SOURCE WATER PROTECTION PROGRAM
ASSESSMENT/PLANNING PROJECT FINAL REPORT

Big Creek Fecal Coliform Sources

by

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Grant # C9-996102-12

EXECUTIVE SUMMARY

Project Title: Big Creek Fecal Coliform Sources

Grant Number: C9-996102-12
CFMS Cooperative Endeavor Agreement No. 668802
OCR Cooperative Endeavor Agreement No. 853-900311

Grant Source: Louisiana Department of Environment Quality

Initiation Date: September 1, 2008 Expiration Date: September 30, 2009

FUNDING

Total EPA Grant: Cash	$49,960.00
ULM Match: Cash	$ 500.00
ULM In-kind:	$33,500.00
TOTAL FUNDING	$83,960.00

EXPENDITURES

Expenditures of EPA Funds:	$43,285.76
Other Expenditures:	$29,383.48
TOTAL EXPENDITURES	$72,669.24

Summary Accomplishments:

Sampling: Twelve sampling events were conducted from 3-11-09 to 7-29-09 to identify fecal coliforms sources in Big Creek. Four of the sampling trips were conducted during rain events and identified several areas adjacent to pasture land and a construction site that contribute to elevated fecal coliform levels in Big Creek. During non-rain events, elevated levels were measured from drainage ditches originating behind residential trailer homes. It is not known if the high levels are due to faulty sewage systems or natural sources. Several BMPs could be implemented to reduce nonpoint source runoff from pasture land and construction activities (sites 4, 4b, 12 and 6e). In addition, a site investigation should be conducted behind the trailer homes adjacent to site 6a and 6d for evidence of faulty sewage systems.

Other Issues: Based on recent studies, *E. coli* is a better indicator of human sewage contamination than fecal coliforms since *Klebsiella* (a non-fecal coliform) can be a false positive in fecal coliform tests. If it is preferred that fecal coliforms are measured, an additional "Presence/Absence" coliform test is recommended to provide evidence that *E. coli* is in the sample and rule out *Klebsiella*. The measurement of optical brighteners for Microbial Source Tracking (MST) may provide useful confirmatory information, especially if measurements are taken near the source of septic drainage.

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1.0 INTRODUCTION

The Safe Drinking water Act Amendments (SDWA) of 1996 required all states to develop a Source Water Assessment Program (SWAP) to ensure safe drinking water for citizens through protection of water sources. The Congress intended the states to utilize the SWAP information to substantially implement a source water protection strategy developed by each state. The strategy is designed to protect both surface water and groundwater sources of drinking water.

Big Creek in Grant Parish, Louisiana is a drinking water source for the surrounding community. Big Creek flows through part of the Kisatchie National Forest and the majority of the creek is surrounded by bald cypress groves and old growth pines with few residential dwellings. Widlife such as deer and wild turkeys are frequently observed in the forest. Based upon discussions with LDEQ and monitoring data downstream of the water intake, unacceptable levels of fecal coliform bacteria have been observed. Because Big Creek is a drinking water source and an outstanding natural resource, it is in the public interest to determine what is contributing fecal coliform bacteria to the creek. Several sites were identified for sampling along Big Creek and in the contributing creek branches that enter into Big Creek (Figures 2 and 3; Appendix 1). Based on an initial site survey and sampling data, a total of 18 sites were sampled beginning below Dry Prong, Louisiana and ending at the bridge in Fishville, Louisiana.

2.0 PROJECT GOALS, OBJECTIVES, AND ACTIVITIES

Goal: To determine whether on site sewage systems and/or agricultural and pasture land are significant sources of high fecal levels in Big Creek.

Objective 1: To conduct targeted monitoring of selected sites for fecal coliform sources.

Objective 2: To analyze microbial, orthophosphate-P, and fluorometric optical brightener data to identify “hot spots” that may be contributing fecal coliforms to the creek, so that Best Management Practices (BMPs) may be implemented to address the problem areas.

In order to accomplish the goal, an initial site visit was conducted using maps and potential sites provided by LDEQ. Initially, fifteen sites were chosen that targeted tributaries entering into Big Creek as well as Big Creek itself. Both rain and non-rain events were sampled. After the second sampling event, an additional site (#7b; Bridge at Fishville) was included in sampling. Following a site visit by LDEQ project manager and a site survey behind several residential trailer homes, additional sites were included and a revised sampling scheme was developed and used throughout the remainder of the project (Table 1). The parameters and methods for water quality analysis are provided in Table 2. A total of twelve sampling events (4 rain and 8 non-rain events;

including a limited sampling during the site visit with LDEQ) were conducted during the project (Table 3).

KEY OF SAMPLING LOCATIONS FOR FIGURE 1

SITE NUMBER	DESCRIPTION
1	Flem Branch off of Mary Barron Road at Sand Spur
2	Big Creek at Mary Barron Road
3	Branch off 165 below Sand Spur
4	Big Creek at 165
4b	Creek flowing into site 4
5	Dyson Creek at Dyson Creek Road
6	Sugar Branch at 165
6a	Creek behind residential trailers
6d	Creek behind residential trailers
6e	“Headwater” pool upstream from site 6
7	Water Intake
8	Sugar Branch off Hughart Road
9	Haw Branch off Hughart Road
10,11	Dyson Creek branches at North Tower Road
12	Big Creek north of Dyson Road
13	Socia Branch north of Big Creek
14	Big Creek at Dry Prong, LA (not shown on maps)

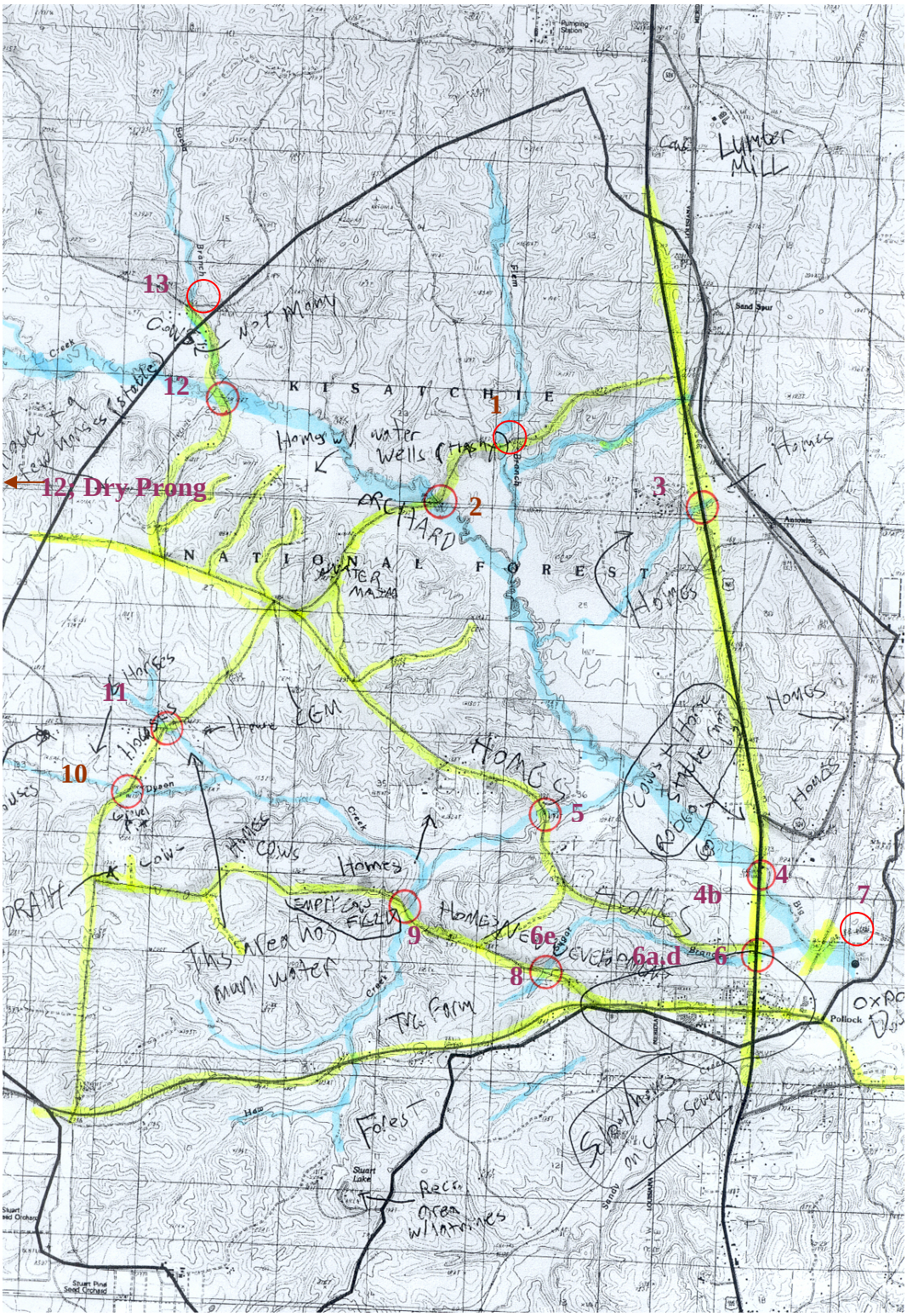


Figure 1. Map of sampling locations

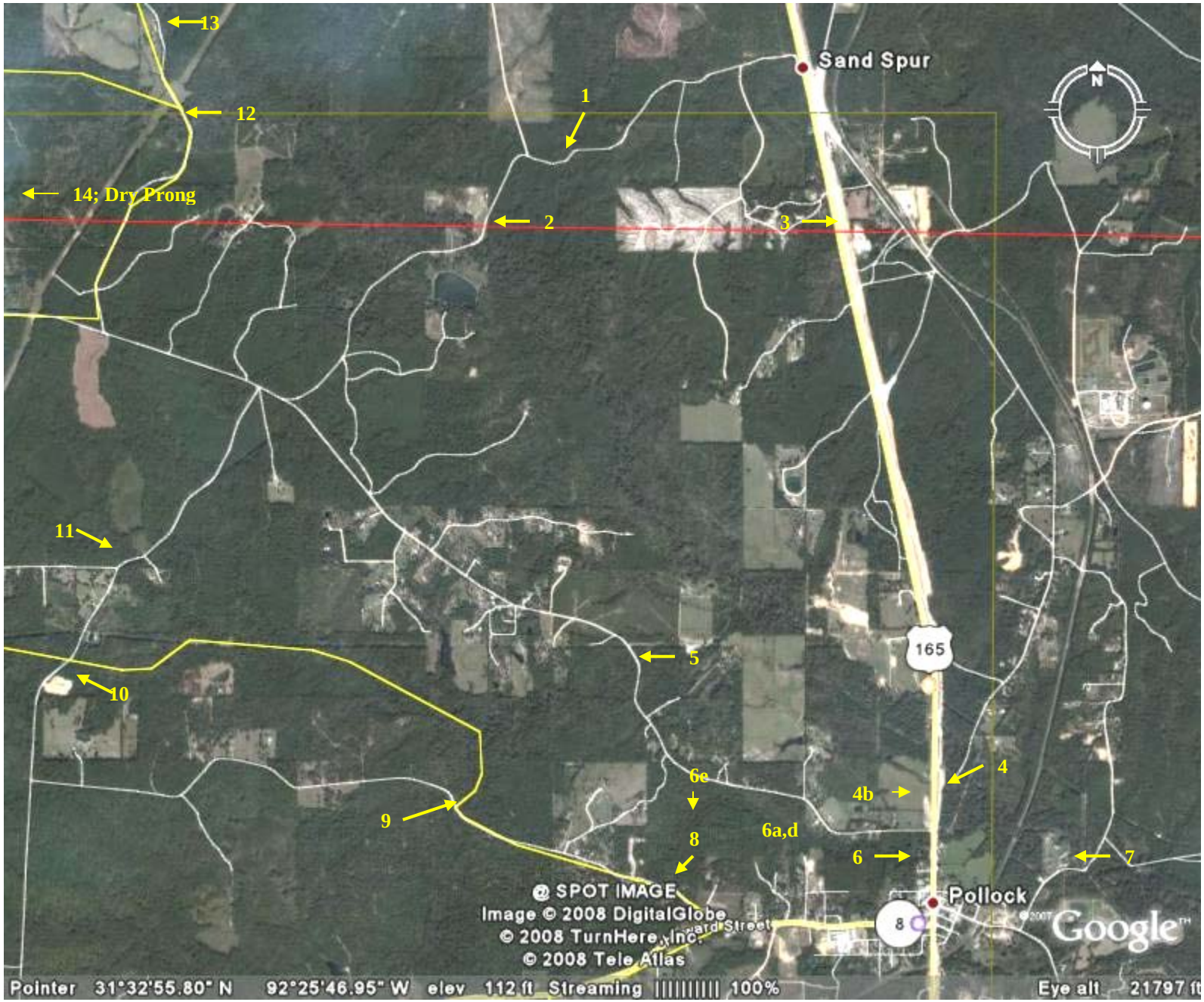


Figure 2. Aerial view of sampling locations

Table 1. Revised sampling locations for rain, non-rain events

Site	Eliminate	NRE	RE	Justification
1		X	X	25% NRE; high RE
2		X	X	Approximately halfway between 12 and 4
3			X	Storm drain; dry during NRE
4		X	X	Big Creek upstream from SWI; pasture
4b		X	X	50% NRE; high RE; pasture or field
5		X	X	0% NRE
6		X	X	100% NRE; high RE
6a		X		Fecals 1,280; totals, 1,829
6d		X		Fecals 1,600; totals Confluent
6e		X	X	Site upstream from d (perhaps near site 8 at the "pool")
7		X	X	Immediately downstream from SWI
12		X	X	50% NRE; high RE; adjacent to goat pasture
14		X	X	"Headwaters" at Dry Prong

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6a: Creek behind Dyson Creek Road	31º31′44″N; 92º24′41″W
6d: Creek behind Dyson Creek Road	31º31′44″N; 92º24′44″W
6e: "Headwater pool" for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W

Additional Justification for sampling revision:

Sites 9, 10, and 11 were eliminated due to low fecal levels. However, Site 5 receives drainage from these sites and remained on the sampling list during both rain and non-rain events. Site 13 was eliminated because of low fecal levels and is located out of the protection critical area. Site 6 is a potential "hot spot" and sites 6a and 6d (upstream from site 6) were added to better target the elevated fecal sources. These sites were below discharges apparently coming from behind residential trailer homes. Sites 6b and 6c (in between 6a and 6d) were eliminated because did not significantly contribute to the elevated fecals (no discharge was observed at these sites). Site 6e was added because it was considered the source of the flow in this small tributary (apparent ground water upwelling). Site 8 was eliminated because there is no flow during non-rain events and the construction of new homes adjacent to the area has rerouted flow to Site 6e. Site 7b was eliminated because it was downstream from the drinking water intake and therefore out of the scope of the project.

