

IDENTIFICATION OF TECHNIQUES TO MEET PH STANDARD DURING IN-STREAM CONSTRUCTION

Problem

Many of Maryland's tributaries traverse highway infrastructure via culverts that are managed and maintained by SHA. These culverts are often made of galvanized steel and over time are subjected to scour. Concrete grout is often used as a repair material when these issues are identified. However, once water is allowed to inundate the freshly paved culvert, the grout surface can produce a dissolution effect in which elevated pH can impact downstream waters. The occurrence of this pH spike from grout has been reported in past projects, and has resulted in concerns as the pH of water may reach above the regulatory limit of 8.5.

Objective

The goal of this project was to ensure that SHA has a proper specification and remedial actions for addressing the pH concern. The overall objectives were to:

- review the current specification for using grout for culvert maintenance,
- determine the various parameters that control pH spikes for effluent waters,
- determine applicable remedial applications, and
- update the current specification and provide a guidance document/tool for SHA and contractors.

Description

To satisfy these objectives, this project assessed elevated pH, along with other related water quality measures from grout paving activities. Field monitoring at construction locations in Maryland and laboratory studies were conducted, including:

1. Identified the current technologies, methods, and materials used in culvert rehabilitation and maintenance, and determined what methods and materials can be used to mitigate water quality impacts.
2. Coordinated with SHA to identify field sites that represent a variety of environmental conditions and flow regimes for field studies.
3. Conducted concurrent tank leaching and flow-through laboratory testing. Laboratory leaching tests were performed to measure pH variations under various experimental conditions. Laboratory tests of proposed mitigation techniques were done for consideration in future maintenance contracts.
4. Using the knowledge gained from laboratory studies, additional field sites were studied to evaluate the recommended mitigation techniques.
5. Developed a construction technique flowchart and best management practices for in-stream grout paving work.



Flow-through leaching test

Results

Results indicate that the pH spike is primarily related to the contact time that the water has with the paved grout surface and its flow rate, while other parameters, such as surface washing and temperature, may have a subtle impact on the extent of the pH spike. The following recommendations are made:

- If possible, it is recommended that pH be minimally monitored from the influent and effluent sides of the culvert during the construction period. The interpolation can be used if flow rate is obtained along with the dimensions of the culvert. The monitoring ensures that the water quality regulation is being met.
- At the effluent side, a catchment area devised by sandbags (at adequate height) should be used to capture the “first flush” from the culvert effluent side. This flush should then be pumped to the sediment bag which can be underlain with peat and straw at sufficient distance from the stream.
- Following grout placement and cure, any loose pieces of dried grout or dust should be removed from within the culvert. Washing the surface with water and treating this wash water with the “first flush” over the paved invert can reduce the time of an anticipated pH spike.
- The water should be pumped from the culvert effluent area into the sediment bag on a bed of wetted peat contained in burlap bags at a minimum depth of 4 inches. The peat should be wetted and mixed in a 3:1 ratio (peat to water by volume). This setup should be placed, at a minimum 30 feet from the stream.
- If grout bags are used to secure the inlet or effluent ends of the culvert, it should be constructed in such a way to ensure water is not allowed to pond on these materials. The extended contact time could result in a possible high pH reading.

Report Information

For more information about the study please contact:

James G. Hunter Jr., Ph.D.
Morgan State University
Phone: 443-885-4733
Email: james.hunter@morgan.edu

Link to the final report: http://www.roads.maryland.gov/OPR_Research/MD-14-SP109B4D_pH-Standard_Report.pdf.