Clean Water Act §319(h) Nonpoint Source Grant Program

Modeling Support for Buck Creek Watershed Protection Plan Development
TSSWCB Project # 08-05

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

Revision 2

prepared by

Texas A&M AgriLife

Texas Water Resources Institute

and the

Texas A&M University Department of Biological and Agricultural Engineering

Effective Period: October 2008 to May 2011

Questions concerning this quality assurance project plan should be directed to:

Lucas Gregory, TWRI Quality Assurance Officer
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-or-

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Section A1 Approval Sheet

Quality Assurance Project Plan (QAPP) for the *Modeling Support for Buck Creek Watershed Protection Plan Development* project.

United States Environmental Protection Agency (USEPA), Region VI

Name: Curry Jones
Title: USEPA Chief State/Tribal Programs Section

Signature: _____ Date:_____

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source Project Manager

Signature: _____ Date:_____

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Mitch Conine
Title: TSSWCB Project Manager

Signature:_____Date:_____

Name: Donna Long
Title: TSSWCB Quality Assurance Officer (QAO)

Signature:_____Date:_____

Texas AgriLife Research - Texas Water Resources Institute (TWRI)

Name: Bill Harris
Title: Acting Director, TWRI Project Lead

Signature:_____Date:_____

Name: Lucas Gregory
Title: TWRI QAO
Signature:_____Date:_____

Texas A&M University - Department of Biological and Agricultural Engineering (BAEN)

Name: R. Karthikeyan
Title: Assistant Professor, Project Co-Lead

Signature:_____ Date:_____

Texas AgriLife Research and Extension Center at Vernon (AgriLife Vernon)

Name: Dr. Paul DeLaune
Title: Assistant Professor,

Signature:_____ Date:_____

Section A2: Table of Contents

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List of Acronyms and Abbreviations

BAEN	Department of Biological and Agricultural Enginnering
BSLC	Bacteria Source Load Calculator
CAR	corrective action report
CWA	Clean Water Act
DQO	data quality objectives
GIS	geographic information system
LDC	load duration curve
NLCD	national land cover data set
QA	quality assurance
QAPP	quality assurance project plan
QAO	Quality Assurance Officer
QC	quality control
QPR	quarterly progress report
RRA	Red River Authority
SELECT	Spatially Explicit Load Enrichment Calculation Tool
SOP	standard operating procedures
SSL	Spatial Sciences Laboratory
SSURGO	soil survey geographic
TAMU	Texas A&M University; College Station Campus
TCEQ	Texas Commission on Environmental Quality
TMDL	total maximum daily load
TSSWCB	Texas State Soil and Water Conservation Board
TWRI	Texas Water Resources Institute
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Section A3: Distribution List

Organizations, and individuals within, which will receive copies of the approved QAPP and any subsequent revisions include:

United States Environmental Protection Agency, Region VI

6WQ-AT
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Name: Curry Jones
Title: USEPA Chief State/Tribal Programs Section

Name: Henry Brewer
Title: USEPA Texas Nonpoint Source Project Manager

Texas State Soil and Water Conservation Board

PO Box 658
Temple, TX 76503

Name: Mitch Conine
Title: TSSWCB PM

Name: Donna Long
Title: TSSWCB QAO

Texas AgriLife Research - Texas Water Resources Institute

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Name: Bill Harris,
Title: Acting Director; Project Lead

Name: Lucas Gregory
Title: TWRI QAO

Texas A&M University—Department of Biological and Agricultural Engineering

306A Scoates
2117 TAMU
College Station, TX 77843-2117

Name: R. Karthikeyan
Title: Assistant Professor; Project Co-Leader

Texas AgriLife Research and Extension Center at Vernon

PO Box 1658
Vernon, TX 76385

Name: Paul DeLaune, Ph.D.
Title: Assistant Professor

Section A4: Project/Task Organization

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities:

USEPA – Provides project oversight and funding at the federal level.

Henry Brewer, USEPA Texas Nonpoint Source PM

Responsible for overall performance and direction of the project at the federal level. Ensures that the project assists in achieving the goals of the clean water act (CWA). Reviews and approves the quality assurance project plan (QAPP), project progress, and deliverables.

TSSWCB –Texas State Soil and Water Conservation Board, Temple, Texas. Provides project overview at the State level.

Mitch Conine, TSSWCB Project Manager

Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified. Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants.

Donna Long; TSSWCB Quality Assurance Officer

Reviews and approves QAPP and any amendments or revisions. Responsible for verifying that the QAPP is followed by project participants. Monitors implementation of corrective actions. Coordinates or conducts audits of field and laboratory systems and procedures. Determines that the project meets the requirements for planning, quality assessment (QA), quality control (QC), and reporting under the TSSWCB Total Maximum Daily Load Program.

TWRI – Texas AgriLife Research, Texas Water Resources Institute (TWRI), College Station, Texas. Responsible for development of data quality objectives (DQOs) and a QAPP.

Bill Harris, Project Lead

The TWRI Project Lead is responsible for ensuring that tasks and other requirements in the contract are executed on time and with the QA/QC requirements in the system as defined by the contract and in the project QAPP; assessing the quality of subcontractor/participant work; and submitting accurate and timely deliverables to the TSSWCB Project Manager.

Lucas Gregory, Quality Assurance Officer & Project Manager

Responsible for determining that the QAPP meets the requirements for planning, QA and QC. Conducts audits of field and laboratory systems and procedures. Responsible

for maintaining the official, approved QAPP, as well as conducting quality assurance audits in conjunction with TSSWCB personnel. Responsible for ensuring the timely completion of project deliverables, fiscal oversight and project reporting.

BAEN – Department of Biological and Agricultural Engineering, Texas A&M University, College Station, Texas. Responsible for modeling activities associated with the Spatially Explicit Load Enrichment Calibration Tool (SELECT) and Load Duration Curve (LDC) development.

