Clean Water Act Section 319(h) Nonpoint Source Pollution Control Program

SWAT Model Simulation of the Arroyo Colorado Watershed

TSSWCB Project Number 02-21

Revision #0

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

prepared by

Texas Water Resources Institute

Effective Period: Upon EPA Approval through July 2008

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

Kevin Wagner
Quality Assurance Officer
Texas Water Resources Institute
2118 TAMU
College Station, Texas 77843-2118
klwagner@ag.tamu.edu
(979) 845-2649

A1 APPROVAL PAGE

Quality Assurance Project Plan for *SWAT Model Simulation of the Arroyo Colorado Watershed.*

United States Environmental Protection Agency (EPA), Region VI

Name: Donna Miller
Title: EPA Chief; State/Tribal Programs Section

Signature:_____ Date:_____

Name: Ellen Caldwell
Title: EPA Texas Nonpoint Source Project Manager

Signature:_____ Date:_____

Texas State Soil and Water Conservation Board (TSSWCB)

Name: Pamela Casebolt
Title: TSSWCB Project Manager

Signature:_____ Date:_____

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

Signature:_____ Date:_____

Texas Water Resources Institute (TWRI)

Name: B.L. Harris
Title: TWRI Associate Director; Project Lead

Signature:_____ Date:_____

Name: Kevin Wagner
Title: TWRI Quality Assurance Officer (QAO)

Signature:_____ Date:_____

Texas Agricultural Experiment Station (TAES)—Blackland Research & Extension Center

Name: Narayanan Kannan
Title: Postdoctoral Research Associate; Project Co-Lead

Signature:_____Date:_____

Texas A&M University Spatial Sciences Laboratory (SSL)

Name: Raghavan Srinivasan
Title: SSL Director

Signature:_____Date:_____

A2 TABLE OF CONTENTS

A3 DISTRIBUTION LIST

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

U.S. Environmental Protection Agency Region 6
1445 Ross Avenue, Suite # 1200; Dallas, TX 75202-2733

Name: Ellen Caldwell
Title: Texas NPS Project Manager, Water Quality Division

Texas State Soil and Water Conservation Board (TSSWCB)
P.O. Box 658; Temple, Texas 76503

Name: Pamela Casebolt
Title: TSSWCB Project Manager

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

Texas Water Resources Institute (TWRI)
2118 TAMU; College Station, TX 77843-2118

Name: B.L. Harris
Title: TWRI Associate Director; Project Lead

Name: Kevin Wagner
Title: TWRI Quality Assurance Officer

TAES—Blackland Research and Extension Center
720 E. Blackland Rd; Temple, TX 76502

Name: Narayanan Kannan
Title: Project Co-Lead

Texas A&M University – Spatial Sciences Laboratory (SSL)
2120 TAMU; College Station, TX 77843-2120

Name: Raghavan Srinivasan
Title: SSL Director

List of Acronyms

ARS	USDA-Agricultural Research Service
BMP	Best Management Practice
BOD	Biological Oxygen Demand
CAR	Corrective Action Report
CBMS	Computer Based Mapping System
CMS	Cubic Meters Per Second
CWA	Clean Water Act
DEM	Digital Elevation Model
DQO	Data Quality Objectives
EFDC	Environmental Fluid Dynamics Code
EPA	Environmental Protection Agency
GIS	Geographic Information System
HSPF	Hydrologic Simulation Program – Fortran
IBWC	International Boundary Water Commission
NLCD	National Land Cover Dataset
NH_3-N	Ammonia
NO_2	Nitrite
NO_3	Nitrate
NPS	Nonpoint Source
NRA	Nueces River Authority
NRCS	USDA-Natural Resource Conservation Service
OP	Orthophosphorus
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
SSL	TAMU Spatial Sciences Laboratory
SSURGO	Soil Survey Geographic
SWAT	Soil and Water Assessment Tool
SWCD	Soil and Water Conservation District
TAES	Texas Agricultural Experiment Station
TAMU	Texas A&M University
TCE	Texas Cooperative Extension
TCEQ	Texas Commission on Environmental Quality
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSSWCB	Texas State Soil and Water Conservation Board
TTVN	Trans-Texas Videoconference Network
TWRI	Texas Water Resources Institute
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WQMP	Water Quality Management Plan

A4 PROJECT/TASK ORGANIZATION

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

U.S. Environmental Protection Agency Region 6

Ellen Caldwell, EPA Project Officer

Responsible for managing the project for EPA. Reviews project progress and reviews and approves QAPP and QAPP amendments.

Texas State Soil and Water Conservation Board (TSSWCB)

Pamela Casebolt, TSSWCB Project Manager

Responsible for ensuring that the project delivers data of known quality, quantity, and type on schedule to achieve project objectives. Provides the primary point of contact between the TWRI and the TSSWCB. Tracks and reviews deliverables to ensure that tasks in the work plan are completed as specified in the contract. Responsible for verifying that the QAPP is followed by the TWRI. Notifies the TSSWCB QAO of significant project nonconformances and corrective actions taken as documented in quarterly progress reports from TWRI Project Lead.

Donna Long, TSSWCB Quality Assurance Officer

Reviews and approves QAPP and any amendments or revisions and ensures distribution of approved/revised QAPPs to TSSWCB participants. Assists the TSSWCB Project Manager on QA-related issues. Coordinates reviews and approvals of QAPPs and amendments or revisions. Conveys QA problems to appropriate TSSWCB management. Monitors implementation of corrective actions. Coordinates and conducts audits.

Texas Water Resources Institute (TWRI)

B.L. Harris, TWRI Associate Director; 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 quality assurance/quality control 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. Responsible for ensuring adequate training and supervision of all activities involved in generating analytical and field data.

Kevin Wagner, TWRI Quality Assurance Officer

Responsible for coordinating development and implementation of the TWRI's QA program. Responsible for writing and maintaining QAPPs and monitoring its implementation. Responsible for maintaining records of QAPP distribution, including

appendices and amendments. Ensures the data collected for the project is of known and acceptable quality and adheres to the specifications of the QAPP. Responsible for identifying, receiving, and maintaining project quality assurance records. Responsible for coordinating with the TSSWCB to resolve QA-related issues. Notifies the TWRI Project Lead, TAES Project Co-Lead, and TSSWCB Project Manager of particular circumstances which may adversely affect the quality of data. Coordinates the research and review of technical QA material and data related to water quality monitoring system design and analytical techniques. Conducts assessments of participating organizations during the life of the project as noted in Section C1. Implements or ensures implementation of corrective actions needed to resolve nonconformance noted during assessments. Provides copies of QAPP and any amendments or revisions to each project participant. Documents receipt of the plan by participants and maintains this documentation as part of the project's quality assurance records.

