

Big Creek Research and Extension Team
University of Arkansas System Division of Agriculture
Quarterly Report – July 1 to September 30, 2015

**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 2015 for the Big Creek Research and Extension Team that details the following progress made from July 1 through September 30, 2015.

1. We continue to collect weekly baseflow 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.
2. Nitrate-N concentration in Big Creek below the C&H Farm continue to be greater than those measured at the upstream site. Based on numerous stream-water monitoring studies conducted by USGS, U.S. EPA, and Land-Grant entities, we know that there are temporal and spatial factors, such as land use in the drainage watershed, which influence stream water nitrate-N concentrations. We will continue to monitor nitrate-N and other constituents to determine if and when they exceed known standards. For nitrate-N, the drinking water standard is 10.0 mg/L., which has not been exceeded. Standards or thresholds related to recreational or increased algal productivity involve phosphorus and not nitrogen forms.
3. Concentrations of nitrate-N and bacteria collected from the house well, which is approximately 400 ft deep and adjacent to the manure holding ponds have periodic high values. These increases were inconsistent, highly sporadic, and other constituents did not show similar increases. We investigated further and discovered intermittent potential sources of contamination between the sampling port and wellhead, which is not representative of the quality of ground water in the aquifer. We have installed a new sampling port closer to the wellhead at the beginning of October, 2015 to ensure that there is reduced potential for contamination of the water from external sources. We will continue to closely monitor the site.

Big Creek Research Team

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

Brian Breaker, M.Sc., Hydrologic Technician, 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

Rick Cartwright, Ph.D., Professor – Associate Director of Extension for Agriculture and Natural Resources

Mark Cochran, Ph.D., – Vice President, University of Arkansas System Division of Agriculture.

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

Nathan McKinney, Ph.D., – Assistant Director, Agriculture Experiment Station

Morteza Mozaffari, Ph.D. – Director, Univ. of Arkansas Soil Testing and Research Laboratory, Marianna.

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

Thad Scott, Ph.D., Associate Professor - Water quality, transport of contaminants to and within water bodies

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 excellent Program Technicians based in Little Rock and Fayetteville.

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Water Sampling and Analytical Methods

Sampling Locations

Water quality monitoring sites are shown in Figure 1 and are;

- Site 1. Edge-of-field monitoring on Field 1 permitted to receive slurry.
- Site 2. Edge-of-field monitoring on Field 5a excluded from receiving slurry.
- 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 Creek downstream of the C&H Farm operation.
- Site 8. Manure holding pond trench. The site was visited weekly and trench water sampled when flowing.

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. The minimum detection limits (MDLs) for each chemical and biological constituent measured are listed in Table 1.
8. Chemical and biological analyses of samples collected from the beginning of 2015 to the end of August, 2015 are presented in Tables 2, 3, and 4.

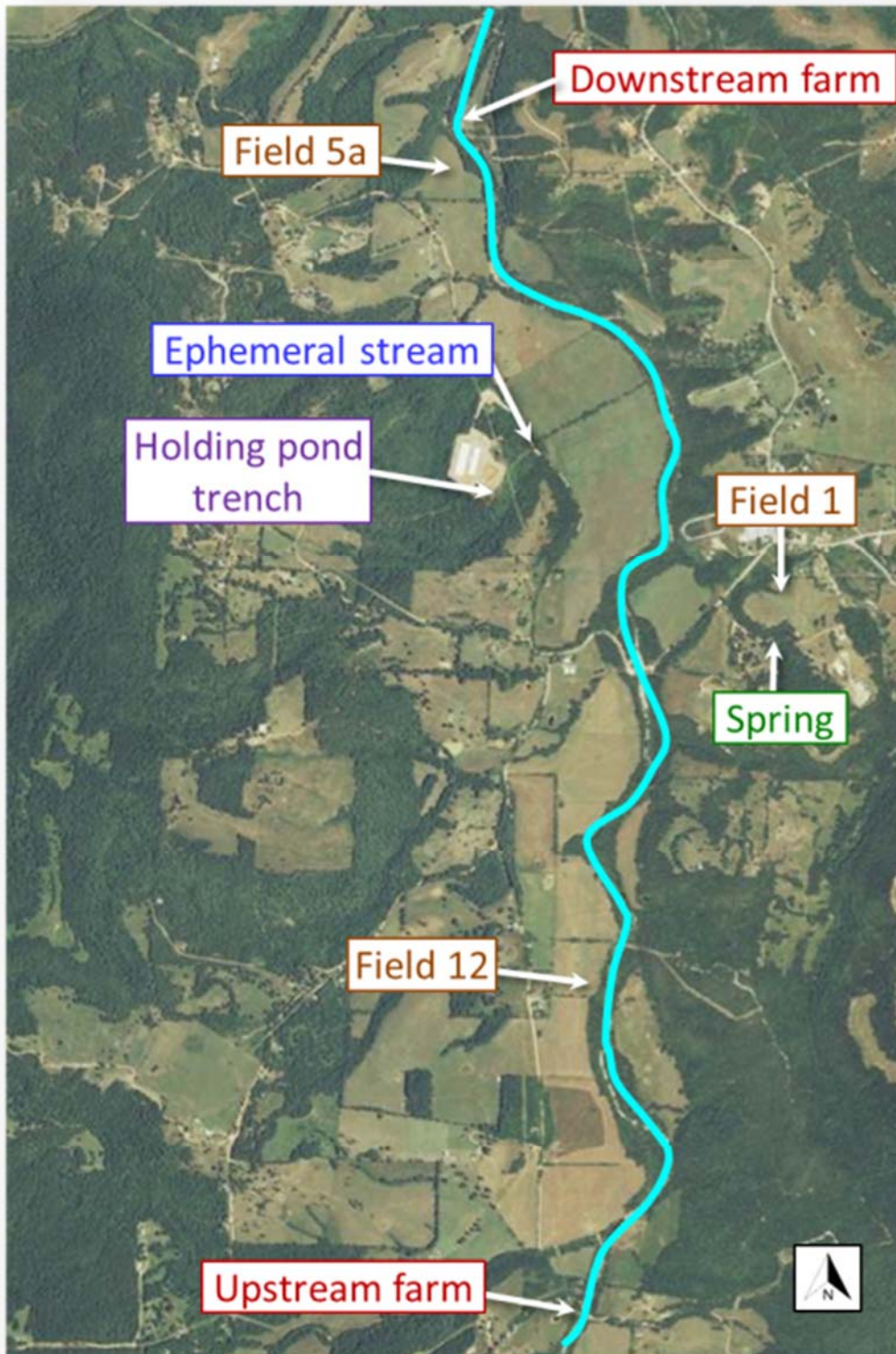


Figure 1. Location of water quality sampling sites on Big Creek and the C&H Farm.

Table 1. Minimum detection limits (MDLs) for each chemical and biological constituent measured.

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 a analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. MDL is also known as the Method Detection Limit. Further information is available on the U.S. EPA website at http://water.usgs.gov/owq/OFR_99-193/detection.html

USGS Stations

Big Creek Continuous Flow

We are collaborating with USGS at Big Creek near Mt. Judea (USGS 705579; downstream of the C&H Farm operation) and at Left Fork Big Creek near Vendor (USGS 07055792), to collect base and storm water flows for N, P, and bacteria analysis. The USGS Big Creek site is instrumented with continuous flow gaging equipment and a nitrate sensor, which provides real-time flow, water temperature, nitrate-N, and precipitation data. These data are available on line at the USGS website below. Gage height, water temperature, precipitation, and continuous nitrate concentrations for the USGS downstream site for the last quarter are shown in Figures 2, 3, 4, and 5.

USGS 07055790 Big Creek near Mt. Judea, AR

http://nwis.waterdata.usgs.gov/ar/nwis/uv/?site_no=07055790&agency_cd=USGS

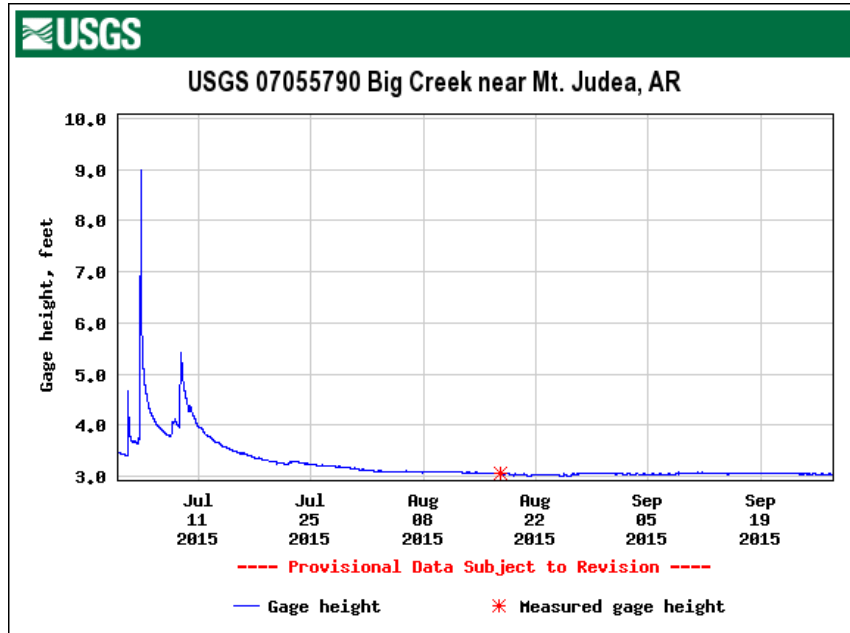


Figure 2. Gage height at the Big Creek monitoring site downstream of the C&H Farm during the 3rd quarter of 2015.

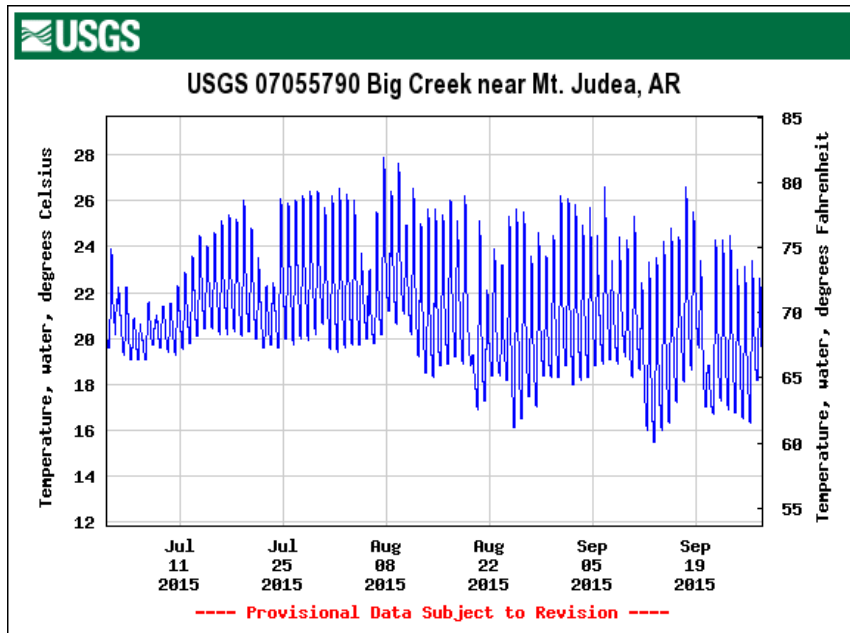


Figure 3. Water temperature at the Big Creek monitoring site downstream of the C&H Farm during the 3rd quarter of 2015.

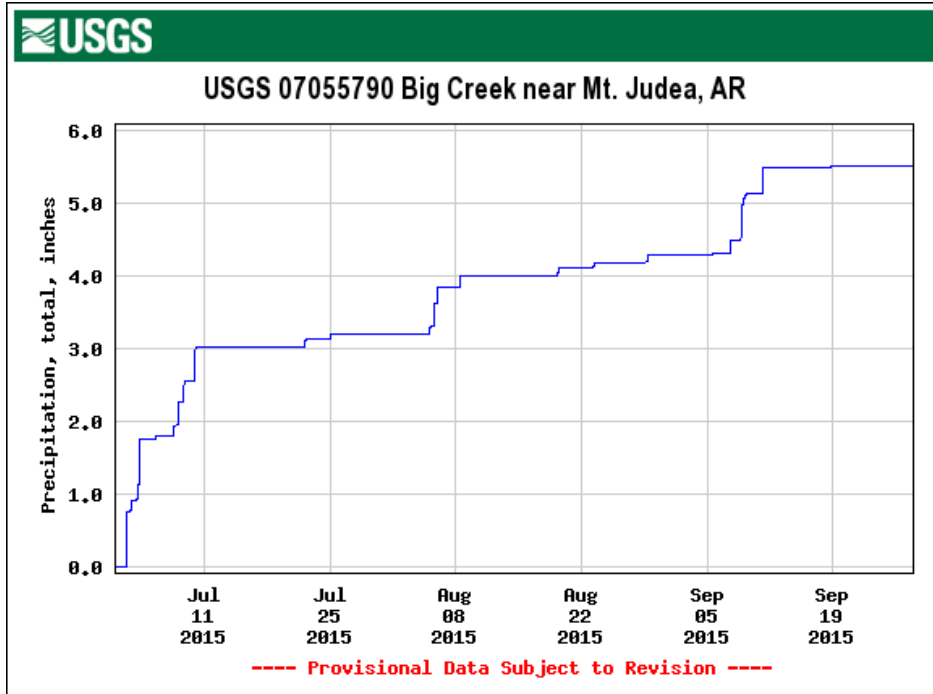


Figure 4. Precipitation at the Big Creek monitoring site downstream of the C&H Farm during the 3rd quarter of 2015.