R. Karthikeyan, Assistant Professor, Biological and Agricultural Engineering

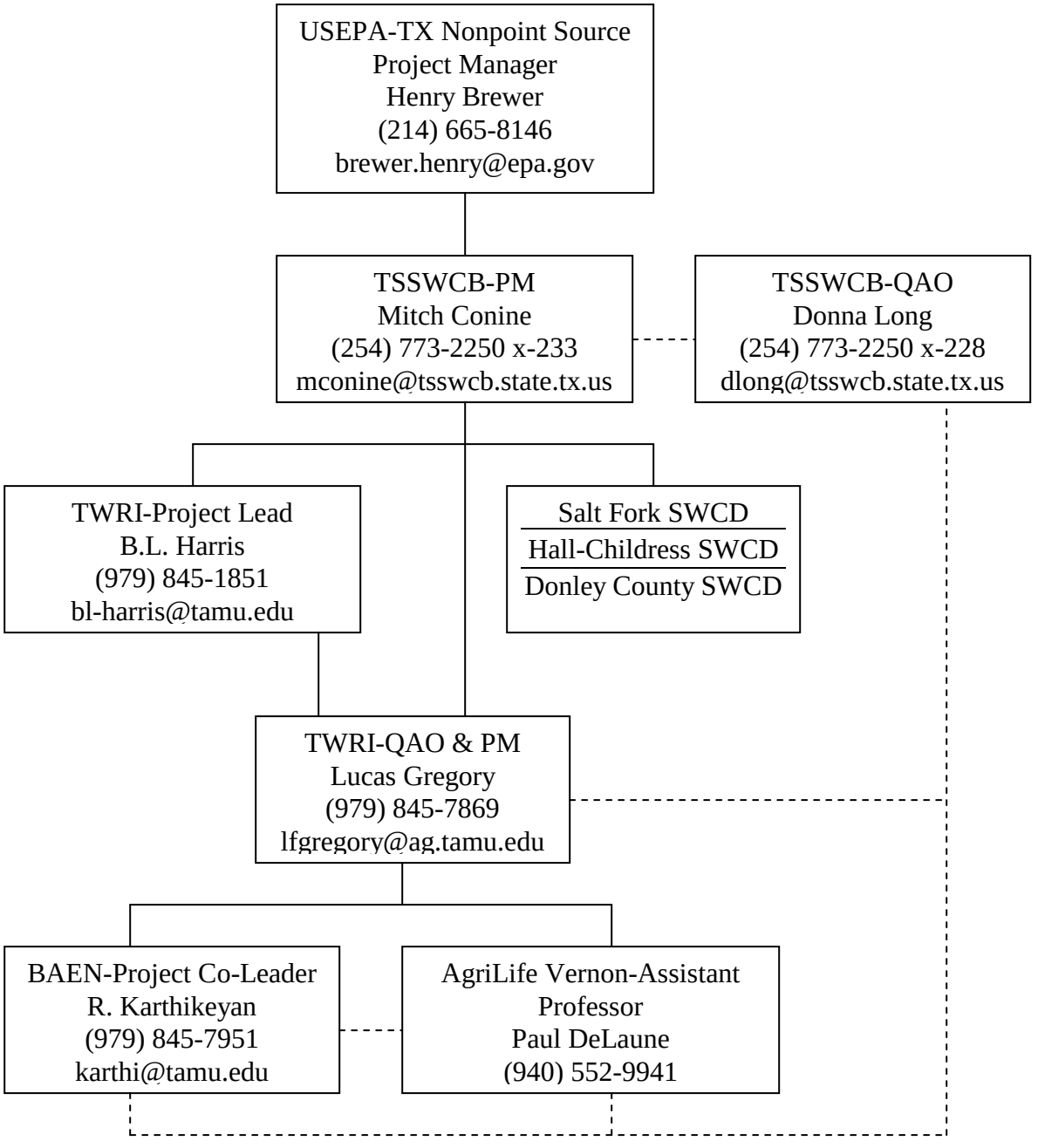
Responsible for performing LDC analysis and SELECT modeling. Responsible for assisting in the development of a GIS inventory of the selected project watersheds and designing the watershed source survey.

AgriLife Vernon – Responsible for providing needed water quality data and summarizing the results of the project and incorporating them into the Buck Creek Watershed Protection Plan.

Dr. Paul DeLaune, Assistant Professor

Responsible for providing needed water quality data from TSSWCB Projects 03-07 and 06-11 for use in developing the SELECT analysis and the LDC for the creek. Responsible for developing a summarized version of the project final report and incorporating it into the Buck Creek Watershed Protection Plan.

Figure A.4-1. Project Organization Chart



Section A5: Problem Definition/Background

Buck Creek is a small waterbody situated within the Red River Basin and is located in the southeastern portion of the Texas panhandle. This stream segment is located within Ecoregion 27, Central Great Plains and is situated within a predominantly rural and agricultural landscape in the panhandle region of Texas. During periods of rainfall, which averages approximately 21 inches annually, bacteria [*Escherichia coli* (*E. coli*) specifically] originating from birds and mammals, livestock, inadequately treated sewage, wildlife and/or failing septic systems may be washed into the streams and have the potential to impede recreational use of the waterbody. The State of Texas requires that water quality in Buck Creek be suitable for fishing, swimming, and wading, as well as support a healthy aquatic ecosystem. However, data obtained from periodic water quality monitoring indicate that bacteria and nitrate levels are sometimes elevated in the creek. These data indicate a temporal water quality problem, but do not provide conclusive evidence of persistent impairment.

In August 2001, the TCEQ proposed developing a total maximum daily load (TMDL) for Buck Creek utilizing the data collected through the Clean Rivers Program. Since the TSSWCB is the lead agency for planning, implementing, and managing programs and practices for preventing and abating agricultural and silvicultural nonpoint source pollution the TSSWCB took the lead in Buck Creek, working closely with the Hall-Childress, Donley County, and Salt Fork SWCDs; Red River Authority (RRA); Texas Water Resources Institute (TWRI), Texas AgriLife Extension Service (Extension) and Texas AgriLife Research (Research). TSSWCB's first step was to initiate a Clean Water Act 319(h) funded project, "*Bacterial Monitoring for the Buck Creek Watershed*" (TSSWCB 03-7), 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 at one site. *E. coli* levels were monitored at 13 sites throughout the watershed and verified the bacterial concerns in the watershed (see map on following page). In 2006, efforts began to identify the sources of the bacteria loads and develop a Watershed Protection Plan (WPP) through the Clean Water Act 319(h) funded project, *Watershed Protection Plan Development for Buck Creek* (TSSWCB 06-11). Nitrate levels were also listed as a water quality concern on the 2006 *Texas 303(d) List*, prompting evaluation of nitrate levels in the waterbody and including source descriptions and mitigation strategies in the WPP currently in development.

