Texas State Soil and Water Conservation Board
Clean Water Act §319(h) Nonpoint Source Grant Program
FY 2006 Project 06-11

NONPOINT SOURCE SUMMARY PAGE for the CWA, Section 319(h) Agricultural/Silvicultural Nonpoint Source Program					
Title of Project:	Watershed Protection Plan Development for Buck Creek				
Project Goals/Objectives:	(1) Identify specific sources of the bacteria in Buck Creek; (2) Evaluate potential management alternatives for restoring the waterbody and educate landowners on best management practices; (3) Develop a Watershed Protection Plan (WPP) to restore the waterbody through a stakeholder driven process.				
Project Tasks:	(1) Project Coordination and Administration; (2) Quality Assurance Project Plan Development; (3) Sanitary Survey of Buck Creek Watershed; (4) Micro-Watershed Monitoring and Sampling; (5) Bacterial Source Tracking; (6) Stakeholder Coordination and Education, (7) Watershed Protection Plan				
Measures of Success:	(1) Coordination of a watershed stakeholder committee; (2) Identification of sources of bacteria and potential management measures; (3) Development of a WPP for Buck Creek				
Project Type:	Statewide ( ); Watershed Implementation/Education ( ); Watershed Planning/Assessment (X); Watershed Protection ( )				
Status of Water Body: 2006 Water Quality Inventory and 303(d) List	Segment ID: Buck Creek (0207A)		Parameter: Bacteria		Category: 5c
Project Location:	Buck Creek watershed from the Oklahoma State Line east of Childress in Childress County upstream through Collingsworth County to its headwaters near Hedley in Donley County				
Key Project Activities:	Hire Staff (X); Monitoring (X); Regulatory Assistance ( ); Technical Assistance ( ); Education (X); Implementation ( ); Demonstration (X); Other (X)				
NPS Management Program Elements:	This project supports implementation of Goal One – Data Collection and Assessment. Specifically, this project addresses the objectives of (1) conducting special studies to determine sources of NPS pollution and (2) developing and adopting, at the state level, WPPs for watersheds identified as impacted by NPS pollution. Finally, this project helps achieve the following milestones: (A) Stakeholder Group – Employ or develop a local watershed committee to solicit input and encourage the participation of affected stakeholders in the decision-making process; (B) Data Review – Complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point and nonpoint sources, land use data, and all known stressors influencing water quality; (C) Targeted Assessment – Complete water quality monitoring. Analyze data, assess loadings, and determine the origin and distribution of pollutants; and (E) Action Plan – Develop a detailed action plan (WPP) which establishes overall goals and objectives, load allocations, strategy for achieving load allocation, timetable for implementation, and a list of expected results.				
Project Costs:	Federal:	$430,181	Non-Federal Match:	$290,158	Total:	$720,339
Project Management:	• Texas AgriLife Research, Texas Water Resources Institute • Texas AgriLife Research – Vernon				
Project Period:	October 1, 2006 – December 31, 2011				

Part I – Applicant Information

Applicant

Project Lead	B. L. Harris
Title	Acting Director
Organization	Texas AgriLife Research, Texas Water Resources Institute
E-mail Address	**bl-harris@tamu.edu**
Street Address	1500 Research Parkway, Suite 240A 2118 TAMU

City	College Station	County	Brazos	State	TX	Zip Code	77843-2118
Telephone Number	(979) 845-1851			Fax Number	(979) 845-8554		

Project Partners

Names	Roles & Responsibilities
Texas State Soil and Water Conservation Board (TSSWCB)	Project oversight
Texas AgriLife Research, Texas Water Resources Institute (TWRI)	Project coordination, quality assurance, and reporting
Texas AgriLife Research and Extension Center at Vernon – Dr. John Sij (AgriLife Vernon)	Sanitary survey, micro-watershed monitoring and sampling, and development of WPP through a stakeholder driven process
Texas AgriLife Research and Extensión Center at El Paso – Dr. George D. DiGiovanni (AgriLife El Paso)	Bacterial source tracking
Texas AgriLife Extension Service	Education and outreach
Hall-Childress, Donley County, and Salt Fork Soil and Water Conservation Districts (SWCDs)	Assist with project oversight and dissemination of information and educational efforts related to project activities
Red River Authority (RRA)	Participation in project meetings and report review, and perform laboratory analysis

Part II – Project Information

Project Type

Surface Water	X	Groundwater					
Does the project implement recommendations made in a completed Watershed Protection Plan or approved TMDL Report or Implementation Plan?				Yes		No	X
If yes, identify the document.							
If yes, identify the agency/group that developed and/or approved the document.				Year Developed			

Watershed Information

Watershed Name(s)	Hydrologic Unit Code (8 Digit)	Segment ID	305 (b) Category	Size (Acres)
Buck Creek	11120105	0207A	5c	184,960

Project Narrative

Problem/Need Statement

The Red River Basin includes 29 classified segments and 11 major reservoirs covering 145,169 acres. Buck Creek is a small waterbody situated within the Red River Basin and is located within a subwatershed to the Lower Prairie Dog Town Fork of the Red River (Segment 0207). This stream segment is located within Ecoregion 27, Central Great Plains. Small streams within this region are typically characterized by widely varying flows and high levels of dissolved salts, generally originating from saltwater seeps and springs. Buck Creek (segment 0207A) is situated within a predominantly rural and agricultural landscape in the panhandle region of Texas.