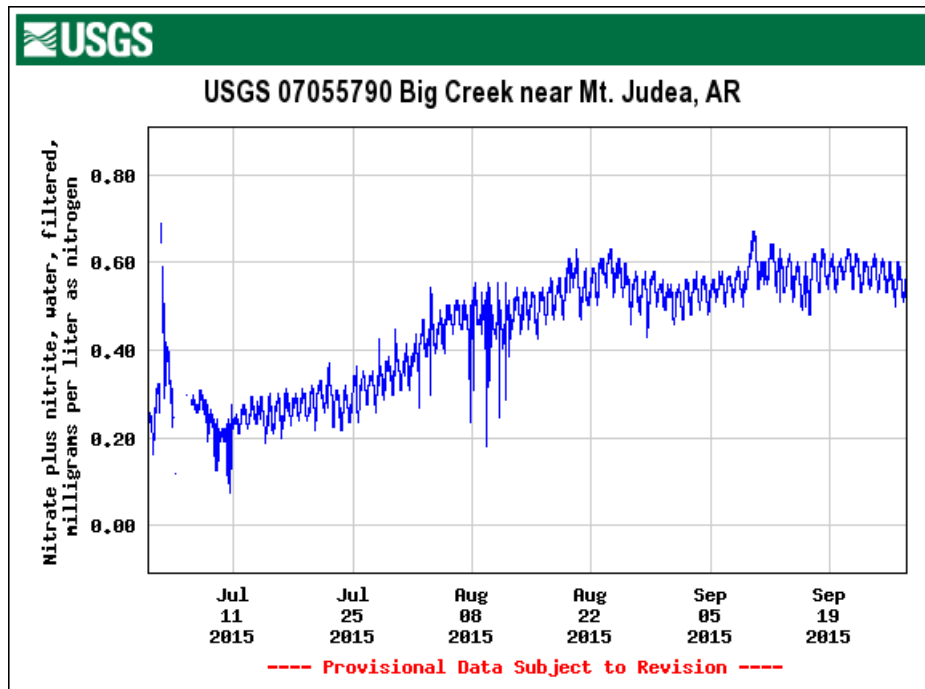


Figure 5. Nitrate concentration at the Big Creek monitoring site downstream of the C&H Farm during the 3rd quarter of 2015.

Big Creek Research and Extension Team Monitoring Data

Nutrients, Sediment, and Bacteria by Date of Sampling

Table 2. Water quality analyses at each sample site. Coliform units are Most Probable Number (MPN) per 100 mL of water for the 3rd Quarter of 2015.

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 --		
1/8/2015	1/8/2015	Base flow									
11:05	15:05	Spring	0.010	0.014	<0.03 ¶	0.376	0.56	2.0	3.80	14.8	686.7
11:25	15:05	Upstream farm	0.009	0.022	<0.03	0.187	0.21	2.3	1.41	30.9	547.5
10:53	15:05	Downstream farm	0.011	0.024	<0.03	0.376	0.39	2.5	1.22	42.6	980.4
11:40	15:05	Ephemeral stream	0.008	0.022	<0.03	0.448	0.59	2.4	1.73	25.6	1203.3
12:00	15:05	Trench 1	0.005	0.022	<0.03	0.769	0.75	4.7	0.88	1.0	13130.0
1/14/2015	1/14/2015	Base flow									
11:30	15:20	Spring	0.010	0.028	<0.03	0.473	0.66	1.1	10.20	21.6	613.1
11:45	15:20	Upstream farm	0.012	0.032	<0.03	0.135	0.19	1.1	3.02	88.2	727.0
11:15	15:20	Downstream farm	0.011	0.020	<0.03	0.388	0.34	1.0	2.03	25.6	613.1
12:00	15:20	Ephemeral stream	0.007	0.028	<0.03	0.469	0.55	1.9	0.55	7.4	1413.6

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
1/21/2015	1/21/2015	Base flow									
11:15	15:28	Spring	0.009	0.020	<0.03	0.552	0.69	1.5	2.29	9.8	461.1
11:52	15:28	Upstream farm	0.008	0.018	<0.03	0.089	0.12	1.1	0.95	70.3	579.4
11:05	15:28	Downstream farm	0.010	0.026	0.06	0.197	0.30	1.1	1.60	37.4	613.1
11:25	15:28	Ephemeral stream	0.005	0.016	<0.03	0.370	0.46	1.0	2.34	155.3	2419.2
1/29/2015	1/29/2015	Base flow									
10:40	15:28	Spring	0.010	0.018	0.03	0.886	0.74	2.3	4.27	1.0	2850.0
11:45	15:28	Upstream farm	0.006	0.060	<0.03	0.065	0.21	47.8	1.71	727.0	1413.6
1:20	15:28	Downstream farm	0.009	0.020	0.04	0.168	0.27	1.3	1.50	19.9	1046.2
2/3/2015	2/3/2015	Base flow									
11:05	15:40	Spring	0.008	0.018	<0.03	0.691	0.77	3.8	7.64	1.0	461.1
11:40	15:40	Upstream farm	0.006	0.022	<0.03	0.051	0.28	1.1	2.69	4.1	1203.3
10:50	15:40	Downstream farm	0.009	0.018	<0.03	0.140	0.29	4.1	2.66	1.0	547.5
2/10/2015	2/10/2015	Base flow									
10:38	15:08	Spring	0.010	0.010	<0.03	0.544	0.64	1.9	0.76	2.0	686.7
11:05	15:08	Upstream farm	0.009	0.012	<0.03	0.056	0.09	0.7	1.04	1119.1	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
10:25	15:08	Downstream farm	0.011	0.012	<0.03	0.143	0.23	1.0	1.15	7.4	1553.1
2/26/2015	2/26/2015	Base flow									
10:45	15:30	Spring	0.009	0.042	0.02	0.237	0.38	5.0	3.97	37.3	2419.2
11:36	15:30	Upstream farm	0.006	0.024	<0.03	0.100	0.13	0.6	1.20	47.9	686.7
10:34	15:30	Downstream farm	0.008	0.026	0.02	0.200	0.25	0.8	1.17	48.7	866.4
10:55	15:30	Ephemeral stream	0.006	0.022	<0.03	0.530	0.57	1.3	1.38	16.1	4790.0
11:15	15:30	Trench 1	0.004	0.028	0.01	0.712	0.76	46.0	0.60	1.0	41063.0
3/3/2015	3/3/2015	Base flow									
11:07	15:33	Spring	0.008	0.052	<0.03	0.124	0.35	13.5	4.90	N.S. §	N.S.
11:50	15:33	Upstream farm	0.006	0.026	0.02	0.048	0.11	2.3	1.50	N.S.	N.S.
10:55	15:33	Downstream farm	0.007	0.028	<0.03	0.138	0.23	1.3	1.50	N.S.	N.S.
11:18	15:33	Ephemeral stream	0.006	0.020	<0.03	0.477	0.52	2.0	1.84	N.S.	N.S.
11:30	15:33	Trench 1	0.003	0.024	<0.03	0.867	0.89	14.9	0.95	N.S.	N.S.
3/11/2015	3/11/2015	Storm Flow									
11:30	14:58	Spring	0.009	0.030	<0.03	0.242	2.37	5.5	14.79	19.5	111.9

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
12:30	14:58	Upstream farm	0.005	0.026	0.02	0.118	0.16	2.1	3.38	34.5	579.4
11:20	14:58	Downstream farm	0.007	0.030	0.02	0.209	0.27	1.8	1.44	66.3	770.1
11:45	14:58	Ephemeral stream	0.006	0.022	0.04	0.567	0.60	0.5	2.20	6.3	410.0
12:10	14:58	Trench 1	0.003	0.014	0.07	0.989	0.97	0.3	2.00	<1.0	2419.2
12:15	14:58	Trench 2	0.003	0.056	0.04	1.443	1.59	1.2	3.51	<1.0	2419.2
3/19/2015	3/19/2015	Base flow									
10:59	15:10	Spring	0.010	0.028	0.03	0.184	0.29	10.6	7.37	38.9	79.4
12:00	15:10	Upstream farm	0.007	0.024	0.04	0.111	0.20	1.7	2.53	42.6	866.4
11:13	15:10	Downstream farm	0.009	0.028	0.04	0.234	0.35	2.8	2.87	71.7	1119.9
11:08	15:10	Ephemeral stream	0.007	0.018	0.01	0.529	0.63	1.0	4.31	14.6	866.4
11:13	15:10	House well	0.009	0.020	0.02	0.467	0.55	1.2	4.93	1.0	31.3
11:30	15:10	Trench 1	0.003	0.012	0.01	0.849	0.93	<6.58	3.11	1.0	275.5
11:35	15:10	Trench 2	0.004	0.062	0.09	1.036	1.42	1.9	5.12	5.2	2419.2
3/25/2015	3/25/2015	Base flow									

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
11:45	15:20	Spring	0.006	0.014	0.02	0.197	0.39	1.6	1.45	23.1	275.5
13:30	15:20	Upstream farm	0.006	0.028	0.02	0.056	0.16	2.9	1.36	125.9	2419.2
11:30	15:20	Downstream farm	0.008	0.036	0.04	0.162	0.29	5.0	1.41	547.5	3410.0
12:00	15:20	Ephemeral stream	0.007	0.014	0.02	0.462	0.53	1.1	0.64	8.6	344.8
12:20	15:20	House well	0.007	0.016	<0.03	0.450	0.52	1.9	0.03	18.5	30.1
12:30	15:20	Trench 1	0.003	0.008	<0.03	0.838	0.88	0.2	0.59	<1.0	410.6
3/26/2015	3/26/2015	Storm flow									
13:10	15:25	Upstream farm	0.013	0.064	0.06	0.090	0.30	11.4	3.71	547.5	5200.0
13:35	15:25	Downstream farm	0.013	0.076	0.06	0.144	0.41	14.1	3.94	816.4	4960.0
12:55	15:25	Trench 1	0.004	0.026	0.02	0.904	1.00	15.4	0.69	<1.0	1553.1
12:50	15:25	Trench 2	0.004	0.126	0.13	0.873	1.44	22.2	4.63	105.4	6950.0
13:20	15:25	Field 1	0.143	0.346	0.41	0.216	2.68	65.5	15.65	N.S.	N.S.
12:30	15:25	Field 5a	0.813	1.330	0.39	0.225	2.59	72.3	15.95	N.S.	N.S.
4/2/2015	4/2/2015	Base flow									

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	15:25	Spring	0.008	0.042	0.04	0.173	0.35	3.5	10.47	248.1	1299.7
12:15	15:25	Upstream farm	0.007	0.040	0.02	0.045	0.14	3.1	3.61	166.9	2419.2
1:30	15:25	Downstream farm	0.007	0.042	0.02	0.139	0.22	2.5	2.71	121.1	1986.3
12:30	15:25	Ephemeral stream	0.006	0.032	0.02	0.467	0.46	1.8	4.41	5.2	547.5
12:48	15:25	House well	0.008	0.030	<0.03	0.477	0.50	0.7	6.05	39.3	9060.0
12:54	15:25	Trench 1	0.003	0.028	0.02	0.865	0.87	0.3	3.34	1.1	308.6
4/9/2015	4/9/2015	Base flow									
11:45	15:30	Spring	0.011	0.034	0.01	0.257	0.42	4.9	9.11	7380.0	9040.0
12:30	15:30	Upstream farm	0.011	0.042	0.04	0.066	0.18	13.1	2.13	86.0	2650.0
12:50	15:30	Downstream farm	0.010	0.048	0.03	0.157	0.25	19.7	1.82	47.2	1986.3
12:00	15:30	House well	0.011	0.026	<0.03	0.499	0.50	1.5	0.74	4.1	325.5
12:10	15:30	Trench 1	0.006	0.018	<0.03	0.790	0.83	0.8	2.99	<1.0	187.2
4/15/2015	4/15/2015	Storm Flow									
11:38	14:55	Spring	0.007	0.034	<0.03	0.210	0.39	7.7	4.70	275.5	2280.0

