Toward Modeling and Analysis Tools For the 2017 Midpoint Assessment: The Assessment of CB Shallow Water Multiple Management Models

STAC Workshop on Using Multiple Management Models in the Chesapeake Bay: A Shallow Water Pilot Project

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Background

A system of models designed for the 2017 Midpoint Assessment will be applied to the last and most difficult reductions in CBP to take place from between 2017 to 2025.

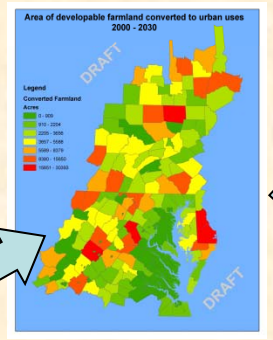
Any CBP model refinements addressing the 2017 Midpoint Assessment will be assessed on a *value added* basis for CBP decision making.

Key Points

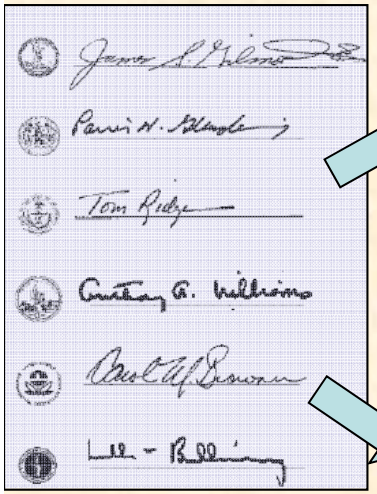
- The CBP models guiding TMDL planning and implementation are well founded and fully suited to their current task.
- Nevertheless, over the last quarter century, the CBP has been committed to refinement of our watershed, estuary, and airshed analysis tools to improve CBP decision making and is now interested in examining the value of Multiple Management Models (M3) in the shallow waters of the Chesapeake Bay.
- Refinement of the CBP modeling tools over the past 3 decades have always been oriented to value added development of the best available scientific tools for use by CBP decision makers.

