Protocol for the Development, Review, and Approval of Land Use Loading Estimates and Best Management Practices Effectiveness Estimates for Nutrient and Sediment Reduction in the Chesapeake Bay Watershed Model

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Introduction

The Chesapeake Bay Program (CBP) uses land use loading estimates to quantify expected amounts of nutrients (nitrogen and phosphorus) or sediment loads to water from specific land uses or point sources. Changes in estimated loads from a particular piece of land can occur in two ways: 1) A change in the land use (e.g. forest instead of grassland), or 2) an adjustment based on an effective estimate of a best management practice (BMP). These effectiveness estimates are a percentage adjustment used by the CBP to modify these expected loadings. Loads from a point source can be adjusted by modifying the expected load based on a new treatment process or practice. The Water Quality Goal Implementation Team (WQGIT) is responsible for approving loading rates and BMP effectiveness estimates for use in the Chesapeake Bay Watershed Model (CBWM). The CBP Executive Council's 2009 commitment to meet two-year milestones that accelerate the pace of Chesapeake Bay restoration, and the need to quantify practices that will achieve Total Maximum Daily Load (TMDL) allocations, will likely spur innovation and identification of new BMPs.

Direct load reductions from point sources often can be estimated with a high degree of accuracy. However, due to the variability of available data, the development of loading and effectiveness estimates will always include a significant element of best professional judgment. Since the definitions and values used for both loading and effectiveness estimates have important implications for the CBP and the various partners, it is critical that they be developed in a process that is consistent, transparent, and scientifically defensible.

This document contains four sections addressing the following process steps: 1) determining the need for a review process, 2) definition of a point source, land use, or BMP, 3) CBP technical review and approval of loading and/or effectiveness estimates, and 4) periodic reevaluation of existing loading and/or effectiveness estimates.

I. Determining the Need for a Review Process

The CBP expects to receive numerous requests to evaluate effectiveness estimates for innovative technologies and practices, it will necessary to review and prioritize these requests. Proposed technologies and practices that have been identified by jurisdictions in their milestones or can be tracked with existing reporting practices will be given highest priority.

II. Definition of a Point Source, Land use, or BMP

Step 1. Proposing a new or revised estimate
Proposals can be initiated by the following groups:

- A CBP technical workgroup
- A jurisdiction
- A different group/organization/agency *if* a CBP workgroup agrees to sponsor the recommendation through the CBP review process

Step 2. Identifying experts to serve on a panel
The WQGIT will assign a moderator to assist in the development of effectiveness estimates. The appropriate source sector workgroup will convene a panel of experts to develop the loading and effectiveness estimates. Each request for review should include suggestions for such panel members. The panel must include at least three recognized experts approved by the CBP workgroup, as well as at least three other individuals with expertise in water quality-related issues.

Step 3. Developing estimates
The panel report should include the following information:

- Identity and expertise of panel members
- Land Use or BMP name/title
- Detailed definition of the land use or BMP
- Recommended nitrogen, phosphorus, and sediment loading or effectiveness estimates
  - Discussion may include alternative modeling approaches if appropriate
- Justification for the selected effectiveness estimates, including
  - List of references used (peer-reviewed, etc)
  - Detailed discussion of how each reference was considered. This discussion should include the rationale used by the expert panel to weigh the different sources of information.
- Land uses to which the BMP is applied
- Load sources that the BMP will address and potential interactions with other practices
- Description of pre-BMP and post-BMP circumstances, including the baseline conditions for individual practices
- Conditions under which the BMP works:
  - Should include conditions where the BMP will not work, or will be less effective. Examples may include large storms that overwhelm the design, etc.
  - Any variations in BMP effectiveness across the Watershed due to climate, hydrogeomorphic region, or other measureable factors.
- Temporal performance of the BMP including lag times between establishment and full functioning (if applicable)
- Unit of measure (e.g., feet, acres)
- Locations within the Chesapeake Bay watershed where this BMP is applicable