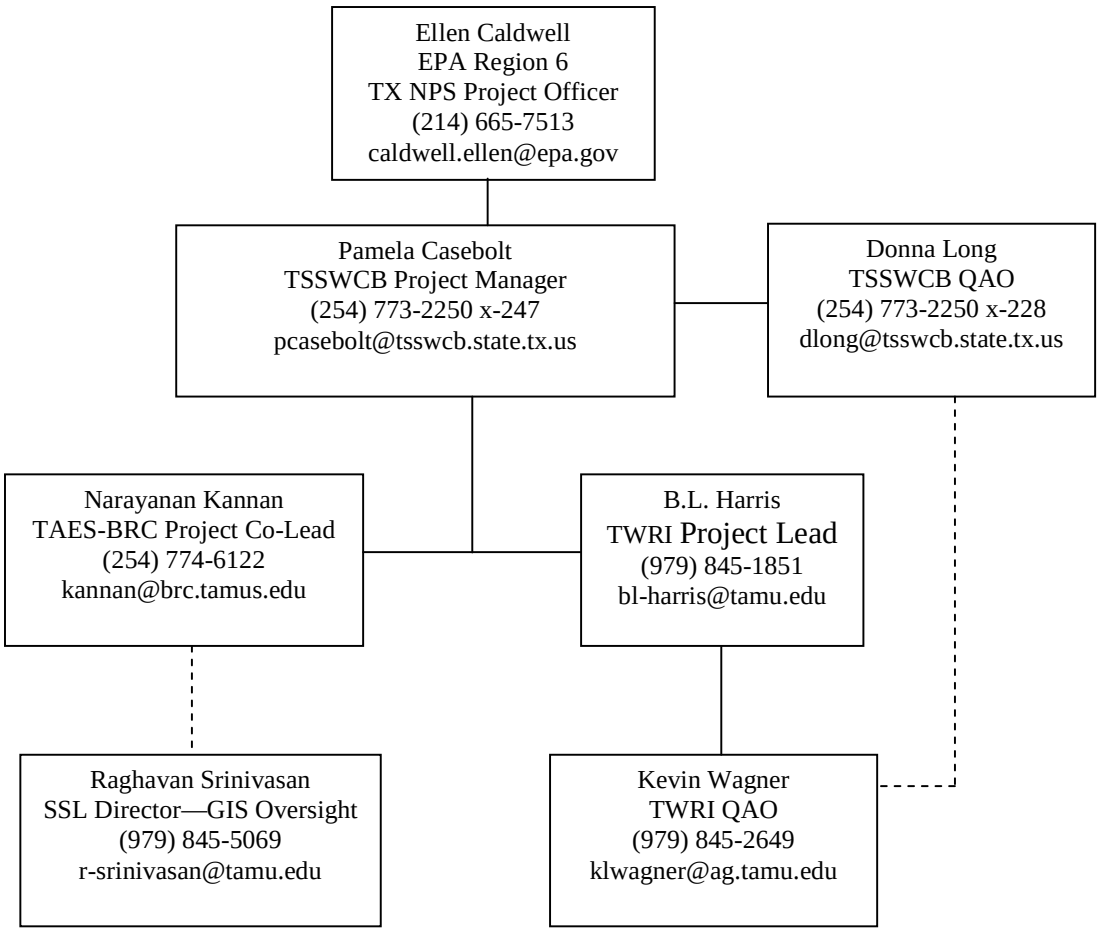
Texas Agricultural Experiment Station

Narayanan Kannan, Project Co-Lead
Responsible for water quality modeling, data analysis, and reporting tasks for the project including development of data quality objectives (DQOs) and a quality assurance project plan (QAPP). Responsible for coordination, development, and delivery of quarterly reports and the final project report.

Texas A&M University Spatial Science Laboratory (SSL)

Raghavan Srinivasan, SSL Director
Responsible for technical oversight and GIS.

Figure A4.1 Organization Chart



A5 PROBLEM DEFINITION/BACKGROUND

The Arroyo Colorado flows through Hidalgo, Cameron and Willacy Counties in the Lower Rio Grande Valley of Texas into the Laguna Madre. As a result of low dissolved oxygen levels, the tidal segment of the Arroyo Colorado (2201) does not currently support the aquatic life use designated by the State of Texas and described in the Water Quality Standards. This has been the case for every *303(d) List* prepared by the State since 1986. There have also been concerns about high nutrient levels in this stream as documented on every *305(b) Assessment* prepared by the State since 1988. The watershed was originally modeled by TCEQ in 1999 using the HSPF model. This model indicated that a 90% reduction in nitrogen, phosphorous, oxygen demanding substances and sediment was necessary to meet the dissolved oxygen criteria at least 90% of the time during the critical period of March through October. In 2003, the TCEQ directed staff to collect additional data and increase the sophistication of the TMDL analysis to reduce uncertainty and to better characterize the watershed and then to reassess needed loading reductions. This project will help with the reassessment of the needed loading reductions by simulating current loadings using the SWAT model.

The need for this project is substantiated in *A Watershed Protection Plan for the Arroyo Colorado Phase I* and specifically in the volume *Components Addressing Agricultural NPS Pollution*. This project utilizes information generated and compiled through TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* and quantifies load reductions achieved through TSSWCB CWA §319(h) projects 05-10 *Education of BMPs in the Arroyo Colorado Watershed* and 05-12 *WQMP Implementation Assistance in the Arroyo Colorado Watershed*.

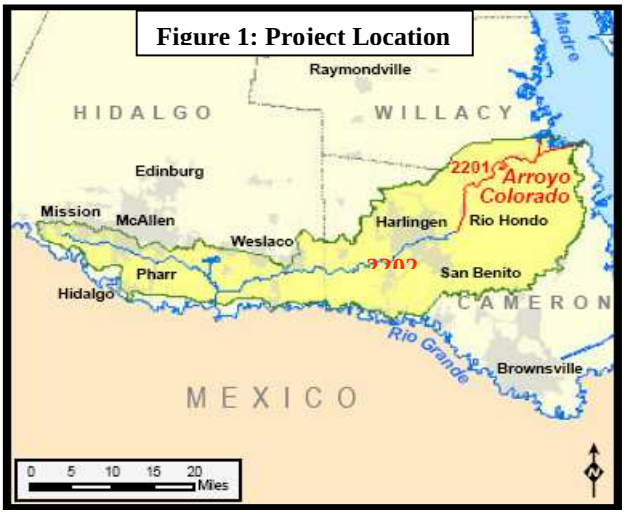


Figure 1: Project Location

A6 PROJECT/TASK DESCRIPTION

The project will consist of using a computer modeling software (SWAT model) and a geographic information system (GIS) to simulate the current sediment, BOD and nutrient loadings in the Arroyo Colorado watershed. The SWAT model will be used to quantify the sediment and nutrient loadings in the watershed. TAES-Blackland will conduct the model simulations.

