Moving Toward Final 2010 Nutrient and Sediment Targets

Water Quality Goal Implementation Team Conference Call

May 10, 2010

Lewis Linker and Bob Koroncai

Key points

• We're developing new information every week. Some of this information is reinforcing earlier findings, and other information has identified model limitations or assessment method corrections in several segments.

• A new Tributary Strategy Scenario has been added to our library of model results.

• We'll assume the "1% Rule" going forward in this analysis.

Key points *(continued)*

- We need to achieve all water quality standards in the Chesapeake.
- Deep Water and Deep Channel designated use attainment require global reductions.
- Open Water, Chlorophyll, and Clarity are designated uses that may respond to local reductions.
- Achievement of a limited number of Open Water (8), Chlorophyll (4), and Clarity (4) designated uses will require local reductions beyond E3.

Key points *(continued)*

- In the problem segments we continue to test:
  - loads and model connections
  - model performance in the problem segments
  - assessment methodology and assessment code
- We've found a bug in the assessment code related to salinity that's improved open water attainment in some segments like the Mobjack and Anacostia Tidal Fresh.
- We've also found limitation in the simulation of Open Water DO in some small embayments.

WQSTM Scenarios Completed:

- 1985 Scenario - 342 TN, 24.1 TP (completed)
- Base Case Scenario - 309 TN, 19.5 TP (completed)
- 2007 Scenario - 254 TN, 17.1 TP (completed)
- Target Load Option A - 200 TN, 15 TP (completed)
- Target Load Option B -195 TN, 14.3 TP (completed)
- Loading Scenario - 190 TN, 13.4 TP (completed)
- Tributary Strategy Scenario - (completed)
- Loading Scenario - 186 TN, 10.9 TP (completed)
- E3 Scenario - 141 TN, 8.5 TP (completed)

WQSTM Scenarios Pending:

- All Forest Scenario – To examine loads beyond E3 in order to achieve all water quality standards (or to document the need for variances).
- Several load scenarios in the region of 191 TN 14.4TP to examine achievement of the Deep Water and Deep Channel standards.
- Two scenarios examining the loads between E3 and All Forest to better quantify the loads beyond E3.
- Correct 2007 Scenario and Target Load A 200TN 15TP Scenario for sediment load errors in the Susquehanna.

Loads of the Coupled Phase 5.3 and WQSTM Scenarios By Basin

Total Nitrogen Loads by Basin (millions of pounds/year)

Basins	1985 Scenario 342TN, 24.1TP	Base Case Scenario 309TN, 19.5TP	2007 Scenario 254TN, 17.1TP	Target Load Scenario A 200TN, 15.0TP	Target Load Scenario B 195TN, 14.3TP	Tributary Strategy 191TN, 14.4TP	Loading Scenario 186TN, 10.9TP	E3 Scenario 141TN, 8.5TP
Susquehanna	146.4	135.9	115.0	85.9	83.3	81.9	76.5	65.3
Western Shore	27.0	17.8	14.4	9.8	9.7	9.9	13.0	5.6
Patuxent	4.2	3.9	3.1	2.9	2.9	2.8	2.5	1.9
Potomac	81.3	75.5	55.5	46.9	45.8	43.8	43.2	33.4
Rappahannock	8.9	8.4	7.5	6.2	5.9	5.6	5.3	4.5
York	7.6	7.4	6.9	5.6	5.5	5.1	5.3	3.8
James	42.6	36.8	31.4	27.1	26.9	27.5	26.6	16.1
Eastern Shore	23.9	23.9	20.4	15.5	14.6	14.3	14.0	10.6
Total	341.8	309.4	254.2	200.0	194.6	190.9	186.4	141.2

Loads of the Coupled Phase 5.3 and WQSTM Scenarios By Basin

Total Phosphorus Loads by Basin (millions of pounds/year)

