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

Seven Lakes Atrazine Modeling Project

TSSWCB Project # FY03-16

Quality Assurance Project Plan

Texas State Soil and Water Conservation Board

prepared by

USDA- Natural Resources Conservation Service
Water Resources Assessment Team

Effective Period: March 30, 2004 to March 31, 2006

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Section A1 Approval Sheet

Quality Assurance Project Plan for TSSWCB project # FY03-16, *Seven Lakes Atrazine Modeling Project.*

United States Environmental Protection Agency (USEPA), Region VI

Name: Sunita Singhri
Title: USEPA Chief; Assistance Programs Branch (acting)

Signature:_________________________________Date:_____________

Name: Randall Rush

Title: USEPA Texas Nonpoint Source Project Manager

Signature:_________________________________Date:_____________

Texas Soil and Water Conservation Board (TSSWCB)

Name: Lee Munz
Title: TSSWCB Project Manager

Signature:_________________________________Date:_____________

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

Signature:_________________________________Date:_____________

USDA-NRCS / Water Resources Assessment Team (USDA-NRCS / WRAT)

Name: Steven T. Bednarz
Title: NRCS-WRAT Team Leader; Quality Assurance (QA) Manager

Signature:_________________________________Date:_____________

Name: Carl Amonett
Title: NRCS-WRAT Project Leader

Signature:_________________________________Date:_____________

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List of Acronyms and Abbreviations

BASINS	better assessment science integrating point and nonpoint sources
BMP	best management practices
BREC	Blackland Research and Extention Center
CBMS	computer based mapping system
CWA	Clean Water Act
CAR	corrective action report
DEM	digital elevation model
DQO	data quality objectives
EPA	Environmental Protection Agency
GIS	geographic information system
GPS	global positioning system
HUMUS	hydrologic modeling of the United States project
NPS	nonpoint source
NRCS	Natural Resources Conservation Service
NRCS-WRAT	Natural Resources Conservation Service-Water Resources Assessment Team
QA	quality assurance
QAPP	quality assurance project plan
SSURGO	soil survey geographic
SWAT	surface water assessment tool
SWCD	Soil and Water Conservation District
TAES	Texas Agricultural Experiment Station
TCEQ	Texas Commission on Environmental Quality
TMDL	total maximum daily load
TSSWCB	Texas State Soil and Water Conservation Board
TWBD	Texas Water Development Board
USDA-ARS	United States Department of Agriculture-Agricultural Research Service
USDA-NRCS	United States Department of Agriculture-Natural Resources Conservation Service
USDA-NRCS/WRAT	United States Department of Agriculture-Natural Resources Conservation Service/Water Resources Assessment Team
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USGS NLCD	United States Geological Survey-national land cover database

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

  Name: Sunita Singhri
  Title: USEPA Chief; Assistance Programs Branch (acting)

  Name: Randall Rush
  Title: USEPA Texas Nonpoint Source Project Manager

- Texas Soil and Water Conservation Board

  Name: Lee Munz
  Title: TSSWCB Project Manager

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

- USDA-Natural Resources Conservation Service / Water Resources Assessment Team

  Name: Steven T. Bednarz
  Title: Asst. State Conservationist for Water Resources; QA Manager

  Name: Carl Amonett
  Title: NRCS-WRAT Project Leader

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 – United States Environmental Protection Agency, Region VI, Dallas. Provides project overview at the Federal level.

Randall Rush, USEPA Texas Nonpoint Source Project Manager

Responsible for overall performance and direction of the project at the Federal level. Ensures that the project assists in achieving the goals of the federal 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.

Lee Munz, 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 and USEPA participants. Determines that the project meets the requirements for planning, quality assessment (QA), quality control (QC), and reporting under the CWA Section 319 program.

Kevin Wagner, TSSWCB Program Leader; 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.

USDA-NRCS / WRAT – U.S.Department of Agriculture-Natural Resources Conservation Service / Water Resources Assessment Team, Temple, Texas. Project Lead.

