Protocol for the Development, Review, and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model

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Introduction

The Chesapeake Bay Program (CBP) uses 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 four ways: 1) A change in the land use (e.g. forest instead of grassland), 2) an adjustment based on an estimate of effectiveness of a best management practice (BMP), 3) a measured reduction in direct load to the land use, and 4) a measured reduction from a treatment process. Effectiveness estimates and direct load reductions to land result in percentage adjustments on a per acre basis (as opposed to an adjustment in concentration or a load per farm operation) used by the CBP to modify the existing baseline loading for particular land uses and practices. Loads from point sources can be adjusted based on a new treatment process or practice.

The Water Quality Goal Implementation Team (WQGIT) is responsible for approving the loading rates, and percentage adjustments to these rates, used 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 to be used in Watershed Implementation Plans (WIPs) that will achieve Total Maximum Daily Load (TMDL) allocations, will likely spur innovation and identification of new BMPs.

Direct load reductions and reductions from treatment process often can be estimated, or measured, with a relatively high degree of accuracy. However, due to the variability of available data, loading rates and effectiveness estimates for nonpoint sources are based largely on 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 three sections addressing the following process steps:

I. Determine the need for a review process,
II. Review process:
    a. For new estimates
    b. For existing estimates or treatment processes
III. Chesapeake Bay Program review and approval

I. Determine the Need for a Review Process for:

A. New estimates

As the Executive Order and Bay TMDL processes unfold, the CBP expects to receive numerous requests to evaluate innovative technologies and practices. It will be necessary to review and prioritize these requests. Requests can be initiated by the following groups:

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

Requests should be submitted to the Chair of the WQGIT who will then route requests to the Watershed Technical Workgroup (WTWG) and to the relevant source sector Workgroup. These Workgroups will determine if sufficient credible data is available for a full review process. This determination will be made within 60 days from the date received by the WQGIT Chair. The decision to proceed will include a timeframe for completion of the review that will be based on the complexity of the review and workload issues. Proposed technologies and practices that have been identified by jurisdictions in their Watershed Implementation Plans (WIPs) will be given highest priority.

B. Existing estimates or treatment processes

The WQGIT will evaluate existing loading and effectiveness estimates on a three year schedule, or as appropriate, to determine if a review is warranted. Such reviews can be prompted by the availability of new information, such as a new treatment process. Reviews can also be initiated if current estimates produce illogical model outputs or if there is reason to believe that they were developed using inaccurate information.

IIA. Review Process for New Estimates

Convene a review panel

The source sector Workgroup, in consultation with the WTWG and WQGIT Chair, will identify and convene a panel of experts on the relevant topic. Each request for review should include suggestions for such panel members. The panel must include at least six individuals; three recognized topic experts and three individuals with expertise in environmental and water quality-related issues. It is also important that the review panel has appropriate geographic representation.

Expectations of the review panel

The review panel will develop definitions and loading or effectiveness estimates. The panel will work with the source Workgroup and WTWG to develop a report that addresses the following:

- Identity and expertise of panel members
- Land Use or practice name/title
- Detailed definition of the land use or practice
- 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.
- 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. An example is large storms that overwhelm the design.
  - 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 practice 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 be used and reported by jurisdictions
- Identification of any ancillary benefits or unintended consequences beyond impacts on nitrogen, phosphorus 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 estimate
- 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:

- 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.
- Include results where the practice relocated pollutants to a different location. An example is where a practice eliminates a pollutant from surface transport but moves the pollutant into groundwater.

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.

Data sources should be characterized using Table 1 (below).

Table 1. Data source characterization matrix

	High confidence	**Medium confidence**	**Lowest confidence**
Applicability [a]	Definition matches technical specifications	Generally representative	Somewhat representative
Study location [b]	Very representative of soils and hydrology	Generally representative	Somewhat representative
Variability [c]	Relatively Low	Medium	Relatively High
Number of studies [d]	Many	Moderate	Few
Scientific support [e]	Operational scale research (peer reviewed)	Research scale (peer reviewed)	Not peer reviewed ("gray" literature)

a = How well does the practice match any established technical standards (according to participating professionals).
b = How well does the location of the reported practice match conditions in the Chesapeake Bay watershed (e.g. soil type, hydrologic flow paths, and species composition)?
c = How much variability is there in the reported results?
d = The number of studies included in the reference.
e = Has the source been peer reviewed in a scientific setting, and was the work done on an operational or a smaller (research/small plot) scale?

The panel should also consider the following:

- Was the data generated from a BMP design and implementation consistent with those found in the Chesapeake Bay watershed?
- How does is the duration of the experiment impact the operational effectiveness of the practice?
- Do results reflect changes in pollution reduction benefits over the lifetime of the practice?
- What parameters were sampled and monitored (paired watershed study, grab samples, etc.)?
- What, if any, assumptions were made during the experiment and conclusion?

Once the panel has characterized a data source, 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

influence of a particular data source will also consider other factors, such as those listed in the questions above, which the panel will consider.

IIB. Review Process for Existing Estimates or Treatment Processes

If approved by the WQGIT Chair, the review of existing estimates can be conducted within a source Workgroup in consultation with the WTWG. This approach should reduce the amount of time necessary to conduct the review because the definition(s) have already been developed, a background of available data already exists, and issues of how the practices or land use is incorporated into the CBWM have been addressed. Reviews of existing estimates should follow the guidelines listed in IIA above except that a separate review panel is not convened and the information generated is added to the existing support documentation for the estimate.

III. Chesapeake Bay Program Review and Approval

Review panel recommendations will follow a specific procedure through the CBP (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 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 WTWG. This group will be responsible for analyzing the modeling components of the recommendation(s) 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.