Meteorological, in-stream flow, wastewater flow and loading, GIS and measured water quality data will be compiled along with information on the type and extent of management measures implemented for both agricultural and urban areas in the watershed. Examples of GIS data that may be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, landuse developed through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment*, and the USGS 30-meter resolution digital elevation model (DEM). Measured precipitation and temperature will be collected from National Weather Service climate stations for input to SWAT. Measured stream flow will be collected from USGS, IBWC and other stream gage stations. Water quality data will be compiled from USGS, IBWC, NRA, TCEQ and Clean Rivers Program sources.

Information on typical crops and management practices (e.g. tillage practices, irrigation management, and nutrient application rate and timing) will be obtained from TAES, TCE, TSSWCB, and local NRCS and SWCD field offices. Existing BMPs (e.g. land leveling, irrigation management, nutrient management methods) will be obtained through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* for the period of 1999-2006. Non-agricultural input data will also be obtained from TAES, TCEQ, TSSWCB, NRCS, and SWCD field offices. SWAT inputs will be prepared to accurately represent existing conditions and management

After compiling all available data for the watershed, the SWAT model will be set up and calibrated using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 1999-2003 with 1999 as warm-up period. If measured data is not available for a particular sub-watershed, SWAT inputs will be selected and adjusted based on recent research and calibration in other watersheds. After calibration, the model will be validated using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 2004-2006. Existing conditions and load reduction scenarios specified by TSSWCB will be simulated to determine nutrient, BOD, and sediment loadings.

SWAT output will be provided to the TSSWCB formatted for input into the model by TCEQ. A final report for the project will also be prepared.

SWAT Watershed Model description
SWAT is a physically-based watershed and landscape simulation model developed by the USDA-ARS. Major components of the model include hydrology, weather, erosion, soil temperature, crop growth, nutrients, pesticides and agricultural management. SWAT has the ability to predict changes in sediment, nutrients (i.e. organic and inorganic nitrogen and organic and soluble phosphorus), pesticides, dissolved oxygen, bacteria and algae loadings from different management conditions in large ungauged basins. SWAT operates on a daily time step and can

be used for long-term simulations. The model output is available in daily, monthly and annual time scales. SWAT coding and subroutines are modular, allowing for addition of new subroutines when necessary. SWAT has been successfully applied to model water quality issues including sediments, nutrients and pesticides in watersheds. SWAT will be used in this study because it represents landscape processes and the impacts of agricultural management and land uses on water quality.

Table A6.1. Project Plan Milestones

Task	Project Milestones	Agency	Start	End
1.1	Conduct TTVN meetings or teleconferences.	TWRI	05/07	03/09
1.2	Prepare & submit quarterly reports to TSSWCB & participants	TWRI	05/07	03/09
1.3	Develop QAPP	TWRI	05/07	08/07
1.4	QAPP Annual Revision #1	TWRI	05/08	08/08
1.8	Final Report	TWRI, SSL, TAES	03/09	06/09
2.1	Compile data for model	SSL, TAES	05/07	11/07
2.2	Set up and calibrate model	SSL, TAES	11/07	05/08
2.3	Validate model	SSL, TAES	05/08	11/08
2.4	Simulate load reduction scenarios	SSL, TAES	05/08	11/08
2.5	Provide TSSWCB flow and watershed loadings	SSL, TAES	05/08	11/08

A7 QUALITY OBJECTIVES AND CRITERIA

The objective of the water quality modeling for this project is to characterize flow and watershed loadings to the Arroyo Colorado for input into the EFDC model. The Soil and Water Assessment Tool (SWAT) will be used to quantify time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).

GIS data and measured data will be collected for each of the sub-watersheds. It is anticipated that most of the data will have a scale of 1:24,000 with a 30-meter resolution. GIS data to be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, USGS NLCD (National Land Cover Dataset) landuse developed through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment*, and the USGS 30-meter resolution digital elevation model (DEM). Measured precipitation and temperature will be collected from National Weather Service climate stations for input to SWAT. Measured stream flow will be collected from USGS, IBWC and other stream gage stations. Water quality data will be compiled from USGS, IBWC, NRA, TCEQ and Clean Rivers Program sources.

Information on typical crops and management practices (e.g. tillage practices, irrigation management, and nutrient application rate and timing) will be obtained from TAES, TCE, TSSWCB, and local NRCS and SWCD field offices. Existing BMPs (e.g. land leveling, irrigation management, nutrient management methods) will be obtained through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* for the period of 1999-2006. Non-agricultural input data will also be obtained from TAES, TCEQ, TSSWCB, NRCS, and SWCD field offices. SWAT inputs will be prepared to accurately represent existing conditions and management.

Model calibration, in this setting, is defined as how well the model is able to reproduce current observed flow rates and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 1999-2003 with 1999 as warm-up period. If measured data is not available for a particular sub-watershed, SWAT inputs will be selected and adjusted based on recent research and calibration in other watersheds. Thus, the calibration procedure is able to divide the total variability of the model predictions into two sources:

1. Within-station variability in the input measurements.
2. Variability and uncertainty associated with how well the model fits the data (i.e. lack of fit).

The following criterion has been established for this project as acceptable model calibration inputs and outputs, respectively:

- Annual flow will be calibrated so that predicted values agree to measured values within 15%,

- Partitioning of stream flow *between surface and subsurface flows (as defined by base flow filter)* will be calibrated so that predicted values agree to measured values within 15%,
- Sediment, nutrients and BOD *(where data is available)* will be calibrated so that predicted values agree to measured values within 20 %,

In the instance that these calibration standards are not obtained, TAES will:

- Check data for deficiencies and correct any that are found,
- Check model algorithms for deficiencies and correct any that are found, and
- Re-calibrate the model after corrections of deficiencies.

If the standards are obtained, a corrective action report will be submitted to TSSWCB with the following quarterly report. If these steps do not bring predicted values within calibration standards, the Quality Assurance Officer will work with TSSWCB and EPA to arrive at an agreeable compromise.

Information gathered from this study will allow TSSWCB and TCEQ to develop a more comprehensive simulation of pollutant loading in the Arroyo Colorado.

A8 SPECIAL TRAINING/CERTIFICATION

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

A9 DOCUMENTS AND RECORDS

The document and records that describe, specify, report, or certify activities, requirements, procedures, or results for this project and the items and materials that furnish objective evidence of the quality of items or activities are listed below.

