Use Attainability Analysis for the federal navigation channels located in tidal portions of the Patapsco River.

Use Attainability Analysis For Patapsco River Mesohaline (PATMH):

Preamble

In April 2003, the U.S. Environmental Protection Agency (EPA) Region III issued guidance entitled *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll* a *for the Chesapeake Bay and Its Tidal Tributaries* (*Regional Criteria Guidance*). The development of the *Regional Criteria Guidance* was the realization of a key commitment in the *Chesapeake 2000* agreement. In that agreement, the signatories (the states of Pennsylvania, Maryland and Virginia; the District of Columbia; the Chesapeake Bay Commission and the EPA) committed to, "by 2001, define the water quality conditions necessary to protect aquatic living resources." New York Delaware and West Virginia agreed to the same commitment through a separate six-state memorandum of understanding with the EPA.

The EPA, in the *Regional Criteria Guidance*, defined the water quality conditions called for in the *Chesapeake 2000* agreement through the development of Chesapeake Bay-specific water quality criteria for dissolved oxygen, water clarity and chlorophyll *a*. The EPA also identified and described five habitats, or designated uses, that provide the context in which the EPA Region III derived adequately protective Chesapeake Bay water quality criteria for dissolved oxygen, water clarity and chlorophyll *a.* Collectively, the three water quality conditions provide the best and most direct measures of the effects of too much nutrient and sediment pollution on the Bay's aquatic living resources—fish, crabs, oysters, their prey species and underwater bay grasses. These criteria were developed as part of a larger effort to restore Chesapeake Bay water quality.

The Maryland Department of the Environment, as a partner working in good faith to fulfill the goals of the *Chesapeake 2000* agreement, is currently in the process of promulgating the new Chesapeake Bay water quality standards to protect the Bay's aquatic living resources within the State of Maryland. This Use Attainability Analysis was developed by the Department to be a companion to the new Chesapeake Bay water quality standards (COMAR 26.08.01.01, 26.08.02.02, 26.08.02.03-3, and 26.08.08.08). This analysis describes the development and geographical extent of the designated uses to which the water quality criteria may apply, and as such serves as a resource to the State and its citizens to assist them in the monitoring, assessment, and protection of the Bays' resources.

The Use Attainability Analysis is not law or regulation; it is an assessment of the attainability of the current Bay water quality standards as well as the newly proposed water quality standards.

Purpose:
This use attainability analysis is provided to support the proposed water quality regulation at COMAR 26.08.02.03-3 §C (7)(f)

Executive Summary:
The current designated use for the Patapsco River (including Baltimore Harbor) is Use I, meaning that the water quality should be expected to support aquatic life and provide for recreation in and on the water. The Chesapeake Bay Program in collaboration with the Bay

Watershed States (MD, VA, PA , NY, DE, and Washington D.C.) have recently developed new water quality standards for the Bay mainstem and its tidal tributaries, including the Patapsco River. The new standards proposes up to 4 designated uses for the Patapsco River applied spatially and temporally based on the needs of living resources and the hydrology and bathymetry of the Patapsco River.

An analysis of the existing water quality data indicates that the dissolved oxygen criteria for the deep channel seasonal refuge use (instantaneous minimum of 1.0 mg/L, applied June 1 to September 30) cannot be met, even after projected nutrient reductions from point sources (based on implementation of ENR to achieve 3 mg/L TN) and the application of the Tributary Strategies reductions for nonpoint sources. The current best projections of the water quality model indicate a minimum 70% exceedence rate in the deep channel seasonal refuge designated use. The dissolved oxygen criteria for the open water designated use, which applies from October 1 to May 31, is projected to be attained within the accepted biologic reference curve.

The application of 40CFR§131.10(g) use attainability factors 1, 3, and 4 are necessary based on the analyses of existing water quality data and the Chesapeake Bay water quality model's calculations of expected conditions following nutrient reductions projected by the implementation of the Tributary Strategies. Further, this analysis is supported by examining the historical background of Army COE activities conducted in the Patapsco River pursuant to the Federal Rivers and Harbors Act of 1852 and its subsequent reauthorizations. Therefore, the Department of the Environment is proposing a modification of the designated uses and criteria within the Chesapeake Bay Segment "Patapsco River Mesohaline (PATMH)". The proposed modification is to the dissolved oxygen criteria for the deep channel seasonal refuge designated use from an instantaneous minimum of 1.0 mg/L to an instantaneous minimum of 0.0 mg/L applied temporally and spatially from June 1 to September 30. The proposed modification will result in a further subcategorization from the designated use subcategory of "Deep Channel Seasonal Refuge" to a limited use subcategory of "Navigation Channel", thus removing the support of aquatic life use normally required by water quality standards.

