Texas State Soil and Water Conservation Board
State General Revenue Nonpoint Source Grant Program
FY 2011 Project 11-51 Workplan

PROJECT SUMMARY PAGE			
Title of Project	Instream Bacteria Influences from Bird and Bat Habitation of Bridges		
Project Goals/Objectives	To develop and implement an experimental study design providing for the collection of environmental data to test the hypothesis that bridges containing significant numbers of roosting and nesting birds and bats increase ambient bacteria concentrations of streams under low flow conditions as compared to the situation where roosting and nesting is absent.		
Project Tasks	(1) Project Administration; (2) Quality Assurance; (3) Conduct RUAA Surveys; (4) Data Reporting and Final Report		
Measures of Success	• Finding and selecting appropriate bridge crossings of streams for the study. • Collection of adequate environmental data to allow statistical evaluation of a test hypothesis regarding instream bacteria influences from bird and bat habitation of bridges. • Development of a final technical report providing results, discussions, and conclusions from the study.		
Project Type	Implementation ( ); Education ( ); Planning ( ); Assessment (X)		
Status of Waterbody on 2008 Texas Water Quality Inventory and 303(d) List	Segment ID Leon River below Proctor Lake Lampasas River	Parameter Bacteria Bacteria	Category 5a 5c
Project Location (Statewide or Watershed and County)	Leon River Watershed below Proctor Lake and above Belton Lake in Comanche, Hamilton, Erath, Coryell, Mills, and Bell Counties and Lampas River Watershed in Bell, Burnet, Coryell, Hamilton, Lampasas, Mills, and Williamson Counties		
Key Project Activities	Hire Staff ( ); Surface Water Quality Monitoring (X); Technical Assistance ( ); Education ( ); Implementation ( ); BMP Effectiveness Monitoring ( ); Demonstration ( ); Planning ( ); Modeling ( ); Bacterial Source Tracking (X); Other (X)		
Texas NPS Management Program Elements	• Element 1 (LTG Objective A) • Element 1 (STG 1B) • Element 5		
Project Costs	$143,312		
Project Management	Texas Institute for Applied Environmental Research		
Project Period	August 29, 2011 – July 31, 2013		

Part I – Applicant Information

Applicant							
Project Lead	Larry Hauck						
Title	Lead Scientist						
Organization	Texas Institute for Applied Environmental Research						
E-mail Address	hauck@tiaer.tarleton.edu						
Street Address	Box T-0410						
City	Stephenville	County	Erath	State	Texas	Zip Code	76402
Telephone Number	254.968.9561			Fax Number	254.968.9559		

Project Partners	
Names	Roles & Responsibilities
Texas State Soil and Water Conservation Board (TSSWCB)	Provide state oversight and management of all project activities and ensure coordination of activities with related projects.
Texas Institute for Applied Environmental Research at Tarleton State University (TIAER)	Coordinate and manage all work described in Tasks. Conduct water quality monitoring and analyses. Disseminate information about the project to key agencies and interest groups.
Texas AgriLife Research (AgriLife)	Recipient of BST samples
Texas Parks and Wildlife Department (TPWD)	Assist in site selection for the project and provide limited participation and assistance during sampling events.

Part II – Project Information

Watershed Information				
Watershed Name	Hydrologic Unit Code (8 Digit)	Segment ID	305(b) Category	Size (Acres)
Leon River below Proctor Lake and above Belton Lake	12070201	1221	5a	871,488
Lampasas River above Stillhouse Hollow Lake	12070203	1217	5c	839,800

Water Quality Impairment
Describe all known causes of water quality impairments from any of the following sources: 2008 Texas Water Quality Inventory and 303(d) List, Clean Rivers Program Basin Summary/Highlights Reports, or other documented sources.
The 2008 303(d) List identifies 379 impairments (waterbody-pollutant combinations) for contact recreation use and 26 impairments for oyster water use. These impairments are due to excessive bacteria (E. coli, Enterococcus spp., or fecal coliform). These 405 total bacteria impairments account for more than 48% of all waterbody-pollutant combinations on the 2008 List. Wildlife, including birds and bats nesting under bridges, are a known or attributed source of fecal NPS pollution and bacteria loading in most of these watersheds.

