Bay TMDL 101

Gary Shenk

CBPO

2017 01 06

New Targets are Nothing ‘New’

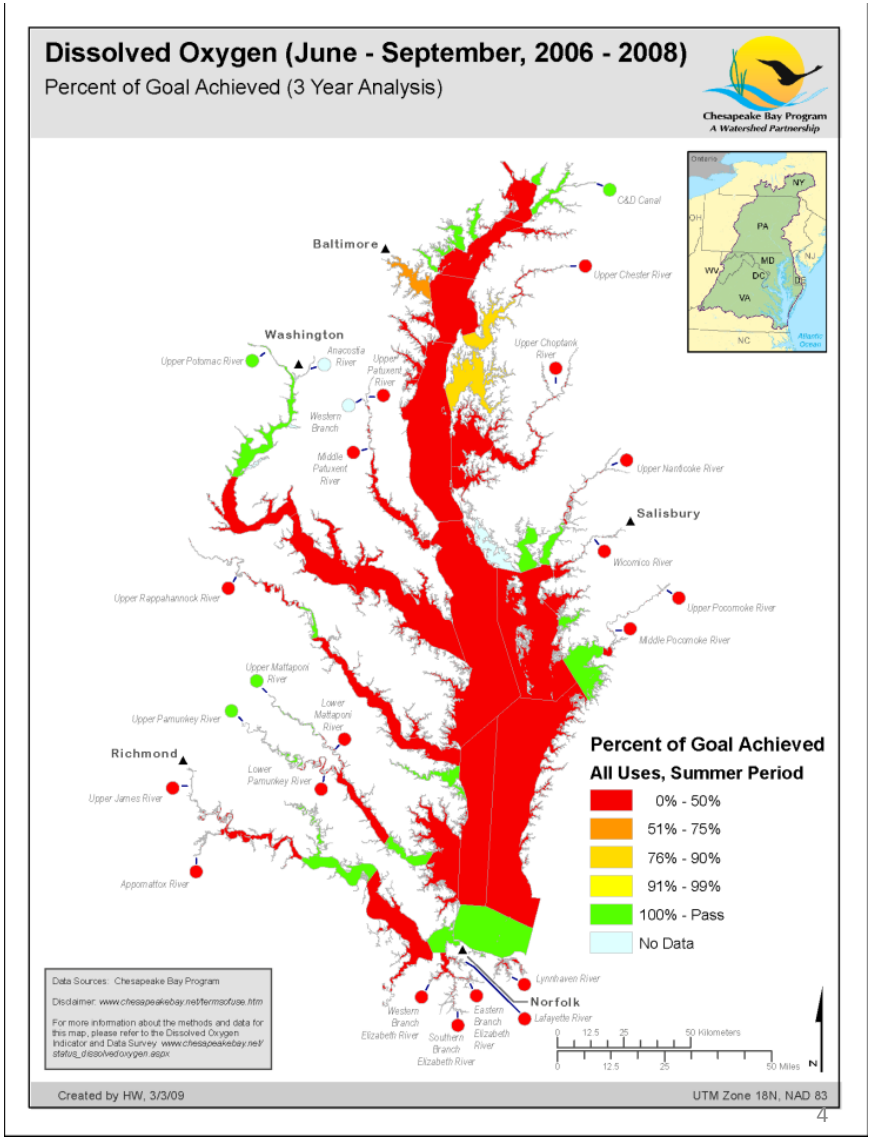
Year	Model Phase	Goal
• 1987	0	40% reduction
• 1992	2	40% of controllable loads
• 1997	4.1	Confirm 1992 loads
• 2003	4.3	Reallocation
• 2010	5.3.0	TMDL
• 2011	5.3.2	Phase 2 WIP targets
• 2017	6.0	Phase 3 WIP targets

TMDL Timeline

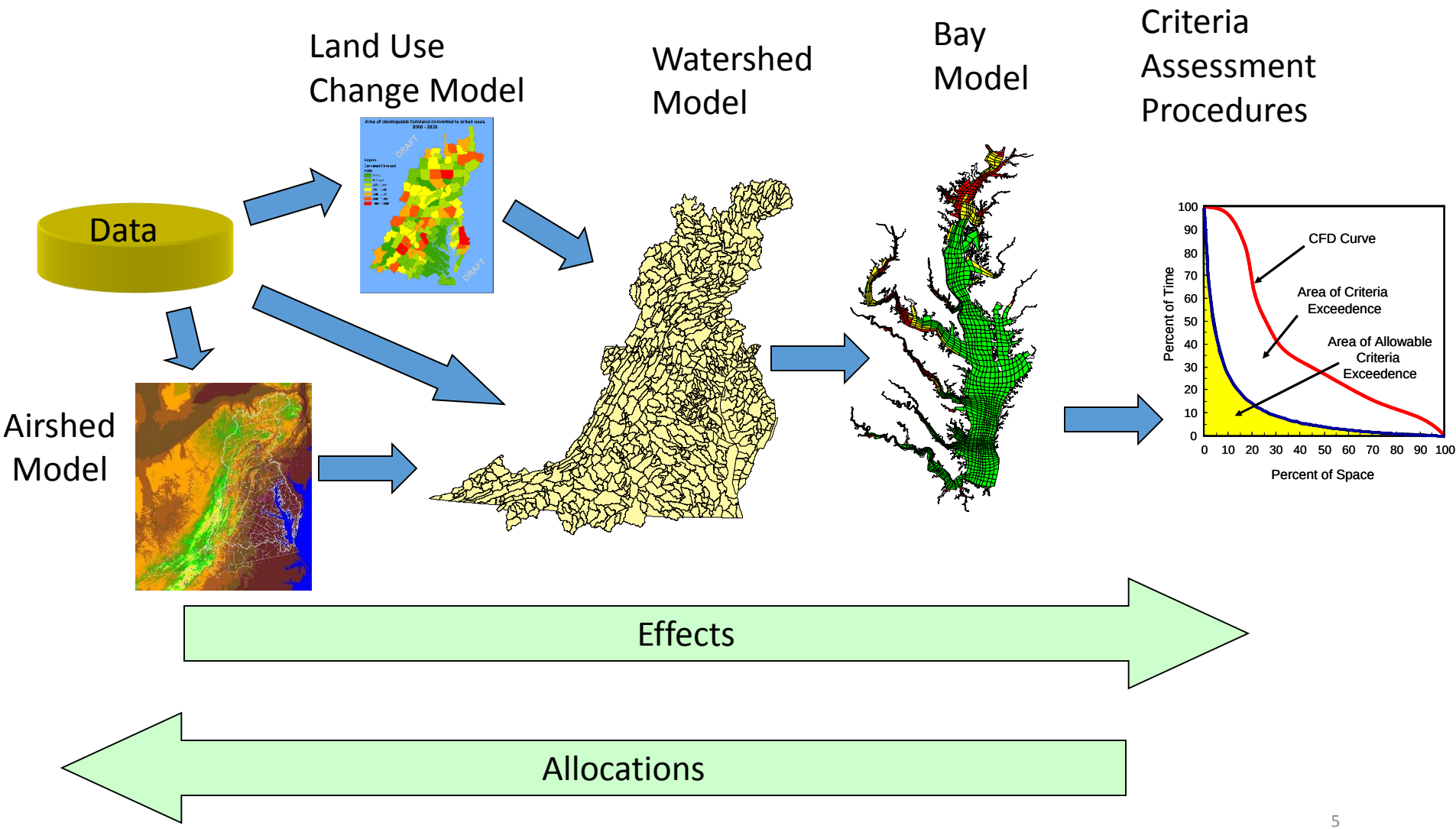
- 1999 – Lawsuit by American Canoe Association and American Littoral Society
- 2010 – TMDL put in place, Phase I WIPs completed
- 2011 – 2 updates to Watershed Model, Phase II WIPs completed
- 2017 MidPoint Assessment
  - 60% of the management practices implemented
  - Improved models
  - Mid-Course Correction?
- 2025 TMDL Goal Date
  - 100% of the management practices implemented

Chesapeake Bay TMDL

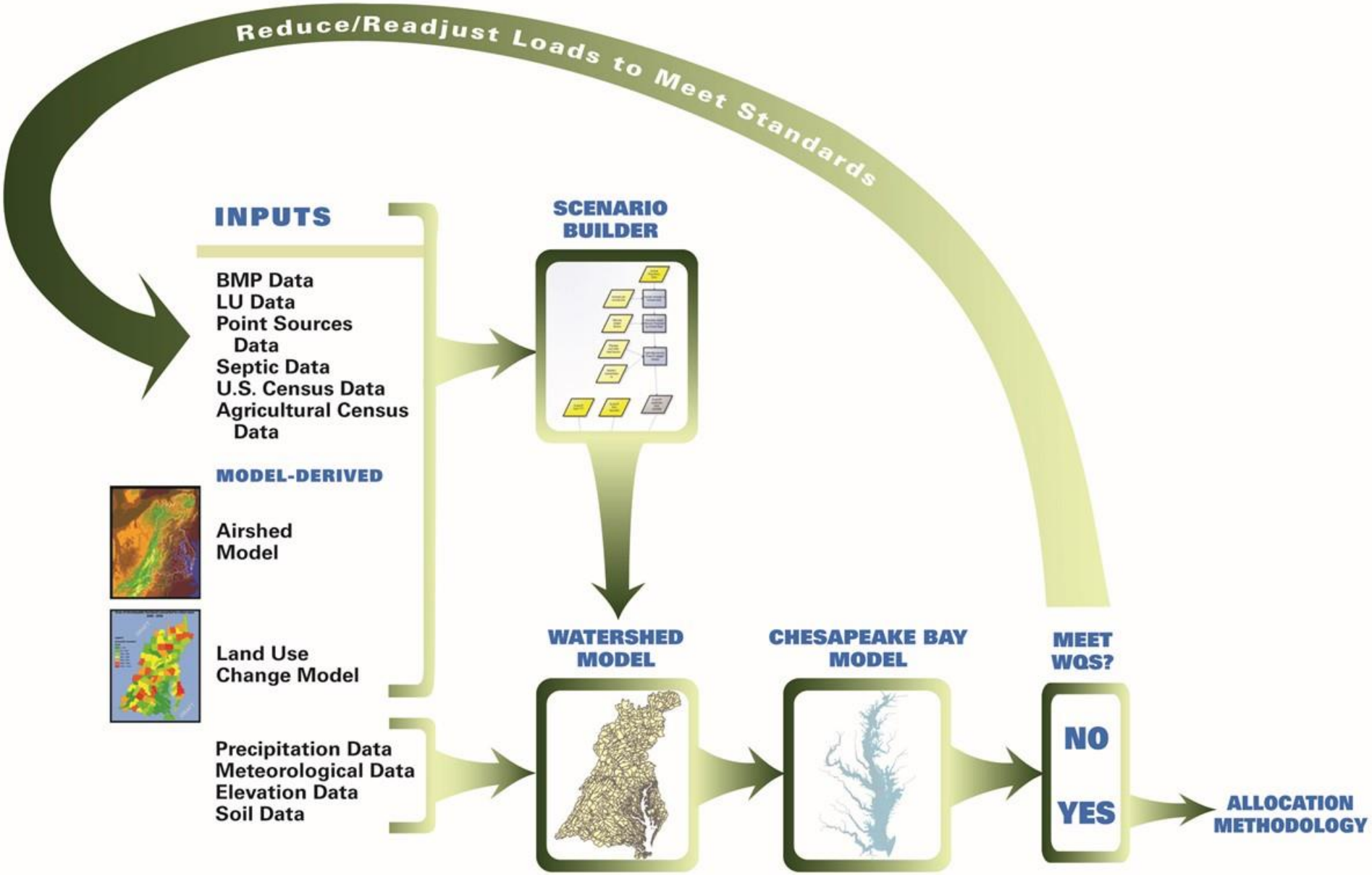
Necessitated by failure to meet water quality standards



