Chesapeake Bay Program Water Quality Goal Implementation Team
June 7, 2010 Conference Call
Advance Briefing Paper

Attachment C

Accounting for and Resolving Dissolved Oxygen Criteria Non-attaining Chesapeake Bay Segments under the Four Loading Scenarios

BACKGROUND

Four key loading scenarios are under consideration by the Water Quality Goal Implementation Team for use in establishing the basinwide total nitrogen (TN) and total phosphorus (TP) loading caps for allocating TN and TP loads by jurisdiction by major basin:

- 200 TN and 15 TP (current basinwide target loads approved by the PSC in October 2009);
- 191 TN and 14.4 TP (Tributary Strategy scenario);
- 190 TN and 12.6 TP (loading scenario put forward by EPA); and
- 179 TN and 12 TP (loading scenario put forward by EPA).

Metrics

The dissolved oxygen criteria attainment/non-attainment results from all four loading scenarios were compared using five non-attaining segment metrics:

- Total number of non-attaining segments;
- Mainstem Bay or major lower tributary/embayment segments with >1% nonattainment;
- Segments with 1% or less nonattainment;
- Segments with other lines of evidence support attainment at these loading levels; and
- Non-attaining segments requiring resolution to reach attainment.

The *total number of non-attaining segments* metric includes a count of all designated use-segments with any originally non-zero level of non-attainment (prior to applying the recommended Microsoft Excel-based data reporting—see Data Report section below). The *mainstem Bay or major lower tributary/embayment segments with >1% nonattainment* metric is directed towards enumerating the

remaining number of non-attaining designated use-segments likely requiring further nutrient reductions from a number of the larger river basins in order to come into attainment. The *segments with 1% or less nonattainment* metric accounts for segments considered to be in attainment at values of 1% or less.[1] The *segments with other lines of evidence support attainment at these loading levels* metric accounts for segments for which EPA, working through the WQGIT, has developed other information, besides Bay water quality/sediment transport model simulation outputs for that segment, which provides supporting documentation of the designated use-segment's attainment at defined TN/TP loading levels. The *non-attaining segments requiring resolution to reach attainment* metric includes those designated use-segments which still require some additional action—e.g., further nutrient reductions from the more directly effecting basins, development of other lines of evidence supporting a determination of attainment, and/or establishment of a restoration variance within that jurisdiction's water quality standards regulations—in order to document attainment of the applicable water quality standard within the Bay TMDL.

Data Reporting

As part of this analysis for the first time, all non-attainment values were rounded to the nearest whole number. Based on the established Microsoft Excel rounding procedures, whole numbers plus values of .499 and less were rounded down to the nearest whole number; whole numbers plus values of .5 and higher were rounded up to the nearest whole number; and values of 0.499 and less were rounded down to a value of zero.

FINDINGS

Table 1 summarizes the quantification for all five non-attaining segment metrics across the four TN and TP load scenarios. There are clear differences in the outcomes from each of the four loading scenarios, summarized below and described in more detail later:

- Going from 200/15 to 191/14.4 yields less mainstem Bay/lower river/embayment segments in non-attainment (6 vs. 4) and significantly less non-attaining segments still requiring resolution (18 vs. 10).

- Going from 191/14.4 to 190/12.6 further reduces the total number of non-attaining segments from 32 to 29, drops the number of mainstem Bay/lower river/embayment segments in non-attainment from 4 to 2, and cuts down the number of non-attaining segments still requiring resolution from 10 down to 6.

- Going from 190/12.6 to 179/12 further reduces the total number of non-attaining segments from 29 to 25 and cuts down the number of non-attaining segments still requiring resolution from 6 down to 3.

[1] EPA is currently developing documentation outlining the supporting technical basis and rationale for considering segment-designated uses with non-attainment at 1% or less to be considered in attainment with the respective dissolved oxygen criterion for that designated use for purposes of developing the Bay TMDL. EPA will be sharing this documentation with WQGIT members. Please note that the 1% or less considered in attainment does not apply to those segments with restoration variances in place through that jurisdiction's water quality standards regulations for reasons explained in the forthcoming documentation.

Table 1. Key findings regarding non-attaining dissolved oxygen criteria segments at four TN and TP load scenarios.