Land use in the watershed is predominantly row crops and grasslands. During periods of rainfall, which averages approximately 21 inches annually, bacteria [*Escherichia coli* (*E. coli*) specifically] originating from aquatic birds and mammals, livestock, inadequately treated sewage, and/or failing septic systems may be washed into the streams and have the potential to impede recreational use of the waterbody. Bacterial indicators, such as *E. coli*, may remain in the streams at levels exceeding established criteria and can be measured well after a rain event has occurred. These microorganisms are normally found in wastes of warm-blooded animals and are generally not harmful to human health, but may indicate the presence of pathogens that can cause disease.
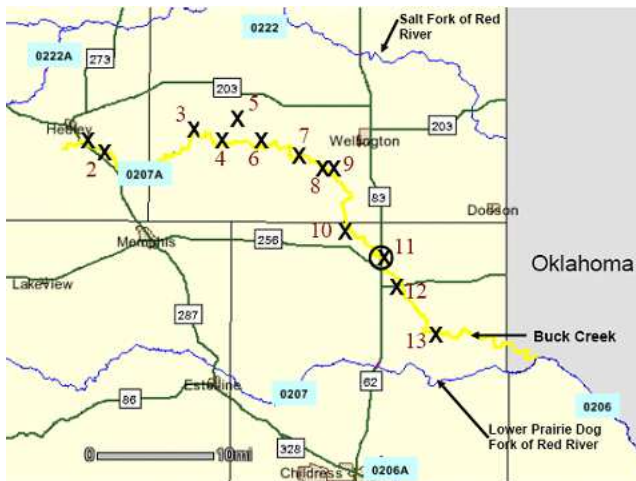
The State of Texas requires that water quality in Buck Creek be suitable for fishing, swimming, wading, and a healthy aquatic ecosystem. However, data obtained from periodic water quality monitoring indicate that bacteria levels are sometimes elevated in the creek. Although these data points provide an indicator of a potential water quality problem, the data do not provide conclusive evidence of persistent impairment; rather, it suggests a temporal recurring phenomenon. Recent data evaluations conducted by Texas Commission on Environmental Quality (TCEQ) have also revealed that periodically nitrate levels in the creek exceed the screening level and are, therefore, a concern. This concern justifies the need for more extensive nitrate analysis to better understand the situation and determine the source of the elevated nutrients.

Like most states, Texas does not directly monitor pathogens because of the difficulty and expense of measuring them. Instead, it tests for the presence of organisms that indicate the likely presence of pathogens—for example, *E. coli* is typically used as the indicator in the assessment of fresh water. These indicators are used to estimate the relative risk of swimming or other recreation involving direct contact with the water because the probability of becoming ill is greater when the bacteria counts are elevated.

In August 2001, the TCEQ proposed developing a total maximum daily load (TMDL) for Buck Creek utilizing the data collected through the Texas Clean Rivers Program. However, because TSSWCB is the lead agency for the State of Texas in abating agricultural NPS pollution, the TSSWCB took the lead in Buck Creek, working closely with the Hall-Childress, Donley County, and Salt Fork SWCDs; RRA; TWRI; Texas AgriLife Research and Extension. TSSWCB's first step (Phase I) was to initiate a Clean Water Act §319(h) funded project, "*Bacterial Monitoring for the Buck Creek Watershed*" (TSSWCB 03-07), to verify the impairment and assess the levels of *E. coli* throughout the watershed because the existing dataset was very limited, composed of only 20 fecal coliform samples and 14 *E. coli* samples over the course of 5 years, and represented only one site. Through Phase I, *E. coli* levels were monitored at 13 sites throughout the watershed and verified the bacterial impairment in the watershed (see map).

This project will basically pick up where TSSWCB Project 03-07 left off and develop a WPP through a stakeholder driven process.

Project Narrative

General Project Description

The seasonal dynamics in fecal bacteria populations in Buck Creek can be the result of a number of landscape utilization processes associated with human habitation, agricultural activities, herbivore and avian guild landscape utilization patterns and cattle landscape utilization patterns. A proactive WPP for mitigating fecal bacteria impairment will be based on understanding and then altering the timing, frequency and duration of fecal bacteria loading activities within the riparian zone immediately adjacent to Buck Creek. Currently there is not a geospatial inventory of the landscape components in this watershed. Furthermore, there is an information vacuum as to the spatial and temporal distribution of potential sources of fecal bacteria loading. In this phase of the program we propose to examine landscape utilization patterns potential role in Buck Creek fecal coliform impairment and evaluate subsequent mitigation strategies.