Introduction to Use Attainability Analysis:
The Water Quality Standards Regulation (40 CFR 131.3) defines a UAA as "…a structured scientific assessment of the factors affecting the attainment of a use which may include physical, chemical, biological, and economic factors…" (40 CFR 131.10[g]). The Water Quality Standards Regulation requires a state to conduct a UAA when it designates uses that D.O. not include those specified in Section 101(1)(2) of the Federal Water Pollution Control Act. The regulation at 131.10(j) provide that a state must conduct a use attainability analysis (UAA) whenever:

> the State designates or has designated uses that D.O. not include those specified in CWA Section 101(a)(2); or
> the State wishes to remove a CWA Section 101(a)(2) use, or to aD.O.pt subcategories of uses specified in CWA Section 101(a)(2) which require less stringent criteria.

States may remove a designated use which is not an existing use, as defined in Sec. 131.3, or establish sub-categories of a designated use, if the State can demonstrate that attaining the designated use is not feasible because:

(1) Naturally occurring pollutant concentrations prevent the attainment of the use; or
(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
(4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use; or
(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
(6) Controls more stringent than those required by 33 USC 1301 §§ 301(b)(1)(A) and (B) and 306 of the Act would result in substantial and widespread economic and social impacts.

The Water Quality Standards Regulation also specifies that any change in designated uses must show that the existing uses are still being protected. "Existing uses" means those uses *actually attained in the water body on or after November 28, 1975*, whether or not they are included in the water quality standards. Existing uses can include those uses (i.e. fishing, swimming, navigation) people make or have made sometime since November 1975, whether or not the water quality supports that use; and/or uses that the water quality is good enough to support, unless there are physical problems, such as substrate or flow, that prevent use attainment.

Patapsco River Existing Use (Navigation Channel) - Historical Background:

In 1830, the Patapsco River was surveyed and it was determined that the controlling depth was 17 ft from the Chesapeake Bay to Fort McHenry. By 1836, Congress appropriated funds to dredge the entrance channels for the Baltimore Harbor, although no channel dimensions were specified in the law. Dredging was completed in 1838. This was the initiation of dredging activity in the Patapsco River to enable Baltimore Harbor to remain a productive commercial port. The following table is a summary of major activities under the Federal Rivers and Harbors Act.

Table 1. Timeline of major ACOE activities pursuant to Federal Rivers and Harbors Act

1852	Rivers & Harbors Act of 1852 authorized a channel 22 ft deep by 150 ft wide from Fort McHenry to the Chesapeake Bay off Swan Point.
1892	A 27-ft-deep Federal channel to Curtis Bay was authorized and completed
1903	The main Patapsco River channel was deepened to a 30-ft depth.
1917	The Act authorized the branch channels to 35 ft deep and 250 ft wide to the head of Curtis Bay, 35 ft deep by 400 ft wide from Fort McHenry to the Ferry Bar, then 27 ft deep by 50 ft wide to the Western Maryland Railway Bridge. The Act also authorized

