

## **LONG-TERM BED DEGRADATION IN MARYLAND STREAMS (PHASE III, PART I): URBAN STREAMS IN THE PIEDMONT PLATEAU PROVINCE**

### **Problem**

Estimation of potential long-term down-cutting of the stream bed is necessary for evaluation and design of bridges for scour and culverts for fish passage. Existing guidelines for assessing this potential long-term bed degradation (LTBD) in Maryland streams require expertise that may not be available and/or field studies that, depending on the project budgets, may be cost prohibitive, especially for replacement of county structures. The morphological techniques recommended by these guidelines also lack verification data and may lead to overly conservative estimates, unnecessarily large foundation depths, and consequently, significantly higher costs.

### **Objectives**

The purpose of this study was to improve predictions of LTBD in Maryland streams through the measurement and analysis of stream bed and waterway structure survey data and bridge plans. A primary objective was the development of equations for estimating potential LTBD in urban streams in the Piedmont Plateau Province.

### **Description**

The first two phases of the study examined LTBD in six Maryland counties in the Blue Ridge and Piedmont physiographic provinces: Garret, Allegany, Washington, Frederick, Carroll, and Montgomery. These six counties contain non-urbanized watersheds of the Allegany Plateau, Blue Ridge, and the Western Piedmont physiographic provinces. The present study, Phase 3, was limited to urban watersheds (those with impervious ground cover greater than 10%) of the Piedmont Plateau province in Montgomery, Baltimore, and Howard counties and Baltimore City.

Following the same sampling and surveying methodology in the first two phases, this study evaluated six factors that may influence a site's risk of LTBD: (1) the valley slope, (2) the effective valley width, (3) discharge, (4) bed material size, (5) downstream channel entrenchment, and (6) downstream grade controls. Three relations between LTBD and these factors were examined: LTBD and valley slope; LTBD and an index combining Factors 1-3; and LTBD and an index combining Factors 1-4.

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## Results

Part 1 of a two-part study of urban streams in the Piedmont Plateau province was completed. Many sites were selected for sampling; the remainder of the sample will be selected in Part 2. The range of watershed drainage areas of the selected LTBD sampling sites is 0.2 mi<sup>2</sup> to approximately 40 mi<sup>2</sup>; only one site, however, has a drainage area greater than 6 mi<sup>2</sup>. The current range of impervious area of the LTBD sampling sites is approximately 19% to 58%, but only one site has an impervious area of less than 25%. The current range of valley slopes of the LTBD sampling sites is approximately 0.5% to 4%. Given the high correlation of LTBD with valley slope found in previous investigation of LTBD and the lack of data for Part 1 sites with slopes lower than 0.5%, additional data on streams with less than 0.5 % slope is needed and will be collected in Part 2. A database of preliminary estimates of LTBD was initiated. Additional data collection in regions of the urban Piedmont Plateau is required to cover the range of watershed areas, percentage of impervious area, and valley slope for a comprehensive assessment of LTBD in the urban Piedmont. Travel time and access were factors that increased the time required to screen and select sampling locations. Site selection, data collection, and analysis will be completed in Part 2 of this project. The results of this study are preliminary and should only be applied to assess data gaps.

## Report Information

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## Link to Final Report:

[http://www.roads.maryland.gov/OPR\\_Research/MD-14-SP309B4S\\_Long-Term-Bed-Degradation\\_Phase-III-1\\_Report.pdf](http://www.roads.maryland.gov/OPR_Research/MD-14-SP309B4S_Long-Term-Bed-Degradation_Phase-III-1_Report.pdf)

## Links to Reports of the Previous Two Phases:

[http://www.roads.maryland.gov/OPR\\_Research/MD-12-SP109B4K\\_Long-Term-Bed-Degradation\\_Phase%20II\\_Report.pdf](http://www.roads.maryland.gov/OPR_Research/MD-12-SP109B4K_Long-Term-Bed-Degradation_Phase%20II_Report.pdf)

[http://www.roads.maryland.gov/OPR\\_Research/MD-11-SP909B4G\\_Long-Term-Bed-Degradation\\_Phase-I\\_Report.pdf](http://www.roads.maryland.gov/OPR_Research/MD-11-SP909B4G_Long-Term-Bed-Degradation_Phase-I_Report.pdf)