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USGS Chesapeake Bay Activities

Joint Development of USGS/CBP Watershed Model

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Collaborators: Chesapeake Bay Program (over 25 Federal Agencies, 6 States, the District of Columbia, and numerous local customers and partners)

Statement of Problem: Elevated nutrient and suspended solid levels in the Chesapeake Bay adversely affect water clarity and DO levels, stressing living resources in the Bay and its tributaries. In 1987, the Chesapeake Bay Agreement called for 40% reduction in controllable nutrients entering the Bay by the year 2000. In 2000, a renewed Chesapeake Bay agreement was created to reinforce and redefine efforts toward these nutrient reductions. In an effort to reduce nutrients and sediments entering the Bay, management strategies have been implemented in the tributary basins. Quantification of loads and trends is useful for assessing the success of these management practices in improving water quality and living resource response.

Objectives: The USGS is collaborating with the Chesapeake Bay Program (CBP) to incorporate the USGS Potomac Watershed and Chesapeake Bay Virginia Watershed models into Phase 5 of the Chesapeake Bay Watershed Model (CBWM). This effort includes the following objectives:

1. Compile necessary spatial and temporal databases for simulation of Chesapeake Bay watershed processes (hydrological, nutrient cycling, and sediment transport) using HSPF, in cooperation with ICPRB and CBP staff.

2. Create watershed segmentation, river reach segmentation, and associated control files for HSPF simulation of the Chesapeake Bay Watershed.

3. Develop and implement innovative calibration procedures, such as inverse modeling and analysis of scaled model sensitivities, to improve HSPF model calibration and provide additional insight into important controls on nutrient and sediment transport and processing within the Chesapeake Bay Watershed.

4. Calibrate an HSPF model for the Chesapeake Bay Watershed, in collaboration with CBP.

5. Prepare reports on subjects that might include (but are not limited to) the following: calibration of the CBWM; analysis of calibration strategies; CBWM uncertainty; analysis of CBWM results; implications for present and future monitoring and other data collection activities.

6. As an additional objective, the CBWM will be expanded in Virginia to include the parts of the state outside the Chesapeake Bay Watershed.

Approach: The study involves the following tasks:

Data Compilation: compilation of existing input data (e.g., land use/cover, sources of N and P, and meteorological data; development of model segmentation, model network, and construction of UCI (User's Control Input) files; processing of time-series data to create input WDM (Watershed Data Management) files; compilation of ancillary data and observational data (for model calibration).

Development of Model Calibration Strategy: implementation of existing software for general inversion and calibration of multi-parameter hydrological models.

Model Calibration: calibration of hydrological model; calibration of water- quality model (suspended sediment and nutrients, N and P, and their speciation).

Analysis of Model Results: results of model calibration, examination of model output, and consideration of specific study questions.

Delivery of Results and Final Reports: dissemination of data sets and model input and output files and preparation of final reports analyzing the model results.

Selected Reports and Other Products:

Report, Planned: Jeff P. Raffensperger, Lauren E. Hay, Jonathan J.A. Dillow, and Gary T. Fisher, Spatial modeling of precipitation, temperature, and potential evapotranspiration in support of HSPF modeling, Chesapeake Bay Watershed and Maryland, Delaware, and Virginia, USGS, Scientific Investigations Reports

Report, Planned: by Sarah K. Martucci (U.S. Geological Survey), Jennifer Krstolic (U.S. Geological Survey), Jeff P. Raffensperger (U.S. Geological Survey), and Kate Hopkins (U.S. Environmental Protection Agency Chesapeake Bay Program), Development of land segmentation, stream reach network, and watersheds in support of HSPF modeling, Chesapeake Bay Watershed and Maryland, Delaware, and Virginia, USGS, Scientific Investigations Reports

Report, Planned: Douglas L. Moyer and Mark R. Bennett, Development of HSPF function tables (FTABLES) for simulated stream segments in the Chesapeake Bay

Watershed, and Virginia, Maryland, and Delaware, USGS, Scientific Investigations Reports.

Relevance and Benefits: Federal, State, and Local governments need tools to evaluate alternative approaches for correcting existing water-quality and water- quantity problems and for forecasting future conditions within the Chesapeake Bay Watershed. The development and calibration of an HSPF model of the watershed will provide insight into processes controlling the processing of nutrients and sediment within the watershed. The calibrated watershed will allow resource managers to simulate large-scale effects of land-use changes and best management practices on water-quality. Critical areas needing nonpoint-pollution control measures can be identified, and benefits to be gained by various management strategies can be evaluated.

The study meets several goals of the Water Resources Discipline (WRD) of the USGS, by: 1) advancing knowledge of the regional hydrological system; 2) advancing understanding of hydrological processes; and 3) providing water-resources information that will be used by multiple parties for planning and operational purposes. In addition, the proposed study will benefit ongoing PODL (Potomac-Delmarva Subunit) NAWQA studies that address questions related to fate and transport of agrochemicals, nutrient enrichment, and nutrient processing within the watersheds and stream.