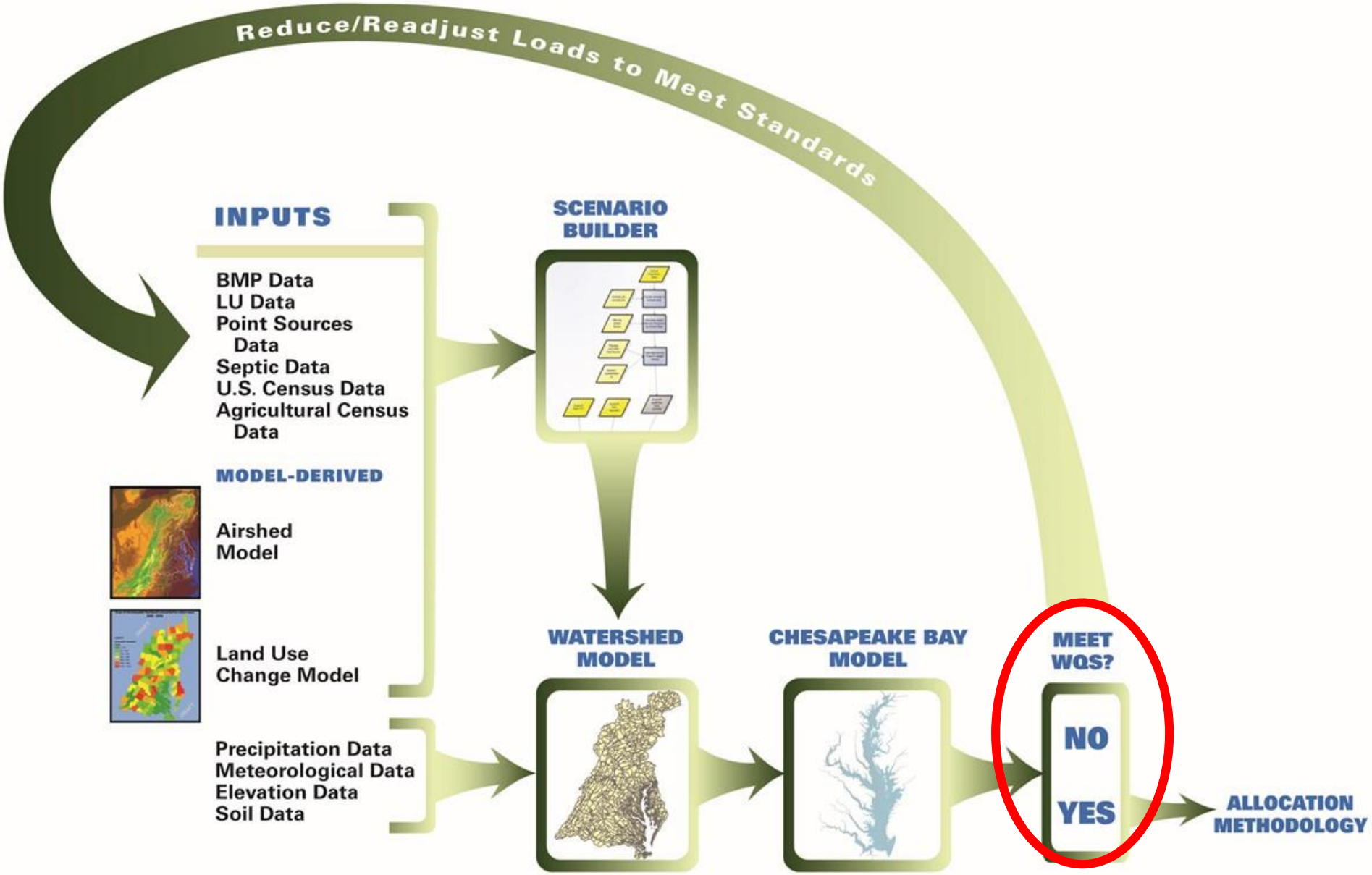
Decision Support System



Chesapeake Bay Partnership Models



Chesapeake Bay Partnership Models



Bay Dissolved Oxygen Criteria

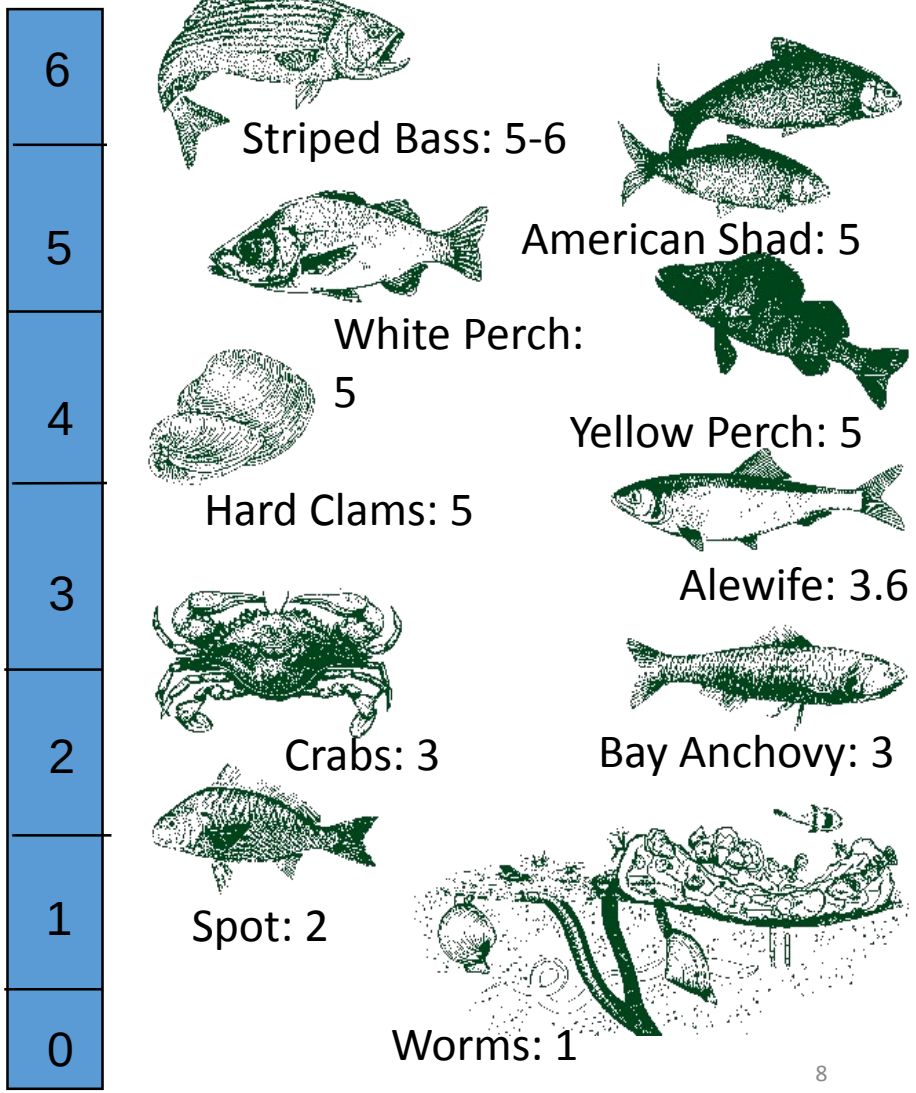
Minimum Amount of Oxygen (mg/L) Needed to Survive by Species