Chesapeake Bay Program Modeling

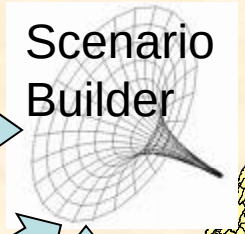
Land Use Change Model



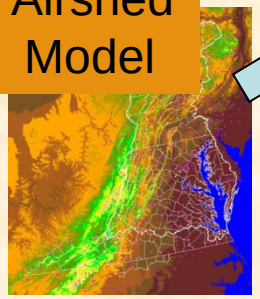
Management Actions



Scenario Builder

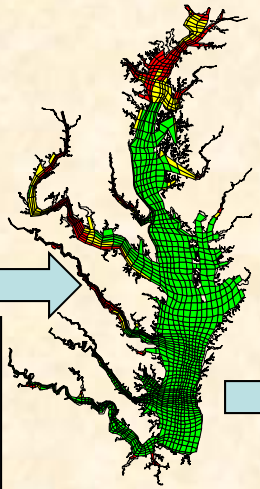


Airshed Model

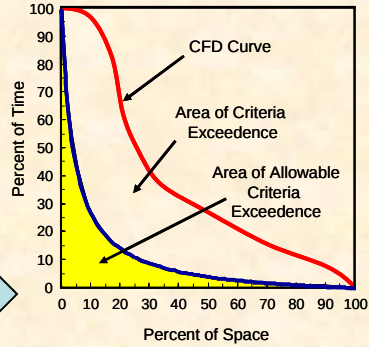


Watershed Model

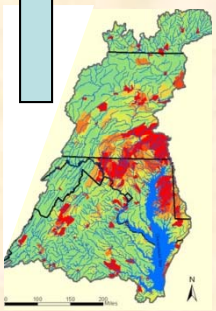
Bay Model



Criteria Assessment Procedures



Sparrow



Effects

Allocations

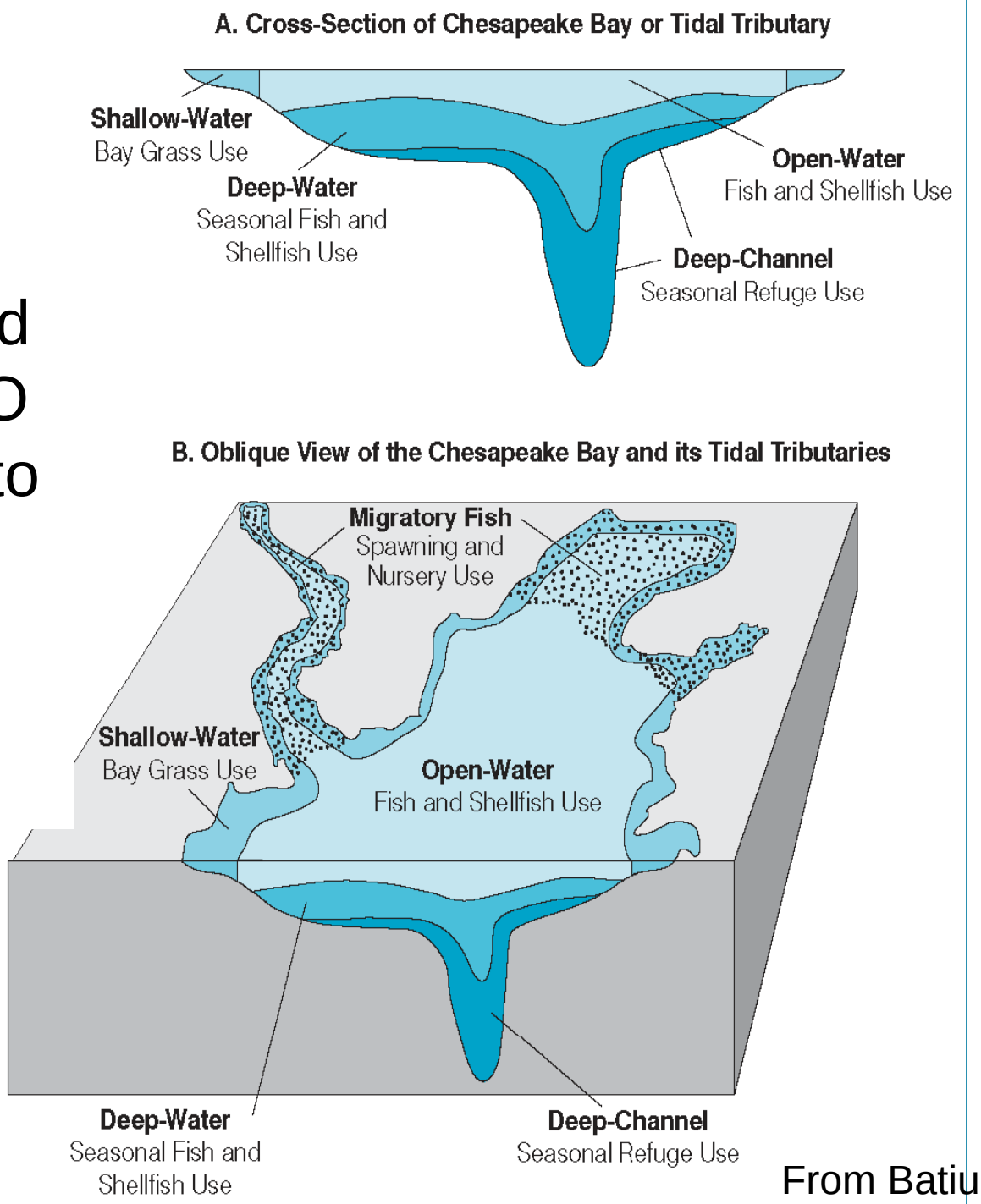
The shallow water M3 work should be relevant, bold, and forward-leaning.

- **Relevant** – The shallow water M3 work should grapple with, and address to the fullest extent possible, CBP shallow water management and decision making needs.
- **Bold** – At this point we should identify ideal outcomes of the shallow water M3, regardless of known technical and resource challenges.
- **Forward-leaning** – Shallow water M3 practitioners should anticipate operational challenges of scaling up to cover all shallow waters of the Chesapeake, working in a scenario mode and developing climate change scenarios.

CBP Management Shallow Water Modeling Needs (or how to dress for success)

- Bay Program managers will want to know, “What’s in it for me?” or, “What is the value added to the 2017 Assessment by multiple shallow water models?”
- The CBP shallow water models should directly assess the quantifiable shallow water quality standards of light attenuation (clarity), SAV, and open water DO.
- Beyond calibration and application as a prototype, successful prototype shallow water models should anticipate whole Bay shallow water simulation in a scenario mode.

Quantifiable water quality standards of clarity/SAV and open water DO are designed to protect SAV and shallow water living resources.



From Batiuk (2003)

VA Water Quality Standards for Clarity/SAV

9 VAC 25-260 March 2005

B. Submerged Aquatic Vegetation and Water Clarity

If the submerged aquatic vegetation (SAV) acres in this subsection are met in any individual Chesapeake Bay Program segment as described in subsection D of this section, then the shallow-water submerged aquatic vegetation use is met in that segment. If the SAV acres in this subsection are not met in any individual Chesapeake Bay Program segment, then the water clarity criteria shall apply to the water clarity acres in that segment. If these water clarity criteria are met to the bottom water-sediment interface for the number of water clarity acres in that segment, then the shallow-water submerged aquatic vegetation use is met; regardless of the number of acres of SAV in that segment.