Table 2. Parameters and Methods for Water Quality Analyses

Parameter	Analysis Method	MDL	Preservation (chemical, temperature, light)	Maximum Holding Times	Container (Bottles)	Container Volume	Sample Volume
Total Orthophosphates	EPA 365.3	0.02 mg/L	Cool 4°C	48 hours	Nalgene or Glass	0.5 L	0.5 L
Fecal Coliforms	SM 9222D	1 col/100 mLs	Cool 4°C	6 hours (including travel and incubation set up)	Sterile Bags/Containers	0.1 L	0.1 L
Fecal Coliforms	SM 9222B	1 col/100 mLs	Cool 4°C	6 hours (including travel and incubation set up)	Sterile Bags/Containers	0.1 L	0.1 L

No deviations from the QAPP occurred during sampling for this project.

Table 3. Total rainfall amounts within 24 hours of sampling

Month	Rainfall (inches)
3-11-09	0.00
3-25-09	3.23
4-9-09	0.00
4-23-09	0.00
5-5-09	0.00
5-14-09	0.00
5-20-09	0.00
6-2-09	0.00
6-16-09	0.00
7-6-09	1.18
7-22-09	3.21
7-29-09	1.07[a]

[a]Sampling occurred approximately 12 hours following the rainfall; no significant runoff observed.

2.1 PLANNED AND ACTUAL MILESTONES, PRODUCTS, AND COMPLETION DATES

Activity	Dates (*Completion)	Explanation
Contract approved/signed	September 24, 2008	Effective: September 1, 2008 Termination: September 30, 2009
Notice to Proceed on the Project	November 7, 2008	None
Task 1.1 Develop QAPP	December, 2008	January 29, 2009
Task 2.1 Identification of Sampling Locations	February 25, 2009	Site Survey
Task 2.2 Conduct sampling	March 11 – July 29, 2009	12 sampling events conducted
Task 3.1 Submit Quarterly Reports	January 10, April 10, July 10, August 14, 2009	None
Task 3.2 Submit Final Report	August 14, 2009	Draft submitted
LDEQ Project Manager, Ms. Micaela Coner project visits	November 25, 2008; March 26, 2009, May 14, 2009; September 2, 2009	Project visits

Twelve sampling events were conducted during the project and four events were associated with rain events, as described above in Table 3.

2.2 EVAULATION OF GOAL ACHIEVEMENT AND RELATIONSHIP TO THE STATE NPS MANAGEMENT PLAN/SUPPLEMENTAL INFORMATION

The Louisiana Department of Environmental Quality (LDEQ) administers the Source Water Protection Program (SWPP) in order to protect the state's ground water aquifers and surface waters that are utilized as drinking water supplies.

In 1996, the Safe Drinking Water Act Amendments required all states to develop a Source Water Assessment Program (SWAP). Assessments were completed for all public water supply systems. The assessments contained a delineation of the source water protection area, a contamination source inventory, and an analysis of the systems' susceptibility to contamination. The most susceptible public water supply sources are prioritized for protection activities and monitoring as needed. Watersheds that drain to drinking water sources are of special concern in that the myriad of activities that occur within them can potentially affect the health and safety of the drinking water supply.

In addition to the assessments, the LDEQ SWPP staff rely on the 305(b) Integrated Report as the basis to determine whether surface source waters are impaired or fully meeting their designated uses. Big Creek, which is a source of drinking water for people in southern Grant Parish and northern Rapides Parish, is not meeting the fecal coliform standard necessary to support its designated use for primary contract recreation. Reasons cited for this in DEQ's 2006 Integrated Report are livestock (grazing or feeding operations) and sewage discharges in unsewered areas.

In order to meet the state's water quality goals, nonpoint pollution sources on Big Creek needed to be identified so that they may be controlled and/or managed to the extent that water quality standards can be met and designated uses can be restored. As Big Creek is a drinking water source, it is also important that any further degradation of the water quality be prevented. This project, titled "Source Water Protection- Big Creek Coliform Sources" is a monitoring project designed to identify the source of coliforms.

As a result of this project, hot spots and probable sources of coliforms in Big Creek have been identified. The next step will be to address coliform loading from these sources and at these sites accordingly through implementation of recommended Best Management Practices as described in this report. Key sites may be re-sampled in order to demonstrate water quality improvements.

LDEQ outlined a set of water quality goals in 2004 aimed at restoring 25% of the state's impaired water bodies and removing them from the 303(d) list by 2012. The Nonpoint Source Management Plan clearly outlines a long-range goal of improving water quality to the extent that the designated uses for fishing and swimming are restored. As described on page 16 of the plan, "the short-term goal is to implement the type and the number of practices necessary to reduce the concentration of fecal coliform coming

from the identified source, such as home sewage systems, urban communities or animal operations."

3.0 MONITORING RESULTS

General Evaluation

A summary of sampling results from rain, non-rain, and both rain and non-rain events at each site are provided in Tables 4, 5, and 6, respectively. Results from individual sampling events are presented in Appendix 2. Fecal coliform levels measured at each sampling event per site are presented in Figures 4-20 and Appendices 3 and 4. Initial sampling during non-rain events indicated high fecal coliform levels at Site 6 (Sugar Branch at Hwy 165). As a result, a site survey of this creek was conducted on May 5, 2009. The creek was behind several trailer homes, and drainage ditches or seepage fields were observed coming from these locations and flowing into the creek. These sites, especially Site 6d, showed elevated levels of fecal coliforms in the subsequent sampling events. Since this ditch appeared to

Drainage ditch at Site 6d

Site 6e during rain events

Site 6e during non-rain events

originate on private property, no additional surveillance was conducted. After further site survey, a "Headwater" pool (Site 6e) was located that provided the flow downstream from ground water upwelling. This site during non-rain events had the lowest fecal coliform values measured in the project. It became apparent that the source of the high fecals measured at Site 6 during non-rain events was due to drainage originating behind the trailers and not from upstream sources. To date, it is not known if the elevated fecal coliform levels from this location are due to faulty sewage system or natural background seepage (i.e., soil bacteria and/or indigenous wildlife).

Field draining into Site 6e

During rain events with significant runoff, values were generally higher at all sites compared to non-rain events, presumably from natural soil and/or wildlife bacteria carried by the runoff. However, there were several sites that were notably higher than the rest. For example, high fecal coliform values were observed at the Site 3 Highway 165 storm drain (average of 6,673 col/100 mL), Site 12 adjacent to a goat pasture (average of 7,674 col/100 mL), Sites 4 and 4b adjacent to a horse pasture (average of 3,727 and 4,916, respectively), and Site 6e, the "Headwater" pool (average of 5,025 col/100 mL). The high values at Site 6e appear to be from natural sources. The site is surrounded by a recent clear-cut area and significant erosion occurs during periods of heavy rain. The high fecal and total coliform levels are probably from natural background vegetation and soil organisms or wildlife (i.e., deer) and not due to faulty sewage systems. There is currently no BMP implemented to reduce soil erosion and runoff into Site 6e. In addition, there are not any buffer zones reducing runoff from the pasture lands (Site 4, 4b, and 12).

Specific issues (advantages/disadvantages) of individual sampling parameters will be discussed below.

Fecal coliform and total coliform sampling

There are three bacterial indicator parameters generally measured for water quality testing including fecal coliforms, total coliforms, fecal streptococcus, and *E. coli* (Rider, 1996). When the fecal coliform values are close to the total coliform count, this usually indicates that the majority of the contamination is fecal in nature and good evidence that there is a source of fecal influx from warm-blooded animals (i.e., *E. coli* from humans) near the sampling location. For example, Site 7 averaged 1,557 ± 799 and 1,549 ± 397 for fecal coliforms and total coliforms, respectively. But as sewage percolates through a septic field, other coliforms (fecal and non-fecal) are added. One non-fecal coliform, *Klebsiella*, can give false readings for fecal coliforms. Fecal coliforms may also include fecal streptococcus from warm-blooded mammals and avian species. Therefore, *E. coli* is a better indicator of human sewage contamination then fecal coliforms since *Klebsiella* is not enumerated in the *E. coli* test (Warrington, 1988). It should be noted that high *E. coli* counts may also be attributed to other warm blooded animals such as livestock, but an appropriate site survey should aid the interpretation of results. However, if it is preferred that fecal coliforms are measured in any given water quality management scheme, an additional "Presence/Absence" (P/A) coliform test is recommended to give more evidence that *E. coli* is in the sample and rule out other

confounding factors such as *Klebsiella*. The fecal coliform levels measured at Site 7 would need additional conformational tests (P/A or *E. coli*) to rule out false positives.

Orthophosphate sampling

Orthophosphate P (or reactive phosphate) is produced by natural processes (formed by biological processes) and in sewage (body waste and/or food residues). Their inclusion with other parameters (i.e., fecal coliform levels) provides evidence of human sewage discharge. Orthophosphate levels were generally very low in samples collected during non-rain events and were elevated during rain events. There did not appear to be any significant correlation between orthophosphate levels and fecal coliform or total fecal coliform levels.

Optical Brightener Sampling

Optical brighteners (OBs) are fluorescent white dyes that are added to laundry soaps and detergents to enhance the appearance of color of fabric and paper. Basic class types of brighteners include triazine-stilbenes (di, tetra- or hexa-sulfonated), coumarins, imidazolines, diazoles, triazoles, and biphenyl-stilbenes. These chemicals absorb light in the ultraviolet and violet region (usually 340-370 nm) and re-emit light in the blue region (420-470 nm). Because laundry effluents discharge into sewer or septic systems, OBs in the receiving waters indicate the presence of human sewage. Since they are easily detected in water by fluorometric analysis, they are a useful Microbial Source Tracking (MST) tool for water quality management and targeted and effective remediation.

Combined with enumerating fecal indicator bacteria, OB measurements have potential for identifying sources of the contamination. However, there are several issues that need to be considered. OBs are removed from underground waters by adsorption onto soil and organic materials. They are removed from surface waters by adsorption and photodecay. Since adsorption is a critically important process in the performance of septic field systems, the detection of OBs in adjacent surface waters indicate ineffective natural attenuation of the wastewater or septic discharge.

Some natural organic matter (NOM) has similar fluorescent properties that interfere with detection of OBs in the environment. About 50% of NOM comes from humic material of plant and microbial origin (fulvic and humic acid). Other chemicals/substances that may interfere with OBs include oils/grease, pulp and paper mill effluents, and radiator flush water. However, changing the fluorometer filter to a narrow wavelength (415-445 nm) will decrease background NOM by greater than 50% (Hartel et al, 2007). Many of these interfering substances are relatively resistant to UV light compared to OBs. In the present project, exposing a standard Tide™ solution (0.025%) to 5 minutes of UV light reduced the fluorescent units by 60-70%. Therefore,

exposing water samples to UV light is an effective method to differentiate between optical brighteners and other fluorescing organic compounds.

When combined with fecal coliform counts, the OB fluorometric method may be a simple, quick, and effective way to identify human fecal contamination in surface waters. When combining targeted sampling with these measurements, there are four possible contamination scenarios: 1) high OBs and high fecal coliform levels suggests a malfunctioning septic drainfield or leaking sewer pipe, 2) high OBs and low fecal coliform levels suggests gray water in the storm water system, 3) low OBs and high fecal coliform levels suggests warm-blooded animals or a human source from something like an outhouse, or the sampling was simply too far from the suspected source and the OBs photodecayed, and 4) low OBs and low fecal coliform levels suggest no source of fecal contamination (Hartel et al., 2007).

OB values measured throughout this project were typically below 3 OB units (calibrated using 0.05% standard Tide™ solution set at 100 units). The values were near the detection limit of the fluorometer. Following exposure to UV light, the majority of the sample units did not significantly decrease (as compared to the 60-70% decrease for the standard). Therefore, the fluorescence of the water samples was either due to NOM, other unknown fluorescing chemicals, or due to photodecay and/or adsorption in the field. Since no obvious sources of sewage discharge were observed at any site, several "suspect" sites (Sites 6a, 6d) were probably too far from any potential human source discharge.

4.0 PUBLIC INVOLVEMENT AND COORDINATION

Through the Source Water Protection Program, public education campaigns were conducted and volunteer stakeholder committees were formed in both Grant Parish and Rapides Parish. The goal of the stakeholder committees is to work on projects aimed at protecting the quality of the local drinking water sources. Big Creek is a drinking water source for citizens in southern Grant Parish and northern Rapides Parish. For more information on the Source Water Protection Program, visit the website http://www.deq.louisiana.gov/aeps.

4.1 STATE AGENCIES

As a result of the findings from this project, the Louisiana Department of Environmental Quality will partner with the Louisiana Department of Health and Hospitals to determine if the trailer homes near sites 6a and 6d have malfunctioning sewer systems that may be contributing fecal coliforms to Big Creek.

4.2 FEDERAL AGENCIES

Funding for this project was administered through the Louisiana Department of Environmental Quality in cooperation with the Environmental Protection Agency.

4.3 LOCAL GOVERNMENTS, INDUSTRY, ENVIRONMENTAL AND OTHER GROUPS, PUBLIC-AT-LARGE

See Section 4.0.

4.4 OTHER SOURCES OF FUNDS

Funds for this project were provided by the 319 Nonpoint Source Pollution Control grant funds, with a match supplied by the University of Louisiana, Monroe.

5.0 ASPECTS OF THE PROJECT THAT DID NOT WORK WELL

There were no significant problems encountered during the project.

6.0 FUTURE ACTIVITY RECOMMENDATIONS

Several BMPs could be implemented to reduce nonpoint source runoff from pasture land and due to construction activities (sites 4, 4b, 12 and 6e), respectively. In addition, a site investigation should be conducted behind the trailer homes adjacent to site 6a and 6d for evidence of faulty sewage systems.

It is recommended that *E. coli* is a better indicator of human sewage contamination than fecal coliforms since Klebsiella can be a false positive in fecal coliform tests. If it is preferred that fecal coliforms are used, it would be recommended to perform a "Presence/Absence" coliform test in the samples to give more evidence that *E. coli* is in the sample and rule out *Klebsiella*.