Project Narrative

Problem/Need Statement

Bridge crossings often afford a place of ready convenience and safe access for water quality sample collection of streams and rivers. The representativeness of ambient water samples collected from bridge crossings is, however, at times brought into question during public meetings and other forums. The questions typically arise where there is a concern that there might be a bias toward more elevated pollutant concentrations in the immediate vicinity of bridges as compared to river reaches not immediately influenced by bridge crossings. The additional pollutants are derived from birds and bats roosting and nesting on the bridge structures that can occur at some bridge locations.

Water quality specialists recognize the potential legitimacy of the concern of bias from sample location, but must weigh that concern against other factors that include personnel safety, cost, and ease of access. To minimize against any possible biases, the general practice is to sample from the upstream side of the bridge whenever safety issues do not necessitate sampling from the downstream side.

One area of water quality studies where this issue of potential bias toward elevated pollutant levels is often vocalized, especially by stakeholders and local citizenry, is during watershed planning efforts to develop Total Maximum Daily Loads (TMDLs) or Watershed Protection Plans (WPPs) addressing bacteria contamination and recreational use. Because fecal material of bat and bird species that may nest and roost on bridges contains bacteria, such as the state's freshwater indicator bacteria *Escherichia coli* (*E. coli*), at concentrations multiple orders-of-magnitude higher than ambient water criteria and because bacteria concentrations may rapidly decrease in concentration downstream of sources due to settling and die-off, there seems to be some legitimacy to the concerns being vocalized.

There is a broadly recognized concern that collection of water samples from a bridge represents the potential of collecting a sample with higher levels of pollutants than contained in waters removed from proximity to a bridge crossing. This concern of higher pollutant levels is especially pertinent regarding bacteria sampling where direct deposition of fecal material from bat and bird species inhabiting the bridge can contain bacteria concentrations multiple orders-of-magnitude higher than relevant water quality criteria.

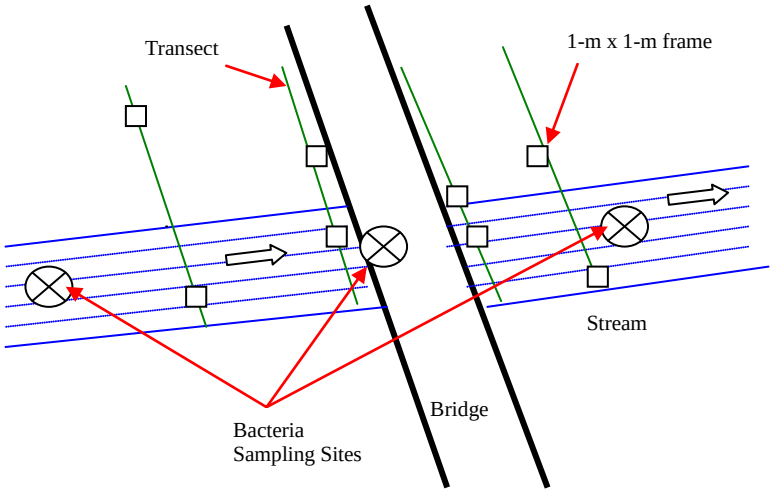
The results of this project have the potential to prove or disprove sampling bias for bacteria collected from bridge locations under certain environmental conditions, which in turn has implications on the validity of the bacteria data used in the 305(b) assessment process and cascading implications on the validity of some waterbodies on the 303(d) list and those waterbodies needing NPS abatement efforts in their watersheds. Further, the results of the project have the potential to inform the selection of stream sampling locations in future projects to minimize potential biases in bacteria results.

Project Narrative

General Project Description (Include Project Location Map)

This project is designed to investigate the presence or absence of statistically significant increases in bacteria concentrations in samples collected from the upstream side of bridge crossings of streams inhabited by significant populations of birds or bats. To obtain the necessary number of *E. coli* samples and ancillary data to perform the statistical computations, three bridge crossings of streams will be sampled repeatedly by means of multiple samples collected during the same one-day survey and by conducting multiple surveys at each crossing.