Migratory Fish Spawning & Nursery Areas

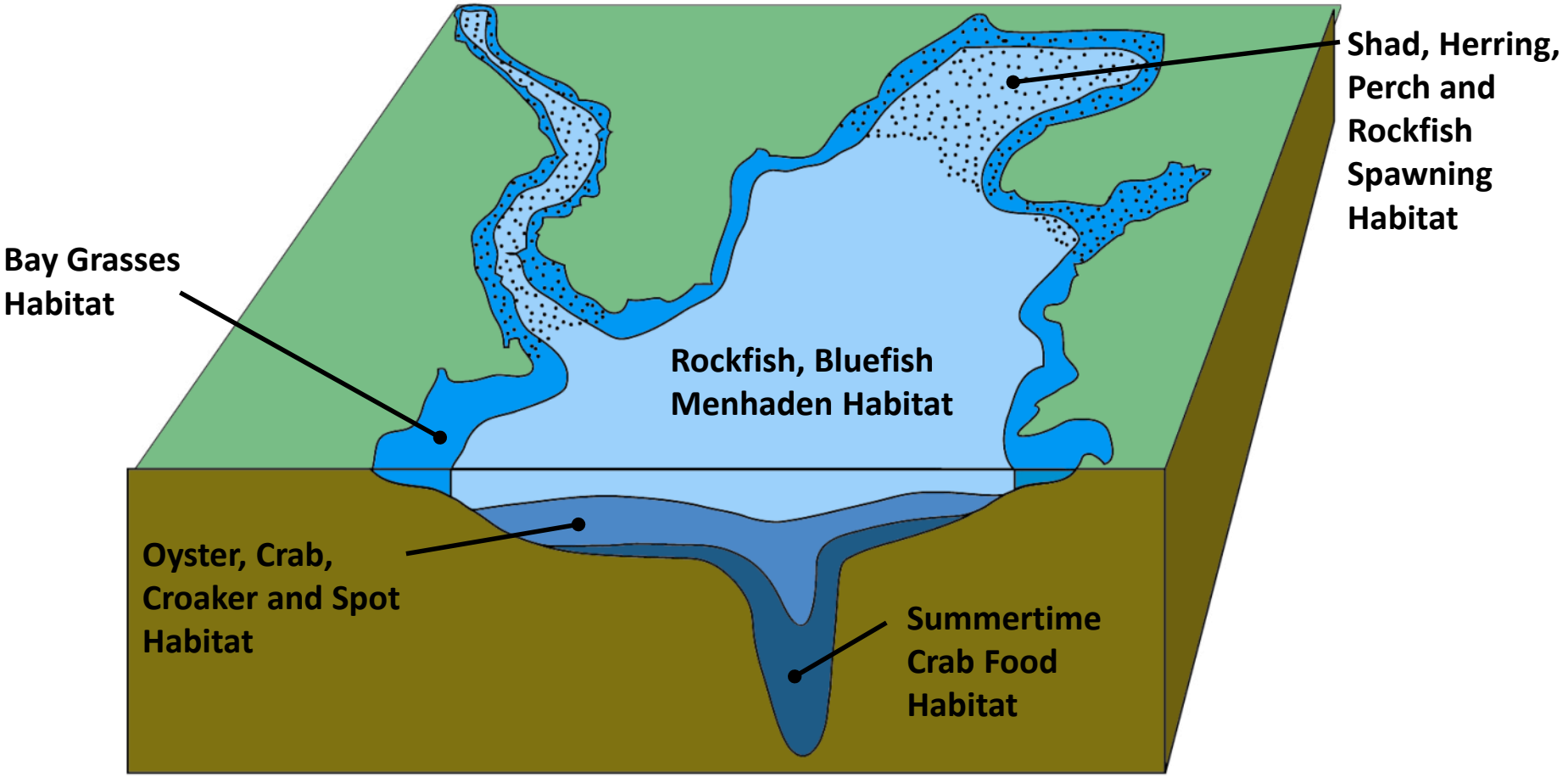
Shallow and Open Water Areas

Deep Water

Deep Channel

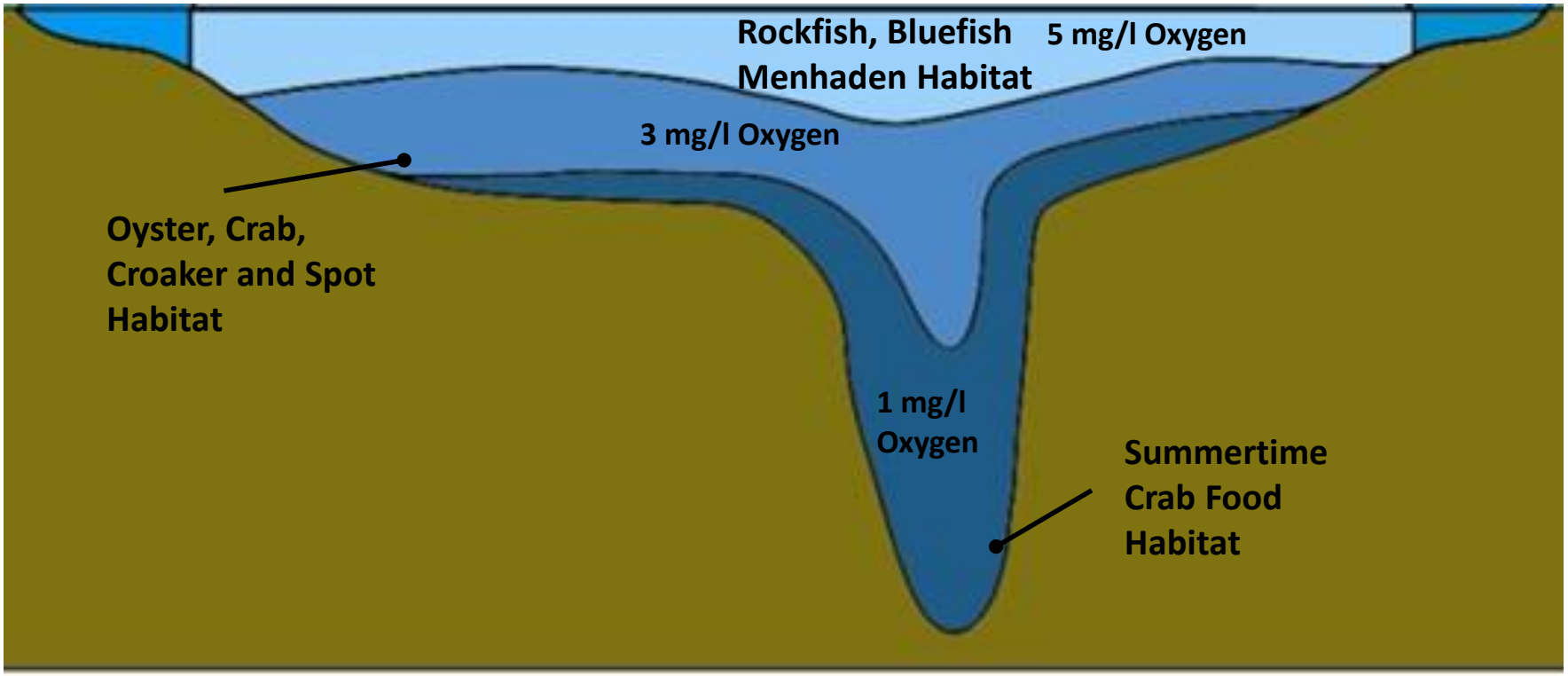


Local “Zoning” for Bay and Tidal River Fish, Crab and Grasses Habitats



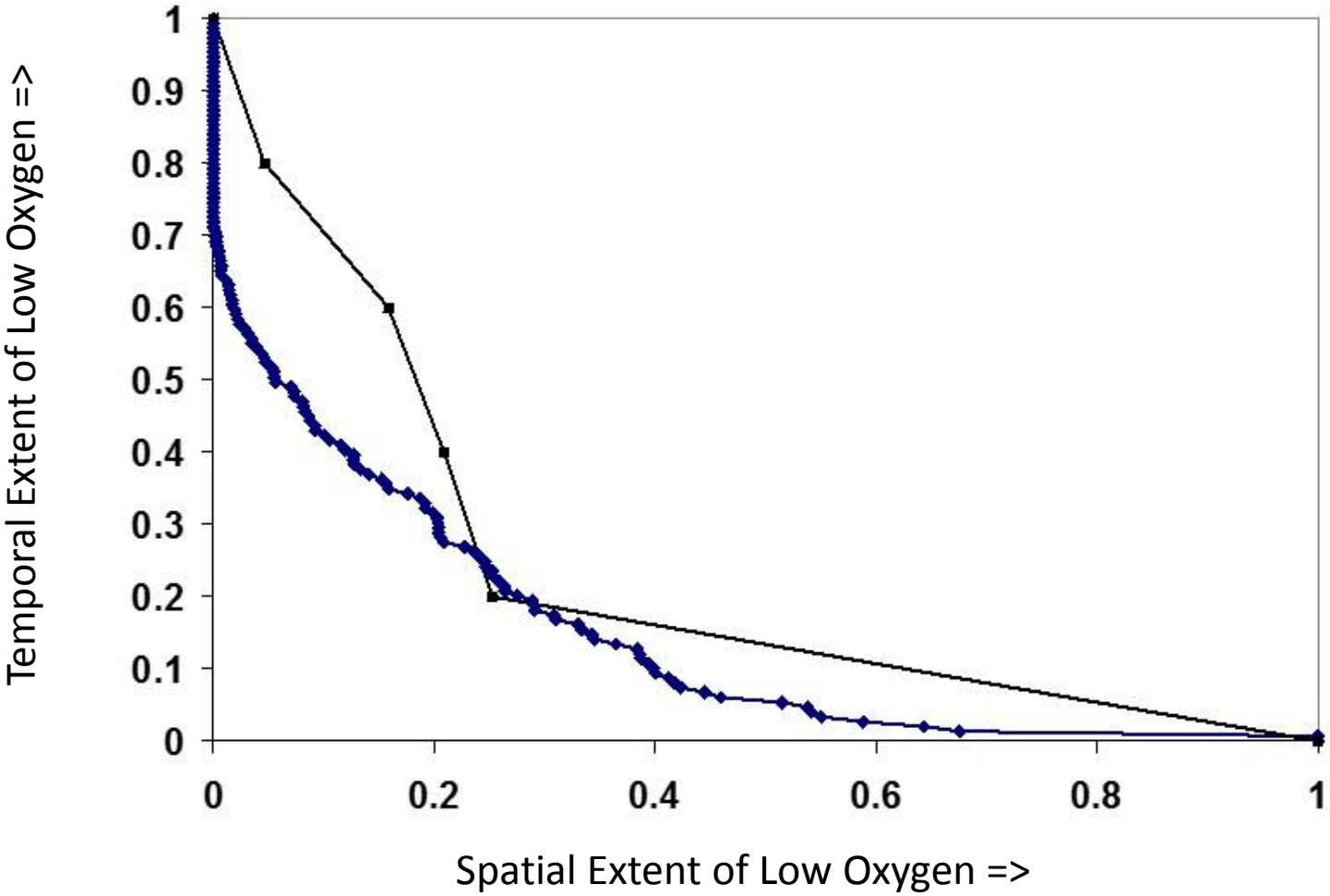
Redefined ‘swimmable/fishable’ in terms the public could relate to

Local “Zoning” for Bay and Tidal River Fish, Crab and Grasses Habitats

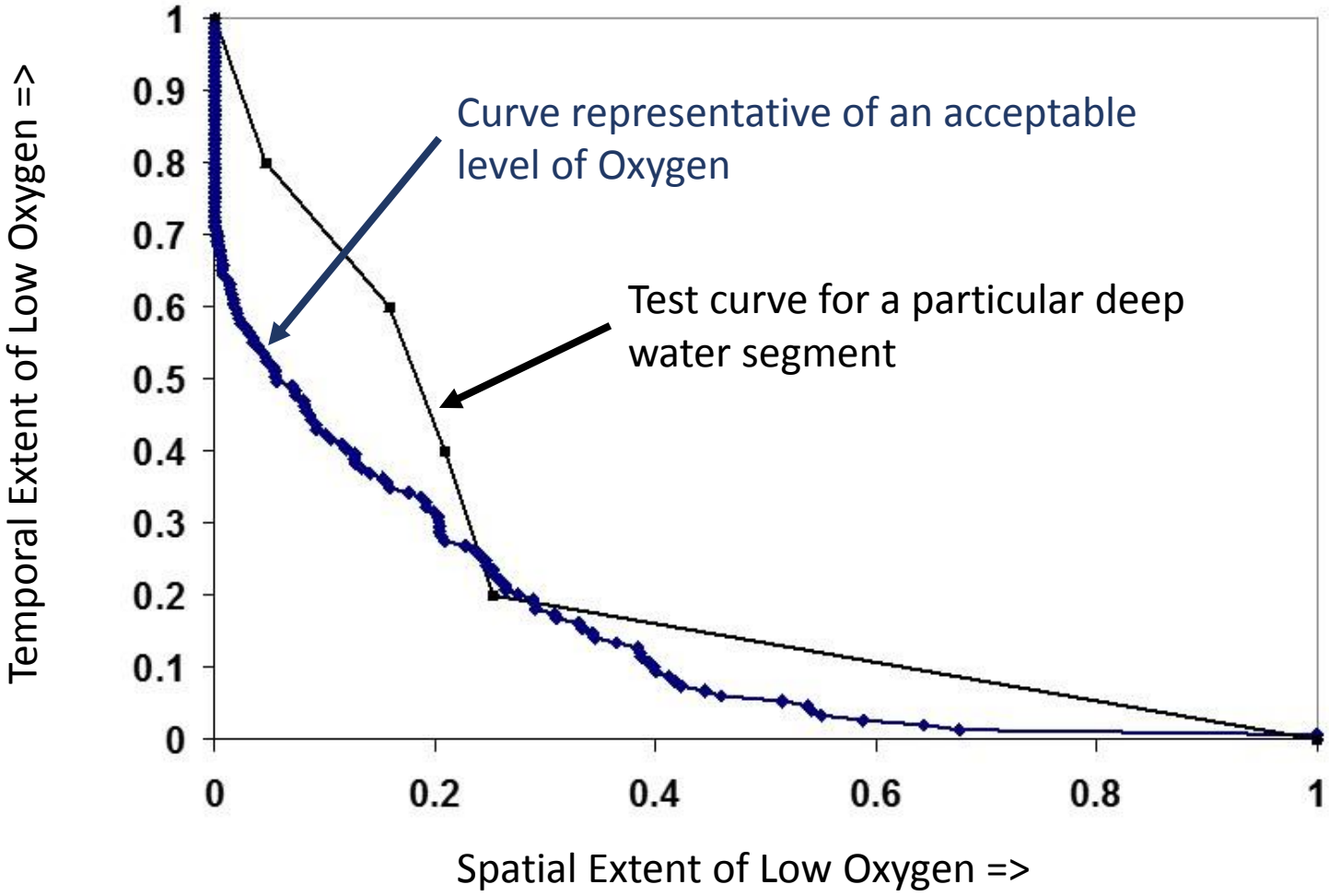


Redefined ‘swimmable/fishable’ in terms the public could relate to

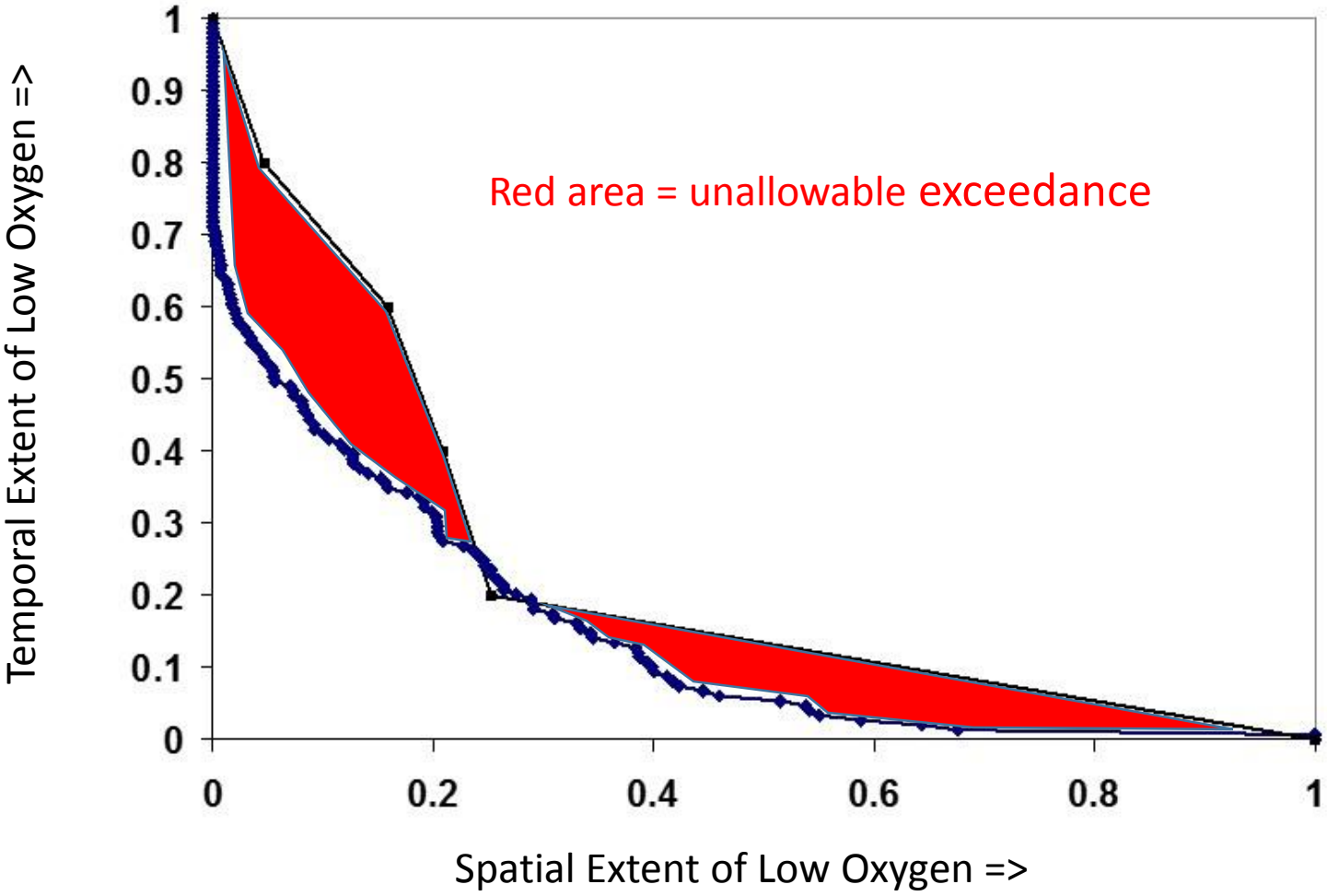
An Assessment of Dissolved Oxygen Criteria



An Assessment of Dissolved Oxygen Criteria



An Assessment of Dissolved Oxygen Criteria



‘Stoplight’ Table

Deep Water Attainment			
Cbseg	Base	Draft Allocation	E3
CB3MH	2.5%	0.1%	0.0%
CB4MH	23.3%	3.8%	1.5%
CB5MH	5.3%	0.0%	0.0%
CB6PH	0.6%	0.0%	0.0%
CB7PH	0.4%	0.0%	0.0%
CHSMH	5.5%	0.0%	0.0%
EASMH	3.3%	0.0%	0.0%
Calculated January 2009			

Critical Period 1993-1995

- Stoplight tables are calculated over a 3-year period
- Regulations require that ‘critical conditions’ be determined where variable environmental factors make attainment more difficult
- Often interpreted as a ‘once in 10 years’ event
- 1993–1995 selected for stream flows with a 10-year return.
  - 1996-1998 was more extreme
- Choice of the critical period affects the overall effort required to meet the TMDL

Hydrologic Averaging Period 1991-2000

- Loads from the watershed model are based on the weather during the hydrologic averaging period
- Wetter periods would show more load from nonpoint source
- Dryer periods would show more load from point source
- Any 10-year period is representative, 1991-2000 chosen as
  - slightly more representative
  - Includes the critical period

- Choice of hydrologic averaging period affects point/nonpoint balance.