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
12:23	14:55	Upstream farm	0.007	0.040	0.03	0.090	0.16	3.5	3.24	648.8	4040.0
12:40	14:55	Downstream farm	0.009	0.048	0.03	0.166	0.26	4.4	2.67	344.8	2920.0
11:48	14:55	Ephemeral stream	0.005	0.026	0.03	0.472	0.56	0.8	1.26	305.0	2430.0
11:58	14:55	House well	0.008	0.022	0.02	0.475	0.60	1.2	3.72	9.6	80.9
12:10	14:55	Trench 1	0.003	0.020	<0.03	0.857	0.93	1.3	4.29	<1.0	3180.0
4/23/2015	4/23/2015	Base Flow									
12:23	15:30	Spring	0.008	0.034	<0.03	0.264	0.36	7.4	3.64	71.7	648.8
13:00	15:30	Upstream farm	0.007	0.032	0.03	0.083	0.18	4.0	5.11	104.6	2419.2
12:15	15:30	Downstream farm	0.007	0.032	0.03	0.162	0.25	2.6	2.51	65.7	2419.2
11:55	15:30	Ephemeral stream	0.008	0.026	0.03	0.520	0.56	2.0	1.78	12.0	3270.0
11:35	15:30	House well	0.008	0.082	<0.03	0.496	0.53	1.4	1.69	18.5	35.0
11:48	15:30	Trench 1	0.003	0.034	<0.03	0.877	0.97	1.2	1.18	3.1	2690.0
4/29/2015	4/29/2015	Base flow									
11:25	14:05	Spring	0.010	0.028	<0.03	0.419	0.59	9.0	4.28	25.6	1732.9

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
11:53	14:05	Upstream farm	0.010	0.020	0.03	0.082	0.13	2.7	1.58	58.3	1732.4
12:13	14:05	Downstream farm	0.012	0.018	0.03	0.189	0.82	2.1	1.64	58.6	1986.3
11:30	14:05	Ephemeral stream	0.012	0.018	0.02	0.569	0.61	3.5	1.98	14.3	4080.0
11:35	14:05	House well	0.010	0.006	<0.03	0.517	0.51	0.7	2.26	248.1	5040.0
5/7/2015	5/7/2015	Base flow									
11:10	14:10	Spring	0.011	0.036	0.02	0.499	0.58	9.9	44.04	135.4	980.4
11:43	14:10	Upstream farm	0.008	0.032	0.01	0.110	0.16	7.5	10.16	77.6	3280.0
12:05	14:10	Downstream farm	0.009	0.034	<0.03	0.267	0.36	4.5	7.70	27.8	2280.0
11:18	14:10	Ephemeral stream	0.013	0.066	0.02	0.628	0.71	3.2	16.41	71.7	7170.0
11:23	14:10	House well	0.008	0.022	0.01	0.512	0.49	<6.58	28.63	3.1	59.4
5/8/2015	5/8/2015	Storm flow									
13:25	15:32	Upstream farm	0.134	0.354	0.16	0.340	1.12	51.4	9.30	N.S.	N.S.
13:25	15:32	Downstream farm	0.195	0.544	0.27	0.292	1.20	113.2	7.47	N.S.	N.S.

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
11:43	15:32	Ephemeral stream	0.005	0.254	0.41	2.287	3.23	127.1	6.45	N.S.	N.S.
13:00	15:32	Field 1	0.525	0.714	0.16	0.475	2.19	16.9	13.28	N.S.	N.S.
12:38	15:32	Field 12	0.675	0.956	0.14	0.303	1.82	57.0	16.00	N.S.	N.S.
5/11/2015	5/12/2015	Storm Flow									
11:35	8:30	Spring	0.008	0.058	0.01	0.339	0.49	8.7	3.67	N.S.	N.S.
11:28	8:30	Upstream farm	0.004	0.074	0.04	0.004	0.24	4.5	4.31	N.S.	N.S.
12:47	8:30	Downstream farm	0.031	0.530	0.11	0.071	1.12	277.5	8.48	N.S.	N.S.
12:05	8:30	Ephemeral stream	0.008	0.146	0.15	0.941	1.80	22.0	8.09	N.S.	N.S.
12:15	8:30	House well	0.009	0.038	0.02	0.541	0.55	4.2	0.89	N.S.	N.S.
12:25	8:30	Trench 1	0.003	0.060	0.02	0.916	0.97	27.6	1.78	N.S.	N.S.
12:35	8:30	Trench 2	0.003	0.042	0.05	0.553	0.76	8.8	3.44	N.S.	N.S.
11:25	8:30	Field 1	0.251	0.386	0.09	0.055	0.86	44.4	6.31	N.S.	N.S.

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
11:40	8:30	Field 5a	0.248	0.968	0.26	0.127	1.50	320.1	8.58	N.S.	N.S.
1:05	8:30	Field 12	0.194	0.364	0.09	0.135	0.83	36.7	7.03	N.S.	N.S.
5/14/2015	5/14/2015	Base flow									
12:35	15:12	Spring	0.009	0.062	0.02	0.222	0.35	41.5	2.84	121.1	2419.2
12:28	15:12	Upstream farm	0.011	0.046	0.02	0.177	0.23	2.8	1.35	145.5	2470.0
12:47	15:12	Downstream farm	0.015	0.050	0.02	0.326	0.39	6.1	1.16	128.1	4370.0
12:57	15:12	Left Fork	0.015	0.038	0.02	0.321	0.38	3.3	1.36	83.3	2690.0
12:15	15:12	Ephemeral stream	0.010	0.022	0.01	0.527	0.50	1.7	0.73	41.3	1986.3
12:05	15:12	Trench 1	0.005	0.042	0.02	0.904	0.94	29.9	1.20	81.6	1732.9
5/18/2015	5/18/2015	Storm Flow									
10:45	14:43	Spring	0.005	0.084	0.05	0.209	0.56	114.2	2.79	98.7	1413.6
11:57	14:43	Upstream farm	0.007	0.034	0.02	0.110	0.15	5.2	1.29	137.6	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
12:17	14:43	Downstream farm	0.009	0.040	0.03	0.201	0.25	6.1	1.47	185.0	6770.0
12:29	14:43	Left Fork	0.011	0.040	0.04	0.209	0.29	4.1	1.90	167.4	8300.0
11:14	14:43	Ephemeral stream	0.007	0.028	0.03	0.525	0.55	0.7	1.18	90.7	7630.0
11:20	14:43	House well	0.008	0.018	<0.03	0.529	0.53	0.9	0.90	5.2	13.4
12:55	14:43	Trench 1	0.002	0.020	<0.03	0.897	0.93	0.3	1.28	32.3	1732.9
10:58	14:43	Field 1	0.208	0.512	0.54	0.410	3.59	53.7	26.12	N.S.	N.S.
5/26/2015	5/26/2015	Base flow									
11:49	15:48	Spring	0.021	0.020	<0.03	0.205	0.29	1.2	2.66	N.S.	N.S.
13:20	15:48	Upstream farm	0.012	0.044	0.04	0.080	0.19	6.4	1.50	N.S.	N.S.
13:32	15:48	Downstream farm	0.045	0.200	0.11	0.096	0.56	94.7	4.57	N.S.	N.S.
13:45	15:48	Left Fork	0.014	0.048	0.04	0.139	0.29	6.1	2.41	N.S.	N.S.
13:11	15:48	Ephemeral stream	0.017	0.030	0.03	0.514	0.60	0.9	1.12	N.S.	N.S.
12:43	15:48	House well	0.013	0.020	<0.03	0.514	0.54	2.7	0.87	N.S.	N.S.

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
12:55	15:48	Trench 1	0.007	0.012	0.01	0.752	0.80	1.0	0.78	N.S.	N.S.
1:00	15:48	Trench 2	0.007	0.112	0.04	1.190	1.44	131.9	1.23	N.S.	N.S.
12:09	15:48	Field 1	0.245	0.432	0.20	0.174	1.66	37.8	11.28	N.S.	N.S.
6/1/2015	6/1/2015	Storm Flow									
13:15	15:20	Downstream farm	0.006	0.050	0.05	0.109	0.25	13.7	1.80	N.S.	N.S.
12:00	15:20	Ephemeral stream	0.002	0.056	0.01	0.851	1.05	18.3	2.46	N.S.	N.S.
6/4/2015	6/4/2015	Base Flow									
12:50	15:20	Spring	0.010	0.028	<0.03	0.239	0.3	6.2	9.54	44.3	1413.8
12:00	15:20	Upstream farm	0.008	0.026	0.03	0.083	0.11	2.3	2.93	38.6	>2419.2
13:05	15:20	Downstream farm	0.009	0.034	<0.03	0.184	0.23	1.7	2.64	24.7	2419.2
13:13	15:20	Left Fork	0.008	0.022	<0.03	0.145	0.19	2.1	3.15	38.9	2560.0
11:40	15:20	Ephemeral stream	0.010	0.024	0.02	0.572	0.58	0.8	5.35	21.6	3890.0
11:35	15:20	House well	0.012	0.022	0.02	0.561	0.52	1.3	6.07	<1.0	14.6
6/8/2015	6/8/2015	Base flow									
11:36	15:30	House well	0.008	0.018	0.27	0.475	0.82	0.7	6.67	<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
10:45	15:30	Spring	0.011	0.046	0.03	0.322	0.53	12.7	11.18	20.1	1986.3
12:26	15:30	Upstream farm	0.010	0.030	0.06	0.058	0.24	4.5	3.63	866.4	2780.0
13:12	15:30	Downstream farm	0.009	0.022	0.05	0.185	0.27	0.9	2.66	57.4	4640.0
13:25	15:30	Left Fork	0.006	0.024	0.02	0.102	0.23	1.1	2.78	32.7	4550.0
11:51	15:30	Ephemeral stream	0.009	0.020	0.03	0.560	0.62	0.6	2.81	65.7	9870.0
6/17/2015	6/17/2015	Base flow									
12:08	15:40	Spring	0.009	0.046	0.07	0.224	0.47	9.4	8.92	517.2	24890.0
10:10	15:40	Upstream farm	0.009	0.036	0.03	0.050	0.16	3.5	2.83	435.2	13130.0
12:49	15:40	Downstream farm	0.007	0.034	0.03	0.106	0.23	2.3	2.92	344.8	20980.0
13:01	15:40	Left Fork	0.005	0.026	0.04	0.112	0.22	2.8	1.62	26.2	8550.0
11:50	15:40	Ephemeral stream	0.009	0.032	0.04	0.948	1.04	6.7	0.97	770.1	8840.0
11:47	15:40	House well	0.010	0.028	0.03	0.466	0.52	0.06	3.08	488.4	15390.0
6/22/2015	6/22/15	Storm flow									

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
12:30	15:55	Spring	0.009	0.032	0.03	0.218	0.26	5.3	3.01	61.3	1413.6
12:15	15:55	Upstream farm	0.010	0.030	0.01	0.042	0.05	2.9	0.99	78.0	4960.0
12:55	15:55	Downstream farm	0.009	0.032	0.04	0.136	0.16	2.9	1.15	36.8	5040.0
13:10	15:55	Left Fork	0.011	0.030	0.02	0.147	0.18	2.5	1.59	35.4	5910.0
10:50	15:55	Ephemeral stream	0.011	0.026	0.05	0.563	0.61	1.3	1.21	37.9	2419.2
10:45	15:55	House well	0.010	0.032	0.02	0.459	0.43	0.4	1.85	27.2	1732.9
10:30	15:55	Trench 1	0.005	0.048	0.07	0.653	0.76	47.3	1.86	21.1	1986.3
6/29/2015	6/29/2015	Storm flow									
10:47	15:32	Spring	0.013	0.018	0.03	0.235	0.30	1.7	5.26	93.3	2419.2
12:30	15:32	Upstream farm	0.010	0.028	0.14	0.055	0.13	2.7	2.49	117.8	4710
13:22	15:32	Downstream farm	0.068	0.748	0.17	0.147	1.88	571	6.57	135.4	7540
13:30	15:32	Left Fork	0.010	0.026	0.02	0.189	0.26	2.9	2.80	53.6	10170
12:20	15:32	Ephemeral stream	0.067	1.268	0.34	0.580	3.42	1366.8	11.04	69.7	4040
12:15	15:32	Trench 1	0.008	0.022	0.05	0.394	0.42	56.8	4.17	82.3	11450