Rider (1996) reviewed parameters to detect sewage leachate including OBs, nitrogen (nitrate, nitrite, ammonia and organic N, and total N), phosphorus (ortho-P, total dissolved P, and total P), ionic indicators (specific conductance and chloride) and bacteria counts (fecal coliforms, fecal streptococcus and *E. coli* coliforms). Results combining secondary water chemistry and bacteriology sampling was inconclusive. For example, *E. coli* counts were quite high suggesting possible septic leachate presence and/or livestock water contamination. However, chloride ion, ammonia and nitrate levels were low, and other nitrogen indicators of seepage were also quite low suggesting that septic seepage was not present. The fluorometer worked well as a synoptic survey tool and measured an area of elevated fluorescence. However, it could not be substantiated that high readings were sewage related seepage or the result of stream inflow to the lake. The author concluded that samples from an unimpacted

background site would have indicated if these results were relatively high or low. A survey of local land use practices would also help to explain high reading sites. In addition, the author recommended continuing to use water chemistry and bacteriology as the most effective secondary method(s) to help verify that high readings detected by the fluorometer are caused by sewage related seepage.

In conclusion, the following future activities along Big Creek are recommended:

1. Conduct a follow-up investigation with the Louisiana Department of Health and Hospitals to determine the source of apparently high fecal coliform values behind the residential trailer homes along Site 6a and 6d.
2. Implement Best Management Practices (BMPs) adjacent to the pasture lands (Sites 4, 4b, and 12) and construction sites (large area adjacent to Site 6e). Examples of BMPs that may be appropriate for pasture land include fencing, filter strips, and prescribed grazing. BMPs appropriate for construction areas include straw or hay bales, silt fencing and/or vegetative buffers. Prior to BMP implementation, sampling is recommended using DNA fingerprinting technology to identify sources of fecal coliform to Big Creek. This will, in turn, show how to best target the implementation plan and bacteria reduction efforts to meet water quality goals in the watershed.
3. Conduct follow-up sampling to monitor success of BMP implementation. Based on Rider (1996) and the results of the current project, the sampling parameters would include fecal coliforms, total coliforms, *E. coli*, and optical brightener measurements.

7.0 REFERENCES

Hartel PG, Hagedorn C, McDonald JL, Fisher JA, Saluta MA, Dickerson JW Jr, Gentit LC, Smith SL, Mantripragada NS, Ritter KJ, Belcher CN. (2007). Exposing water samples to ultraviolet light improves fluorometry for detecting human fecal contamination. Water Research 41 (16): 3629-3642.

Petch, Rider (1996). The feasibility of using a fluorometer to detect septic leachate. Environment Canada; document DOE FRAP 1996-31.

Warrington, Dr. P. 1988. Water Quality Criteria for Microbiological Indicators. Water Quality Branch, Water Management Division, Ministry of Environment, Lands and Parks, Victoria, B.C.

Sampling Location Key for Tables

1: Flem Branch off of Mary Barron Road	31º34′06″N; 92º25′54″W
2: Big Creek at Mary Barron Road	31º33′49″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′27″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′39″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6a: Creek behind Dyson Creek Road	31º31′44″N; 92º24′41″W
6d: Creek behind Dyson Creek Road	31º31′44″N; 92º24′44″W
6e: “Headwater pool” for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′49″W
7b: Bridge at Fishville, LA	31º31′26″N; 92º21′42″W
9: Haw Branch off Hughart Road	31º31′54″N; 92º26′23″W
10: Dyson Creek branch at North Tower	31º32′25″N; 92º27′54″W
11: Dyson Creek branch #2 at North Tower	31º32′43″N; 92º27′40″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′28″W
13: Socia Branch north of Big Creek	31º34′41″N; 92º27′31″W
14: Big Creek at Dry Prong, LA	31º34′11″N; 92º31′33″W
15: Duplicate of #14	

Table 4. Big Creek Coliform Sources
Summary of Rain Events (n=4)

Site #	Orthophosphate P (mg/L) [a]	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.08 (0.04)	2049 (780)	2162 (613)	1.839 (0.384)	1.738 (0.371)	-6 (2)	22.0 (2.0)
2	0.07 (0.01)	1713 (1067)	1267 (253)	1.375 (0.107)	1.344 (0.098)	-2 (3)	22.3 (2.1)
3	0.09 (0.03)	6673 (4104)[c]	1911 (471)[d]	3.706 (0.637)	3.609(0.644)	-3 (1)	22.3 (2.3)
4	0.13 (0.04)	3727 (1861) [c]	2338 (138) [d]	1.671 (0.224)	1.539 (0.152)	-6)3)	22.4 (2.3)
4b	0.12 (0.03)	4916 (1780)	14400 (11600)[d]	2.153 (0.286)	2.110 (0.321)	-3 (2)	23.4 (2.8)
5	0.08 (0.03)	5503 (2205)	8314 (5846)[c]	1.378 (0.306)	1.307 (0.295)	-5 (3)	22.0 (2.4)
6	0.27 (0.12)	4724 (2370)	2010 (690) [d]	2.004 (0.552)	1.947 (0.541)	-4 (1)	21.8 (2.3)
6a	0.04[b]	1483 [b]	1480 [b]	0.687 [b]	0.560 [b]	-18 [b]	24 [b]
6d	0.07 [b]	580 [b]	732 [b]	0.621 [b]	0.569 [b]	-8 [b]	24 [b]
6e	0.15 (0.09)	5025 (3369)	10662 (8671)	1.459 (0.447)	1.444 (0.466)	-3 (3)	23.7 (1.5)
7	0.10 (0.03)	1557 (799)	1549 (397)	1.300 (0.353)	1.270 (0.333)	-2 (2)	23.0 (2.3)
9	0.21 [b]	1320 [b]	2314 [b]	2.410 [b]	2.332 [b]	-3 [b]	15.5 [b]
10	0.14 [b]	1160 [b]	1714 [b]	2.594 [b]	2.531 [b]	-2 [b]	15.5 [b]
11	0.06 [b]	2000 [b]	2800 [b]	1.567 [b]	1.613 [b]	3 [b]	15.0 [b]
12	0.25 (0.18)	7674 (6791)	845 (380) [c]	1.724 (0.314)	1.644 (0.289)	-5 (1)	22.1 (2.2)
13	0.09 [b]	688 [b]	1213 [b]	2.863 [b]	2.782 [b]	-3 [b]	15.5 [b]
14	0.07 (0.01)	1571 (1228)	928 (363) [c]	1.261 (0.368)	1.156 (0.354)	-10 (2)	22.1 (2.2)
15	0.04 [b]	400 [b]	400 [b]	0.654 [b]	0.619 [b]	-5 [b]	25.0 [b]

Values represent mean (± Standard Error). [a]Several values were below detection limit and "0" was used in the average. [b]Only one value obtained. [c]One sample was confluent (too numerous to count) and was not averaged. [d]Two samples were confluent (too numerous to count) and were not averaged. Not all sites were sampled per event; refer to Appendix 2 for sample size/site.

Table 5. Big Creek Coliform Sources
Summary of Non-Rain Events (n=7)

Site #	Orthophosphate P (mg/L)[a]	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.01 (0.01)	102 (20)	404 (74)	1.184 (0.161)	1.048 (0.132)	-15 (2)	18.4 (1.2)
2	0.04 (0.01)	204 (60)	519 (101)	1.624 (0.183)	1.453 (0.166)	-10 (2)	19.1 (1.3)
4	0.04 (0.01)	147 (30)	553 (97)	1.298 (0.134)	1.172 (0.100)	-8 (3)	19.4 (1.3)
4b	0.09 (0.01)	181 (66)	323 (148)	2.521 (0.182)	2.348 (0.144)	-6 (2)	19.9 (1.2)
5	0.02 (0.01)	126 (14)	401 (95)	0.909 (0.141)	0.728 (0.097)	-20 (7)	19.4 (1.2)
6	0.02 (0.01)	537 (102)	1166 (153)	0.843 (0.336)	0.452 (0.084)	-20 (12)	18.8 (1.2)
6a	0.02 (0.02)	523 (271)	1166 (375)	0.445 (0.101)	0.351 (0.102)	-22 (8)	19.8 (2.5)
6d	0.08 (0.03)	1790 (489)	743[b]	1.348 (0.398)	1.150 (0.412)	-19 (7)	20.0 (2.3)
6e	0 (0)	45 (26)	237 (104)	0.063 (0.063)	0.042 (0.042)	-11 (11)	20.3 (1.2)
7	0.04 (0.01)	125 (27)	446 (99)	1.254 (0.158)	1.146 (0.127)	-10 (5)	19.9 (1.4)
7b	0.05 (0.00)	474 (263)	1057 (145)	1.459 (0.145)	1.467 (0.113)	2 (12)	18.5 (1.6)
9	0.02 (0.01)	58 (19)	229 (39)	1.196 (0.129)	1.003 (0.102)	-15 (9)	18.4 (1.0)
10	0.05 (0.00)	160 (99)	430 (170)	0.662 (0.126)	0.594 (0.011)	-18 (13)	17.8 (1.0)
11	0.02 (0.01)	115 (99)	239 (115)	0.686 (0.076)	0.558 (0.050)	-8 (20)	17.3 (0.8)
12	0.06 (0.00)	194 (43)	339 (32)	1.497 (0.163)	1.321 (0.125)	-11 (3)	19.8 (1.4)
13	0.04 (0.01)	97 (47)	315 (98)	1.815 (0.238)	1.704 (0.219)	-6 (4)	17.8 (1.2)
14	0.02 (0.01)	208 (83)	383 (93)	0.856 (0.152)	0.742 (0.131)	-8 (8)	19.7 (1.4)
15	0.03 (0.01)	123 (38)	265 (46)	0.871 (0.208)	0.702 (0.155)	-16 (8)	19.8 (1.7)

Values represent mean (± Standard Error). [a]Several values were below detection limit and "0" was used in the average. [b]Three samples were confluent (too numerous to count) and were not averaged. Not all sites were sampled per event; refer to Appendix 2 for sample size/site.

Table 6. Big Creek Coliform Sources
Summary of Rain and Non-Rain Events (n=12)

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.03 (0.02)	810 (393)	1043 (338)	1.422 (0.190)	1.324 (0.192)	-11 (2)	19.7 (1.2)
2	0.05 (0.01)	752 (422)	791 (154)	1.534 (0.124)	1.413 (0.109)	-7 (2)	20.3 (1.1)
3	0.09 (0.03)	6673 (4104)[a]	1911 (471)[b]	3.706 (0.637)	3.609 (0.644)	-3 (1)	22.3 (2.3)
4	0.07 (0.02)	1221 (728)[a]	950 (274)[b]	1.434 (0.125)	1.305 (0.097)	-7 (2)	20.5 (1.2)
4b	0.10 (0.01)	1903 (931)	3451 (2834)[b]	2.387 (0.157)	2.261 (0.143)	-5 (1)	21.2 (1.3)
5	0.05 (0.01)	2081 (1095)	2775 (1935)[a]	1.080 (0.151)	0.960 (0.154)	-14 (5)	20.3 (1.2)
6	0.11 (0.05)	2060 (1011)	1354 (206)[b]	1.266 (0.328)	0.996 (0.294)	-14 (8)	19.9 (1.2)
6a	0.02 (0.01)	715 (285)	1229 (297)	0.493 (0.092)	0.393 (0.089)	-21 (6)	20.9 (2.0)
6d	0.08 (0.02)	1548 (450)	738 (6)[c]	1.203 (0.341)	1.034 (0.339)	-16 (6)	21.0 (1.9)
6e	0.08 (0.05)	2535 (1873)	5449 (4525)	0.761 (0.372)	0.743 (0.377)	-7 (5)	22.0 (1.1)
7	0.06 (0.02)	646 (343)	847 (221)	1.271 (0.152)	1.196 (0.143)	-7 (3)	21.0 (1.3)
7b	0.05 (0.00)	474 (263)	1057 (149)	1.459 (0.145)	1.467 (0.113)	2 (12)	18.5 (1.6)
9	0.06 (0.04)	311 (253)	646 (418)	1.439 (0.263)	1.269 (0.277)	-12 (7)	17.8 (0.9)
10	0.07 (0.02)	360 (214)	687 (289)	1.049 (0.398)	1.079 (0.484)	-14 (10)	17.3 (0.9)
11	0.03 (0.01)	492 (385)	751 (520)	0.862 (0.186)	0.822 (0.266)	-5 (14)	16.8 (0.7)
12	0.12 (0.07)	2914 (2515)	491 (127)[a]	1.580 (0.149)	1.439 (0.132)	-9 (2)	20.6 (1.2)
13	0.05 (0.01)	215 (124)	494 (195)	2.025 (0.279)	1.920 (0.274)	-5 (3)	17.3 (1.0)
14	0.04 (0.01)	703 (458)	547 (141)[a]	1.003 (0.166)	0.893 (0.155)	-9 (5)	20.6 (1.2)
15	0.04 (0.01)	169 (56)	287 (44)	0.828 (0.167)	0.685 (0.121)	-13 (6)	20.8 (1.7)

Values represent mean (± Standard Error). [a]One sample was confluent (too numerous to count) and was not averaged. [b]Two samples were confluent (too numerous to count) and were not averaged. [c]Three samples were confluent (too numerous to count) and were not averaged. Not all sites were sampled per event; refer to Appendix 2 for sample size/site.