The *Watershed Protection Plan Development for Buck Creek* project will basically pick up where the *Bacterial Monitoring for the Buck Creek Watershed* project (TSSWCB Project 03-07) left off. The TSSWCB, TWRI, AgriLife Research, Hall-Childress, Donley County, and Salt Fork SWCDs, RRA and AgriLife Extension will work together to (1) identify the specific sources of the bacteria, (2) evaluate alternatives for restoring the waterbody, and (3) develop a WPP to restore the waterbody through a stakeholder driven process.
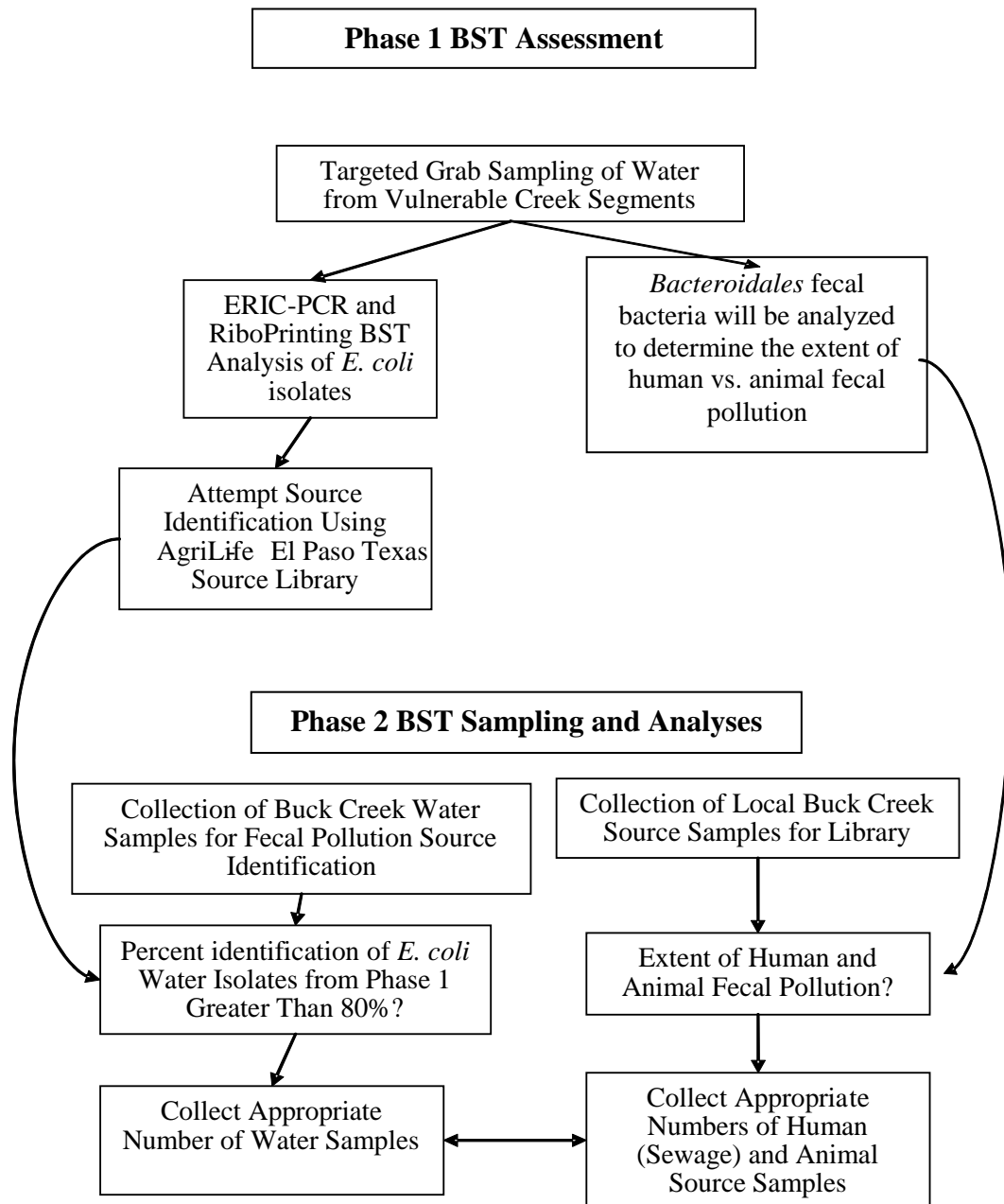
Identification of Sources
The project will include review and evaluation of existing data and information pertaining to bacterial contributions and sources to Buck Creek. New data, of known and specified quality, will be collected and analyzed to differentiate and quantify the relative contributions of bovine livestock and other human and animal bacteria sources into Buck Creek. This assessment and differentiation between bacteria sources will utilize, and be coordinated with, the Bacterial Source Tracking (BST) Texas Known Source Library generated by AgriLife El Paso which now contains almost 2,000 *E. coli* isolates from over 1,500 different domestic sewage and animal fecal samples. The library contains diverse *E. coli* isolates which were selected after screening over 4,400 isolates by genetic fingerprinting to exclude identical isolates from the same sample and include isolates with unique genetic fingerprints. This project will provide sufficient documentation of the data and technical analyses conducted that will aid the project staff in communicating the assessment results to watershed stakeholders, TSSWCB, TCEQ, and USEPA, as necessary.

Livestock and wildlife fecal samples, along with septic system samples will be obtained from a variety of sources in the watershed. Sources will be identified through a sanitary survey to be conducted by AgriLife Vernon. An inventory of existing land use patterns in the Buck Creek watershed will be conducted utilizing available imagery and aerial observation. The locations of bridges, springs and human habitation will be ground-truthed to ensure high quality data.

BST for this project will be conducted in two phases. Phase 1 involves assessment and monthly targeted grab sampling of creek segments at greatest risk for fecal pollution loading for a period of six months. Phase 1 will include analysis of water samples for *E. coli* as previously performed by AgriLife Vernon using USEPA Method 1603 {USEPA, 2002 #612} and *Enterococcus* bacteria using a modification of USEPA Method 1600 and mEI medium {USEPA, 1997 #765}. A polymerase chain reaction (PCR) genetic test for *Bacteroidales* fecal bacteria will be performed by AgriLife El Paso to determine if creek segments are being impacted by human or animal fecal pollution. Approximately 50 *E. coli* isolates from 50 different water samples will be analyzed using the BST methods described below and compared with isolates from the previously developed Texas Known Source Library to determine the need for the development of a local Buck Creek source library. Depending on the results of the Phase 1 BST work, the number of water and source isolates and the types (sewage or animal) of source samples listed below for Phase 2 may change. That is, if we determine that a larger local Buck Creek source library is needed, we will analyze more source samples and fewer water samples. Conversely, if it appears that the existing Texas Known Source Library is suitable for identification of water isolates, more water samples and fewer Buck Creek source samples may be analyzed. This will allow us to provide the most useful BST results within funding limitations. Phase 2 of the BST work will involve the development of a local Buck Creek library of *E. coli* from known sewage and animal sources and BST analysis of *E. coli* isolated from water samples, with the

sampling design dependent on the results of the Phase 1 BST assessment. An experimental approach flow diagram is presented in the following figure.

Phase 1 BST Assessment

Targeted Grab Sampling of Water from Vulnerable Creek Segments

ERIC-PCR and RiboPrinting BST Analysis of *E. coli* isolates

Bacteroidales fecal bacteria will be analyzed to determine the extent of human vs. animal fecal pollution

Attempt Source Identification Using AgriLife El Paso Texas Source Library

Phase 2 BST Sampling and Analyses

Collection of Buck Creek Water Samples for Fecal Pollution Source Identification

Collection of Local Buck Creek Source Samples for Library

Percent identification of *E. coli* Water Isolates from Phase 1 Greater Than 80%?