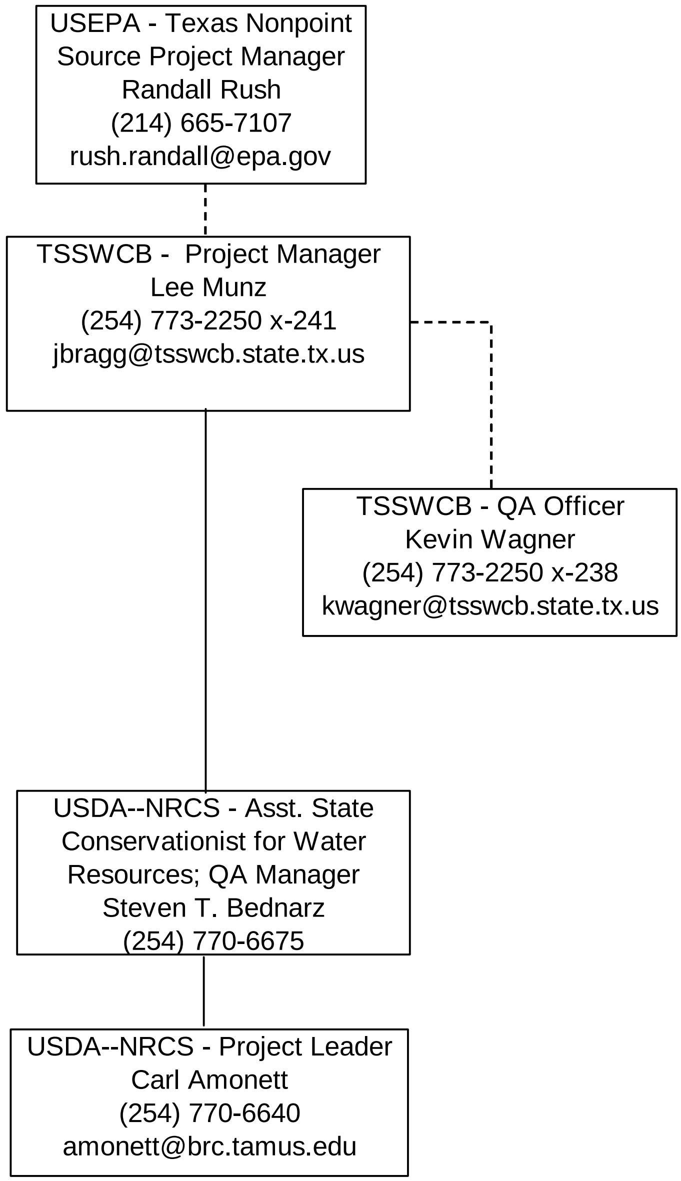
Steven T. Bednarz, Asst. State Conservationist for Water Resources; QA Manager

Responsible for overall operations of the NRCS-Water Resources Assessment Team, which includes oversight of all modeling operations and ensuring that all quality assurance-quality control requirements are met. Enforces corrective action, as required. Responsible for determining that the Quality Assurance Project Plan (QAPP) meets the requirements for planning, quality control, quality assessment, and reporting for activities conducted by USDA-NRCS / WRAT. Responsible for maintaining the official, approved QAPP, as well as conducting Quality Assurance audits in conjunction with TSSWCB and EPA personnel.

Carl Amonett, Project Leader

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.

Figure A4-1. Project Organization Chart
Dashed lines indicate communication only



Section A5: Problem Definition/Background

Water quality is becoming an increasing concern in the United States. The U.S. Environmental Protection Agency's (EPA) 1996 water quality inventory report indicated that 40% of the surface waters that were surveyed were not meeting their designated uses (EPA, 1998). To restore impaired water bodies, EPA established the Total Maximum Daily Load (TMDL) program under the Clean Water Act (CWA). Over the next decade, EPA estimates that more than 36,000 TMDLs will be implemented across the country at a cost of $1 to $3 billion (EPA, 2001). Because of this investment, EPA identified "improved watershed and water quality modeling" to support TMDLs as a high priority research need (EPA, 2002).

Mathematical models are one of the best tools for analyzing water quality issues. Models can replicate the flow of pollutants throughout watersheds and can be utilized to evaluate the consequences of management practices, control measures, and planning decisions. Models can also reduce the cost of water resources management (Barfield et al., 1991). Using a modeling approach for evaluating best management practices (BMPs) is cost-effective and time-saving, compared to field monitoring. For the purposes of this project, we will focus on using computer models and geographic information systems (GIS) to simulate the effects of applying best management practices on Atrazine loadings in Texas watersheds that are listed under "threatened status" by the Texas Commission for Environmental Quality (TCEQ).

Atrazine, a systemic herbicide that blocks photosynthesis, is currently one of the two most widely used agricultural pesticides in the U.S. Approximately 64 to 75 million pounds (lbs) of active ingredient (a.i.) are applied per year. About three-fourths of all field corn and sorghum are treated with Atrazine annually for weed control. Seventy percent (70%) of the atrazine applied to corn and sorghum is used prior to emergence (pre-emergence), and thirty percent (30%) is applied post-emergence.