A critical component of a fully developed WPP is an estimate of needed load reduction for specific pollutants; in this case, *E. coli* and nitrates. The current project, *Watershed Protection Plan Development for Buck Creek* (TSSWCB 06-11) does not have a component that will enable the needed load reduction estimate to be developed. The work conducted under this QAPP will provide essential information by incorporating data collected in TSSWCB projects 03-7 and 06-11 into the SELECT model and by developing LDCs for the creek. The SELECT model will utilize a spatially-explicit Geographic Information System (GIS) methodology to

identify and rank specific areas of the watershed that likely contribute higher amounts of bacteria to the stream. This information will be used to aid in recommending potential management strategies to reduce bacterial loading to Buck Creek. The LDCs will be used to specifically determine what level of bacteria and nitrate load reductions will be needed to reduce pollutant levels in the creek so that they meet the state's surface water quality standards. As mentioned above, this information will be incorporated into the WPP and stakeholders will use this information to help in determining which management practices will be recommended in the WPP.

Section A6: Project Goals and Task Description

The current project (TSSWCB 06-11) is identifying specific sources of bacteria in the Buck Creek watershed utilizing Bacterial Source Tracking. This project will utilize the data and information from TSSWCB project 06-11, as well as monitoring data (see sample sites below) from TSSWCB project 03-7, to rank the sources of bacteria within the watershed using a spatially-explicit GIS methodology. For this approach, the watershed will be divided into sub-watersheds and pollutant loads from various sources, i.e. agriculture, human, and wildlife, will be identified and quantified for each. From this information, total pollutant loading for the watershed can be calculated and contributing components will be ranked based on percentage and estimated production.

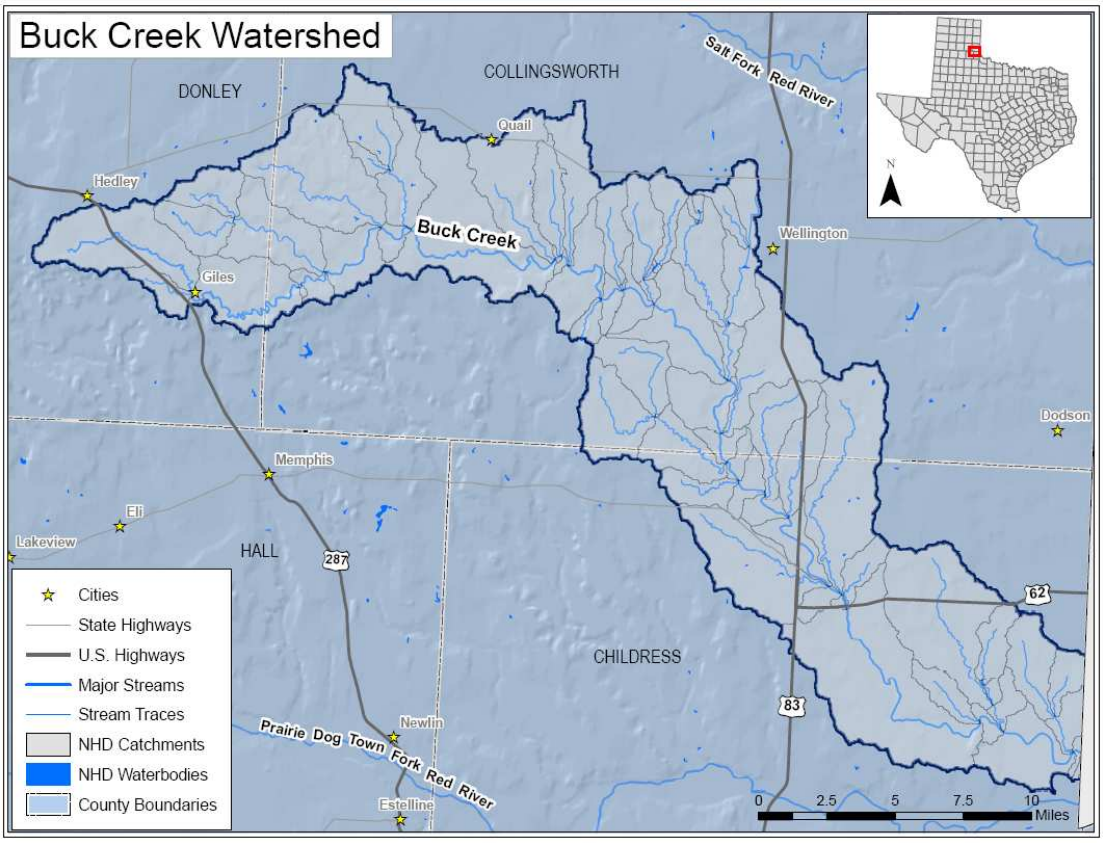


Figure A.6-1. The Buck Creek Watershed

The modeling effort will be conducted by BAEN. Other project partners include TSSWCB, TWRI, and Texas AgriLife Extension Service. The primary goal of this effort will be to gather basic information to facilitate and support stakeholder decision-making processes as a part of the Buck Creek WPP development process (TSSWCB Project 06-11). At the same time and in the process of plan development, an attempt will be made to determine the level of model-based information necessary to meet the needs of the stakeholders and satisfy USEPA's nine key elements for developing WPPs.

The results of the modeling effort will be included in a technical report submitted to TSSWCB and Texas AgriLife Research for inclusion in the Buck Creek WPP (TSSWCB Project 06-11).