Table A9.1 Project Documents and Records

Document/Record	Location	Retention	Form
QAPP, amendments, and appendices	TWRI	5 years	Paper/Electronic
QAPP distribution documentation	TWRI	5 years	Paper/Electronic
Corrective Action Reports (CARs)	TWRI	5 years	Paper
Modeler notebooks	TAES	5 years	Paper
Model Input Data files	TAES	5 years	Electronic
Model Calibration Documentation	TAES	5 years	Paper/Electronic
Model Validation Documentation	TAES	5 years	Paper/Electronic
Model Output	TAES	5 years	Paper/Electronic
Progress reports/final report	TWRI/TSSWCB	3 years	Paper/Electronic

The TSSWCB may elect to take possession of records at the conclusion of the specified retention period.

QAPP Revision

Until the work described is completed, this QAPP shall be revised as necessary and reissued annually on the anniversary date, or revised and reissued within 120 days of significant changes, whichever is sooner. The last approved versions of QAPPs shall remain in effect until revised versions have been fully approved; the revision must be submitted to the TSSWCB for approval before the last approved version has expired. If the entire QAPP is current, valid, and accurately reflects the project goals and the organization's policy, the annual re-issuance may be done by a certification that the plan is current. This can be accomplished by submitting a cover letter stating the status of the QAPP and a copy of new, signed approval pages for the QAPP.

Amendments

Amendments to the QAPP may be necessary to reflect changes in project organization, tasks, schedules, objectives and methods; address deficiencies and nonconformances; improve operational efficiency; and/or accommodate unique or unanticipated circumstances. Requests for amendments are directed from the TWRI Project Lead to the TSSWCB Project Manager in writing. The changes are effective immediately upon approval by the TSSWCB Project Manager and Quality Assurance Officer, or their designees, and the EPA Project Officer. Amendments to the QAPP and the reasons for the changes will be documented, and copies of the approved QAPP Expedited Amendment form will be distributed to all individuals on the QAPP distribution list by the TWRI QAO. Amendments shall be reviewed, approved, and incorporated into a revised QAPP during the annual revision process.

B1 SAMPLING PROCESS DESIGN

Not relevant.

B2 SAMPLING METHODS

Not relevant.

B3 SAMPLE HANDLING AND CUSTODY

Not relevant.

B4 ANALYTICAL METHODS

Not relevant.

B5 QUALITY CONTROL

Not relevant.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

Not relevant.

B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

Calibration is the process where the model input parameters are adjusted until the simulated data from the model match with observed data. Model calibration, in this setting, is defined as how well the model is able to reproduce current observed flow rates and concentrations of sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (e.g., trends and peak values), as measured from multiple field surveys and stored in the respective monitoring databases. Model parameters related to watershed/landscape processes will be adjusted to match the measured and simulated flow, sediment, nutrients, and BOD at key locations in the watershed. During the calibration process, all model parameters will be adjusted within literature recommended ranges. Calibration will be done to represent normal, wet and dry years. Time series plots (between simulated and observed data) and statistical measures such as mean, standard deviation, coefficient of determination and Nash-Suttcliffe simulation efficiency will be used to evaluate the prediction (performance) of the model during calibration. Calibration is done systematically, first for flow, then for sediment and followed by organic and mineral nutrients.

Annual flow will be calibrated so that predicted values agree to measured values within 15%. Partitioning of stream flow between surface and subsurface flows (as defined by base flow filter) will be calibrated so that predicted values agree to measured values within 15%. Sediment (where sedimentation survey or other data is available) will be calibrated so that predicted values also agree to measured values within 20%. Finally, nutrients and BOD (where in-stream data is available) will be calibrated so that the mean of the predicted values falls within 20% of the measured values.

When calibration standards are not obtained, TAES will check data for deficiencies and correct them. Model algorithms will be checked for deficiencies and corrected, and the model will be re-calibrated. If at that time, predictive values fall within the established standards, a corrective action report will be submitted to TSSWCB with the following quarterly report. If these steps do not bring predicted values within calibration standards, the TWRI Quality Assurance Officer will work with TSSWCB and EPA to arrive at an agreeable compromise.

Geographic Information System (GIS) data required for SWAT modeling (i.e., topography, land use, soils and river segments) will be collected for the Arroyo Colorado watershed. Data collected for the watershed will be processed and run for the watershed to develop model inputs. Qualitative assessments will be done when evaluating the outcome of model calibration by evaluating how well the outputs of the fitted model are able to match the overall trend in prediction over time and over the entire watershed area.

Calibration of a SWAT model for the watershed will begin immediately after QAPP approval. After collecting all available data for the watershed, the SWAT model will be calibrated to measured stream flow, sediment, nutrients and BOD. Model parameters related to subwatersheds and landscape processes will be adjusted to match measured and simulated flow and water quality trends at key locations in the watershed. If measured data is not available for a particular sub-watershed, SWAT inputs will be selected and adjusted based on recent research and calibration in other watersheds. All model parameters will be adjusted within ranges

recommended in published literature. Then the model will be validated without adjusting any parameters. The calibration period will be from 1999-2003 (with 1999 as preparation period) and the validation period will be from 2004-2006. Time series plots and standard statistical measures will be used to evaluate the performance of modeling during calibration and validation. After calibration, the existing condition will be simulated for a 30-year period to determine time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Not relevant.

B9 NON-DIRECT MEASUREMENTS

Various data such as land use (current and historical), soil, BMP implementation locations, topography, sub-watershed delineation (matching earlier HSPF sub-watersheds), long-term weather data, crop management practices, stream flow and water quality data (current and historical) on sediment, BOD, and nutrients, for the Arroyo Colorado Watershed will be compiled for the period of 1999-2006 from sources such as USGS, TCEQ, TWDB, TPWD, IBWC, Nueces River Authority (NRA), TAES, TCE, and NRCS.

Meteorological, in-stream flow, wastewater flow and loading, GIS and measured water quality data will be compiled along with information on the type and extent of management measures implemented for both agricultural and urban areas in the watershed. GIS data that will be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, landuse developed through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment*, and the USGS 30-meter resolution digital elevation model (DEM). Measured precipitation and temperature will be collected from National Weather Service climate stations for input to SWAT. Measured stream flow will be collected from USGS, IBWC and other stream gage stations. Water quality data will be compiled from USGS, IBWC, NRA, TCEQ and Clean Rivers Program sources.