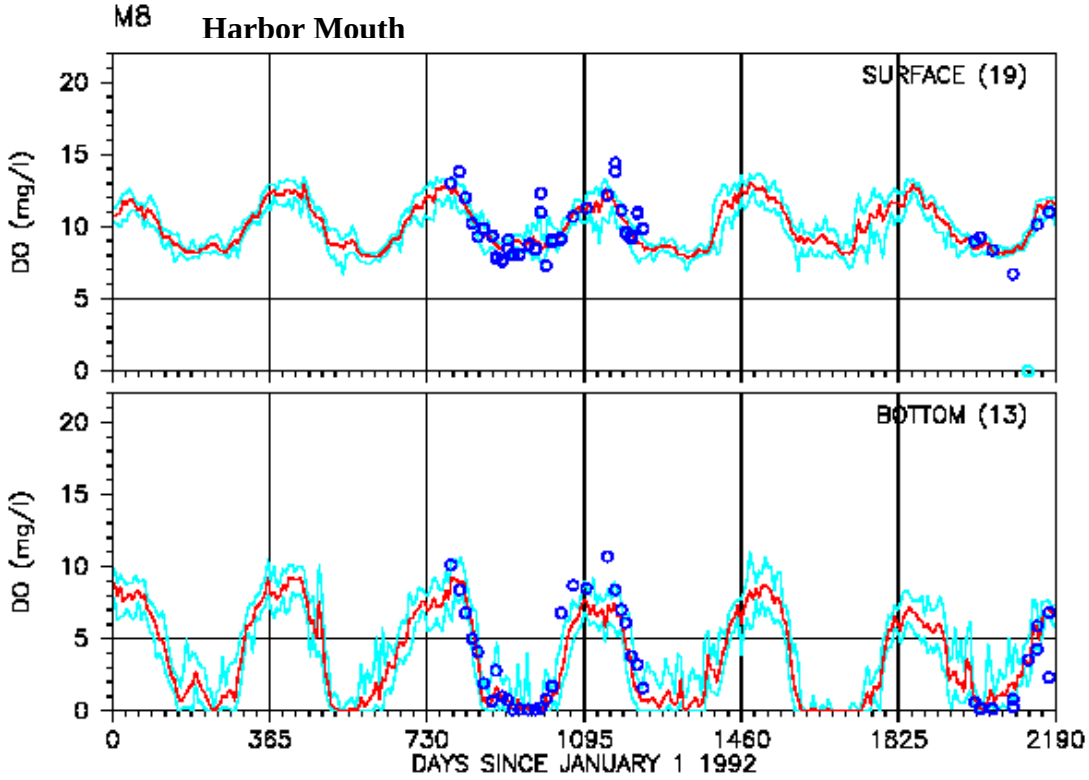
	Federal maintenance of a 35-ft channel in the Northwest Branch .
1930	The Act authorized the deepening of the Baltimore Harbor channel depth to 37 ft for the York Spit Channel in Virginia and channels from the Baltimore Light to the Sparrows Point entrance. The Act also authorized widening the channel angles between Fort McHenry and the Ferry Bar Section and increasing the channel width to 400 ft for the Curtis Bay Section.
1945	The Act authorized increasing the channel depth to 39 ft deep and 1,000 ft wide in the Cape Henry and York Spit Channels in Virginia, and to 39 ft deep and 600 ft wide from the Craighill Entrance to Fort McHenry. The 1945 Act also authorized the dredging of Curtis Creek to 35 ft deep and 200 ft wide from the head of Curtis Bay to the Pennington Avenue Bridge.
1958	The Act authorized the deepening of the main channel to 42 ft and widening the channels from the Craighill Entrance to Fort McHenry from 600 to 800 ft and the deepening and widening of the Curtis Bay and Ferry Bar Channels of the Harbor to 42 ft deep and 600 ft wide.
1970	The Act authorized deepening the main channel from Cape Henry to Fort McHenry, and the Curtis Bay Channel to 50 ft, and deepening the Northwest Branch East and West Channels to 49 and 40 ft, respectively.