Task 1: Project Administration

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: TWRI will coordinate project efforts with all project partners, as well as with the *Watershed Protection Plan Development for Buck Creek* project (TSSWCB 06-11). TTVN meetings or teleconferences will be held, as appropriate, with project partners to discuss project activities, project schedule, lines of responsibility, communication needs, and other requirements. (Start Date: Month 1; Completion Date: Month 33)

Subtask 1.2: TWRI will prepare electronic quarterly reports that document all activities performed within a quarter and shall be submitted to the TSSWCB no later than the 15th of January, April, July and October. All progress reports will also be provided to Research, Extension, RRA, and Hall-Childress, Salt Fork, and Donley County SWCD directors and placed on the project website maintained by TWRI. (Start Date: Month 1; Completion Date: Month 33)

Subtask 1.3: TWRI will submit appropriate Reimbursement Forms to TSSWCB. (Start Date: Month 1; Completion Date: Month 33)

Deliverables

- Quarterly Progress Reports in electronic format
- Reimbursement Forms in either electronic or hard copy format

Task 2: Modeling of Pollutant Loads using the SELECT model and LDCs

Objective: Develop estimate of bacteria and nitrate loading using LDCs to determine respective load reductions for bacteria and nitrates needed to achieve water quality standards and to identify highest point and nonpoint source contributors of bacteria using SELECT, a spatially-explicit GIS methodology. Incorporate the results into the Buck Creek WPP.

Subtask 2.1: BAEN will conduct SELECT modeling analysis efforts to estimate bacteria loadings across the Buck Creek and identify critical bacterial loading areas within the watershed. SELECT will not be used to assess nitrates as it is currently not capable of producing reliable nitrate analysis results. LDCs will be used to estimate needed load reductions from these areas to reduce bacteria and nitrate levels in the creek to desired levels. (Start Date: Month 3; Completion Date: Month 15)

Subtask 2.2: Research will incorporate the results of the modeling analysis into the Buck Creek WPP that will be developed in TSSWCB project (06-11). (Start Date: Month 3; Completion Date: Month 15)

Subtask 2.3: BAEN and Research, with assistance from TWRI, will develop the technical report for the project for submission to TSSWCB, USEPA, and project partners. (Start Date: Month 9; Completion Date: Month 27)

Subtask 2.4: BAEN and Research, with assistance from TWRI, will develop the technical report for the project for submission to TSSWCB, EPA, and project partners. (Start Date: Month 9; Completion Date: Month 33)

Deliverables

- Modeling results that estimate bacteria loading, identify highest point and nonpoint source contributors of bacteria, and determine bacteria and nitrate load reductions needed to achieve water quality standards in the Buck Creek watershed
- Technical Report detailing modeling results for incorporation into Buck Creek WPP

Task 3. Quality Assurance

Objective: To develop and implement DQOs and QA/QC activities to ensure data of known and acceptable quality are generated through this project.

Subtask 3.1: TWRI will develop a QAPP for activities in Task 2 consistent with *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* (May 2006) and the *TSSWCB Environmental Data Quality Management Plan* (August 2007). (Start Date: Month 1; Completion Date: Month 3)

Subtask 3.2: TWRI will submit revisions and necessary amendments to the QAPP as needed. (Start Date: Month 3; Completion Date: Month 33)

Deliverables

- QAPP for Task 2 approved by TSSWCB in both electronic and hard copy formats
- Approved revisions and amendments to QAPP

The purpose of this QAPP is to clearly delineate the QA policy, management structure, and procedures, which will be used to implement the QA requirements necessary to analyzing data using Load Duration Curves and spatially explicit modeling under subtasks 2.1-2.3.

Table A6-1. Project Plan Milestones

Task	Project Milestones	Agency	Start	End
1.1	TWRI will coordinate project efforts with all project partners, as well as with the *Watershed Protection Plan Development for Buck Creek* project (TSSWCB 06-11). TTVN meetings or teleconferences will be held, as appropriate, with project partners to discuss project activities, project schedule, lines of responsibility, communication needs, and other requirements.	TWRI	Oct 08	May 11
1.2	TWRI will prepare electronic quarterly reports that document all activities performed within a quarter and shall be submitted to the TSSWCB no later than the 15th of January, April, July and October. All progress reports will also be provided to Research, Extension, RRA, and Hall-Childress, Salt Fork, and Donley County SWCD directors and placed on the project website maintained by TWRI.	TWRI	Oct 08	May 11
1.3	TWRI will submit appropriate Reimbursement Forms to TSSWCB.	TWRI	Oct 08	May 11
2.1	BAEN will conduct SELECT modeling analysis efforts to estimate bacteria loadings across the Buck Creek and identify critical bacterial loading areas within the watershed.	BAEN	Dec 08	Dec 09
2.2	LDCs will be used to estimate needed load reductions from these areas to reduce bacteria and nutrient levels in the creek to desired levels.	BAEN	Dec 08	Dec 09
2.3	Research will incorporate the results of the modeling analysis into the Buck Creek WPP that will be developed in TSSWCB project (06-11).	AgriLife Vernon	June 09	Nov 10
2.4	BAEN and Research, with assistance from TWRI, will develop the technical report for the project for submission to TSSWCB, USEPA, and project partners.	BAEN, AgriLife Vernon, TWRI	June 09	May 11
3.1	TWRI will develop a QAPP for activities in Task 2 consistent with *EPA Requirements for Quality Assurance Project Plans (QA/R-5)* (May 2006) and the *TSSWCB Environmental Data Quality Management Plan* (August 2007).	TWRI	Oct 08	Nov 08
3.2	TWRI will submit revisions and necessary amendments to the QAPP as needed.	TWRI	Dec 08	May 11

Model descriptions

Statistical Models

- Spatially Explicit Load Enrichment Calculation Tool (SELECT)
- Load duration curves (LDC)

Spatially Explicit Load Enrichment Calculation Tool

The Center for TMDL and Watershed Studies at Virginia Tech has been involved in TMDL development for bacteria impairments. The Center personnel developed a systematic process for source characterization that includes the following steps:

- inventorying bacterial sources (including livestock, wildlife, humans, and pets);
- distributing estimated loads to the land as a function of land use and source type; and
- generating bacterial load input parameters for watershed-scale simulation models.