Designated Use	Chesapeake Bay Program Segment	SAV Acres[1]	Water Clarity Criteria (percent light-through-water)[2]	Water Clarity Acres[1]	Temporal Application
Shallow-Water Submerged Aquatic Vegetation Use	CB5MH	7,633	22%	14,514	April 1 - October 31
	CB6PH	1,267	22%	3,168	March 1 - November 30
	CB7PH	15,107	22%	34,085	March 1 - November 30
	CB8PH	11	22%	28	March 1 - November 30
	POTTF	2,093	13%	5,233	April 1 - October 31
	POTOH	1,503	13%	3,758	April 1 - October 31
	POTMH	4,250	22%	10,625	April 1 - October 31
	RPPTF	66	13%	165	April 1 - October 31
	RPPOH	0	-	0	-
	RPPMH	1700	22%	5000	April 1 - October 31
	CRRMH	768	22%	1,920	April 1 - October 31
	PIAMH	3,479	22%	8,014	April 1 - October 31
	MPNTF	85	13%	213	April 1 - October 31
	MPNOH	0	-	0	-
	PMKTF	187	13%	468	April 1 - October 31
	PMKOH	0	-	0	-
	YRKMH	239	22%	598	April 1 - October 31
	YRKPH	2,793	22%	6,982	March 1 - November 30
	MOBPH	15,901	22%	33,990	March 1 - November 30
	JMSTF2	200	13%	500	April 1 - October 31
	JMSTF1	1000	13%	2500	April 1 - October 31
	APPTF	379	13%	948	April 1 - October 31
	JMSOH	15	13%	38	April 1 - October 31
	CHKOH	535	13%	1,338	April 1 - October 31
	JMSMH	200	22%	500	April 1 - October 31
	JMSPH	300	22%	750	March 1 - November 30
	WBEMH	0	-	0	-
	SBEMH	0	-	0	-
	EBEMH	0	-	0	-
	LAFMH	0	-	0	-
	ELIPH	0	-	0	-
	LYNPH	107	22%	268	March 1 - November 30
	POCOH	0	-	0	-
	POCMH	4,066	22%	9,368	April 1 - October 31
	TANMH	13,579	22%	22,064	April 1 - October 31

1 = The assessment period for SAV and water clarity acres shall be the single best year in the most recent three consecutive years. When three consecutive years of data are not available, a minimum of three years within the most recent five years shall be used.

MD Water Quality Standards for Clarity/SAV

MD 26.08.02.03-3

.03-3 Water Quality Criteria Specific to Designated Uses.

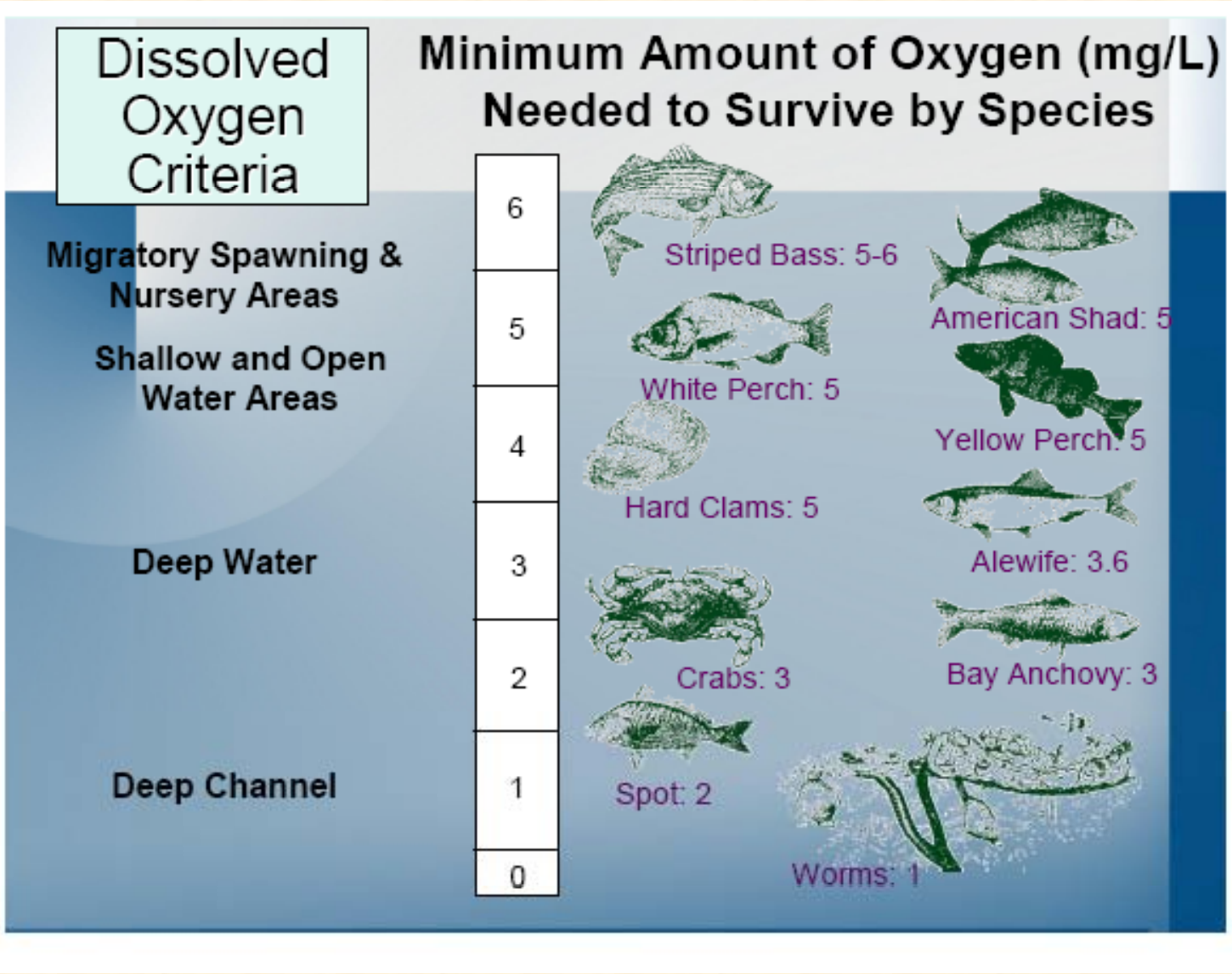
(9) Water Clarity Criteria for Seasonal Shallow-Water Submerged Aquatic Vegetation Subcategory.