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
10:48	15:32	Field 1	0.354	0.524	0.37	0.226	1.64	11	11.32	N.S.	N.S.
7/6/2015	7/7/2015	Storm flow									
19:45	14:58	Downstream farm	0.275	0.380	0.22	0.204	1.03	19.1	7.91	N.S.	N.S.
17:10	14:58	Ephemeral stream	0.063	0.658	0.37	0.717	2.75	567.3	8.52	N.S.	N.S.
13:25	14:58	Field 1	0.387	0.444	0.23	0.345	1.30	4.9	8.32	N.S.	N.S.
16:45	14:58	Field 12	0.796	0.910	0.13	0.567	1.58	29.0	7.67	N.S.	N.S.
18:25	14:58	Field 5a	0.094	0.448	0.13	0.172	1.01	261.3	4.38		
7/9/2015	7/9/2015	Base flow									
13:37	15:15	Spring	0.011	0.048	0.09	0.144	0.41	4.3	6.47	77.1	3050.0
12:25	15:15	Upstream farm	0.013	0.048	0.02	0.087	0.18	6.8	2.75	201.4	10140.0
12:55	15:15	Downstream farm	0.014	0.050	0.03	0.117	0.24	8.8	2.32	275.5	10760.0
13:15	15:15	Left Fork	0.015	0.058	0.04	0.138	0.31	11.4	2.67	387.3	12670.0
12:12	15:15	Ephemeral stream	0.010	0.034	<0.03	0.569	0.71	4.9	2.56	78.9	5560.0
12:07	15:15	House well	0.011	0.024	0.01	0.423	0.48	2.0	1.69	9.8	4160.0
12:00	15:15	Trench 1	0.007	0.030	<0.03	0.520	0.62	7.1	2.52	63.7	12330.0

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
7/16/2015	7/16/2015	Base flow									
12:15	15:10	Upstream farm	0.010	0.024	0.02	0.065	0.15	0.5	1.91	41.3	52.0
12:54	15:10	Downstream farm	0.011	0.030	<0.03	0.195	0.33	0.5	1.35	11.8	6310.0
13:03	15:10	Left Fork	0.010	0.042	0.01	0.181	0.28	0.9	1.64	21.6	9330.0
12:33	15:10	Ephemeral stream	0.011	0.046	0.01	0.517	0.61	0.4	2.16	45.7	14830.0
12:28	15:10	House well	0.012	0.024	0.01	0.471	0.47	0.0	4.00	2.0	727.0
12:42	15:10	Spring	0.010	0.024	0.01	0.303	0.41	5.7	5.54	22.8	1413.6
7/23/2015	7/23/2015	Storm flow									
10:55	15:20	Spring	0.010	0.026	<0.03	0.436	0.60	2.7	1.12	61.3	1046.2
11:15	15:20	Upstream farm	0.009	0.026	0.02	0.096	0.18	1.3	0.97	93.3	7490.0
12:40	15:20	Downstream farm	0.011	0.028	0.02	0.198	0.31	0.8	1.06	16.8	4870.0
13:02	15:20	Left Fork	0.009	0.028	0.04	0.239	0.40	1.4	1.21	35.4	8360.0
12:00	15:20	Ephemeral stream	0.011	0.034	<0.03	0.511	0.68	11.3	0.33	201.4	24950.0
12:23	15:20	House well	0.015	0.030	<0.03	0.442	0.52	1.0	0.89	8.5	35.0
7/30/2015	7/30/2015	Base flow									

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
12:28	15:20	Spring	0.011	0.026	0.03	0.479	0.65	6.3	4.73	6.3	920.8
12:17	15:20	Upstream farm	0.014	0.024	<0.03	0.101	0.15	0.9	1.61	27.2	2880.0
12:50	15:20	Downstream farm	0.012	0.022	0.02	0.268	0.38	1.9	2.16	11.9	6500.0
13:00	15:20	Left Fork	0.008	0.020	0.04	0.221	0.37	2.3	2.60	30.3	8160.0
11:58	15:20	House well	0.013	0.014	0.02	0.466	0.51	0.3	0.90	1.0	7.4
8/6/2015	8/6/2015	Storm flow									
12:05	14:50	Spring	0.008	0.240	0.07	0.265	0.97	0.0	7.10	23.1	48840.0
11:36	14:50	Upstream farm	0.009	0.028	<0.03	0.147	0.24	1.8	3.37	488.4	13540.0
12:22	14:50	Downstream farm	0.010	0.028	0.03	0.406	0.52	1.7	3.06	40.2	10390.0
12:37	14:50	Left Fork	0.007	0.026	0.04	0.310	0.47	1.2	3.16	217.8	8130.0
10:37	14:50	House well	0.010	0.018	0.04	0.482	0.52	0.5	3.33	920.8	21870.0
8/13/2015	8/13/2015	Base flow									
11:40	15:30	Spring	0.009	0.360	0.15	0.735	1.12	254.9	7.29	21.6	3360.0
12:06	15:30	Upstream farm	0.013	0.018	0.04	0.124	0.16	0.3	4.32	13.4	2460.0
13:01	15:30	Downstream farm	0.011	0.024	<0.03	0.384	0.50	4.0	3.74	24.0	3310.0
13:12	15:30	Left Fork	0.007	0.016	0.03	0.192	0.52	1.4	4.50	13.2	4810.0
11:53	15:30	House well	0.025	0.012	0.03	0.498	0.58	0.5	6.15	4.1	228.2

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
8/20/2015	8/20/2015	Storm flow									
11:32	14:05	Spring	0.009	0.276	0.07	0.337	0.89	223.6	17.88	148.3	3270.0
11:49	14:05	Downstream farm	0.015	0.022	0.03	0.491	0.53	2.2	5.94	39.3	66.3
12:04	14:05	Left Fork	0.009	0.028	0.04	0.306	0.42	2.3	5.12	48.8	3930.0
10:52	14:05	House well	0.012	0.018	<0.03	0.545	0.56	0.9	6.63	1.0	29.5
8/27/2015	8/27/2015	Base flow									
12:48	15:35	Spring	0.007	0.158	0.04	0.329	0.69	103.7	9.07	27.2	7540.0
12:37	15:35	Upstream farm	0.005	0.028	0.04	0.084	0.28	2.9	4.30	104.6	7710.0
1:20	15:35	Downstream farm	0.013	0.024	<0.03	0.450	0.54	2.5	4.43	137.4	5730.0
1:30	15:35	Left Fork	0.008	0.024	0.02	0.218	0.33	2.0	3.79	7.4	3010.0
12:20	15:35	House well	0.012	0.018	<0.03	0.599	0.61	1.6	3.66	1.0	61.3

¶ Values preceded 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 3. Water quality analyses at the spring and in Big Creek upstream and downstream of the C&H Farm boundary of permitted land application for the 3rd Quarter of 2015.

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 ---					
1/8/2015									
Spring	0.010	0.014	<0.03 ¶	0.376	0.56	2.0	3.80	14.8	686.7
Upstream	0.009	0.022	<0.03	0.187	0.21	2.3	1.41	30.9	547.5
Downstream	0.011	0.024	<0.03	0.376	0.39	2.5	1.22	42.6	980.4
1/14/2015									
Spring	0.010	0.028	<0.03	0.473	0.66	1.1	10.20	21.6	613.1
Upstream	0.012	0.032	<0.03	0.135	0.19	1.1	3.02	88.2	727.0
Downstream	0.011	0.020	<0.03	0.388	0.34	1.0	2.03	25.6	613.1
1/21/2015									
Spring	0.009	0.020	<0.03	0.552	0.69	1.5	2.29	9.8	461.1
Upstream	0.008	0.018	<0.03	0.089	0.12	1.1	0.95	70.3	579.4
Downstream	0.010	0.026	0.06	0.197	0.30	1.1	1.60	37.4	613.1

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
1/29/2015									
Spring	0.010	0.018	0.03	0.886	0.74	2.3	4.27	1.0	2850.0
Upstream	0.006	0.060	<0.03	0.065	0.21	47.8	1.71	727.0	1413.6
Downstream	0.009	0.020	0.04	0.168	0.27	1.3	1.50	19.9	1046.2
2/3/2015									
Spring	0.008	0.018	<0.03	0.191	0.77	3.8	7.64	1.0	461.1
Upstream	0.006	0.022	<0.03	0.051	0.28	1.1	2.69	4.1	1203.3
Downstream	0.009	0.018	<0.03	0.140	0.29	4.1	2.66	1.0	547.5
2/10/2015									
Spring	0.010	0.010	<0.03	0.544	0.64	1.9	0.76	2.0	686.7
Upstream	0.009	0.012	<0.03	0.056	0.09	0.7	1.04	1119.1	2419.2
Downstream	0.011	0.012	<0.03	0.143	0.23	1.0	1.15	7.4	1553.1
2/26/2015									
Spring	0.009	0.042	0.02	0.237	0.38	5.0	3.97	37.3	2419.2
Upstream	0.006	0.024	<0.03	0.100	0.13	0.6	1.20	47.9	686.7
Downstream	0.008	0.026	0.02	0.200	0.25	0.8	1.17	48.7	866.4

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/3/2015									
Spring	0.008	0.052	<0.03	0.124	0.35	N.D.†	4.90	N.S. §	N.S.
Upstream	0.006	0.026	0.02	0.048	0.11	N.D.	1.50	N.S.	N.S.
Downstream	0.007	0.028	<0.03	0.138	0.23	N.D.	1.50	N.S.	N.S.
3/11/2015									
Spring	0.009	0.030	<0.03	0.242	2.37	5.5	14.79	19.5	111.9
Upstream	0.005	0.026	0.02	0.118	0.16	2.1	3.38	34.5	579.4
Downstream	0.007	0.030	0.02	0.209	0.27	1.8	1.44	66.3	770.1
3/19/2015									
Spring	0.010	0.028	0.03	0.184	0.29	10.6	7.37	38.9	79.4
Upstream	0.007	0.024	0.04	0.111	0.20	1.7	2.53	42.6	866.4
Downstream	0.009	0.028	0.04	0.234	0.35	2.8	2.87	71.7	1119.9
3/25/2015									
Spring	0.006	0.014	0.02	0.197	0.39	1.6	1.45	23.1	275.5
Upstream	0.006	0.028	0.02	0.056	0.16	2.9	1.36	125.9	2419.2
Downstream	0.008	0.036	0.04	0.162	0.29	5.0	1.41	547.5	3410.0

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/26/2015									
Spring	0.013	0.064	0.06	0.090	0.30	11.4	3.71	547.5	5200.0
Upstream	0.013	0.076	0.06	0.144	0.41	14.1	3.94	816.4	4960.0
Downstream	0.004	0.026	0.02	0.904	1.00	15.4	0.69	<1.0	1553.1
4/2/2015									
Spring	0.008	0.042	0.04	0.173	0.35	3.5	10.47	248.1	1299.7
Upstream	0.007	0.040	0.02	0.045	0.14	3.1	3.61	166.9	2419.2
Downstream	0.007	0.042	0.02	0.139	0.22	2.5	2.71	121.1	1986.3
4/9/2015									
Spring	0.011	0.034	0.01	0.257	0.42	4.9	9.11	7380.0	9040.0
Upstream	0.011	0.042	0.04	0.066	0.18	13.1	2.13	86.0	2650.0
Downstream	0.010	0.048	0.03	0.157	0.25	19.7	1.82	47.2	1986.3
4/15/2015									
Spring	0.007	0.034	<0.03	0.210	0.39	7.7	4.70	275.5	2280.0
Upstream	0.007	0.040	0.03	0.090	0.16	3.5	3.24	648.8	4040.0
Downstream	0.009	0.048	0.03	0.166	0.26	4.4	2.67	344.8	2920.0

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
4/23/2015									
Spring	0.008	0.034	<0.03	0.264	0.36	7.4	3.64	71.7	648.8
Upstream	0.007	0.032	0.03	0.083	0.18	4.0	5.11	104.6	2419.2
Downstream	0.007	0.032	0.03	0.162	0.25	2.6	2.51	65.7	2419.2
4/29/2015									
Spring	0.010	0.028	<0.03	0.419	0.59	9.0	4.28	25.6	1732.9
Upstream	0.010	0.020	0.03	0.082	0.13	2.7	1.58	58.3	1732.4
Downstream	0.012	0.018	0.03	0.189	0.82	2.1	1.64	58.6	1986.3
5/7/2015									
Spring	0.011	0.036	0.02	0.499	0.58	9.9	44.04	135.4	980.4
Upstream	0.008	0.032	0.01	0.110	0.16	7.5	10.16	77.6	3280.0
Downstream	0.009	0.034	<0.03	0.267	0.36	4.5	7.70	27.8	2280.0
5/8/2015									
Spring	0.134	0.354	0.16	0.340	1.12	51.4	9.30	N.S.	N.S.
Upstream	0.195	0.544	0.27	0.292	1.20	113.2	7.47	N.S.	N.S.
Downstream	0.005	0.254	0.41	2.287	3.23	127.1	6.45	N.S.	N.S.

