

## 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. 17 From 10/8/07 Through 1/7/08

### **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), Espey Consultants, Inc. (EC) and the Texas AgriLife Research and Extension Urban Solutions Center have been diligently working to complete project deliverables. Project efforts during the seventeenth quarter focused on modeling activities, BMP scenario runs and stakeholder and workgroup development. The SSL and EC have collaborated on efforts to interact SWAT, QUAL2E and WASP models to predict nutrient and sediment loadings of Cedar Creek, Eagle Mountain and Richland Chambers Reservoir Watersheds. SWAT, QUAL2E and WASP have successfully been integrated. APAI has continued collecting data from wastewater treatment plants within Richland Chambers Watershed and inputting this data into an Access database. The research team and consultants have developed an interface for using NEXRAD weather information for SWAT. TWRI continues to update its Web site containing water quality information, specifically related to project efforts, for scientists and the general public.

In looking forward to the next quarter, the research team will finalize computing the economic cost associated with BMPs for the Cedar Creek Watershed. Modeling activities for Eagle Mountain and Richland Chambers Reservoir Watershed will continue. Additionally, work will continue in the development of a draft of the watershed protection plan for Cedar Creek Watershed and Eagle Mountain Watershed. The process will continue to gather stakeholder input for the watershed plan. The watershed protection plan will include EPA's nine elements.

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 Reservoir Watershed
4/1/04	Completed	2. Development of Watershed Databases
10/1/04	Completed	3. Development and Evaluation of Different BMP strategies for Cedar Creek Watershed
1/1/05	Completed	4. Model calibration and validation for Eagle Mountain Watershed
9/1/05	Initiated	5. Development and evaluation of different BMP strategies for Eagle Mountain Watershed
9/1/05	Initiated	6. Development of ArcGIS/ArcHydro interface for SWAT and WASP
9/1/05	Completed	7. Development of interface for using NEXRAD weather information for SWAT
7/1/06	Initiated	8. Model calibration and validation for Richland Chambers Watershed
10/1/06	Pending	9. Development and evaluation of different BMP strategies for Richland Chambers Watershed

Comments:

- The Spatial Sciences Lab (SSL), in cooperation with Blackland Agricultural Research and Extension Center (AREC), 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. This deliverable is currently 95 percent complete.
- The research team has finalized BMP scenarios runs through the SWAT/QUAL2E/WASP model to look at plausible BMPs to implement and at which locations, as well as the overall reduction these BMPs will have on nutrient and sediment loading into Cedar Creek Reservoir. This deliverable is 100 percent complete.
- SSL has collected water quality and weather station data for Eagle Mountain Reservoir. Basins and sub-basins have been delineated for the SWAT model and the process is under way to calibrate and validate the model. The SWAT model has been calibrated and validated for hydrologic processes. Furthermore SWAT has been calibrated and preliminarily validated for water quality parameters.
- SSL and Blackland AREC have initiated data collection and SWAT Model development for the Richland Chambers Reservoir Watershed.

- Utilizing funds from TRWD, Baylor University conducted a sediment survey of Eagle Mountain Reservoir in order to verify storage capacity, flows and sediment size for the model.
- Using stakeholder input, SSL updated the landuse information to include more pasture land and associated fertilizer application.
- In a modeling exercise to determine the direct effect of landuses directly adjacent to Cedar Creek Reservoir, the SSL modeled a buffer strip of 2,000 ft around the reservoir with regards to fertilizer application of yards and runoff rates in the reservoir. No significant impacts were noted.
- Developed a modeling tool to capture averaged NEXRAD weather data for the subwatershed scale on a daily basis. This tool averages rainfall over the subwatershed and spatially divides the data within the watershed. This deliverable is 100 percent complete
- Modeling activities continue for Eagle Mountain Reservoir Watershed. The SWAT model has been calibrated for flow and sediment. The research team is working on calibrating the model for water quality parameters (nutrients). This activity should be complete this quarter.
- Modeling activities continue for Richland Chambers Reservoir Watershed. Data has been gathered and analyzed and the model has been set-up. This quarter modelers will focus on calibrating the model for flow.

**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	Completed	2. Development of Reservoir Modeling (WASP) for Cedar Creek Reservoir
10/1/04	Completed	3. Development and Evaluation of Different BMP strategies for Cedar Creek Reservoir
1/1/05	Completed	4. Data Collection for Reservoir Modeling (WASP) for Eagle Mountain
7/1/05	Initiated	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
7/1/06	Pending	7. Assist TRWD in development of In-stream Modeling (QUAL2E) for Richland Chambers Watershed
7/1/06	Pending	8. Development of Reservoir Modeling (WASP) for Richland Chambers Reservoir
10/1/06	Pending	9. Development and Evaluation of Different BMP strategies for Richland Chambers Watershed

Comments:

- QUAL2E modeling has been completed and coefficients have been submitted to the SWAT modeling team. This deliverable is 100 percent complete.
- EC completed its work on the Cedar Creek WASP postprocessor, and input data related to nutrient kinetics and sediment sources of nutrients were finalized. The Cedar Creek WASP model has been validated and calibrated. This deliverable is 100 percent complete.
- The research team has identified specific BMPs, which will be beneficial in reducing nutrient loadings in stream segments and Cedar Creek Reservoir. A technical memo with regard to BMP suggestions has been completed. Results show a necessary reduction of nutrients entering the reservoir to be within the 30-40 percent range in order to effectively reduce chlorophyll a concentrations within Cedar Creek Reservoir.
- EC has begun collecting data and delineating Eagle Mountain Reservoir segments for WASP modeling. The group is working on the reservoir's mass balance calibration for modeling runs. This task is 75 percent complete.
- EC has been working with TRWD to refine the WASP model as it relates to issues of flux within Cedar Creek Reservoir. The issue of modeling resuspension of sediment and nutrients within the reservoir has been corrected.
- EC and TRWD have refined the WASP model to more accurately account for model variation between dry and wet years and to better capture the internal dynamics of the reservoir with regard to modeling flux and resuspension of nutrients bound to sediment. This issue has been corrected.