Non-attaining Segments Metric	200/15	191/14.4	190/12.6	179/12
Total number of non-attaining segments	36	32	29	25
Mainstem Bay or major lower tributary/embayment segments with >1% nonattainment	6[1]	4[2]	2[3]	2[4]
Segments with 1% or less nonattainment	14	15	16	12
Segments with other lines of evidence support attainment at these loading levels	4	7	7	10
Non-attaining segments requiring resolution to reach attainment	18	10	6	3

1. YRKMH-OW, CHSMH-DW, MD5MH-DW, CB4MH-DC, CHSMH-DC and EASMH-DC.
2. CHSMH-DW, CB4MH-DC, CHSMH-DC and EASMH-DC.
3. CHSMH-DW and CHSMH-DC.
4. CHSMH-DW and CHSMH-DC.

For each of the four loading scenarios, the following are provided in the pages which follow:

- a table summarizing the findings for each of the five metrics; and
- a detailed table listing all the non-attaining designated use-segments and the current status relative to addressing non-attainment for each listed designated use-segment.

200 TN, 15 TP Loading Scenario

Table 1. Key findings regarding non-attaining dissolved oxygen criteria segments at 200 TN and 15 TP.

Total number of on-attaining segments	36
Mainstem Bay or major lower tributary/embayment segments with >1% nonattainment	6[1]
Segments with 1% or less nonattainment	14
Segments with other lines of evidence support attainment at these loading levels	4
Non-attaining segments requiring resolution to reach attainment	18

1. YRKMH-OW, CHSMH-DW, MD5MH-DW, CB4MH-DC, CHSMH-DC and EASMH-DC.

Table 2. Status relative to addressing non-attaining dissolved oxygen criteria segments at 200 TN and 15 TP.

Segment	DU	Status Relative to Addressing Non-attainment
APPTF	OW	Other lines of evidence: in attainment under the base calibration
CB7PH	OW	1% non-attainment therefore considered in attainment
CHOMH1	OW	Less than 0.5% non-attainment rounded to zero
CHSTF	OW	1% non-attainment therefore considered in attainment
DCATF	**OW**	**14% non-attainment; requires resolution to reach attainment**
EBEMH	**OW**	**5% non-attainment; requires resolution to reach attainment**
GUNOH	OW	Other lines of evidence: generally health conditions; 1 unusually low observation; poor regression; nearby segments attain at 200/15
MAGMH	OW	Less than 0.5% non-attainment rounded to zero
MANMH	OW	Other lines of evidence: few observed DO criteria violations; poor model simulation and poor regression response; most nearby segments attain at 200/15
MDATF	**OW**	**18% non-attainment; requires resolution to reach attainment**
MOBPH	OW	Less than 0.5% non-attainment rounded to zero
MPCOH	**OW**	**25% non-attainment; requires resolution to reach attainment**
PAXOH	OW	Less than 0.5% non-attainment rounded to zero
PAXTF	OW	1% non-attainment therefore considered in attainment
PIAMH	**OW**	**5% non-attainment; requires resolution to reach attainment**
PMKOH	OW	Less than 0.5% non-attainment rounded to zero
PMKTF	OW	Other lines of evidence: single month (July 1995) prevents non-attainment; month shows marginal hypoxia (3.6

		mg/L) and poor regression response
POCTF	**OW**	**25% non-attainment; requires resolution to reach attainment**
SBEMH	**OW**	**8% non-attainment; requires resolution to reach attainment**
SEVMH	**OW**	**6% non-attainment; requires resolution to reach attainment**
VPCOH	**OW**	**25% non-attainment; requires resolution to reach attainment**
WBEMH	**OW**	**8% non-attainment; requires resolution to reach attainment**
WICMH	**OW**	**15% non-attainment; requires resolution to reach attainment**
YRKMH	**OW**	**3% non-attainment: requires resolution to reach attainment**
CB3MH	DW	Less than 0.5% non-attainment rounded to zero
CB5MH	DW	Less than 0.5% non-attainment rounded to zero
CHSMH	**DW**	**3% non-attainment; requires resolution to reach attainment**
EASMH	DW	1% non-attainment therefore considered in attainment
MAGMH	**DW**	**16% non-attainment; requires resolution to reach attainment**
MD5MH	**DW**	**2% non-attainment; requires resolution to reach attainment**
PATMH	DW	1% non-attainment therefore considered in attainment
VA5MH	DW	Less than 0.5% non-attainment rounded down to zero
CB3MH	DC	Less than 0.5% non-attainment rounded down to zero
CB4MH	**DC**	**4% non-attainment; requires resolution to reach attainment**
CHSMH	**DC**	**14% non-attainment; requires resolution to reach attainment**
EASMH	**DC**	**4% non-attainment; requires resolution to reach attainment**

191 TN, 14.4 TP Loading Scenario

Table 3. Key findings regarding non-attaining dissolved oxygen criteria segments at 191 TN and 14.4 TP.