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
5/11/2015									
Spring	0.008	0.058	0.01	0.339	0.49	8.7	3.67	N.S.	N.S.
Upstream	0.004	0.074	0.04	0.004	0.24	4.5	4.31	N.S.	N.S.
Downstream	0.031	0.530	0.11	0.071	1.12	277.5	8.48	N.S.	N.S.
5/14/2015									
Spring	0.009	0.062	0.02	0.222	0.35	41.5	2.84	121.1	2419.2
Upstream	0.011	0.046	0.02	0.177	0.23	2.8	1.35	145.5	2470.0
Downstream	0.015	0.050	0.02	0.326	0.39	6.1	1.16	128.1	4370.0
5/18/2015									
Spring	0.005	0.084	0.05	0.209	0.56	114.2	2.79	98.7	1413.6
Upstream	0.007	0.034	0.02	0.110	0.15	5.2	1.29	137.6	2419.2
Downstream	0.009	0.040	0.03	0.201	0.25	6.1	1.47	185.0	6770.0
5/26/2015									
Spring	0.021	0.020	<0.03	0.205	0.29	1.2	2.66	N.S.	N.S.
Upstream	0.012	0.044	0.04	0.080	0.19	6.4	1.50	N.S.	N.S.
Downstream	0.045	0.200	0.11	0.096	0.56	94.7	4.57	N.S.	N.S.

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
6/1/2015									
Downstream	0.006	0.050	0.05	0.109	0.25	13.7	1.80	N.S.	N.S.
6/4/2015									
Spring	0.010	0.028	<0.03	0.239	0.3	6.2	9.54	44.3	1413.8
Upstream	0.008	0.026	0.03	0.083	0.11	2.3	2.93	38.6	>2419.2
Downstream	0.009	0.034	<0.03	0.184	0.23	1.7	2.64	24.7	2419.2
6/8/2015									
Spring	0.011	0.046	0.03	0.322	0.53	12.7	11.18	20.1	1986.3
Upstream	0.010	0.030	0.06	0.058	0.24	4.5	3.63	866.4	2780.0
Downstream	0.009	0.022	0.05	0.185	0.27	0.9	2.66	57.4	4640.0
6/17/2015									
Spring	0.009	0.046	0.07	0.224	0.47	9.4	8.92	517.2	24890.0
Upstream farm	0.009	0.036	0.03	0.050	0.16	3.5	2.83	435.2	13130.0
Downstream	0.007	0.034	0.03	0.106	0.23	2.3	2.92	344.8	20980.0
6/22/2015									
Spring	0.009	0.032	0.03	0.218	0.26	5.3	3.01	61.3	1413.6

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
Upstream	0.010	0.030	0.01	0.042	0.05	2.9	0.99	78.0	4960.0
Downstream	0.009	0.032	0.04	0.136	0.16	2.9	1.15	36.8	5040.0
6/29/2015									
Spring	0.013	0.018	0.03	0.235	0.30	1.7	5.26	93.3	2419.2
Upstream	0.010	0.028	0.14	0.055	0.13	2.7	2.49	117.8	4710
Downstream	0.068	0.748	0.17	0.147	1.88	571	6.57	N.S.	N.S.
7/6/2015									
Downstream	0.275	0.380	0.22	0.204	1.03	19.1	7.91	N.S.	N.S.
7/9/2015									
Spring	0.011	0.048	0.09	0.144	0.41	4.3	6.47	77.1	3050.0
Upstream	0.013	0.048	0.02	0.087	0.18	6.8	2.75	201.4	10140.0
Downstream	0.014	0.050	0.03	0.117	0.24	8.8	2.32	275.5	10760.0
7/16/2015									
Spring	0.010	0.024	0.01	0.303	0.41	5.7	5.54	22.8	1413.6
Downstream	0.011	0.030	<0.03	0.195	0.33	0.5	1.35	11.8	6310.0
7/23/2015									

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
Spring	0.010	0.026	<0.03	0.436	0.60	2.7	1.12	61.3	1046.2
Upstream	0.009	0.026	0.02	0.096	0.18	1.3	0.97	93.3	7490.0
Downstream	0.011	0.028	0.02	0.198	0.31	0.8	1.06	16.8	4870.0
7/30/2015									
Spring	0.011	0.026	0.03	0.479	0.65	6.3	4.73	6.3	920.8
Upstream	0.014	0.024	<0.03	0.101	0.15	0.9	1.61	27.2	2880.0
Downstream	0.012	0.022	0.02	0.268	0.38	1.9	2.16	11.9	6500.0
8/6/2015									
Spring	0.008	0.240	0.07	0.265	0.97	0.0	7.10	23.1	48840.0
Upstream	0.009	0.028	<0.03	0.147	0.24	1.8	3.37	488.4	13540.0
Downstream	0.010	0.028	0.03	0.406	0.52	1.7	3.06	40.2	10390.0
8/13/2015									
Spring	0.009	0.360	0.15	0.735	1.12	254.9	7.29	21.6	3360.0
Upstream	0.013	0.018	0.04	0.124	0.16	0.3	4.32	13.4	2460.0
Downstream	0.011	0.024	<0.03	0.384	0.50	4.0	3.74	24.0	3310.0
8/20/2015									

Sample location	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
Spring	0.009	0.276	0.07	0.337	0.89	223.6	17.88	148.3	3270.0
Downstream	0.015	0.022	0.03	0.491	0.53	2.2	5.94	39.3	66.3
8/27/2015									
Spring	0.007	0.158	0.04	0.329	0.69	103.7	9.07	27.2	7540.0
Upstream	0.005	0.028	0.04	0.084	0.28	2.9	4.30	104.6	7710.0
Downstream	0.013	0.024	<0.03	0.450	0.54	2.5	4.43	137.4	5730.0

¶ Values preceded 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, House Well, Trenches, Left Fork and Field Runoff

Table 4. Water quality analyses at the ephemeral stream draining the subwatershed containing the production houses and manure holding ponds, the well adjacent to the ponds, and surface runoff from Fields 1, 5a, and 12 for the 3rd Quarter of 2015.

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									
1/8/2015	0.008	0.022	<0.03 ¶	0.448	0.59	2.4	1.73	25.6	1203.3
1/15/2015	0.007	0.028	<0.03	0.469	0.55	1.9	0.55	7.4	1413.6
1/21/2015	0.005	0.016	<0.03	0.370	0.46	1.0	2.34	155.3	2419.2
2/26/2015	0.006	0.022	<0.03	0.530	0.57	1.3	1.38	16.1	4790.0
3/3/2015	0.006	0.020	<0.03	0.477	0.52	ND	1.84	N.S. §	N.S.
3/11//2015	0.006	0.022	0.04	0.567	0.60	0.5	2.20	6.3	410.0
3/19/2015	0.007	0.018	0.01	0.529	0.63	1.0	4.31	14.6	866.4
3/25/2015	0.007	0.014	0.02	0.462	0.53	1.1	0.64	8.6	344.8
4/2/2015	0.006	0.032	0.02	0.467	0.46	1.8	4.41	5.2	547.5
4/15/2015	0.005	0.026	0.03	0.472	0.56	0.8	1.26	305.0	2430.0
4/23/2015	0.008	0.026	0.03	0.520	0.56	2.0	1.78	12.0	3270.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
4/29/2015	0.012	0.018	0.02	0.569	0.61	3.5	1.98	14.3	4080.0
5/7/2015	0.013	0.066	0.02	0.628	0.71	3.2	16.41	71.7	7170.0
5/8/2015	0.005	0.254	0.41	2.287	3.23	127.1	6.45	5200.0	241920
5/11/2015	0.008	0.146	0.15	0.941	1.80	22.0	8.09	N.S.	N.S.
5/14/2015	0.010	0.022	0.01	0.527	0.50	1.7	0.73	41.3	1986.3
5/18/2015	0.007	0.028	0.03	0.525	0.55	0.7	1.18	90.7	7630.0
5/26/2015	0.017	0.030	0.03	0.514	0.60	0.9	1.12	N.S.	N.S.
6/1/2015	0.002	0.056	0.01	0.851	1.05	18.3	2.46	N.S.	N.S.
6/4/2015	0.010	0.024	0.02	0.572	0.58	0.8	5.35	21.6	3890.0
6/8/2015	0.009	0.020	0.03	0.560	0.62	0.6	2.81	65.7	9870.0
6/17/2015	0.009	0.032	0.04	0.948	1.04	6.7	0.97	770.1	8840.0
6/22/2015	0.011	0.026	0.05	0.563	0.61	1.3	1.21	37.9	2419.2
6/29/2015	0.067	1.268	0.34	0.580	3.42	1366.8	11.04	N.S.	N.S.
7/6/2015	0.063	0.658	0.37	0.717	2.75	567.3	8.52	N.S.	N.S.
7/9/2015	0.010	0.034	<0.03	0.569	0.71	4.9	2.56	78.9	5560.0
7/16/2015	0.011	0.046	0.01	0.517	0.61	0.4	2.16	45.7	14830.0
7/23/2015	0.011	0.034	<0.03	0.511	0.68	11.3	0.33	201.4	24950.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
House well									
3/19/2015	0.009	0.020	0.02	0.467	0.55	1.2	4.93	1.0	31.3
3/25/2015	0.007	0.016	<0.03	0.450	0.52	1.9	0.03	18.5	30.1
4/2/2015	0.008	0.030	<0.03	0.477	0.50	0.7	6.05	39.3	9060.0
4/9/2015	0.011	0.026	<0.03	0.499	0.50	1.5	0.74	4.1	325.5
4/15/2015	0.008	0.022	0.02	0.475	0.60	1.2	3.72	9.6	80.9
4/23/2015	0.008	0.082	<0.03	0.496	0.53	1.4	1.69	18.5	35.0
4/29/2015	0.010	0.006	<0.03	0.517	0.51	0.7	2.26	248.1	5040.0
5/7/2015	0.008	0.022	0.01	0.512	0.49	<6.58	28.63	3.1	59.4
5/11/2015	0.009	0.038	0.02	0.541	0.55	4.2	0.89	N.S.	N.S.
5/18/2015	0.008	0.018	<0.03	0.529	0.53	0.9	0.90	5.2	13.4
5/26/2015	0.013	0.020	<0.03	0.514	0.54	2.7	0.87	N.S.	N.S.
6/4/2015	0.012	0.022	0.02	0.561	0.52	1.3	6.07	<1.0	14.6
6/8/2015	0.008	0.018	0.27	0.475	0.82	0.7	6.67	<1.0	<1.0
6/17/2015	0.010	0.028	0.03	0.466	0.52	0.06	3.08	488.4	15390.0
6/22/2015	0.010	0.032	0.02	0.459	0.43	0.4	1.85	27.2	1732.9

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
7/9/2015	0.011	0.024	0.01	0.423	0.48	2.0	1.69	9.8	4160.0
7/16/2015	0.012	0.024	0.01	0.471	0.47	0.0	4.00	2.0	727.0
7/23/2015	0.015	0.030	<0.03	0.442	0.52	1.0	0.89	8.5	35.0
7/30/2015	0.013	0.014	0.02	0.466	0.51	0.3	0.90	1.0	7.4
8/6/2015	0.010	0.018	0.04	0.482	0.52	0.5	3.33	920.8	21870.0
8/13/2015	0.025	0.012	0.03	0.498	0.58	0.5	6.15	4.1	228.2
8/20/2015	0.012	0.018	<0.03	0.545	0.56	0.9	6.63	1.0	29.5
8/27/2015	0.012	0.018	<0.03	0.599	0.61	1.6	3.66	1.0	61.3
Interceptor Trench 1 (South)									
1/8/2015	0.005	0.022	<0.03	0.769	0.75	4.7	0.88	1.0	13130.0
1/14/2015	0.007	0.028	<0.03	0.469	0.55	1.9	0.55	7.4	1413.6
2/26/2015	0.004	0.028	0.01	0.712	0.76	46.0	0.60	1.0	41063.0
3/3/2015	0.003	0.024	<0.03	0.867	0.89	N.D. †	0.95	N.S.	N.S.
3/11/2015	0.003	0.014	0.07	0.989	0.97	0.3	2.00	<1.0	2419.2
3/19/2015	0.003	0.012	0.01	0.849	0.93	<6.58	3.11	1.0	275.5
3/25/2015	0.003	0.008	<0.03	0.838	0.88	0.2	0.59	<1.0	410.6