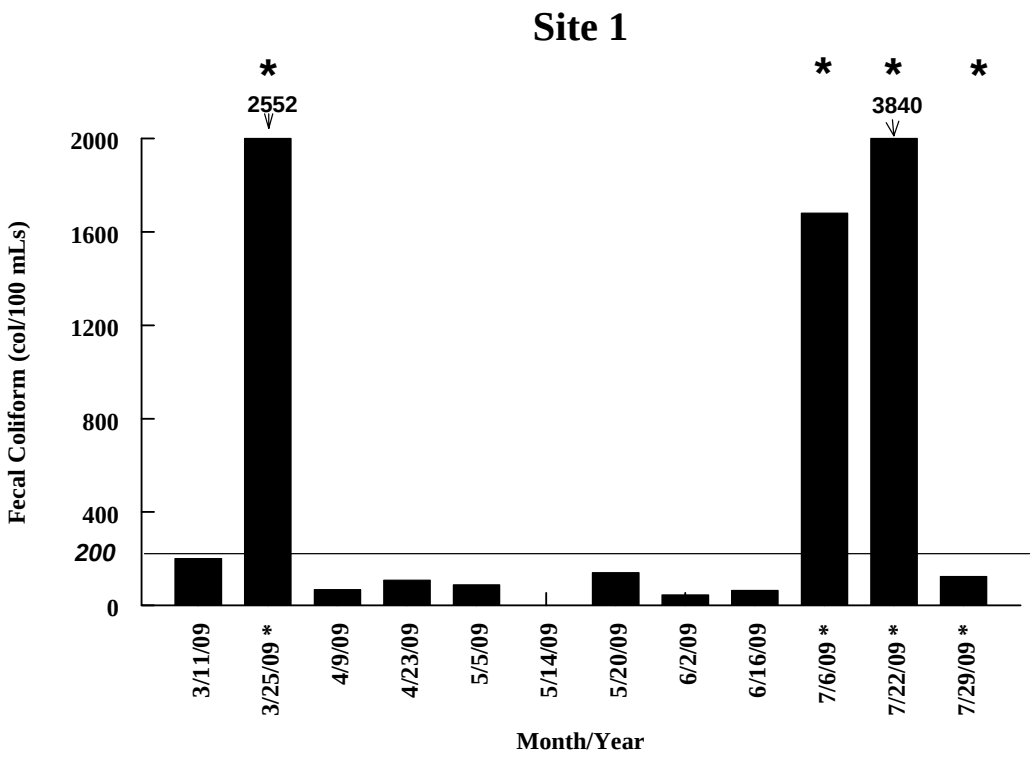


Figure 3. Fecal coliform levels at Site 1 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

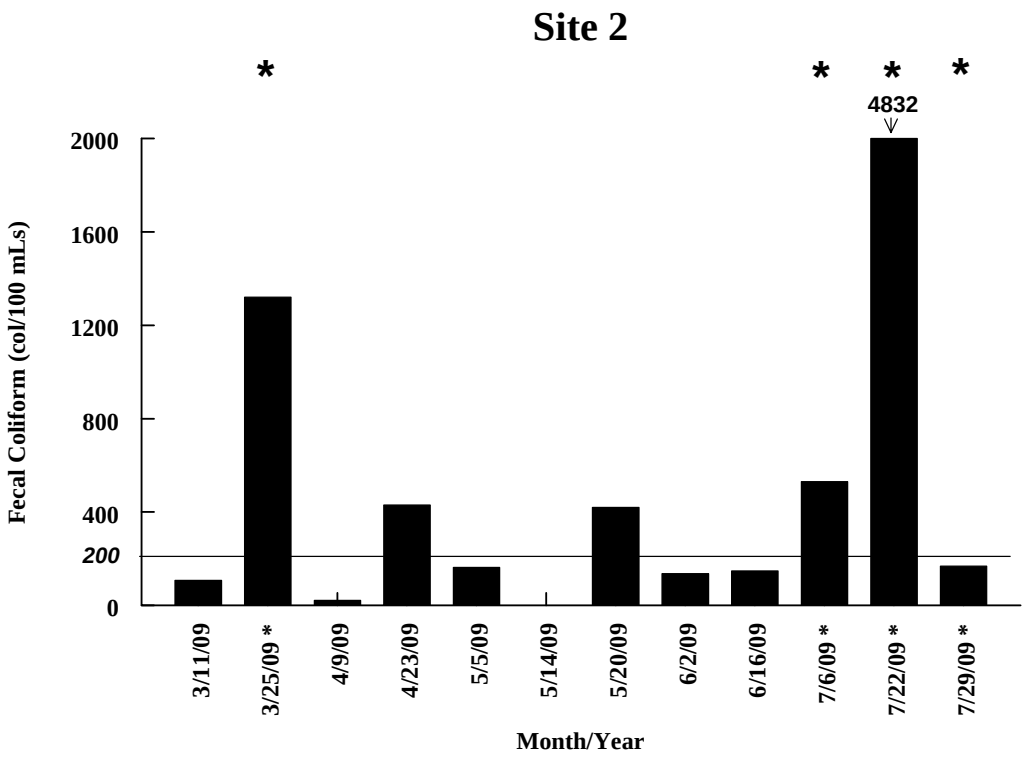


Figure 4. Fecal coliform levels at Site 2 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

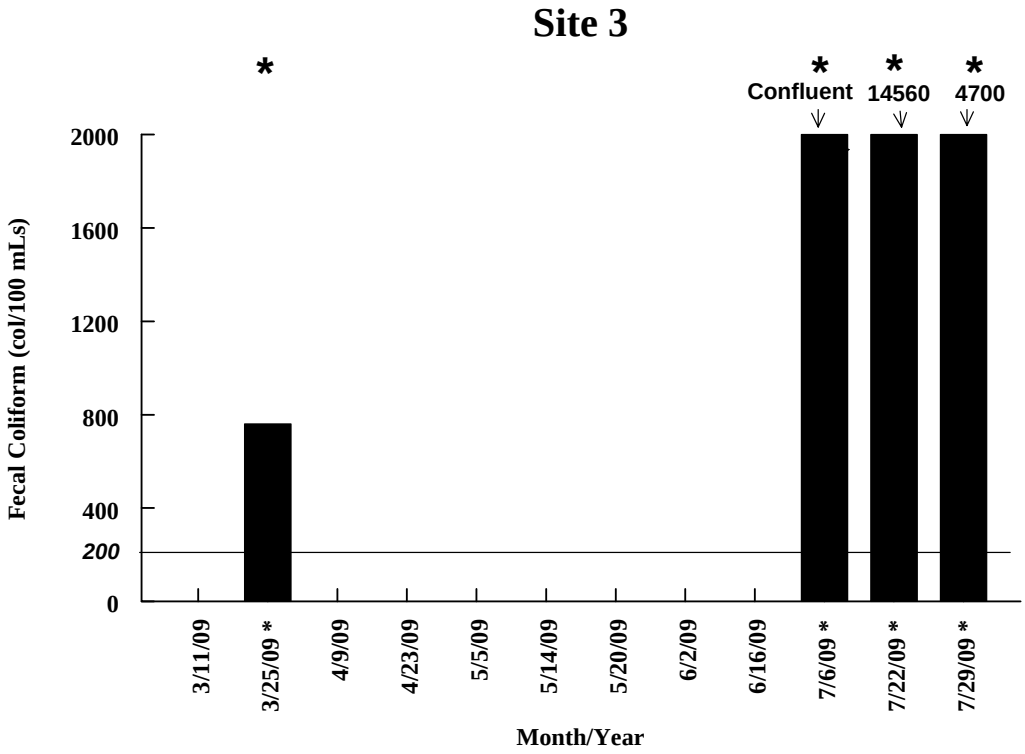


Figure 5. Fecal coliform levels at Site 3 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was only sampled during the rain events.

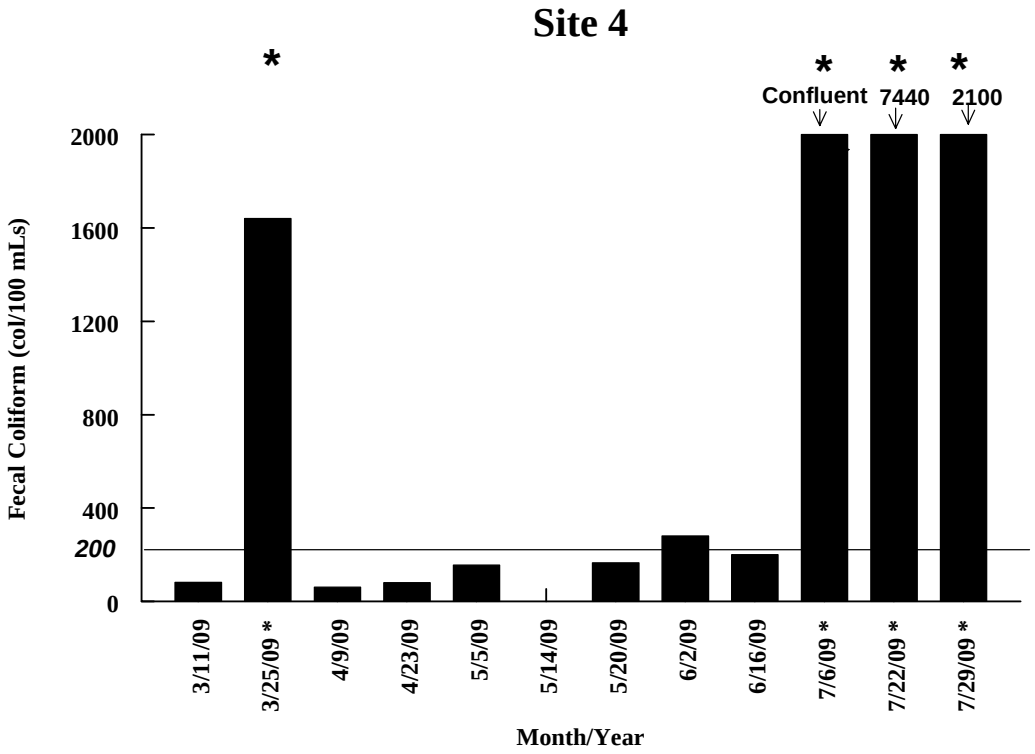


Figure 6. Fecal coliform levels at Site 4 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

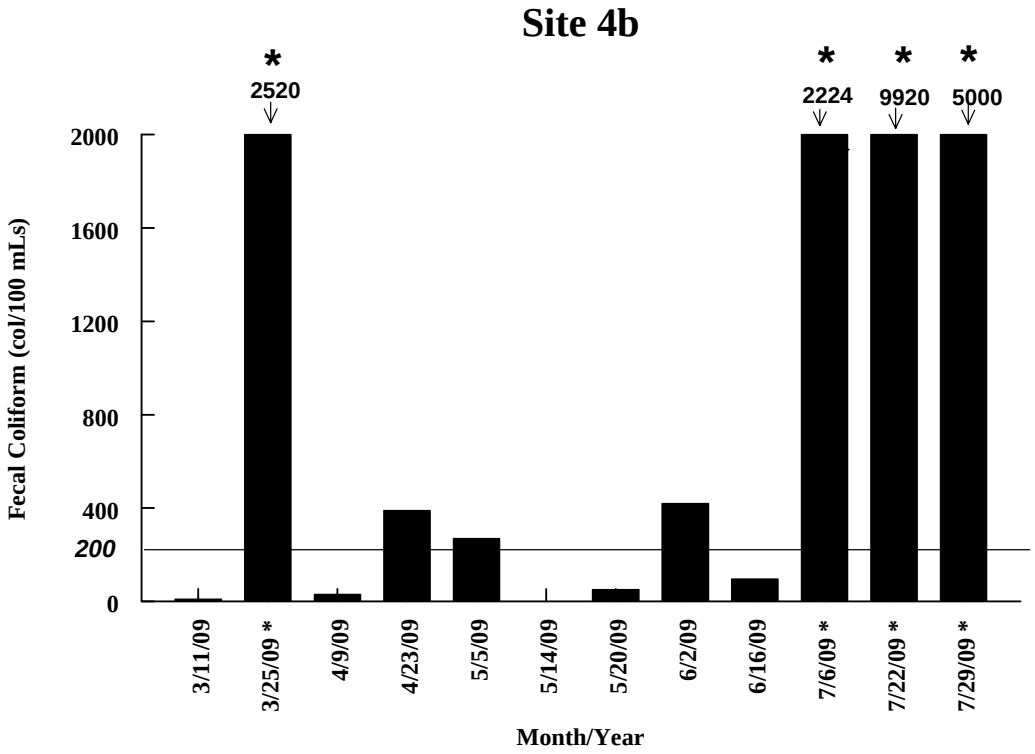


Figure 7. Fecal coliform levels at Site 4b in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

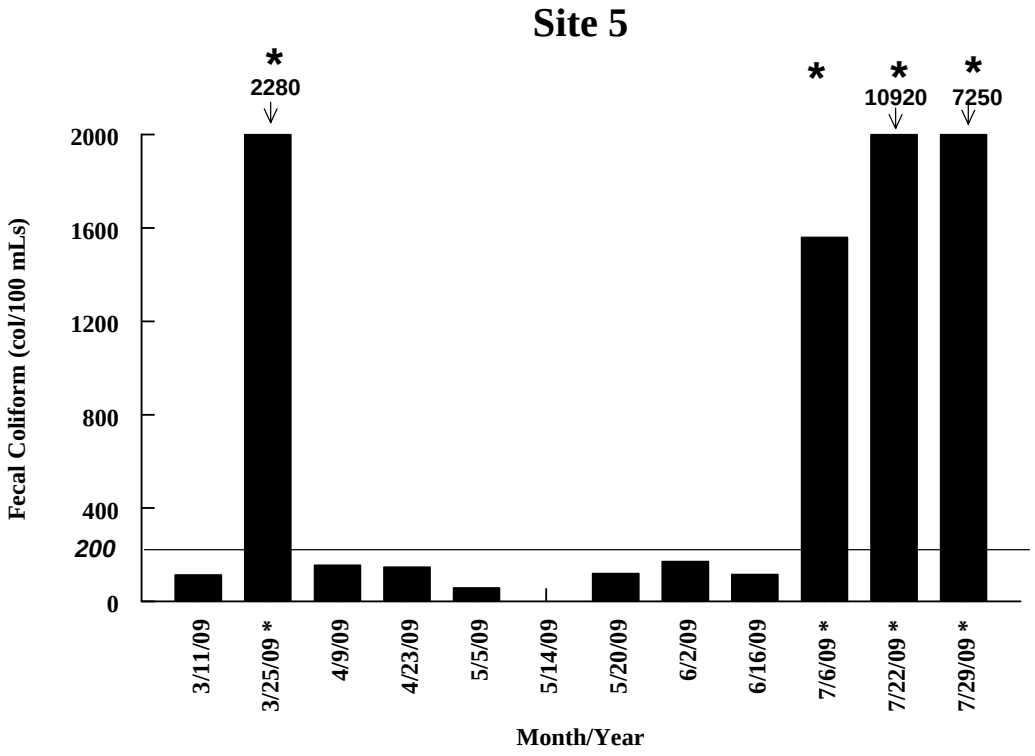


Figure 8. Fecal coliform levels at Site 5 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