Information on typical crops and management practices (e.g. tillage practices, irrigation management, and nutrient application rate and timing) will be obtained from TAES, TCE, TSSWCB, and local NRCS and SWCD field offices. Existing BMPs (e.g. land leveling, irrigation management, nutrient management methods) will be obtained through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* for the period of 1999-2006. Non-agricultural input data will also be obtained from TAES, TCEQ, TSSWCB, NRCS, and SWCD field offices. SWAT inputs will be prepared to accurately represent existing conditions and management

All data used in the modeling procedures for this project are collected in accordance with an approved QAPP under the state's Clean Rivers Program, the TSSWCB NPS Program, TCEQ's targeting monitoring approach, the Texas Water Development Board, or the USGS.

B10 DATA MANAGEMENT

Systems Design

TAES uses laptop personal computers, desktop personal computers and Unix workstations. The computers run Windows operating system and Unix Solaris operating system. Databases include Microsoft® Excel, Microsoft® Access database, and a SAS database management system run through a Unix Solaris operating system.

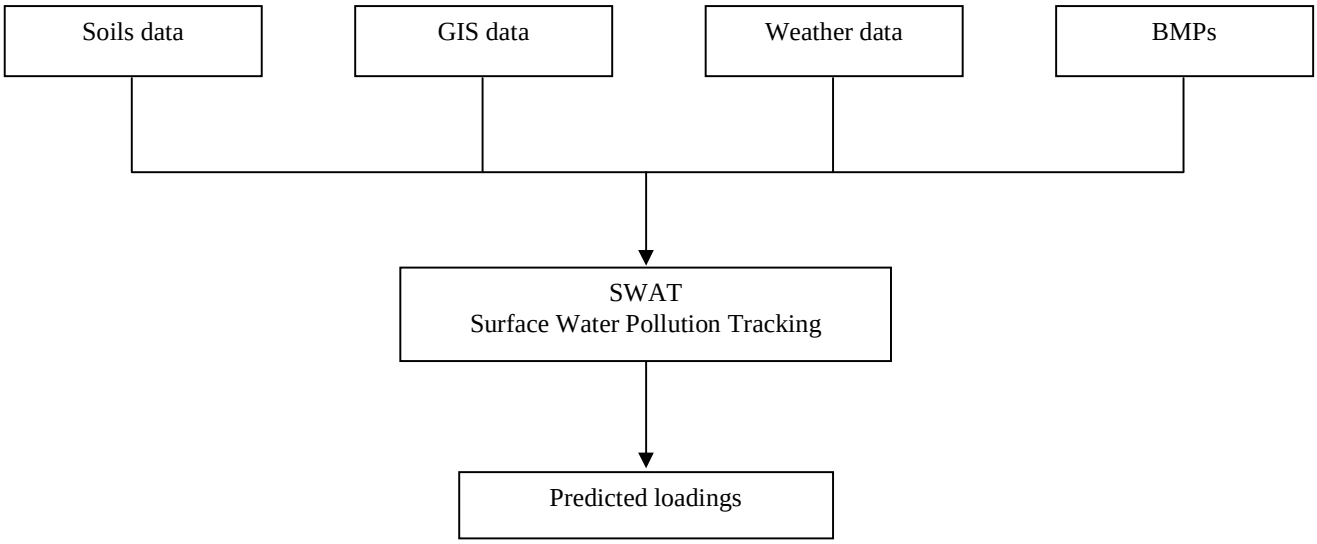
Backup and Disaster Recovery

The Unix drive and the network server are backed up daily to a tape drive. 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 CDs in a climate controlled room at TAES-Blackland Reasearch and Extention Center.

Figure B10-1. Information Dissemination Diagram



C1 ASSESSMENTS AND RESPONSE ACTIONS

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) and will follow-up with the various data sources on any concerns that may arise.

The model calibration procedure is discussed in Section B7 (Instrument/Equipment Calibration and Frequency), and criteria for acceptable outcomes are provided in Section A7 (Quality Objectives and Criteria).

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 TWRI Project Lead to assure that the correct files are read appropriately and the test is repeated to document compliance. If the predicted value cannot be brought within calibration standards, the TWRI Quality Assurance Officer will work with TSSWCB and EPA 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 specified 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.

C2 REPORTS TO MANAGEMENT

Quarterly progress reports will note activities conducted in connection with this water quality modeling project, items or areas identified as potential problems, and any variations or supplements to the QAPP. Corrective action report forms will be utilized when necessary (Appendix B). CARs will be maintained in an accessible location for reference at TAES-Blackland. 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. Corrective action reports will be filled out to document the problems and the remedial action taken. Copies of corrective action reports will be included with quarterly report. The corrective action reports and quarterly reports will discuss any problems encountered and solutions made. These reports are the responsibility of the TWRI QAO and Project Lead and are available for review upon request.

D1 DATA REVIEW, VERIFICATION AND VALIDATION

All data obtained will be reviewed and verified for integrity and continuity, reasonableness, and conformance to project requirements, and then validated against the data quality objects outlined in Section A7. Only those data that are supported by appropriate quality control data will be considered acceptable for use.

The procedures for verification and validation are described in Section D2, below. The TAES Project Co-Lead is responsible for ensuring that data are properly reviewed, verified, and submitted in the required format for the project database.

D2 VERIFICATION AND VALIDATION METHODS

In the validation process, the model is operated with input parameters set during the calibration process, as described in Section B7, without any change and the results are compared to the measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 2004-2006 to evaluate the model prediction. Same evaluation measures will be used for assessing the performance of the model during validation. In case the matching between simulated and observed data is not to the standard, the calibration process will be revisited until a best fit between simulated and observed data is obtained. The validation and verification process will be conducted by the Project Co-Lead.

The watershed model, Soil Watershed Assessment Tool (SWAT) is built with state-of-the-art components with an attempt to simulate the processes physically and realistically. Most of the model inputs are physically based (that is, based on readily available information). It is important to understand that SWAT is not a parametric model with a formal optimization procedure (as part of the calibration process) to fit any data. Instead, a few input variables that are not well defined physically such as runoff curve number and Universal Soil Loss Equation's cover and management factor (C factor) may be adjusted to provide a better fit. Moreover, these model parameters are adjusted within literature recommended values so that the results are scientifically valid and defensible. In addition, statistical measures used for evaluating the model's predicted data using the observed data during calibration and validation help to maintain the quality of the model simulation processes and the model results reliable.

D3 RECONCILIATION WITH USER REQUIREMENTS

The modeling framework developed for this project will be used to evaluate flow and watershed loadings to the Arroyo Colorado. It will be incorporated to provide the TSSWCB, TCEQ, and local stakeholder groups with optimum information pertaining to watershed characteristics and to the prediction of possible pollution problems. This, in turn, will enhance decision-making as part of watershed planning management efforts underway.

The flow and watershed loadings to the Arroyo Colorado, as determined by SWAT, will be provided to TSSWCB for input by TCEQ into the EFDC model. SWAT output will include time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).