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
3/26/2015	0.004	0.026	0.02	0.904	1.00	15.4	0.69	<1.0	1553.1
4/2/2015	0.003	0.028	0.02	0.865	0.87	0.3	3.34	1.1	308.6
4/9/2015	0.006	0.018	<0.03	0.790	0.83	0.8	2.99	<1.0	187.2
4/15/2015	0.003	0.020	<0.03	0.857	0.93	1.3	4.29	<1.0	3180.0
4/23/2015	0.003	0.034	<0.03	0.877	0.97	1.2	1.18	3.1	2690.0
5/11/2015	0.003	0.060	0.02	0.916	0.97	27.6	1.78	N.S.	N.S.
5/14/2015	0.005	0.042	0.02	0.904	0.94	29.9	1.20	81.6	1732.9
5/18/2015	0.002	0.020	<0.03	0.897	0.93	0.3	1.28	32.3	1732.9
5/26/2015	0.007	0.012	0.01	0.752	0.80	1.0	0.78	N.S.	N.S.
6/22/2015	0.005	0.048	0.07	0.653	0.76	47.3	1.86	21.1	1986.3
6/29/2015	0.008	0.022	0.05	0.394	0.42	56.8	4.17	82.3	11450
7/9/2015	0.007	0.030	<0.03	0.520	0.62	7.1	2.52	63.7	12330.0
Interceptor Trench 2 (North)									
3/11/2015	0.003	0.056	0.04	1.443	1.59	1.2	3.51	<1.0	2419.2
3/19/2015	0.004	0.062	0.09	1.036	1.42	1.9	5.12	5.2	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
3/26/2015	0.004	0.126	0.13	0.873	1.44	22.2	4.63	105.4	6950.0
5/11/2015	0.003	0.042	0.05	0.553	0.76	8.8	3.44	N.S.	N.S.
5/14/2015	0.005	0.042	0.02	0.904	0.94	29.9	1.20	81.6	1732.9
5/18/2015	0.002	0.020	<0.03	0.897	0.93	0.3	1.28	32.3	1732.9
5/26/2015	0.007	0.112	0.04	1.190	1.44	131.9	1.23	N.S.	N.S.
Left Fork									
5/14/2015	0.015	0.038	0.02	0.321	0.38	3.3	1.36	83.3	2690.0
5/18/2015	0.011	0.040	0.04	0.209	0.29	4.1	1.90	167.4	8300.0
5/26/2015	0.014	0.048	0.04	0.139	0.29	6.1	2.41	N.S.	N.S.
6/4/2015	0.008	0.022	<0.03	0.145	0.19	2.1	3.15	38.9	2560.0
6/8/2015	0.006	0.024	0.02	0.102	0.23	1.1	2.78	32.7	4550.0
6/17/2015	0.005	0.026	0.04	0.112	0.22	2.8	1.62	26.2	8550.0
6/22/2015	0.011	0.030	0.02	0.147	0.18	2.5	1.59	35.4	5910.0
6/29/2015	0.010	0.026	0.02	0.189	0.26	2.9	2.80	53.6	10170
7/9/2015	0.015	0.058	0.04	0.138	0.31	11.4	2.67	387.3	12670.0

Date sample collected	Dissolved P	Total P	Ammonia-N	Nitrate-N	Total N	Total suspended solids	Dissolved Organic C	E. coli	Total coliform
7/16/2015	0.010	0.042	0.01	0.181	0.28	0.9	1.64	21.6	9330.0
7/23/2015	0.009	0.028	0.04	0.239	0.40	1.4	1.21	35.4	8360.0
7/30/2015	0.008	0.020	0.04	0.221	0.37	2.3	2.60	30.3	8160.0
8/6/2015	0.007	0.026	0.04	0.310	0.47	1.2	3.16	217.8	8130.0
8/13/2015	0.007	0.016	0.03	0.192	0.52	1.4	4.50	13.2	4810.0
8/20/2015	0.009	0.028	0.04	0.306	0.42	2.3	5.12	48.8	3930.0
8/27/2015	0.008	0.024	0.02	0.218	0.33	2.0	3.79	7.4	3010.0
Field 1									
3/26/2015	0.143	0.346	0.41	0.216	2.68	65.5	15.65	N.S.	N.S.
5/8/2015	0.525	0.714	0.16	0.475	2.19	16.9	13.28	N.S.	N.S.
5/11/2015	0.251	0.386	0.09	0.055	0.86	44.4	6.31	N.S.	N.S.
5/18/2015	0.208	0.512	0.54	0.410	3.59	53.7	26.12	N.S.	N.S.
5/26/2015	0.245	0.432	0.20	0.174	1.66	37.8	11.28	N.S.	N.S.
6/29/2015	0.354	0.524	0.37	0.226	1.64	11	11.32	N.S.	N.S.
7/6/2015	0.387	0.444	0.23	0.345	1.30	4.9	8.32	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
Field 5a									
3/26/2015	0.813	1.330	0.39	0.225	2.59	72.3	15.95	N.S.	N.S.
5/8/2015	0.248	0.968	0.26	0.127	1.50	320.1	8.58	N.S.	N.S.
7/6/2015	0.796	0.910	0.13	0.567	1.58	29.0	7.67	N.S.	N.S.
Field 12									
5/8/2015	0.675	0.956	0.14	0.303	1.82	57.0	16.00	N.S.	N.S.
5/11/2015	0.194	0.364	0.09	0.135	0.83	36.7	7.03	N.S.	N.S.
7/6/2015	0.094	0.448	0.13	0.172	1.01	261.3	4.38	N.S.	N.S.

¶ Values preceded 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

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 5.

Table 5. The pH, Chloride concentration, electrical conducting, and total solids concentration of water samples collected at upstream, downstream, spring, house well and trench sites, initiated at the beginning of 2015.

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
		mg/L	mg/L	μS/cm	mg/L
Upstream					
1/8/2015	7.3	36	1.80	90	71.6
1/14/2015			2.09	105	49.1
1/21/2015	7.6	48	1.85	121	71.1
1/29/2015			2.09	140	71.3
2/3/2015	7.7	54	2.40	129	71.1
2/10/2015			2.51	132	67.6
2/26/2015	7.6	40	1.98	107	56.4
3/3/2015			2.08	112	58.9
3/11/2015	7.8	30	1.88	85	269.3
3/19/2015			1.55	98	58.0
3/25/2015	8.0	42	1.77	110	67.6
3/26/2015			1.33	115	64.4
4/2/2015	8.0	42	1.57	110	76.0
4/9/2015			1.73	116	74.9
4/15/2015	7.7	36	1.38	91	63.8
4/23/2015			1.65	95	60.4
4/29/2015	8.1	50	1.56	85	54.3

June 1 to September 30, 2015

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
5/7/2015			1.40	123	70.7
5/8/2015			1.80	157	88.4
5/11/2015	7.5	24	1.63	131	110.0
5/14/2015			1.55	143	79.3
5/18/2015			1.20	107	56.2
5/26/2015	7.7	28	1.10	90	58.4
6/4/2015			1.08	78	55.3
6/8/2015	8.2	60	2.03	149	111.3
6/17/2015			1.51	128	70.2
6/22/2015	8.2	40	1.36	114	64.9
6/29/2015			1.74	55	49.8
7/9/2015	7.7	32	1.53	90	64.7
7/16/2015			1.33	161	78.9
7/23/2015	7.9	78	1.63	180	50.2
7/30/2015			1.75	224	113.3
8/6/2015	7.7	100	1.84	218	75.3
8/13/2015			1.91	210	121.6
8/20/2015	7.3	108	2.15	219	120.0
8/27/2015			2.11	240	131.3
Median	7.8	42	1.74	115	70.5
Downstream					
1/8/2015	7.6	64	2.02	144	89.3
1/14/2015			2.76	166	79.8
1/21/2015	7.6	84	2.44	191	91.1
1/29/2015			2.51	205	109.1
2/3/2015	7.7	88	2.82	196	103.3

June 1 to September 30, 2015

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
2/10/2015			3.01	204	105.5
2/26/2015	7.8	66	2.27	162	88.0
3/3/2015			2.39	170	80.0
3/11/2015	7.8	52	2.02	128	77.3
3/19/2015			1.75	148	84.9
3/25/2015	7.8	64	2.07	158	88.7
3/26/2015			1.46	83	78.7
4/2/2015	8.1	68	1.95	163	103.0
4/9/2015			2.08	168	100.4
4/15/2015	7.8	56	1.54	130	82.0
4/23/2015			1.81	142	81.0
4/29/2015	8.0	80	2.15	150	97.3
5/4/2015					
5/7/2015			1.84	185	101.1
5/8/2015			2.50	225	125.8
5/11/2015	7.5	36	1.73	149	130.9
5/14/2015			1.06	103	80.2
5/18/2015			1.55	150	58.7
5/26/2015	7.7	46	1.25	137	89.1
6/1/2015			1.20	125	93.3
6/8/2015	8.0	94	1.44	163	86.9
6/17/2015			2.14	216	141.3
6/22/2015	7.9	76	1.76	204	106.5
7/7/2015			1.55	177	79.3
7/9/2015	7.7	50	1.63	116	77.6
7/16/2015			1.50	124	72.2
7/23/2015	7.8	108	1.84	223	111.8

June 1 to September 30, 2015

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
7/30/2015			2.18	248	122.0
8/6/2015	7.6	154	2.31	286	142.9
8/13/2015			2.78	283	159.1
8/20/2015	7.2	142	2.83	287	156.0
8/27/2015			3.01	300	153.3
Median	7.8	68	2.02	166	93.3
Spring					
1/8/2015			2.27	534	321.1
1/14/2015			2.79	517	310
1/21/2015			2.27	553	324
2/3/2015			2.20	562	321.8
2/10/2015			2.44	581	314.2
2/26/2015			1.74	491	266.4
3/3/2015			1.57	430	234.9
3/11/2015			1.63	495	54.7
3/19/2015			1.54	474	220.0
3/25/2015			2.08	544	277.6
4/2/2015			1.78	515	289.8
4/9/2015			2.03	509	305.8
4/15/2015			1.76	480	276.9
4/23/2015			1.93	512	297.3
4/29/2015			2.55	564	294.9
5/4/2015			1.57	554	251.8
5/7/2015			2.29	623	318.9
5/11/2015			1.11	408	202.0
5/14/2015			1.35	507	259.6

June 1 to September 30, 2015

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
5/18/2015			1.17	508	265.8
5/26/2015			1.08	516	250.4
6/8/2015			1.95	615	341.8
6/17/2015			1.65	532	276.0
6/22/2015			1.79	601	301.1
7/9/2015			1.43	542	266.9
7/16/2015			2.02	629	309.3
7/23/2015			2.17	656	312.0
7/30/2015			2.26	648	334.9
8/6/2015			0.92	606	330.7
8/13/2015			2.71	522	328.0
8/20/2015			2.09	554	330.9
8/27/2015			2.01	575	318.2
Median			1.86	518	269.4
House well					
3/19/2015			4.79	458	232.2
3/25/2015			5.27	453	221.6
4/2/2015			4.91	453	256.0
4/9/2015			5.10	419	242.2
4/15/2015			5.02	426	240.9
4/23/2015			4.83	414	237.3
4/29/2015			4.96	436	226.4
5/7/2015			5.08	458	243.6
5/14/2015			5.10	452	238.2
5/18/2015			5.19	484	234.7
5/26/2015			4.82	481	178.0

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
6/4/2015			5.02	488	249.6
6/8/2015			7.09	437	246.4
6/17/2015			5.13	493	234.0
6/22/2015			5.17	481	240.2
7/9/2015			5.86	481	240.7
7/16/2015			5.38	495	254.9
7/23/2015			5.42	481	234.0
7/30/2015			5.85	499	251.8
8/6/2015			5.74	449	233.8
8/13/2015			4.89	448	240.0
8/20/2015			4.65	427	234.0
8/27/2015			4.81	441	245.1
Median			5.10	453	240.0
Trench 1					
1/8/2015			2.01	154	103.6
1/14/2015			2.81	166	81.8
2/26/2015			2.08	171	78.4
3/3/2015			2.11	177	86.7
3/11/2015			1.95	193	114.0
3/19/2015			1.70	209	109.3
3/25/2015			2.13	238	105.1
3/26/2015			1.64	209	120.2
4/2/2015			1.94	261	151.3
4/9/2015			1.99	260	154.0
4/15/2015			1.80	260	146.7
4/23/2015			2.06	231	132.7

June 1 to September 30, 2015

Date	pH	Alkalinity	Chloride	Electrical conductivity	Total dissolved solids
5/11/2015			2.09	262	126.5
5/14/2015			1.86	299	156.5
5/18/2015			1.57	346	173.1
5/26/2015			1.65	297	146.0
6/22/2015			1.99	341	169.8
6/29/2015			2.63	342	167.8
7/9/2015			2.08	171	78.4
Median			1.97	260	139.3
Trench 2					
3/11/2015			1.77	159	140.8
3/19/2015			1.04	168	104.9
3/26/2015			0.78	135	160.9
5/11/2015			0.41	165	88.5
5/26/2015			0.93	284	141.3
Median			0.93	165	140.8

Nutrient and Bacteria Concentration in Big Creek over the Monitoring Period

Upstream and Downstream Trends

The difference in dissolved P, total P, nitrate-N, total N, E. coli, and total coliform between down- and upstream monitoring sites are presented in Figures 6, 7, and 8, respectively. No consistent differences in the trends in concentrations at the downstream site on Big Creek compared with the upstream site appear evident over the current monitoring period, except for nitrate-N, which tends to be higher downstream. For nitrate-N, concentrations in Big Creek below the C&H Farm are generally greater than above it (Figure 7).