Source: http://www.nab.usace.army.mil/projects/Maryland/DMMP/history.html

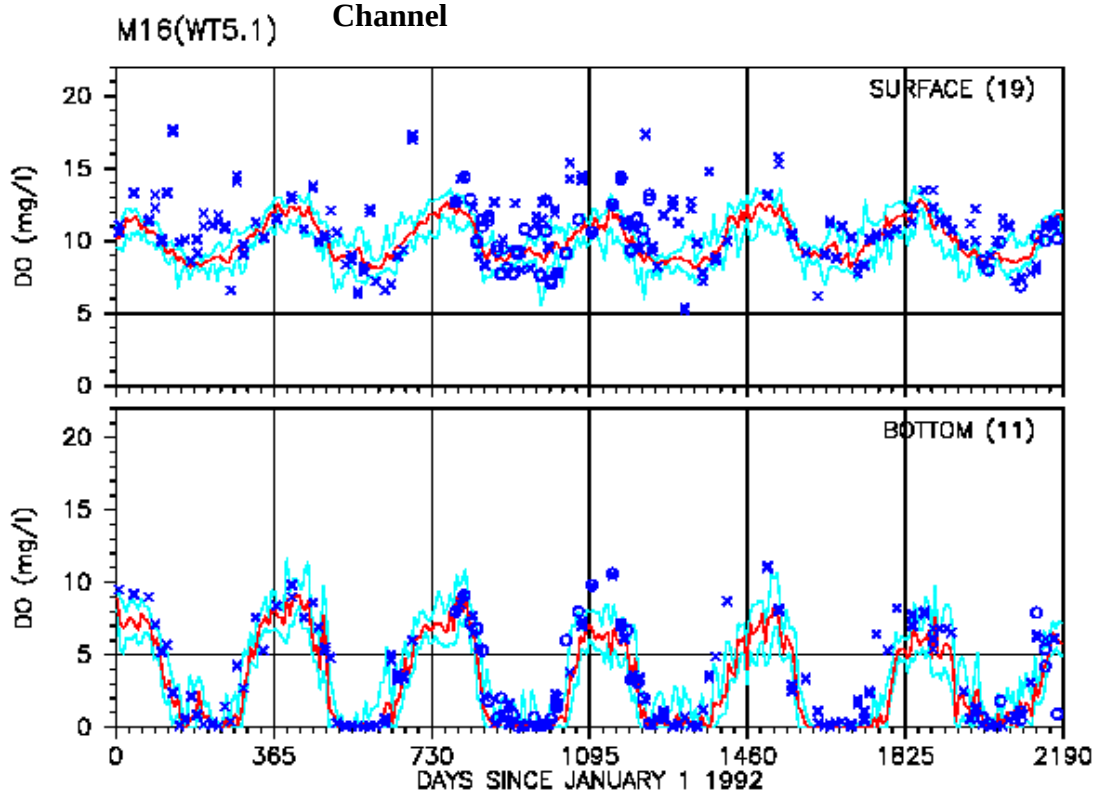
Existing Conditions (Water Quality):

Dissolved Oxygen

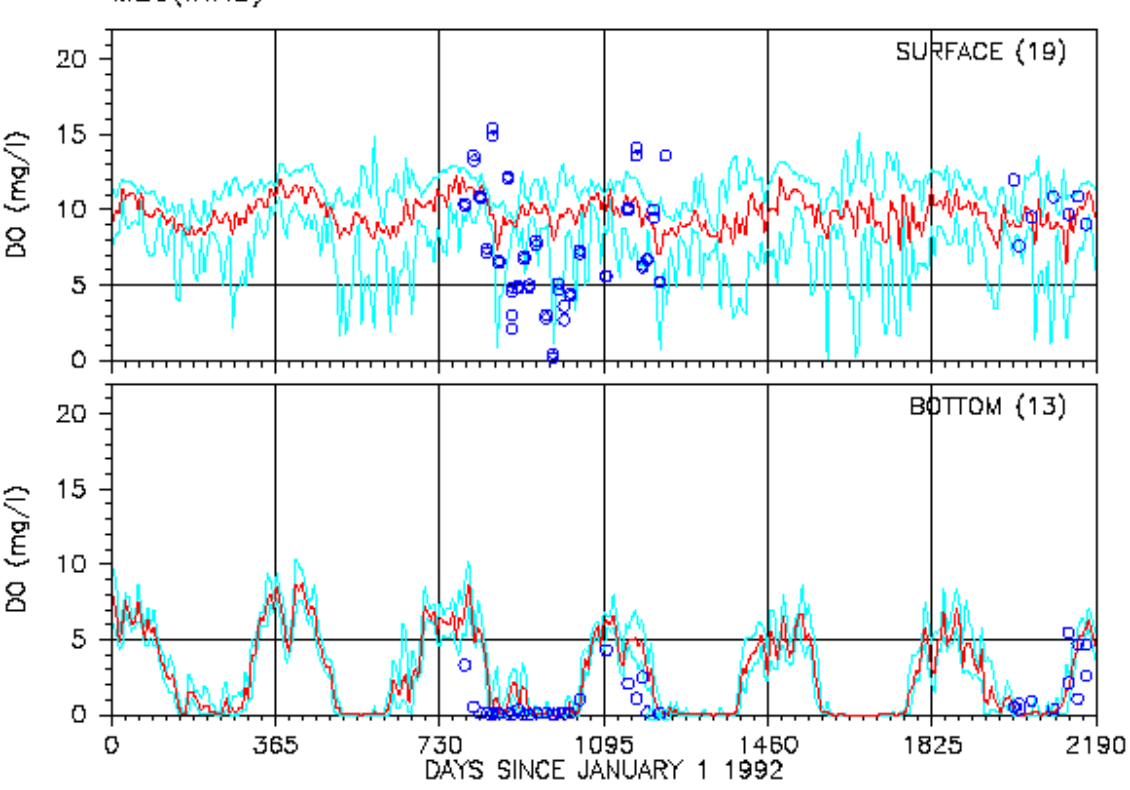
The following plots show the calibration of the Baltimore Harbor D.O. against observed data from 1992 to 1997. Note the anoxic conditions of the Harbor in the bottom layer at each station during the summer months. Anoxic conditions may start as early as as March in the Inner Harbor and May in the Middle of the Harbor Channel.