(a) Water Clarity Criteria Measurement. The attainment of the water clarity criteria for a given Bay segment can be determined using any of the following methods:

(i) Shallow-water acreage meets or exceeds the percent-light-through-water (PLW) criteria expressed in Secchi depth equivalence (Table 1) at the segment specific application depth specified in Regulation .08 of this chapter (excludes no grow zones);

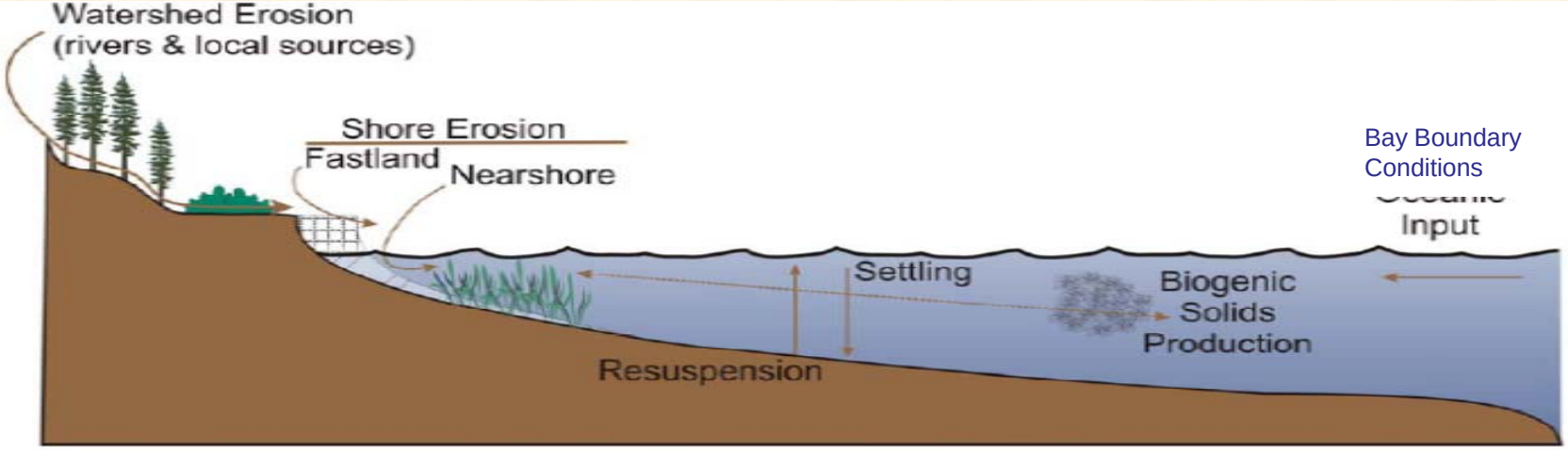
(ii) Submerged aquatic vegetation (SAV) acreage meets or exceeds the acreage restoration goal (Table 2); or

(iii) Shallow-water acreage meeting or exceeding the secchi depth requirements in combination with actual SAV acreage equal or exceed the SAV restoration goal acreage.


Dissolved Oxygen Criteria
Minimum Amount of Oxygen (mg/L) Needed to Survive by Species
Migratory Spawning & Nursery Areas
Shallow and Open Water Areas
Deep Water
Deep Channel
6
5
4
3
2
1
0
Striped Bass: 5-6
American Shad: 5
White Perch: 5
Yellow Perch: 5
Hard Clams: 5
Alewife: 3.6
Crabs: 3
Bay Anchovy: 3
Spot: 2
Worms: 1

