<0.03	0.124	0.30	8.8	3.01	26.5	393.0
6/7/2016	**6/7/2016**	**Grab sample**									
11:25	14:30	Spring	0.011	0.026	<0.03	0.327	0.46	4.6	6.06	140.1	2460.0
12:16	14:30	Upstream farm	0.013	0.018	0.06	0.131	0.14	1.3	2.8	120.1	2720.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:10	14:30	Downstream farm	0.012	0.018	0.04	0.123	0.19	1.5	1.94	73.8	2980.0
11:37	14:30	Ephemeral stream	0.012	0.024	0.01	0.503	0.65	6.9	3.89	2419.2	7980.0
10:50	14:30	Left Fork	0.009	0.016	0.04	0.124	0.19	0.8	2.08	31.8	3180.0
12:00	14:30	House well	0.011	0.014	0.03	0.500	0.58	0.1	3.06	<1.0	<1.0
6/15/2016	**6/15/2016**	**Grab sample**									
11:40	15:00	Spring	0.010	0.016	0.03	0.466	0.65	4.2	0.00	153.9	1553.1
12:40	15:00	Upstream farm	0.007	0.010	<0.03	0.097	0.15	1.6	0.02	69.1	2310.0
11:25	15:00	Downstream farm	0.008	0.050	0.05	0.181	0.42	25.4	0.38	33.2	4740.0
11:15	15:00	Left Fork	0.009	0.012	0.01	0.198	0.29	2.0	0.94	63.1	8860.0
12:15	15:00	House well	0.008	0.008	<0.03	0.506	0.59	0.7	0.00	<1.0	<1.0
6/22/2016	**6/22/2016**	**Grab sample**									
10:40	14:35	Spring	0.008	0.012	<0.03	0.532	0.60	1.0	0.00	38.2	1413.6
12:20	14:35	Upstream farm	0.008	0.016	0.02	0.237	0.33	2.3	0.20	455.0	547.5
10:23	14:35	Downstream farm	0.015	0.028	0.04	0.327	0.44	14.9	0.00	46.4	4570.0
10:08	14:35	Left Fork	0.008	0.018	0.05	0.220	0.37	2.1	0.70	37.9	676.0
11:38	14:35	House well	0.009	0.008	<0.03	0.545	0.58	0.5	0.00	<1.0	<1.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
6/29/2016	**6/29/2016**	**Grab sample**									
10:53	14:00	Spring	0.009	0.083	0.02	0.487	0.73	43.4	1.10	5.2	648.8
11:37	14:00	Upstream farm	0.006	0.029	0.06	0.186	0.34	4.6	0.92	55.4	9888.0
10:41	14:00	Downstream farm	0.010	0.021	0.03	0.395	0.47	2.5	0.46	41.3	6310.0
10:25	14:00	Left Fork	0.006	0.023	0.03	0.251	0.35	2.0	0.94	23.5	5200.0
11:12	14:00	House well	0.008	0.014	<0.03	0.569	0.56	0.0	0.23	<1.0	<1.0
7/6/2016	**7/6/2016**	**Grab sample**									
6:44	10:16	Spring	0.011	0.027	<0.03	0.465	0.53	9.8	1.15	25.3	4430
7:41	10:16	Upstream farm	0.009	0.023	<0.03	0.221	0.27	5.9	0.66	387.3	12230.0
6:26	10:16	Downstream farm	0.010	0.023	0.01	0.461	0.43	2.1	0.47	39.3	8570.0
6:08	10:16	Left Fork	0.006	0.020	0.04	0.271	0.36	2.7	0.96	248.1	12590.0
7:18	10:16	House well	0.009	0.013	<0.03	0.874	0.96	1.0	0.73	<1.0	13.5
7/13/2016	**7/13/2016**	**Grab sample**									
7:53	12:30	Spring	0.003	0.023	<0.03	0.355	0.42	12.3	0.90	71.7	2920
7:33	12:30	Downstream farm	0.006	0.017	<0.03	0.365	0.43	4.3	1.12	129.6	8390.0
7:15	12:30	Left Fork	0.005	0.017	<0.03	0.172	0.29	1.9	0.85	95.9	12360.0
8:34	12:30	House well	0.005	0.011	<0.03	0.627	0.63	0.5	0.09	<1.0	<1.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
7/20/2016	**7/20/2016**	**Grab sample**									
7:56	12:05	Spring	0.006	0.024	<0.03	0.298	0.35	9.4	0.55	N.S.	N.S.
7:39	12:05	Downstream farm	0.005	0.024	<0.03	0.356	0.44	5.1	3.93	N.S	N.S.
7:25	12:05	Left Fork	0.005	0.013	<0.03	0.197	0.76	2.3	2.21	N.S.	N.S.
8:30	12:05	House well	0.007	0.009	0.02	0.594	0.70	0.1	0.14	N.S.	N.S.
7/27/2016	**7/27/2016**	**Grab sample**									
7:38	14:15	Spring	0.001	0.043	<0.03	0.375	0.46	17.6	2.64	55.6	980.4
7:21	14:15	Downstream farm	0.007	0.027	<0.03	0.423	0.47	2.3	1.62	140.8	17260.0
7:02	14:15	Left Fork	0.004	0.021	<0.03	0.255	0.35	3.6	1.79	920.8	15000.0
8:14	14:15	House well	0.006	0.010	<0.03	0.650	0.67	0.1	1.41	<1.0	<1.0
8/3/2016	**8/3/2016**	**Grab sample**									
8:03	12:10	Spring	0.006	0.104	<0.03	0.201	0.49	64.8	7.41	65.7	2920
7:43	12:10	Downstream farm	0.013	0.014	<0.03	0.221	0.29	3.2	3.46	115.3	9320.0
7:28	12:10	Left Fork	0.007	0.016	<0.03	0.212	0.32	2.4	2.21	101.4	7430.0
8/16/2016	**8/16/2016**	**Grab sample**									
10:58	14:50	Spring	0.007	0.027	0.02	0.223	0.39	7.7	9.89	88.2	5380.0
12:16	14:50	Upstream farm	0.009	0.031	0.03	0.089	0.23	4.6	3.14	248.9	9330.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
10:41	14:50	Downstream farm	0.011	0.039	0.03	0.161	0.33	8.1	2.94	178.2	17820.0
11:25	14:50	Ephemeral stream	0.011	0.023	0.01	1.365	1.59	2.6	2.47	137.6	154945.0
10:28	14:50	Left Fork	0.012	0.082	0.07	0.118	0.30	19.5	3.64	201.4	14550.0
11:40	14:50	Trench 1	0.005	0.006	0.02	0.130	0.17	0.2	2.14	93.4	48840.0
11:50	14:50	Trench 2	0.004	0.036	0.05	0.344	0.99	1.5	8.98	290.9	198630.0
8/24/2016	**8/24/2016**	**Grab sample**									
11:29	15:30	Spring	0.004	0.046	<0.03	0.477	0.97	29.9	2.99	27.8	5630
12:40	15:30	Upstream farm	0.004	0.014	0.03	0.046	0.14	2.0	1.08	72.3	2620.0
10:53	15:30	Downstream farm	0.005	0.016	<0.03	0.122	0.22	3.2	0.85	72.8	7030.0
10:40	15:30	Left Fork	0.004	0.013	0.00	0.045	0.13	1.5	1.62	43.5	6690.0
8/24/2016	**8/24/2016**	**Storm sample**									
11:03	15:30	Downstream farm	<0.002	0.109	0.01	0.002	0.42	66.9	5.89	N.S.	N.S.
12:05	15:30	Trench 1	<0.002	0.019	0.03	0.033	0.30	8.3	1.99	21.8	3450.0
8/30/2016	**8/30/2016**	**Grab sample**									
11:24	14:55	Spring	0.003	0.020	<0.03	0.501	0.58	2.9	3.28	195.6	9090.0
12:35	14:55	Upstream farm	0.003	0.020	<0.03	0.042	0.13	1.7	1.37	102.5	5210.0

Time sample collected	Time received @ laboratory	Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic Carbon	E. coli	Total coliform
11:10	14:55	Downstream farm	0.004	0.020	<0.03	0.116	0.21	1.7	1.19	30.1	5200.0
11:00	14:55	Left Fork	0.005	0.021	0.02	0.157	0.28	2.7	2.00	111.2	17850.0

¶ Values proceeded by '<' were reported by the analytical laboratory as zero and the minimum detection limit is given.
§ N.S. is No Sample.

Nutrients, Sediment, and Bacteria by Date Spring, Upstream, and Downstream Sites

Table 4. Water quality analyses in Big Creek upstream and downstream of the C&H Farm boundary of permitted land application since January 2016, with those collected since the last report noted.

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
	mg/L							MPN/100 mL	
1/5/2016									
Upstream	0.008	0.026	<0.03	0.158	0.20	0.5	0.95	67.7	648.8
Downstream	0.011	0.026	<0.03	0.419	0.46	0.1	1.13	40.8	648.8
1/25/2016									
Upstream	0.010	0.022	<0.03	0.068	0.09	1.1	1.52	16.9	290.9
Downstream	0.011	0.022	<0.03	0.213	0.24	0.7	1.29	8.6	365.4
2/10/2016									
Upstream	0.005	0.016	<0.03	0.048	0.11	0.5	1.11	14.5	178.5
Downstream	0.005	0.016	<0.03	0.198	0.24	0.9	0.99	4.1	218.7
2/24/2016									
Upstream	0.014	0.052	<0.03	0.099	0.28	6.1		1203.3	7330.0
Downstream	0.015	0.058	<0.03	0.142	0.37	8.3		1986.3	6500.0
3/10/2016									
Upstream	0.012	0.048	0.13	0.082	0.20	8.6	2.66	770.1	>2419.2
Downstream	0.010	0.044	0.11	0.118	0.25	6.2	2.28	298.7	>2419.2

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/16/2016									
Upstream	0.008	0.034	0.00	0.060	0.13	0.4	1.10	52.9	579.4
Downstream	0.006	0.028	0.01	0.170	0.24	0.9	1.17	81.3	>2419.2
3/24/2016									
Upstream	0.011	0.032	0.06	0.04	0.14	4.5	1.60	N.S.	N.S.
Downstream	0.011	0.024	0.00	0.106	0.20	3.9	1.29	N.S.	N.S.
3/31/2016									
Upstream	0.008	0.042	0.08	0.100	0.22	6.1	2.49	186.0	>2419.2
Downstream	0.011	0.056	0.08	0.156	0.33	12.4	2.67	365.0	>2419.2
4/4/2016									
Upstream	0.008	0.026	<0.03	0.065	0.08	1.7	0.71	8.3	648.8
Downstream	0.010	0.026	<0.03	0.176	0.20	1.9	0.98	77.6	1046.2
4/20/2016									
Upstream	0.003	0.020	<0.03	0.047	0.06	1.9	0.61	185.0	1299.7
Downstream	0.004	0.018	<0.03	0.152	0.20	1.2	0.74	38.4	2920.0
4/28/2016									
Upstream	0.009	0.012	<0.03	0.035	0.12	1.2	N.D.	58.6	648.8
Downstream	0.010	0.012	<0.03	0.154	0.27	1.5	N.D.	36.4	2149.2