TMDL Allocation Calculation

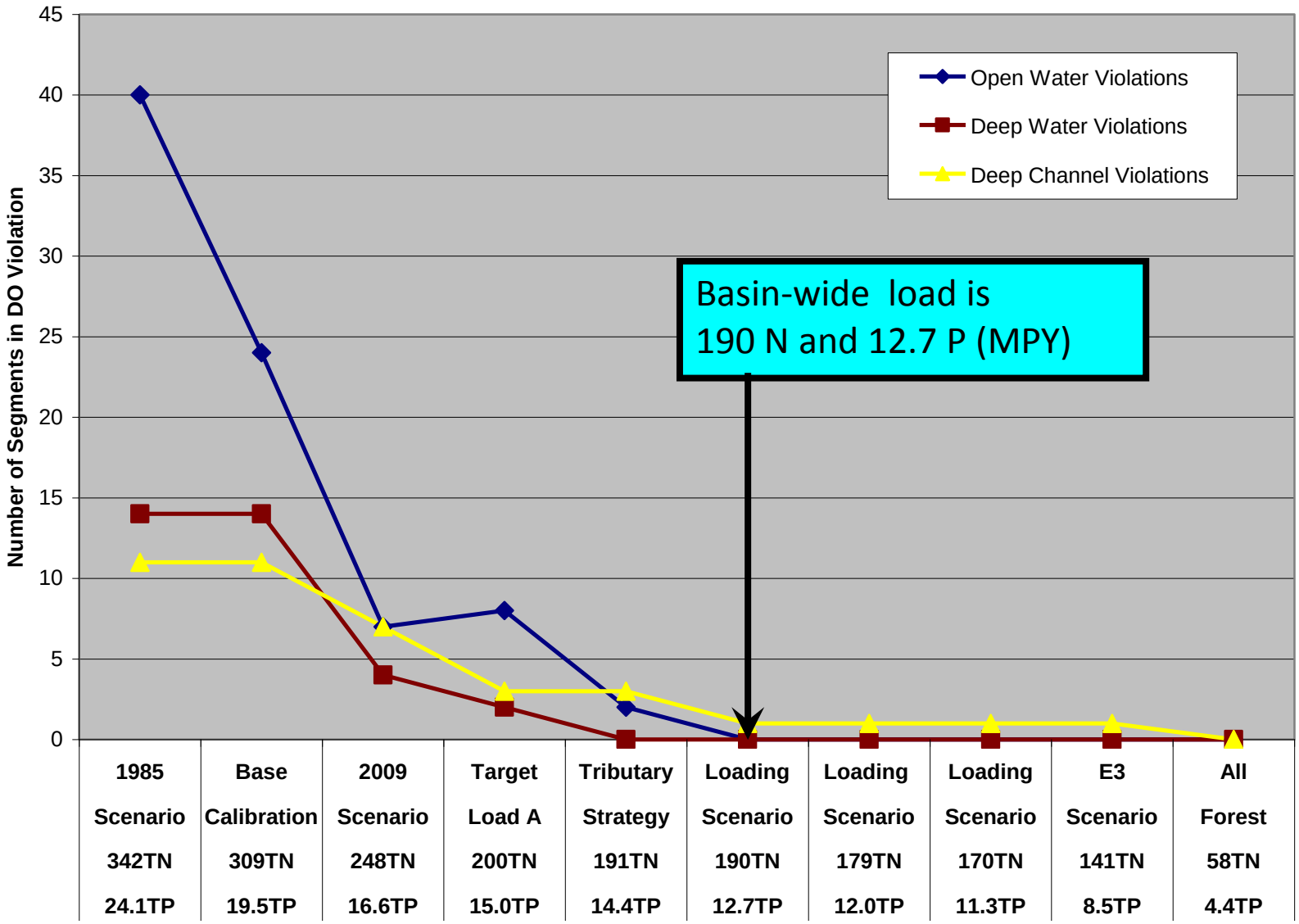
Guidelines for Allocations

- Areas that contribute the most to the problem must do the most to resolve the problem.
- All tracked and reported reductions in nutrient loads are credited toward achieving final assigned loads.
- Allocated N and P loads must result in attainment of water quality standards

Guidelines for Allocations

- Areas that contribute the most to the problem must do the most to resolve the problem.
- All tracked and reported reductions in nutrient loads are credited toward achieving final assigned loads.
- Allocated N and P loads must result in attainment of water quality standards

Dissolved Oxygen Criteria Attainment



Guidelines for Allocations

- Areas that contribute the most to the problem must do the most to resolve the problem.
- All tracked and reported reductions in nutrient loads are credited toward achieving final assigned loads.
- Allocated N and P loads must result in attainment of water quality standards

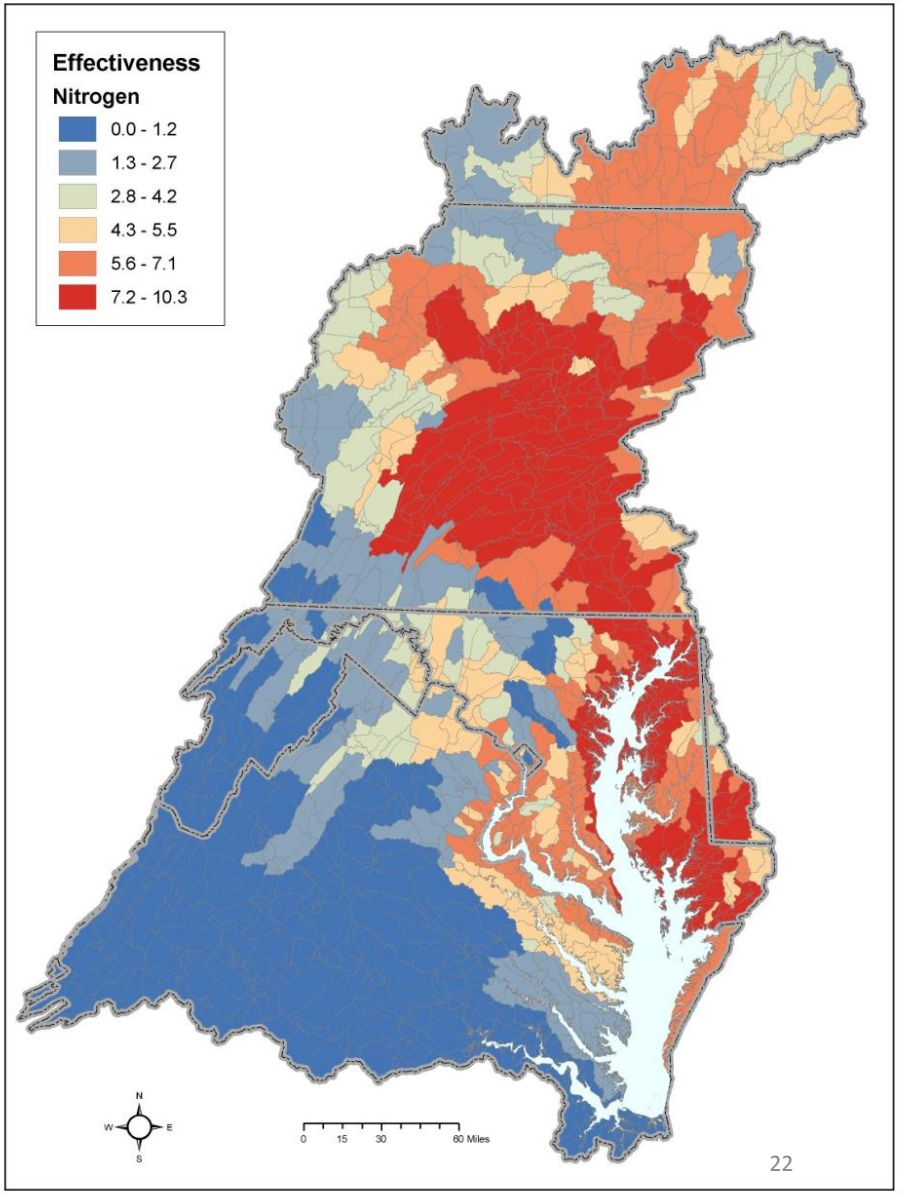
Determining Who Contributes the Most

Key factors:

Distance from Tidal water
- Riverine transport

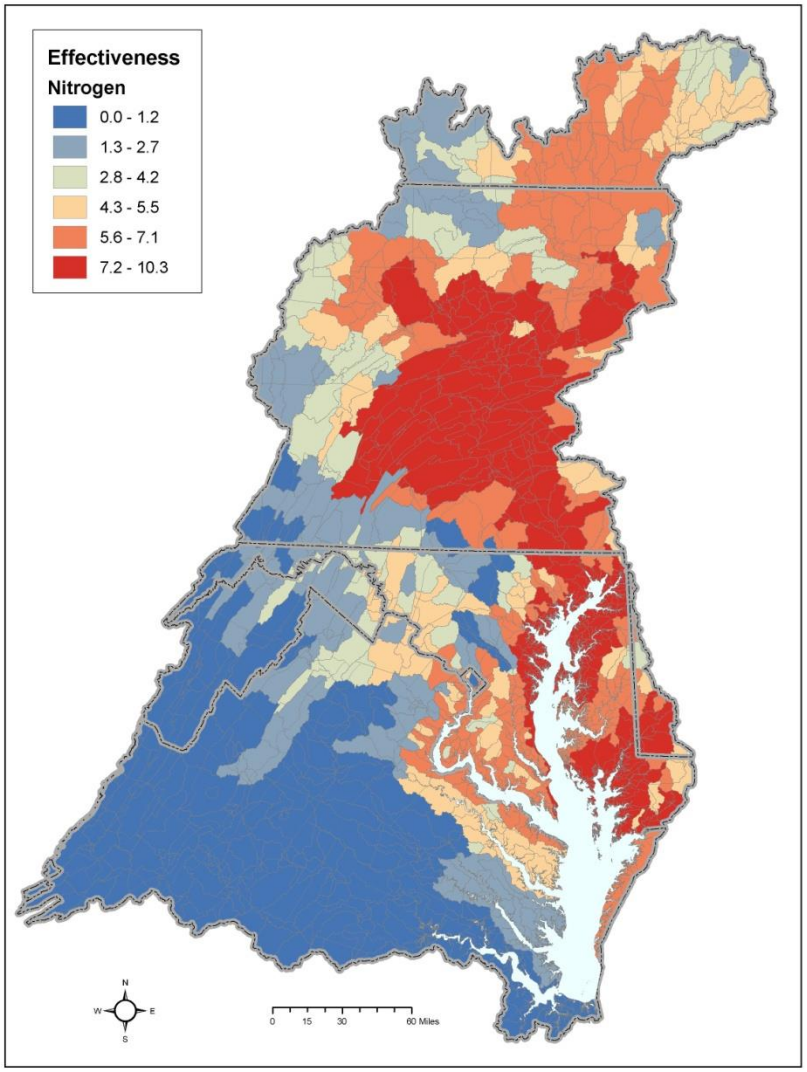
Position along mainstem bay
- Estuarine circulation

