

Evaluating Water Quality Best Management Practices for Reservoirs in North Central Texas

Texas Water Resources Institute
FY 03 Federal Appropriated Funds
Project # X7-9764801-0

Quarter no. 3 From 4/8/04 Through 7/7/04

Progress in Meeting Project Milestones and Output Commitments

Task, Deliverables and Schedules

The Texas Water Resources Institute (TWRI) along with the Texas A&M University Spatial Sciences Laboratory (SSL), Alan Plummer Associates, Inc. (APAI) and Espey Consultants, Inc. (EC) has been diligently working to complete project deliverables. Project efforts during the third quarter focused on modeling activities. The SSL and EC have collaborated on efforts to interact SWAT and QUAL2E models to predict loadings within Cedar Creek Reservoir. SWAT and QUAL2E has successfully been integrated. Work continues on linking these two models with WASP in order to have a model that predicts entire watershed loadings. APAI has completed collecting data from wastewater treatment plants within Cedar Creek and Eagle Mountain Reservoirs and has input this data into an Access database. TWRI continues to update its Web site containing water quality information, specifically related to project efforts, for scientist and the general public and is currently working to produce a watershed management bulletin.

In looking forward to the next quarter, SWAT, QUAL2E and WASP modeling activities should be completed, giving us a clear understanding of sediment and nutrient loadings within Cedar Creek Reservoir and Watershed. Preliminary work has begun to identify BMP's that will be effective in reducing loadings into stream segments and Cedar Creek Reservoir. Identifying BMP's and running them through the newly developed SWAT/QUAL2E/WASP model will be the focus of the forth quarter.

The status of tasks, milestones and deliverables will be defined using the following terms:

Pending	Work has not started on the deliverable
Initiated	Work has started
Completed	Objectives were achieved and deliverables are finished
Deferred	Work has started, but further action is delayed pending other information, the completion of another objective, staff restraints, etc.
Ongoing	Work will continue throughout the term of the contract

Task 1 SWAT Modeling

Due Date	Status	Deliverables
1/1/04	Completed	1. Complete model calibration and validation for Cedar Creek
4/1/04	Initiated	2. Development of Watershed databases
10/1/04	Initiated	3. Development and Evaluation of Different BMP strategies for Cedar Creek Watershed
1/1/05	Pending	4. Model calibration and validation for Eagle Mountain Watershed
9/1/05	Pending	5. Development and evaluation of different BMP strategies for Eagle Mountain Watershed
9/1/05	Pending	6. Development of ArcGIS/ArcHydro interface for SWAT and WASP
9/1/05	Pending	7. Development of interface for using NEXRAD weather information for SWAT

Comments:

- The Spatial Sciences Lab (SSL) in cooperation with Blackland Agricultural Research and Extension Center has completed the validation and calibration of the SWAT model for Cedar Creek Watershed. This deliverable is 100 percent complete.
- SSL has been in contact with state and federal agencies (TCEQ, TRWD, NRCS and USGS) to obtain GIS data for the watershed database. The Access database, once complete, will contain information on land use, soils, elevation, weather and watershed delineation data. TWRI is working to obtain soil sample data of Cedar Creek Watershed from Texas A&M University's Soil, Water and Forage Testing Laboratory for the time period of 1990-2000. Once this information is added to the database, it will be complete. This deliverable is currently 85 percent complete.
- The research team has begun to identify specific BMPs which will be beneficial in reducing loadings in stream segments and Cedar Creek Reservoir.

Task 2 In-Stream and Reservoir Modeling

Due Date	Status	Deliverables
4/1/04	Completed	1. Development of In-stream modeling (QUAL2E) for Cedar Creek Watershed
10/1/04	Initiated	2. Development of Reservoir Modeling (WASP) for Cedar Creek Reservoir
10/1/04	Initiated	3. Development and Evaluation of Different BMP strategies for Cedar Creek Reservoir
1/1/05	Pending	4. Data Collection for Reservoir Modeling (WASP) for Eagle Mountain
7/1/05	Pending	5. Development of Reservoir Modeling (WASP) for Eagle Mountain Watershed
9/1/05	Pending	6. Development and Evaluation of Different BMP strategies for Eagle Mountain Watershed

Comments:

- QUAL2E modeling has been completed and coefficients have been submitted to the SWAT modeling team. This deliverable is 100 percent complete.
- Work is being done to develop the five-year hydrodynamic portion of WASP 6.1 for Cedar Creek Reservoir and the five-year water quality database to be used for calibrating the model. EC has been working on balancing tributary flows with net rainfall/evaporation, water withdrawals and reservoir volume change. Atmospheric loads have been estimated using data from the NADP networks Longview station, and the vertical dispersion coefficients have been estimated using Thomann and Mueller methodology for the set five year period. Work continues to develop input data related to nutrient kinetics and sediment sources of nutrients. This deliverable is 50 percent complete. This deliverable cannot be complete until APAI completes work on the WASP postprocessor.
- The research team has begun to identify specific BMPs which will be beneficial in reducing loadings in stream segments and Cedar Creek Reservoir.