Basins	1985 Scenario 342TN, 24.1TP	Base Case Scenario 309TN, 19.5TP	2007 Scenario 254TN, 17.1TP	Target Load Scenario A 200TN, 15.0TP	Target Load Scenario B 195TN, 14.3TP	Tributary Strategy 191TN, 14.4TP	Loading Scenario 186TN, 10.9TP	E3 Scenario 141TN, 8.5TP
Susquehanna	5.64	4.84	4.20	3.36	3.32	3.36	2.26	2.22
Western Shore	1.62	0.87	0.80	0.54	0.55	0.68	0.47	0.23
Patuxent	0.48	0.36	0.33	0.25	0.25	0.29	0.24	0.12
Potomac	5.21	4.90	4.49	4.10	4.01	3.76	2.83	2.33
Rappahannock	1.30	1.24	1.17	1.13	0.92	0.94	0.77	0.61
York	1.03	0.76	0.70	0.64	0.58	0.59	0.48	0.34
James	6.51	4.34	3.56	3.05	2.92	3.29	2.49	1.50
Eastern Shore	2.36	2.23	1.85	1.92	1.78	1.45	1.43	1.14
Total	24.14	19.54	17.11	15.00	14.32	14.36	10.98	8.49

Loads of the Coupled Phase 5.3 and WQSTM Scenarios By Basin

Sediment (TSS) Loads by Basin (millions of pounds/year)

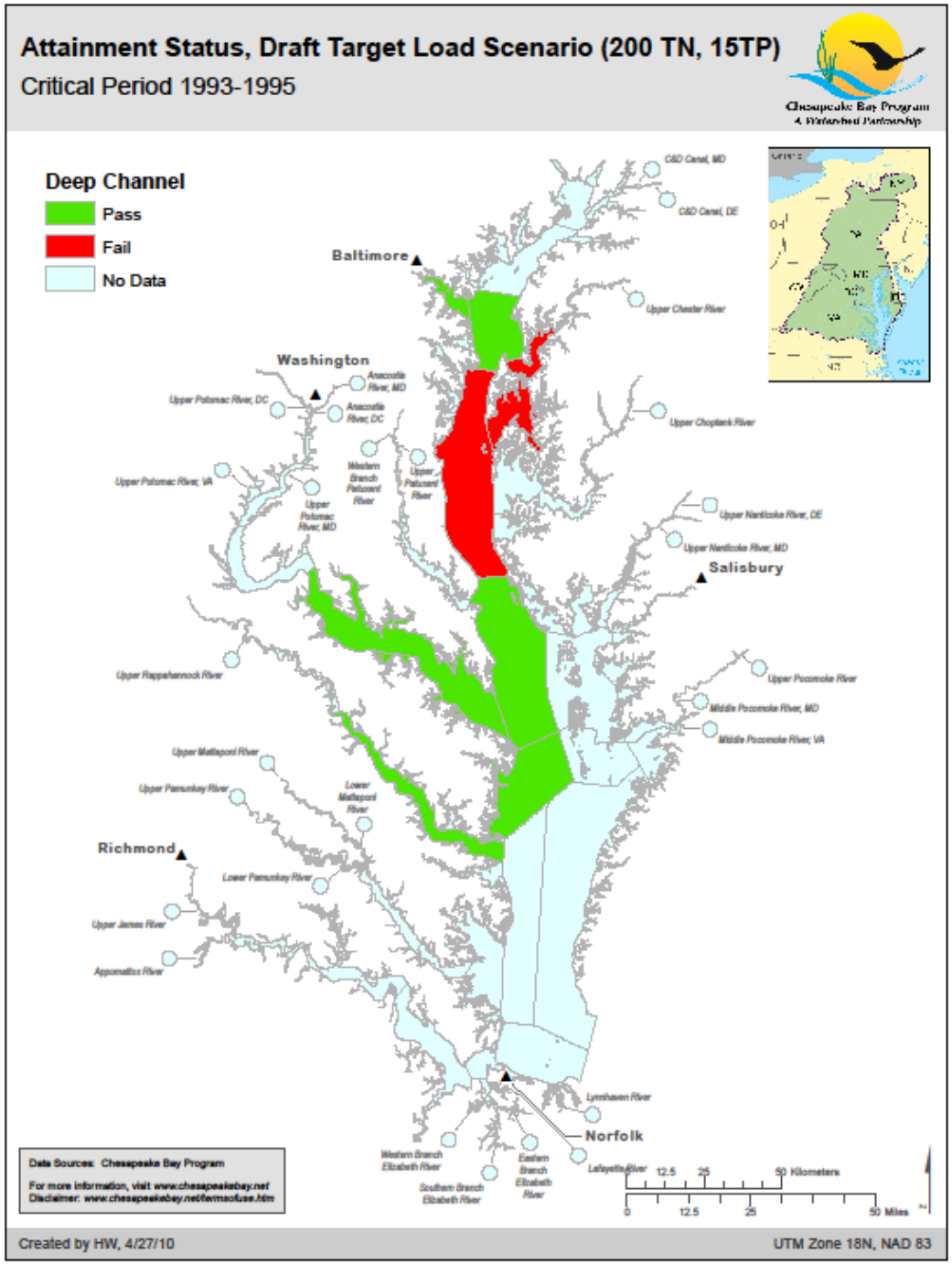
Basins	1985 Scenario 342TN, 24.1TP	Base Case Scenario 309TN, 19.5TP	2007 Scenario 254TN, 17.1TP	Target Load Scenario A 200TN, 15.0TP	Target Load Scenario B 195TN, 14.3TP	Tributary Strategy 191TN, 14.4TP	Loading Scenario 186TN, 10.9TP	E3 Scenario 141TN, 8.5TP
Susquehanna	3,187	2,820	1,183	1,459	1,462	2,130	706	1,829
Western Shore	314	268	253	182	185	206	163	99
Patuxent	190	171	131	104	105	104	101	60
Potomac	3,009	2,788	2,444	2,265	2,217	1,956	2,132	1,464
Rappahannock	888	841	761	752	700	688	1,064	629
York	213	180	167	153	137	114	115	82
James	1,587	1,502	1,297	1,155	1,108	1,022	1,002	713
Eastern Shore	399	378	316	330	295	242	228	182
Total	9,786	8,947	6,552	6,399	6,210	6,462	5,510	5,058

