



Guiding Chesapeake Bay Water Quality Restoration: The Use Attainability Analysis Technical Support Document and Economic Analyses Document

The most recent Chesapeake Bay protection and restoration agreement—*Chesapeake 2000*—calls for Chesapeake Bay Program partners to achieve and maintain the water quality necessary to support the aquatic resources of the Bay and its tidal tributaries and to protect human health. To achieve these objectives, the U.S. Environmental Protection Agency (EPA), in close collaboration with its watershed partners—the states of Maryland, Virginia, Pennsylvania, New York, Delaware and West Virginia and the District of Columbia—published new Chesapeake Bay regional **water quality criteria** for dissolved oxygen, water clarity and chlorophyll *a* in April 2003.

These new water quality criteria are the building blocks for improving water quality for the plants and animals that live in the Chesapeake Bay. By 2005, Maryland, Virginia, Delaware and the District of Columbia will develop and adopt new state **water quality standards** that reflect the newly established water quality criteria. Part of the development and adoption of new standards will entail revising current underlying tidal-water **designated uses** in these jurisdictions. Current designated uses applied to the waters of the Chesapeake Bay and its tidal tributaries do not fully reflect natural conditions and are too broad in their definition of 'use' to support the adoption of more habitat-specific aquatic life criteria.

The Use Attainability Analysis

As part of their water quality standards development process, the states and the District of Columbia will conduct use attainability analyses (UAA). A UAA is a scientific study to assess the factors affecting the attainment of a use. The factors may be of a physical, chemical biological and/or economic nature. The federal water quality standards regulation requires states to undertake UAAs to remove or establish a subcategory of a designated use that requires less stringent water quality criteria. The evaluations conducted in a UAA determine the attainable uses for a water body.

The Technical Support Document

While a Use Attainability Analysis is conducted by a state in the course of adopting new or revised water quality standards, the Chesapeake Bay Program developed information on a watershed-wide scale to promote coordination and consistency across all jurisdictions during the UAA processes.

The document containing this information is entitled the *Technical Support Document for Identification of Chesapeake Bay Designated Uses and Attainability (Technical Support Document)*. The *Technical Support Document* is not a regulation or a mandatory requirement; it is a guidance and technical document cooperatively developed by all Chesapeake Bay jurisdictions. Throughout each jurisdiction's water quality standards development process, further jurisdiction-specific analyses may be conducted to supplement basin-wide information.

Key Terms

A **designated use** is an element of a water quality standard, expressed as a narrative statement, describing an appropriate intended human and/or aquatic life objective for a water body. Designated uses for a water body may include: recreation, shellfishing, water supply and/or aquatic life habitat.

Water quality criteria are part of a water quality standard, and may be numeric or narrative. Criteria represent a quality of water that supports a particular designated use. When criteria are met, water quality will generally protect the use.

Water quality standards are a provision of State or Federal law consisting of a designated use or uses for a water body and the quantifiable criteria protective of the use(s). Standards may be annual or seasonal, depending on the designated use.

Designated Use Development

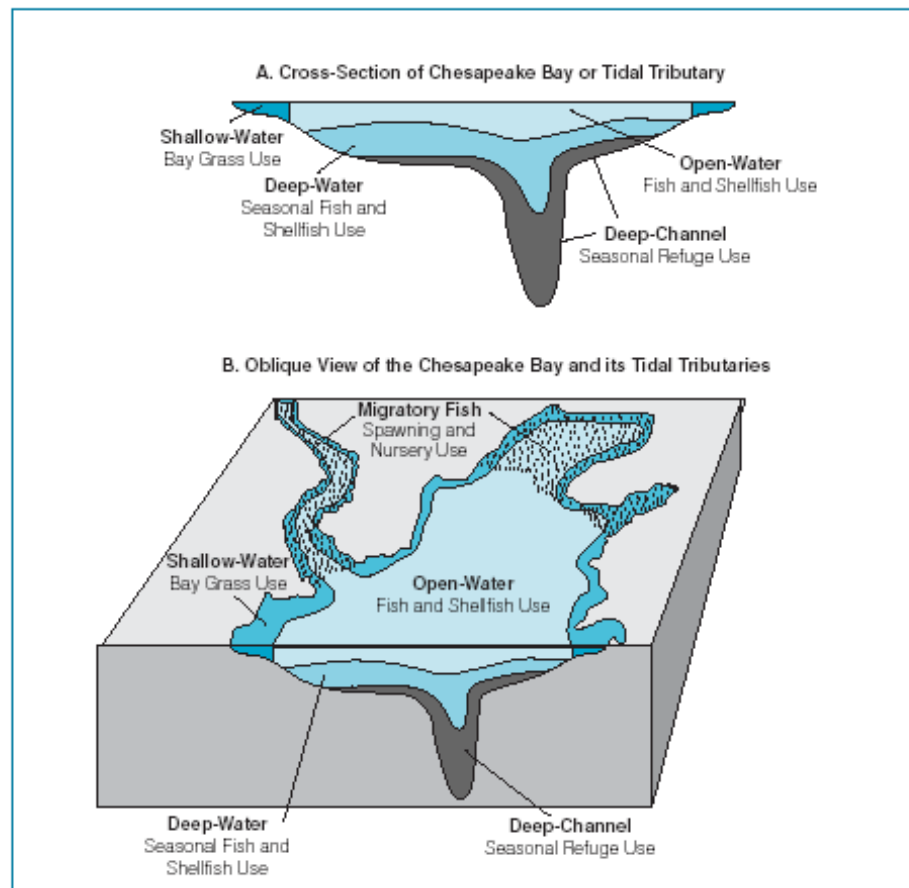
The *Technical Support Document* provides guidance for revising current designated uses, as well as for setting appropriate new uses. The current designated uses in the tidal portions of the Chesapeake Bay are for the protection of aquatic life and have a dissolved oxygen criterion of 5 mg/l. As the *Technical Support Document* illustrates, two factors--natural conditions and human-caused conditions that cannot be remedied--are likely to be sufficient justification for showing why the current designated uses cannot be met, particularly in the deeper waters of the Bay.

