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Slow Release

By Zachary H. Ranstead

An approved alternative to storm water volume management in Pennsylvania

The 2006 Pennsylvania Stormwater Best Management Practices (BMP) Manual placed the commonwealth at the forefront of states addressing the adverse impacts of storm water. Its Control Guideline 1 (CG-1) is no increase in the pre-post two-year, 24-hour volumetric change in runoff, while providing rate control and water quality within 72 hours of the end of the storm event. Though non-structural BMPs are encouraged, these criteria primarily are met by structural BMPs employing infiltration, capture and reuse, and/or evapotranspiration. In many cases, soil infiltration is limited and challenging to implement, due to natural or manmade conditions and/or compliance through reuse or evapotranspiration.

Beyond these methods, the manual's guidance for allowable compliance is less clear. Incorporating spray irrigation for captured runoff to provide volume reduction is one alternative design practice. However, the cost to install, operate and maintain these systems can be a considerable additional expense.

Updated Regulations

In 2010, the Pennsylvania Department of Environmental Protection (PADEP) updated the pertinent regulations to provide more clarity (e.g., Pennsylvania Code Title 25, Chapter 102 relating to Erosion Control & Stormwater Management). Specifically, §102(g)(2)(iv) now acknowledges that alternative approaches can be proposed by applicants as long as there is a demonstration that the alternative to manage changes in runoff is equal to or better than CG-1. The underlying principle is that the proposed alternative "will maintain and protect existing water quality and existing and designated uses by maintaining the site hydrology, water quality, and erosive impacts of the conditions prior to initiation of any earth disturbance activities."

As an alternative to the volume reduction strategies, storm water facilities can be designed to mimic the natural process of shallow lateral groundwater interflow. This process is acknowledged as a "common occurrence" in the BMP manual, but no specific design methodology currently is presented. The primary result of interflow is groundwater emerging as seeps and springs that provide stream baseflow, which also is an intended outcome of conventional infiltration design.

This approach was first discussed with PADEP in 2006 in response to the then-pending manual, subsequently presented at PADEP and other engineering training seminars, and detailed in the 2012 white paper I authored as an associate of the Pennsylvania Stormwater Technical Workgroup. The mission of the workgroup was to provide independent technical recommendations to PADEP for its impending update to the 2006 BMP manual. PADEP recently has given favorable consideration to this approach, referred to as the Slow Release Concept, and it currently is being adapted into formal written guidance.

In the long term, it is anticipated that the updated manual will incorporate slow release as an alternative strategy where volume management with infiltration is proven partly or completely infeasible, and all other options are exhausted. While at T&M Associates, I have incorporated this strategy into numerous NPDES-approved projects, including both standard and special protection watersheds.

Design Specifics

The slow release design typically is achieved with a small orifice in conjunction with an underdrain or well-designed debris screen. It differs from extended detention, which focuses on releasing runoff of the two- through 100-year storms over 24 hours. PADEP's pending guidance for slow release is based on a 72-hour maximum dewater time for storms up to the two-year, which is consistent with the current infiltration guidance. This duration is a function of several factors, including small storm frequency and mosquito lifecycle.

Discharges to headwater and physically impaired streams are expected to maximize the dewatering time. In natural systems, stream gauge data can show that the flow response from a two-year storm can take approximately seven days to return to pre-storm conditions. Depending on the circumstances of a project and the receiving waterway or conveyance, a longer dewatering duration may be justified. This simple, cost-effective methodology can facilitate a streamlined approval process for public and private projects. SWS

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