

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

Quarter no. 4 From 4/1/08 Through 6/30/08

**I. Abstract**

Progress continues to be made on collection of data for input into the SWAT model. While some data still needs to be entered into the model (e.g. quantity, timing and number of irrigations for all crops), the personnel are preparing for model validation by collecting actual data for comparison to model runs.

**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. A special Ag Workgroup Session was held in preparation for the upcoming Ag Issues Workgroup Meeting in July. The development of the SWAT Model was not discussed at this meeting. However, the expected results of the model will likely be used to assess impacts of installed BMPs and project effects of agricultural activities on the Arroyo Colorado watershed.

**50% 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 1, Quarter 4 Report on July 25, 2008.

**60% 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. Nothing to report at this time.

**0% 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 met with Temple personnel on April 16, 2008 to discuss status of the project including data collection and deliverables. It was determined from the meeting that data collection was on task, yet model run and validation will likely take longer than projected. It is anticipated that the personnel will need a no-cost project extension to complete project deliverables (development of SWAT model).

**50% 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 \$898.88 was submitted for the period of March 1, 2008 through May 31, 2008.

**4% 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.

***Crop rotation and management operations***

In the SWAT model setup, each Hydrologic Response Unit (HRU) is made up of one or more fields/farms in the watershed. Crop rotation and the associated management operations need to be defined for each HRU as input to the model. Each field or farm (in the updated land use map prepared in 2007) is associated with crop rotation information from 2004-2006. As well the land use map has tentative dates of planting in the field/farm. To identify the crop rotation that is most representative of HRU the following procedure is used.

The land use, soil and sub basin information of the watershed were overlaid and a composite map is prepared that shows all the 3 attributes for each location in the map. Then each unique combination of soil and land use within a sub-basin is separated. Within the unique combination of soil and land use, each different crop rotation is identified and the total area of the HRU that comes under the particular crop rotation is determined. Similarly the area of all the other crop rotations within the HRU is worked out. The crop rotation that comes under the maximum area is identified and allotted as the representative crop rotation for the HRU. Once the crop rotation for the period 2004-2006 is identified, the same rotation is extended for the remainder of the simulation period (1999-2003). This procedure is completed for all the sub basins in the watershed.

***Dates of tillage, planting and harvest***

Typically there are two tillage operations (in conventional tillage) for each crop rotation, one soon after the harvest of the previous crop and the other midway between the harvest of the previous crop and the planting of the present crop. In conservation tillage one tillage operation (mostly soon after harvest of the previous crop) or no tillage operation is performed. Planting dates are available from the land use map for each crop rotation. The durations of crops were obtained from crop fact sheets from Texas A&M extension publications based on which the tentative harvest dates are identified for each crop. In any case, all the management operations such as tillage, planting and harvest were scheduled on non-rainy days (In reality these operations were less likely to have happened on rainy days). To accommodate this constraint in dates of management operation, a computer program is written that reads the observed precipitation data of the nearest weather station in the sub-basin and identifies whether a particular day is rainy day or not.

***Scheduling irrigation (ongoing)***

Tentative quantity, timing and frequency of irrigation required for major crops (such as sorghum, cotton and sugar cane) were obtained from NRCS and TSSWCB staff in the watershed. Crop fact sheets published by Texas A&M extension were also collected to work out the irrigation information for the remaining crops. Once the quantity, timing and number of irrigations for all the crops are obtained they will be entered in the management data required by the model.

**90% 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:

***Water Quality Data collection***

Data for water temperature, dissolved oxygen, sediments and nutrients were obtained from TCEQ and arranged in the required format for comparison with the model results.

**50% 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. In preparation for validation:

***Water Quality Data collection***

Data for water temperature, dissolved oxygen, sediments and nutrients were obtained from TCEQ and arranged in the required format for comparison with the model results.

**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, NH3-N, NO2+NO3, 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 or Unusual Developments**

- None to report at this time.

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

#### **Task 1**

- Submit year 1, quarter 4 report

#### **Task 2**

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