Atrazine is the most commonly detected pesticide in ground and surface water. It has been the subject of multiple monitoring programs conducted by the registrant, academia, states, and government agencies, in particular the U.S. Geological Survey (USGS). Atrazine's frequent detection in streams, rivers, groundwater, and reservoirs is related directly to both its volume of usage, and its tendency to persist in soils and move with water.

Section A6: Project/Task Description

The overall goal of this project consists of using computer models and geographic information systems (GIS) to simulate the effects of applying best management practices on Atrazine loadings in seven Texas watersheds. The seven watersheds are (1) Lake Lavon, (2) Lake Tawakoni, (3) Richland-Chambers Reservoir, (4) Lake Bardwell, (5) Lake Waxahachie, (6) Lake Aquilla, and (7) the Little River Watershed from the release point of lakes Belton, Stillhouse Hollow, and Granger to the junction with the Brazos River.

The Soil and Water Assessment Tool (SWAT) will be used to quantify the effects of applying BMPs on atrazine loadings to streams, rivers, and lakes in each watershed. The Natural Resources Conservation Service (NRCS) Water Resources Assessment Team (WRAT) located at the Blackland Research and Extension Center (BREC) will conduct the model simulations.

GIS and measured data will be collected for each of the watersheds. It is anticipated that most of the data will have a scale of 1:24,000 with a 30-meter resolution. Examples of GIS data that may be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, USGS NLCD (National Land Cover Dataset) landuse, 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 at USGS stream gage stations, and measured sediment will be obtained from reservoir owners/operators, or the Texas Water Development Board (TWDB).

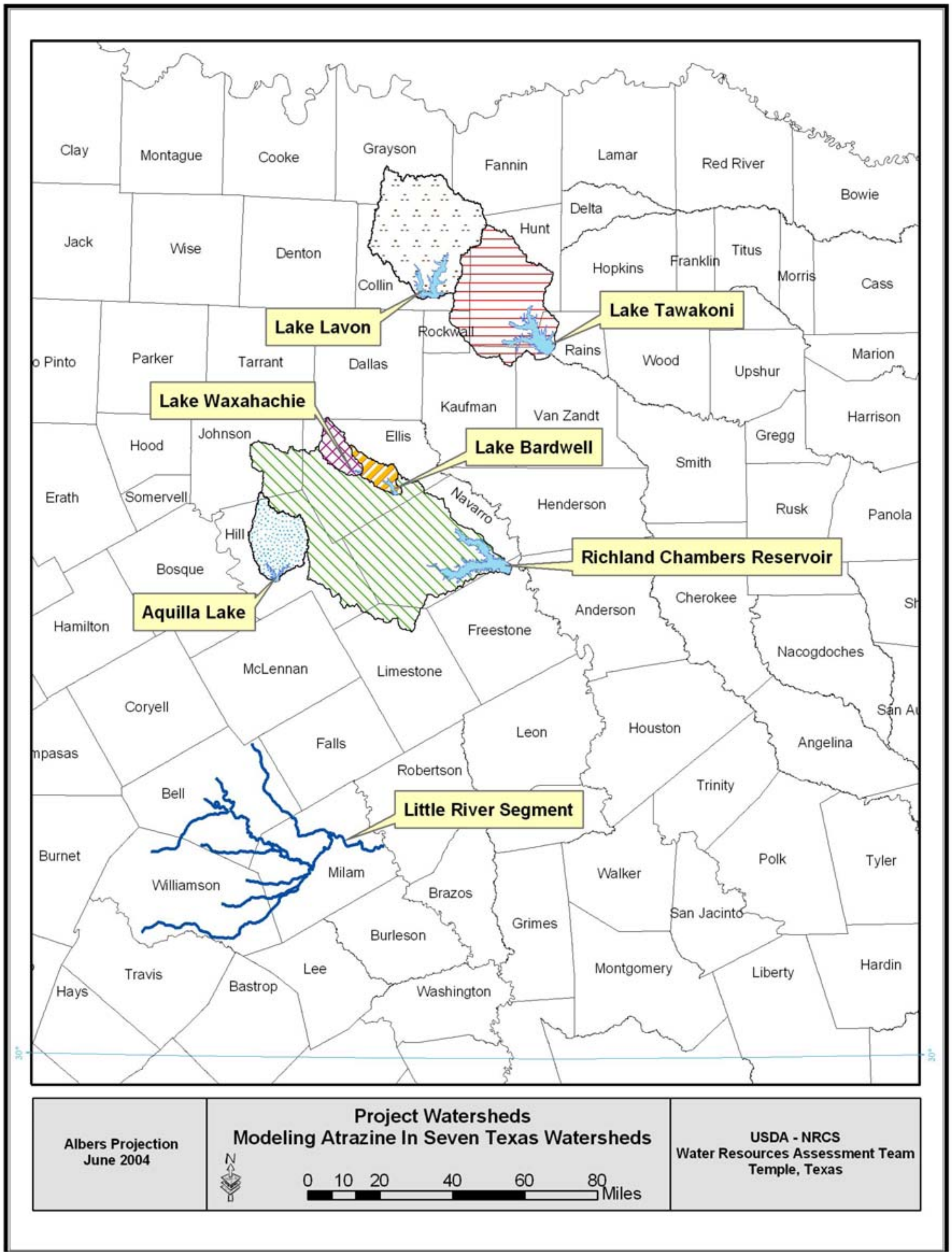
Within each watershed, information on typical crops and management practices (e.g. tillage, atrazine application rate and timing) will be obtained from local NRCS and SWCD field offices. Existing cropland BMPs (e.g. terraces, waterways, buffers) will be determined from field office records. SWAT inputs will be adjusted to accurately represent existing conditions and management.