Total number of on-attaining segments	32
Mainstem Bay or major lower tributary/embayment segments with >1% nonattainment	4[1]
Segments with 1% or less nonattainment	15
Segments with other lines of evidence support attainment at these loading levels	7
Non-attaining segments requiring resolution to reach attainment	10

1. CHSMH-DW, CB4MH-DC, CHSMH-DC and EASMH-DC.

Table 4. Status relative to addressing non-attaining dissolved oxygen criteria segments at 191 TN and 14.4 TP.

Segment	DU	Status Relative to Addressing Non-attainment
APPTF	OW	Other lines of evidence: in attainment under the base calibration
CB7PH	OW	Less than 0.5% non-attainment rounded to zero
CHOMH1	OW	Less than 0.5% non-attainment rounded to zero
DCATF	OW	1% non-attainment therefore considered in attainment
GUNOH	OW	Other lines of evidence: generally health conditions; 1 unusually low observation; poor regression; nearby segment attain at 191/14.4
MAGMH	OW	Less than 0.5% non-attainment rounded to zero
MANMH	OW	Other lines of evidence: few observed DO criteria violations; poor model simulation and poor regression response; most nearby segments attain at 191/14.4
MDATF	OW	Other lines of evidence: moderate to severe hypoxia observed in critical period; poor estuarine model simulation and poor regression response; the adjoining tidal segment, DCATF, does attain at 191 TN and 14.4TP; flag for further future evaluation
MPCOH	**OW**	**25% non-attainment; requires resolution to reach attainment**
PAXOH	OW	1% non-attainment therefore considered in attainment
PAXTF	**OW**	**7% non-attainment; requires resolution to reach attainment**
PIAMH	OW	Less than 0.5% non-attainment rounded to zero
PMKTF	OW	Other lines of evidence: single month (July 1995) prevents non-attainment; month shows marginal hypoxia (3.6 mg/L) and poor regression response
POCTF	**OW**	**25% non-attainment; requires resolution to reach attainment**
SBEMH	OW	Less than 0.5% non-attainment rounded to zero
SEVMH	**OW**	**6% non-attainment; requires resolution to reach attainment**

VPCOH	**OW**	**25% non-attainment; requires resolution to reach attainment**
WBEMH	OW	Other lines of evidence: marginal to moderated hypoxia observed; monitoring data outside of the range of the estuarine model simulations; inconsistent regression response; nearby segments attain at 191 TN, 14.4 TP
WICMH	OW	Other lines of evidence: single month (July 1994) prevents attainment at 191 TN, 14.4 TP; month shows marginal hypoxia (4.4 mg/L) and poor regression response
YRKMH	OW	1% non-attainment therefore considered in attainment
CB3MH	DW	Less than 0.5% non-attainment rounded to zero
CB5MH	DW	Less than 0.5% non-attainment rounded to zero
CHSMH	**DW**	**2% non-attainment; requires resolution to reach attainment**
EASMH	DW	1% non-attainment therefore considered in attainment
MAGMH	**DW**	**16% non-attainment; requires resolution to reach attainment**
MD5MH	DW	1% non-attainment therefore considered in attainment
PATMH	DW	1% non-attainment therefore considered in attainment
VA5MH	DW	Less than 0.5% non-attainment rounded down to zero
CB3MH	DC	Less than 0.5% non-attainment rounded down to zero
CB4MH	**DC**	**3% non-attainment; requires resolution to reach attainment**
CHSMH	**DC**	**14% non-attainment; requires resolution to reach attainment**
EASMH	**DC**	**2% non-attainment; requires resolution to reach attainment**

190 TN, 12.6 TP Loading Scenario

Table 5. Key findings regarding non-attaining dissolved oxygen criteria segments at 190 TN and 12.6 TP.

Total number of on-attaining segments	29
Mainstem Bay or major lower tributary/embayment segments with >1% nonattainment	2[1]
Segments with 1% or less nonattainment	16
Segments with other lines of evidence support attainment at these loading levels	7
Non-attaining segments requiring resolution to reach attainment	6

1. CHSMH-DW and CHSMH-DC.

Table 6. Status relative to addressing non-attaining dissolved oxygen criteria segments at 190 TN and 12.6 TP.