Statistical measures such as means, standard deviation, coefficient of determination (r^2), and Nash-Suttcliffe simulation efficiency to show the model's prediction with respect to observed data at several locations in the watershed will also be provided.

APPENDIX A. WORK PLAN

Texas State Soil and Water Conservation Board
CWA §319(h) Agricultural/Silvicultural Nonpoint Source Grant Program
FY 2002 Project Workplan (02-21)

NONPOINT SOURCE SUMMARY PAGE for the CWA §319(h) Agricultural/Silvicultural Nonpoint Source Grant Program						
Title of Project:	SWAT Model Simulation of the Arroyo Colorado Watershed					
Project Goals/Objectives:	(1) Obtain flow, meteorological, water quality, stream morphology, wastewater flow/loading, available information on management measures and pollutant export coefficients, land use and other applicable data for the Arroyo Colorado watershed for the period of 1999-2006. (2) Set up and calibrate a watershed model using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 1999-2003. (3) Validate watershed model using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 2004-2006. (4) Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB					
Project Tasks:	(1) Coordinate and Administer the Project (2) Watershed data compilation, analysis, and simulation using SWAT					
Measures of Success:	Characterization of flow and watershed loadings to the Arroyo Colorado for input into the EFDC model, including time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins)					
Project Type:	Statewide ( ); Watershed Implementation/Education ( ); Watershed Planning ( ); Watershed Assessment (X); Groundwater ( )					
Status of Water Body: 2004 Water Quality Inventory and 303(d) List	Segment ID: Arroyo Colorado (Tidal) 2201 Arroyo Colorado (Above Tidal) 2202		Parameters: Depressed dissolved oxygen Bacteria		Category: 5c 5c	
Project Location:	Arroyo Colorado Watershed (Segments 2201 and 2202) in Hidalgo, Cameron and Willacy Counties					
Key Project Activities:	Hire Staff (X); Monitoring ( ); Regulatory Assistance ( ); Technical Assistance ( ); Education ( ); Implementation ( ); Demonstration ( ); Modeling (X); Other ( )					
NPS Management Program Elements:	This project assists the State in achieving the Data Collection and Assessment Objective by (1) conducting special studies to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation and (2) develop and adopt, at the state level, TMDLs, I-Plans and WPPs for watersheds identified as impacted by NPS pollution on the latest state approved CWA §303(d) List. The project also assists the State in meeting Milestones to (1) Complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point / nonpoint sources, land use data, and all known stressors influencing water quality and (2) Develop and apply model(s) to determine numerical load allocations. Recommend control strategies for implementation.					
Project Costs:	Federal:	$94,997	Non-Federal Match:	$64,263	Total:	$159,260
Project Management:	• Texas Water Resources Institute • Texas Agricultural Experiment Station – Blackland Research and Extension Center					
Project Period:	May 2007 through April 2009					

Part I – Applicant Information

Applicant							
Project Lead	B.L. Harris						
Title	Associate Director						
Organization	Texas Water Resources Institute						
E-mail Address	bl-harris@tamu.edu						
Street Address	1500 Research Pkwy, Ste 240A 2118 TAMU						
City	College Station	County	Brazos	State	TX	Zip Code	77843-2118
Telephone	(979) 845-1851			Fax	(979) 845-8554		

Project Co-Lead	Dr. Narayanan Kannan						
Title	Postdoctoral Research Associate						
Organization	TAES – Blackland Research and Extension Center						
E-mail Address	kannan@brc.tamus.edu						
Street Address	720 E Blackland Rd						
City	Temple	County	Bell	State	TX	Zip Code	76502
Telephone	(254) 774-6122			Fax	(254) 774-6001		

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 TCEQ and ACWP
Texas Water Resources Institute (TWRI)	Project coordination and reporting (Task 1) and coordination with TSSWCB CWA §319(h) project 06-10.
Texas Agricultural Experiment Station – Blackland Research and Extension Center (TAES-Blackland)	SWAT Modeling (Task 2)
Texas A&M University Spatial Sciences Laboratory (SSL)	Technical Oversight and GIS (Task 2)
Texas Commission on Environmental Quality (TCEQ)	Coordination with TMDL and EFDC model efforts
Texas Cooperative Extension (TCE)	Coordination with ACWP and TSSWCB CWA §319(h) project 05-10
Arroyo Colorado Watershed Partnership (ACWP)	Coordination with WPP implementation

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	X	No	
If yes, identify the document.	*A Watershed Protection Plan for the Arroyo Colorado Phase I*						
If yes, identify the agency/group that developed and/or approved the document.	Texas Sea Grant and TCEQ			Year Developed	2007		

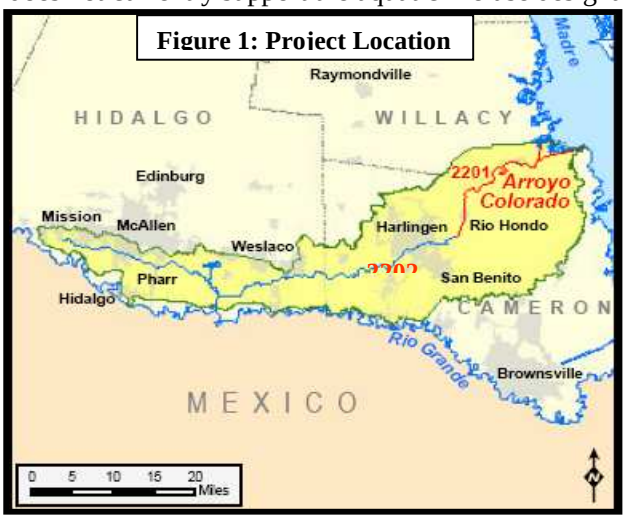
Watershed Information				
Watershed Name(s)	Hydrologic Unit Code (8 Digit)	Segment ID	305 (b) Category	Size (Acres)
Arroyo Colorado Watershed	12110208	2201/2202	5(c)	451,709

Project Narrative

Problem/Need Statement

The Arroyo Colorado flows through Hidalgo, Cameron and Willacy Counties in the Lower Rio Grande Valley of Texas into the Laguna Madre. As a result of low dissolved oxygen levels, the tidal segment of the Arroyo Colorado (2201), does not currently support the aquatic life use designated by the State of Texas and described in the Water Quality Standards. This has been the case for every *303(d) List* prepared by the State since 1986. There have also been concerns about high nutrient levels in this stream as documented on every *305(b) Assessment* prepared by the State since 1988. The watershed was originally modeled by TCEQ in 1999 using the HSPF model. This model indicated that a 90% reduction in nitrogen, phosphorous, oxygen demanding substances and sediment was necessary to meet the dissolved oxygen criteria at least 90% of the time during the critical period of March through October . In 2003, the TCEQ directed staff to collect additional data and increase the sophistication of the TMDL analysis to reduce uncertainty and to better characterize the watershed and then to reassess needed loading reductions. This project will help with the reassessment of the needed loading reductions by simulating current loadings using the SWAT model.