Shallow Water Model Inputs

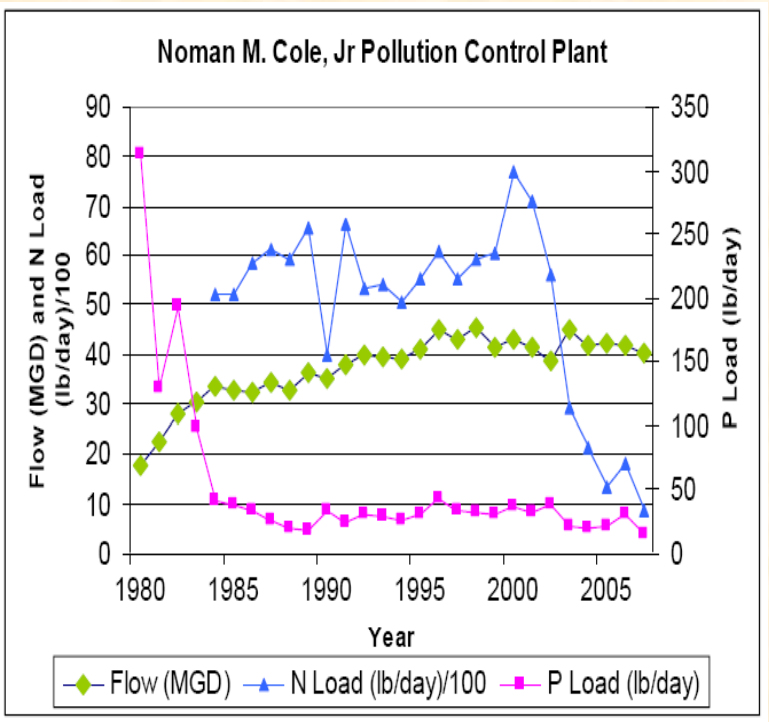
Shallow water model inputs include the five sources of suspended solids shown here, including watershed sources, shore erosion, resuspension, biogenic solids production, and Bay deep water (>2m) boundary inputs and the nutrient inputs from the watershed, atmospheric deposition, and Bay boundary condition sources.

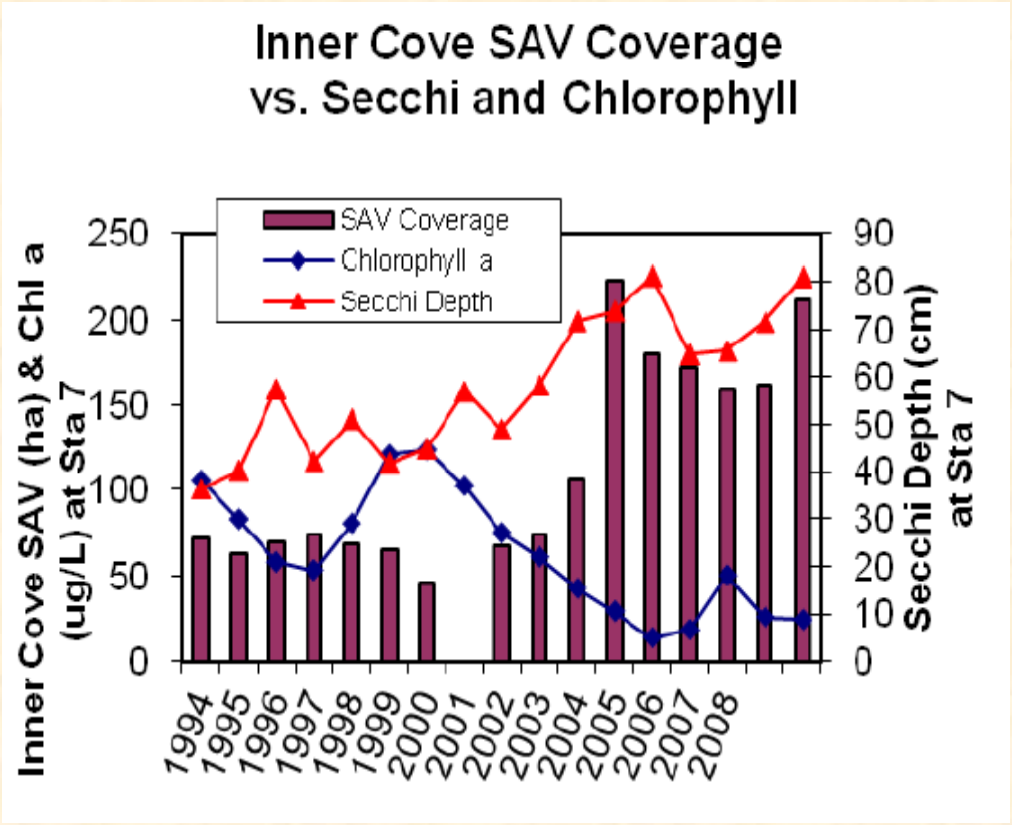


VA-MD state line = grey, major watershed boundary = green, Watershed Model segment = blue

Application site(s)

- There are compelling reasons to choose Gunston Cove as the primary shallow water multiple model site.