This process provides a consistent approach that is necessary to develop comprehensive bacteria TMDLs. The Center personnel developed a software tool, the Bacteria Source Load Calculator (BSLC), to assist with the bacterial source characterization process and to automate the creation of input files for water quality modeling (Zeckoski, et al., 2005). But BSLC does not spatially reference the sources. A spatially-explicit tool, SELECT is being developed by Spatial Sciences Laboratory and Biological and Agricultural Engineering, TAMU to calculate contaminant-loads resulting from various sources within a watershed. SELECT spatially references the sources, and is being developed under ArcGIS 9 environment. SELECT will calculate and allocate pathogen loading to a stream from various sources within a watershed. All loads will be spatially referenced. In order to allocate the *E. coli* load throughout the Buck Creek watershed, estimations of the source contributions will be made. This in turn allows the sources and locations to be ranked according to their potential contribution for each sub-watershed. The populations of agricultural animals, wildlife, and domestic pets will be calculated and distributed throughout each watershed according to appropriate land use. Furthermore, point sources such as Waste Water Treatment Plants will be identified and their contribution quantified based on flow and outflow concentration. Septic system contribution will also be estimated based on criteria including distance to a stream, soil type, failure rate, and age of system. Once the watershed profile is developed for each potential source, the information can be aggregated to the sub-watershed level to identify the top contributing areas in the watershed.

Load duration Curve

This is a simple and an effective first-step methodology to obtain data-based TMDLs (Cleland, 2003; Stiles, 2001). A duration curve is a graph that illustrates the percentage of time during which a given parameter's value is equaled or exceeded. For example, a flow duration curve (FDC) (Figure A6-1) uses the hydrograph of the observed stream flows to calculate and depict the percentage of time the flows are equaled or exceeded.

A LDC (Figure A6-2), which is related to the FDC, shows the corresponding relationship between the contaminant loadings and stream flow conditions at the monitoring site. In this manner, it assists in determining patterns in pollution loading (point sources, non point sources, erosion, etc.) depending on the streamflow conditions. Based on the observed patterns, specific restoration plans can be implemented that target a particular kind of pollutant source. For example, if the pollutant loads exceed the allowable loads (see Figure A6-3) for low stream flow regimes, then the point sources such as waste water treatment plants and direct deposition sources (wildlife, livestock) should be targeted for the restoration

plans. Another main advantage of the LDC method is that it can also be used to evaluate the current impairment as some percent of samples which exceed the standard, and therefore it allows for the rapid development of TMDLs (Stiles, 2001).

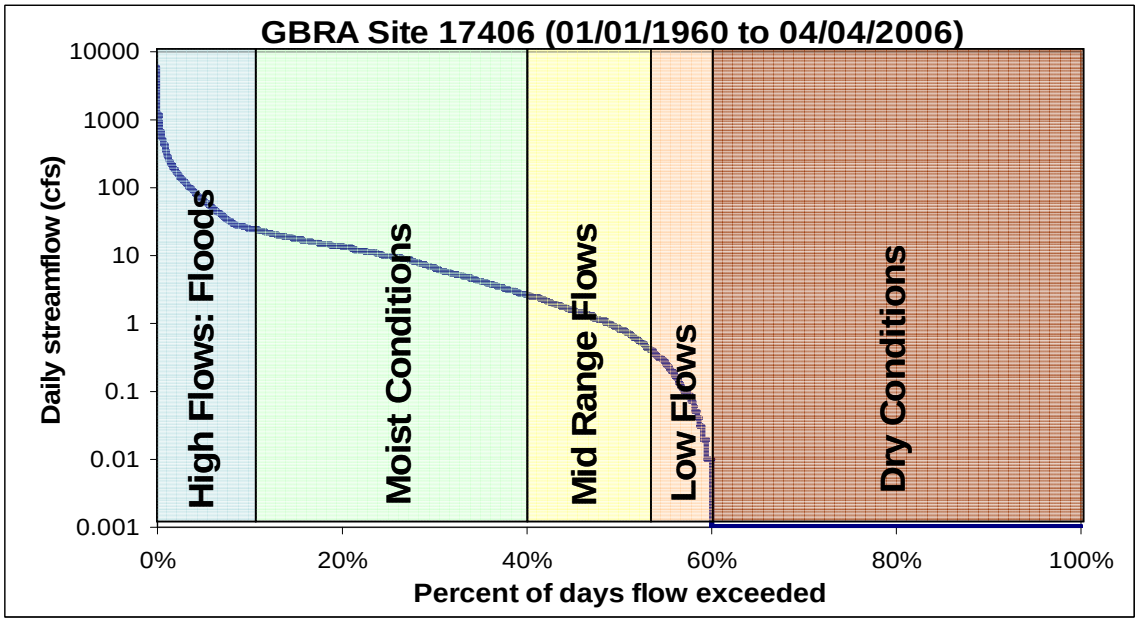


Figure A6-2 Flow Duration Curve (FDC) for streamflow conditions at GBRA monitoring station 17406 on Plum Creek, near Uhland, TX. The flow data at 17406 was obtained from the nearest USGS gage station 8172400, after adjusting for subwatershed aerial contribution during runoff events.