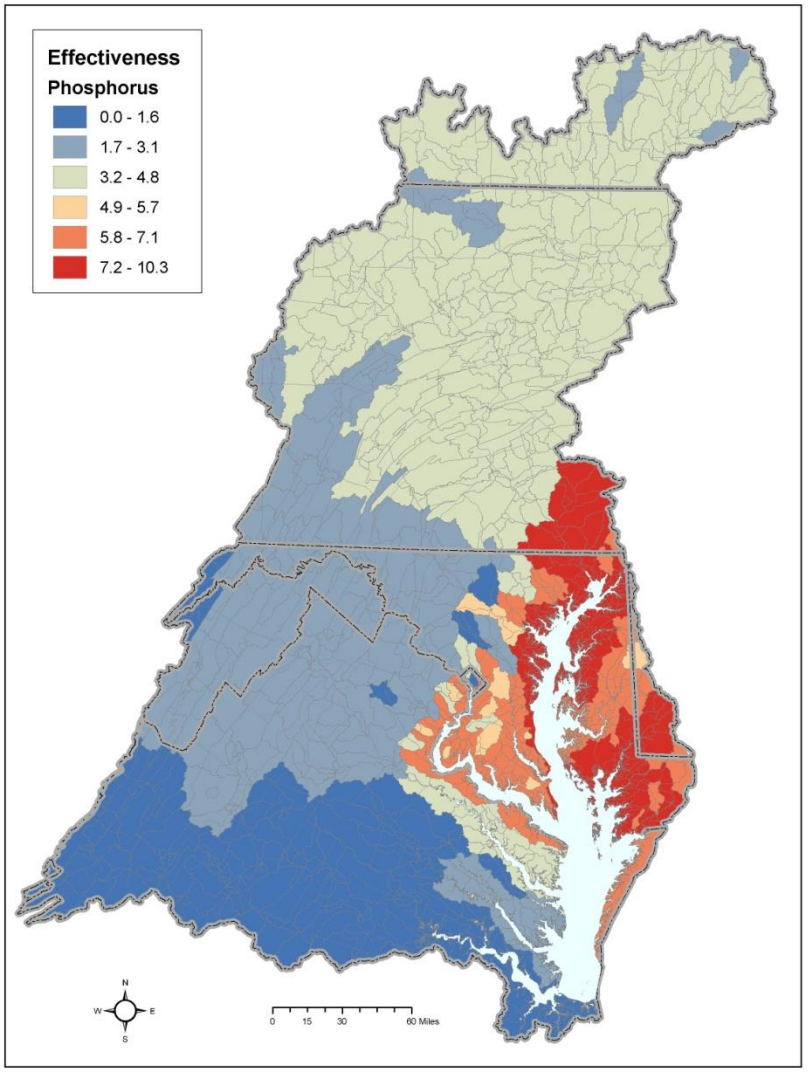
Existence of riverine estuary



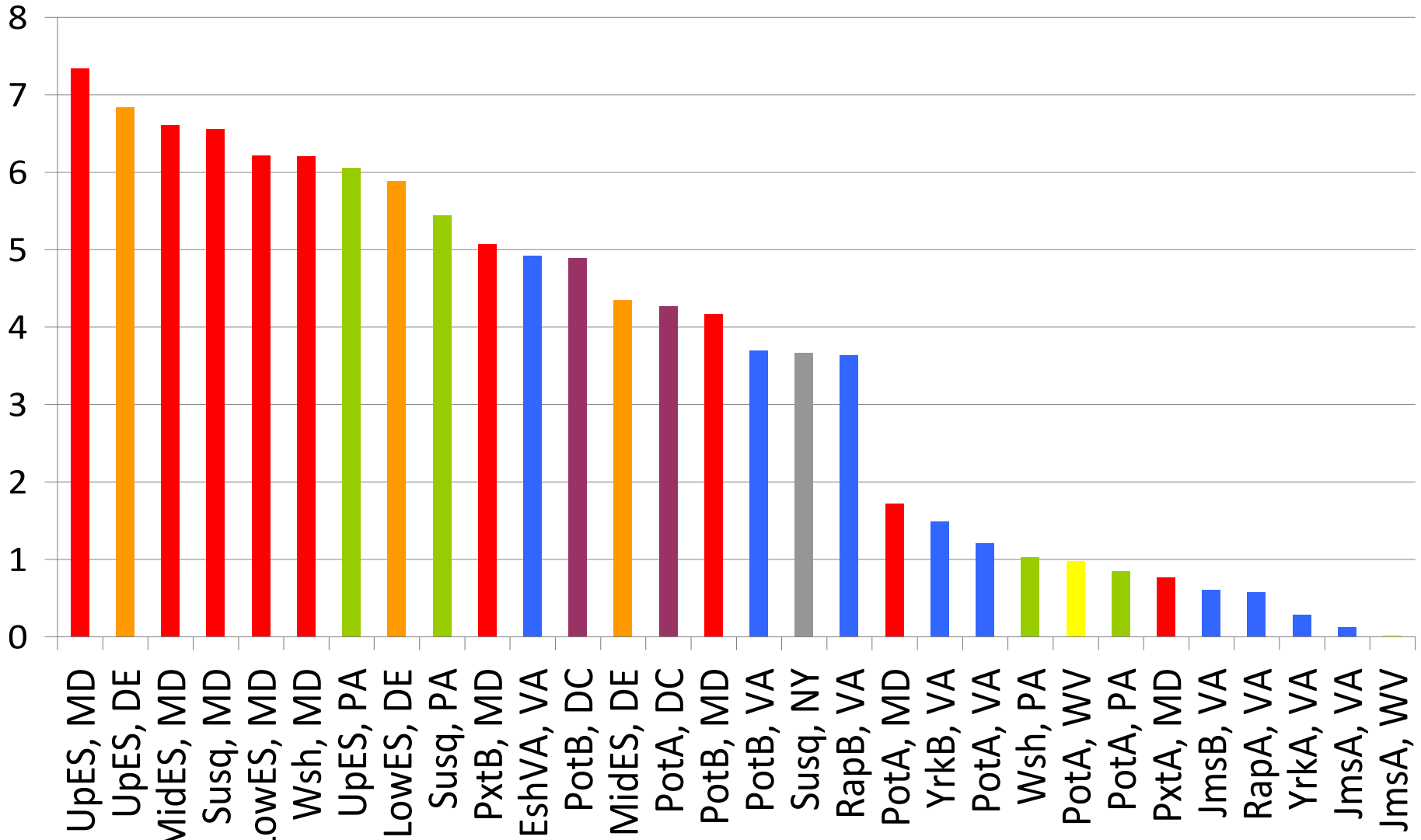
Riverine delivery:
Pound delivered per pound produced
Estuarine delivery
Oxygen reduced per pound delivered
Overall Effectiveness
Oxygen reduced per pound produced

Relative Effect of a Pound of Pollution on Bay Water Quality





Major River Basin by Jurisdiction Relative Impact on Bay Water Quality



Guidelines for Allocations

- Areas that contribute the most to the problem must do the most to resolve the problem.

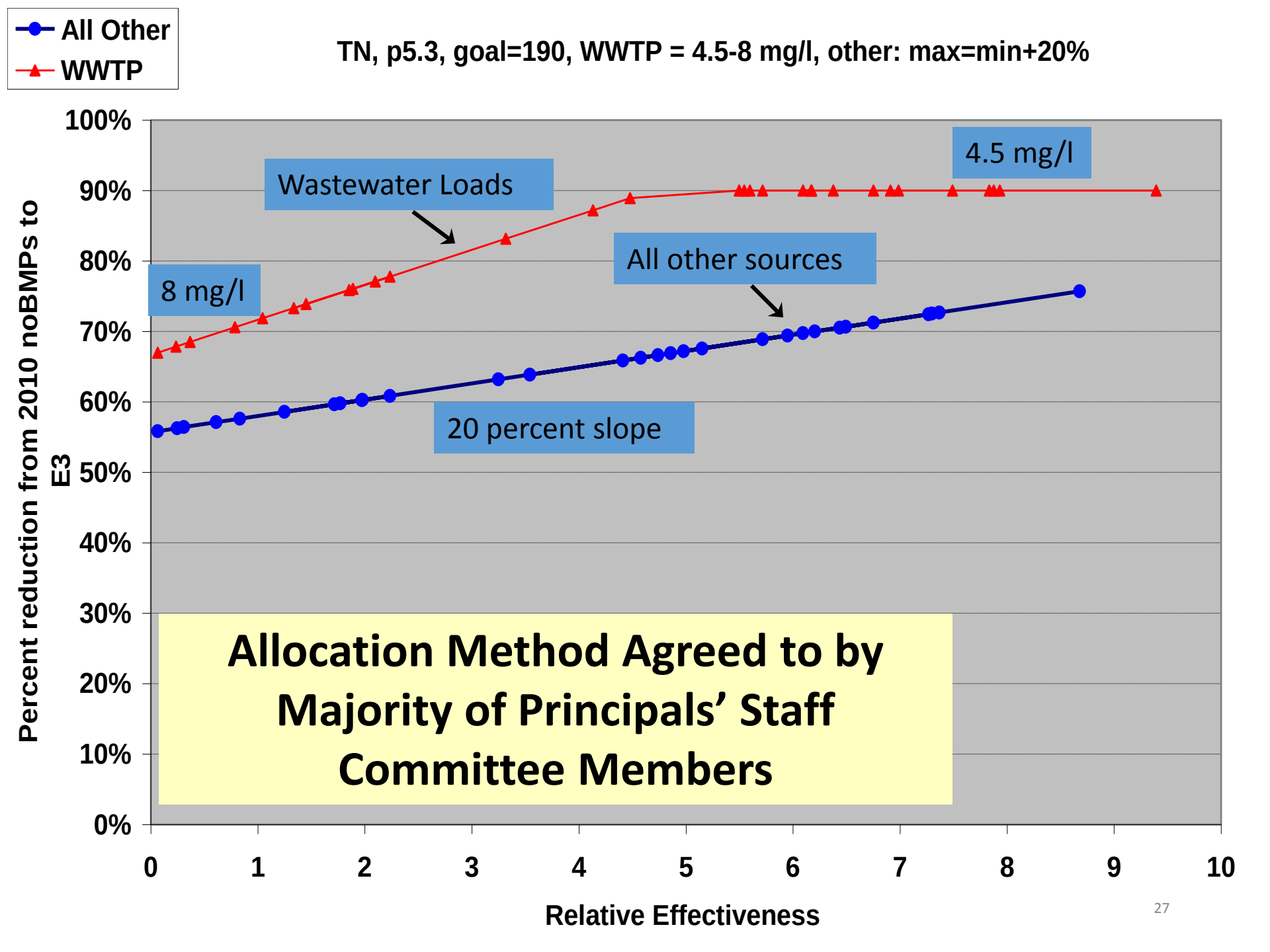
- All tracked and reported reductions in nutrient loads are credited toward achieving final assigned loads.

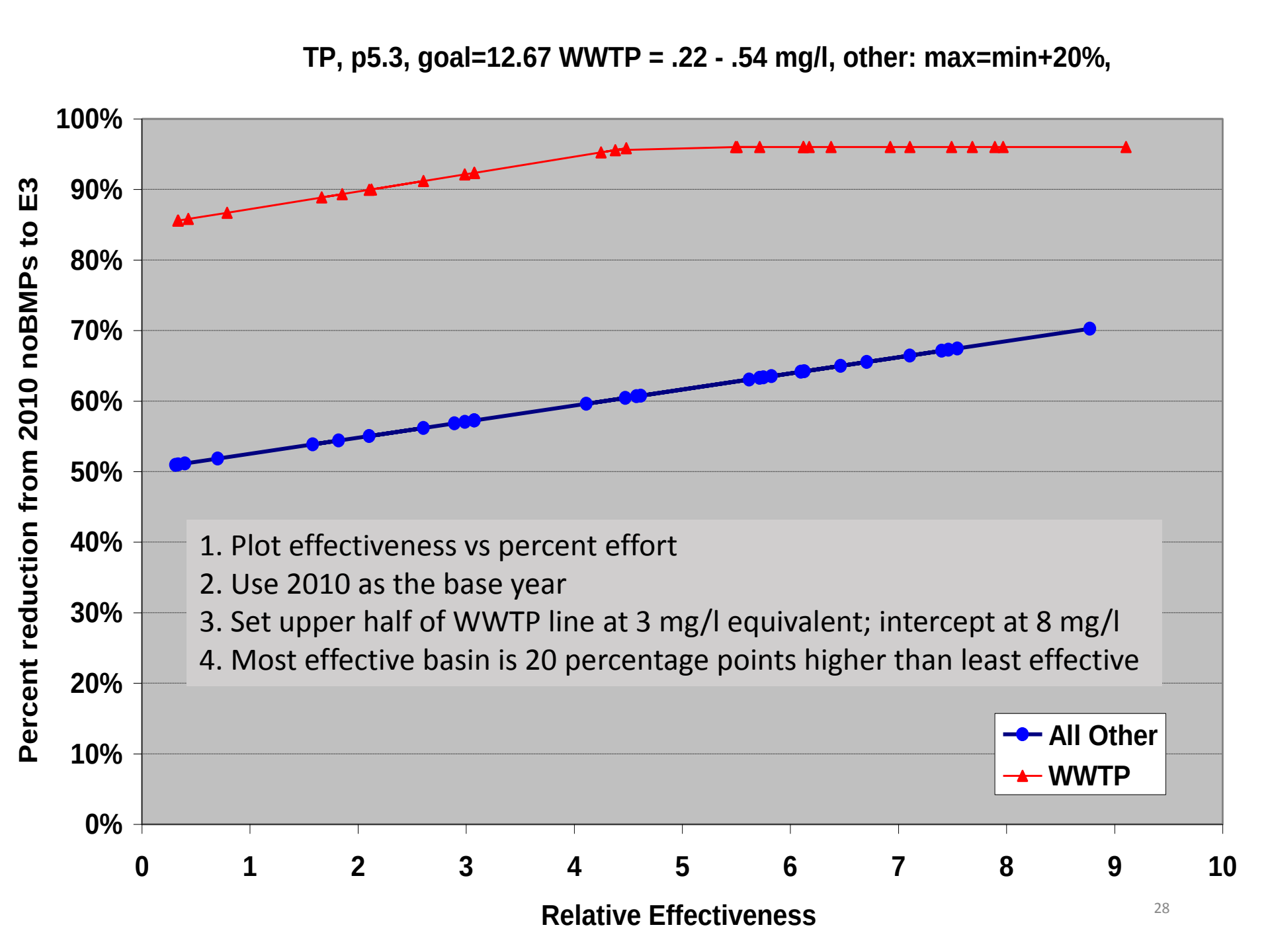
- Allocated N and P loads must result in attainment of water quality standards

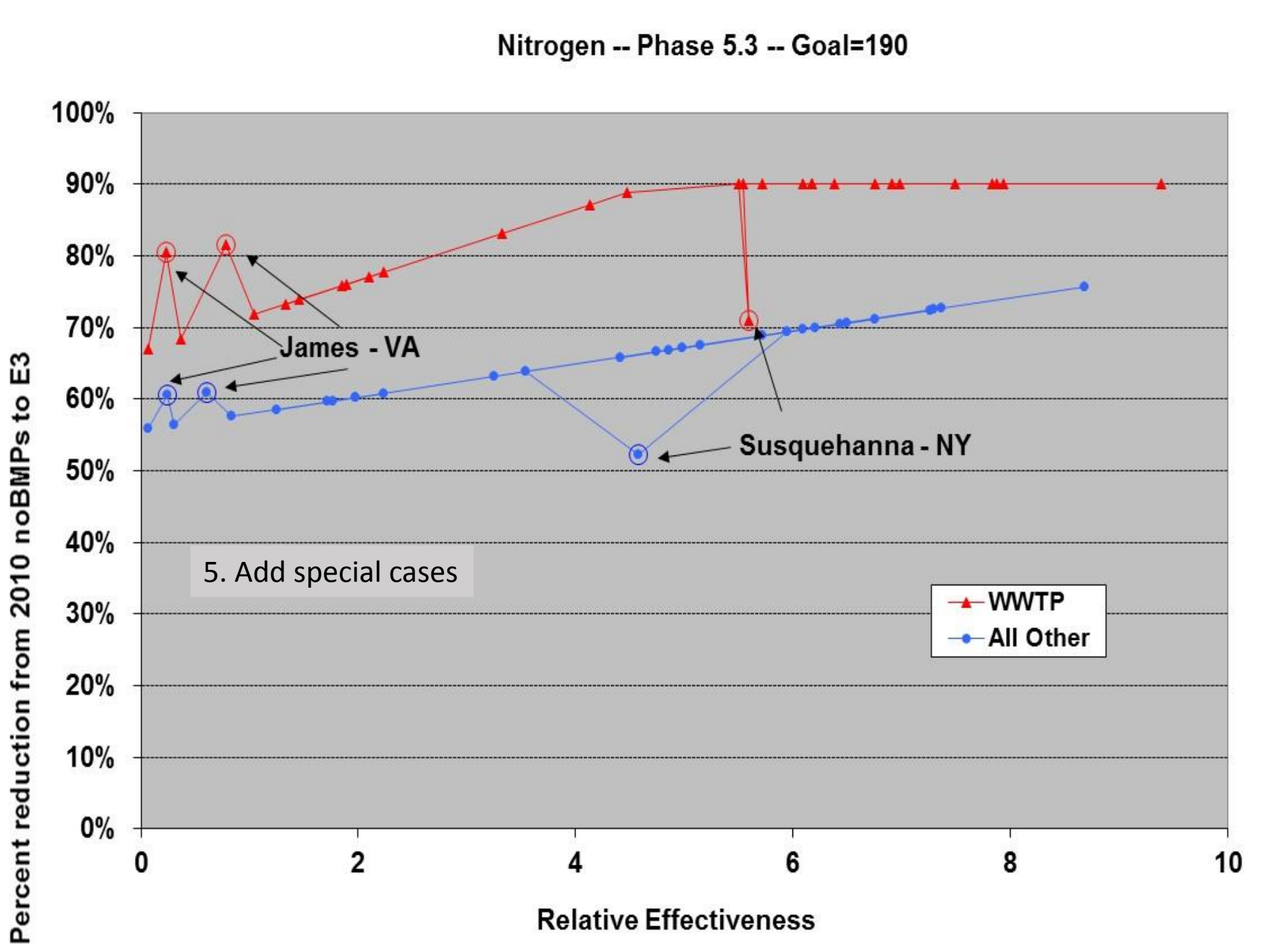
Accounting for Previous Reductions

- An allocation method that requires all states to make a similar effort from here on out would disadvantage states that have already done more.