The *Technical Support Document* also provides information used to develop five refined designated use categories, or habitat zones, and includes their geographic and temporal extent, or 'boundaries.' All of these designated uses are based on the needs of living resources, as well as the bathymetry, hydrology, physical features and natural stratifications of the Bay's waters.

The Chesapeake Bay Program partners have recommended that the following five aquatic life designated uses, illustrated at right, be applied to the appropriate habitats in the Chesapeake Bay and its tidal tributaries:

- * Migratory fish spawning and nursery;
- * Shallow-water bay grass;
- * Open-water fish and shellfish;
- * Deep-water seasonal fish and shellfish; and
- * Deep-channel seasonal refuge.

Conceptual illustration of the five recommended Chesapeake Bay tidal-water designated uses.



Implementation Tiers

To explore the attainability of the refined designated uses from a technological perspective, the EPA and its partners developed implementation tier scenarios. Each tier represents a specific 'level-of-effort' combination of best management practices (BMPs) and wastewater treatment upgrades. Associated with each tier are load reductions for nitrogen, phosphorus and sediment determined by the technologies and levels of implementation assigned to the tier.

These 'level-of-effort' scenarios range from Tier 1 (which represents current level of implementation throughout the watershed, plus regulatory requirements implemented through the year 2010), up to a limit of technology scenario referred to as E3 or 'Everything, Everywhere by Everyone.' Two other scenarios, Tier 2 and Tier 3, were also developed to represent intermediate levels between Tier 1 and E3.

The tiers are designed to represent potential technological levels of effort and do not represent actual programs jurisdictions may implement to meet water quality standards. Rather, these tiers are *assessment tools* to determine potential load reductions achievable by various levels of technological effort and were modeled to determine water

quality responses. The *Technical Support Document* presents the results of the water quality model analyses by tier to estimate the level of attainment achieved within each designated use.

Based on the nutrient and sediment reductions estimated from the tiers, and results of the water quality model analyses, the *Technical Support Document* provides information showing that the designated uses can be realized for most segments of the Chesapeake Bay under load reductions represented by the E3 scenario. A limited number of segments, particularly for deep-water uses in certain mainstem segments, would not achieve full attainment at Tier 3 implementation levels.

Implementation Tiers Cost Development and the Economic Analyses Document

A companion piece to the *Technical Support Document* is the *Economic Analyses of the Nutrient and Sediment Reduction Actions to Restore Chesapeake Bay Water Quality (Economic Analyses)*. The *Economic Analyses* document provides capital and annualized cost estimates for technologies and BMPs defined in each tier. Costs are presented for the Tier 1 - 3 scenarios, but not for the E3 scenario as the implementation of the tier is considered physically implausible. Annualized costs developed for the *Economic Analyses* consist of capital costs amortized over time, plus annual operating and maintenance costs to continue the implementation of each BMP. Cost estimates and total nitrogen reduction for each tier are provided below.

Cumulative Load Reductions and Costs for the Chesapeake Bay Watershed

Tier	Total Nitrogen Reduction from levels in 2000 (million pounds/yr)*	Capital Costs (in millions of 2001 dollars)	Annualized Costs (in millions of 2001 dollars)
Tier 1	23.9	\$1,391	\$196
Tier 2	63.5	\$3,593	\$553
Tier 3	104.0	\$7,713	\$1,125
E3 (Limits of Technology)	168.4	not costed	not costed

* Phase 4.3 of the Chesapeake Bay Programs Watershed Model. Current modeling estimates that approximately 283 million pounds of nitrogen entered Chesapeake Bay in 2000.

Economic Impact Analysis

The *Economic Analyses* document also provides a summary of *screening*-level social and economic impacts that can be used to show where substantial and widespread impacts may occur, and where more comprehensive analyses need to be focused. *In-depth* analyses performed by the jurisdictions would need to be completed to make a final determination of social and economic impacts. Each jurisdiction may also choose to use the screening-level economic information to determine where and how much public financial assistance will be most effective.

Costs and screening-level impact information provided in the *Economic Analyses* are not used to delineate the designated use boundaries. Through their own processes, the states and the District of Columbia will determine affordability and their own final designated use boundaries.

For more information on restoring Chesapeake Bay water quality, please visit <http://www.chesapeakebay.net/restoringwater.htm>.