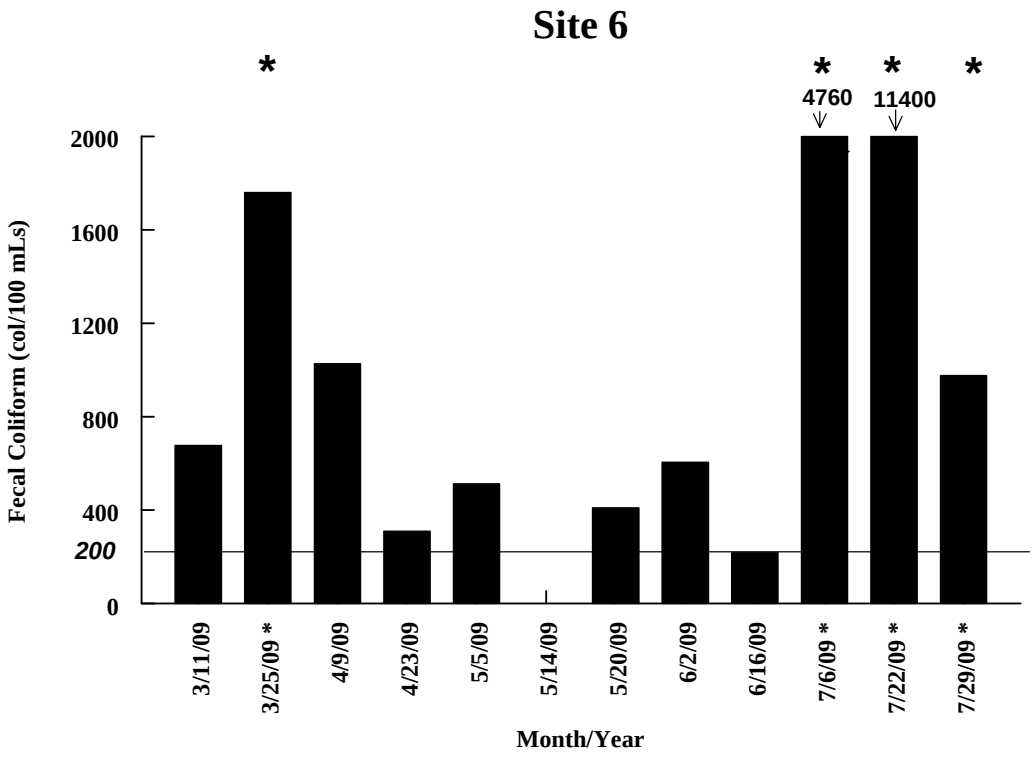


Figure 9. Fecal coliform levels at Site 6 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

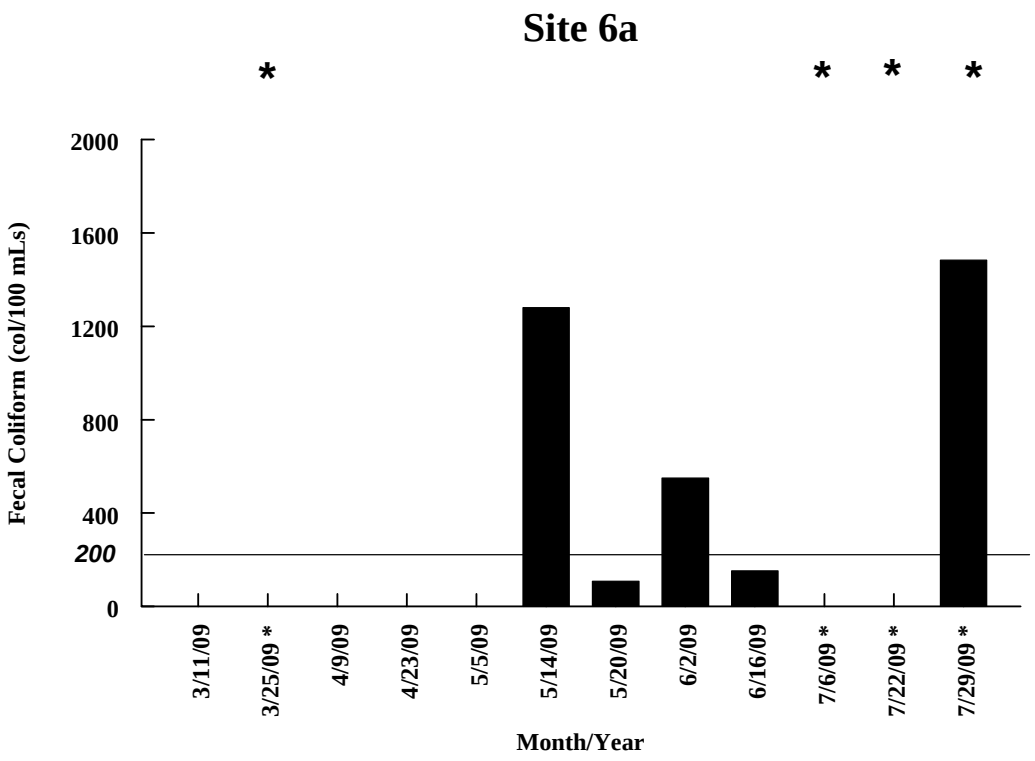


Figure 10. Fecal coliform levels at Site 6a in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 5/14/09, 5/20/09, 6/2/09, 6/16/09, and 7/29/09).

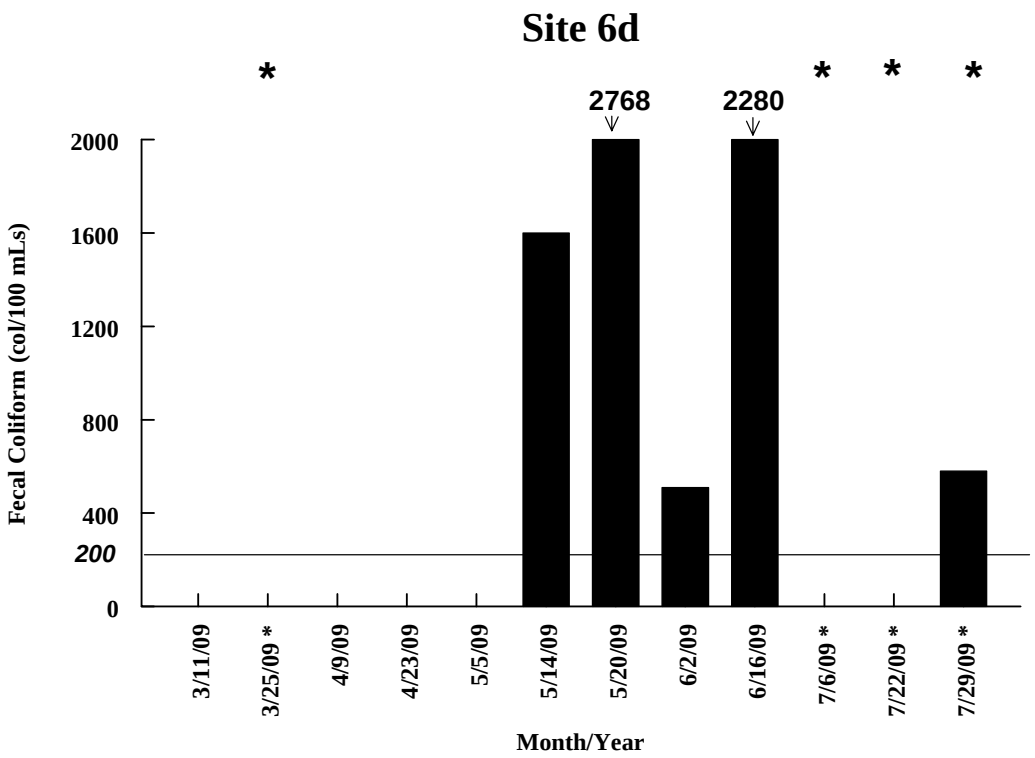


Figure 11. Fecal coliform levels at Site 6d in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 5/14/09, 5/20/09, 6/2/09, 6/16/09, and 7/29/09).

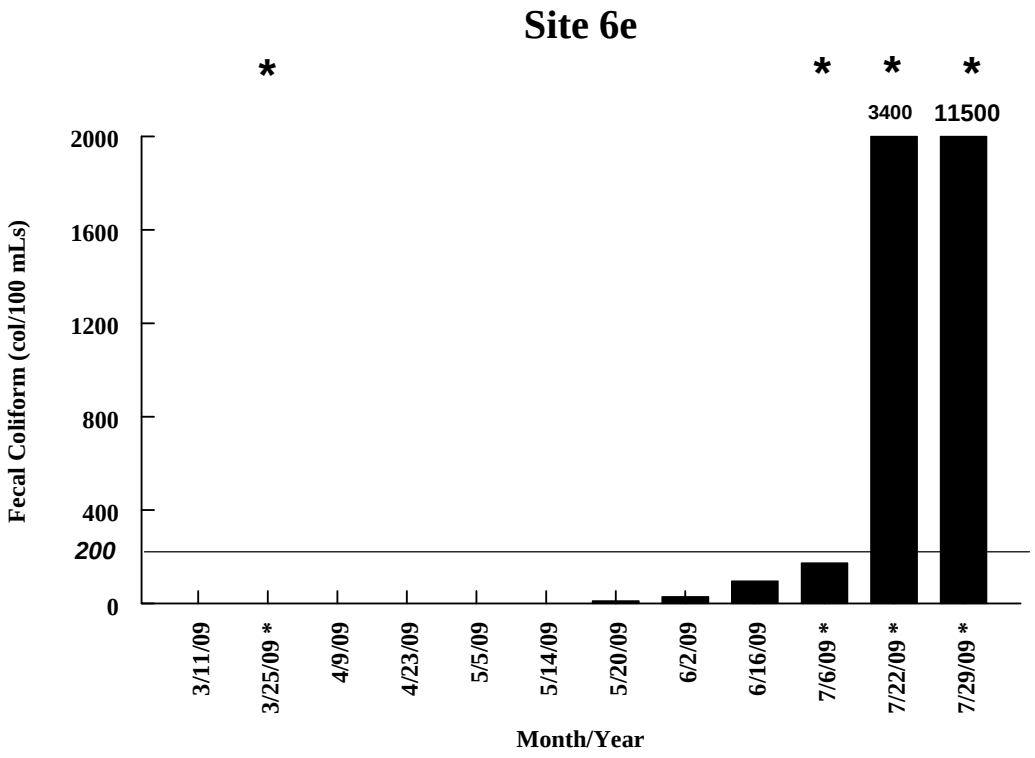


Figure 12. Fecal coliform levels at Site 6e in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 5/20/09, 6/2/09, 7/6/09, 7/22/09, and 7/29/09).

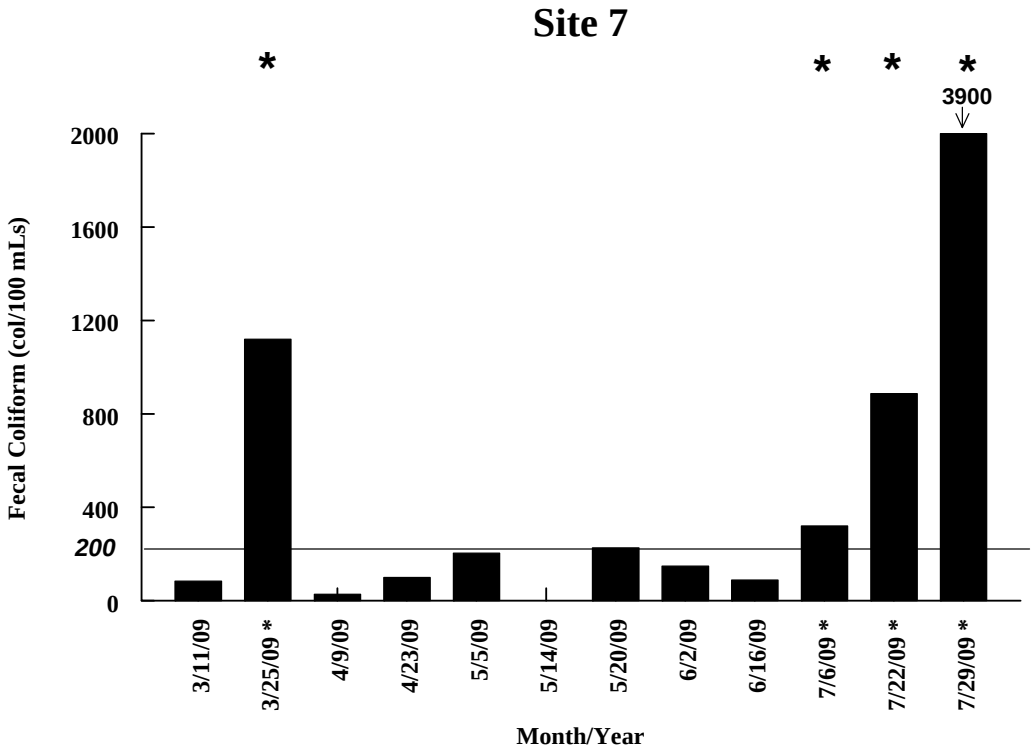


Figure 13. Fecal coliform levels at Site 7 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

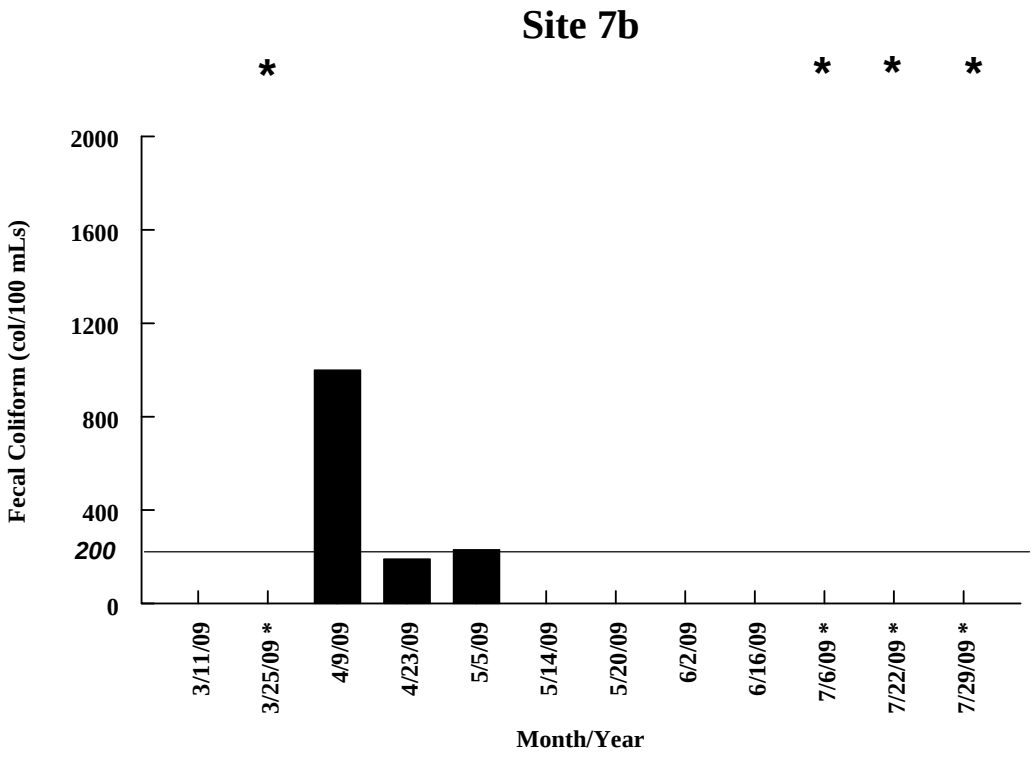


Figure 14. Fecal coliform levels at Site 7b in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 4/9/09, 4/23/09, and 5/5/09).

