DETAILED ASSESSMENT OF FLOW AND SEDIMENT LOADINGS, AND BMP ANALYSIS FOR

LAKE AQUILLA WATERSHED

Prepared in Cooperation with the

BRAZOS RIVER AUTHORITY

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EXECUTIVE SUMMARY

The purpose of this study was to simulate sediment deposition in Lake Aquilla for current conditions, and analyze the effects on sediment yields of applying BMP's in the watershed. This detailed study of the watershed complemented an earlier preliminary study made in 1998 by the Water Resources Assessment Team at Blackland Research Center. The detailed study, however, made use of more detailed spatial data (soils, landuse, topography and climate) than the earlier study.

This study was performed using the SWAT basin scale model and the APEX farm scale model. Included in the SWAT modeling portion of the study (PART I) were analyses of cropland BMP's (no till conservation tillage, terraces, and contour farming) and additional sediment retention ponds or reservoirs. Included in the APEX portion (PART II) were analyses of terracing, contouring, grassed waterways, filter strips, and small on-farm sediment basins on a sample farm in the watershed.

SWAT was calibrated to measured stream flow at a USGS stream gauge, and to measured sediment (TWDB hydrographic survey) in Lake Aquilla. Results from the APEX simulation are not calibrated or validated because measured data was not available for the sample farm.

There exists good potential for reducing sediment deposition in Lake Aquilla through application of BMP's. Simulated results from SWAT indicated that application of BMP's on cropland alone reduced sediment deposition by 21 percent. Adding sediment retention ponds and reservoirs to the BMP applications resulted in a 37 percent reduction.

For the 1996 through 2000 period, the simulated sediment deposited in the lake was 2,873,584 metric tons, or about 2,644 acre-feet. This represents the estimated sediment deposition that has occurred since the TWDB sediment survey.

Simulated results from APEX indicated a reduction in sediment yield from the farm of 55 percent, assuming installation of all BMP's except the sediment basins. Adding the sediment basins to the BMP's resulted in a reduction in sediment yield of 96 percent.

It should be noted that results of the APEX simulations are from one sample farm, and simulated sediment yields would most likely be different for other farms in the watershed. Sediment yield reductions are dependent on soil, topographical features, type of BMP's applied, and other factors specific to individual farms.

All simulations assume the effectiveness of BMP's remains constant for the entire modeling period, and do not account for loss of capacity in BMP's due to sediment accumulation.

Water and sediment yields for each subbasin and each scenario modeled are provided in tables in the report. This data provides a means of prioritizing subbasins for treatment.

BACKGROUND

Sediment deposition in Lake Aquilla is occurring at much higher rates than anticipated during the planning and design of the reservoir. Based on volumetric storage capacity measurements taken by the Texas Water Development Board (TWDB) in 1995, the capacity of the lake has been reduced by approximately 6,438 acre-feet since impoundment began in 1983. A preliminary study of the Lake Aquilla basin (USDA-NRCS-WRAT, 1998), performed with the SWAT watershed scale model, indicated that significant reductions in erosion and sedimentation could be achieved by installing best management practices (BMP's). However, simulated sediment loads from a few subbasins remained very high, and questionably low sediment reductions were attained by applying BMP's on cropland.

The resolution of Geographic Information System (GIS) input data for the first study ranged from 100 to 250 meters, and the subbasin size used for modeling averaged about fourteen square miles. Since then, more detailed data (30 meter resolution) has become available. The new GIS data should provide more accurate input and allow modeling with smaller subbasins. In addition, some improvements have been made in the sheet and rill erosion subroutines (land phase portion) of the SWAT model, which might result in improved prediction of sediment yields on cropland.

It was determined that a more detailed study using both the improved SWAT model, and the APEX farm scale model may provide additional insight to erosion and sediment sources in the watershed.

Part I of this report describes the use of the Soil and Water Assessment Tool (SWAT) to simulate flow and sediment loading into Lake Aquilla. Part II describes the use of the Agricultural Policy Environmental Extender (APEX) model to simulate the hydrology and erosion on a sample farm in the watershed.