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
5/2/2016									
Upstream	0.006	0.018	<0.03	0.039	0.10	6.7	1.76	185.0	2419.2
Downstream	0.008	0.016	<0.03	0.075	0.16	2.0	1.50	178.9	4720.0
5/10/2016									
Upstream	0.007	0.044	0.01	0.070	0.20	6.1	3.10	613.1	4480.0
Downstream	0.011	0.060	0.01	0.101	0.31	11.6	2.95	1203.3	7490.0
5/18/2016									
Upstream	0.007	0.016	<0.03	0.043	0.13	1.4	1.00	85.5	1299.7
Downstream	0.009	0.020	0.02	0.117	0.25	1.2	0.98	107.1	>2419.2
5/26/2016									
Upstream	0.007	0.030	<0.03	0.056	0.12	4.2	1.56	238.2	5290.0
Downstream	0.009	0.036	<0.03	0.094	0.20	4.6	1.75	547.5	3640.0
Samples analyzed since the last Quarterly Report									
6/12/2016									
Upstream	0.007	0.018	0.00	0.046	0.13	4.1	1.8	224.7	1986.3
Downstream	0.006	0.018	0.00	0.106	0.20	1.4	1.8	104.6	3410.0
6/7/2016									
Upstream	0.013	0.018	0.06	0.131	0.14	1.3	2.8	120.1	2720.0

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
Downstream	0.012	0.018	0.04	0.123	0.19	1.5	1.94	73.8	2980.0
6/15/2016									
Upstream	0.007	0.010	0.00	0.097	0.15	1.6	0.02	69.1	2310.0
Downstream	0.008	0.050	0.05	0.181	0.42	25.4	0.38	33.2	4740.0
6/22/2016									
Upstream	0.008	0.016	0.02	0.237	0.33	2.3	0.20	455.0	547.5
Downstream	0.015	0.028	0.04	0.327	0.44	14.9	0.00	46.4	4570.0
6/29/2016									
Upstream	0.006	0.029	0.06	0.186	0.34	4.6	0.92	55.4	9888.0
Downstream	0.010	0.021	0.03	0.395	0.47	2.5	0.46	41.3	6310.0
7/6/2016									
Upstream	0.009	0.023	0.00	0.221	0.27	5.9	0.66	387.3	12230.0
Downstream	0.010	0.023	0.01	0.461	0.43	2.1	0.47	39.3	8570.0
8/16/2016									
Upstream	0.009	0.031	0.03	0.089	0.23	4.6	3.14	248.9	9330.0
Downstream	0.011	0.039	0.03	0.161	0.33	8.1	2.94	178.2	17820.0
8/24/2016									
Upstream	0.004	0.014	0.03	0.046	0.14	2.0	1.08	72.3	2620.0

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
Downstream	0.005	0.016	0.00	0.122	0.22	3.2	0.85	72.8	7030.0
8/30/2016									
Upstream	0.003	0.020	0.00	0.042	0.13	1.7	1.37	102.5	5210.0
Downstream	0.004	0.020	0.00	0.116	0.21	1.7	1.19	30.1	5200.0
9/7/2016									
Upstream	0.007	0.020	0.01	0.113	0.21	1.9	1.89	195.6	5380.0
Downstream	0.008	0.059	0.01	0.265	0.46	25.4	1.39	30.9	4790.0

¶ Values proceeded by '<' were reported by the analytical laboratory as zero and the Minimum detection limit is given.

§ N.S. is No Sample.

† N.D. is No Data.

Nutrients, Sediment, and Bacteria by Site for Ephemeral Stream, Trenches, Left Fork and Field Runoff

Table 5. Water quality analyses at the ephemeral stream draining the subwatershed containing the production houses and manure holding ponds, and surface runoff from Fields 1, 5a, and 12 since January, 2015, with those collected since the last report noted.

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
	mg/L							MPN/100 mL	
Ephemeral stream									
1/5/2016	0.007	0.018	<0.03	0.883	1.00	1.2	2.15	32.7	686.7
1/25/2016	0.011	0.030	<0.03	0.762	0.87	9.8	3.10	1.0	816.4
2/24/2016	0.010	0.056	<0.03	0.195	0.40	12.8		387.3	4870.0
3/10/2016	0.006	0.050	0.13	0.918	1.22	26.7	3.12	648.8	8840.0
3/16/2016	0.006	0.022	0.01	0.520	0.54	0.0	1.75	88.0	461.1
3/24/2016	0.010	0.012	<0.03	0.531	0.64	1.3	1.44	N.S.	N.S.
3/31/2016	0.013	0.656	0.68	1.211	3.05	375.0	12.14	16160.0	198630.0
4/4/2016	0.008	0.018	<0.03	0.462	0.48	1.3	1.79	12.0	727.0
4/20/2016	0.008	0.020	<0.03	0.517	0.66	4.1	0.68	44.3	21430.0
5/2/2016	0.007	0.016	<0.03	0.468	0.59	1.7	2.56	118.7	5380.0
5/10/2016	0.195	0.560	0.32	0.649	4.01	1346.7	11.94	579.4	241920.0
5/18/2016	0.008	0.014	<0.03	0.479	0.63	3.0	0.84	34.1	2419.2

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
5/26/2016	0.052	0.424	0.39	0.858	2.20	350.6	8.58	22470.0	241920..0
Samples analyzed since the last quarterly report									
6/2/2016	0.008	0.022	0.03	0.494	0.63	3.6	2.15	770.1	1986.3
6/7/2016	0.012	0.024	0.01	0.5	0.7	6.9	3.89	2419.2	7980
8/16/2016	0.011	0.023	0.01	1.365	1.59	2.6	2.47	137.6	154945.0
Interceptor Trench 1 (South)									
1/5/2016	0.003	0.016	<0.03	0.243	0.29	0.9	1.11	1.0	209.8
2/24/2016	0.005	0.014	<0.03	0.345	0.39	2.1		<1.0	9070.0
3/10/2016	0.005	0.036	0.10	0.264	0.45	3.5	2.87	2419.2	16690.0
3/16/2016	0.003	0.032	0.02	0.331	0.37	0.0	1.23	101.7	290.9
3/24/2016	0.008	0.016	<0.03	0.208	0.20	2.8	1.33	N.S.	N.S.
3/31/2016	0.004	0.018	<0.03	0.347	0.49	5.5	4.76	4.1	2419.2
5/10/2016	0.002	0.016	<0.03	0.228	0.30	3.9	2.91	13.9	2419.2
5/18/2016	0.006	0.006	<0.03	0.169	0.22	0.1	0.54	2.0	5200.0
5/26/2016	0.008	0.006	<0.03	0.217	0.23	1.4	1.29	1.0	4260.0
Samples analyzed since the last quarterly report									
6/2/2016	0.002	0.018	0.00	0.124	0.30	8.8	3.01	26.5	393.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
8/16/2016	0.005	0.006	0.02	0.130	0.17	0.2	2.14	93.4	48840.0
8/24/2016	0.000	0.019	0.03	0.033	0.30	8.3	1.99	21.8	3450.0
Interceptor Trench 2 (North)									
2/24/2016	0.005	0.066	0.13	6.298	7.02	9.7	4.27	30.1	18720.0
3/10/2016	0.005	0.054	0.14	1.716	2.35	6.8	6.77	613.1	34480.0
3/31/2016	0.006	0.040	0.06	2.800	3.54	20.9	9.29	7.4	10810.0
4/4/2016	0.004	0.012	<0.03	0.236	0.25	0.0	0.85	1.0	2419.2
5/10/2016	0.002	0.038	<0.03	1.706	2.18	5.2	3.72	38.7	1553.0
Samples analyzed since the last quarterly report									
8/16/2016	0.004	0.036	0.05	0.344	0.99	1.5	8.98	290.9	198630.0
Left Fork									
1/5/2016	0.013	0.028	<0.03	0.427	0.48	0.7	1.51	34.1	686.7
1/25/2016	0.010	0.024	<0.03	0.198	0.25	1.0	1.30	21.1	435.2
2/10/2016	0.003	0.012	<0.03	0.175	0.24	0.8	1.15	7.4	209.8
2/24/2016	0.015	0.088	<0.03	0.249	0.63	15.6		2780.0	14390.0
3/10/2016	0.013	0.046	0.01	0.154	0.38	8.7	2.64	367.3	2750.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/16/2016	0.009	0.032	<0.03	0.190	0.26	0.3	1.45	35.9	980.4
3/24/2016	0.013	0.048	0.09	0.186	0.39	10.7	2.65		
3/31/2016	0.013	0.056	0.09	0.199	0.40	11.9	2.59	172.0	3640.0
4/4/2016	0.009	0.022	<0.03	0.131	0.17	1.5	0.87	44.8	1119.9
4/20/2016	0.005	0.020	<0.03	0.157	0.21	2.1	0.84	35.0	6160.0
5/2/2016	0.009	0.020	<0.03	0.095	0.20	1.9	2.30	172.6	3640.0
5/10/2016	0.011	0.072	0.02	0.121	0.37	17.2	3.35	980.4	8230.0
5/18/2016	0.010	0.016	0.01	0.139	0.27	1.4	1.54	60.1	2620.0
5/26/2016	0.010	0.048	0.02	0.123	0.24	10.6	2.66	461.1	6890.0
Samples analyzed since the last quarterly report									
6/2/2016	0.007	0.022	0.00	0.117	0.22	1.4	1.40	44.1	1986.3
6/7/2016	0.009	0.016	0.04	0.124	0.19	0.8	2.08	31.8	3180.0
6/15/2016	0.009	0.012	0.01	0.198	0.29	2.0	0.94	63.1	8860.0
6/22/2016	0.008	0.018	0.05	0.220	0.37	2.1	0.70	37.9	676.0
6/29/2016	0.006	0.023	0.03	0.251	0.35	2.0	0.94	23.5	5200.0
7/6/2016	0.006	0.02	0.04	0.271	0.36	2.7	0.96	248.1	12590.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
7/13/2016	0.005	0.017	0.00	0.172	0.29	1.9	0.85	95.9	12360.0
7/20/2016	0.005	0.013	0.00	0.197	0.76	2.3	2.21		
7/27/2016	0.004	0.021	0.00	0.255	0.35	3.6	1.79	920.8	15000.0
8/3/2016	0.007	0.016	0.00	0.212	0.32	2.4	2.21	101.4	7430.0
8/16/2016	0.012	0.082	0.07	0.118	0.30	19.5	3.64	201.4	14550.0
8/24/2016	0.004	0.013	0.00	0.045	0.13	1.5	1.62	43.5	6690.0
8/30/2016	0.005	0.021	0.02	0.157	0.28	2.7	2.00	111.2	17850.0
9/7/2016	0.006	0.021	0.00	0.151	0.24	2.8	1.58	27.5	10170.0
Field 1									
No samples collected and analyzed for 2016									
Field 5a									
3/31/2016	1.154	1.352	0.27	0.302	1.67	26.5	32.74	N.S.	N.S.
5/10/2016	1.114	1.458	1.69	2.894	6.35	79.9	12.82	N.S.	N.S.
No samples analyzed since the last quarterly report									
Field 12									
3/10/2016	0.411	0.522	1.17	0.852	4.49	621.5	12.58	N.S.	N.S.