Segment	DU	Status Relative to Addressing Non-attainment
CB7PH	OW	Less than 0.5% non-attainment rounded to zero
CHOMH1	OW	Less than 0.5% non-attainment rounded to zero
DCATF	OW	1% non-attainment therefore considered in attainment
GUNOH	OW	Other lines of evidence: generally health conditions; 1 unusually low observation; poor regression; nearby segment attain with moderate load reduction
MANMH	OW	Other lines of evidence: few observed DO criteria violations; poor model simulation and poor regression response; most nearby segments attain at these loading levels
MDATF	OW	Other lines of evidence: moderate to severe hypoxia observed in critical period; poor estuarine model simulation and poor regression response; DCATF does attain at 190 TN and 12.6 TP; flag for further future evaluation
MPCOH	**OW**	**18% non-attainment; requires resolution to reach attainment**
PAXOH	OW	Less than 0.5 % non-attainment rounds to zero
PAXTF	OW	1% non-attainment therefore considered in attainment
PIAMH	OW	Less than 0.5% non-attainment rounded to zero
PMKTF	OW	Other lines of evidence: single month (July 1995) prevents non-attainment; month shows marginal hypoxia (3.6 mg/L) and poor regression response
POCTF	**OW**	**18% non-attainment; requires resolution to reach attainment**
SBEMH	OW	Less than 0.5% non-attainment rounded to zero
SEVMH	**OW**	**6% non-attainment; requires resolution to reach attainment**
VPCOH	**OW**	**25% non-attainment; requires resolution to reach attainment**
WBEMH	OW	Other lines of evidence: marginal to moderated hypoxia observed; monitoring data outside of the range of the estuarine model simulations; inconsistent regression response; nearby segments attain at 191 TN, 14.4 TP

WICMH	OW	Other lines of evidence: single month (July 1994) prevents attainment at 191 TN, 14.4 TP; month shows marginal hypoxia (4.4 mg/L) and poor regression response
YRKMH	OW	1% non-attainment therefore considered in attainment
CB3MH	DW	Less than 0.5% non-attainment rounded to zero
CB5MH	DW	Less than 0.5% non-attainment rounded to zero
CHSMH	**DW**	**2% non-attainment; requires resolution to reach attainment**
EASMH	DW	1% non-attainment therefore considered in attainment
MAGMH	DW	Other lines of evidence: very low bottom DO values observed; poor estuarine model simulation; moderate to substantial improvement in bottom DO with load reduction scenarios; lack of fit in estuarine model simulations reduces confidence in the regression response; flag for further future evaluation
MD5MH	DW	1% non-attainment therefore considered in attainment
PATMH	DW	Less than 0.5% non-attainment rounded down to zero
VA5MH	DW	Less than 0.5% non-attainment rounded down to zero
CB3MH	DC	Less than 0.5% non-attainment rounded down to zero
CHSMH	**DC**	**14% non-attainment; requires resolution to reach attainment**
EASMH	DC	1% non-attainment therefore considered in attainment

179 TN, 12 TP Loading Scenario

Table 7. Key findings regarding non-attaining dissolved oxygen criteria segments at 179 TN and 12 TP.

Total number of on-attaining segments	25
Mainstem Bay or major lower tributary/embayment segments with >1% nonattainment	2[1]
Segments with 1% or less nonattainment	12
Segments with other lines of evidence support attainment at these loading levels	10
Non-attaining segments requiring resolution to reach attainment	3

1. CHSMH-DW and CHSMH-DC.

Table 8. Status relative to addressing non-attaining dissolved oxygen criteria segments at 179 TN and 12 TP.

Segment	DU	Status Relative to Addressing Non-attainment
CB7PH	OW	Less than 0.5% non-attainment rounded to zero
CHOMH1	OW	Less than 0.5% non-attainment rounded to zero
DCATF	OW	Less than 0.5% non-attainment rounded to zero
GUNOH	OW	Other lines of evidence: generally health conditions; 1 unusually low observation; poor regression; nearby segment attain with moderate load reduction
MANMH	OW	Other lines of evidence: few observed DO criteria violations; poor model simulation and poor regression response; most nearby segments attain at these loading levels
MDATF	OW	Other lines of evidence: moderate to severe hypoxia observed in critical period; poor estuarine model simulation and poor regression response; DCATF does attain at 179 TN and 12 TP; flag for further future evaluation
MPCOH	OW	Other lines of evidence: single month (July 1995) prevents non-attainment: month shows marginal hypoxia (3.6 mg/L) and poor regression response
PAXTF	OW	1% non-attainment therefore considered in attainment
PIAMH	OW	Less than 0.5% non-attainment rounded to zero
PMKTF	OW	Other lines of evidence: single month (July 1995) prevents non-attainment; month shows marginal hypoxia (3.6 mg/L) and poor regression response
POCTF	OW	Other lines of evidence: single month (July 1995) prevents non-attainment: month shows marginal hypoxia (3.6 mg/L) and poor regression response
SEVMH	**OW**	**6% non-attainment; requires resolution to reach attainment**
VPCOH	OW	Other lines of evidence: single month (July 1995) prevents non-attainment: month shows marginal hypoxia (3.6 mg/L) and poor regression response
WBEMH	OW	Other lines of evidence: marginal to moderated hypoxia observed; monitoring data outside of the range of the