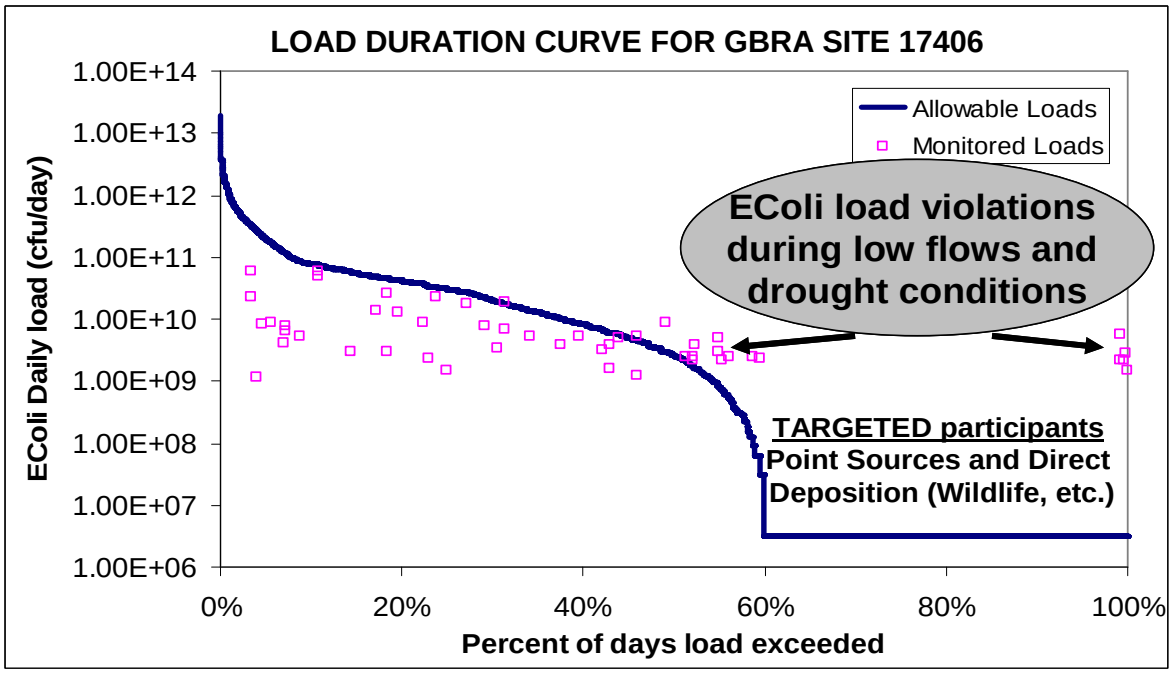


Figure A6-3 Load Duration Curve for *E. coli* at GBRA monitoring station 17406 on Plum Creek, near Uhland, TX. The flow data at 17406 was obtained from the nearest USGS gage station 8172400, after adjusting for subwatershed aerial contribution during runoff events.

Section A7: Quality Objectives and Criteria for Model Inputs / Outputs

Faculty in BAEN at TAMU will conduct a phased modeling effort to develop pollutant source and loading information and estimates of needed bacteria and nitrate reductions. The objectives of the water quality modeling for this project are as follows:

1) Develop and obtain approval for a QAPP
2) Spatially characterize and rank sources of bacteria and within the watershed using SELECT, a spatially-explicit GIS methodology. Divide the area into sub-watersheds and identify, quantify and rank pollutant loads from various sources, i.e. agriculture, urban/human, wildlife, and other sources in the study area.
3) Develop LDCs to analyze the temporal trends in the observed water quantity and quality data for the watershed. The LDCs will be developed using currently existing water quality and flow data available from RRA and AgriLife Vernon (collected under TSSWCB projects 03-07 and 06-11). Obtain an interpolated model to simulate the trends of the monitored data. Evaluate the violations and the required load-reductions of bacteria and nitrates for different flow-rate regimes (low, medium, and high flow) using LDC and interpolated model.

SELECT – this approach is being developed by the Spatial Sciences Laboratory (SSL) at TAMU and BAEN. It is similar to BSCL (Zeckoski, et al. 2005) in TMDL development. High quality spatial data (Landuse data developed under TSSWCB Project 08-52, SSURGO soils data, NHD, etc) will be processed and utilized in SELECT approach. Distributions for input parameters for SELECT will be created based on literature values and expert knowledge.

LDC – this approach has been utilized in several TMDL projects as an initial screening-tool to evaluate the actual temporal load trends in streams (Cleland, 2003; Stiles, 2001). In cases of violations, it is necessary to determine the required load-reduction in that region near the monitoring station. Load-reductions should be calculated for all flow-regimes of the stream. In order to do this continuous monitoring data will be simulated using the actual monitoring data by regression methods. Uncertainty of the model will be estimated via residual error analysis. The straight line passing through residual error plot should have a slope of zero.

Section A8: Special Training Requirements/Certification

All personnel involved in model calibration, validation, and development will have the appropriate education and training required to adequately perform their duties. No special certifications are required.

Section A9: Documentation and Records

All records, including modeler's notebooks and electronic files, will be archived by BAEN for at least five years. These records will document model testing, calibration, and evaluation and will include documentation of written rationale for selection of models, record of code verification (hand-calculation checks, comparison to other models), source of historical data, and source of new theory, calibration and sensitivity analyses results, and documentation of adjustments to parameter values due to calibration. Electronic data on the project computers and the network server are backed up daily to the network drive and weekly to an external hard drive and the PI's computer. In the event of a catastrophic systems failure, the tapes can be used to restore the data in less than one day's time. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases.

TWRI's QAO will produce an annual QA/QC report, which will be kept on file at TWRI with copies distributed to individuals listed in section A3. Any items or areas identified as potential problems and any variations or supplements to QAPP procedures noted in the QA/QC report will be made known to pertinent project personnel and included in an update or amendment to the QAPP.

Quarterly progress reports disseminated to the individuals listed in section A3 will note activities conducted in connection with the water quality modeling project, items or areas identified as potential problems, and any variations or supplements to the QAPP. Final reports on the SELECT modeling analysis and the LDC analysis will be developed. Outcomes will be submitted to the established stakeholder group and utilized in future TMDL development.

Corrective Action Reports (CARs) will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at TWRI and will be disseminated to the individuals listed in section A3. CARs resulting in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in updates or amendments to the QAPP.

Section B1: Sampling Process Design (Experimental Design)

Not relevant.

Section B2: Sampling Method Requirements

Not relevant.

Section B3: Sample Handling and Custody Requirements

Not relevant.

Section B4: Analytical Methods

Not relevant.

Section B5: Quality Control Requirements

Not relevant.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

Not relevant.

Section B7: Instrument Calibration and Frequency

Not relevant.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

Not relevant.