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
5/10/2016	0.370	0.666	0.12	0.062	1.03	96.7	6.92	N.S.	N.S.
No samples analyzed since the last quarterly report									

¶ Values proceeded by '<' were reported by the analytical laboratory as zero and the minimum detection limit is given.

§ N.S. is No Sample. E. coli and total coliform were not measured on surface runoff samples collected by ISCO samplers when sample holding time exceeded the required 8-hour threshold.

† N.D. is No Data.

Temporal Trends in Phosphorus, Nitrogen and Bacteria in Big Creek Above and Below the C&H Farm

The concentration of dissolved P, total P, nitrate-N, total N, bacteria and chloride in Big Creek above and below the C&H Farm are presented in subsequent figures to show the season / temporal trends in measured concentrations (Figures 5, 6, 7, 8, 9, 10, and 11).

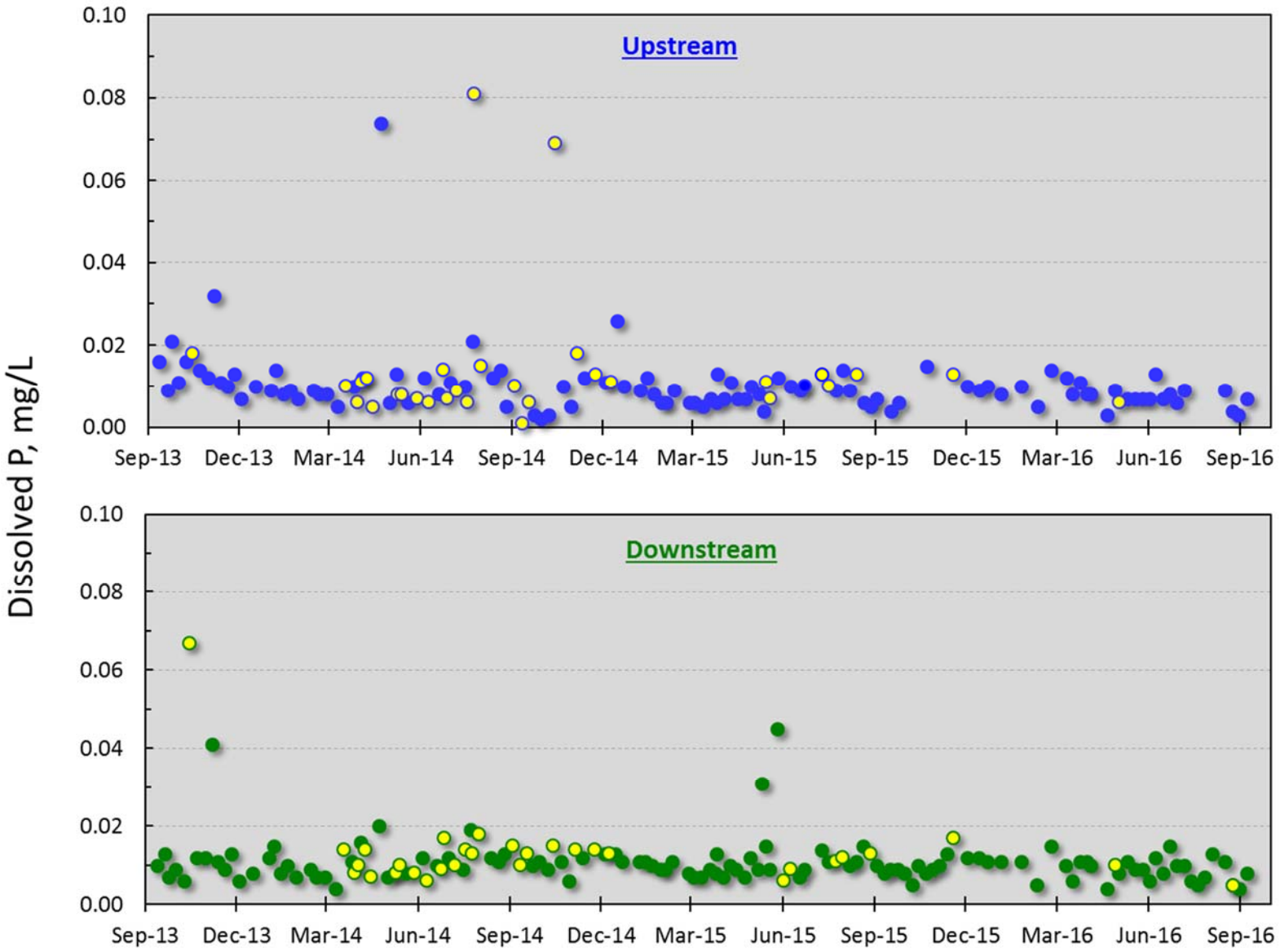

Figure 5. Dissolved P concentration at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

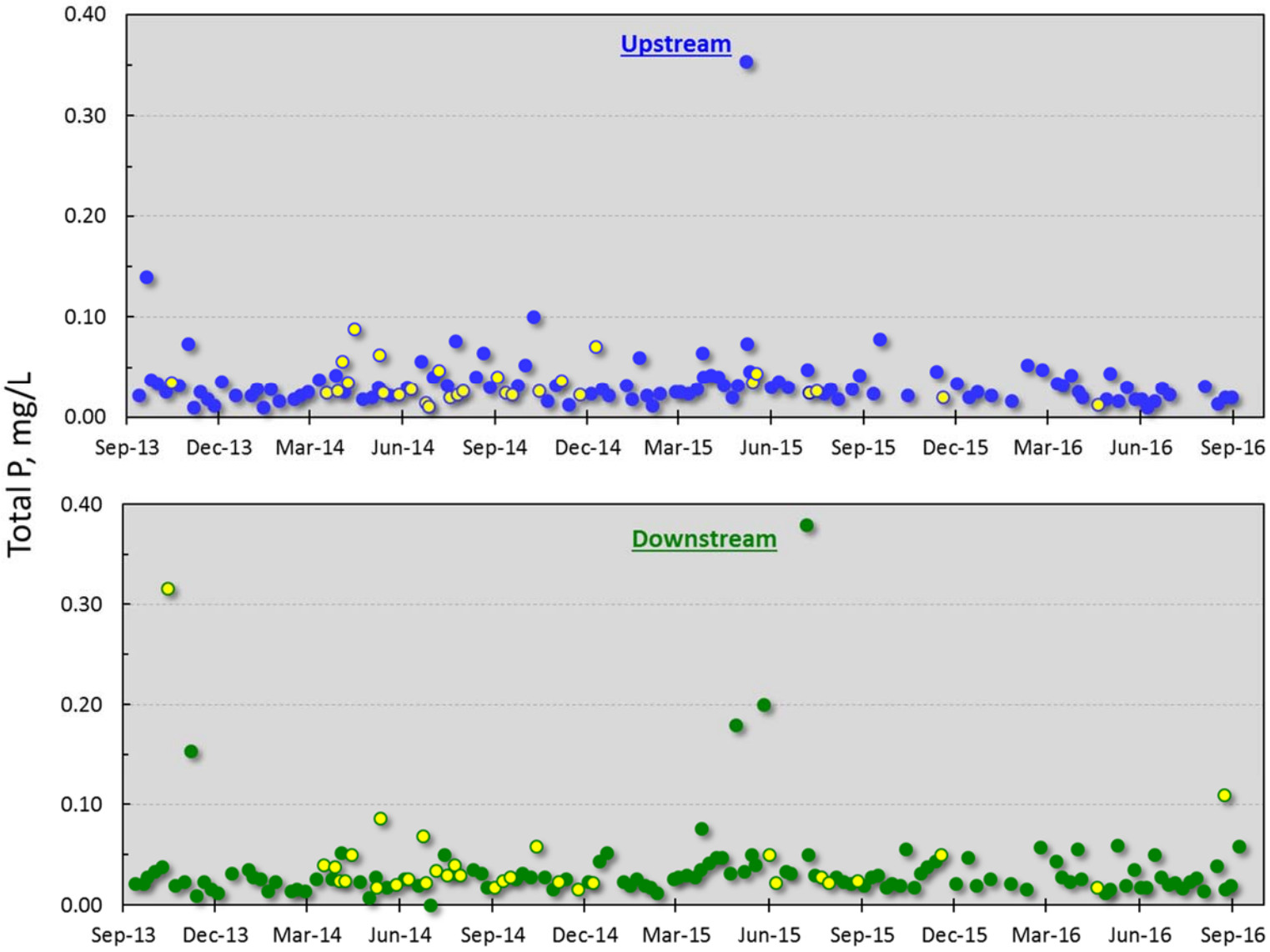

Figure 6. Total P concentration at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