		estuarine model simulations; inconsistent regression response; nearby segments attain at 191 TN, 14.4 TP
WICMH	OW	Other lines of evidence: single month (July 1994) prevents attainment at 191 TN, 14.4 TP; month shows marginal hypoxia (4.4 mg/L) and poor regression response
YRKMH	OW	1% non-attainment therefore considered in attainment
CB3MH	DW	Less than 0.5% non-attainment rounded to zero
CB5MH	DW	Less than 0.5% non-attainment rounded to zero
CHSMH	**DW**	**2% non-attainment; requires resolution to reach attainment**
EASMH	DW	Less than 0.5% non-attainment rounded to zero
MAGMH	DW	Other lines of evidence: very low bottom DO values observed; poor estuarine model simulation; moderate to substantial improvement in bottom DO with load reduction scenarios; lack of fit in estuarine model simulations reduces confidence in the regression response; flag for further future evaluation
MD5MH	DW	1% non-attainment therefore considered in attainment
VA5MH	DW	Less than 0.5% non-attainment rounded down to zero
CHSMH	**DC**	**14% non-attainment; requires resolution to reach attainment**
EASMH	DC	Less than 0.5% non-attainment rounded to zero

FINDINGS (CON'T)

Key changes between 200/15 and 191/14.4:

- The total number of non-attaining segments falls from 36 down to 32.
- There are two less mainstem Bay/lower river/embayment segments in non-attainment (6 vs. 4).
- Significantly less non-attaining segments still requiring resolution (18 vs. 10).
- With exception of Virginia's portion of the middle Pocomoke River segment (PCOH), all the non-attaining segment requiring resolution now fall within Maryland's jurisdiction at 191/14.4 compared with segments in Maryland, Virginia and the District under 200/15.
- Six additional segments—District's portion of the Anacostia River segment (DCATF (OW)), Eastern Branch of the Elizabeth River (EBEMH-OW), Piankatank River (PIAMH-OW), Southern Branch Elizabeth River (SBEMH-OW), middle York River (YRKMH-OW), and Maryland's portion of segment CB5 (MD5MH-DW)—come into attainment.

Key changes between 191/14.4 and 190/12.6:

- The total number of non-attaining segments further reduces down to 29 from 32.
- Only two mainstem Bay/lower river/embayment segments remain in non-attainment—both in the lower Chester River (deep-water and deep-channel)—down from 4.
- The number of non-attaining segments still requiring resolution falls to 6, down from 10.
- MAGMH drops from 16% to 3% non-attainment and comes under the 'other lines of evidence' category for attainment.
- Three additional segments—PAXTF (OW), CB4MH (DC), and EASMH (DC)—come into attainment.

Key changes between 190/12.6 and 179/12:

- The total number of non-attaining segments drops to 25, down from 29.
- The number of non-attaining segments still requiring resolution is cut in half, from 6 down to 3 so that only the Severn River open-water, the lower Chester River deep-water and the lower Chester River deep-channel designated use-segments remain.

FOLLOW UP ACTIONS/NEXT STEPS

- Provide time for additional feedback following the conference call from the jurisdictions, partners and stakeholders prior to the follow-up EPA/jurisdictional co-regulators conference call on June 14th. Call or send emails to Bob Koroncai and Rich Batiuk to provide follow-up feedback by close of business on Wednesday, June 9th.

- Confirm whether the other lines of evidence, established for the 179/12 loading scenario can apply to one or more of the higher loading scenarios. (For example, is there still only a single month preventing attainment for segments MPCOH and VPCOH with only marginal hypoxia observed at the 190/12.6 loading scenario given non-attainment has increased from 5% to 18%?)

- Develop segment by segment recommendations for how to resolve the remaining non-attaining segments and bring them into attainment—other lines of evidence, further nutrient reductions from more local contributing watersheds, and/or restoration variance.

- Share the '1% non-attainment yields attainment' technical documentation with the WQGIT members.

- Bring forward a set of recommended basinwide TN and TP loading caps and the accompanying jurisdiction-basin allocations to the June 14th conference call with the watershed states/District co-regulators.

- Develop much more detailed documentation for each designated use-segment considered in attainment using other lines of evidence for incorporation as appendices to the Bay TMDL document.