Based on reconnaissance within the Leon and Lampasas Rivers watersheds, two bridges will be selected that host roosting or nesting populations of birds or bats and one bridge will be selected as a control with either an absence or minimal presence of birds and bats. At each bridge crossing three sampling sites will be established—upstream of the bridge, at the upstream side of the bridge, and downstream of the bridge. During a single survey each of the three sites in the vicinity of a bridge crossing will be sampled 15 times for *E. coli*. Seven surveys will be conducted at each crossing. Each of the three sites at each of the three bridges will over the course of the study have 105 *E. coli* samples collected. All *E. coli* analyses will be performed by the TIAER Laboratory, which is NELAP accredited for this analyte. All surveys will be conducted under low-flow conditions not influenced by stormwater runoff. Low-flow conditions were selected as a criterion for survey conditions, because these conditions occur frequently in Texas streams and these conditions maximize the influence of fecal deposition on instream conditions as compared to higher flows that afford greater dilution. A single streamflow measurement and a single multiprobe instrument reading of water temperature, pH, dissolved oxygen, and specific conductance will be made in the vicinity of each bridge crossing during each survey.



Each survey event will also consist of a semi-quantitative measurement of direct fecal matter deposition using 1-meter x 1-meter frames covered with a material such as thick plastic. Immediately following completion of the bacteria sampling, eight frames will be positioned horizontally along four pre-determined transects; two frames per transect. One transect will be a short distance upstream of the bridge, the second along the upstream end of the bridge, the third along the downstream end of the bridge, and the fourth a short distance downstream of the bridge. Each transect will start at the far edge of the water and be aligned perpendicular to the bridge such that the transect continues across the water and partially through the floodplain of the stream. Frame locations will be determined by using stratified random sampling wherein two frames will be placed along each of the four transects and one frame will be positioned over the water and the other over the land. A rough schematic of a bridge crossing showing sampling sites and transects is provided.

Random sampling repeated for each event will determine the exact position of each frame within its water or land portion of each transect. All frames will be retrieved the following day after approximately 24-hours of deployment and the number of droppings counted. Data obtained from frames will be normalized to an exact 24-hour period.

The environmental data will be evaluated statistically using as the controls both the upstream sample site for bridges with habitation of birds and bats and the bridge without such habitation occurring. Study design, all environmental data, statistical methods, findings, discussion, and conclusions will comprise a final technical project report.

Project Goals (Expand from Summary Page)

The goal of this project is to test the hypothesis that bridges containing significant populations of roosting and nesting birds and bats result in an increase in *E. coli* concentrations in the stream water immediately below and downstream of the bridge under low-flow conditions not influenced by stormwater runoff. This goal addresses a concern voiced on occasion at stakeholder meetings for TMDLs and WPPs directed to bacteria as a pollutant. That concern is that sampling from bridges may result in data that are biased higher as a result of deposition of materials containing bacteria from sources especially congregated under and around bridges, which for this study is nesting and roosting birds and bats. While this study is too small to be considered comprehensive, the goal of this study is to scientifically address these concerns regarding biases from sampling at bridges for bacteria as a pollutant.

Measures of Success (Expand from Summary Page)

The measures of success discussed below represent a progression that must be sequentially accomplished to realize the ultimate success of this project.

- Appropriate bridge crossings of streams must be located through a reconnaissance process. Three bridge crossings are planned for the study with two bridges habited by populations of birds and/or bats and the third bridge having either an absence or negligible habitation of birds and bats. The bridges must also be associated with physical and morphological characteristics of the stream and floodplain that allow access to the water both upstream and downstream along with other conditions favorable to conducting stream and the fecal deposition sampling.
- Adequate environmental data need to be collected to allow statistical evaluation of a test hypothesis regarding instream bacteria influences from bird and bat habitation of bridges. Based on *E. coli* data collected on the North Bosque River and its tributaries, a sample size of approximately 100 was determined as appropriate for the bacteria portion of the project. The present study provides for 105 samples per site.
- Publishing of the findings of the study is critical to informing others regarding pertinent results. This measure of success will be accomplished when the project report is finalized.