Figure 1: Project Location



The need for this project is substantiated in *A Watershed Protection Plan for the Arroyo Colorado Phase I* and specifically in the volume *Components Addressing Agricultural NPS Pollution.* This project utilizes information generated and compiled through TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* and quantifies load reductions achieved through TSSWCB CWA §319(h) projects 05-10 *Education of BMPs in the Arroyo Colorado Watershed* and 05-12 *WQMP Implementation Assistance in the Arroyo Colorado Watershed.*

Project Narrative
General Project Description
The project will consist of using a computer modeling software (SWAT model) and a geographic information system (GIS) to simulate the current sediment, BOD and nutrient loadings in the Arroyo Colorado watershed. The SWAT model will be used to quantify the sediment and nutrient loadings in the watershed. TAES-Blackland will conduct the model simulations. Meteorological, in-stream flow, wastewater flow and loading, GIS and measured water quality data will be compiled along with information on the type and extent of management measures implemented for both agricultural and urban areas in the watershed. Examples of GIS data that may be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, landuse developed through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment*, and the USGS 30-meter resolution digital elevation model (DEM). Measured precipitation and temperature will be collected from National Weather Service climate stations for input to SWAT. Measured stream flow will be collected from USGS, IBWC and other stream gage stations. Water quality data will be compiled from USGS, IBWC, NRA, TCEQ and Clean Rivers Program sources. Information on typical crops and management practices (e.g. tillage practices, irrigation management, and nutrient application rate and timing) will be obtained from TAES, TCE, TSSWCB, and local NRCS and SWCD field offices. Existing BMPs (e.g. land leveling, irrigation management, nutrient management methods) will be obtained through the TSSWCB CWA §319(h) project 06-10 *Arroyo Colorado Agricultural NPS Assessment* for the period of 1999-2006. Non-agricultural input data will also be obtained from TAES/TCEQ/TSSWCB/NRCS and SWCD field offices .SWAT inputs will be prepared to accurately represent existing conditions and management. After compiling all available data for the watershed, the SWAT model will be set up and calibrated using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 1999-2003 with 1999 as warm-up period. If measured data is not available for a particular sub-watershed, SWAT inputs will be selected and adjusted based on recent research and calibration in other watersheds. After calibration, the model will be validated using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 2004-2006. Existing conditions and load reduction scenarios specified by TSSWCB will be simulated to determine nutrient, BOD, and sediment loadings. SWAT output will be provided to the TSSWCB formatted for input into the model by TCEQ. A final report for the project will also be prepared.

Water Quality Impairment		
Describe all known causes (pollutants of concern) of water quality impairments from any of the following sources: 2004 Water Quality Inventory and 303(d) List, 2004 Summary of Waterbodies with Water Quality Concerns (Secondary Concerns List) or Other Documented Sources (ex. Clean Rivers Program Basin Summary or Basin Highlights Reports).		
Waterbody (Segment)	Standards not met in 2002 (parameter)	2002 Concerns
Arroyo Tidal (2201)	Aquatic Life Use Not Supporting (DO and ambient toxicity in sediment)	Nutrient Enrichment (ammonia, nitrate+nitrite) Historic Fish Kills (low DO)
Arroyo Above Tidal (2202)	Contact Recreation Not Supporting (bacteria) Fish Consumption Partially Supporting (DDE, and other organic compounds in fish tissue)	Nutrient Enrichment (ammonia, nitrate+nitrite, ortho-phosphorous, total phosphorus) Algal Growth (excessive) Aquatic Life Use (DO) Historic Fish Kills
Waterbody (Segment)	Standards not met in 2004 (parameter)	2004 Concerns
Arroyo Tidal (2201)	Aquatic Life Use Not Supporting (DO)	Nutrient Enrichment (ammonia, nitrate+nitrite) Historic Fish Kills
Arroyo Above Tidal (2202)	Contact Recreation Not Supporting (bacteria) Fish Consumption Not Supporting (DDD, DDE, DDT, chlordane, dieldrin, endrin, heptachlor epoxide, heptachlor, lindane, hexachlorobenzene, toxaphene)	Nutrient Enrichment (ammonia, nitrate+nitrite, ortho-phosphorous, total phosphorus) Algal Growth (excessive) Historic Fish Kills

Project Goals
The goal of this project is to simulate the current nutrient, BOD, and sediment loading to the Arroyo Colorado using the SWAT model. Model output will provide the needed input for the EFDC model. To achieve this, the following objectives will be accomplished: (1) Collect meteorological, landuse, crops, flow, soils, topographic, irrigation and nutrient management, wastewater discharges, water quality, and other necessary data needed to model the Arroyo Colorado with SWAT (2) Calibrate SWAT watershed model to measured flow, water/stream temperature, sediment, BOD and nutrients (3) Simulate/validate flow, water/stream temperature, nutrient, BOD and sediment loads for current conditions (4) Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB

Tasks, Objectives, and Schedules						
Task 1:	Coordinate and Administer Project					
Costs:	Federal:	$7,822	State:	$2,073	Total:	$9,895
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. This project will be coordinated with ongoing efforts in the Arroyo Colorado, especially the TSSWCB CWA §319(h) project 06-10, but also the TSSWCB CWA §319(h) projects 05-10 and 05-12, and other projects with which TWRI has involvement. TWRI will perform quality assurance functions, accounting functions for project funds and will be responsible for developing timely and accurate reports.. An interactive internet website will also be created and maintained to provide the most current progress.					
Subtask 1.1:	TWRI will coordinate project efforts with all project partners, as well as ongoing projects in the watershed. These projects include the *Arroyo Colorado Ag NPS Assessment*, *Education of BMPs in the Arroyo Colorado Watershed*, and the *WQMP Implementation Assistance in the Arroyo Colorado Watershed*. TWRI will participate in Arroyo Colorado Watershed Partnership meetings (steering committee and work groups) to report progress and coordinate efforts. 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 24		
Subtask 1.2:	TWRI will prepare electronic quarterly reports for submission to the TSSWCB. Progress reports shall document all activities performed within a quarter and shall be submitted by the 15th of January, April, July, and October. All progress reports will be provided to all project partners.					
	Start Date:	Month 1	Completion Date:	Month 24		
Subtask 1.3:	TWRI, with support from SSL and TAES, 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 Quality Management Plan* (July 2006).					
	Start Date:	Month 1	Completion Date:	Month 3		
Subtask 1.4:	TWRI will implement the approved QAPP and provide revisions and necessary amendments to the QAPP.					
	Start Date:	Month 3	Completion Date:	Month 24		
Subtask 1.5:	TWRI will attend meetings with the TSSWCB project manager and other meetings, as needed, to review project status, deliverables, and other project matters.					
	Start Date:	Month 1	Completion Date:	Month 24		
Subtask 1.6:	TWRI 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 1.7:	TWRI will develop (Months 1-3), host and maintain (Months 3-24) an internet website for the dissemination of information.					
	Start Date:	Month 1	Completion Date:	Month 24		
Subtask 1.8:	TWRI, with assistance from SSL and TAES, will develop the final report and technical documentation of the project for submission to TSSWCB, EPA, and project partners.					
	Start Date:	Month 18	Completion Date:	Month 24		