Extent of Human and Animal Fecal Pollution?

Collect Appropriate Number of Water Samples

Collect Appropriate Numbers of Human (Sewage) and Animal Source Samples

AgriLife Vernon will be responsible for collecting, processing, and isolating *E. coli* from water and fecal samples. *E. coli* will be isolated from the samples using standard microbiological methods as previously used in TSSWCB and TCEQ BST projects. *E. coli* will be isolated from water samples using USEPA Method 1603 and modified mTEC medium. Counts of *E. coli* obtained using this method can be used for regulatory purposes as well. Fecal specimens or domestic sewage samples will also be streaked (resuspended in buffer if necessary) onto modified mTEC medium. The use of

modified mTEC medium for isolation of *E. coli* from both water and source samples will help avoid selection of different types of *E. coli* due to different media. Inoculated plates will be incubated at $35\pm0.5^{\circ}$C for 2 hours to resuscitate stressed bacteria, then incubated at $44.5\pm0.2^{\circ}$C for approximately 20-24 hours. The modified mTEC method is a single-step method that uses one medium and does not require testing using any other substrate. The modified medium contains the chromogen 5-bromo-6-chloro-3-indolyl-β-D-glucuronide (Magenta Gluc), which is catabolized to glucuronic acid, a red/magenta-colored compound, by *E. coli* that produces the enzyme β-D-glucuronidase. This enzyme is the same enzyme tested for using other substrates such as the fluorogenic reaction with 4-methylumbelliferyl-β-D-glucuronide (MUG) observed using UV fluorescence in other *E. coli* assays (e.g. IDEXX Colilert and QuantiTray). *E. coli* colonies from the modified mTEC medium will be picked and streaked for purity on nutrient agar with MUG (NA-MUG) to confirm glucuronidase activity and culture purity. Cultures of selected isolates will be archived using glycerol freezing medium. AgriLife Vernon will ship bacterial cultures to the AgriLife El Paso Environmental Microbiology Laboratory (DiGiovanni) for BST analyses. In addition, AgriLife Vernon will also be responsible for collecting water samples from selected sampling sites and nearby water wells that will be analyzed by the RRA for nitrates.

E. coli source isolates will be selected using an approach to maximize the diversity of strains represented in the library. AgriLife El Paso will screen confirmed *E. coli* bacterial colonies with the repetitive sequence PCR method, Enterobacterial Repetitive Intergenic Consensus-PCR (ERIC-PCR). ERIC-PCR will be used to identify unique *E. coli* isolates from each sample and eliminate further analysis of identical isolates (clones). At least one *E. coli* isolate from each fecal or wastewater sample will be included in the library, even if it is identical to a previously isolated *E. coli*. Therefore, abundant/common strains will be sufficiently represented in the libraries. It is anticipated that over 300 *E. coli* colonies from approximately 100 source samples will be screened by ERIC-PCR. Approximately 100 of those isolates will be selected for automated ribotyping (RiboPrinting) BST analysis and inclusion in the source identification library. AgriLife El Paso will simultaneously analyze *Bacteroidales* fecal bacteria to determine the impacts of human vs. animal fecal contamination into the creek.

Ribotyping is a genetic fingerprinting method used in previous BST studies and many microbial ecology and epidemiological studies, although there is not a consensus as to the best protocol. In general, an endonuclease enzyme (*Hin*d III) selectively cuts *E. coli* DNA wherever it recognizes a specific DNA sequence. The resulting DNA fragments are separated by size and probed for fragments containing particular conserved ribosomal RNA gene sequences, which results in DNA banding patterns or fingerprints that look similar to barcode patterns. Different strains of *E. coli* bacteria have differences in their DNA sequences and different numbers and locations of enzyme cutting sites, and therefore have different ribotyping fingerprints. The DuPont Qualicon RiboPrinter Microbial Characterization System allows automation of the ribotyping and has a throughput of 32 isolates per day.

A total of 500 *E. coli* isolates obtained from ambient water samples will be characterized using ERIC-PCR and RiboPrinting. DNA patterns of those isolates will be compared to the Buck Creek source library as well as the Texas Known Source Library of over 1,900 isolates from known animal and human sources collected throughout Texas. Water isolates will be identified to cattle, other livestock, avian and non-avian wildlife, domestic sewage, and pet sources.

Evaluation of Alternative Implementation Measures
A science-based assessment of potential mitigation options for problem animal species will then be developed. Should cattle be identified as a significant source of fecal bacteria in the watershed, the project team will develop integrated watering, grazing, shade development, feeding and prescribed burning strategies to decrease the frequency and duration of cattle residency in the Buck Creek riparian zone. These technologies have proven effective in decreasing cattle impacts on water quality in the Pacific Northwest, the Eastern States and Texas.

Watershed Protection Plan Development
The culmination of the project is a WPP outlining:
  1) The causes and sources or groups of similar sources that will need to be controlled to achieve the load reductions targeted in the WPP.

2) An estimate of the load reductions expected for the management measures described.
3) A description of NPS management measures that need to be implemented to achieve the load reductions estimated.
4) An estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources.
5) An information/education component that will be used to enhance public understanding.
6) A schedule for implementing NPS management measures identified in this plan.
7) A description of interim, measurable milestones for determining whether NPS management measures or other control actions are being implemented.
8) A set of criteria that can be used to determine whether loading reductions are being achieved over time.
9) A monitoring component to evaluate the effectiveness of the implementation efforts over time.

The formation of a stakeholder group to guide the development of this plan will be crucial to the success of this project and the success of future implementation efforts. Project personnel will go to great lengths to ensure stakeholder involvement throughout the process as well as to educate stakeholders on the issues being addressed.

Water Quality Impairment

Describe all known causes (pollutants of concern) of water quality impairments from any of the following sources: 2006 Water Quality Inventory and 303(d) List, 2006 Summary of Waterbodies with Water Quality Concerns (Secondary Concerns List) or Other Documented Sources (ex. Clean Rivers Program Basin Summary or Basin Highlights Reports).