2005 Texas Nonpoint Source Management Program Reference (Expand from Summary Page)

Element 1 – Explicit short- and long-term goals, objectives and strategies that protect surface and groundwater

Long Term Goal, Objective A: Focus NPS abatement efforts, implementation strategies, and available resources in watersheds identified as impacted by nonpoint source pollution.

Short-Term Goal One – Data Collection and Assessment – Objective B: Ensure that monitoring procedures meet quality assurance requirements and are in compliance with EPA-approved TCEQ and/or TSSWCB Quality Management Plans.

Element 5 – The state program identifies water and their watersheds impaired by nonpoint source pollution… Further, the state establishes a process to progressively address these identified waters by conducting more detailed watershed assessments and developing watershed implementation plans, and then by implementing the plans.

Tasks, Objectives and Schedules				
Task 1	Project Administration			
Costs	$7,056			
Objective	To effectively administer, coordinate and monitor all work performed under this project including technical and financial supervision and preparation of status reports.			
Subtask 1.1	TIAER will prepare electronic quarterly progress reports (QPRs) for submission to the TSSWCB. QPRs shall document all activities performed within a quarter and shall be submitted by the 15th of March, June, September, and December. QPRs shall be distributed to all Project Partners.			
	Start Date	Month 1	Completion Date	Month 24
Subtask 1.2	TIAER will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.			
	Start Date	Month 1	Completion Date	Month 24
Subtask 1.3	TIAER will host coordination meetings or conference calls with TSSWCB and other Project Partners, as appropriate, at least quarterly to discuss project activities, project schedule, communication needs, deliverables, and other requirements. TIAER will develop lists of action items needed following each project coordination meeting and distribute to project personnel.			
	Start Date	Month 1	Completion Date	Month 24
Subtask 1.4	TIAER will discuss and promote the project at appropriate meetings, including but not limited to, meetings with SWCDs, watershed planning groups, TSSWCB Southeast and South Central Watershed Coordination Steering Committee, the Texas Watershed Coordinator Roundtable, and the Texas Clean Rivers Program Basin Steering Committees.			
	Start Date	Month 1	Completion Date	Month 24
Deliverables	• Quarterly progress reports in electronic format • Reimbursement Forms and necessary documentation in hard copy format • List of action items needed from project coordination meetings			

Tasks, Objectives and Schedules				
Task 2	Quality Assurance			
Costs	$5,783			
Objective	To develop data quality objectives (DQOs) and quality assurance/quality control (QA/QC) activities to ensure data of known and acceptable quality are generated through this project.			
Subtask 2.1	TIAER will develop a QAPP for activities in Task 3 consistent with the most recent versions of *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* and the *TSSWCB Environmental Data Quality Management Plan.* Consistency with Title 30, Chapter 25 of the Texas Administrative Code, *Environmental Testing Laboratory Accreditation and Certification*, which describes Texas' approach to implementing the National Environmental Laboratory Accreditation Conference standards, shall be required. All monitoring procedures and methods prescribed in the QAPP shall be consistent with the guidelines detailed in the *TCEQ Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods for Water, Sediment, and Tissue (RG-415)* and *Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data (RG-416).*			
	Start Date	Month 1	Completion Date	Month 3
Subtask 2.2	TIAER will implement the approved QAPP. TIAER will submit revisions and necessary amendments to the QAPP as needed.			
	Start Date	Month 4	Completion Date	Month 24
Deliverables	• QAPP approved by TSSWCB in both electronic and hard copy formats • Approved revisions and amendments to QAPP, as needed • Data of known and acceptable quality as reported through Task 4			