Several metrics of nutrient and bacteria concentrations were determined for measured concentrations in Big Creek since inception of the monitoring. These include the mean, standard error

June 1 to September 30, 2015

of the mean, median, minimum, maximum and standard deviation of measured constituents for 2013, 2014, and 2015. Metrics for concentrations at the upstream site are given in Table 6 and for the downstream site in Table 7.

Upstream of C&H, median *E. coli* increased slightly for each period (71, 97, and 93 MPN/100 mL for 2013, 2014, and 2015, respectively), while median nitrate-N (0.245, 0.114, and 0.087 mg/L for 2013, 2014, and 2015, respectively) and total N (0.33, 0.19, 0.17, for 2013, 2014, and 2015, respectively; Table 6) decreased over the same period of record. Downstream of C&H, median concentrations of dissolved and total P remained fairly constant from year to year, although the maximum total P value increased (e.g., 0.316, 0.450, and 0.544 total P mg/L; Table 7). Median nitrate-N concentrations decreased slightly from 2013 through 2015, and were 0.419, 0.256, and 0.189 mg/L, respectively, as did *E. coli*, which decreased from 87, 70, to 47 MPN/100mL, respectively (Table 7).

Few clear trends in measured concentrations are apparent at this time, reflecting fluctuating watershed hydrology, as well as a difference in rainfall amounts and distribution over the monitoring period.

Table 6. Mean, standard error of mean, median, minimum, maximum, and standard deviation of chemical constituents measured upstream of the C&H Farm pre-January 1, 2014 (before slurry applications started) and post-January 1, 2014 (after slurry applications started) through September 1, 2015.

UPSTREAM						
	Mean	St error of mean	Median	Minimum	Maximum	Standard Deviation
PRE 12/31/2013 – NUMBER OF SAMPLES IS 14						
Dissolved P, mg/L	0.014	0.002	0.013	0.007	0.032	0.006
Total P, mg/L	0.038	0.009	0.031	0.010	0.140	0.033
Ammonia-N, mg/L	0.034	0.003	0.030	0.020	0.060	0.012
Nitrate-N, mg/L	0.328	0.063	0.245	0.123	1.024	0.235
Total N, mg/L	0.536	0.143	0.330	0.140	2.200	0.536
Total suspended solids, mg/L	3.0	1.3	1.1	0.3	17.9	4.7
Log. E. coli §	1.913	0.212	1.852	0.799	3.611	0.795
Log. Total Coliform §	3.308	0.131	3.339	2.476	4.455	0.489
E. coli, MPN/100mL ¶	82		71	6	4,080	
Total Coliform, MPN/100mL ¶	2,034		2,183	299	28,510	
1/1/2014 to 12/31/2014 – NUMBER OF SAMPLES IS 57						
Dissolved P, mg/L	0.013	0.002	0.010	0.001	0.081	0.015
Total P, mg/L	0.057	0.017	0.028	0.010	0.888	0.129
Ammonia-N, mg/L	0.039	0.003	0.030	0.010	0.100	0.022
Nitrate-N, mg/L	0.130	0.011	0.114	0.004	0.555	0.084

UPSTREAM						
	Mean	St error of mean	Median	Minimum	Maximum	Standard Deviation
Total N, mg/L	0.232	0.021	0.190	0.090	0.860	0.161
Total suspended solids, mg/L	11.4	7.8	1.9	0.3	447.1	59.0
Log. E. coli §	2.089	0.101	1.989	0.491	4.455	
Log. Total Coliform §	3.415	0.090	3.384	2.322	5.239	
E. coli, MPN/100mL ¶	123		97	3	28,510	
Total Coliform, MPN/100mL ¶	2,997		2,419	210	173,290	
1/1/2015 to 9/1/2015 – NUMBER OF SAMPLES IS 35						
Dissolved P, mg/L	0.012	0.004	0.009	0.004	0.134	0.021
Total P, mg/L	0.125	0.084	0.030	0.012	2.956	0.496
Ammonia-N, mg/L	0.032	0.004	0.030	0.000	0.160	0.026
Nitrate-N, mg/L	0.095	0.010	0.087	0.004	0.340	0.057
Total N, mg/L	0.276	0.076	0.170	0.050	2.640	0.451
Total suspended solids, mg/L	6.0	1.9	2.9	0.3	51.4	11.3
Log. E. coli §	2.063	0.101	1.970	0.613	3.303	0.598
Log. Total Coliform §	3.379	0.092	3.384	1.716	4.714	0.546
E. coli, MPN/100mL ¶	116		99	4	2,010	
Total Coliform, MPN/100mL ¶	2,396		2,440	52	51,720	

§ E. coli and Total Coliform values were Log transformed.

¶ Mean, median, minimum, and maximum values for Log. transformed E. coli and Total Coliform are back transformed to natural numbers for ease of reference.

Table 7. Mean, standard error of mean, median, minimum, maximum, and standard deviation of chemical constituents measured downstream of the C&H Farm pre-January 1, 2014 (before slurry applications started) and post-January, 2014 (after slurry applications started) through September 1, 2015.

DOWNSTREAM						
	Mean	St error of mean	Median	Minimum	Maximum	Standard Deviation
PRE 12/31/2013 – NUMBER OF SAMPLES IS 14						
Dissolved P, mg/L	0.016	0.005	0.011	0.006	0.067	0.017
Total P, mg/L	0.054	0.022	0.024	0.010	0.316	0.083
Ammonia-N, mg/L	0.049	0.014	0.030	0.010	0.200	0.051
Nitrate-N, mg/L	0.415	0.047	0.419	0.172	0.723	0.177
Total N, mg/L	0.541	0.062	0.555	0.240	1.070	0.233
Total suspended solids, mg/L	11.3	7.2	1.5	0.0	101.1	27.0
Log. E. coli §	2.046	0.248	1.937	0.716	3.544	0.927
Log. Total Coliform §	3.627	0.149	3.384	2.465	4.639	0.557
E. coli, MPN/100mL ¶	111		87	5	3,500	
Total Coliform, MPN/100mL ¶	4,241		2,419	292	43,520	
1/1/2014 to 12/31/2014– NUMBER OF SAMPLES IS 55						
Dissolved P, mg/L	0.013	0.002	0.011	0.004	0.110	0.014
Total P, mg/L	0.037	0.008	0.026	0.008	0.450	0.058
Ammonia-N, mg/L	0.038	0.004	0.030	0.010	0.230	0.032
Nitrate-N, mg/L	0.271	0.016	0.256	0.108	0.523	0.117
Total N, mg/L	0.357	0.022	0.330	0.110	1.030	0.160

DOWNSTREAM						
	Mean	St error of mean	Median	Minimum	Maximum	Standard Deviation
Total suspended solids, mg/L	6.3	3.1	2.1	0.0	171.2	22.9
Log. E. coli §	1.950	0.100	1.843	0.301	4.397	0.745
Log. Total Coliform §	3.546	0.075	3.622	2.435	4.464	0.558
E. coli, MPN/100mL ¶	89		70	2	24,950	
Total Coliform, MPN/100mL ¶	3,513		4,115	272	29,090	
1/1/2015 to 9/1/2015 – NUMBER OF SAMPLES IS 37						
Dissolved P, mg/L	0.024	0.009	0.010	0.006	0.275	0.053
Total P, mg/L	0.073	0.021	0.030	0.010	0.544	0.129
Ammonia-N, mg/L	0.045	0.009	0.030	0.000	0.270	0.054
Nitrate-N, mg/L	0.221	0.018	0.189	0.071	0.491	0.108
Total N, mg/L	0.391	0.043	0.295	0.090	1.200	0.259
Total suspended solids, mg/L	17.1	8.2	2.5	0.5	277.5	49.8
Log. E. coli §	1.719	0.097	1.674	0.000	2.912	0.593
Log. Total Coliform §	3.378	0.081	3.384	1.822	4.322	0.495
E. coli, MPN/100mL ¶	52		47	1	816	
Total Coliform, MPN/100mL ¶	2,387		2,419	66	20,980	

§ E. coli and Total Coliform values were Log transformed.

¶ Mean, median, minimum, and maximum values for Log. transformed E. coli and Total Coliform are back transformed to natural numbers for ease of reference.

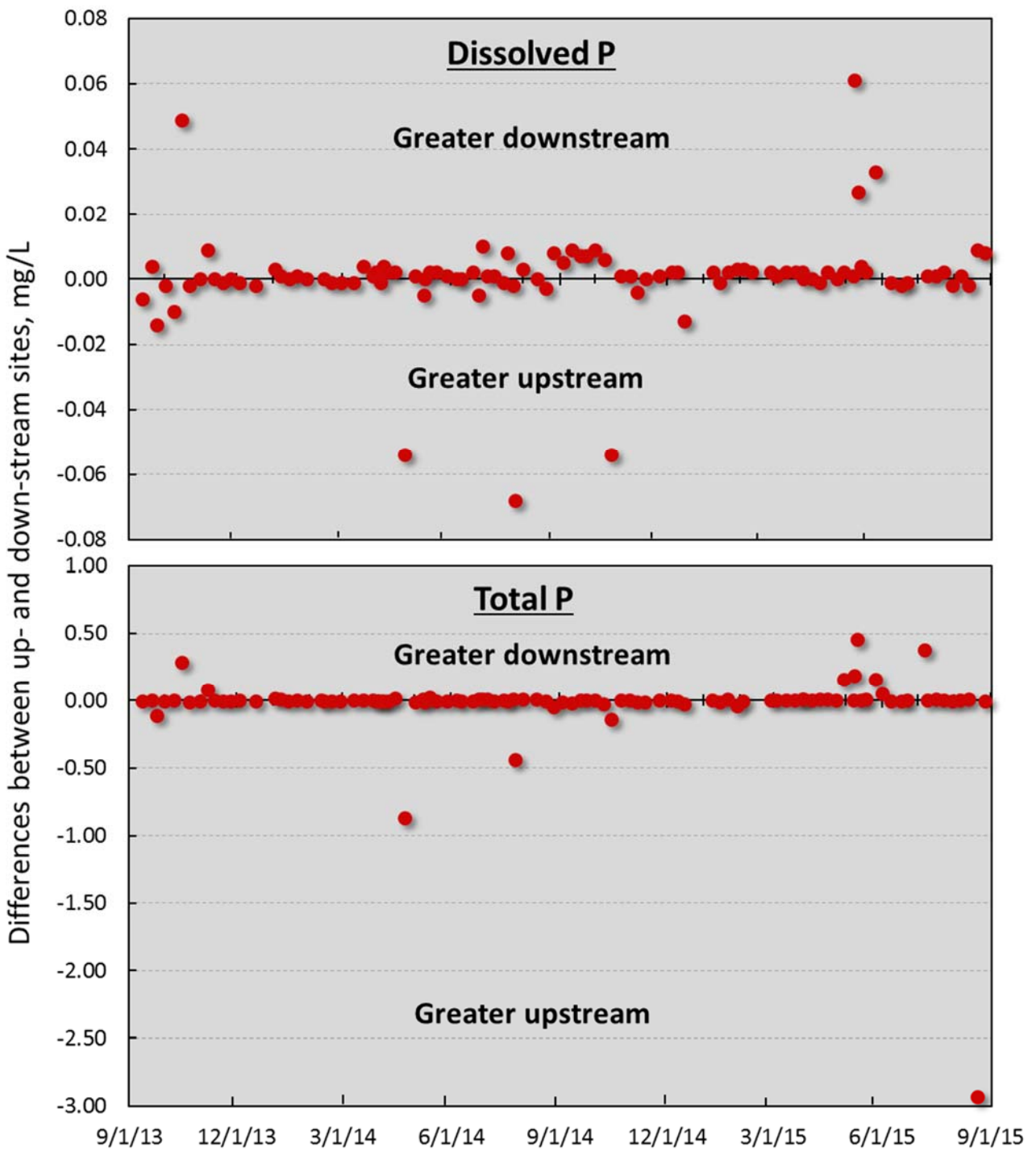


Figure 6. Differences in phosphorus concentrations between upstream and downstream sites on Big Creek.