Buck Creek (unclassified water body) 2006 Texas Water Quality Inventory and 303(d) List

Segment:	0207A
Segment description:	From Oklahoma State Line east of Childress in Childress County to the upstream perennial portion of the stream west of Wellington in Collingsworth County
Waterbody type:	Freshwater Stream
Waterbody size:	68.0 miles
Waterbody uses:	High Aquatic Life Use, Contact Recreation Use, Fish Consumption Use, General Use
Flow type:	intermittent with pools
Assessment Units:	0207A_01 – From Oklahoma state line to House Log Creek (28 miles)
	0207A_02 – House Log Creek to upper end of segment (40 miles)

AU 0207A_01
Nonsupport   bacteria – geomean and single sample
Concern   nitrate – screening level
Source   NPS wildlife other than waterfowl, NPS unrestricted cattle access, NPS grazing in riparian or shoreline zones, NPS rangeland grazing
AU 0207A_02
Not assessed

Project Goals

(1) Identify specific sources of the bacteria in Buck Creek.
(2) Evaluate potential management alternatives for restoring the waterbody and educate landowners on BMPs.
(3) Develop a WPP to restore the waterbody through a stakeholder driven process.

Tasks, Objectives and Schedules						
Task 1:	Project Coordination and Administration					
Costs:	Federal:	$17,030	State:	$4,517	Total:	$21,547
Objective:	To effectively coordinate and monitor all work performed under this project including technical and financial supervision, preparation of status reports, and maintenance of project files and data. TWRI will organize an integrated team among the multiple agencies and groups involved with the project to efficiently and effectively achieve project goals and to summarize activities and achievements made throughout the course of the project. TWRI will perform accounting functions for project funds and be responsible for developing timely and accurate reports. Progress reports shall document all activities performed within a quarter and shall be submitted not later than thirty (30) days after the close of the quarter.					
Subtask 1.1:	Conduct quarterly TTVN meetings as appropriate with project participants to discuss project activities, project schedule, lines of responsibility, communication needs, and other requirements.					
	Start Date:	Month 1		Completion Date:	Month 63	
Subtask 1.2:	TWRI will prepare electronic quarterly reports and submit them to the TSSWCB. All progress reports will also be provided to AgriLife Research, AgriLife Extension, RRA, and Hall-Childress, Salt Fork, and Donley County SWCDs and placed on the project website maintained by TWRI.					
	Start Date:	Month 1		Completion Date:	Month 63	
Subtask 1.3:	Representatives from TWRI will attend meetings with the TSSWCB project manager and other meetings, as needed, to review project status, deliverables, etc.					
	Start Date:	Month 1		Completion Date:	Month 63	
Subtask 1.4:	TWRI will submit appropriate Reimbursement Forms.					
	Start Date:	Month 1		Completion Date:	Month 63	
Subtask 1.5:	TWRI will attend all stakeholder meetings as described in Task 6.					
	Start Date:	Month 1		Completion Date:	Month 63	
Deliverables	• Quarterly Reports • Coordination meeting notices, agendas, minutes, meeting materials, and lists of attendees • Reimbursement Forms					

Tasks, Objectives and Schedules						
Task 2:	Quality Assurance Project Plan Development					
Costs:	Federal:	$7,027	State:	$1,864	Total:	$8,891
Objective:	Develop Data Quality Objectives (DQOs), a Quality Assurance Project Plan (QAPP) and provide amendments and annual revisions to the QAPP, as needed. The QAPP will be developed consistent with USEPA QA/R-5, "EPA Requirements for Quality Assurance Project Plans".					
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 quality assurance protocols.					
	Start Date:	Month 1		Completion Date:	Month 6	
Subtask 2.2:	Provide annual revisions to the QAPP and amendments, as necessary, to the TSSWCB and USEPA.					
	Start Date:	Month 6		Completion Date:	Month 48	
Deliverables	• Approved QAPP • Approved annual revisions and amendments to QAPP					

Tasks, Objectives and Schedules						
Task 3:	Sanitary Survey of Buck Creek Watershed					
Costs:	Federal:	$62,386	State:	$38,895	Total:	$101,281
Objective:	Establish a baseline assessment of the Buck Creek watershed with regards to land use and possible bacteria sources. This phase of the project is absolutely critical to identify and evaluate potential problems and solutions.					
Subtask 3.1:	Acquire available literature, data, and information germane to describing the contributions, both spatially and temporally, and sources of bacterial loading in Buck Creek. The data analyses will include discussion of temporal (inter-annual, seasonal) and spatial trends in water quality, an evaluation of potential sources, and an identification of data gaps. The relevant data and information will include: - reported wastewater permit information, including permit limits, self-reported effluent quality data, violations, and inspection reports if available; - hydrologic data; - land use, population density, and the extent of use of on-site sewage facilities (septic systems) in the watershed; - livestock density and agricultural practices in the watershed from the most recent county-level agricultural census, as well as, abundance and type of concentrated animal feeding operations; - wildlife surveys associated with the Buck Creek watershed; - topography, soil, and vegetation information; and - special studies and published reports for Buck Creek. This task will include an explanation of how BST methods provide useful data to assist in water quality management efforts where bacterial contamination is a concern.					
	Start Date:	Month 1		Completion Date:	Month 36	
Subtask 3.2:	An aerial assessment of watershed will be utilized along the main channel of Buck Creek to identify and characterize stream channel locations, vegetation dynamics, current land use, and potential bacteria sources to the creek. The area will be flown twice during the project to assist in determining possible contributions. This information will be supplemented with a review of current DOQQ photography. Information from this subtask will be crucial in the development of implementation strategies in the WPP.					
	Start Date:	Month 1		Completion Date:	Month 12	
Subtask 3.3:	Conduct an inventory of existing land use patterns in the Buck Creek watershed utilizing available imagery. TSSWCB, in coordination with the Texas A&M University Spatial Sciences Laboratory, will provide TWRI a current land use classification for the study area through TSSWCB project 08-52, *Classification of Current Land Use/Land Cover for Certain Watersheds Where TMDLs or WPPs Are In Development*.					
	Start Date:	Month 1		Completion Date:	Month 12	
Subtask 3.4:	A survey of the watershed will be conducted to identify the potential sources of fecal matter to Buck Creek. Wildlife and domestic animal sources of observed scat can be identified. Concentrated waterfowl areas and bird rookeries or bat colonies may be identified. The utilization of waterways by wildlife, as well as dogs, cats, and other domestic animals will also be assessed. Human influences are also typically identified, including malfunctioning septic systems and sewer overflows.					
	Start Date:	Month 1		Completion Date:	Month 40	
Deliverables	- Aerial photography of the Buck Creek - Technical memorandum summarizing the results that will be modified and incorporated into the WPP					

