USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Methodology for estimating Total Maximum Daily Load in Watersheds with Considerable Ground-Water Surface-Water Interaction.

Focus Categories: MOD, NPP, GW

Keywords: Water Quality Modeling, Ground-Water Surface-water interaction, Total Maximum Daily Loads, Geographic Information Systems.

Duration: September, 2000 to September, 2002

Funds Requested: (Federal $94,764)

Non-Federal Funds Pledged: ($96,801)

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Abstract:

Non-Point Source (NPS) contaminants pose considerable threats to the quality of both surface and ground waters. Moreover, under certain hydrologic conditions, ground-water surface-water (GW/SW) interactions can play an important role in the fate and transport of NPS contaminants. Such interaction should be taken into consideration during the development and implementation of Total Maximum Daily Load (TMDL). The proposed research will address modeling fate and transport of NPS contaminants through complex GW/SW pathways on the watershed scale in support of TMDL development and implementation. The research will be performed in two phases. In the first phase, ground-water flow and transport modules developed earlier will be used to expand the modeling capability of the Soil Water Assessment Tool (SWAT). The ground-water flow and transport modules will be based on the Modular Three-Dimensional Finite-Difference Ground-Water Flow Model MODFLOW, but with enhancements such as a pseudo soil function for unconfined flow and an advective-dispersive module for transport. Verification of the integrated system will be performed in comparison with analytical solutions, available numerical models, and a fully integrated GW/SW system;

MODFLOW-SURFACT. To facilitate the use and implementation of the model in routine TMDL calculations, a Geographic Information System (GIS) interface and database will be developed and implemented in the Better Assessment Science Integrating Point and Non-point Sources (BASINS).

The second phase of the research will benefit from the ongoing MIAMI-NAWQA study for ground water and surface water, which involves a comprehensive monitoring program. The proposed study will involve expanding the surface-water quality model for the Miami River basin to incorporate an active ground water flow and transport component. The SWAT-MODFLOW model developed in the first stage will be used in the modeling effort. Advanced inverse modeling techniques based on the Data-Fusion technology will be used to calibrate the ground-water component. The model will be then used to estimate the mass loading from different NPS within the basin and the role of GW/SW interaction on the impairment of either surface or ground waters. Waste allocation and effect of best management practices on the mass loading to both surface and ground waters will be studied using sensitivity analysis. Efficiency of NPS pollution control measures such as conservation buffers and artificial wetlands will be examined through modeling scenarios applied on zoom models of selected sub-watersheds..4