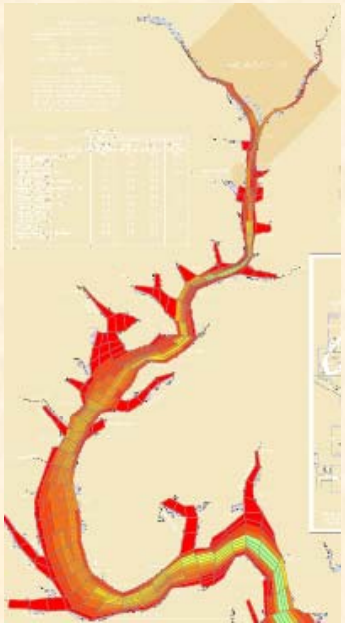


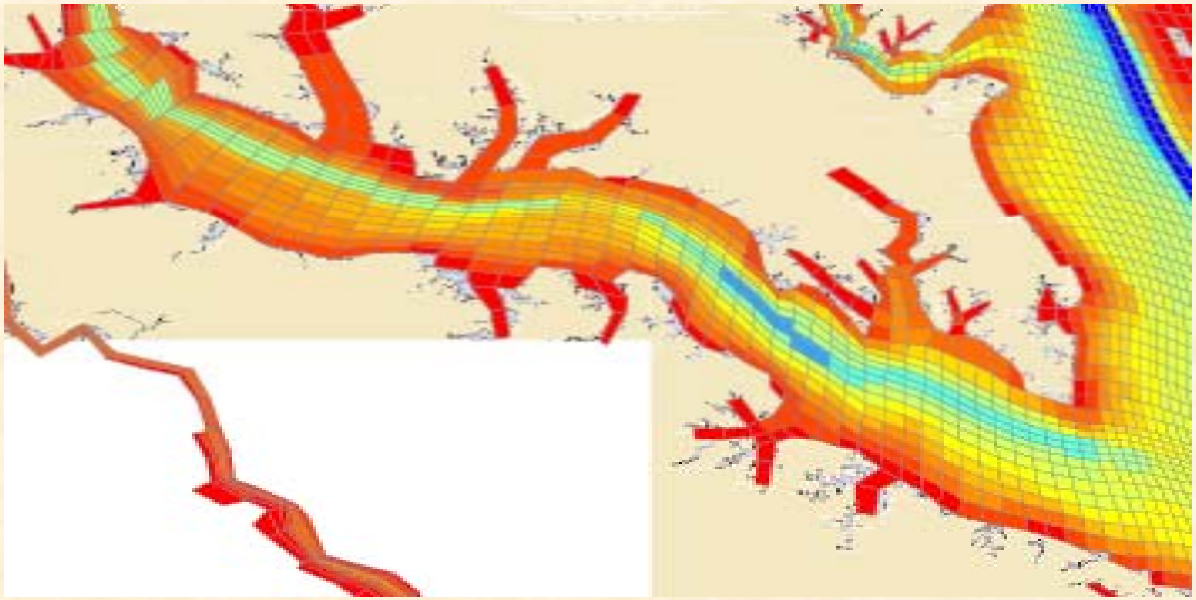


Application site(s)

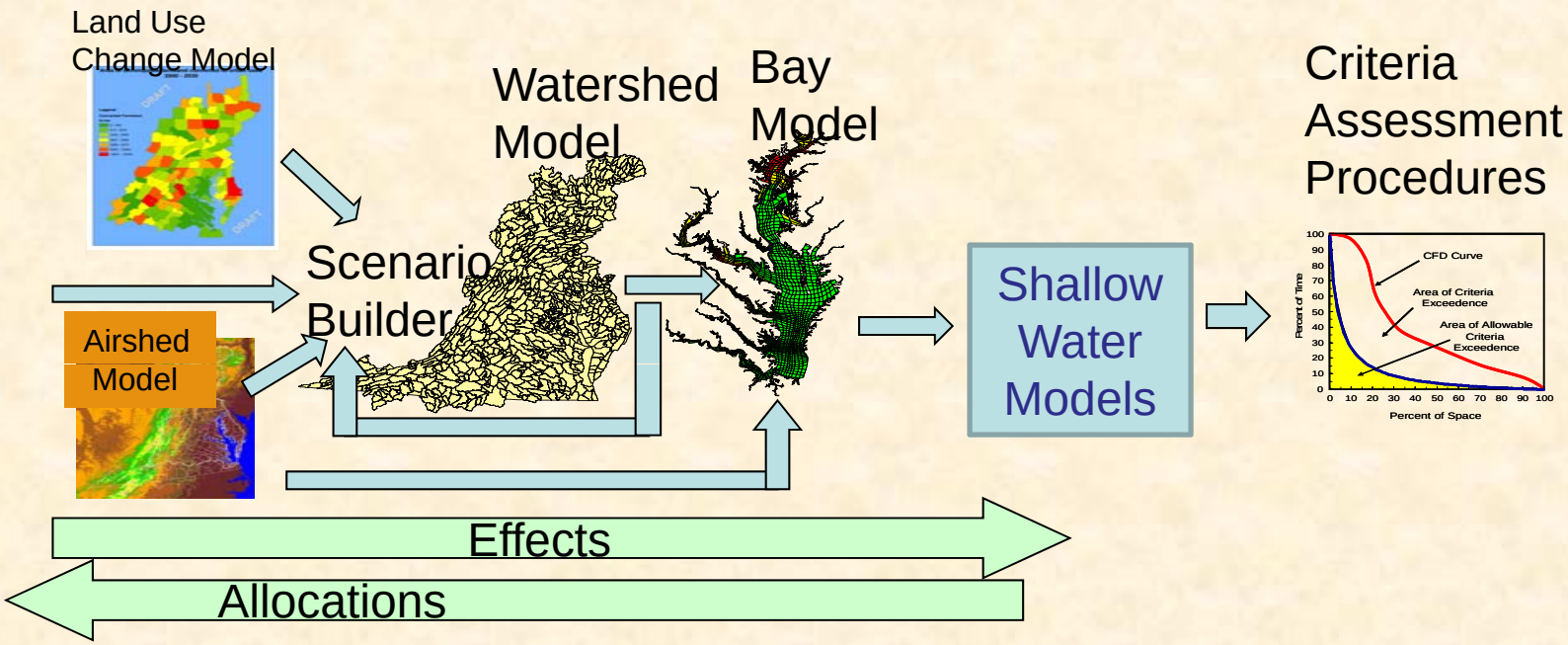
- To avoid artificial limitations on shallow water modeling applications suggest that all of the Potomac River shallow water boundary conditions be made available which include the shallow water monitoring sites of St. Georges Creek (Years deployed: 2006, 2007, 2008, 2009, 2010, 2011, 2012), Mattawoman Creek (Years deployed: 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012), Indian Head (Years deployed: 2009, 2010, 2011, 2012), and perhaps additional Virginia shallow water monitoring sites.