- Useful life; effectiveness of practice over time
- Cumulative or annual practice
- Description of how the BMP will be tracked and reported:
    - Include a clear indication that this BMP will actually be used and reported by jurisdictions
- Identification of any ancillary benefits or unintended consequences of BMP not limited to impacts on nitrogen, phosphorous and sediment loads
    - Examples include increased, or reduced, air emissions
- Suggestion for a review timeline; when will additional information be available that may warrant a re-evaluation of the BMP or land use
- Outstanding issues that need to be resolved in the future and a list of ongoing studies, if any
- Operation and Maintenance requirements and how neglect alters performance

Additional guidelines:

- Reflect operational conditions; conditions as they actually exist in the Bay Watershed
    - Uncertainty in using research scale results to predict operational conditions should be explicitly noted.
- Include negative results
    - Where studies with negative pollution reduction data are found (i.e. the BMP acted as a source of pollutants), they should be considered the same as all other data.
- Peer reviewed literature should be given more weight than literature that has not undergone the same review process. As noted above, the panel should explain how information from different data sources was evaluated.
- Use geographically appropriate data
    - The data used to develop estimates should be selected based on its applicability to the Chesapeake Bay watershed.

Step 4. Data Applicability

Determining which data should be used to develop loading and effectiveness estimates is a critical step. When considering sources of data, the panel must decide: 1) if the data is appropriate, and 2) how much influence each data source should have on the final estimate. Each of these decisions should be discussed explicitly in the final report for each data source.

Before selecting a study the panel should consider the following:

- Was the data used to develop effectiveness estimates selected based on its applicability to the natural conditions of the Chesapeake Bay watershed, such as, soil type, hydrologic flow paths, and species composition?
- Was the data generated from a BMP design and implementation consistent with those found in the Chesapeake Bay watershed?
- Does the practice coincide with NRCS codes, jurisdictional stormwater design manuals?

- How does is the duration of the experiment impact the operational-scale effectiveness of the practice?
- Does the data contain a high degree of uncertainty and/or variability?
- Do results reflect changes in pollution reduction benefits over the lifetime of the BMP?
- What parameters were sampled and monitored (paired watershed study, grab samples, etc.)?
- Who conducted the research?
- How was the effectiveness estimate calculated?
- What, if any, assumptions were made during the experiment and conclusion?

Once the panel has determined that a data source is appropriate, they must determine how much influence (i.e. 'weight) the data should have on resulting estimates. For example, peer-reviewed publications will usually have more weight than non-reviewed sources. However, the exact amount of influence a data-set will be based on other factors, such as those listed in the questions above, that the panel will consider.

III. Chesapeake Bay Program Technical Review and Approval Process

Expert panel recommendations will be undergo a technical review by the CBP. The steps for this process are listed below. Each recommendation must first receive approval from the indicated group before it can be reviewed by the next group listed in the process.

1. Review by the relevant CBP source sector workgroup. This group will be responsible for reviewing the technical components of the recommendation, ensuring that all of the pollutant(s) source loading(s) or BMP pollution reduction mechanisms have been included.

2. Review by the CBP Watershed Technical Workgroup. This group will be responsible for analyzing the modeling components of the recommendation and determining that the tracking and reporting data that is needed to receive credit is available in the appropriate Chesapeake Bay jurisdiction(s) thereby ensuring that no double counting is occurring.

3. Review by the WQGIT. This group will be responsible for reviewing the process used and the recommendation's consistency with other approved BMP effectiveness estimates.

IV. Reevaluation Process

As new information becomes available, loading effectiveness estimates will need to be revised and refined. Each estimate will be discussed by the relevant source sector workgroup every four years to determine if new information available that would warrant a revision. If such information exists, the protocol described in this document for revising a BMP effectiveness estimate will be utilized. To warrant an update, three or more new studies should be available, or a peer-reviewed, operational scale project completed, where the resulting effectiveness estimate is significantly different from the current estimate.

In addition, if it is determined that an existing loading or effectiveness estimate produces illogical output from the Chesapeake Bay Watershed Model, the Watershed Technical Workgroup will work with the appropriate source sector workgroup to revise the effectiveness estimate and its application in the model. Illogical model outputs include situations in which the application of a BMP increases loadings or produces reductions disproportionate to similar BMPs. Such revisions will be brought to the WQGIT for approval.