After collecting all available data for a watershed, the SWAT model will be calibrated to measured stream flow, sediment, and atrazine. If measured data is not available for a particular watershed, calibration will be performed in nearby watersheds, and the same SWAT input adjustments will be used in the watersheds with no measured data. After calibration, the existing condition will be simulated for a 30-year period to determine atrazine loading to the lake.

To simulate the treated condition, BMPs, which may affect atrazine runoff, will be assumed applied on all cropland. Appropriate adjustments will be made to SWAT inputs, and the same 30-year period will be simulated. Model outputs for the existing condition and treated condition will be compared to determine the effects on atrazine loading to the lake or stream.

A final report for each watershed will be prepared at the end of the modeling process.

Figure A6-1. Texas Lakes Threatened or Impaired with Atrazine



Model description

The SWAT watershed model

SWAT is a physically-based watershed and landscape simulation model developed by the USDA-ARS (Arnold et al., 1998). Major components of the model include hydrology, weather, erosion, soil temperature, crop growth, nutrients, pesticides and agricultural management. SWAT also has the ability to predict changes in sediment, nutrients – such as 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 (Arnold et al., 1999; Rosenberg et al., 1999). 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	Lake Aquilla simulations.	NRCS-WRAT	Sept04	Nov04
1.2	Richland-Chambers Reservoir, Lake Bardwell, and Lake Waxahachie similations	NRCS-WRAT	Dec04	Jun05
1.3	Lake Lavon similations	NRCS-WRAT	Jul05	Sept05
1.4	Lake Tawakoni similations	NRCS-WRAT	Oct05	Dec05
1.5	Little River simulations	NRCS-WRAT.	Jan06	Aug06
1.1-1.5	Submit final report for each watershed	NRCS-WRAT	Sept06	Nov06

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

The objectives of the water quality modeling for this project are as follows:

1. This project will model the effects of various BMPs on atrazine loadings to lakes and rivers in seven Texas watersheds.
    a. Lake Aquilla
    b. Richland-Chambers Reservoir
    c. Lake Bardwell
    d. Lake Waxahachie
    e. Lake Lavon
    f. Lake Tawakoni
    g. Little River
2. Modeling work will be used for TSSWCB, USDA-NRCS, and SWCD education and decision-making efforts.

The Soil and Water Assessment Tool (SWAT) will be used to quantify the effects of applying BMPs on atrazine loadings to streams, rivers, and lakes in each watershed. GIS and measured data will be collected for each of the 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, 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, from 1999 to present. Measured stream flow will be collected at USGS stream gage stations, and measured sediment will be obtained from reservoir owners/operators, or the Texas Water Development Board and will be conducted using current QAPPs under which these agencies adhere to.