- Work is underway to extend the WQSTM simulation period from 1985-2005 to ~1980-2011 for recent year boundary conditions for M3 effort.



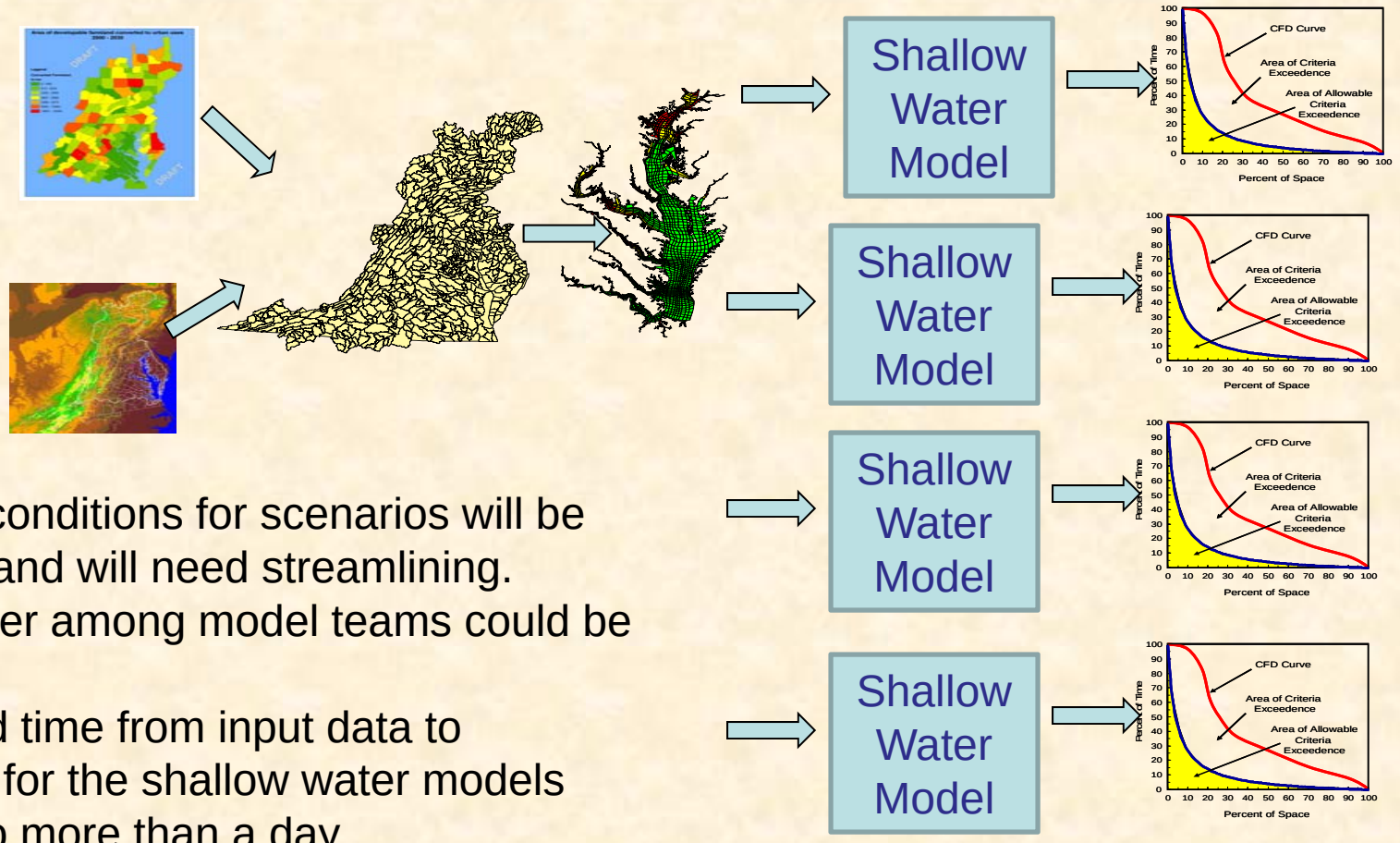


Operational Challenges – Keeping the End Goal in Mind



How do we do 2017 management scenarios that will influence the clarity/SAV and open water DO water quality standards? How do we do climate change scenarios?

Operational Challenges – Keeping the End Goal in Mind



- Boundary conditions for scenarios will be challenging and will need streamlining.
- Data transfer among model teams could be difficult.
- Turnaround time from input data to assessment for the shallow water models should be no more than a day.

Some of the moving parts related to M3s…

- *Modeling Quarterly Reviews – April 16-17, July 10-11, October 2-3 – Annapolis Chesapeake Bay Program*
- *STAC workshop on next generation shallow water model April 26-27 – VIMS*
- *Chesapeake Community Modeling Program Symposium May 21-22 – Double Tree Hotel Annapolis*
- *Multiagency, multi-partner group is being formed as directed by the PSC and Management Board to respond to the NAS modeling laboratory recommendation. The first meeting date has yet TBD.*
- *STAC proposed workshop on multiple CBP management models to take place in late summer. The proposed workshop will discuss scientific questions on the benefits of multiple models and the opportunities and challenges in applying multiple models to CBP management.*

Next Generation CBP Models for Mid-Point 2017 Assessment

- The broad, rough outlines of a draft five year plan.

- Assumes the deadline for completed and approved Phase III WIPs will be 2017.

- Our long-term planning for the CBP models is focused on refining the land use, watershed, airshed, and estuary/living resource models and having a completely calibrated and operational suite of models, including shallow water model(s), by December 2015.

Next Generation Models for Mid-Point 2017 Assessment

The overall timeline might look something like this:

December 2010 - Phase I WIPs published with Phase 5.3 WSM and existing Bay Model.

December 2011 – Draft Phase II WIPs due to EPA with Phase 5.3.2 WSM and recalibrated Bay Model. March 30, 2012 – Final Phase II WIPs due to EPA.

January 2012 - Begin post TMDL 2-year milestone tracking with Phase 5.3.2 WSM and Bay Model.

2012-2014 - Airshed Model updates planned and tracked for bi-modal NH_3 & Hg and new CMAQ scenarios. Expert teams begin assessment of Watershed Model improvements and improvement initiated. Extension of all model simulation periods from current 1985-2005 to ~1980-2011. Value of M3 in Chesapeake shallow waters evaluated.