Tasks, Objectives and Schedules						
Task 4:	Micro-Watershed Monitoring and Sampling					
Costs:	Federal:	$84,189	State:	$56,313	Total:	$140,502
Objective:	Monitor micro-watersheds for data collection and analysis, and provide data to inform SWCDs and landowners of any potential or existing water quality issues and/or problems.					
Subtask 4.1:	AgriLife Vernon will perform routine monthly sampling (grab sampling) at six locations (Sites 3,5,6,10a,10c, 11) on Buck Creek, collecting at least field, flow, bacteria and nitrate parameter groups.					
	Start Date:	Month 6		Completion Date:	Month 48	
Subtask 4.2:	AgriLife Vernon will collect a minimum of 8 rain event/high flow grab samples from the six monthly routine sites over the course of the study, collecting at least field, flow, bacteria and nitrate parameter groups.					
	Start Date:	Month 6		Completion Date:	Month 48	
Subtask 4.3:	AgriLife Vernon will perform quarterly sampling (grab sampling) at selected tributary sites within the Buck Creek watershed when flow is present, collecting at least field, flow, bacteria and nitrate parameter groups.					
	Start Date:	Month 6		Completion Date:	Month 48	
Subtask 4.4:	AgriLife Vernon will compile and analyze the sampling data. Data will be for informational and assessment purposes due to the limited data previously collected.					
	Start Date:	Month 6		Completion Date:	Month 48	
Subtask 4.5:	TWRI will transfer monitoring data from activities in Task 4 to TSSWCB for inclusion in the TCEQ surface water quality monitoring database. 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 *TCEQ Surface Water Quality Monitoring Data Management Reference Guide*. TWRI will submit Station Location Requests as needed to obtain TCEQ station numbers for new monitoring sites. Data Correction Request Forms will be submitted to TSSWCB whenever errors are discovered in data already reported. TWRI will coordinate with RRA to include the final sampling regime, as described in the approved QAPP, in the Clean Rivers Program Coordinated Monitoring Schedule.					
	Start Date:	Month 36		Completion Date:	Month 48	
Deliverables	• Electronic copy of data collected • Station Location Request Forms (as needed) in electronic format. • Data Correction Request Forms (as needed) in electronic format. • Technical memorandum summarizing the results that will be modified and incorporated into the WPP					

Tasks, Objectives and Schedules						
Task 5:	Bacterial Source Tracking					
Costs:	Federal:	$220,084	State:	$168,584	Total:	$388,668
Objective:	Utilize Bacterial Source Tracking to identify the source of *E. coli* in the Buck Creek watershed.					
Subtask 5.1:	Phase 1 BST Assessment. Monthly targeted water grab sampling of creek segments at greatest risk for fecal pollution loading, as identified through the sanitary survey, will be performed for a period of six months (AgriLife Vernon). Approximately 50 *E. coli* isolates from 50 different water samples will be analyzed using ERIC-PCR and RiboPrinting and compared with known isolates from the previously developed Texas Known Source Library to determine the need for the development of a local Buck Creek source library for Phase 2 of the BST work (AgriLife El Paso). *Bacteroidales* fecal bacteria PCR analysis (universal, human, ruminant, swine and horse markers) will be performed by AgriLife El Paso to determine if creek segments are being impacted by human or animal fecal pollution. Depending on the results of the Phase 1 BST work, the number of water and source isolates and the types (sewage or animal) of source samples listed below for Phase 2 may change.					
	Start Date:	Month 6		Completion Date:	Month 12	
Subtask 5.2:	Samples of fecal matter and/or domestic sewage will be collected from the major potential sources of fecal matter in the watershed. These sources will include domestic animals, wildlife, and human sources. In all, 100 known source samples from the Buck Creek watershed will be collected and processed for *E. coli* isolation and archival by AgriLife Vernon. Bacterial cultures of *E. coli* isolates will be archived for future analyses and dissemination to other laboratories. *E. coli* isolates will be sent to the AgriLife El Paso laboratory for BST analyses and selection of isolates for inclusion in the source library. It is anticipated that over 300 *E. coli* colonies from source samples will be screened by ERIC-PCR. Approximately 100 of those isolates will be selected for RiboPrinting BST analysis and inclusion in the source identification library. All sample collection, processing procedures and documentation will be specified in the QAPP.					
	Start Date:	Month 12		Completion Date:	Month 48	
Subtask 5.3:	Ambient water sampling, analysis and isolation of *E. coli* will be conducted by AgriLife Vernon. Ambient water samples will be collected from at least 4 sites in the Buck Creek watershed on ten dates over a 1-year period. These dates would likely include at least five dry weather events and at least three post-rainfall events. Approximately five water samples would be collected on each date from each site, and ten samples from the vicinity of station 15811. *E. coli* in water samples will be enumerated using USEPA Method 1603 by AgriLife Vernon. Following enumeration, AgriLife El Paso will isolate *E. coli* from the samples and archive cultures. Bacterial cultures of *E. coli* isolates will be archived for future analyses and dissemination to other laboratories. *E. coli* isolates will be sent to AgriLife El Paso for ERIC-PCR and RiboPrinting BST analyses and source identification. The AgriLife El Paso laboratory technician will coordinate sample shipment or collection (when necessary) with AgriLife Vernon.					
	Start Date:	Month 12		Completion Date:	Month 48	
Subtask 5.4:	ERIC-PCR and RiboPrinting fingerprints of approximately 500 *E. coli* isolates from ambient water samples will be analyzed and compared to source library isolates using Applied Maths BioNumerics software.					
	Start Date:	Month 12		Completion Date:	Month 48	
Subtask 5.5:	AgriLife El Paso will compile and analyze the BST data. Water isolates will be identified to cattle, other livestock, avian and non-avian wildlife, domestic sewage, and pet sources (six-way split). Results will help identify the sources needed to be addressed by the WPP					
	Start Date:	Month 6		Completion Date:	Month 48	
Deliverables	• Inventory of archived *E. coli* isolates • Publicly available ERIC-PCR and RiboPrinting reference library of known source *E. coli* isolates • Technical memorandum summarizing the results that will be modified and incorporated into the WPP					