Section B9: Data Acquisition Requirements (Non-direct Measurements)

Water quality data collected by the RRA, specifically *E. coli*, nitrates and flow, will be used along with data from two other projects to conduct the SELECT (*E. coli* only) and LDC (*E. coli* and nitrates) analyses. The RRA is a partner in the Clean Rivers Program for the state of Texas. As such, they collect data on a regular basis for routine water quality assessment as part of the state's mandate for CWA §305(b) – Water Quality Inventory Report. These data also are used by Texas for consideration of water bodies to be added to their list of impaired water body segments, as described in CWA §303(d). Additional data obtained from the TCEQ are from the TRACS database.

Data collected under the *Bacterial Monitoring for the Buck Creek Watershed* project (TSSWCB Project 03-07) will also be used to develop SELECT and LDC analyses. These data were taken in accordance with the approved QAPP for the project and encompasses data collected from November 1, 2003 to September 30, 2007. Data that may be used from this project include water quality, rainfall and streamflow information.

Data collected under the *Watershed Protection Plan Development for Buck Creek* project (TSSWCB Project 06-11) will also be used to develop SELECT and LDC analyses. These data were taken in accordance with the approved QAPP for the project and encompasses data collected from October 1, 2007 to September 30, 2009. Data that may be used from this project include water quality, rainfall and streamflow information.

Data collected under the *Classification of Current Land Use/Land Cover for Certain Watersheds Where Total Maximum Daily Loads or Watershed Protection Plans Are In Development* project (TSSWCB Project 08-52) where taken in accordance with the approved QAPP for the project and encompass data collected and analyzed from March 2008 to March 2009. Data that may be used from this project include global positioning points and their associated land use/land cover and will be used to complete the SELECT analysis.

All data used in the modeling procedures for this project are collected in accordance with approved quality assurance measures under the state's Clean Rivers Program, TCEQ, Texas Water Development Board, USDA, National Weather Service, or USGS.

GIS data to be used are 2004 and 2005 NAIP (National Agricultural Imagery Program) aerial photos, SSURGO (Soil Survey Geographic) and Computer Based Mapping System soils, USGS National Land Cover Dataset (NLCD) landuse, National Hydrography Dataset (NHD), Census data (2000), Agricultural Census data from USDA-NASS (2002), and the USGS 30-meter resolution digital elevation model. Depending on the availability of the GIS layers from different data sources, efforts will be made to update the spatial data to the most recent year.

Because most historical data is of known and acceptable quality and were collected and analyzed in a manner comparable and consistent with needs for this project, no limitations will be placed on their use, except where known deviations have occurred.

Section B10: Data Management

Systems Design

BAEN uses laptop personal computers and desktop personal computers. The computers run Windows XP or Vista operating system. Softwares include Microsoft® Word, Microsoft® Excel, Microsoft® Access, and a Statistical Analysis System database management system run through Windows XP operating system. All GIS analysis will be performed using ArcGIS 9x.

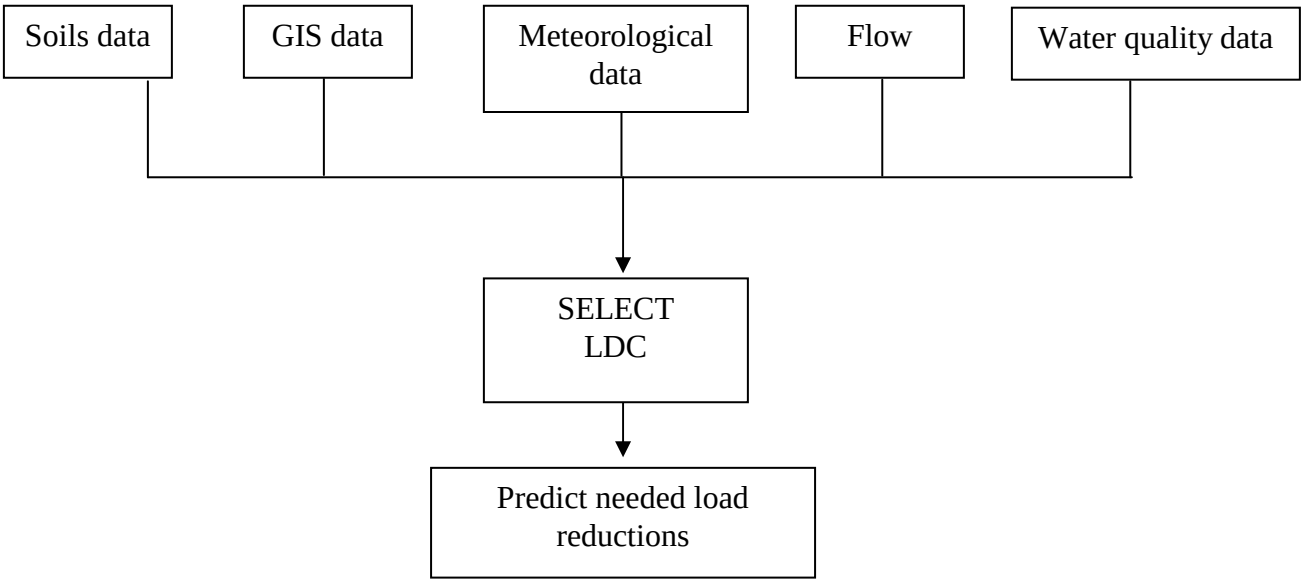
Backup and Disaster Recovery

The personal computer drives are backed up daily on the network server and on a weekly basis to an external hard drive. Data are also backed up weekly to the PI's computer. In the event of a catastrophic systems failure, the tapes can be used to restore the data in less than one day's time. Data generated on the day of the failure may be lost, but can be reproduced from raw data in most cases.

Archives and Data Retention

Original data recorded on paper files are stored for at least five years. Data in electronic format are stored on tape drives in a climate controlled, fire-resistant storage area on the TAMU campus.

Figure B10-1. Information Dissemination Diagram



Section C1: Assessments and Response Actions

Table C1.1 presents the types of assessments and response actions for activities applicable to the QAPP.