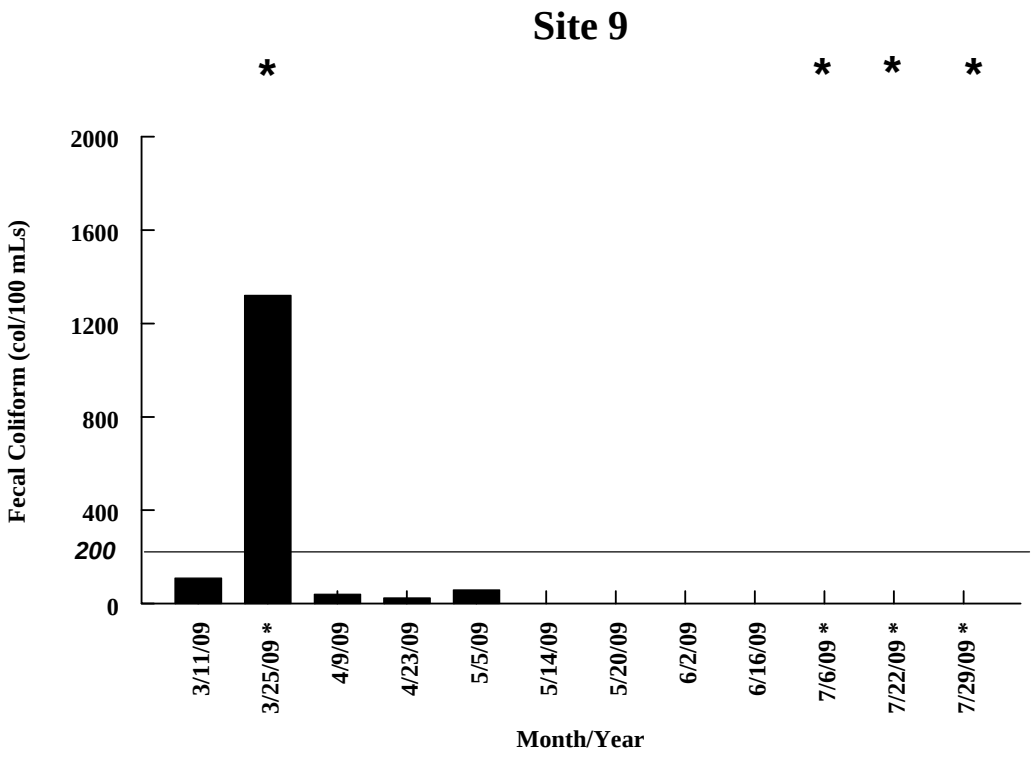


Figure 15. Fecal coliform levels at Site 9 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 3/11/09, 3/25/09, 4/9/09, 4/23/09, and 5/5/09).

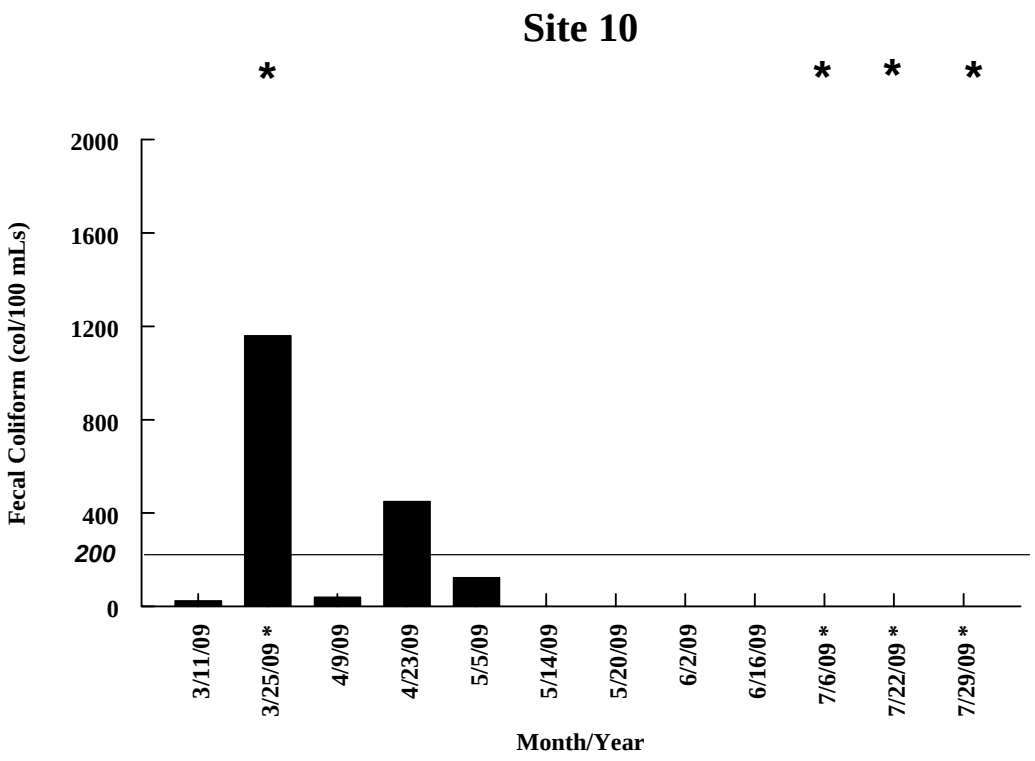


Figure 16. Fecal coliform levels at Site 10 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 3/11/09, 3/25/09, 4/9/09, 4/23/09, and 5/5/09).

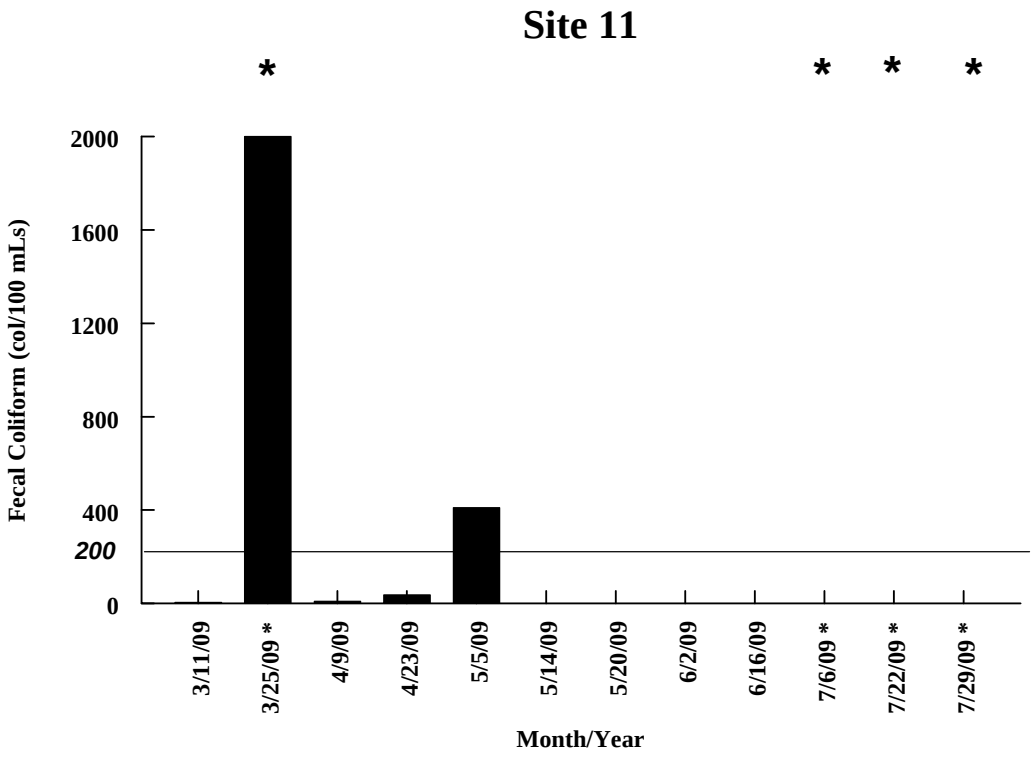


Figure 17. Fecal coliform levels at Site 11 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 3/11/09, 3/25/09, 4/9/09, 4/23/09, and 5/5/09).

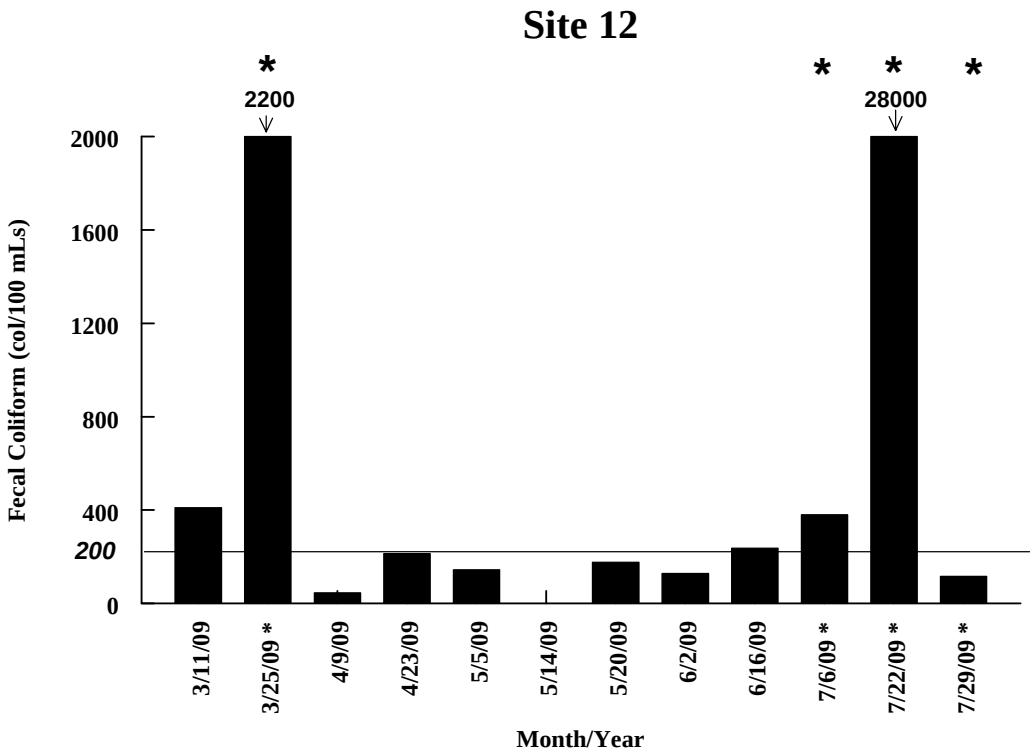


Figure 18. Fecal coliform levels at Site 12 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

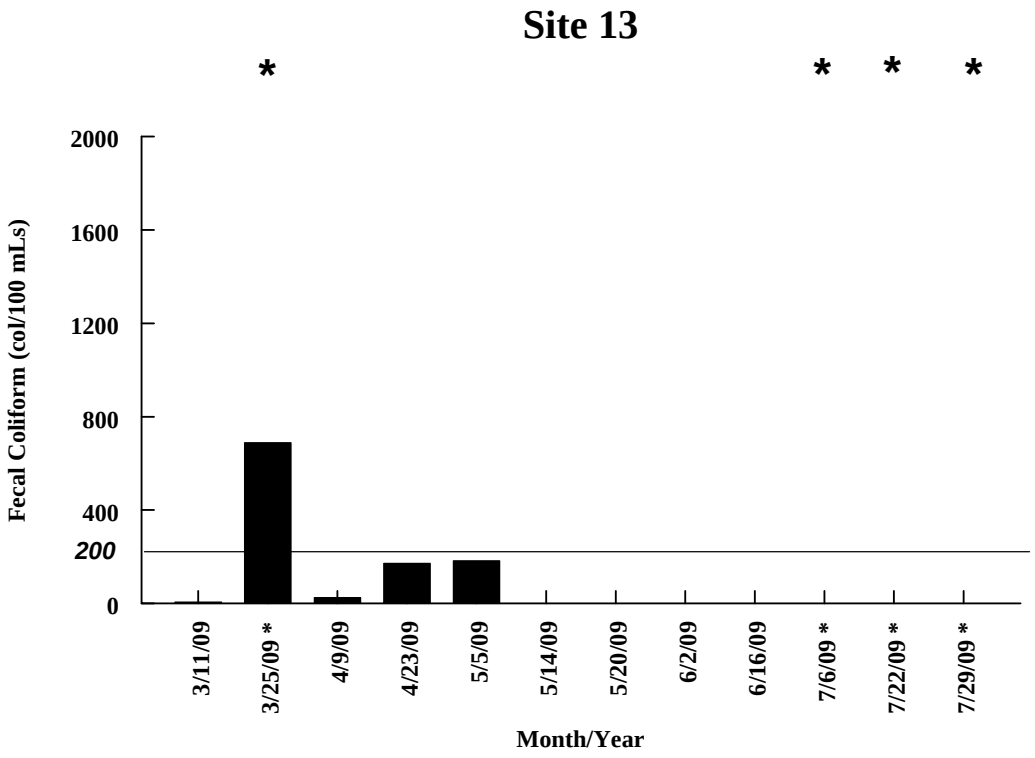


Figure 19. Fecal coliform levels at Site 13 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). This site was sampled only on the bars indicated (including 3/11/09, 3/25/09, 4/9/09, 4/23/09, and 5/5/09).