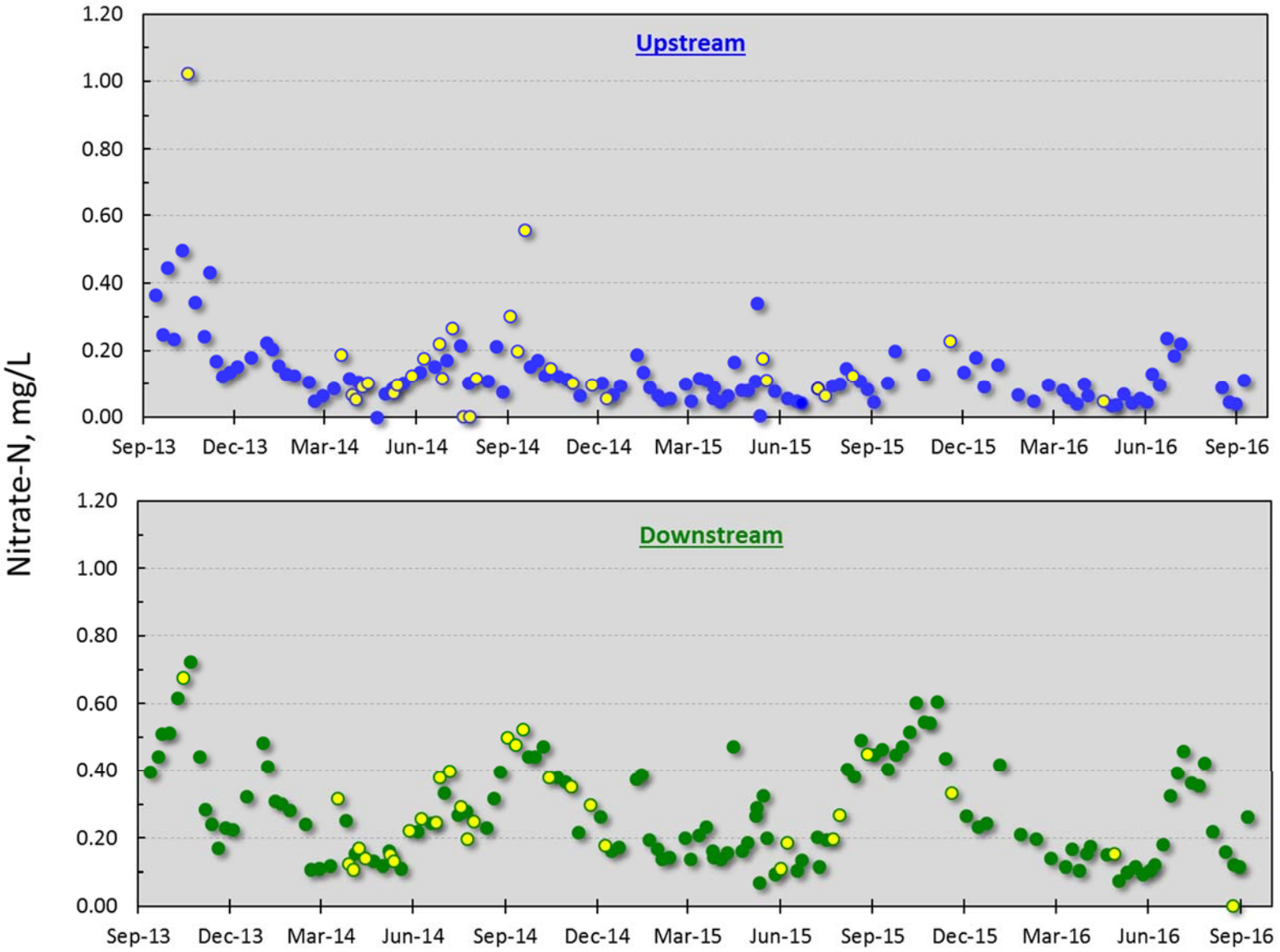

Figure 7. Nitrate-N concentration at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

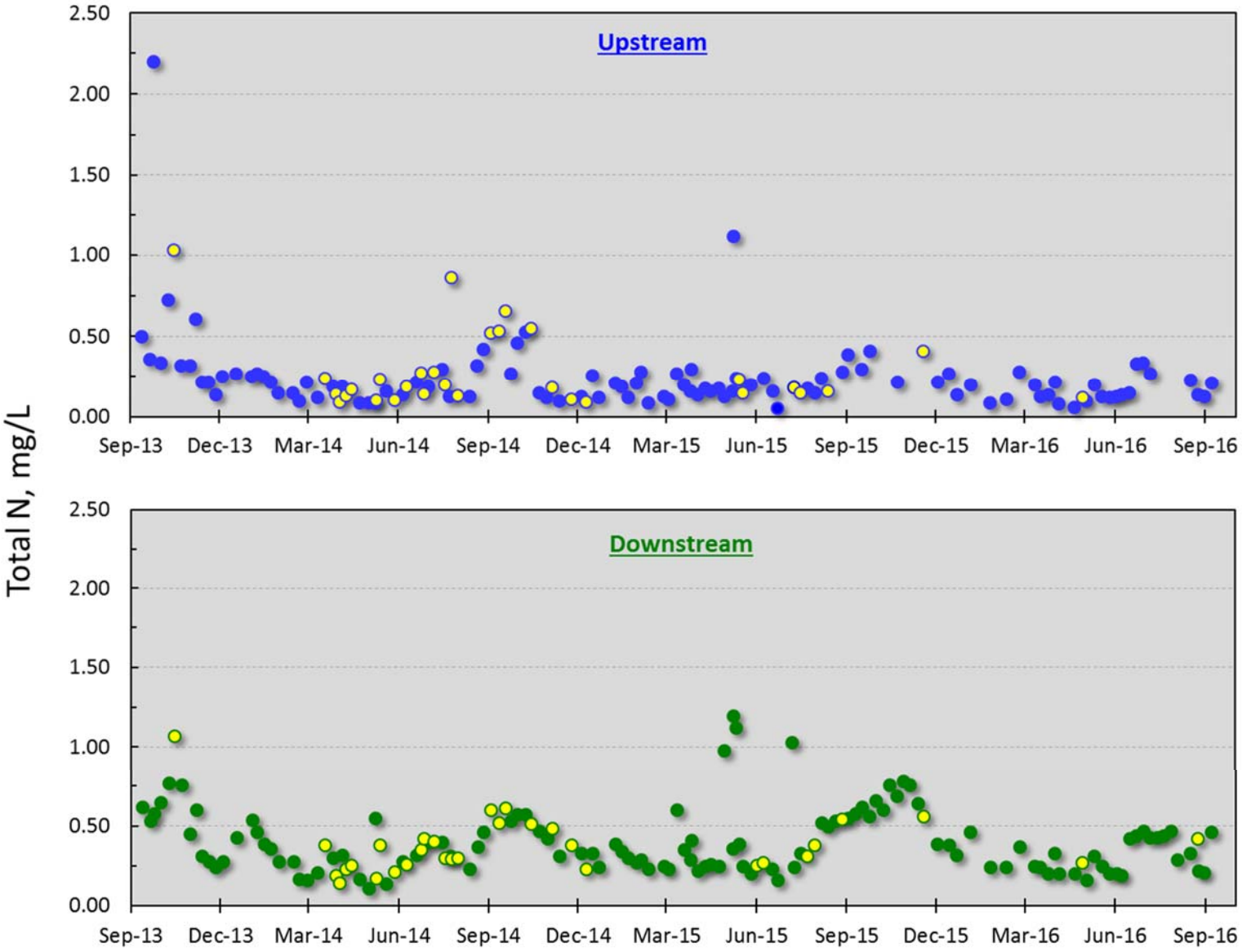

Figure 8. Total N concentration at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

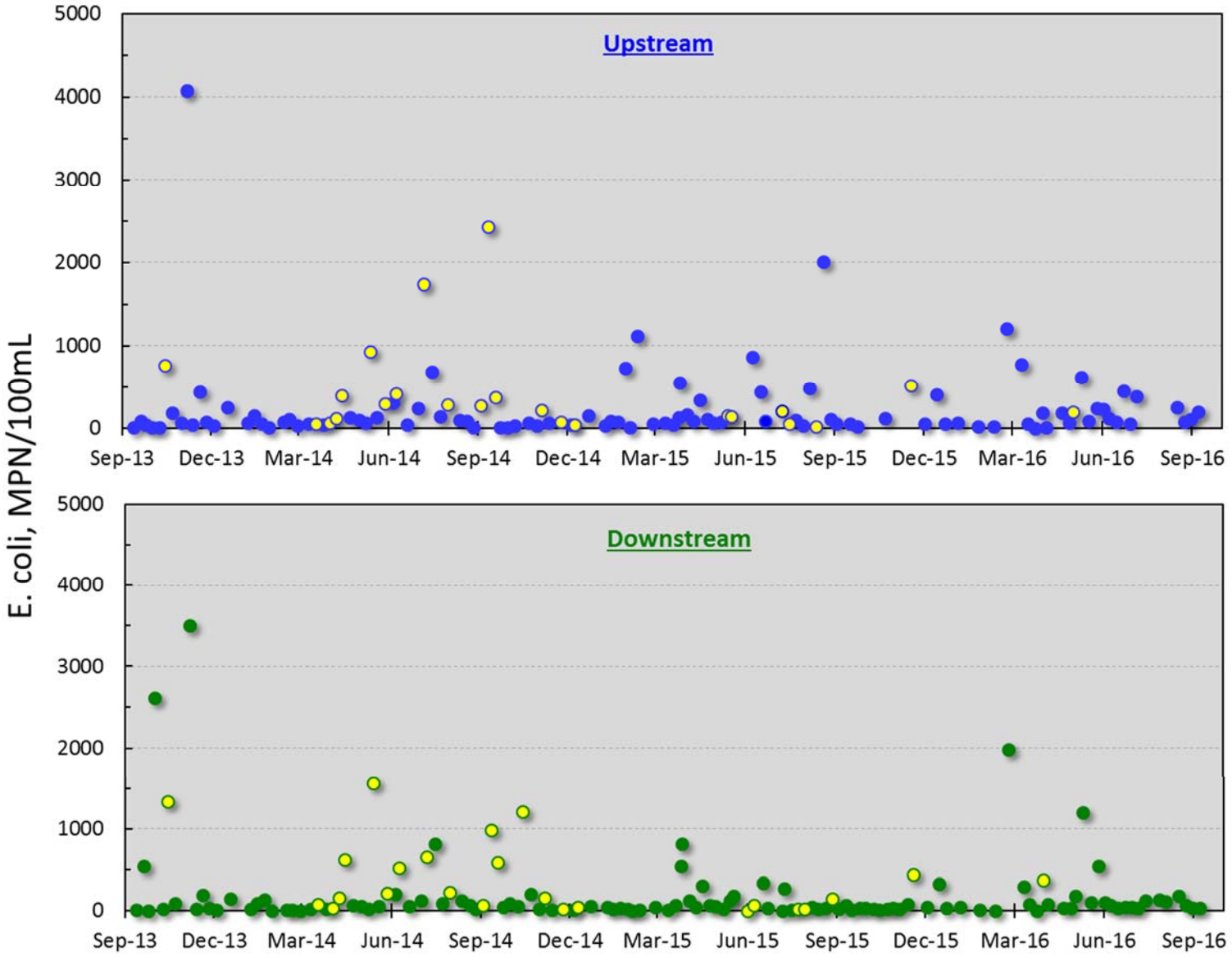

Figure 9. E. coli numbers at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