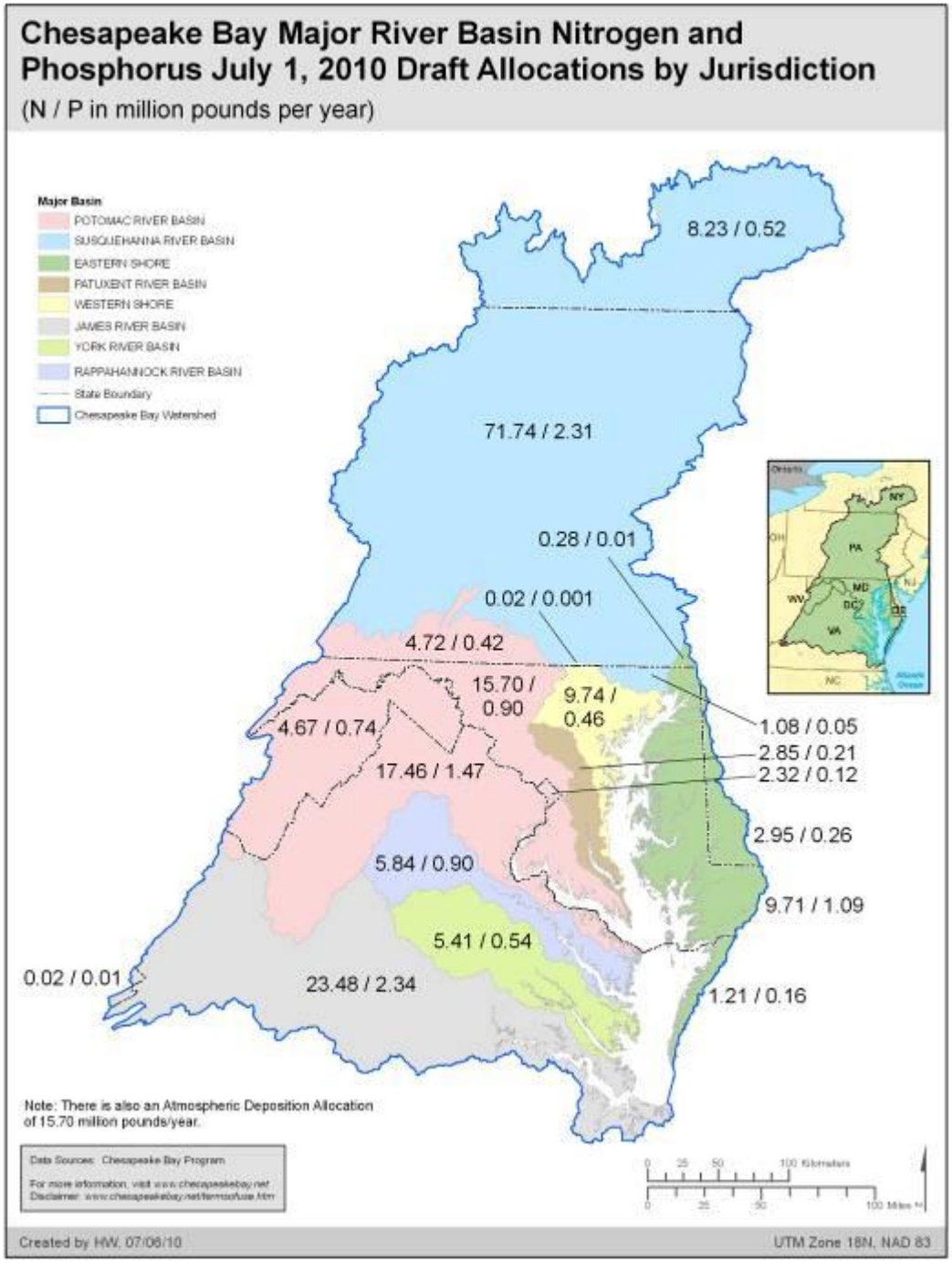
- Require a percentage of the way between:
  - No Action: no BMPs, low level of WWTP
  - Everyone, Everything, Everywhere (E3)


All Other
WWTP
TN, p5.3, goal=190, WWTP = 4.5-8 mg/l, other: max=min+20%
Percent reduction from 2010 noBMPs to E3
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
1
2
3
4
5
6
7
8
9
10
Relative Effectiveness
Wastewater Loads
4.5 mg/l
All other sources
8 mg/l
20 percent slope
Allocation Method Agreed to by Majority of Principals' Staff Committee Members


TP, p5.3, goal=12.67 WWTP = .22 - .54 mg/l, other: max=min+20%,
Percent reduction from 2010 noBMPs to E3
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
1
2
3
4
5
6
7
8
9
10
Relative Effectiveness
1. Plot effectiveness vs percent effort
2. Use 2010 as the base year
3. Set upper half of WWTP line at 3 mg/l equivalent; intercept at 8 mg/l
4. Most effective basin is 20 percentage points higher than least effective
All Other
WWTP

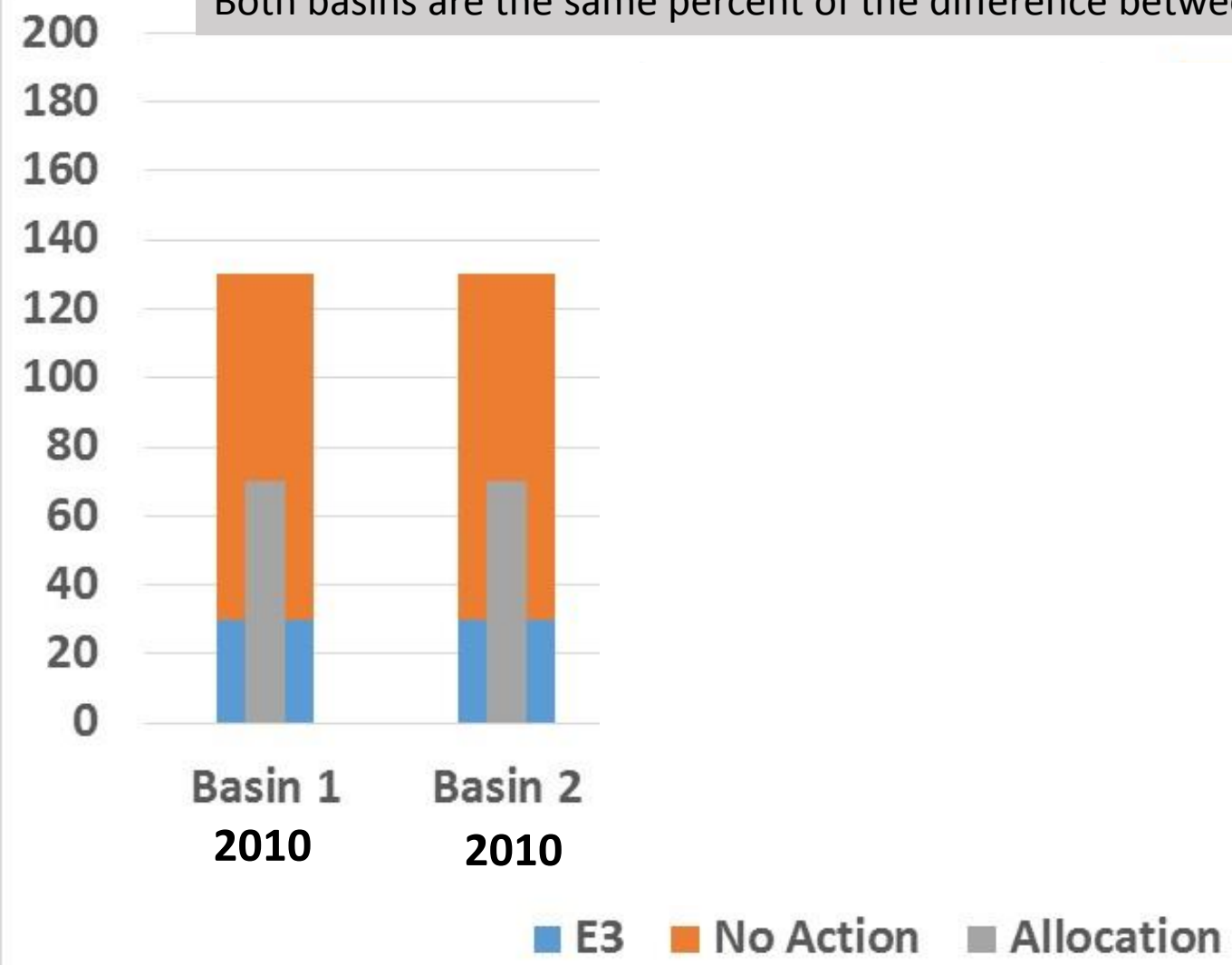

Nitrogen -- Phase 5.3 -- Goal=190
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent reduction from 2010 noBMPs to E3
0
2
4
6
8
10
Relative Effectiveness
James - VA
Susquehanna - NY
5. Add special cases
WWTP
All Other

State/basin allocations
(N/P (MPY))



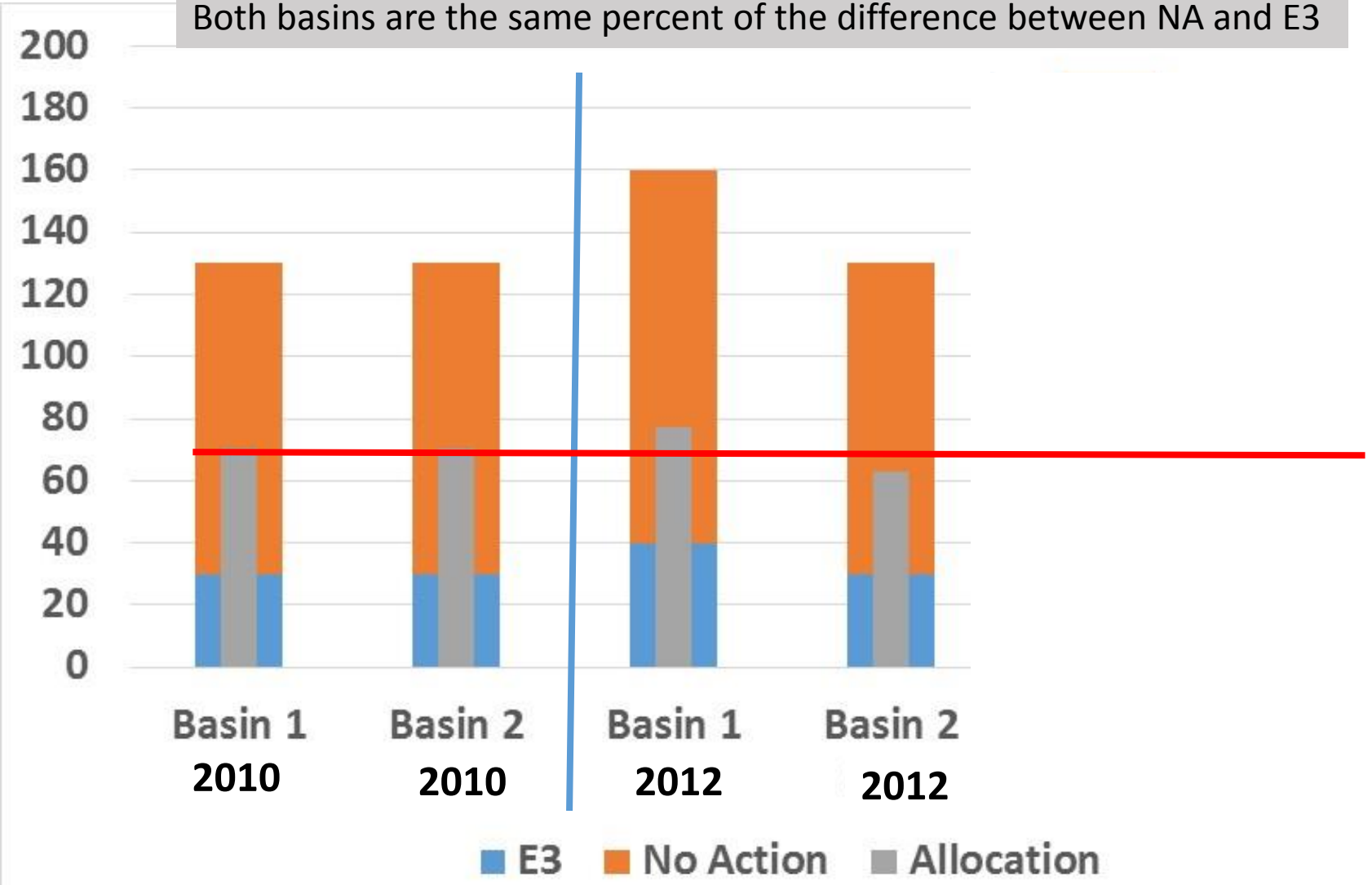
Changing No Action and E3 Year - Theoretical

