SPR RESEARCH PROGRAM
SECOND-STAGE PROBLEM STATEMENT
FY 2017

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I. PROBLEM NUMBER AND TITLE

17-013_GHE Analysis of Highway System Impacts on TMDL Watersheds using the FHWA Stochastic Empirical Loading and Dilution Model (SELDM)

II. RESEARCH PROBLEM STATEMENT

ODOT's stormwater treatment program faces increasing pressure from existing and future permitting requirements from both the Endangered Species Act and the Clean Water Act. Specific issues affecting the cost and effort for project development and operation of the highway system include 1) the proliferation of single project stormwater treatment facilities implemented without consideration of broader transportation system needs, environmental benefits, or additional burden on Maintenance, 2) additional time and costs for projects that must find off-site treatment locations when on-site treatment is not practical, 3) anticipated requirement to implement a stormwater treatment retrofit program in the forthcoming National Pollutant Discharge Elimination System Municipal Separated Storm Sewer System (NPDES MS4) permit, and 4) potentially overestimated pollutant load reduction requirements for Total Daily Maximum Load (TMDL) and Superfund and Sediment Cleanup site compliance that are based on models poorly suited for analyzing highway system impacts.

An integrated strategy for highway system level assessment of water quality within a watershed is needed to address strategic planning for stormwater treatment and facility placement. Considering that stormwater banks can be used both to off-set lack of complete treatment on projects due to constraints and as in-lieu treatment for small projects where treatment would not be cost effective, bank establishment should require demonstration of the level of benefit to the watershed. Strategic planning will reduce the reliance on project by project stormwater management and support a functional retrofit program by identifying and focusing on areas where transportation and environmental priorities coincide. The result can be fewer, larger, well placed facilities instead of scattered, small, maintenance intensive facilities. Watershed level analysis will also ensure that TMDL load allocation and Superfund and Sediment Cleanup responsibilities are based on an accurate assessment of highway impacts.

Implementing a stormwater banking strategy requires an understanding of highway impacts on watersheds that goes beyond single site analysis. Unfortunately, the impact of ODOT's highway system on watershed water quality is currently very poorly understood. The Stochastic Empirical Loading and Dilution Model (SELDM), recently developed by the U.S Geological Survey and now FHWA's preferred stormwater quality model, is intended for project specific analysis. Following the 2014 ODOT sponsored project to calibrate and test SELDM in Oregon, ODOT and the USGS realized that the model was capable of being used to calculate the watershed scale impacts of the highway system. In other words, not only does SELDM have the potential to analyze total impacts, but SELDM could also evaluate how the absolute and relative contribution of highway runoff to stream water quality changes throughout the watershed—including the additional effects of potential stormwater treatment measures. By developing appropriate protocols and procedures, SELDM watershed analysis could be used to identify sites with the greatest overall environmental benefit for treating highway runoff.

III. RESEARCH OBJECTIVES

The proposed research project aims to expand the usefulness of SELDM to watershed level analysis. The procedures to be developed will allow the practitioner to determine both the total and relative pollutant loading attributable to highway sources at any point on a watershed's stream network. Most importantly, expanded SELDM will be used to analyze the effects and benefits of various stormwater treatment facilities and strategies in the watershed in order to: 1) optimize BMP site selection for increased environmental uplift while reducing program stormwater treatment costs, 2) determine more realistic estimations of ODOT specific pollutant loading and contribution relative to total in-stream pollutant concentration, and 3) prepare ODOT for anticipated stormwater permit requirements through use of a strategic and focused planning tool. Specifically, the objectives of this proposed study are to:

1. Develop techniques and protocols for SELDM scale-up. The newly optimized SELDM model will enable impact analysis of water quality from multiple highway discharge points in a watershed as well as from specific points within the watershed.
2. Demonstrate SELDM scale-up protocols using empirical data from Oregon watersheds with highway runoff pollutant related TMDLs and multiple highway discharge points.
3. Develop a guidance manual and final report for watershed level analyses using SELDM, based on the results and experience gained in step 2.

IV. WORK TASKS, COST ESTIMATE AND DURATION

Task 1: Develop procedure for using SELDM to perform watershed level analysis of highway system water quality impacts. Building on the basic structure of the current modeling procedures, the updated SELDM system will account for multiple inputs from highway runoffs within an entire watershed, including progressive changes to the absolute and relative load from highways as the size and land uses change through the watershed.

Task 2: Test the procedure developed in Task 1 by performing analysis using the developed SELDM Watershed impact procedure. The analysis will be conducted for two watersheds scoped and selected by ODOT. Inputs for the model will come from national databases connected to SELDM, site specific information as available, and StreamStats. StreamStats is a USGS web tool for watershed delineation and hydrologic estimates that has been updated with current land use information developed for ODOT for initiating this watershed level analysis.

Task 3: Develop guidance document and final report for using SELDM to perform watershed scale analysis. A guidance manual for SELDM watershed analysis for ODOT and local transportation divisions will be delivered, as will a final report documenting the project. This final published report will include results from Tasks 1 and 2, model limitations, future applications and details of the process for using SELDM for watershed level analysis.

The project cost is $160,000—which is eligible for a 35% contribution through the USGS Cooperative Project funding, plus $10,000 for ODOT administration for a total of $170,000. Estimated duration is one year.

IMPLEMENTATION

Environmental and Hydraulics staff would use the SELDM watershed procedure to analyze watersheds and identify high benefit sites for stormwater banks and retrofit projects. These results would inform discussions with resource and regulatory agencies on permit requirements and compliance, and establishment of stormwater treatment banks. The project products would be useable by agency staff, consultants, and local transportation networks, and will include:

- Guidance manual describing the protocol for conducting watershed level analysis of highway system impacts on TMDL pollutant loads.
- Analysis of highway system impacts on two representative TMDL watersheds using SELDM.

VI. POTENTIAL BENEFITS

This research will enhance ODOT stormwater program efficiency and cost reduction by initiating the development of a formal stormwater banking program and by supporting a shift to a strategic, systems-level approach to stormwater management. Specifically, development of watershed level analysis protocols with SELDM can increase efficiency and reduce costs by 1) eliminating the time needed to find off-site treatment, 2) avoiding multiple small treatment site development (thus reducing the load on Maintenance), 3) providing a tool to set appropriate TMDL treatment requirements, and 4) providing a tool available to meet NPDES MS4 requirements for stormwater retrofits and program effectiveness measures. Additionally, ODOT environmental goals would be supported by identifying treatment sites and strategies with high environmental benefit to the surrounding watersheds.

VII. SUBMITTED BY

Stage 1 Submitter	***Stage 2 Submitter***	***ODOT champions***
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