Texas A&M AgriLife
Texas Water Resources Institute

Fate and Transport of Bacteria in Rural Texas Streams
FY07 CWA Section 319(h)
TSSWCB Project No. 07-06

Quarter no. 6 From 1/01/09 Through 4/15/09

I. Abstract

Work this quarter has focused on the collection of fecal samples and the identification of bacteria sources in the watershed. Live trapping and camera surveillance has been used to carry this task out. During the quarter, a total of 1260 trap nights were completed and numerous animals were identified as a result. Camera surveillance was conducted using 30 cameras for 22 consecutive days resulting in 660 camera nights. Numerous wildlife, livestock and other species were identified using these cameras. Approximately 50 samples have been analyzed thus far. Ambient samples, water samples after bed disturbance, and bed sediment samples were collected at Resley Creek under baseflow conditions. Livestock numbers within the watershed have been estimated based on the CEA and NRCS stocking rate recommendations and land use acreages.

II. Overall Progress and Results by Task

TASK 1: Project Coordination and Administration

Subtask 1.1: TWRI will prepare electronic quarterly reports for submission to the TSSWCB. All progress reports will be provided to all Project Participants. (Month 1 - 36).

The following actions have been completed during this reporting period:

a. The year 2, quarter 2 report was completed and sent to the TSSWCB on April 15, 2009.

50% Complete

Subtask 1.2: TWRI will coordinate quarterly meetings (in person or TTVN) as appropriate with project participants to discuss project activities, project schedule, lines of responsibility, communication needs, and other requirements. (Month 1 – 36).

The following actions have been completed during this reporting period:

a. A meeting was held March 4th with all project personnel to discuss the progress of the project and future activities.

50% Complete

Subtask 1.3: TWRI will attend meetings with the TSSWCB project manager and other meetings, as needed, to review project status, deliverables, etc. (Month 1 – 36).

The following actions have been completed during this reporting period:

a. Project personnel held a meeting on March 4, 2009 to discuss the project.

50% Complete

Subtask 1.4: TWRI will submit appropriate Reimbursement Forms. (Month 1 – 36).

The following actions have been completed during this reporting period:

a. As of February 28, 2009, a total of $89,041.90 or 29.6% of total project funding has been expended.

30% Complete

Subtask 1.5: TWRI will develop (Months 1-3), host and maintain (Months 3-36) an internet website for the dissemination of information. (Month 1 – 36).

The following actions have been completed during this reporting period:

a. The project website has been completed and is now available online. The web address for this site is: http://bft.tamu.edu.
b. The project will be updated at least quarterly throughout the course of this project.

96% Complete

Subtask 1.6: TWRI and Texas AgriLife Extension will work together to develop the Final report. (Month 30 – 36).

The following actions have been completed during this reporting period:

a. No activity to report at this time.

0% Complete

Subtask 1.7: TWRI and Extension will work together to develop publications, brochures and reports that will be disseminated for educational purposes. (Month 1 – 36).

The following actions have been completed during this reporting period:

a. No activity to report at this time.

0% Complete

Task 2: Development of Quality Assurance Project Plan

Subtask 2.1: TWRI will develop a QAPP that will detail project goals and objectives relating to water quality monitoring activities; identify the data needed to fulfill those objectives; list field and laboratory methods; describe procedures and schedules to be followed; and specify a data management structure and the quality assurance protocols. (Month 1 – 6).

The following actions have been completed during this reporting period:

a. The QAPP has been developed and approved by TSSWCB and EPA.

100% Complete

Subtask 2.2: Provide annual revisions to the QAPP and amendments, as necessary, to the TSSWCB and EPA. (Month 6 – 36).

The following actions have been completed during this reporting period:

a. No activity to report at this time.
b. The first annual revision is due next quarter.

0% Complete

Task 3: Conducting sanitary surveys to identify potential *E. coli* contributing sources in the impaired watershed

Subtask 3.1: Choose a suitable watershed from the provided list of bacteria impaired stream segments. (Month 1 – 2).

The following actions have been completed during this reporting period:

a. This subtask is completed. Cedar Creek, Segment 1209G, in the Brazos River basin was selected for this study.

100% Complete

Subtask 3.2: Travel to the selected watershed and conduct a renaissance survey of the watershed and sources. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. In total, two landowners have agreed to cooperate on the project. Several others were contacted but preferred not to participate. The two properties that we will have access to total about 2,500 acres.
b. GIS was used to delineate the research areas to be used within these properties. This information was used to develop trapping and camera grids and estimate the cattle stocking rate within the watershed based on the rates that were given by the local CEA's.