Within each watershed, current information on typical crops and management practices (e.g. tillage, atrazine application rate and timing) will be obtained from local NRCS and SWCD field offices. Existing cropland BMPs (e.g. terraces, waterways, buffers) will be determined from field office records. SWAT inputs will be adjusted 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 concentrations of atrazine (e.g., trends and peak values), as measured from multiple field surveys and stored in the TCEQ monitoring database. Multiple measurements for atrazine are used as input to the models. 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 criteria has been established for this project by NRCS-WRAT and TSSWCB, as acceptable model calibration inputs and outputs, respectively:

- Annual flow will be calibrated so that predicted values agree to measured values within 15%,
- Flow water balance *(relationship between surface and subsurface flows as defined by base flow filter)* will be calibrated so that predicted values also 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 15%,
- Atrazine (where in-stream atazine data is available) will be calibrated so that the mean of the predicted values falls within two standard deviations of the mean of the measured values.

In the instance that these calibration standards are not obtained., NRCS-WRAT 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 TSSWCBwith the following quarterly report. If these steps do not bring predicted values within calibration standards, the Quality Assurance Manager and Officer will work with TSSWCB and EPA to arrive at an agreeable compromise.

Information gathered from this study will allow TSSWCB and cooperating agencies to develop and implement watershed protection plans that will provide the most protection with the least cost to implement.

Section A8: Special Training Requirements/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.

Section A9: Documentation and Records

All records, including modeler's notebooks and electronic files, will be archived by USDA-NRCS / WRAT 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-calc 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

The USDA-NRCS / WRAT's QA Manager will produce an annual quality assurance/quality control report, which will be kept on file at the NRCS-Water Resources Assessment Team offices with copies made available upon request. Any items or areas identified as potential problems and any variations or supplements to QAPP procedures noted in the quality assurance/quality control report will be made known to pertinent project personnel and included in an update or amendment to the QAPP. The Project Manager will ensure distribution of the most recent QAPP to all individuals listed in Section A3.

Quarterly progress reports 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. Corrective Action Reports CARs will be utilized when necessary (Appendix A). CARs will be maintained in an accessible location for reference at USDA-NRCS / WRAT offices. 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.

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 Requirements

Not relevant.

Section B5: Quality Control Requirements

Not relevant.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

Not relevant.

Section B7: Calibration

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 atrazine (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, and pesticides 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 (Nash and Suttcliffe, 1970) 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 (Santhi et al., 2001), as well as pesticides.

Annual flow will be calibrated so that predicted values agree to measured values within 15%. Flow water balance *(relationship between surface and subsurface flows as defined by base flow filter)* will be calibrated so that predicted values also 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 15%. Atrazine (where in-stream atazine data is available) will be calibrated so that the mean of the predicted values falls within two standard deviations of the mean of the measured values.

When calibration standards are not obtained., NRCS-WRAT will check data for deficiencies and correct any that are found. 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 Quality Assurance Manager and 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 all aforementioned watersheds. Data collected for the watersheds will be processed and run for each 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 watersheds will begin immediately after QAPP approval. After collecting all available data for a watershed, the SWAT model will be calibrated to measured stream flow, sediment, and atrazine. 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 each watershed. If measured data is not available for a particular watershed, calibration will be performed in nearby watersheds, and the same SWAT input adjustments will be used in the watersheds with no measured data. All model parameters will be adjusted within ranges recommended in published literature. Then the model will be validated without adjusting any parameters. Depending on the monitoring data available, calibration and validation periods will be chosen. Time series plots and standard statistical measures will be used to evaluate the performance of models during calibration and validation. After calibration, the existing condition will be simulated for a 30-year period to determine atrazine loading to the lake.

Section B8: Inspection/Acceptance Requirements for Supplies and Consumables

Not relevant.

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

The TCEQ Conducts routine monitoring of the State's waterbodies under 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. This data is also used by Texas for consideration of waterbodies to be added to their list of impaired waterbody segments, as described in CWA§303(d).

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, under the TCEQ's TMDL targeting monitoring approach, overseen by the Texas Commission on Environmental Quality, or with an approved QAPP under the Texas Water Development Board or USGS.

GIS data to be used are SSURGO (Soil Survey Geographic) and CBMS (Computer Based Mapping System) soils, USGS NLCD (National Land Cover Dataset) landuse, 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, from 1999 to present. Measured stream flow will be collected at USGS stream gage stations, and measured sediment will be obtained from reservoir owners/operators, or the Texas Water Development Board and will be conducted using current QAPPs under which these agencies adhere to.

Within each watershed, current information on typical crops and management practices (e.g. tillage, atrazine application rate and timing) will be obtained from local NRCS and SWCD field offices. Existing cropland BMPs (e.g. terraces, waterways, buffers) will be determined from field office records. SWAT inputs will be adjusted to accurately represent existing conditions and management.

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Section B10: Data Management

Systems Design

The USDA-NRCS/WRAT 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.