December 2015 - Fully calibrated and operational airshed, watershed, estuary, and shallow water models ready for analysis of Phase III WIPs.

2016 – Jurisdictions develop Phase III WIPs with respect to what remains to be done in the final 7 years of planning (2018 -2025) to fully achieve the Bay water quality standards.

2017 – Jurisdictions submit Phase III WIPs with 2018 - 2025 actions and controls for review and approval.

Managing Expectations

- Funding for shallow water multiple models will likely come from the EPA/CBPO FY13 budget which is dependant on the Federal budget calendar that runs from October 1 through September 30.
- Competing obligations and commitments at all levels in the FY13 budget are expected to be challenging.
- "Standoffs between the President and Congress or between political parties, elections, and more urgent legislative matters complicate the budget process, frequently making the **continuing resolution** a common occurrence in American government." Source: Wikipedia

Managing Expectations

- A **request for proposal (RFP),** or whatever other funding vehicle is used for the multiple shallow water models, will not be issued until funds for the task are identified. "An RFP is issued at an early stage in a procurement process, where an invitation is presented for suppliers, often through a bidding process, to submit a proposal on a specific commodity or service." Source: Wikipedia

- The timing and degree of available funding are uncertain, but uncertainty can be reduced by delivering to CBP decision makers M3 tools for an improved assessment of the water quality standards in shallow waters (light attenuation, SAV, and open water DO) on or before December 2015.

Closing Thoughts

- The CBP partnership continues to need a system of models from the airshed, watershed and estuary for the 2017 Midpoint Assessment.

- Management decision making needs of the 2017 Midpoint Assessment drive the process.

- The Bay Program State and Federal agencies represented by the WQGIT, Management Board, PSC, and other CBP workgroups implementing nutrient and sediment controls are key customers.

- Meeting model delivery deadlines are the first priority.

- CBP partners are committed to continuing to improve the accuracy, utility, and reliability of the modeling effort.

- EO and EC commitments call for consideration of climate change capabilities and this capability needs to be part of all CBP modeling tools.