Problems with some of the initial scenarios have also been identified. The sediment loads in the Susquehanna basin for for the scenarios of 2007, Target Loads A & B, and other loading scenarios are in error due to a BMP unit problem.

An Estimate of the Deep Channel DO Response

- At the Tributary Strategy level of nutrient reductions (191TN and 14.4 TP) CB4MH is within 1% of attainment.
- EASMH is also close to attainment at these reduction levels.

Cbseg	State	1985 Scenario 342TN, 24.1TP, 9790TSS '93-'95 DO Deep Channel	"91 -'00 Base Scenario 309TN, 19.5TP, 8950TSS '93-'95 DO Deep Channel	2007 Scenario 254TN, 17.1TP, 6498TSS '93-'95 DO Deep Channel	Target Load Option A 200TN, 15TP, 6390TSS '93-'95 DO Deep Channel	Target Load Option B 195TN, 14.3TP, 6255TSS '93-'95 DO Deep Channel	Tributary Stategy 191TN 14.4TP, 6462 TSS '93-'95 DO Deep Channel	Loading Scenario 190TN 13.4TP, 5913TSS '93-'95 DO Deep Channel	Loading Scenario 186TN 10.9TP, 5510TSS '93-'95 DO Deep Channel	E3 2010 Scenario 141TN 8.5TP, 5060TSS '93-'95 DO Deep Channel
APPTF	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BACOH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIGMH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BOHOH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BSHOH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB1TF	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB2OH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB3MH	MD	17.9%	14.5%	6.1%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%
CB4MH	MD	51.5%	46.2%	20.9%	4.4%	3.8%	2.6%	2.9%	0.4%	0.0%
CB5MH	both	27.9%	22.3%	2.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB6PH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB7PH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB8PH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHKOH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOMH1	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOMH2	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOOH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOTF	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHSMH	MD	38.0%	38.0%	29.4%	14.0%	14.0%	14.0%	14.0%	13.7%	3.6%
CHSOH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHSTF	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CNDOH	MD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CRRMH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCATF	DC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCPTF	DC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DENTF	DE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EASMH	MD	31.5%	26.1%	12.9%	4.2%	3.9%	2.3%	2.5%	0.3%	0.0%
EBEMH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ELIPH	VA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A