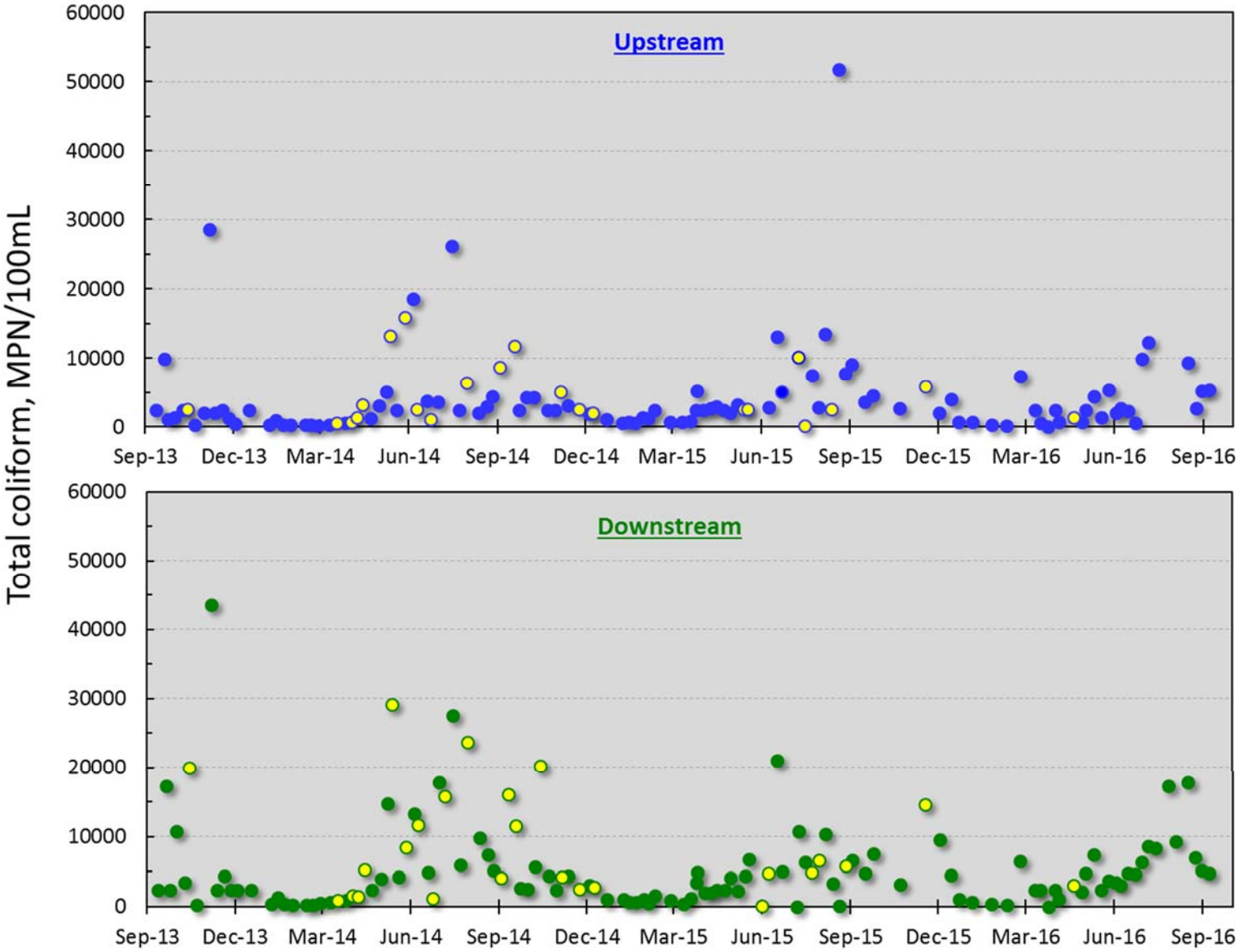

Figure 10. Total coliform numbers at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

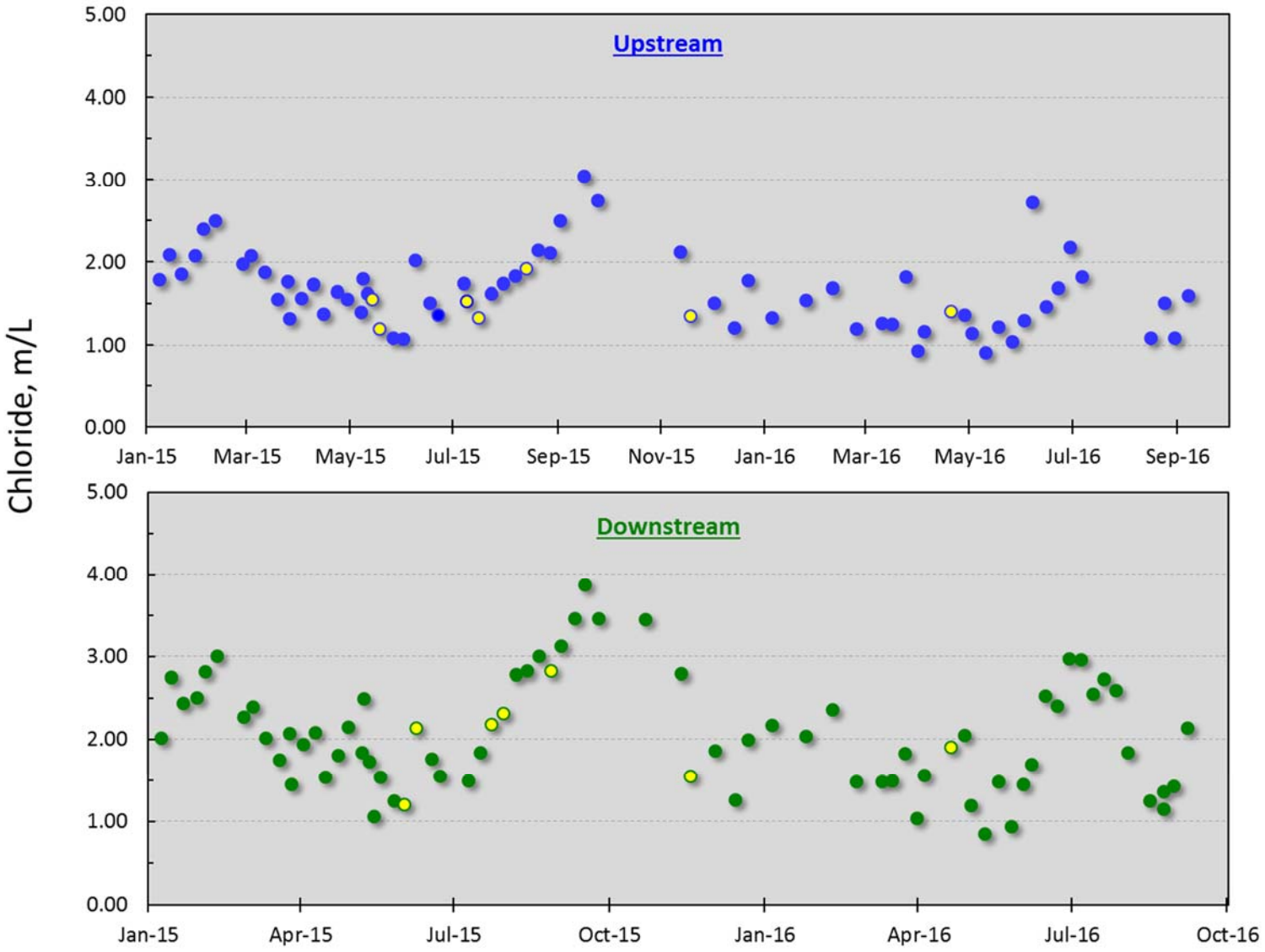

Figure 11. Chloride concentration at the Big Creek monitoring site up- and downstream of the C&H Farm, Newton County, AR.

Differences in dissolved P, total P, nitrate-N, total P, E. coli, total coliform and chloride between upstream and downstream sites from the beginning of monitoring (September 2013) to the present time are given in Figures 12, 13, 14, 15, 16, 17, and 18.

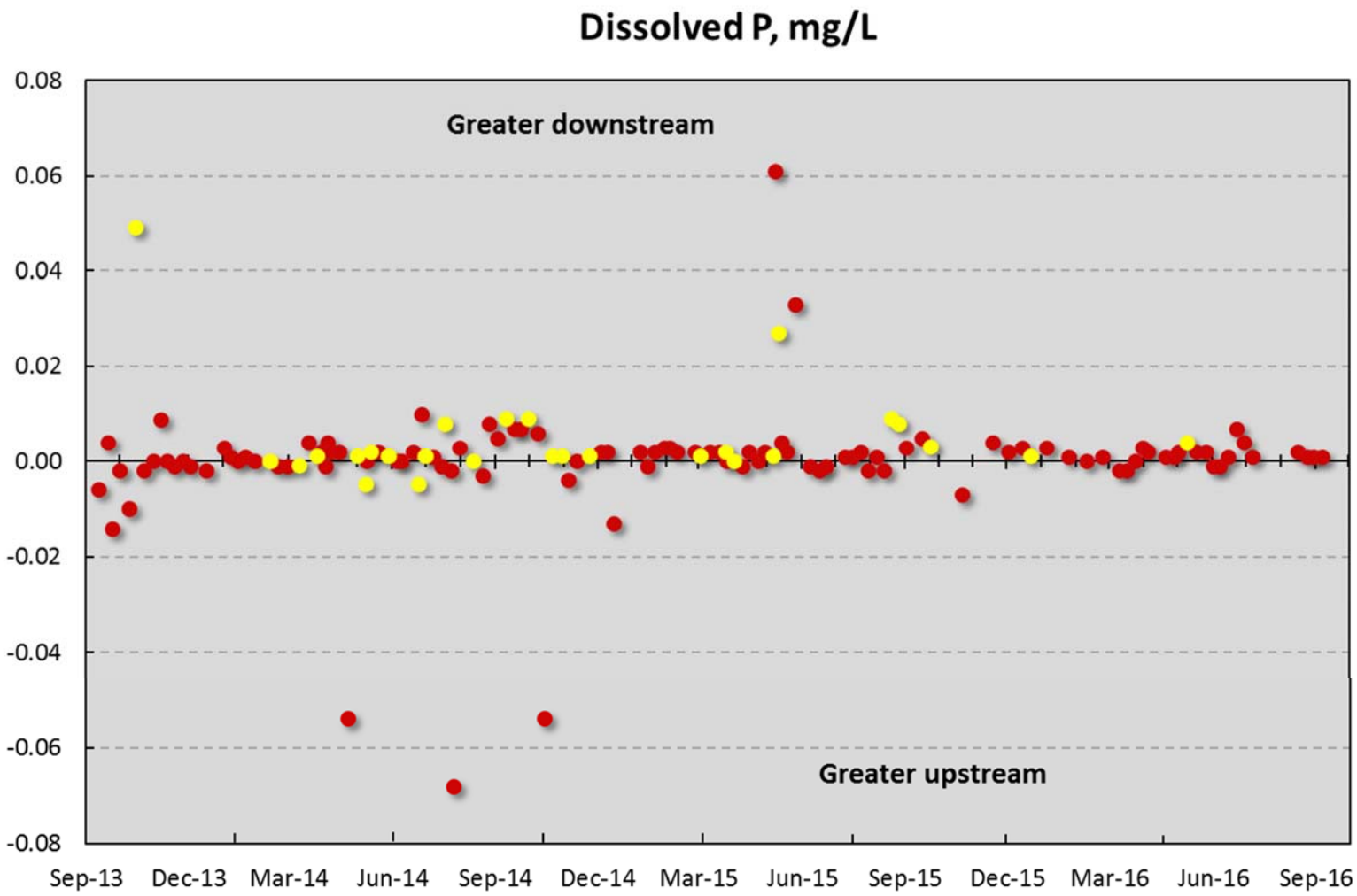

Figure 12. Difference in dissolved P concentrations in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