Tasks, Objectives and Schedules						
Task 6:	Stakeholder Coordination and Education					
Costs:	Federal:	$22,015	State:	$10,598	Total:	$32,613
Objective:	Provide communication of project objectives and receive feedback and information from relevant entities and individuals. Project staff will work with various state and local agencies to organize, promote, and conduct a series of outreach meetings and demonstrations within the Buck Creek watershed. An interactive internet website will also be created and maintained to provide the most current progress.					
Subtask 6.1:	The Vernon Research Tech II will receive training on WPP development and serve as the watershed coordinator for Buck Creek.					
	Start Date:	Month 1		Completion Date:	Month 63	
Subtask 6.2:	The Vernon Research Tech II/Watershed Coordinator, with assistance from TWRI and AgriLife Extension, will assemble a stakeholder group to provide input and assist in the development of a WPP. The stakeholder group will be made up of landowners, elected officials, agency representatives, industry groups, and others as appropriate. Potential agency representatives and industry groups include SWCDs, county commissioners and judges, TSSWCB, RRA, TCEQ, AgriLife Extension, AgriLife Research, TWRI, Texas Parks and Wildlife Department, USDA Natural Resources Conservation Service, USDA Farm Services Agency, Texas Cattle Feeders Association, and Texas Farm Bureau. Participation by all that may be affected will be encouraged throughout the process.					
	Start Date:	Month 1		Completion Date:	Month 6	
Subtask 6.3:	The stakeholder group will meet quarterly, or as needed. These meetings will be held within the Buck Creek watershed to solicit input on the development of the WPP. In addition, the status of monitoring and assessment efforts will be presented in the context of how a WPP will promote recovery or proper functions of the Buck Creek watershed. In Year 1, a kick-off meeting will be held to initiate the formation of the stakeholder group and to provide an overview of the goals and objectives of the project and WPP. Additional meetings will be held as needed to provide stakeholders with a review of the state of our knowledge as to the state of Buck Creek, to facilitate stakeholder input on possible sources of the bacteria loading and other issues within the watershed, discuss the challenges in identifying potential sources of contamination, and develop an approach to generate the knowledge needed to formulate a science-based WPP. In Year 2, stakeholder meetings will be held to discuss the results of the sanitary survey, obtain stakeholder input for the WPP, and provide landowners information on management practices for reducing bacteria. In Year 3-5, stakeholders will be presented the results of the BST, discuss methods for reducing the bacteria from the identified sources, and finalize and approve the WPP.					
	Start Date:	Month 6		Completion Date:	Month 63	
Subtask 6.4:	As appropriate, educational programs will also be provided in conjunction with the stakeholder meetings. Informational programs on topics such as principles of watershed hydrology, primary NPS pollution types, and agricultural BMPs for protecting water quality (i.e. alternative watering sources, riparian management issues, livestock and wildlife management, grazing management, shade development, feeding strategies, cross fencing, and prescribed burning) will also be provided.					
	Start Date:	Month 6		Completion Date:	Month 63	
Subtask 6.5:	The Vernon Research Tech II/Watershed Coordinator will also meet semi-annually with each SWCD to discuss the status of the project and obtain any input the SWCDs have to offer regarding the project and WPP.					

Tasks, Objectives and Schedules	
Task 6:	Stakeholder Coordination and Education

Subtask 6.6:	TWRI will develop (Months 1-3), host and maintain (Months 3-56) an internet website for the dissemination of information on educational, monitoring and demonstration activities taking place across the Buck Creek watershed. Website delivery of information will be the most time and cost effective way to disseminate information to interested people or groups.
	
	Information presented through the website will include:
	• PDF version of all reports, journal articles, faculty papers and presentations generated from this project.
	• Links to all cooperating and/or participating agencies.
	• Links to all project primary investigators.
	• Links to university academic departments that are involved in the project.
	• Links to other related websites
	    o TSSWCB
	    o TWRI
	    o USEPA CWA §319
	    o SWCDs
	• Schedule of upcoming meetings/programs dealing with this project.

	Start Date:	Month 1	Completion Date:	Month 63
Deliverables	• Stakeholder meeting notices, agendas, summaries, meeting materials, and lists of attendees • Promotional materials including news releases, fact-sheets, etc. • Website to publish results, bulletins, and reports.			