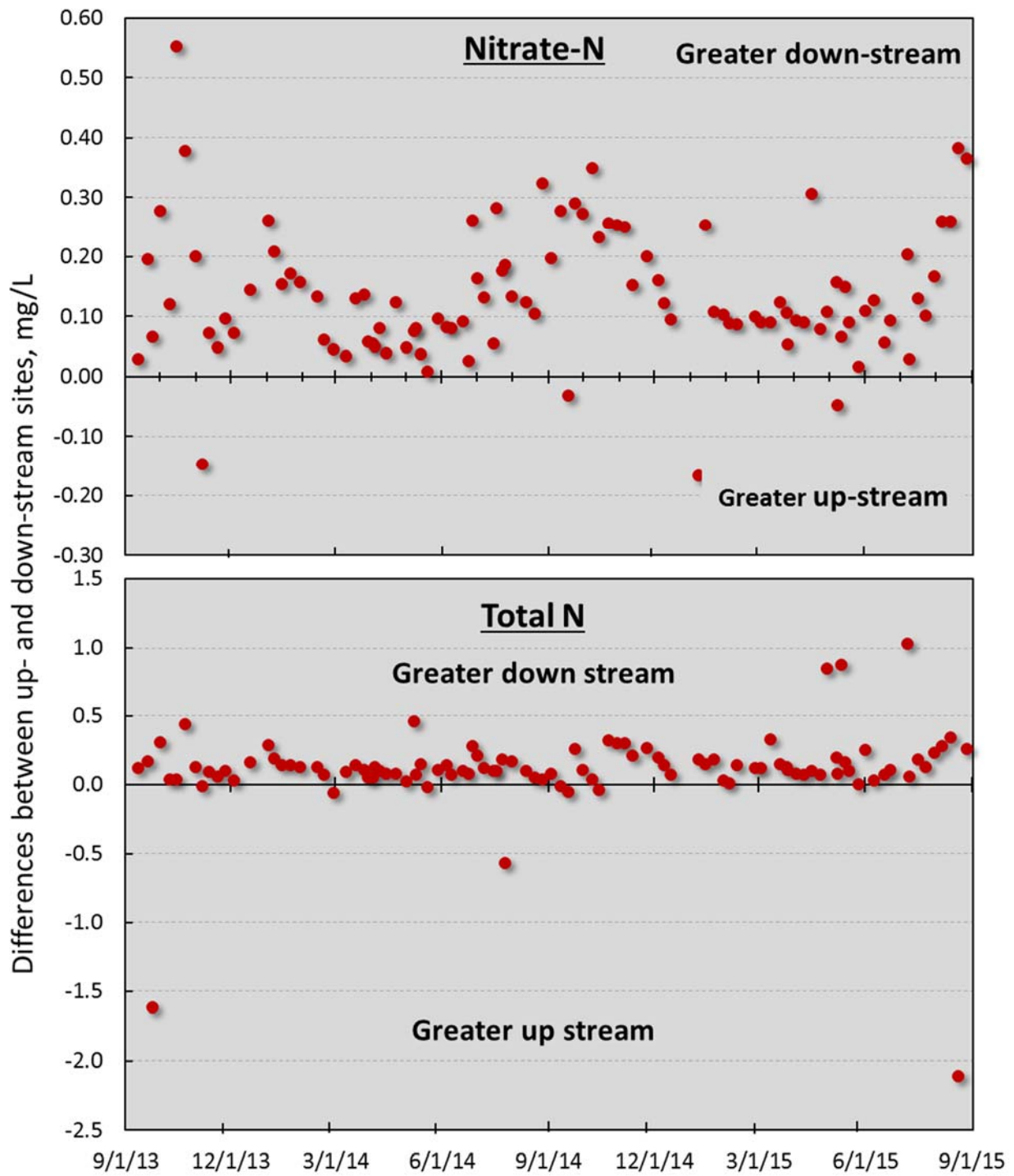


Figure 7. Differences in nitrogen concentrations between upstream and downstream sites on Big Creek.

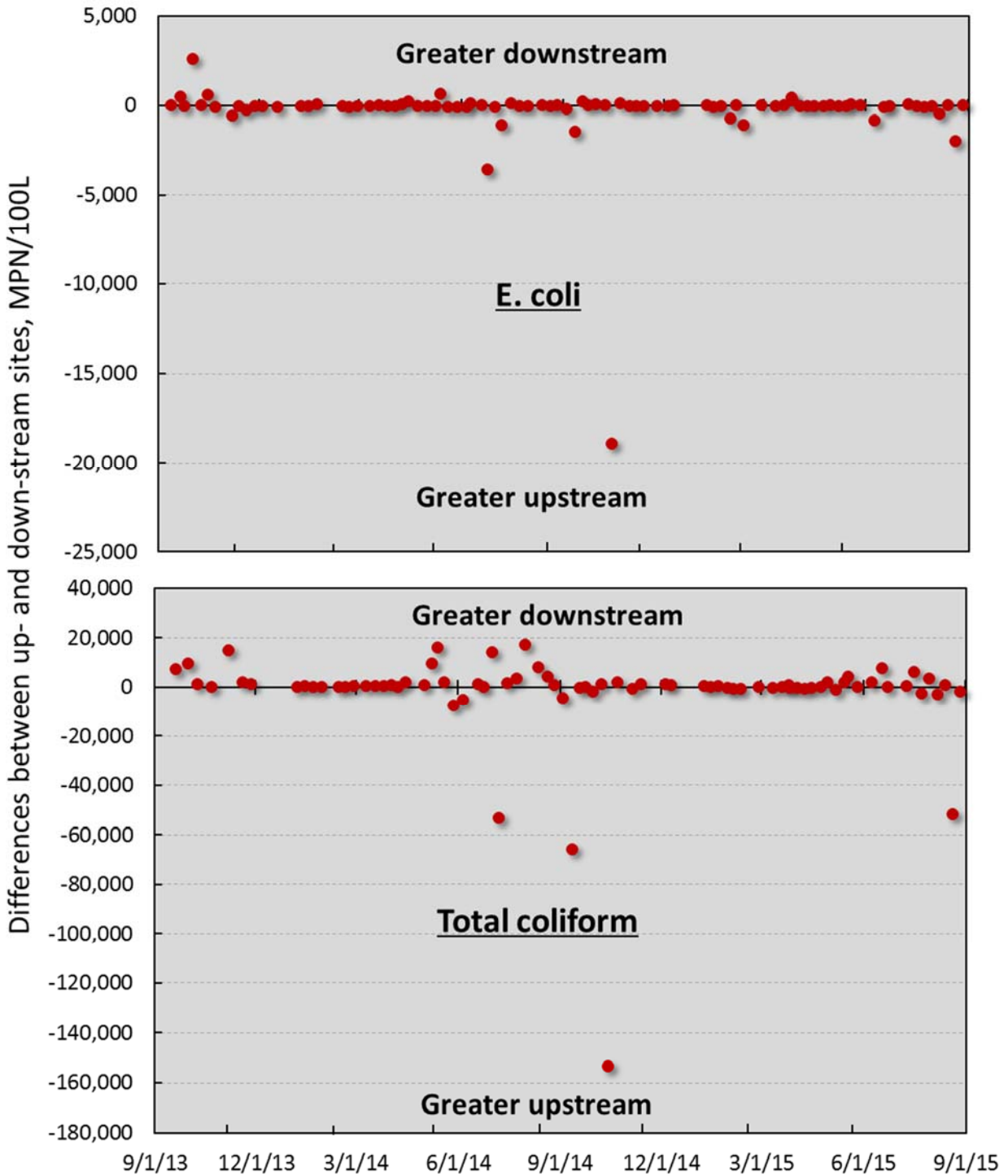


Figure 8. Differences in bacteria concentrations between up and downstream sites on Big Creek.

Temporal Trends in Nitrate-N Concentration in Big Creek

A strong seasonal fluctuation in nitrate-N concentration is apparent at the up and downstream sites on Big Creek, since we initiated monitoring on September 13, 2013 (Figure 9). Nitrate –N concentrations peak in late summer, around August to October and are at their lowest in April and May at both up and downstream sites.

These fluctuations are consistent with other watersheds of similar size and land use, and likely reflect the dominant pathways of water contributing to flow in Big Creek. In April and June (late spring), flows in Big Creek tend to be dominated by surface flows as a result of spring rains. However, in August through October, flows in Big Creek tend to be dominated more by base or groundwater flows, which generally have a higher concentration of nitrate-N than in surface runoff.

Further, the fact that the late summer nitrate-N peak was more clearly defined in 2014 than 2015, reflects the drier summer of 2014 than 2015. In May, June, July, and August 2014 there was 536 mm rainfall, while during the same months in 2015 there was 650 mm rainfall, as a consequence, the baseflow signature would have been stronger in the drier 2014 than the wetter 2015 (Figure 9).

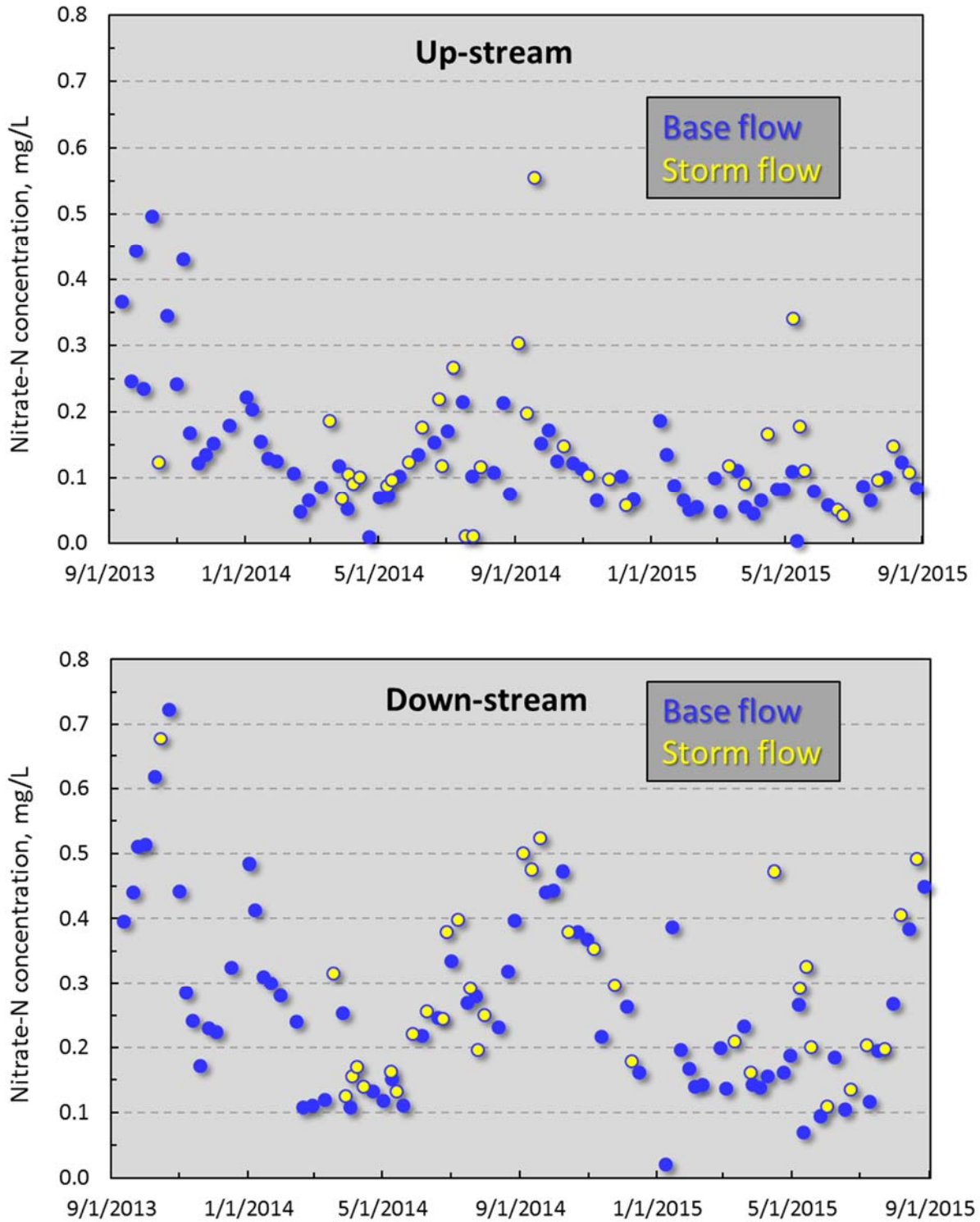


Figure 9. Temporal variation in nitrate-N concentrations upstream and downstream of the C&H Farm, Newton County, over a two-year period of monitoring (Sept. 2013 to Sept. 2015).



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