Task 3 Study of Wastewater Treatment Plants

Due Date	Status	Deliverables
7/1/04	Completed	1. Development of a Database for Wastewater Treatment Plants in Cedar Creek and Eagle Mountain Watersheds
10/1/04	Initiated	2. Assessment of Impact of Wastewater Treatment Plants (point source discharges) for Cedar Creek and Eagle Mountain Reservoirs
4/1/05	Pending	3. Development of a Database for Wastewater Treatment Plants in the Richland-Chambers Watershed
7/1/05	Pending	4. Assessment of Impact of Wastewater Treatment Plants (point source discharge) for Richland-Chambers Reservoir

Comments:

- The wastewater treatment database is complete with information from both Cedar Creek and Eagle Mountain Reservoirs. This deliverable is 100 percent complete.
- Process diagrams for original process are 100 percent complete and will be linked to the database datasets. Process evaluations with future limits are 30 percent complete and will include cost estimates for all process recommendations. This deliverable is 70 percent complete.
- APAI has been asked to enhance the flow balance program that will provide modeling capability within the WASP model that is more compatible with the current modeling employed with the SWAT model. APAI will incorporate the previously developed internal flow balance program into an Access application capable of managing extensive historical flow data and SWAT model output, structure the visual basic program to accommodate user-defined time periods, as small as one day (previously set up on a monthly time period), and develop input data for Eagle Mountain Reservoir. This additional work requires a shift of funds in the amount of \$12,000 from SSL to APAI.

Task 4 Administration

Due Date	Status	Deliverables
1/5/04	Completed	1. Write QAPP
1/7/04	Completed	2. Quarterly Progress Reports
4/7/04	Completed	
7/7/04	Completed	
10/7/04	Ongoing	
1/7/05	Ongoing	
4/7/05	Ongoing	
7/7/05	Ongoing	
10/7/05	Ongoing	3. Final Report

Comments:

- TWRI continually updates the Web site created specifically for the North Central Texas Water Quality Project. The Web site can be accessed at the following address: <http://nctx-water.tamu.edu>.
- On May 6, 2004, researchers met to discuss modeling activities as they relate to the integration of WASP into the SWAT/QUAL2E model.
- On June 14, 2004, project participants met at the Blackland Agricultural Research and Extension Center to present the status of deliverables and discuss objectives for the upcoming quarter.
- TWRI is working with the department of Biological and Agricultural Engineering to create and publish a bulletin on watershed management. The bulletin describes point and nonpoint source pollution and best management practices and emphasizes a holistic approach to solve water quality issues.

Problems or Obstacles Encountered and Remedial Actions Taken

The research team has had difficulty in adapting all the parameters for the SWAT/QUAL2E/WASP model. While SWAT and QUAL2E have been successfully integrated together, work continues to incorporate WASP into the modeling mix. The challenge has been in establishing compatible parameters and coefficients for the three distinct models.

Work continues in the following areas:

- Estimate and rebalance tributary flows from SWAT and recalculate internal flows with the APAI kinetic model.
- Hydrologic balance data for the reservoir with the new SWAT flows. The APAI model depends on the hydrologic balance over time to calculate flows, and the internal flows can not be calculated until final SWAT tributary flow balances have been worked out.
- Chloride concentrations in the tributaries and the reservoir.
- Wastewater treatment plant flows and constituent loads for those plants discharging directly into the reservoir (i.e. those not already included in the SWAT model).
- Understand the sensitivities of the APAI internal flow model that occur under certain conditions at the onset of calculations.

Great strides have been made by the modeling team to configure an accurate up-to-date model, which patterns both the watershed and the reservoir simultaneously for nutrient and sediment loading. SWAT/QUAL2E/WASP model development should be complete before the completion of the next quarter.

Work Planned for Next Quarter

Task 1: SWAT Modeling

Final calibration and validation of the SWAT/QUAL2E/WASP combined model. Finalize inputting data for the watershed database. Finalize which BMP strategies are most effective and least costly at reducing nutrient, sediment and pollutant loadings into Cedar Creek Reservoir. Begin running the SWAT/QUAL2E/WASP model using select BMP scenarios and looking at total load reductions within the reservoir.

Task 2: In-Stream and Reservoir Modeling

Finalize development and integration of WASP reservoir model for Cedar Creek Reservoir.

Task 3: Study of Wastewater Treatment Plants

Begin evaluating impacts that wastewater treatment plants and their discharges have on water quality of Cedar Creek and Eagle Mountain Reservoirs.

Task 4: Administration

Continue working with TRWD, SSL, EC and APAI in moving forward with project deliverables and reporting progress on a quarterly basis. Efforts will be made to publicize the project and raise awareness of water quality issues within the study area. Furthermore, TWRI will work to secure additional funding for this project as additional federally appropriated funds are not available at this time.