Channel



Inner Harbor



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Note: For the graphs above, the light gray lines represent the Chesapeake Bay Model Release 4.3, the dark gray lines represent the MDE adaptation of the Chesapeake Bay Model 4.3, and the open circles represent the data collected by the Department.

A number of sensitivity scenarios were run using MDE adaptation (MDE had finer resolution grid for the Patapsco River) of the Chesapeake Bay Model Release 4.3. The following sensitivity scenarios were run using the calibrated model to estimate the influence of the different loadings sources and to estimate the extend of impairments due to natural conditions and/or man-made conditions.

1) Chesapeake Bay Program (CBP) Load Allocation;
2) CBP Allocation with MDE nonpoint source (NPS) reductions;
3) CBP Allocation with MDE NPS and CBP- "E3" (Everything, everywhere, by everybody) point source (PS) reductions;
4) CBP Allocation with MDE NPS and current permits for PS;
5) CBP Allocation with MDE NPS and "Enhanced Nutrient Removal Strategy" (ENR) PS; and
6) Tributary Strategy (MDE proposed total maximum daily load scenario – results shown in table below):

- Baltimore Harbor Loads
  - Point Source
    - Flow: Maximum permit flow, and
    - Major Municipal PS – ENR: total nitrogen(TN): 4 milligrams/liter annual average: (3 milligrams/liter from May – October; 5 milligrams/liter from November - April), and total phosporus (TP): 0.3 milligrams/liter
    - Minor Municipal PS – ENR: TN: 18 mg/L; TP: 3 mg/L
    - Industrial PS – CBP Tier III Scenario loads
  - Nonpoint Source
    - MDE's "Hydrodynamic Simulation Program – Fortran" model outputs x Pass Through Efficiency
    - Pass Through Efficiency = CBP allocation/CBP calibration
      TN=0.33 TP = 0.33

Scenario Results
D.O. attainment check for the proposed "Deep Channel Seasonal Refuge" use:

MDE Calibration, CBP Allocation and Possible TMDL Scenarios	**Patapsco River Mesohaline D.O. Percent non-attainment**				
	Deep Water June to September	Deep Channel June to September	Open Water June to September	Migratory Fish February to May	Open Water October to January
[1]CBP allocation with MDE projected NPS and ENR-PS	7 (3 mg/L)	**79**	0	0	0

1. This scenario represents the current Tributary Strategies reduction based on N and P allocations produced by the Chesapeake Bay Program (Model Release 4.3). The D.O. attainment check was run against the proposed criteria for each applicable designated use subcategory. A restoration variance of 7% applied temporally and spatially has been proposed for the "Deep Water Seasonal Fish and Shellfish" use, based on those same model runs.

Benthic Characterization:

The existing benthic community in the Outer and Inner Harbor deep-dredged channels can be characterized as unstable due to frequent disturbances, such as the 42-foot dredging project, annual maintenance dredging and prop-washes associated with ship movements, and is thought to consist primarily of opportunistic species. The community likely to recolonize in the deep dredged channels would be similar in nature to the existing benthic community, since the existing benthic community is unstable and frequently disturbed, and recolonization may occur within a relatively short time.

Conclusions:

Due to significant non-attainment (77% when point sources are at E3) resulting from Federally-authorized hydrologic modification under the Rivers and Harbors Act and a complex pattern of tidal circulation that move hypoxic and anoxic waters from the Bay's main channel into the Patapsco through advection, the State has determined that further refinement of the designated use to support only benthic species that are tolerant to periods of hypoxia and/or anoxia during the seasonal application period of June 1 to September 30 is the highest attainable use in this water body segment during this period. Therefore, the State has proposed a "Navigation Channel" designated use subcategory with the applicable D.O. criteria being 0 mg/L from June 1 to September 30 inclusive. The geographic extent of this narrowly structured use is confined to the dredged channels that begin at the mouth of the Patapsco River (confluence with the Chesapeake Bay), and continuing in to the Curtis Bay and Creek, and the Middle and Northwest Branchs.