Deliverables	• Quarterly Progress Reports in electronic format • QAPP for Task 2 approved by TSSWCB and EPA in both electronic and hard copy formats • Approved revisions and amendments to QAPP, as needed • Project Website • Reimbursement Forms • Final Report

Tasks, Objectives, and Schedules						
Task 2:	Watershed data compilation, analysis, and simulation using SWAT					
Costs:	Federal:	$87,175	State:	$62,190	Total:	$149,365
Objective:	TAES, with technical oversight and assistance from SSL, will compile data needed for the SWAT model and characterize the flow and watershed loadings to the Arroyo Colorado for both agricultural and urban areas.					
Subtask 2.1:	Various data such as land use (current and historical), soil, BMP implementation locations, topography, sub-watershed delineation (matching earlier HSPF sub-watersheds), long-term weather data, crop management practices, stream flow and water quality data (current and historical) on sediment, BOD, and nutrients, for the Arroyo Colorado Watershed will be compiled for the period of 1999-2006 from sources such as USGS, TCEQ, TWDB, TPWD, IBWC, Nueces River Authority (NRA), TAES, TCE, and NRCS.					
	Start Date:	Month 1	Completion Date:	Month 6		
Subtask 2.2:	The SWAT model will be set up and calibrated to measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 1999-2003 (with 1999 as warm-up period) using monitoring data available from USGS and IBWC stream gages, as well as data from the TWDB, TCEQ, and NRA. Model parameters related to (sub) watershed/landscape processes will be adjusted to match the measured and simulated flow, sediment, BOD and nutrient loading at key locations in each subwatershed.					
	Start Date:	Month 6	Completion Date:	Month 12		
Subtask 2.3:	Subsequent to calibration, the model will be validated using measured flow and in-stream measurements of temperature, sediment, BOD, and nutrient concentrations for the period of 2004-2006.					
	Start Date:	Month 12	Completion Date:	Month 18		
Subtask 2.4:	Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB.					
	Start Date:	Month 12	Completion Date:	Month 18		
Subtask 2.4:	Provide TSSWCB the flow and watershed loadings to the Arroyo Colorado, as determined by SWAT, for input by TCEQ into the EFDC model. SWAT output will include time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).					
	Start Date:	Month 12	Completion Date:	Month 18		
Deliverables	• GIS maps related to soil, land use, and topography of the watershed • Observed water quality data compiled for 1999-2006 • Description of modeling procedures and results • Time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin (10-14) downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins) formatted for input into EFDC • Statistical measures such as means, standard deviation, coefficient of determination (r^2), and Nash-Suttcliffe simulation efficiency to show the model's prediction with respect to observed data at several locations in the watershed					

Measures of Success
• Characterization of flow and watershed loadings to the Arroyo Colorado for input into the EFDC model, including time series of average daily flow (in CMS) and sediment, BOD, NH_3-N, NO_2+NO_3, TN, OP and TP loadings (in metric units of mass) at the Port of Harlingen and for each sub-basin downstream of the Port of Harlingen (flow to be reported as flow volume for the sub-basins).

2005 Texas Nonpoint Source Management Program Document Reference
Goals &/or Milestone(s)
This project assists the State in achieving the Data Collection and Assessment Objective by conducting special studies to determine sources of NPS pollution and gain information to target TMDL activities and BMP implementation.
This project assists the State in achieving the Data Collection and Assessment Objective by helping develop and adopt, at the state level, TMDLs, I-Plans and WPPs for watersheds identified as impacted by NPS pollution on the latest state approved CWA §303(d) List.
The project assists the State in meeting the Milestone to complete the assessment of pollutant problems by reviewing existing water quality data, conducting an inventory of point / nonpoint sources, land use data, and all known stressors influencing water quality.
The project assists the State in meeting the Milestone to develop and apply model(s) to determine numerical load allocations. Recommend control strategies for implementation.

Part III – Financial Information

Budget Summary			
Federal 319(h)	$94,997	% of total project	60%
Non-Federal Match	$64,263	% of total project (≥ 40%)	40%
Total Project Cost	$159,260		

Category	Federal 319(h)	Non-Federal Match	Total
Personnel	58,862	21,230	80,092
Fringe Benefits	16,894	5,621	22,515
Subtotal Personnel & Fringe	75,756	26,851	102,607
Travel	4,850	0	4,850
Equipment	0	0	0
Supplies	2,000	0	2,000
Contractual	0	0	0
Construction	0	0	0
Other	0	0	0
Subtotal	6,850	0	6,850
Total Direct Costs	82,606	26,851	109,457
Indirect Costs (≤ 15%)	12,391	12,217	24,608
Unrecovered IDC	0	25,195	25,195
Total Project Costs	94,997	64,263	159,260

Budget Justification		
Category	Total Amount	Justification
Personnel & Fringe Benefits	$102,607	Federal • TWRI Project Manager @ 5% effort • TAES-Blackland Post Doc @ 33% effort • SSL Research Associate @ 25% effort Non-Federal Match • TAES-Blackland Assistant Professor @ 20% effort
Travel	$4,850	Federal • TWRI - $425 annually for travel to TSSWCB for quarterly meetings • TAES-Blackland - $1,000 annually for travel to Weslaco for ACWP meetings and data gathering • SSL - $1,000 annually for travel to Weslaco for ACWP meetings and data gathering
Equipment	$0	
Supplies	$2,000	Federal • TAES-Blackland – Computer and other supplies ($2,000)
Contractual	$0	
Construction	$0	
Other	$0	
Indirect	$24,608	Federal: • 15% of Total Direct Federal Non-Federal Match: • 45.5% of Total Direct Non-Federal Match
Unrecovered IDC	$25,195	Non-Federal Match: • 30.5% of Total Direct Federal

APPENDIX B.
CORRECTIVE ACTION REPORT

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:_____

Quality Assurance Officer:_____