

**Texas A&M AgriLife  
Texas Water Resources Institute**

**SWAT Model Simulation of the Arroyo Colorado Watershed  
CWA 319(h)  
TSSWCB Agreement No. 02-021-07-09**

Quarter no. 5 From 7/1/08 Through 9/30/08

**I. Abstract**

Model setup is nearly complete. The present model setup does not include the location of different BMPs in the watershed (not yet received from the valley). However, all other data has been included. It is anticipated as soon as the BMP data is included, the SWAT input files will be changed to accommodate the existing BMPs in the watershed. Then the flow calibration will be repeated for the complete model setup with BMPs before proceeding to sediment and nutrient modeling.

**II. Overall Progress and Results by Task**

**TASK 1: Coordinate and Administer Project**

*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.*

The following actions have been completed during this reporting period:

- a. An Ag Issues Workgroup Meeting was held on August 20, 2008. Although project PI was absent, a brief summary of the status of the SWAT model development was provided at the meeting. It is anticipated that a more detailed overview of the model development will be provided at the next ag issues workgroup meeting in January.

**72% Complete**

*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.*

The following actions have been completed during this reporting period:

- a. Submitted Year 2, Quarter 1 Report on October 13, 2008.

**72% Complete**

*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) and the TSSWCB Quality Management Plan.*

**100% Complete**

*Subtask 1.4: TWRI will implement the approved QAPP and provide revisions and necessary amendments to the QAPP.*

The following actions have been completed during this reporting period:

- a. As required, the annual update of the QAPP was provided to TSSWCB during this quarter. An redline and clean copy of the QAPP was submitted to TSSWCB on September 26, 2008. Changes in the QAPP were made to the end date (to make it consistent with the project end date), Revision Number and date, timeline (to reflect new project end date), Appendix A (workplan was removed), name change (AgriLife), and a few cosmetic edits.
- b. TWRI is waiting on approval from TSSWCB/EPA on the amended QAPP.

**75% Complete**

*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.*

The following actions have been completed during this reporting period:

- a. TWRI received an email from TSSWCB regarding status of project budget (Funds not being expended in a timely manner). TWRI met with Temple personnel, Spatial Sciences personnel (also included in Temple's budget) and TWRI staff to correct the project expenditure issue. Both Temple and Spatial Sciences Laboratory stated they were making changes to begin spending funds on the project.

**72% Complete**

*Subtask 1.6: TWRI will perform accounting functions for project funds and will submit appropriate Reimbursement Forms to TSSWCB at least quarterly.*

The following actions have been completed during this reporting period:

- a. An invoice for the amount of \$906.60 was submitted for the period of June 1, 2008 through August 31, 2008.

**5% Complete**

*Subtask 1.7: TWRI will develop, host and maintain an internet website for the dissemination of information.*

The following actions have been completed during this reporting period:

- a. Upon approval of the updated land use / land cover map by TSSWCB, the map will be posted on the Arroyo Colorado Web site, <http://www.arroyocolorado.org>.

**50% Complete**

*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.*

**0% Complete**

## **Task 2: Watershed data compilation, analysis, and simulation using SWAT**

*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.*

The following actions have been completed during this reporting period:

- a. Data assembly continued including the following.

### ***Mimicking canal irrigation:***

To mimic canal irrigation the following procedure is used. Information on Irrigation districts is available in the form of a map from Irrigation Technology Center, Texas A&M University. In addition, the average water conveyance efficiency for each irrigation district is available separately. Land cover map, soil map and sub-basin map were overlaid using GIS tools and a comprehensive map is prepared that has all 3 layers of information. This composite map is overlaid with the map of irrigation districts to identify the irrigation district that comes under each HRU. This is combined with conveyance efficiency information, to come out with water conveyance efficiency for each HRU. Using this information along with depth of water application for each irrigation for each crop, we can estimate the tentative quantity of water that was actually delivered to the crop in each irrigation application.

**95 % Complete**

*Subtask 2.2: The SWAT model will be set up and calibrated to measured flow and in-stream measurements of 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.*

The following actions have been completed during this reporting period:

- a. In preparation for set-up and calibration:

Model setup is nearly complete. The present model setup does not include the location of different BMPs in the watershed (not yet received from the valley). In the meantime, preliminary stream flow modeling was attempted. About 14 flow based parameters were selected to identify the parameters sensitive to stream flow. Latin hypercube sampling method was used for the sensitivity analysis. The parameters identified as sensitive (to stream flow) were divided into certain intervals and a semi-automated calibration procedure is designed to do flow calibration. The calibration program runs for all the possible combination of parameters within the parameters used for calibration and the ranges considered. For example, if we use 3 parameters for calibration and each parameter has 4 possible values, then the total number of calibration model runs will be 64 (4x4x4). The calibration program has some inbuilt tools for calculating model performance measures (such as Nash and Sutcliffe Efficiency,  $R^2$ , mean absolute error etc.) for each calibration model run. The combination of parameters that brings best model performance will be used for looking at the sediment and nutrient results. After receiving the location of different BMPs, the SWAT input files will be changed to accommodate the existing BMPs in the watershed. Then the flow calibration will be repeated for the complete model setup with BMPs before proceeding to sediment and nutrient modeling.

**70% Complete**

*Subtask 2.3: Subsequent to calibration, the model will be validated using measured flow and in-stream measurements of sediment, BOD, and nutrient concentrations for the period of 2004-2006.*

The following actions have been completed during this reporting period:

- a. No action to report at this time.

**0% Complete**

*Subtask 2.4: Simulate load reduction scenarios for a suite of management measures specified by the TSSWCB.*

The following actions have been completed during this reporting period:

- a. No action to report at this time.

**0% Complete**

*Subtask 2.5: 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<sub>3</sub>-N, NO<sub>2</sub>+NO<sub>3</sub>, 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).*

The following actions have been completed during this reporting period:

- a. No action to report at this time.

**0% Complete**

### **III. Related Issues/Current Problems and Favorable of Unusual Developments**

- None to report at this time.

### **IV. Projected Work for Next Quarter**

#### **Task 1**

- Submit year 2, quarter 2 report
- As soon as we receive approval from TSSWCB, post the LU/LC map on the web site
- Schedule for Kannan to provide an update on the SWAT Model at the January or April Steering Committee Meeting.

#### **Task 2**

- Continue to gather data and if possible, conduct final model runs to calibrate and validate the model per task 2.