**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	Completed	2. Assessment of Impact of Wastewater Treatment Plants (point source discharges) for Cedar Creek and Eagle Mountain Reservoirs
4/1/05	Completed	3. Development of a Database for Wastewater Treatment Plants in the Richland Chambers Watershed
7/1/05	Initiated	4. Assessment of Impact of Wastewater Treatment Plants (point source discharge) for Richland Chambers Reservoir
4/1/06	Initiated	5. Development of a Database for Wastewater Treatment Plants in the Benbrook Watershed
7/1/06	Pending	6. Develop information on biosolid disposal areas in the Benbrook Reservoir Watershed

Comments:

- The wastewater treatment database is complete with information from both Cedar Creek and Eagle Mountain Reservoirs. This deliverable is 100 percent complete.
- APAI has developed a database containing all wastewater treatment plants in the Cedar Creek and Eagle Mountain Watersheds. Data contained in these databases include process diagrams of plant's current capacity, as well as diagrams of future upgrades that could be made to make the plant more efficient and to meet operating demands. Also included in the database is information regarding operating capacity, permit information, quality of discharged effluent, fate of released effluent and proximity to water bodies. Cost estimates for all process recommendations are included. This deliverable is 100 percent complete.
- APAI has developed a flow balance program that provides modeling capability within the WASP model that is more compatible with current modeling employed using SWAT model. APAI incorporated the previously developed internal flow balance program into an Access application capable of managing extensive historical flow data and SWAT model output. The group structured the visual basic program to accommodate user-defined time periods, as small as one day (previously set up on a monthly time period), and developed input data for Eagle Mountain Reservoir. This deliverable is 100 percent complete.
- APAI, working with TRWD, has identified all wastewater treatment plants permitted to discharge waste into Richland Chambers Watershed. APAI has begun to collect general data on all wastewater treatment plants for the database, but will only do further analysis on those whose discharge flows into Richland Chambers Reservoir. They include: Corsicana - both plants; Walden Woods (direct discharge); Pelican Isle (direct discharge); Dawson (Richland Creek); and Ennis (Chambers Creek). This deliverable is 90 percent complete.
- APAI is working with EC and TRWD to formulate flows entering the Eagle Mountain Watershed as well as to evaluate WASP modeling capabilities for reservoir flux.

**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	Completed	
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4/7/07	Completed	
7/7/07	Completed	
10/7/07	Completed	
1/7/08	Completed	
4/7/08		
7/7/08		
10/7/08		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>
- TWRI and representatives from the Texas AgriLife Research and Extension Urban Solutions Center participated in meetings regarding the WPP Short course. It is the intent to present the North Central Texas Water Quality Project as a case study at the event.
- On September 14, 2007, TWRI coordinated a project meeting of the North Central Texas Water Quality Project team to discuss modeling activities, educational programs, stakeholder participation, economic analysis and project deliverables.
- TWRI coordinated 2 work group meetings (July 24 & 25) in the Cedar Creek to gather information for the WPP. The groups focused on the Ag NPS and urban WWTP/Stormwater management.
- TWRI conducted a stakeholder meeting of the Cedar Creek watershed partners on August 28, 2007.
- TWRI and the Texas AgriLife Research and Extension Urban Solutions Center conducted a stakeholder meeting in the Cedar Creek watershed on October 23, 2007. Topics of discussion included the evaluation and ranking of BMPs, modeling data review, educational programs and the nine elements of watershed planning. The next stakeholder meeting is scheduled for January 24, 2008.

**Problems or Obstacles Encountered and Remedial Actions Taken**

The Spatial Sciences Laboratory and Texas AgriLife Research and Extension Center at Temple have been working closely with Texas Water Resources Institute towards successful completion of project deliverables.

## **Work Planned for Next Quarter**

### Task 1: SWAT Modeling

Run the SWAT model for Eagle Mountain Reservoir and begin identifying BMPs for the watershed to meet water quality standards. Continue data collection and model development on Richland Chambers Reservoir.

### Task 2: In-Stream and Reservoir Modeling

Finalize development and integration of QUAL2E and WASP models for Eagle Mountain Reservoir. Continue data collection on Richland Chambers Reservoir.

### Task 3: Study of Wastewater Treatment Plants

Finalize evaluating impacts that wastewater treatment plants and their discharges have on water quality of Richland Chambers Reservoir.

### 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. TWRI, working through the Texas AgriLife Research and Extension Urban Solutions Center, submitted a 319 proposal to the TSSWCB to implement ag/rural BMPs and a proposal to TCEQ to implement Urban BPMs identified by stakeholders in the Cedar Creek WPP. Both of these proposals have received funding. The funds will be utilized to support implementation of activities identified in the WPP for Cedar Creek.

Additional funds currently used to support project activities include federally appropriated monies from USDA-NRCS to conduct economic analysis of BMP scenarios at reducing loadings in North Central Texas Watersheds and to develop educational program materials on watershed management.