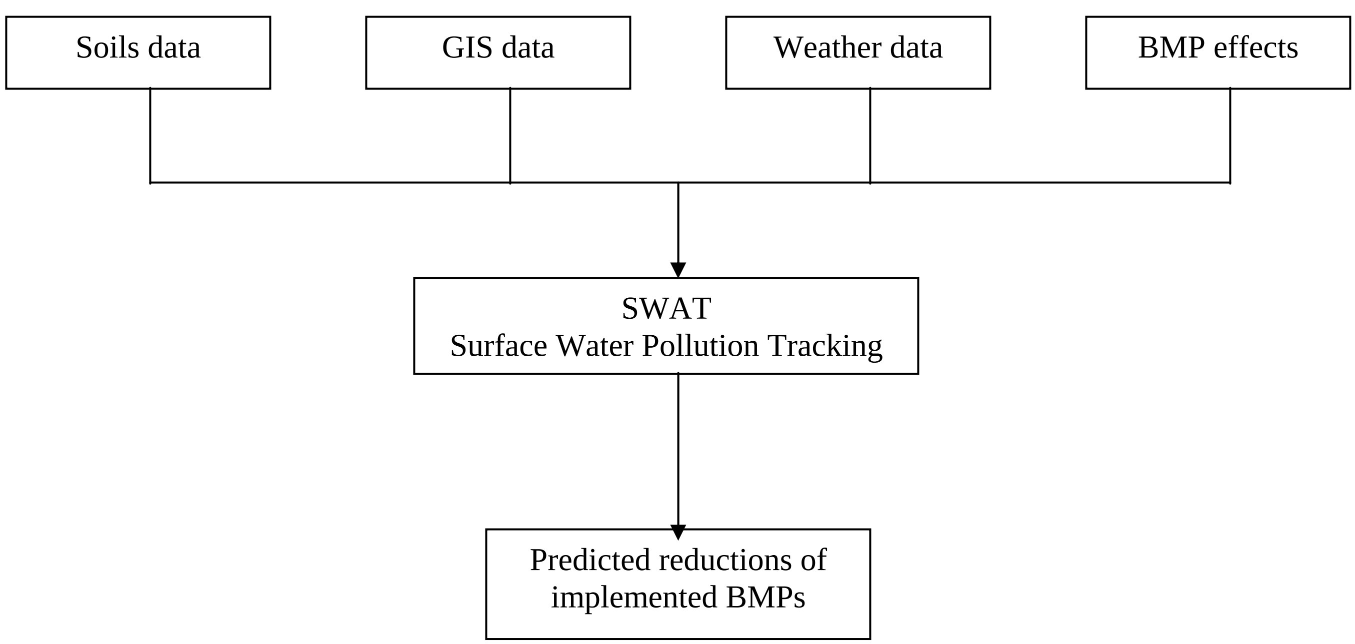
Backup and Disaster Recovery

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 tape drives in a climate controlled room at TAES-Blackland Reasearch and Extention Center.

Figure B10-1. Information Dissemination Diagram



Section 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 for ModelInputs/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 B7 (Calibration), and criteria for acceptable outcomes are provided in Section A7 (QualityObjectives and Criteria for Model Inputs/Outputs).

Results will be reported to the project QA officer 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. If the predicted value cannot be brought within calibration standards, the Quality Assurance Manager and 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.

Section 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 A). CARs will be maintained in an accessible location for reference at USDA-NRCS / WRAT. 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 USDA-NRCS / WRAT'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 Quality Assurance Manager and the Project Manager and are available for review upon request.

Section D1: Data Review, Validation and Verification

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, "Quality Objectives and Criteria for Model Inputs / Outputs." 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 USDA-NRCS / WRAT Project Leader is responsible for ensuring that data are properly reviewed, verified, and submitted in the required format for the project database

Section D2: Validation Methods

In the validation process, the model is operated with input parameters set during the calibration process, as described in Section B7 (Calibration), without any change and the results are compared to the remaining observed data 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 Manager.

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 or 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.

Section D3: Reconciliation with Data Quality Objectives

The modeling framework developed for this project will be used to evaluate water quality issues, as they pertain to atrazine,in the seven watersheds. It will be incorporated to provide the TSSWCB, NRCS, SWCDs and local stakeholder groups with optimum information pertaining to watershed characteristics and to the prediction of possible pollution problems. This, in turn, will enhance their desion-making efforts as part of a comprehensive Watershed Plan management strategy.

References

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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:_____________________________