Allocation = 140
Both basins are the same percent of the difference between NA and E3



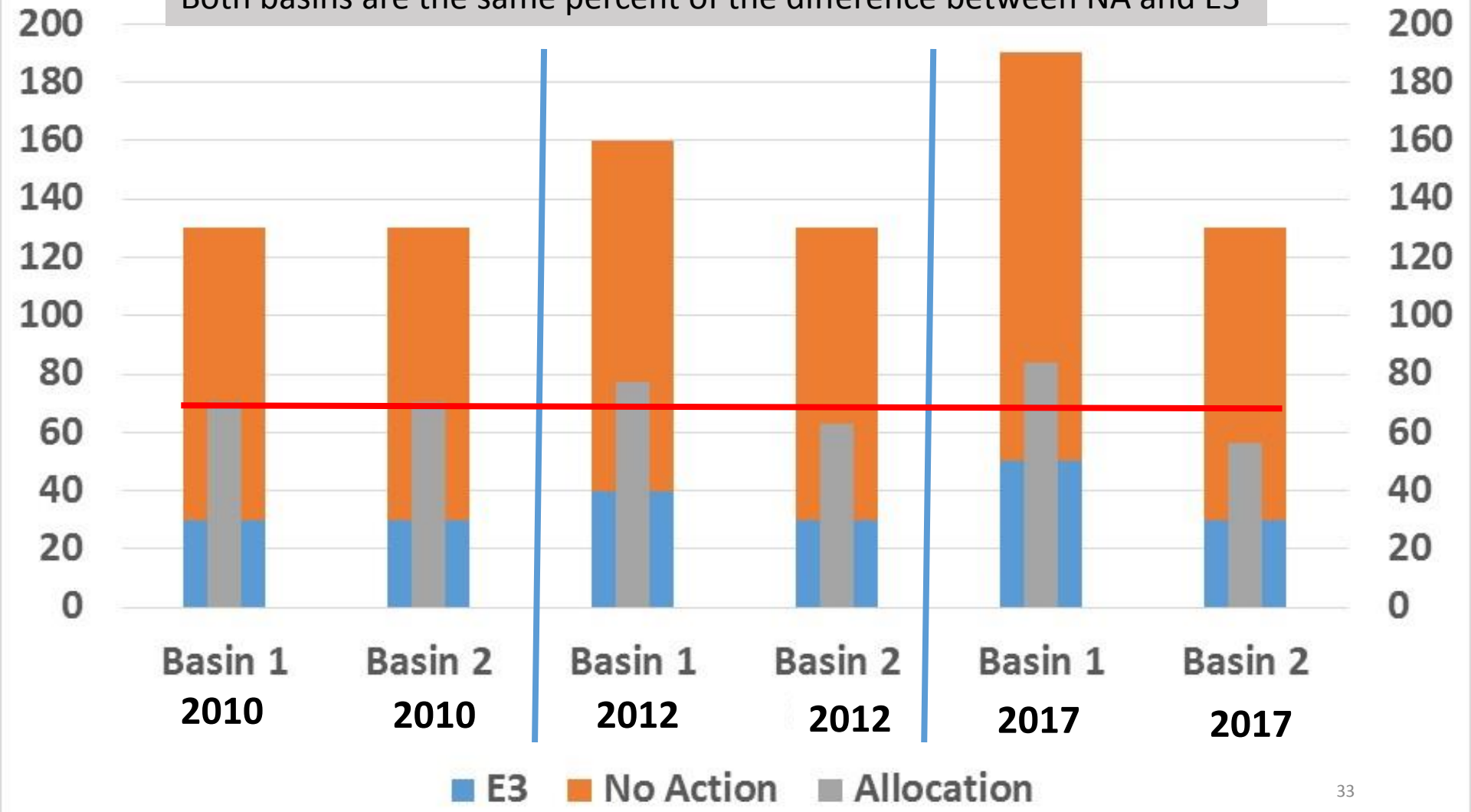
Changing No Action and E3 Year - Theoretical

Allocation = 140
Both basins are the same percent of the difference between NA and E3



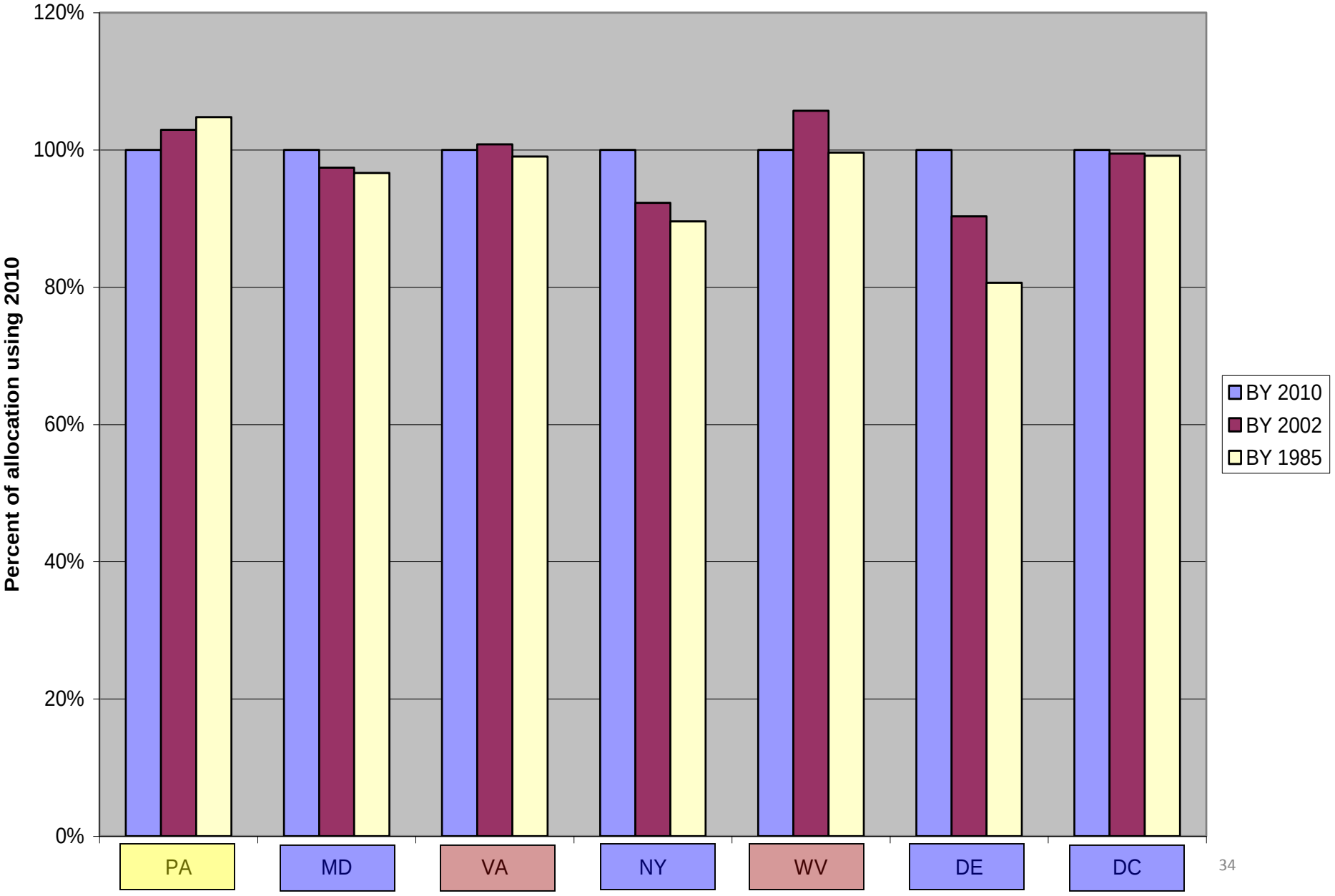
Changing No Action and E3 Year - Theoretical

Allocation = 140
Both basins are the same percent of the difference between NA and E3