Table C1.1 Assessments and Response Actions

Assessment Activity	Approximate Schedule	Responsible Party(ies)	Scope	Response Requirements
Status Monitoring Oversight, etc.	Continuous	TWRI, BAEN	Monitoring of the project status and records to ensure requirements are being fulfilled. Monitoring and review of performance and data quality.	Report to project lead in Quarterly Report
Technical Systems Audit	Minimum of one during the course of this project.	TSSWCB QAO	The assessment will be tailored in accordance with objectives needed to assure compliance with the QAPP. Facility review and data management as they relate to the project.	30 days to respond in writing to the TSSWCB QAO to address corrective actions

In addition to those listed above, the following assessment and response actions will be applied to modeling activities. As described in Section B9 (Non-direct Measurements), modeling staff will evaluate data to be used in calibration and as model input according to criteria discussed in Section A7 (Quality Objectives and Criteria for Model Inputs/Outputs Data) and will follow-up with the various data sources on any concerns that may arise.

The model calibration procedure is discussed in Section D2 (Validation and Verification Methods), and criteria for acceptable outcomes are provided in Section A7 (Quality Objectives and Criteria for Model Inputs/Outputs).

Results will be reported to the project QAO in the format provided in Section A9. If agreement is not achieved between the calibration standards and the predictive values, corrective action will be taken by the Project Manager to assure that the correct files are read appropriately and the test is repeated to document compliance. Corrective action is required to ensure that conditions adverse to quality data are identified promptly and corrected as soon as possible. Corrective actions include identification of root causes of problems and successful correction of identified problem. CARs (Appendix A) will be filled out to document the problems and the remedial action taken. Copies of CARs will be included with the TWRI's annual Quality Assurance report. The Quality Assurance report will discuss any problems encountered and solutions made. These QA reports are the responsibility of the QAO and the Project Manager and will be disseminated to individuals listed in section A3. If the predicted value cannot be brought within calibration standards, the QAO will work with TSSWCB to arrive at an agreeable compromise.

Software requirements, software design, or code are examined to detect faults, programming errors, violations of development standards, or other problems. All errors found are recorded at the time of inspection, with later verification that all errors found have been successfully corrected. Software used to compute model predictions are tested to assess its performance relative to specific response times, computer processing usage, run time, convergence to solution, stability of the solution algorithms, the absence of terminal failures, and other quantitative aspects of computer operation.

Checks are made to ensure that the computer code for each module is computing module outputs accurately and within any specific time constraints. The full model framework is tested as the ultimate level of integration testing to verify that all project-specific requirements have been implemented as intended. All testing performed on the original version of the module or linked modules is repeated to detect new “bugs” introduced by changes made in the code to correct a model.

Section C2: Reports to Management

Quarterly progress reports developed by the Project Manager will note activities conducted in connection with the water quality modeling project, items or areas identified as potential problems, and any variations or supplements to the QAPP. CAR forms will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at TWRI and disseminated to individuals listed in section A3. CARs that result in any changes or variations from the QAPP will be made known to pertinent project personnel and documented in an update or amendment to the QAPP.

If the procedures and guidelines established in this QAPP are not successful, corrective action is required to ensure that conditions adverse to quality data are identified promptly and corrected as soon as possible. Corrective actions include identification of root causes of problems and successful correction of identified problem. CARs will be filled out to document the problems and the remedial action taken. Copies of CARs will be included with the TWRI's annual QA report. The QA report will discuss any problems encountered and solutions made. These QA reports are the responsibility of the QAO and the Project Manager and will be disseminated to individuals listed in section A3.

Section D1: Data Review, Validation and Verification

All data obtained will be reviewed, validated, and verified against the data quality objects outlined in Section A7, "Quality Objectives and Criteria for Model Inputs / Outputs." Only those data that are supported by appropriate QC will be considered acceptable for use.

The procedures for verification and validation are described in Section D2, below. The TAMU BAEN Project Co-Leader is responsible for ensuring that data are properly reviewed, verified, and submitted in the required format for the project database. Finally, the TWRI QAO is responsible for validating that all data collected meet the DQOs of the project and are suitable for reporting.

Section D2: Validation Methods

There is no validation and calibration for the SELECT model or LDC as they are data processors.

Section D3: Reconciliation with User Requirements

The modeling framework developed for this project will be used to evaluate bacteria and nitrate loading in the Buck Creek Watershed. It will provide information pertaining to watershed characteristics and to the prediction of possible pollution, the sources of this pollution and will provide critical information to assist in identifying management practices to prevent pollution loading in area streams. This, in turn, will be useful for incorporation in the WPP being developed under TSSWCB Project 06-11.

The final data will be reviewed to ensure that it meets the requirements as described in this QAPP. CARs will be initiated in cases where invalid or incorrect data have been detected. Data that have been reviewed, verified, and validated will be summarized for their ability to meet the DQOs of the project and the informational needs of water quality agency decision-makers. These summaries, along with a description of any limitations on data use, will be included in the final report.

References

Cleland, B. 2003. TMDL Development from the "bottom up" – Part III: Duration Curves and wet-weather assessments. America's Clean Water Foundation, Washington, DC.

Stiles, T.C., 2001. A simple method to define bacteria TMDLs in Kansas. KS Dept. of Health and Environment. Topeka, KS. http://www.wef.org/pdffiles/TMDL/Stiles.pdf (last accessed, 9/12/2006).

Zeckoski, R.W., B.L. Benham, S.B. Shan, M.L. Wolfe, K.M. Brannan, M. Al-Smadi, T.A. Dillaha, S. Mostaghimi, and C.D. Heatwole, 2005. BSLC: A tool for bacteria source characterization for watershed management. Transactions of ASAE, 21(5): 879-889.

Corrective Action Report
SOP-QA-001
CAR #:_____

Date:_____ Area/Location:_____

Reported by:_____ Activity:_____

State the nature of the problem, nonconformance or out-of-control situation:
_____
_____
_____
_____
_____

Possible causes:
_____
_____
_____

Recommended Corrective Actions:
_____
_____
_____

CAR routed to:_____
Received by:_____

Corrective Actions taken:
_____
_____
_____
_____

Has problem been corrected?: YES NO

Immediate Supervisor:_____

Program Manager:_____

TWRI Quality Assurance Officer:_____

TSSWCB Quality Assurance Officer:_____