Tasks, Objectives and Schedules				
Task 3	Conduct Environmental Monitoring			
Costs	$106,187			
Objective	To collect environmental data of sufficient quantity and quality to allow assessment of the effects of bird and bat habitation under bridges on *E. coli* concentrations under low flow conditions.			
Subtask 3.1	TIAER will conduct a literature search for refereed journal articles, technical reports, and other publications that examine the fecal loading rates and instream bacteria influences of birds and bats inhabiting bridges. TIAER will consult with Center for Research in Water Resources at the University of Texas at Austin and the Texas Department of Transportation to include publications they may have found. Results of literature shall be included in the Final Report.			
	Start Date	Month 1	Completion Date	Month 6
Subtask 3.2	TIAER, with assistance from TPWD, will conduct reconnaissance trips in the Leon River and Lampasas River watersheds to determine the specific bridge locations where monitoring will be conducted. Two bridges will be selected that host roosting or nesting populations of birds and/or bats and one bridge will be selected as a control with either an absence or minimal presence of birds and bats. The QAPP, as detailed in Task 2, will precisely identify sites.			
	Start Date	Month 1	Completion Date	Month 3
Subtask 3.3	TIAER, with limited assistance from TPWD, will conduct water quality monitoring during 7 survey events at 3 bridge crossings collecting field, flow, and bacteria parameter groups under biased flow conditions (low flow not influenced by stormwater runoff). Multiple water samples (15) will be collected from 3 locations at each of the 3 bridges (upstream of bridge, upstream edge of bridge, downstream of bridge) during each survey for bacteria analysis only; field and flow parameters will only be collected once at a single location at each bridge during each survey. TIAER Laboratory will perform *E. coli* enumeration on collected samples within the holding time constraint identified in the QAPP. The number of bacteria samples planned for collection through this subtask is 945; the number of field and flow samples planned for collection through this subtask is 21. Field parameters are pH, temperature, specific conductance, and dissolved oxygen. Flow parameters are flow collected by gage, electric, mechanical or Doppler, including severity. Bacteria parameters are *E. coli* enumerated using USEPA Method 1603.			
	Start Date	Month 4	Completion Date	Month 22
Subtask 3.4	TIAER, with limited assistance from TPWD, will deploy frames for measuring direct fecal matter deposition and directly quantify the deposition by counting droppings in coordination with the survey events of Subtask 3.3. The deployment and quantification will occur at each of the 3 bridges for each of the 7 survey events.			
	Start Date	Month 4	Completion Date	Month 22
Subtask 3.5	TIAER, with assistance from TPWD, will inventory birds and bats inhabiting the 3 bridge crossings, including species identification and population counts.			
	Start Date	Month 4	Completion Date	Month 22
Subtask 3.6	TIAER will store Method 1603 modified mTEC plates, from 90 water samples from subtask 3.3, at 4°C for shipment to AgriLife. TIAER will coordinate the shipment of these samples with AgriLife such that they are received in College Station within 3 days following enumeration. Stored samples may be used by AgriLife to conduct library-dependent BST and analyze E. coli isolates utilizing ERIC-PCR and/or RiboPrinting methods.			
	Start Date	Month 4	Completion Date	Month 22
Subtask 3.7	The Texas Known Source BST Library needs to be supplemented with known fecal samples from the study area. TIAER will deliver to AgriLife up to 20 known source fecal samples collected through subtask 3.4 for possible addition to the BST library. Fecal samples will be stored at 4°C and shipped to AgriLife for analysis. TIAER will coordinated the shipment of these samples with AgriLife such that they are received in College Station within 3 days of collection.			
	Start Date	Month 4	Completion Date	Month 22

Deliverables	• Results of literature search included in Final Report • Water quality and fecal loading data of known and acceptable quality as reported through Task 4. • Samples (bacteria in water and known fecal source) provided to AgriLife for future BST