Deep-Channel Use Dissolved Oxygen at Current Target Loads

(200 TN, 15 TP+ 15.7 air allocation)

- Non-attainment in 3 segments (>1%)
  - CB4 (2%)
  - Lower Chester (14%)
  - Eastern Bay (4%)
- <u>Reaching attainment will require further reductions in nutrient loads from larger Bay watershed</u>

An Estimate of the Deep Water DO Response

- The Tributary Strategy level of nutrient & sediment reductions generally performs better in the global reductions needed to attain the Deep Water standards.
- Other important regions such as the Patuxent mesohaline (1.1%) and MD5MH (1.5%) are close to attainment.

Cbseg	1985 Scenario 342TN, 24.1TP, 9790TSS '93-'95 DO Deep Water	"91 -'00 Base Scenario 309TN, 19.5TP, 8950TSS '93-'95 DO Deep Water	2007 Scenario 254TN, 17.1TP, 6498TSS '93-'95 DO Deep Water	Target Load Option A 200TN, 15TP, 6390TSS '93-'95 DO Deep Water	Target Load Option B 195TN, 14.3TP, 6255TSS '93-'95 DO Deep Water	Tributary Stategy 191TN 14.4TP, 6462 TSS '93-'95 DO Deep Water	Loading Scenario 190TN 13.4TP, 5913TSS '93-'95 DO Deep Water	Loading Scenario 186TN 10.9TP, 5510TSS '93-'95 DO Deep Water	E3 2010 Scenario 141TN 8.5TP, 5060TSS '93-'95 DO Deep Water
APPTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BACOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIGMH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BOHOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BSHOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB1TF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB2OH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CB3MH	2.6%	2.0%	0.6%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
CB4MH	23.8%	19.7%	9.9%	6.0%	5.7%	5.2%	5.6%	4.3%	2.0%
CB5MH	9.8%	6.9%	1.5%	0.5%	0.4%	0.3%	0.3%	0.2%	0.0%
CB6PH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB7PH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB8PH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHKOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOMH1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOMH2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHOTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHSMH	35.5%	24.7%	15.6%	2.7%	1.8%	1.8%	1.9%	1.6%	0.4%
CHSOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CHSTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CNDOH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CRRMH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCATF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DCPTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DENTF	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EASMH	25.4%	5.7%	1.4%	0.8%	0.7%	0.7%	0.8%	0.2%	0.0%
EBEMH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ELIPH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

An Estimate of the Open Water DO Response

- There are 14 CB segments of Open Water DO nonattainment (>1%) in the Target Load Option A Scenario.
- This decreases to 12 non-attaining Open Water segments in the Tributary Strategy.
- At E3 there are 8 segments of Open Water DO that are in nonattainment. These problem segments may be due to assessment limitations and we'll report what we find next week.