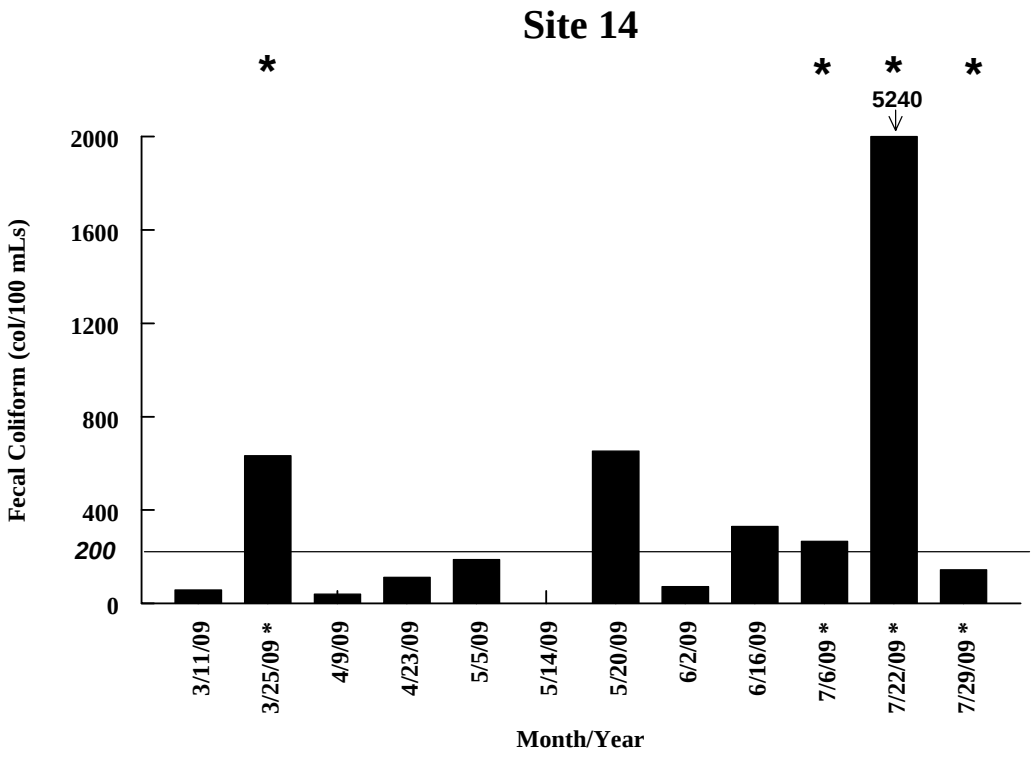


Figure 20. Fecal coliform levels at Site 14 in Big Creek by sampling event. *Indicates rain events (3/25/09, 3.23 inches; 7/6/09, 1.18 inches; 7/22/09, 3.21 inches; 7/29/09, 1.07 inches). On 5/14/09, this site was not sampled.

Appendix 1
Photodocumentation of sampling locations

Site 1

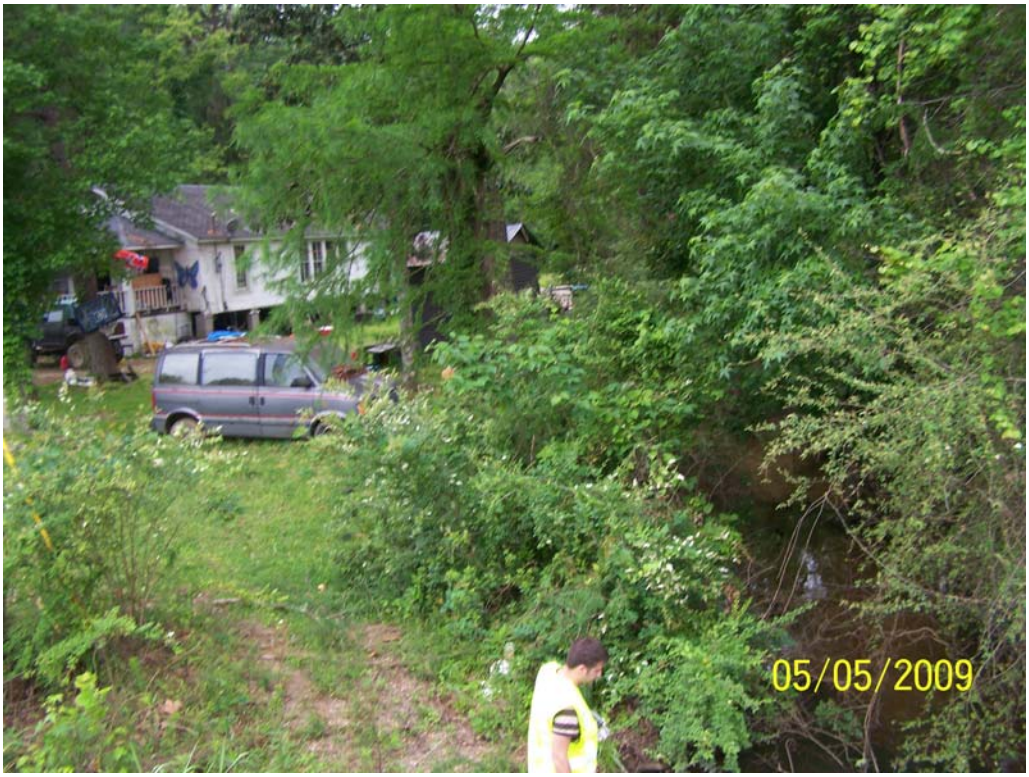
Site 2

Site 3: Storm drain adjacent to Highway 165

Site 4

Site 4b

Site 5



Site 6 off of Highway 165; note the creek to the right of the field assistant

Near site 6a; behind the trailer homes off of Dyson Creek Road

Site 6d; drainage ditch from trailer homes off Dyson Creek Road

Field surrounding Site 6e; runoff travels into the “headwater” pool during rain events

Site 6e; “Headwater” pool upstream from Site 6

Site 6e following heavy rain

Site 7 immediately below the water intake facility

Goat pasture adjacent to Site 12; note heavy runoff from the field; Big Creek behind trees

Goat pasture adjacent to Site 12

Site 12

Site 14 at Dry Prong, LA

PI taking optical brightener measurements during a sampling event

Appendix 2
Individual sampling event results

Site	Sample size
1	11
2	11
3	4
4	11
4b	11
5	11
6	11
6a	5
6d	5
6e	6
7	11
7b	3
9	5
10	5
11	4
12	11
13	5
14	11

Event #1: 3-11-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	200	233	0.846	-- [a]	--	18.5
2	ND	107	250	1.313	1.061	-19	18.5
3	NA	NA	NA	NA	NA	NA	NA
4	ND	82	243	0.930	1.026	+10	19.0
4b	0.05	10	50	2.691	2.628	-2	19.0
5	ND	114	167	0.649	--	--	17.0
6	0.05	677	1,383	2.725	0.621	-77	16.0
7	ND	84	167	0.923	--	--	17.0
8	NA	NA	NA	NA	NA	NA	NA
9	ND	110	317	1.482	0.876	-41	17.0
10	0.04	24	317	0.451	--	--	16.0
11	ND	5	74	0.823	--	---	16.0
12	0.04	410	383	1.390	1.288	-7	16.0
13	ND	6	267	1.922	1.697	-12	16.0
14	ND	58	233	1.239	1.228	-1	16.0
15	0.04	46	233	--	--	--	--
16	ND	<2	<4	-0.105	--	--	16.0

[a]Did not measure; ND means not detected (detection limit = 0.03 mg/L); NA means not available (did not sample due to low flow conditions). A 0.025% standard Tide® solution was reduced by 54% following UV exposure.

Site Description

1: Flem Branch off of Mary Barron Road	31º34′06″N; 92º25′54″W
2: Big Creek at Mary Barron Road	31º33′49″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′27″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′39″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′49″W
8: Sugar Branch off Hughart Road- ditch	31º31′37″N; 92º25′36″W
9: Haw Branch off Hughart Road	31º31′54″N; 92º26′23″W
10: Dyson Creek branch at North Tower	31º32′25″N; 92º27′54″W
11: Dyson Creek branch #2 at North Tower	31º32′43″N; 92º27′40″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′28″W
13: Socia Branch north of Big Creek	31º34′41″N; 92º27′31″W
14: Big Creek at Dry Prong, LA	31º34′11″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #2: 3-25-09
Rain Event: 3.23 inches

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)[a]	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.11	2,552	2,629	2.533	2.442	-4	16.0
2	0.09	1,320	1,471	1.607	1.540	-4	16.0
3	0.09	760	1,440	2.573	2.492	-3	15.5
4	0.22	1,640	2,200	2.203	1.886	-14	15.5
4b	0.21	2,520	2,800	2.690	2.650	-2	15.0
5	0.17	2,280	2,771	2.253	2.171	-4	15.0
6	0.30	1,760	2,700	2.997	2.919	-3	15.0
7	0.20	1,120	1,714	2.070	1.985	-4	16.0
8	0.16	4,560	5,200	2.794	2.714	-3	15.0
9	0.21	1,320	2,314	2.410	2.332	-3	15.5
10	0.14	1,160	1,714	2.594	2.531	-2	15.5
11	0.06	2,000	2,800	1.567	1.613	+3	15.0
12	0.09	2,200	1,600	1.987	1.938	-3	15.5
13	0.09	688	1,213	2.863	2.782	-3	15.5
14	0.09	632	1,624	2.012	1.941	-4	15.5
15	--[b]	--	--	--	--		--
16	--	--	--	--	--		--

[a]These values were taken in the lab and not the field (0.025% standard solution of Tide® was reduced by 72% upon UV exposure); [b]Did not measure; ND means not detected (detection limit = 0.03 mg/L); NA means not available (did not sample due to low flow conditions).

Site Description

1: Flem Branch off of Mary Barron Road	31º34′06″N; 92º25′54″W
2: Big Creek at Mary Barron Road	31º33′49″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′27″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′39″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′49″W
8: Sugar Branch off Hughart Road- ditch	31º31′37″N; 92º25′36″W
9: Haw Branch off Hughart Road	31º31′54″N; 92º26′23″W
10: Dyson Creek branch at North Tower	31º32′25″N; 92º27′54″W
11: Dyson Creek branch #2 at North Tower	31º32′43″N; 92º27′40″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′28″W
13: Socia Branch north of Big Creek	31º34′41″N; 92º27′31″W
14: Big Creek at Dry Prong, LA	31º34′11″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #3: 4-09-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	68	224	1.283	1.062	-17	15.0
2	0.04	22	176	1.301	1.201	-8	14.5
3	NA	NA	NA	NA	NA	NA	NA
4	0.04	62	420	1.340	1.176	-12	15.0
4b	0.09	31	35	2.413	2.365	-2	16.5
5	0.04	156	376	0.950	0.694	-27	16.0
6	ND	1,027	987	0.505	0.460	-9	16.0
7	0.04	28	176	1.345	1.000	-26	16.0
7b	0.05	1,000	771	1.216	1.520	+25	15.5
8	NA	NA	NA	NA	NA	NA	NA
9	ND	40	129	0.863	0.836	-3	16.5
10	0.04	40	176	0.586	0.604	+3	16.0
11	ND	9	47	0.471	0.608	+29	16.0
12	0.05	46	153	1.252	1.186	-5	16.5
13	0.04	25	106	1.436	1.510	+5	16.0
14	0.04	40	118	0.811	0.776	-4	16.0
15	0.04	46	153	1.163	0.722	-38	16.0
16	ND	<4	<20	-0.078	-0.124	--	22.0

[a]Did not measure; ND means not detected (detection limit = 0.03 mg/L); NA means not available (did not sample due to low flow conditions). A 0.025% standard Tide® solution was reduced by 63% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′06″N; 92º25′54″W
2: Big Creek at Mary Barron Road	31º33′49″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′27″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′39″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′49″W
7b: Bridge at Fishville, LA	31º31′26″N; 92º21′42″W
8: Sugar Branch off Hughart Road- ditch	31º31′37″N; 92º25′36″W
9: Haw Branch off Hughart Road	31º31′54″N; 92º26′23″W
10: Dyson Creek branch at North Tower	31º32′25″N; 92º27′54″W
11: Dyson Creek branch #2 at North Tower	31º32′43″N; 92º27′40″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′28″W
13: Socia Branch north of Big Creek	31º34′41″N; 92º27′31″W
14: Big Creek at Dry Prong, LA	31º34′11″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #4: 4-23-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	108	329	1.107	0.911	-18	18.0
2	0.04	430	620	1.731	1.560	-10	18.0
3	NA	NA	NA	NA	NA	NA	NA
4	0.04	80	560	1.393	1.167	-16	19.0
4b	0.10	390	1,120	2.187	1.967	-10	19.0
5	0.04	148	341	0.915	0.821	-10	19.0
6	0.03	310	987	0.520	0.472	-9	18.0
7	0.04	100	657	1.369	1.190	-13	18.0
7b	0.05	191	1,160	1.445	1.250	-13	19.0
8	NA	NA	NA	NA	NA	NA	NA
9	0.03	24	247	1.164	1.012	-13	19.5
10	0.05	450	933	0.997	0.573	-43	19.0
11	0.03	37	294	0.690	0.608	-12	18.0
12	0.05	214	353	1.404	1.329	-5	19.0
13	0.04	172	306	1.459	1.296	-11	18.0
14	0.05	112	318	0.946	0.919	-3	19.0
15	0.04	208	306	0.926	0.869	-6	19.0
16	ND	<4	<20	0.297	0.203	--	26.0

[a]Did not measure; ND means not detected (detection limit = 0.03 mg/L); NA means not available (did not sample due to low flow conditions). A 0.025% standard Tide® solution was reduced by 42% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′06″N; 92º25′54″W
2: Big Creek at Mary Barron Road	31º33′49″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′27″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′39″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′49″W
7b: Bridge at Fishville, LA	31º31′26″N; 92º21′42″W
8: Sugar Branch off Hughart Road- ditch	31º31′37″N; 92º25′36″W
9: Haw Branch off Hughart Road	31º31′54″N; 92º26′23″W
10: Dyson Creek branch at North Tower	31º32′25″N; 92º27′54″W
11: Dyson Creek branch #2 at North Tower	31º32′43″N; 92º27′40″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′28″W
13: Socia Branch north of Big Creek	31º34′41″N; 92º27′31″W
14: Big Creek at Dry Prong, LA	31º34′11″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #5: 5-5-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.04	88	787	2.017	1.635	-19	19.0
2	0.06	163	540	2.333	2.149	-8	20.0
3	NA	NA	NA	NA	NA	NA	NA
4	0.06	156	840	1.733	1.573	-9	20.0
4b	0.10	270	480	3.476	3.024	-13	20.0
5	0.05	59	118	1.091	1.093	+0.2	20.0
6	0.04	512	1,914	1.092	0.796	-27	19.0
7	0.06	204	760	1.557	1.499	-4	20.5
7b	0.06	231	1,240	1.716	1.631	-5	21.0
8	NA	NA	NA	NA	NA	NA	NA
9	0.04	59	224	1.274	1.287	-1	20.5
10	0.06	124	294	0.715	0.606	-15	20.0
11	0.05	410	540	0.758	0.457	-40	19.0
12	0.06	144	376	2.213	1.886	-15	20.5
13	0.06	183	580	2.444	2.314	-5	21.0
14	0.05	188	341	1.119	1.018	-9	20.0
15	0.05	220	420	1.127	0.956	-15	20.0
16	ND	<2	<2	0.320	0.189	--	24.0

[a]Did not measure; ND means not detected (detection limit = 0.03 mg/L); NA means not available (did not sample due to low flow conditions). A 0.025% standard Tide® solution was reduced by 67% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′06″N; 92º25′54″W
2: Big Creek at Mary Barron Road	31º33′49″N; 92º26′17″W
3: Storm Drain off 165 below Sand Spur	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′27″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′39″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′49″W
7b: Bridge at Fishville, LA	31º31′26″N; 92º21′42″W
8: Sugar Branch off Hughart Road- ditch	31º31′37″N; 92º25′36″W
9: Haw Branch off Hughart Road	31º31′54″N; 92º26′23″W
10: Dyson Creek branch at North Tower	31º32′25″N; 92º27′54″W
11: Dyson Creek branch #2 at North Tower	31º32′43″N; 92º27′40″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′28″W
13: Socia Branch north of Big Creek	31º34′41″N; 92º27′31″W
14: Big Creek at Dry Prong, LA	31º34′11″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #6: 5-14-09
Non-Rain Event: Site Survey

Site #	Orthophosphate P (mg/L)[a]	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)[a]
6a	--	1,280	1,829	0.656	0.640	-2	--
6b	--	540	1,040	0.504	0.487	-3	--
6c	--	704	Confluent[b]	0.468	0.463	-1	--
6d	--	1,600	Confluent[b]	2.202	2.154	-2	--

[a]Did not measure. [b]Too numerous to count. This event was a site survey with LDEQ to determine the potential source of high fecals previously measured in Site 6. These samples were taken in the creek behind trailer/camper dwellings off of Dyson Creek Road.

