

SWAT Model Simulation of the Arroyo Colorado Watershed Scope of Work

I. 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*.

II. 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 be obtained from TCEQ, cities, counties, and other entities with jurisdiction over these issues. 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 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 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.

III. Tasks

TASK 1: Coordinate and Administer Project

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.

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.

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.

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

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.

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

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

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.

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

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.

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.

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.

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

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).