EXECUTIVE SUMMARY

Demonstration and Validation of BASINS Watershed Modeling System Enhanced for Military Installations – Ft. Benning

ESTCP Project RC-201307

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ESTCP

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TABLE OF CONTENTS

Page

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1.0 INTRODUCTION

The Better Assessment Science Integrating point and Non-point Sources (BASINS) Modeling System is a geographic information system-based system and features a well-developed interface for different dynamic watershed models, as well as numerous pre- and post-processing tools that are shared by the models. Two types of enhancements, using the Hydrological Simulation Program – FORTRAN (HSPF) as the primary modeling code, were developed for the BASINS modeling system for military-specific applications: (1) data and methodologies that address key military land stressors (i.e., urban encroachment, prescribed burning, timber harvesting, military training, and unpaved roads), and (2) software refinements related to model linkages and algorithms.

Military Enhanced BASINS Modeling System (BASINS.MIL) was used to build a continuous computer simulation model of hydrology and water quality for the watersheds on and surrounding Fort Benning (FB), Georgia (GA). This model is referred to as the FB Model (or FB Enhanced Baseline Model). Preliminary model applications of the FB Model were performed to provide proof-of-principle demonstration of the modeling system and the model enhancements to support watershed management decisions on the Installation.

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2.0 OBJECTIVES

The Environmental Security Technology Certification Program (ESTCP) sponsored the demonstration/validation of BASINS.MIL described in this report as the next step to fully demonstrate the validity of the technology to meet the Department of Defense's (DoD) need for tools to evaluate watershed hydrology and water quality for system-level assessments. The technology transfer of BASINS.MIL demonstration/validation leverages the watershed model developed on FB by conducting further modeling applications on FB, and by developing a watershed model for another installation that will be used to further demonstrate the technology. Fort AP Hill (FAPH), Virginia was selected as the second site since it provides a unique opportunity to (a) demonstrate the transferability of the BASINS.MIL modeling framework to a new installation and (b) demonstrate the ability of BASINS.MIL to address Total Maximum Daily Load (TMDL) issues.

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3.0 TECHNOLOGY DESCRIPTION

Use of continuous simulation computer techniques (such as BASINS.MIL) for evaluation of watershed hydrology and water quality offers much promise as a system-level assessment tool. However, this technology has been slow to be embraced by DoD installations due in part to a variety of perceived and real shortcomings such as: 1) uncertainty about costs related to site-specific data needs, 2) expertise needed to apply the modeling system, 3) disparity between the scale of the assessment need and the scale of the model's resolution, and 4) a lack of knowledge regarding the versatility and relevance of the technology to address compliance-specific management issues on installations.

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4.0 PERFORMANCE ASSESSMENT

This report comprises a main body that contains a synopsis and conclusions/ recommendations for each of the following four FB tasks:

- Task 5: Data Richness Versus Model Performance
- Task 6: Unpaved Road Sediment Erosion Modeling Application
- Task 7: Model Demonstration for Climate Non-Stationarity and Land Use Change Impact Analysis
- Task 9: Demonstration of Sensitivity and Uncertainty Analysis

For each task, the full documents that were submitted to, and approved by ESTCP are included in their entirety as appendices.

Under Task 5, the FB Demonstration implemented an approach to quantify the change in model performance relative to the richness of data that are available for model set up. Specifically, the objective was to quantify the change in performance of a BASINS.MIL hydrology model as a function of the number of observed flow data sites (gages) available for calibration within the watershed. The model that was used for the evaluation was the Hydrological Simulation Program – Fortran (HSPF).

Under Task 6, monitoring data was collected for unpaved road erosion at Fort Benning to validate the Watershed Erosion Prediction Project (WEPP) model. The strategy for selecting data collection sites was established by the WEPP:Road model developer, Dr. William Elliot of the US Forest Service. The primary consideration was characterizing extremes in potential sediment erosion at the Installation and demonstrating the model's ability to reproduce the full range of observed sediment erosion phenomena. The second objective of the task was to evaluate the usefulness of the data gathered in support of the WEPP:Road model as a potential resource for determining justifiable adjustments to the unpaved road land use category in the FB Watershed Model.

Under Task 7, a climate non-stationarity assessment was performed to demonstrate the usefulness of a BASINS.MIL model (i.e., FB Model) to characterize changes in hydrology and sediment associated with potential climate scenarios and land uses for the Southeast US region.

Under Task 9, the objective was to demonstrate that sensitivity and uncertainty analyses conducted with a BASINS.MIL model can be used first, to provide understanding of the relative sensitivities of simulation results to adjustments made in various model input parameters, and second, to quantify uncertainties in model results/predictions related to relevant regulatory standards and/or indicators.

For interested readers, we recommend an initial review of the summaries for these tasks provided in the main body of the Final Report, and then a follow up with a more detailed investigation of the individual appendices for complete details of each specific task effort and the corresponding conclusions and recommendations resulting from each of these task efforts.