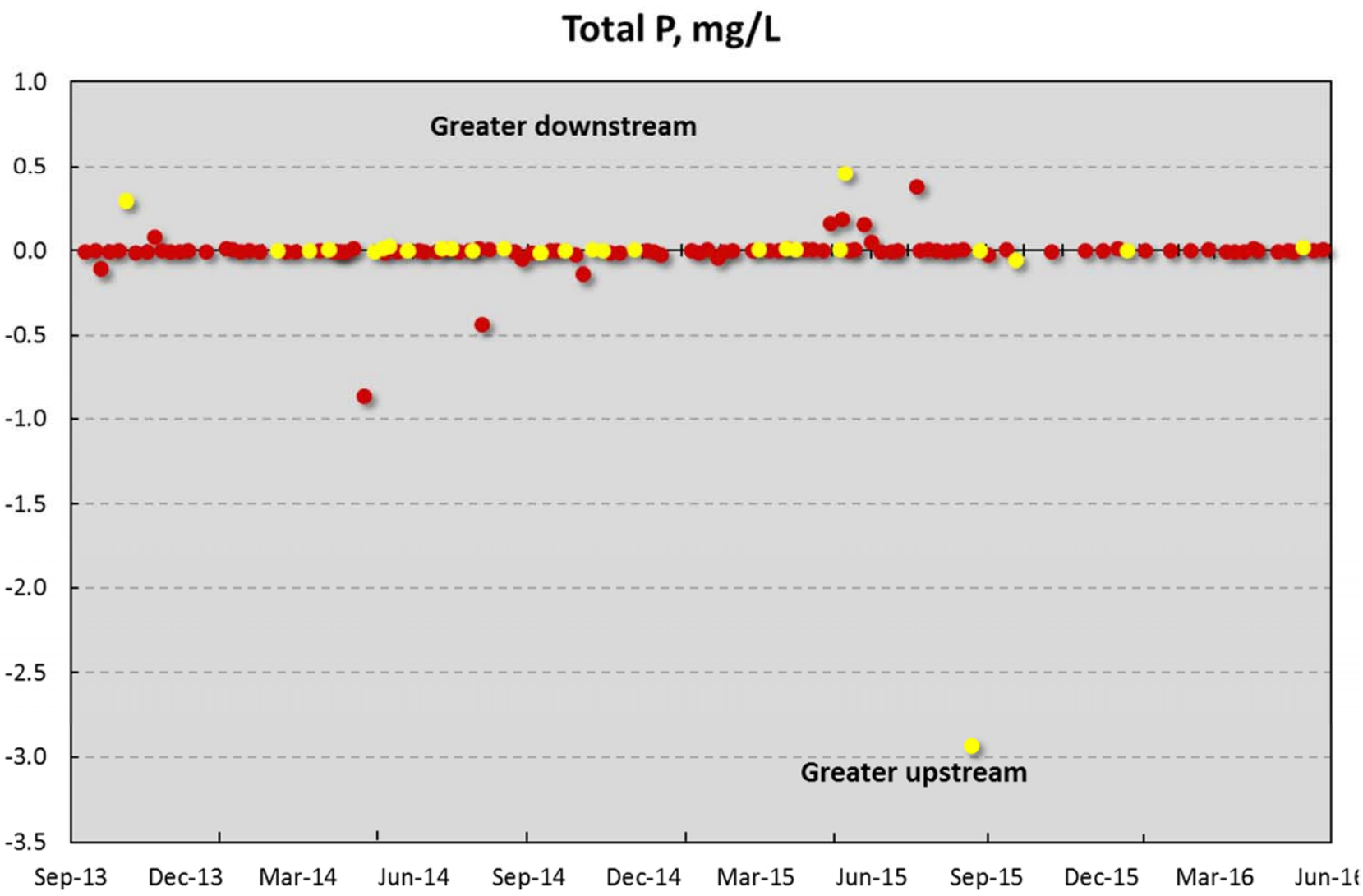

Figure 13. Difference in total P concentrations in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

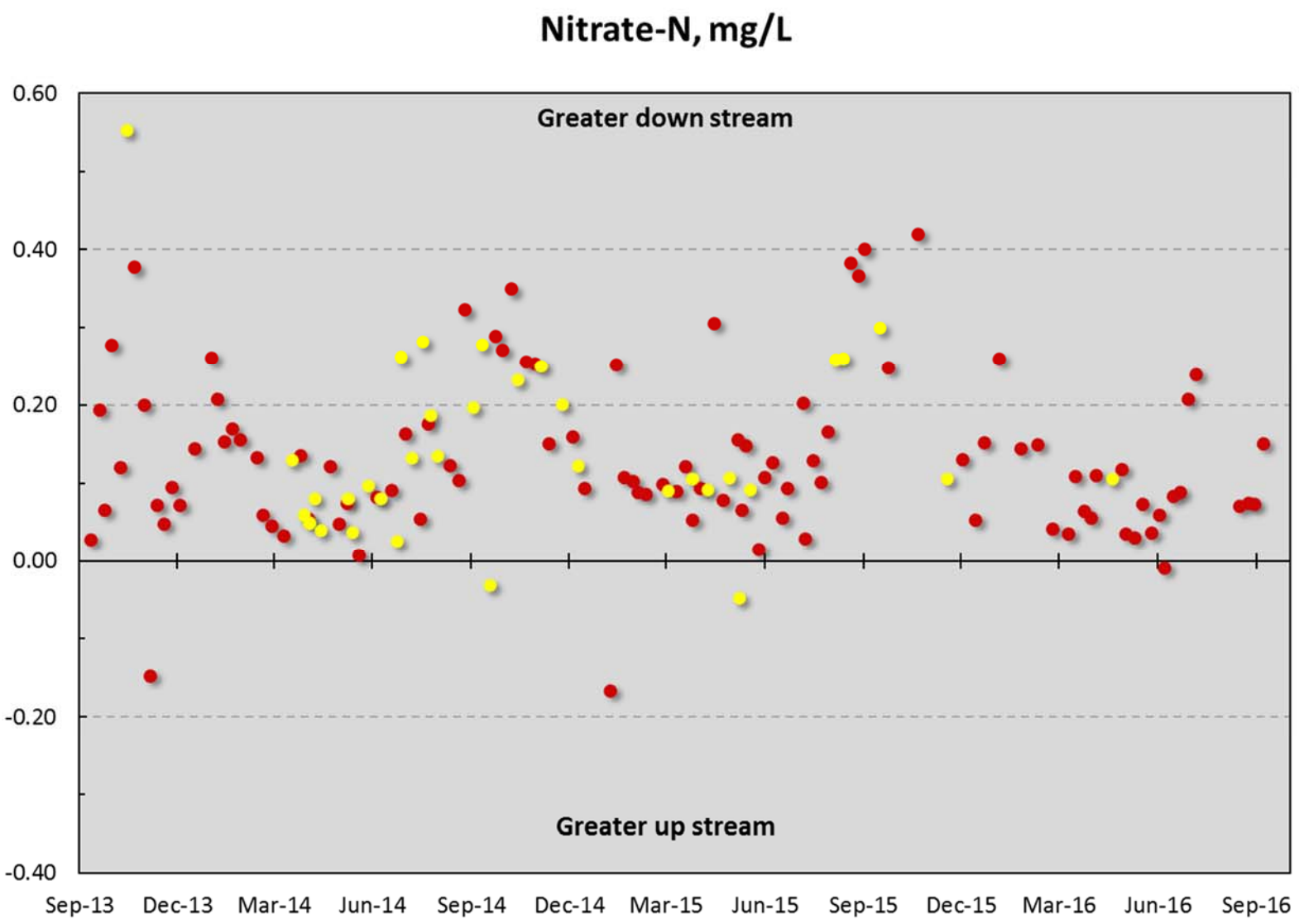

Figure 14. Difference in nitrate-N concentrations in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