Cbseg	1985 Scenario 342TN, 24.1TP, 9790TSS '93-'95 DO Open Water Summer Monthly	"91 -'00 Base Scenario 309TN, 19.5TP, 8950TSS '93-'95 DO Open Water Summer Monthly	2007 Scenario 254TN, 17.1TP, 6498TSS '93-'95 DO Open Water Summer Monthly	Target Load Option A 200TN, 15TP, 6390TSS '93-'95 DO Open Water Summer Monthly	Target Load Option B 195TN, 14.3TP, 6255TSS '93-'95 DO Open Water Summer Monthly	Tributary Stategy 191TN 14.4TP, 6462 TSS '93-'95 DO Open Water Summer Monthly	Loading Scenario 190TN 13.4TP, 5913TSS '93-'95 DO Open Water Summer Monthly	Loading Scenario 186TN 10.9TP, 5510TSS '93-'95 DO Open Water Summer Monthly	E3 2010 Scenario 141TN 8.5TP, 5060TSS '93-'95 DO Open Water Summer Monthly
APPTF	0.0%	0.0%	4.7%	4.6%	4.6%	4.6%	0.0%	0.0%	0.0%
BACOH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BIGMH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
BOHOH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%
BSHOH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB1TF	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB2OH	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB3MH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB4MH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB5MH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB6PH	4.5%	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CB7PH	8.8%	7.0%	2.2%	0.5%	0.5%	0.3%	0.1%	0.1%	0.0%
CB8PH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHKOH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHOMH1	3.1%	1.8%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHOMH2	15.6%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHOOH	16.7%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHOTF	18.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSMH	0.8%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSOH	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHSTF	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.5%	0.0%	0.0%
CNDOH	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CRRMH	39.9%	24.5%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%
DCATF	37.6%	27.5%	22.2%	13.7%	12.4%	1.2%	5.4%	0.3%	0.0%
DCPTF	10.1%	0.6%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
DENTF	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EASMH	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EBEMH	22.7%	22.7%	21.5%	4.7%	4.7%	0.0%	4.7%	3.0%	0.0%
ELIPH	3.6%	4.3%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Getting To A July 1st Delivery of Nutrient State-Basin Allocations

Getting to Attainment in the Problem Segments

- Week of May 3: Initiate runs of several beyond E3 scenarios including an All Forested Watershed scenario.

- Week of May 10: Explore region around 190TN and 14TP and lower in order to achieve Deep and Channel DO standards.

- Week of May 18: Diagnostics work on the remaining dissolved oxygen and chlorophyll a non-attaining segments to get each of the non-attaining segments into full attainment:

    1) Eliminate model or assessment related issues
    2) Estimate local load reductions above E3 that achieve WQS
    3) Estimate local load reductions below E3 that achieve WQS

- Week of May 18: Continue runs of the several beyond E3 scenarios including an All Forested Watershed scenario and initiate calls with WQ standard States to review findings and recommendations regarding non-attaining segments.

May 24: Review non-attainment segment findings and recommendations with the WQGIT.

Finding an Optimal N/P Balance in the Nutrient Reductions

- Recognizing the importance of the phosphorus reductions in setting and achieving the sediment cap load allocations.
- Recognizing that phosphorus reductions will directly benefit local water quality conditions in all the States' free flowing streams and rivers.
- Remembering that the upper mainstem Bay tends towards phosphorus-limited conditions, particularly during the spring and the middle and lower mainstem Bay and lower tidal rivers tend towards nitrogen-limited conditions.
- We'll focus in on an N:P ratio with a nitrogen load around 190 or less, with the corresponding ratioed P load that will yield full attainment of all the deep-water and deep-channel designated use segments (with the likely exception of the lower Chester River deep-channel segment).

Schedule For Evaluating Optimum N/P Ratio

- Week of May 10: Set up and run WQSTM scenarios that will yield full attainment of all the deep-water and deep-channel designated use segments (with the likely exception of the lower Chester River deep-channel segment) keeping in mind an optimum N:P ratio (13.3?).

- Week of May 17: Evaluate dissolved oxygen attainment and establish a new basinwide set of N and P target loads bringing all the deep-water and deep-channel designated use segments into full attainment.

Key Points:

- We need to achieve all water quality standards.
- Overall, the findings of what's needed to achieve water quality standards are generally consistent with the findings of the 20003 Allocation.
- A target load that moves toward the Tributary Strategy loads or less is needed for the Deep Channel and Deep Water standards.
- We have a schedule for laying out the nutrient and sediment target loads by July 1.
- Regions of persistent nonattainment continue to be examined along with refinement of the target load as we move forward.