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TETRA TECH

Memorandum

Date: April 29, 2015

To: Tom Schueler

From: Mark Sievers; Tetra Tech

Cc: Bobby Tucker, Mike Clar; Tetra Tech

Subject: Chesapeake Bay: Results of Outfall Stabilization Literature Review

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The Urban Stormwater Workgroup (USWG) is weighing the possibility of creating an expert panel to define a unique sediment and nutrient removal for outfall stabilization practices in the Chesapeake Bay Model. The Water Quality Goal Implementation Team (WQGIT) developed a protocol[1] for creating expert panels. Sector workgroups, such as the USWQ, submit requests to the WQGIT for new expert panels. The requests should include: "(a) a clear and concise definition of the practice with specific information on how it reduces nitrogen, phosphorus and sediment, and (b) reference available science/data on the nutrient and sediment removal efficiencies with the contact information and affiliation of the lead researchers, including the geographical location of where the data was collected."

Several USWG members questioned whether there was enough scientific literature available on these practices to justify an expert panel. The workgroup decided that an initial *threshold* literature search should be performed to determine whether there was enough monitoring data to warrant launching a full-blown expert panel for either practice. Tetra Tech was tasked by the Chesapeake Bay Program to perform a limited literature review and three municipal representative interviews to determine if there is sufficient scientific data and monitoring results available for the practice to justify launching an expert panel. Outfall stabilization was defined as a practice used to prevent or minimize future erosion of sediments and associated nutrients below a storm drain outfall. The practice uses a combination of engineering and native plantings to stabilize the channel or ditch and keep stream velocities below erosive thresholds during larger storm events.

Tetra Tech preformed a literature review for studies that quantify sediment or nutrient load reductions associated with stormwater outfall stabilization efforts. This work was conducted to determine if sufficient credible data is available to justify a full review process, per the WQGIT protocols.

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[1] *Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model*. Approved by WQGIT July 14, 2014.

As part of the literature review, we identified and obtained over 35 peer-reviewed journal articles or reports from various database and online searches with potential relevance. More articles were found, but they were not relevant to load reductions from outfall stabilization. Prior to reviewing the documents, Tetra Tech identified several subject categories to help organize any documentation. These categories included in-stream nutrient uptake and sediment attenuation studies, erosion rate and sediment budgeting exercises, existing literature and database reviews for various channel restoration performance parameters, design guidance manuals, and technical bulletins for pollutant load crediting for various BMP and restoration practices. Early in the literature review, it was apparent that there were not relevant articles regarding the subject categories. There was no literature found that presented qualitative data of load reductions from outfall stabilization practices. Most of the literature found was *grey* literature.

Tetra Tech also interviewed representatives from several local municipalities regarding their outfall stabilization experiences and practices. From the responses, outfall stabilization is a topic of significant concern for many local jurisdictions for the following reasons:

- Larger counties such as Baltimore and Prince George's and Fairfax Counties have a very large number of outfalls (>7,000).
- Most jurisdictions still use traditional stabilization measures, which consist primarily of riprap aprons and channels, which do not receive credit.
- The counties used to be able to conduct the needed outfall repairs under a general permit that was discontinued after 2007. Currently a traditional outfall repair could require as much permitting burden as a stream restoration project.
- Many outfalls are within streams or discharge to the headwaters of a first order stream. The traditional stabilization practices do not usually recognize the fluvial geomorphic issues that need to be considered when tying an outfall into a natural channel.
- Some respondents indicated that an expert panel should be formed to develop credits for current outfall stabilization practices with respect to reduced erosion and sediment generation and the associated nutrient reduction.

A growing number of jurisdictions are now using regenerative stormwater conveyance (RSC) practices as the preferred method of outfall stabilization. However, these interviews revealed a need for research on outfall stabilization and whether traditional outfall stabilization practices are generally adequate. In addition, there is a need for technical guidance on how to address the interface between outfalls and the receiving natural channels, particularly with respect to fluvial geomorphology.

RSC practices, which are now used as either wet or dry-channel retrofits, have already been evaluated by the Urban Stream Restoration Expert Panel and were thus disregarded during this literature review. Based on the Panel's recommendations for RSC, sediment and nutrient removal credits were allocated for dry channel RCS as an upland stormwater retrofit according to Protocol 4 in the Urban Stream Restoration Final Report. Wet channel RSC, which is considered a stream restoration practice by the Expert Panel, receives removal credits according to Protocol 3 (Floodplain Reconnection Volume) when implemented in conjunction with a natural channel design (NCD) restoration project.

On the basis of the literature review and interviews with representatives from several local municipalities, **no relevant information** currently exists that specifically quantifies any water quality impacts directly associated with outfall stabilization. Although many studies included stormwater outfall stabilization efforts as part of a reach-scale restoration project, removal rates directly attributed to outfall stabilization alone were not evaluated or reported separately by the authors. As a result, we determined there is currently not enough monitoring data associated with outfall stabilization practices to justify a BMP expert panel.

Attachments

- *Outfall_Literature List 20150313.xlsx*: List of literature found and reviewed. (Note: some articles were spot reviewed and were not entered since there was no relevant information.)
- *Outfall Stabilization_Calls_20150223.docx*: Documentation of calls with representatives from local municipalities regarding outfall stabilization.