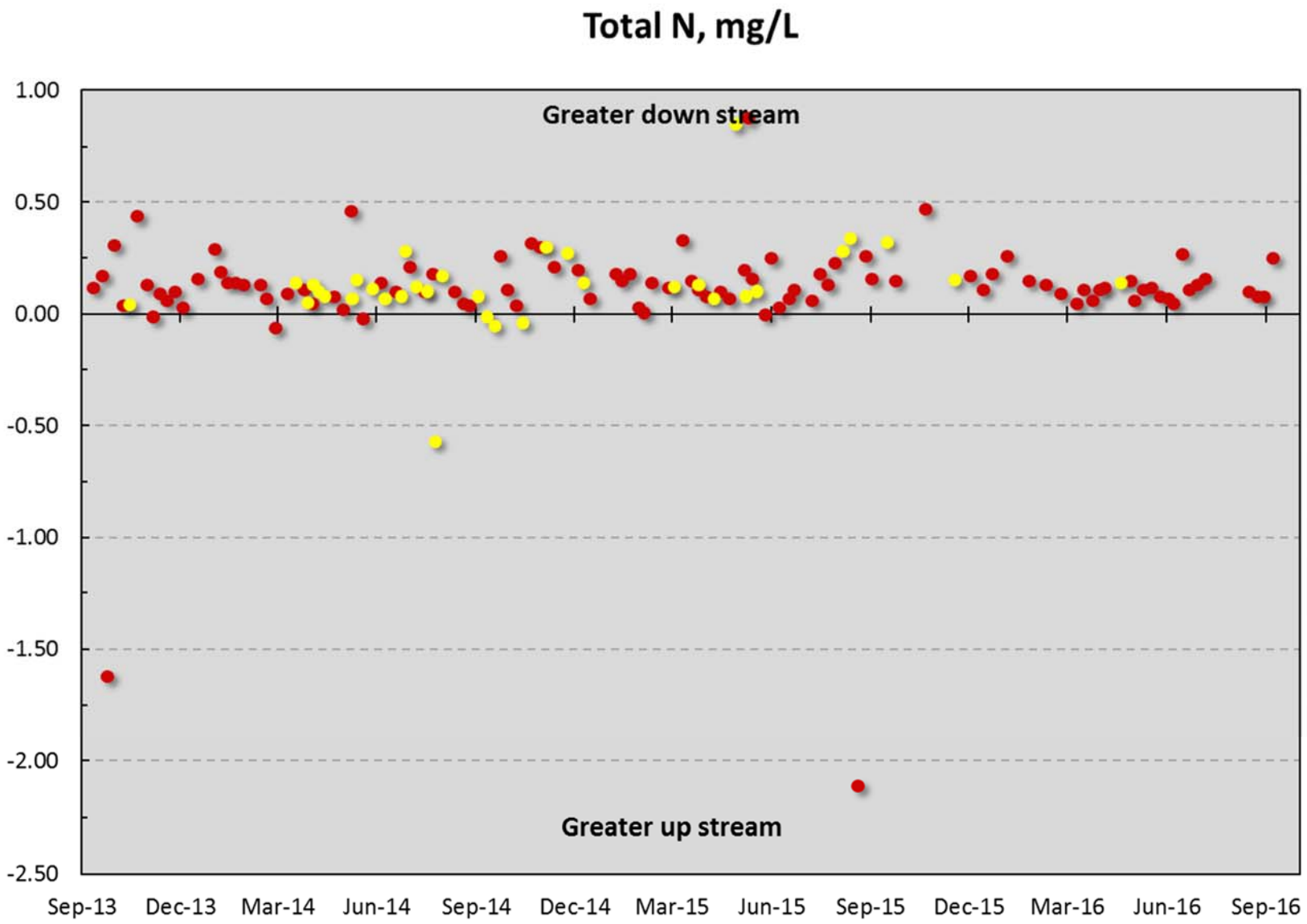

Figure 15. Difference in total N concentrations in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

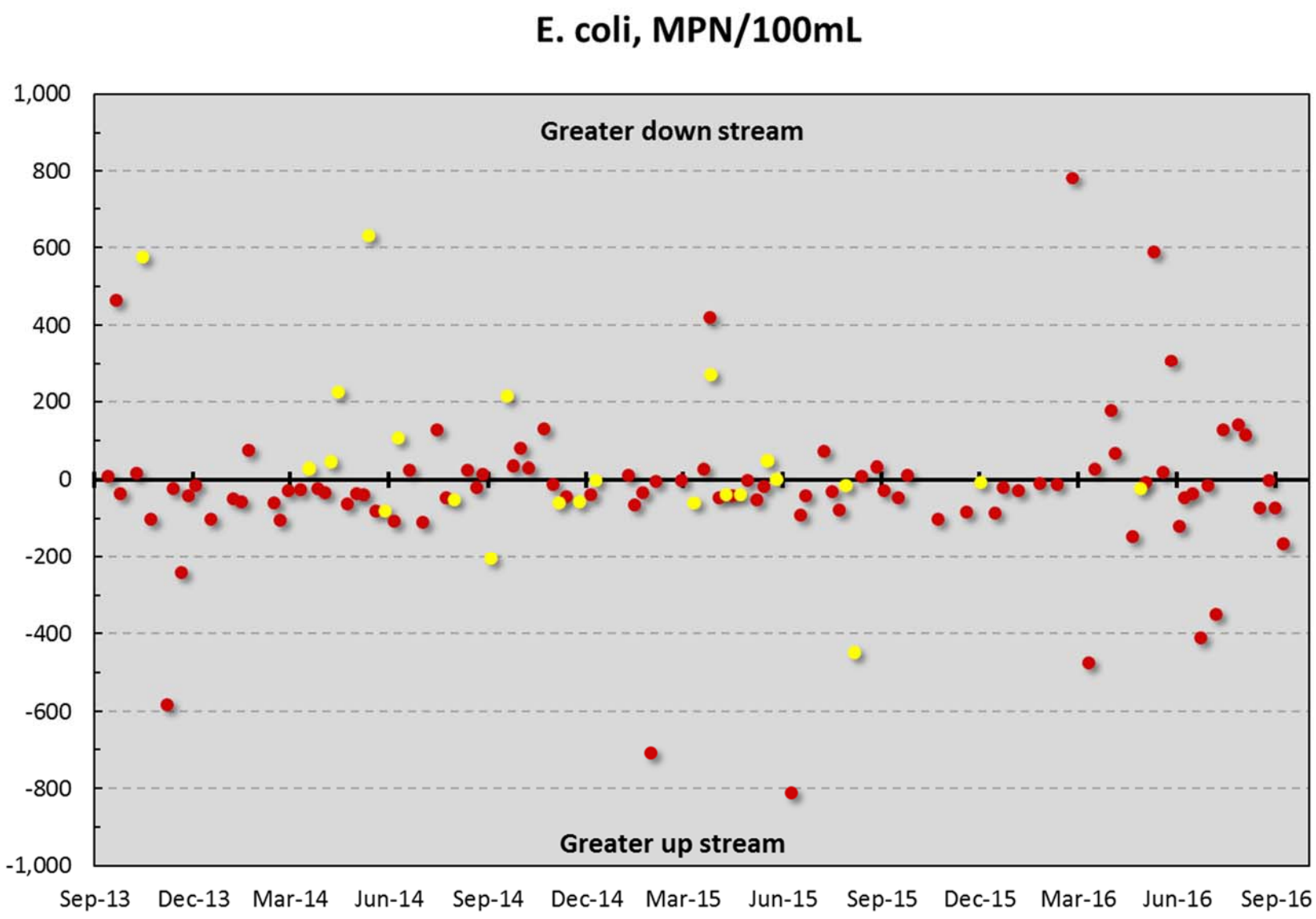

Figure 16. Difference in E. coli numbers in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

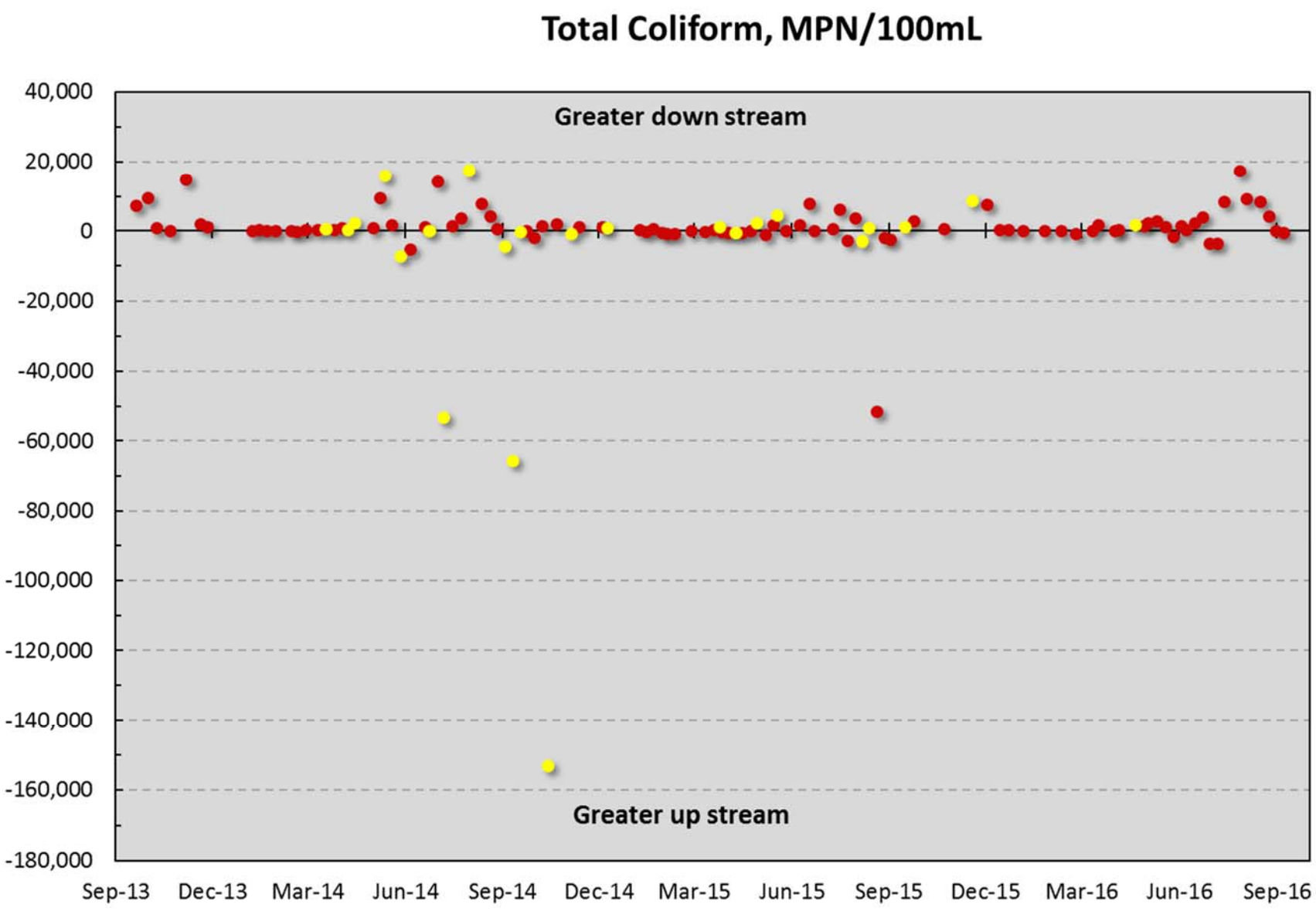

Figure 17. Difference in total coliform numbers in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