100% Complete

Subtask 3.3: Conduct a thorough sanitary survey to identify various wildlife sources that contribute E. coli loads during winter. This survey will be conducted by a wildlife expert. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. During this quarter wildlife experts have conducted trapping and visual surveillance using motion activated cameras to identify wildlife sources, collect fecal samples and to determine population densities of various species.
b. In total, 3,730 trap nights have been completed and 1360 trap nights have been completed using motion activated cameras. Approximately 2500 pictures have been taken prior to March 31st.

100% Complete

Subtask 3.4: Conduct a thorough sanitary survey to identify various domestic livestock and poultry sources and waste streams that contribute E. coli loads during winter. This survey will be conducted by an extension county agent and/or an animal-production agriculture expert. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. Information on poultry litter application has been requested from TSSWCB's Centerville Field Office; but has not been received as of yet.
b. Livestock stocking rates have been calculated for the watershed using NRCS' recommended stocking rates for designated land uses.

20% Complete

Subtask 3.5: Verify and update wildlife survey with inputs from stakeholders and Texas Parks and Wildlife personnel and domestic animal survey with inputs from stakeholders, ranchers, and extension county agents. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. Contacts have been made with TPWD local biologists to begin verifying estimated wildlife numbers in the watershed.

15% Complete

Subtask 3.6: Conduct a thorough sanitary survey to identify various wildlife sources that contribute E. coli loads during summer. This survey will be conducted by a wildlife expert. (Month 8 – 12).

The following actions have been completed during this reporting period:

a. No activity to report this quarter.

75% Complete

Subtask 3.7: Conduct a thorough sanitary survey to identify various domestic livestock and poultry sources and waste streams that contribute E. coli loads during summer. This survey will

be conducted by an extension county agent and/or an animal-production agriculture expert. (Month 8 – 12).

The following actions have been completed during this reporting period:

c. Information on poultry litter application has been requested from TSSWCB's Centerville Field Office; but has not been received as of yet.
d. Livestock stocking rates have been calculated for the watershed using NRCS' recommended stocking rates for designated land uses.

20% Complete

Subtask 3.8: Verify and update wildlife survey with inputs from stakeholders and Texas Parks and Wildlife personnel and domestic animal survey with inputs from stakeholders, ranchers, and county Extension agents. (Month 12 – 14).

The following actions have been completed during this reporting period:

a. Contacts have been made with TPWD local biologists to begin verifying estimated wildlife numbers in the watershed.

15% Complete

Task 4: Conducting demonstration experiments to characterize and quantify *E. coli* loads from identified sources

Subtask 4.1: Collect feces samples of relevant and dominant identified sources (five maximum) and samples of waste streams (five maximum) identified in Task 4 during winter. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. A wildlife expert has conducted 160 fecal transects and collected 20 cow fecal samples. A total of 158 small mammals were captured this quarter.
b. White-tailed deer trapping will continue into the next quarter and its completion will conclude this task.

85% Complete

Subtask 4.2: Extract feces samples and waste streams for E. coli collected during winter. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. Samples collected this quarter have not been extracted yet.

0% Complete

Subtask 4.3: Analyze samples collected during winter for E. coli using EPA's approved enumeration technique. (Month 6 – 8).

The following actions have been completed during this reporting period:

a. Samples collected this quarter have not yet been analyzed.

0% Complete

Subtask 4.4: Calculate the E. coli load resulting from all identified sources collected during winter. (Month 8 – 10).

The following actions have been completed during this reporting period:

a. No activity to report this quarter.

0% Complete

Subtask 4.5: Collect feces samples of relevant and dominant identified sources (five maximum) and samples of waste streams (five maximum) identified in Task 3 during summer. (Month 10 – 12).

The following actions have been completed during this reporting period:

a. Fecal material samples were collected regularly from 2 identified ranches.
b. The collected samples were delivered to the BAEN lab for analysis.

55% Complete

Subtask 4.6: Extract feces samples and waste streams for E. coli collected during summer. (Month 10 – 12).

The following actions have been completed during this reporting period:

a. *E. coli* is extracted from all the samples that gave positive results upon analysis.

50% Complete

Subtask 4.7: Analyze samples collected during summer for E. coli using EPA's approved enumeration technique. (Month 10 – 12).

The following actions have been completed during this reporting period:

b. No activity to report this quarter.

20% Complete

Subtask 4.8: Calculate the E. coli load resulting from all identified sources collected during summer. (Month 12 – 14).

