

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. 13 From 10/8/06 Through 1/7/07

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) have been diligently working to complete project deliverables. Project efforts during the thirteenth quarter focused on modeling activities. The SSL and EC have collaborated on efforts to interact SWAT, QUAL2E and WASP models to predict nutrient and sediment loadings of Cedar Creek and Eagle Mountain 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. 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, work will be finalized as it relates to running BMP scenarios through SWAT seeking a 30 to 40 percent reduction in loadings for the Cedar Creek Watershed. Making BMP scenario runs through the newly developed SWAT/QUAL2E/WASP model and computing the economic cost associated with these BMPs will be completed as well, modeling activities for Eagle Mountain Reservoir Watershed will continue. Additionally, work will continue in the developing a draft of the watershed protection plan for Cedar Creek watershed. The process will begin to gather stakeholder input for the watershed plan. The watershed protection plan will include EPA's nine elements. Activities for Richland Chambers Reservoir will be initiated.

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 | Initiated | 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 | Initiated | 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 |
| 7/1/06 | Pending | 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, 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 90 percent complete.
- The research team has identified BMPs which will be beneficial in reducing loadings in stream segments and Cedar Creek Reservoir. SWAT runs have been made to get estimates as to the type of reservoir loadings (point or non point sources) and sources of contamination (stream segments, tributary flow or resuspension of reservoir sediments). These model runs have helped focus BMP selection.
- The research team has begun to run BMP scenarios 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 85 percent complete.
- SSL has collected water quality data 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.

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 | Initiated | 3. Development and Evaluation of Different BMP strategies for Cedar Creek Reservoir |
| 1/1/05 | Initiated | 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 begun to identify 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 is in the process of being completed. Preliminary 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 65 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 of some concern.

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 | Pending | 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 | |
| 1/7/05 | Completed | |
| 4/7/05 | Completed | |
| 7/7/05 | Completed | |
| 10/7/05 | Completed | |
| 1/7/06 | Completed | |
| 4/7/06 | Completed | |
| 7/7/06 | Completed | |
| 10/7/06 | Completed | |
| 1/7/07 | Completed | |
| 4/7/07 | | |
| 7/7/07 | | |
| 10/7/07 | | 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 October 17, 2006, 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.
- On December 15, 2006, TWRI coordinated a project meeting with EC, SSL, and TRWD to discuss modeling activities in Cedar Creek and Eagle Mountain Reservoir and discuss a report made by a third party independent science-based review of acutities.
- On January 11, 2007, TWRI coordinated a meeting of the economic team to discuss BMPs and the cost associated with them.

Problems or Obstacles Encountered and Remedial Actions Taken

The Spatial Sciences Laboratory and Blackland Agricultural Research and Extension Center have been working closely with Texas Water Resources Institute (TWRI) towards successful completion of project deliverables. Significant progress has been made in modeling Cedar Creek and Eagle Mountain Watersheds. For the Cedar Creek Watershed, hydrology calibration and validation is 100 percent complete, and for Eagle Mountain Watershed, hydrology calibration and validation is 100 percent complete. Efforts continue to complete water quality validations for Eagle Mountain watershed.

The sediment survey for Cedar Creek Reservoir Watershed is complete and those findings are being used to update SWAT parameters. The sediment survey for Eagle Mountain watershed was completed this summer and the data is being analyzed to update SWAT parameters. The goal is to have the most accurate information possible to use in developing a scientifically sound watershed protection plan. EPA Project funds were not used to pay for this additional work.

Work Planned for Next Quarter

Task 1: SWAT Modeling

Continue running the SWAT/QUAL2E/WASP model using select BMP scenarios and looking at total load reductions within the reservoir. Finalize which BMP strategies are most effective and least costly at reducing nutrient, sediment and pollutant loadings into Cedar Creek Reservoir. Using stakeholder input update landuse information to include more pasture land and associated fertilizer application. Look at the buffer strip of 2,000 ft around the reservoir with regards to fertilizer application of yards and runoff rates in the reservoir. Finalize model validation for Eagle Mountain Reservoir. Begin data collection on Richland Chambers Reservoir.

Task 2: In-Stream and Reservoir Modeling

Finalize WASP model changes to better capture issues of flux within the reservoir. Finalize development and integration of QUAL2E and WASP models for Eagle Mountain Reservoir. Begin data collection on Richland Chambers Reservoir.

Task 3: Study of Wastewater Treatment Plants

Continue evaluating impacts that wastewater treatment plants and their discharges have on water quality of Richland Chambers Reservoir. Begin looking at Benbrook 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. Furthermore, TWRI will work to secure additional funding for this project above the additional federally appropriated funds received in FY 06. TWRI will work with TAES contracts and grants to allocate funds to cooperating entities. TWRI was successful in obtaining a grant from the Texas Commission on Environmental Quality to implement BMPs in the Cedar Creek Reservoir Watershed. This grant is scheduled to begin on 10/1/07.

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.