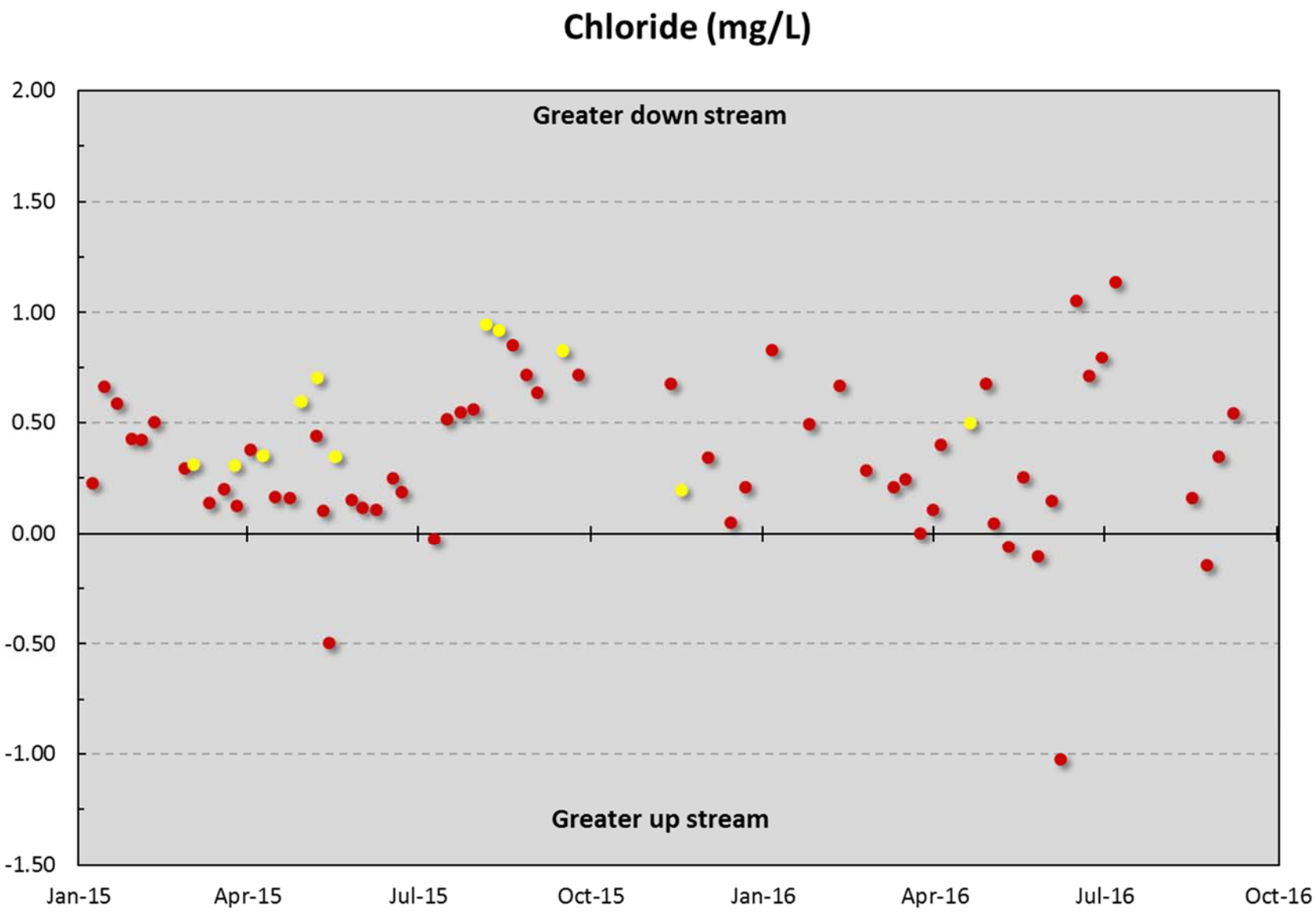

Figure 18. Difference in chloride concentrations in Big Creek up- and downstream of the C&H Farm, Newton County, AR.

Water pH, Alkalinity, Chloride, Electrical Conductivity, and Total Dissolved Solids for Several Big Creek Sites

At the beginning of 2015, the pH, alkalinity, chloride concentration, electrical conductivity and total dissolved solids were determined on water samples collected at the upstream and downstream sites, spring, house well, and trenches, to build a data base that will enable to eventually source track the major water source pathways at these sites. These values are given below in Table 6.

Table 6. The pH, Chloride concentration, electrical conducting, and total solids concentration of water samples collected at upstream, downstream, spring, ephemeral stream, house well and trench sites, initiated at the beginning of 2015, with those collected since the last report noted.

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
		------- mg/L ------		µS/cm	mg/L
Upstream					
1/5/2016	7.5	40	1.34	102	62.5
1/25/2016	8.2	46	1.50	115	65.0
2/10/2016	8.6	54	1.69	141	60.0
2/24/2016	7.2	66	1.20	102	97.5
3/10/2016	7.6	38.0	1.268	84.5	60.0
3/16/2016	6.7	38.0	1.252	88.3	52.5
3/24/2016	7.7	46.0	1.825	103.3	56.5
3/31/2016	7.3	30.0	0.933	65.8	235.0
4/4/2016	7.4	40.0	1.163	86.9	55.0
4/20/2016	8.0	58.0	1.405	125.7	65.0
4/29/2016	8.1	66.0	1.373	134.8	72.5
5/3/2016	7.7	38.0	1.150	83.7	52.5
5/10/2016	7.6	32.0	0.914	67.6	57.5
518/2016	8.0	48.0	1.228	102.8	57.5
5/26/2016	7.8	76.0	1.045	78.4	50.0
Samples analyzed since the last quarterly report					
6/2/2016	7.9	68.0	1.298	105.4	75.0

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
6/7/2016	8.1	58.0	2.722	128.3	77.5
6/15/2016	8.3	72.0	1.471	150.3	77.5
6/22/2016	8.1	88.0	1.695	182.3	112.5
6/29/2016	7.4	110.0	2.176	203.0	112.5
7/6/2016	7.5	106.0	1.821	212.0	117.5
8/16/2016	7.7	40.0	1.092	88.1	60.0
8/24/2016	8.3	54.0	1.513	121.7	95.0
8/30/2016	8.2	64.0	1.088	143.3	70.0
9/7/2016	7.9	82.0	1.601	176.0	97.5
Downstream					
1/5/2016	7.5	60	2.17	158	92.5
1/25/2016	8.0	80	2.00	191	95.0
2/10/2016	8.0	94	2.36	214	102.5
2/22/2016	7.5	80	1.48	156	110.0
3/10/2016	7.3	54.0	1.481	126.1	80.0
3/16/2016	7.1	60.0	1.500	137.6	75.0
3/24/2016	7.3	68.0	1.827	156.8	79.0
3/31/2016	7.3	48.0	1.043	95.9	50.0
4/4/2016	7.4	66.0	1.563	138.6	80.0
4/20/2016	7.3	92.0	1.903	187.0	105.0
4/29/2016	7.7	100.0	2.052	199.1	107.5
5/3/2016	7.8	60.0	1.197	130.5	87.5
5/10/2016	7.6	44.0	0.856	93.5	75.0
518/2016	7.8	74.0	1.482	154.5	82.5
5/26/2016	7.7	34.0	0.941	114.1	72.5
Samples analyzed since the last quarterly report					

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
6/2/2016	8.0	48.0	1.447	154.8	100.0
6/7/2016	7.8	88.0	1.698	176.8	97.5
6/15/2016	7.9	108.0	2.525	205.0	115.0
6/22/2016	7.8	120.0	2.406	230.0	145.0
6/29/2016	7.5	132.0	2.971	259.0	322.5
7/6/2016	7.4	136.0	2.960	262.0	157.5
7/13/2016	7.4	130.0	2.549	289.0	137.5
7/20/2016	7.7	138.0	2.726	305.0	145.0
7/27/2016	7.5	134.0	2.599	286.0	150.0
8/3/2016	7.9	144.0	1.845	258.0	137.5
8/16/2016	7.7	60.0	1.255	128.9	82.5
8/24/2016	7.8	84.0	1.368	174.8	97.5
8/24/2016			1.152	122.8	97.5
8/30/2016	7.8	88.0	1.435	193.5	97.5
9/7/2016	7.9	112.0	2.143	240.0	125.0
Spring					
3/10/2016			1.109	359.0	210.0
3/16/2016			2.038	516.0	250.0
3/24/2016			1.939	446.0	214.0
3/31/2016			1.324	414.0	45.0
4/4/2016			1.971	506.0	272.5
4/20/2016			2.111	554.0	300.0
4/29/2016			2.234	522.0	285.0
5/3/2016			1.879	486.0	275.0
5/10/2016			1.190	417.0	245.0
518/2016			2.206	493.0	275.0

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
5/26/2016			1.370	450.0	250.0
Samples analyzed since the last quarterly report					
6/2/2016			2.111	512.0	285.0
6/7/2016			2.348	503.0	280.0
6/15/2016			2.523	526.0	305.0
6/22/2016			2.659	543.0	322.5
6/29/2016			2.864	545.0	322.5
7/6/2016			2.749	533.0	267.5
7/13/2016			2.661	272.0	292.5
7/20/2016			2.271	594.0	292.5
7/27/2016			2.424	593.0	297.5
8/3/2016			2.151	541.0	280
8/16/2016			1.435	434.0	242.5
8/24/2016			2.644	556.0	312.5
8/30/2016			2.710	604.0	310.0
9/7/2016			2.822	598.0	322.5
Ephemeral Stream					
1/5/2016			2.908	368.0	
1/25/2016			3.454	392.0	
2/24/2016			2.427	264.0	
3/10/2016			2.530	288.0	
3/16/2016			2.427	356.0	
3/24/2016			3.467	399.0	
3/31/2016			3.366	153.2	
4/4/2016			2.544	330.0	
4/20/2016			2.758	380.0	

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
5/2/2016			2.068	329.0	
5/2/2016			2.571	241.0	
5/10/2016			1.617	143.3	
5/18/2016			2.726	360.0	
5/26/2016			2.031	194.5	
Samples analyzed since the last quarterly report					
6/2/2016			2.733	359.0	
6/7/2016			2.930	344.0	
8/16/2016			3.309	357.0	
Trench 1					
1/5/2016			1.61	161	82.5
2/24/2016			1.16	162	102.5
3/10/2016			1.019	173.7	117.5
3/16/2016			1.451	226.0	120.0
3/24/2016			1.732	229.0	99.0
3/31/2016			1.280	167.9	100.0
5/10/2016			1.122	226.0	130.0
5/19/2016			0.405	196.5	115.0
5/18/2016			1.653	234.0	125.0
5/262016			1.421	262.0	142.5
Samples analyzed since the last quarterly report					
6/2/2016			1.229	320	192.5
8/16/2016			2.051	293	130.0
8/24/2016			1.259	318	170.0
Trench 2					
2/24/2016			0.99	144	122.5

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
3/10/2016			0.349	106.8	80.0
3/31/2016			0.424	134.5	87.5
4/4/2016			1.4	192.1	107.5
Sample analyses since the last quarterly report					
8/16/2016			0.597	219	117.5