The following actions have been completed during this reporting period:

a. Based on the analyses carried out in Task 4.7, E. coli loads resulting from the identified sources are calculated.

25% Complete

Task 5: Monitoring fate (survival, growth, re-growth, and die-off) of *E. coli* under different environmental conditions

Subtask 5.1: Prepare collected samples in Task 4.5 for this monitoring study. (Month 12)

The following actions have been completed during this reporting period:

a. 3 samples each from 2 species are selected for the monitoring study.

20% Complete

Subtask 5.2: Measure growth kinetics of E. coli in different sources under varying environmental conditions. (Month 12 – 20).

The following actions have been completed during this reporting period:

a. The growth of E. coli for 2 species (taking 3 sub-samples and 3 replicates of each sub-sample) was measured under four different temperature conditions (0°, 10°, 20°, 50°)
b. The growth of E. coli for 2 species (taking 3 sub-samples and 3 replicates of each sub-sample) is being measured under four different moisture conditions (0%, 20%, 50% and 75%)

30% Complete

Subtask 5.3: Measure survival of E. coli in different sources under varying environmental conditions. (Month 12 – 20).

The following actions have been completed during this reporting period:

a. The growth of E. coli for 2 species (taking 3 sub-samples and 3 replicates of each sub-samples) was measured under four different temperature conditions (0°, 10°, 20°, 50°).
b. The growth of E. coli for 2 species (taking 3 sub-samples and 3 replicates of each sub-sample) is being measured under four different moisture conditions (0%, 20%, 50% and 75%)

30% Complete

Subtask 5.4: Measure re-growth of E. coli in different sources under optimum conditions. (Month 20 – 26).

The following actions have been completed during this reporting period:

a. No activity to report this quarter.

0% Complete

Task 6: Monitoring concentration of *E. coli* in the instrumented stream as a result of rainfall and runoff events

Subtask 6.1: Collect water samples during summer for two rainfall-runoff events. (Month 8 - 32).

The following actions have been completed during this reporting period:

a. Samples from one runoff event have been collected.

25% Complete

Subtask 6.2: Collect water samples during winter for two rainfall-runoff events. (Month 8 – 32).

The following actions have been completed during this reporting period:

a. No activity to report at this time.

0% Complete

Subtask 6.3: Collect stream bed sediments after each water sample collection periods. (Month 8 – 32).

The following actions have been completed during this reporting period:

a. Streambed samples were collected for one baseflow event (3/17/2009)

35% Complete

Subtask 6.4: Analyze water and sediment for E. coli concentrations. (Month 8 – 34).

The following actions have been completed during this reporting period:

a. Water samples and streambed samples collected have been sent to the lab for analysis next quarter.

25% Complete

Subtask 6.5: Measure growth kinetics, survival, and re-growth E. coli in stream bed sediments under different environment conditions. (Month 9 – 32).

The following actions have been completed during this reporting period:

a. No activity to report this quarter.

0% Complete

Subtask 6.6: Mechanically disturb stream bed sediments four times; twice each during summer and winter, collect grab water samples, and analyze the samples for E. coli. (Month 9 – 32).

The following actions have been completed during this reporting period:

a. Collected ambient water samples, water samples after bed disturbance, and bed sediment samples all under baseflow conditions at Resley Creek on March 17, 2009.

25% Complete

III. Related Issues/Current Problems and Favorable or Unusual Developments

a. Two landowners have agreed to cooperate on the project and allow sampling to be conducted on their properties. Ideally, more landowners would have been willing to cooperate; however, the two landowners that did agree to cooperate own approximately 2,500 acres that spans a representative portion of the watershed.
b. Stocking rates were estimated within the watershed at NRCS recommended stocking rates of 4 animal units (AU) per acre (ac) for improved pasture, and 8 AU/ac for rangeland. This respectively resulted in 17,920 and 8,960 AU in the watershed assuming that all appropriate landuses were utilized.
c. Runoff producing rainfall events continue to elude the monitoring area; as a result runoff sample collection is lagging behind.

IV. Projected Work for Next Quarter

- More fecal samples are being received therefore the laboratory analysis will continue.
- Out of the samples analyzed, some samples will be selected and prepared for monitoring fate of *E. coli* under different environmental conditions. The growth kinetics and survival of *E. coli* will be measured under varying environmental conditions and its re-growth will be monitored under optimum conditions.
- Conduct White-tailed Deer trapping to collect further fecal samples and estimate watershed populations.