

Evaluation of Travel Path Ratio as a Measure of Short-Circuiting Potential in Stormwater Quality Basins using Ideal Flow Modeling

Samuel Orozco and Theodore G. Cleveland¹
Department of Civil and Environmental Engineering
University of Houston
Houston, Texas 77204-4003

Permitted Best Management Practices (BMPs) serving recent development in Harris County and the City of Houston were examined to select two basin-type BMPs for performance monitoring. Over 750 permits were examined and relevant permit details entered into a database management system; 440 were basin-type BMPs. Detailed examination of the engineering drawings for 440 basin-type BMPs discovered that many BMPs while trying to adhere with local design guidelines confused the meaning of length-to-width ratio as a geometric basin-shape requirement without regard to flow path through the basin. Thus some basins while long and slender have inlets and outlets located across from each other on the short dimension of the basin and arguably are likely to short-circuit.

In the selection of the basins for performance monitoring a scoring criteria called Travel Path Ratio (TPR) was created to account for basins that otherwise met design guidelines but were likely to have short circuiting. An ideal flow model was constructed to test the relevance of this measure in the context of short-circuiting. The ideal flow model generates velocity potentials that are used in a particle-tracking model to create residence-time distributions for the basins. The residence time distributions of different geometric designs, all with the same volume are compared and demonstrate that the TPR criteria is a reasonable measure of the potential for short circuiting. Inclusion of such a criterion as a design guideline could provide both designers and reviewers a quick tool to evaluate short-circuits potential in future basin designs.

Key Words: Best Management Practices, Stormwater Quality Basins, Design Guidelines, Flow Model

¹corresponding author 713-743-4280; cleveland@uh.edu