Tasks, Objectives and Schedules							
Task 7:	Watershed Protection Plan						
Costs:	Federal:	$17,450	State:	$9,387	Total:	$26,837	
Objective:	TAES and TWRI will facilitate the development of a WPP for the Buck Creek watershed through a stakeholder driven process. The WPP will contain the nine elements fundamental to a potentially successful WPP: 1) identification of causes and sources; 2) estimate of load reductions expected from management measures; 3) description of the NPS management measures to be implemented; 4) estimate of the amounts of technical and financial assistance needed; 5) an information/education component; 6) implementation schedule; 7) description of interim, measurable milestones; 8) a set of evaluative criteria to determine if load reductions are being achieved; and 9) a monitoring component to evaluate effectiveness.						
Subtask 7.1:	AgriLife Vernon and TWRI will develop a WPP for Buck Creek based on criteria set forth in the USEPA *FY2004 NPS Program and Grants Guidelines for States and Territories*. Findings from Tasks 3-5 and stakeholder input obtained from Task 6 will be utilized to develop the plan.						
	Start Date:	Month 1		Completion Date:	Month 63		
Subtask 7.2:	TSSWCB, AgriLife Extension, RRA, and local SWCDs will assist with composition, editing, and publication of the final WPP, as needed.						
	Start Date:	Month 1		Completion Date:	Month 63		
Deliverables	• Draft Watershed Protection Plan • Final Watershed Protection Plan						

Measures of Success
• Coordination of a watershed stakeholder committee • Identification of sources of bacteria and potential management measures • Develop a WPP for the Buck Creek watershed

2005 Texas Nonpoint Source Management Program Document Reference
Goals &/or Milestone(s)
Goal One – Data Collection and Assessment
Milestone (A) Stakeholder Group – Employ or develop a local watershed committee to solicit input and encourage the participation of affected stakeholders in the decision-making process
Milestone (B) Data Review – Complete the assessment of pollutant problems by reviewing existing water quality data, conducting and inventory of point and nonpoint sources, land use data, and all known stressors influencing water quality
Milestone (C) Targeted Assessment – Complete water quality monitoring. Analyze data, assess loadings, and determine the origin and distribution of pollutants
Milestone (E) Action Plan – Develop a detailed action plan (WPP) which establishes overall goals and objectives, load allocations, strategy for achieving load allocation, timetable for implementation, and a list of expected results

Part III – Financial Information

Budget Summary

Federal 319(h)	$430,181	% of total project	60%
Non-Federal Match	$290,158	% of total project (at least 40%)	40%
Total $ Cost	$720,339	Total project %	100%

Category	Federal	Non-Federal Match	Total
Personnel	$199,759	$98,285	$298,044
Fringe Benefits	$52,056	$25,616	$77,672
Subtotal Personnel & Fringe	$251,815	$123,901	$375,716
Travel	$4,584		$4,584
Equipment	$12,474		$12,474
Supplies	$95,797		$95,797
Contractual	$0		$0
Construction	$0		$0
Other	$9,400		$9,400
Subtotal	$122,255	$0	$122,255
Total Direct Costs	$374,070	$123,901	$497,971
Indirect Costs (15%)	$56,111	$56,375	$112,486
Unrecovered IDC	$0	$109,882	$109,882
Total Project Costs	$430,181	$290,158	$720,339

Budget Justification		
Category	Total Amount	Justification
Personnel & Fringe Benefits	$375,716	Federal: • TWRI Project Manager @ 13.3 % in yrs 1 & 3 and 5% in yr 2 • TWRI IT Associate @ 4.2% effort • Vernon Research Tech II @ 100% effort • Vernon Student Worker • AgriLife Extension Post Doc @ 37% effort in yr 1, 60% effort in yr 2, & 30% effort in yr 3 Non-Federal Match: • Vernon Project Leader @ 6% in yr 1, 9% in yr 2 & 12% in yr 3 • Vernon Research Assoc @ 20% in yrs 1 & 3 and 30% in yr 2 • AgriLife El Paso Assoc Prof of Microbiology @ 7% effort • AgriLife El Paso Post Doc @ 25% in yr 1, 40% in yr 2, & 14% in yr 3
Travel	$4,584	Federal: • TWRI = $2,800: 7 trips to Childress @ $400/trip • AgriLife Vernon = $1,184: for BST Training in El Paso in yr 1 ($520), Watershed Planning Training in yr 2 ($664) • AgriLife El Paso = 1 trip to Childress @ $600
Equipment	$12,474	Federal: • AgriLife Vernon Freezer (-80°C) = $4,474 • AgriLife Vernon Autoclave = $8,000

Supplies	$95,797	Federal:
		• AgriLife Vernon Supplies = $17,652 yr 1, $15,274 yr 2 and $10,321 yr 3 for lab supplies, collection supplies, and educational supplies as follows:
		  1. Lab supplies: autoclave tape; autoclave trays; autoclave bags; YSI replacement sensors - pH, dissolved oxygen membranes; compound microscope; disposable funnel filters; sterile supplies; modified agar plates; medium; Petri dish trays.
		  2. Collection supplies: blue ice packs; Whirl-Pac collection bags; sterile gloves; bait for live traps; 3 have a heart 2 exit traps; 2 motion/infrared cameras for detection of nocturnal mammals.
		  3. Educational supplies for demonstrations by project personnel: covers for yearly reports, paper, sample bottles, poster board, film and processing. Shipping containers and costs for BST study and miscellaneous supplies.
		  4. Fuel: 30 trips/yr @ 375 mi/trip = 25 gal/trip = 2,250 gal/yr @ $2.88/gal
		• AgriLife El Paso Lab Supplies = $9,150 yr 1 and $21,700 in yrs 2 & 3 for RiboPrinter instrument consumable kits, enzymes, PCR reagents and plastic ware, bacterial media, electrophoresis supplies, etc.

Other	$9,400	Federal: • Shipping BST samples from Vernon to El Paso ($1,400) • AgriLife Vernon Helicopter Flyover of Watershed ($1,000) • Vehicle maintenance: ($2,500) • Watershed Protection Plan printing: ($1,500) • NELAC lab certification ($2,000) • Instrumentation Repair/Maintenance ($1,000)
Indirect	$112,486	Federal: • 15% of Total Direct Federal Non-Federal Match: • 45.5% of Total Direct Non-Federal Match
Unrecovered IDC	$109,882	Non-Federal Match: • 30.5% of Total Direct Federal