Tasks, Objectives and Schedules				
Task 4	Data Management and Reporting			
Costs	$24,286			
Objective	To manage and transfer monitoring data for inclusion in the TCEQ SWQMIS and to develop a Final Report summarizing the results and activities of the project.			
Subtask 4.1	TIAER will review and transfer appropriate monitoring data from activities in Task 3 to TSSWCB for inclusion in the TCEQ SWQMIS quarterly. Data will be transferred in the correct format using the TCEQ file structure, along with a completed Data Summary, as described in the most recent version of the *TCEQ Surface Water Quality Monitoring Data Management Reference Guide*. TIAER will submit Station Location Requests as needed to obtain TCEQ station numbers for new monitoring sites. TIAER will input monitoring regime, as detailed in the QAPP, into the TCEQ CMS. Data Correction Request Forms will be submitted to TSSWCB whenever errors are discovered in data already reported. If the data collected for this project are inappropriate for inclusion into TCEQ SWQMIS in part or in whole, data management will be largely the same, except Station Location Requests and submittal of the data electronically to TSSWCB for SWQMIS will not be required. Rather, the data will be provided in hard copy form as appendices to the final report and electronically in spreadsheets (or in other electronic format).			
	Start Date	Month 4	Completion Date	Month 24
Subtask 4.2	TIAER will develop a Final Report, which will discuss the literature search, study design, all environmental data collected, statistical methods, findings, discussion, and conclusions. A draft of this report will be submitted to TSSWCB for review prior to finalizing the report.			
	Start Date	Month 19	Completion Date	Month 24
Subtask 4.3	TIAER will present findings of this project and discuss implications of findings on TCEQ monitoring procedures, water quality standards, and modeling of fecal loading at appropriate meetings of staff from USEPA, TCEQ, TPWD, TxDOT, and computer modelers.			
	Start Date	Month 19	Completion Date	Month 24
Deliverables	• Station Location Request Forms (as needed) in electronic format • Monitoring data files and Data Summary Form in electronic format • Data Correction Request Forms (as needed) in electronic format • Final Report			

Part III – Financial Information

Budget Summary		
Category	**Costs**	
Personnel	$	60,151
Fringe Benefits	$	16,967
Travel	$	4,178
Equipment	$	0
Supplies	$	5,300
Contractual	$	0
Construction	$	0
Other	$	43,570
Total Direct Costs	$	130,166
Indirect Costs (≤15%)	$	13,146
Total Project Costs	$	143,312

Budget Justification		
Category	Costs	Justification
Personnel	$ 60,151	See attached TIAER personnel budget justification table found below.
Fringe Benefits	$ 16,967	Standard Tarleton State University fringe rates per individual; average 28.2%
Travel	$ 4,178	Travel expenses associated with reconnaissance trips, 1 trip each to establish sites for conduction surveys (3 trips), 21 two-day survey events (3 stations x 7 surveys), 2 bird survey trips, and approximately 10 trips for meetings.
Equipment	$ 0	N/A
Supplies	$ 5,300	Field survey supplies ($2,300), Laboratory incubator ($3,000)
Contractual	$ 0	N/A
Construction	$ 0	N/A
Other	$ 43,570	TIAER Laboratory to perform 945 *E. coli* analyses at an average price of $45.00 / sample (total $42,525); shipping, postage, and vehicle maintenance.
Indirect	$ 13,146	Indirect at 15% of total direct less the $42,525 for the TIAER Laboratory.
SOURCE	TSSWCB will provide $143,312 in non-federal funds sourced from state appropriations (FY2011 General Revenue) through the Nonpoint Source Grant Program to the Texas Institute for Applied Environmental Research at Tarleton State University.	

TIAER Personnel Budget Justification		
Name	**Title**	**Estimated % Time**
Field Operations		
Tim Jones	Sr. Research Associate	6.5%
Jeff Stroebel	Research Associate	3.2%
Abel Martinez	Research Associate	5.4% *
David Pendergrass	Sr. Research Associate	5.4%
David Blankenship	Research Assistant	3.1%
Todd Adams	Research Associate	4.8% **
James Hunter	Research Associate	3.1% ***
Jimmy Millican	Sr. Research Associate	3.0%
Phil Sudman	Research Associate	1.3% ****
Analytical Laboratory		
Mark Murphy	Lab Manager	0.8%
Vickie Hunt	Technician	0.8%
Dovie Reynolds	Sr. Research Assistant	0.8%
Data Management, Assessment & Reporting		
Anne McFarland	Research Scientist	4.2%
Jim Rogers	Sr. Program Analyst	1.5%
Nancy Easterling	Research Associate	1.3%
Project Administration, Information Dissemination		
Larry Hauck	Lead Scientist	3.4%
Nikki Jackson	Project Manager	2.4%

* Position also involves QA/QC efforts
** Position also involves GIS work for project maps
*** Position also involves TIAER Laboratory assignments
**** Tarleton faculty to assist on field work and bird surveys