6a: Below seepage coming from a "drainage pool"	31º31′45″N; 92º24′41″W
6b: In the creek below PVC pipe (no drainage observed)	31º31′45″N; 92º24′41″W
6c: In the creek upstream from 6b	31º31′44″N; 92º24′42″W
6d: Drainage ditch from trailer	31º31′44″N; 92º24′44″W

Event #7: 5-20-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	140	520	1.348	1.125	-17	16.0
2	0.05	420	840	2.231	1.932	-13	17.0
4	0.05	166	960	1.754	1.469	-16	17.0
4b	0.10	51	171	2.600	2.341	-10	17.0
5	0.04	120	857	1.621	0.819	-49	16.5
6	ND	410	733	0.729	0.459	-37	16.5
6a	ND	108	520	0.579	0.346	-40	15.5
6d	0.13	2,768	Confluent	1.751	1.457	-17	16.0
6e	ND	11	94	0.189	0.126	-33	18.0
7	0.05	226	693	1.925	1.515	-21	18.0
12	0.06	176	341	1.982	1.597	-19	17.5
14	ND	653	860	1.250	0.609	-51	18.0

ND means not detected (detection limit = 0.03 mg/L); A 0.025% standard Tide® solution was reduced by 79% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6a: Creek behind Dyson Creek Road	31º31′44″N; 92º24′41″W
6d: Creek behind Dyson Creek Road	31º31′44″N; 92º24′44″W
6e: “Headwater pool” for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W

Event #8: 6-02-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	45	365	0.889	0.846	-5	17.0
2	0.05	136	840	1.305	1.196	-8	21.0
4	0.04	280	435	0.982	0.889	-9	20.0
4b	0.09	420	371	2.278	2.161	-5	23.0
5	ND	172	580	0.574	0.476	-17	22.0
6	ND	605	1,320	0.176	0.174	-1	21.0
6a	0.05	550	1,800	0.264	0.194	-27	20.0
6d	0.04	510	743	0.387	0.308	-20	20.0
6e	ND	29	176	-0.100	-0.131	--	21.0
7	0.04	148	212	0.926	0.899	-3	24.0
12	0.05	128	365	1.089	1.069	-2	23.0
14	ND	72	271	0.321	0.275	-14	24.0
15	ND	93	212	0.268	0.259	-3	24.0
16	ND	<2	<2	-0.020	-0.114	--	26.0

ND means not detected (detection limit = 0.03 mg/L); A 0.025% standard Tide® solution was reduced by 66% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6a: Creek behind Dyson Creek Road	31º31′44″N; 92º24′41″W
6d: Creek behind Dyson Creek Road	31º31′44″N; 92º24′44″W
6e: “Headwater pool” for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #9: 6-16-09
Non-Rain Event

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	64	371	0.795	0.707	-11	25.0
2	0.05	148	364	1.157	1.071	-7	25.0
4	0.04	200	412	0.957	0.906	-5	26.0
4b	0.08	96	35	2.002	1.949	-3	25.0
5	ND	116	365	0.565	0.467	-17	25.0
6	ND	217	840	0.157	0.183	+17	25.0
6a	ND	152	514	0.280	0.223	-20	24.0
6d	0.08	2,280	Confluent	1.052	0.680	-35	24.0
6e	ND	96	440	-0.140	-0.113	--	22.0
7	0.05	88	460	0.733	0.772	+5	26.0
12	0.08	237	400	1.150	0.897	-22	26.0
14	ND	330	543	0.303	0.372	+23	25.0
16	ND	<2	<2	-0.089	-0.039	--	26.0

ND means not detected (detection limit = 0.03 mg/L); A 0.025% standard Tide® solution was reduced by 65% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6a: Creek behind Dyson Creek Road	31º31′44″N; 92º24′41″W
6d: Creek behind Dyson Creek Road	31º31′44″N; 92º24′44″W
6e: “Headwater pool” for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W
16: Field Blank	

Event #10: 7-6-09
Rain Event: 1.18 inches

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.04	1,680	1,657	1.205	1.166	-3	24.0
2	0.06	530	829	1.194	1.255	+5	25.0
3	0.15	Confluent	Confluent	4.834	4.801	-1	25.0
4	0.06	Confluent	Confluent	1.142	1.157	+1	26.0
4b	0.09	2,224	Confluent	2.598	2.680	+3	26.5
5	0.05	1,560	2,171	0.865	0.893	+3	25.0
6	0.18	4,760	Confluent	1.620	1.608	-1	25.0
6e	0.06	174	1,686	0.621	0.565	-9	21.0
7	0.06	320	840	0.832	0.857	+3	26.0
12	0.06	380	540	1.119	1.067	-5	25.0
14	0.04	266	400	0.699	0.636	-9	25.0
15	0.04	400	400	0.654	0.619	-5	25.0
16	ND	<2	<2	0.255	0.163	-36	24.0

ND means not detected (detection limit = 0.03 mg/L); A 0.025% standard Tide® solution was reduced by 67% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
3. Hwy 165 Storm Drain	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6e: “Headwater pool” for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #11: 7-22-09
Rain Event: 3.21 inches

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	0.17	3,840	3,600	2.474	2.312	-7	23.5
2	0.08	4,832	1,886	1.190	1.112	-7	24.0
3	0.12	14,560	Confluent	4.782	4.646	-3	24.0
4	0.16	7,440	Confluent	1.813	1.624	-10	24.0
4b	0.09	9,920	Confluent	1.741	1.608	-8	25.0
5	0.06	10,920	Confluent	1.075	0.978	-9	23.0
6	0.58	11,400	Confluent	2.780	2.692	-3	24.0
6e[a]	0.06	3,400	2,300	1.608	1.617	+1	24.0
7	0.05	885	1,040	0.585	0.571	-2	25.0
12	0.78	28,000	Confluent	2.481	2.307	-7	24.0
14	0.08	5,240	Confluent	1.769	1.560	-12	24.0
16	ND	<2	<2	-0.058	-0.090	--	24.5

[a]Sample was taken in a ditch upstream from the "Headwater" pool; ND means not detected (detection limit = 0.03 mg/L); A 0.025% standard Tide® solution was reduced by 67% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
3. Hwy 165 Storm Drain	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6e: Upstream from"Headwater pool" for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W
15: Duplicate of #14	
16: Field Blank	

Event #12: 7-29-09
Rain Event: 1.07 inches

Site #	Orthophosphate P (mg/L)	Fecal Coliforms (col/100 mL)	Total Coliforms (col/100 mL)	Optical Brighteners (OB units)	Optical Brighteners (OB units) UV Light	% Change	Temp (ºC)
1	ND	124	761	1.144	1.033	-10	24.5
2	0.05	168	880	1.508	1.469	-3	24.0
3	ND	4,700	2,381	2.633	2.496	-5	24.5
4	0.06	2,100	2,476	1.524	1.487	-2	24.0
4b	0.08	5,000	26,000	1.585	1.502	-5	27.0
5	0.05	7,250	20,000	1.319	1.184	-10	25.0
6	0.03	977	1,320	0.620	0.568	-8	23.0
6a	0.04	1,483	1,480	0.687	0.560	-18	24.0
6d	0.07	580	732	0.621	0.569	-8	24.0
6e	0.33	11,500	28,000	2.149	2.150	0	26.0
7	0.09	3,900	2,600	1.714	1.668	-3	25.0
12	0.05	116	394	1.310	1.263	-4	24.0
14	0.05	144	761	0.562	0.485	-14	24.0
15	ND	<2	<2	-0.210	-0.079	--	23.0
16	0.04	1,250	1,560	NM[a]	NM	NM	23.0

ND means not detected (detection limit = 0.03 mg/L); [a] Not Measured; A 0.025% standard Tide® solution was reduced by 74% following UV exposure.

1: Flem Branch off of Mary Barron Road	31º34′07″N; 92º25′55″W
2: Big Creek at Mary Barron Road	31º33′48″N; 92º26′17″W
3. Hwy 165 Storm Drain	31º33′32″N; 92º24′46″W
4: Big Creek Bridge at 165	31º32′09″N; 92º24′27″W
4b: Bridge at 165 southbound of site 4	31º32′02″N; 92º24′28″W
5: Dyson Creek at Dyson Creek Road	31º32′23″N; 92º25′38″W
6: Sugar Branch at 165	31º31′45″N; 92º24′27″W
6a: Creek behind Dyson Creek Road	31º31′44″N; 92º24′41″W
6d: Creek behind Dyson Creek Road	31º31′44″N; 92º24′44″W
6e: Upstream from“Headwater pool” for Site 6	31º31′43″N; 92º25′33″W
7: Downstream from Waste Treatment	31º31′41″N; 92º23′48″W
12: Big Creek north of Dyson Road	31º34′16″N; 92º27′29″W
14: Big Creek at Dry Prong, LA	31º34′12″N; 92º31′33″W
15: Field Blank	
16: Duplicate of Site #6	

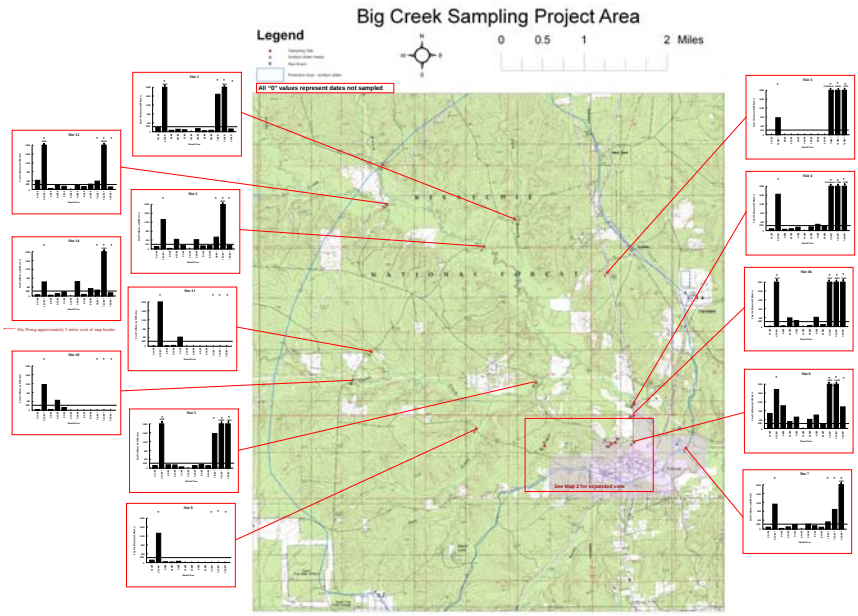
Appendix 3
Map with fecal coliform results

Big Creek Fecal Coliform Sources

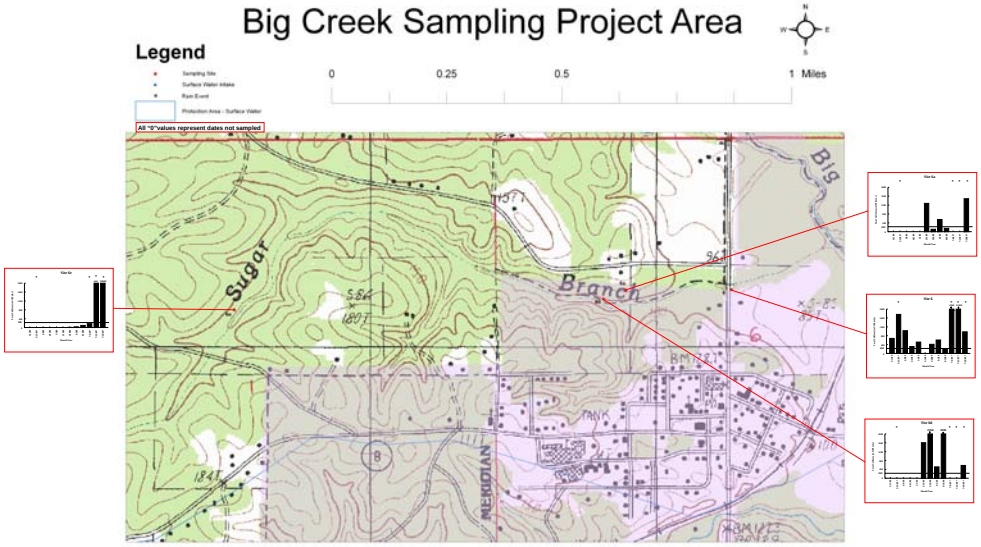
Kevin N. Baer [1], Micaela Coner[2]

[1]University of Louisiana at Monroe, College of Pharmacy, Department of Toxicology, Monroe, LA 71209-0470

[2]Louisiana Department of Environmental Quality, Office of Environmental Assessment, Baton Rouge, LA 70821-4314



Appendix 4
Map 2 with fecal coliform results from
Sites 6, 6a, 6d, and 6e

Big Creek Fecal Coliform Sources
Map 2: Sites 6, 6a, 6d, and 6e

Kevin N. Baer [1], Micaela Coner[2]
[1]University of Louisiana at Monroe, College of Pharmacy, Department of Toxicology, Monroe, LA 71209-0470
[2]Louisiana Department of Environmental Quality, Office of Environmental Assessment, Baton Rouge, LA 70821-4314