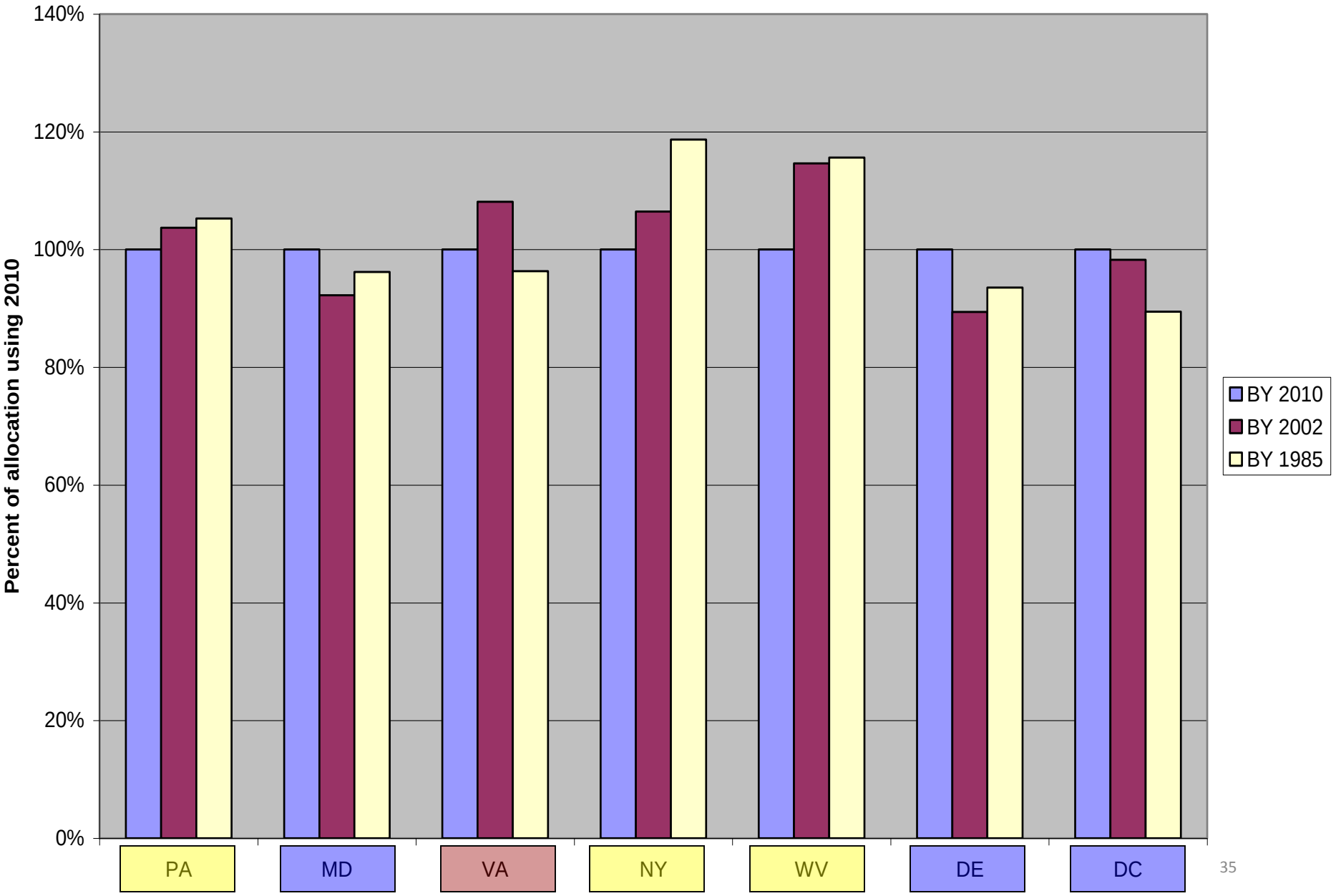


TN Allocation Relative to using 2010 for No Action and E3

2009 WQGIT presentation

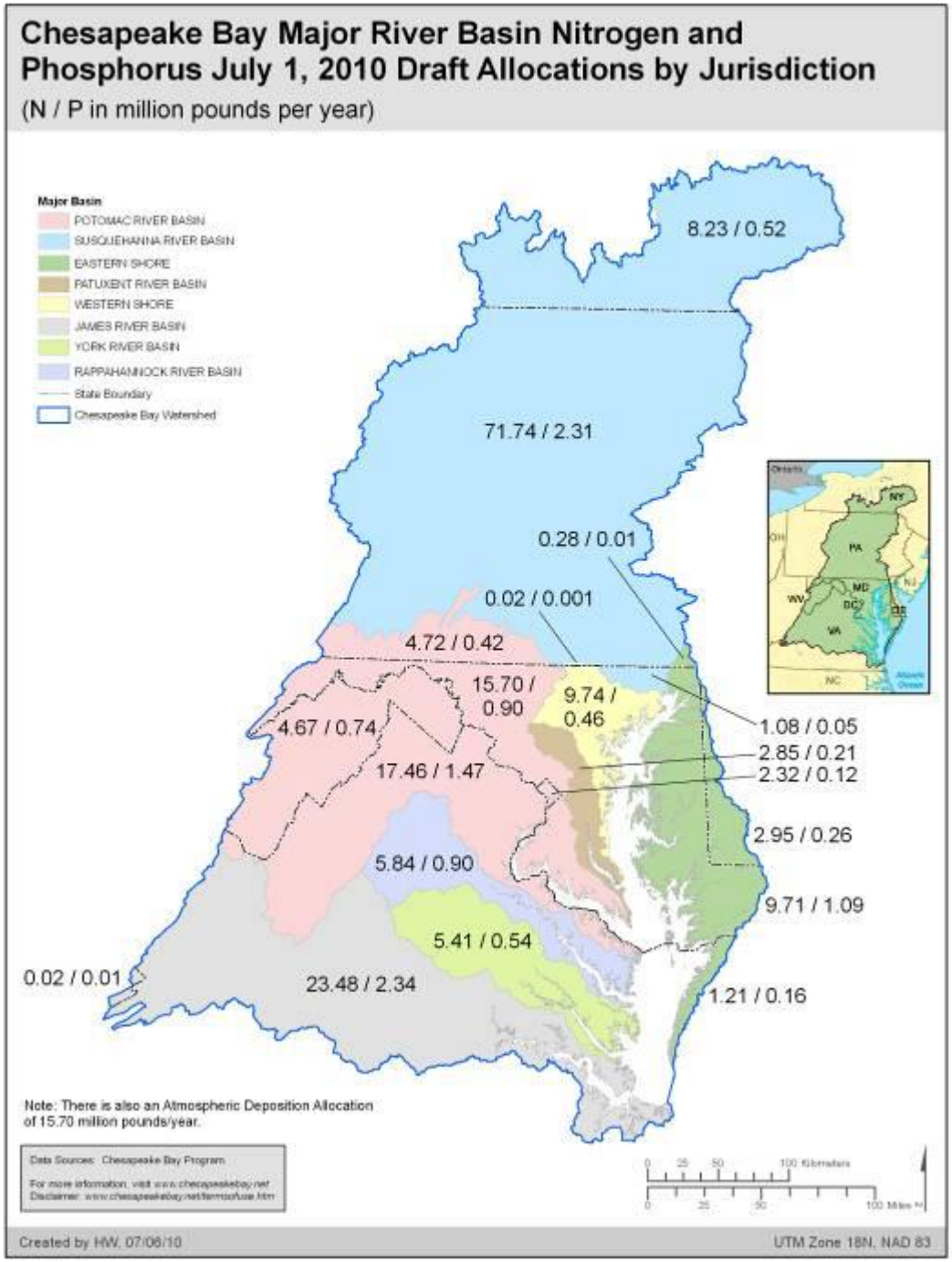


TP Allocation Relative to using 2010 for No Action and E3



State/basin allocations (N/P (MPY))

Phase I WIPs developed to meet these numbers



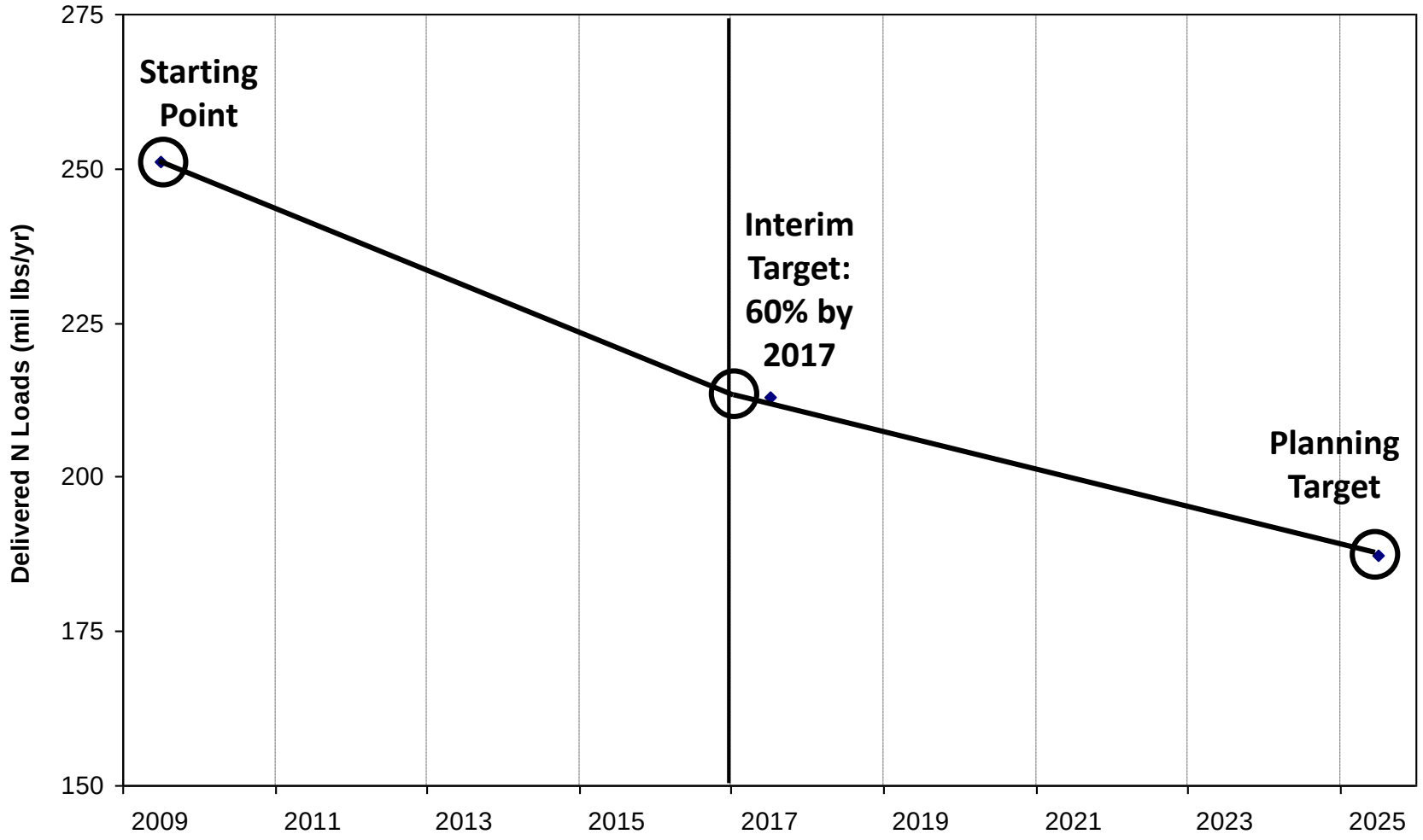
Scenario Year for WIP Development

- Once load targets are established jurisdictions develop WIPs to meet those loads in the watershed model.
- To generate the loads, the partnership must choose a scenario year to estimate the available land for BMP implementation, the human and animal populations, agricultural systems, etc.
- Choosing a current year answers the question: “What BMPs are needed to meet the goals given the current state of the watershed”.
  - Future growth might be handled through offsets
- Choosing a future year answers the question: “What BMPs are needed to meet the goals given the projected state of the watershed”.
  - Future growth might already be included
- 2010 was chosen for Phase I and Phase II WIPs

Phase II WIPs - 2011

- 2010 TMDL based on Phase 5.3 watershed model
- Partnership requested changes to Phase 5.3 during 2010
  - Land use
  - Nutrient Management
- Phase I WIPs (plus small adjustments to meet WQS) were run on the Phase 5.3.2 watershed model to generate **planning targets**
  - Consistent with the 2010 TMDL
  - Numbers were different but represented the same level of effort
- Phase II WIPs were developed to meet the planning targets.

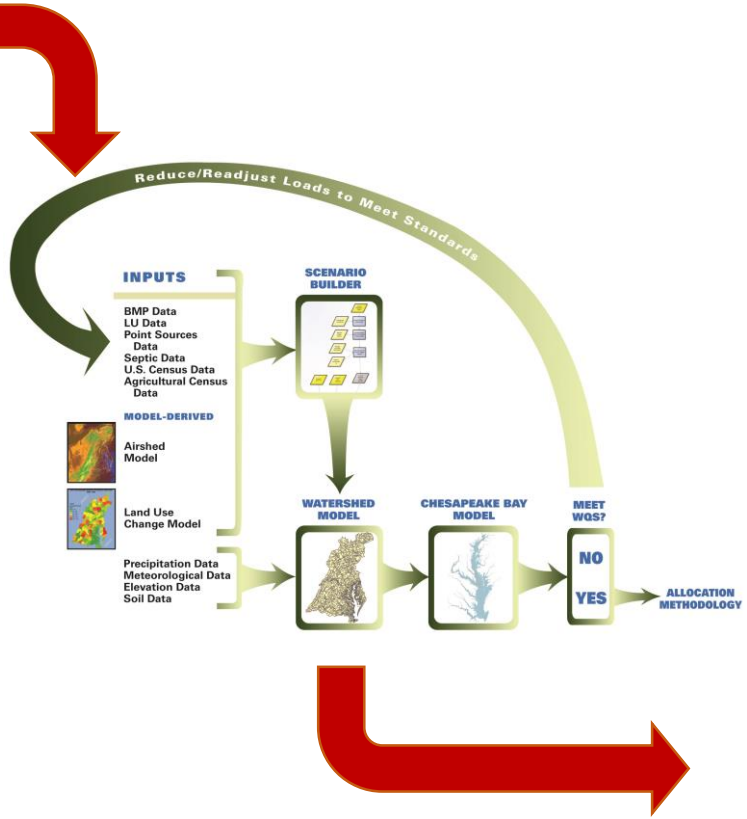
Two-Year Milestones and 2017

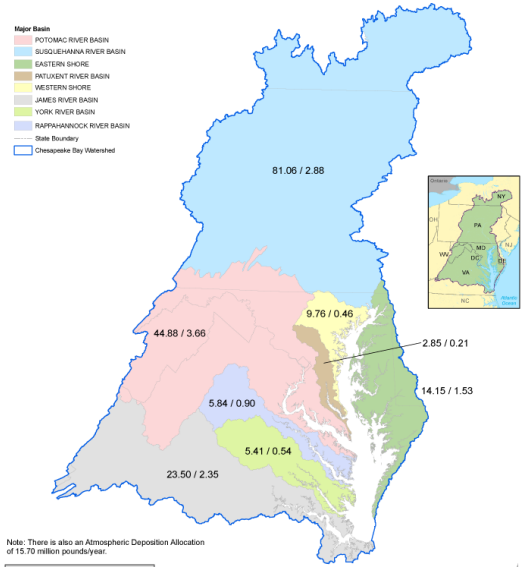


Assumes Constant Reduction Over Time

Phase III WIPs and Planning Targets

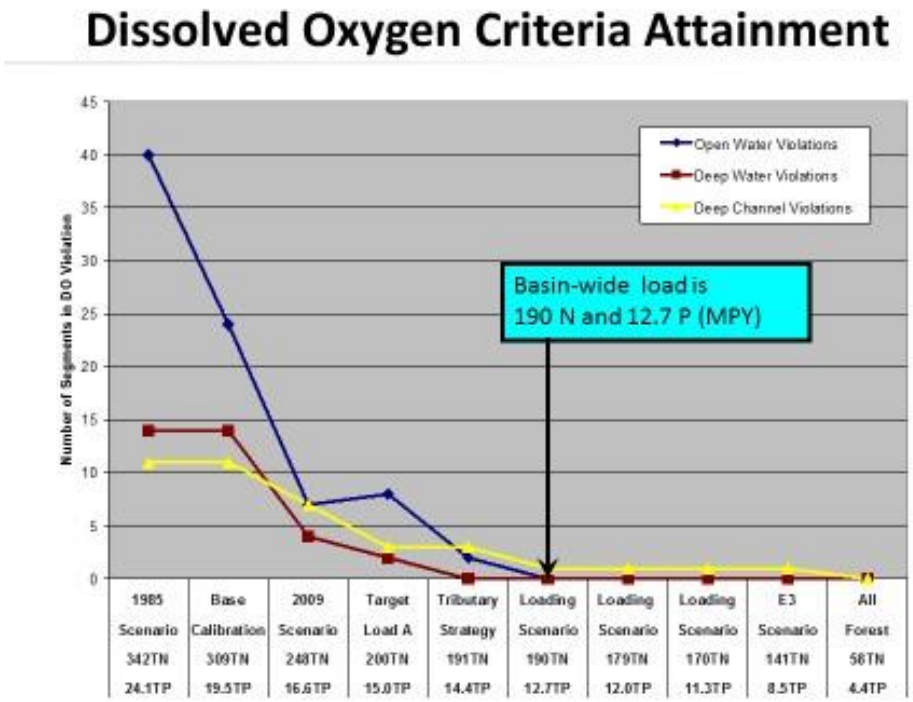
Target Method





Changes

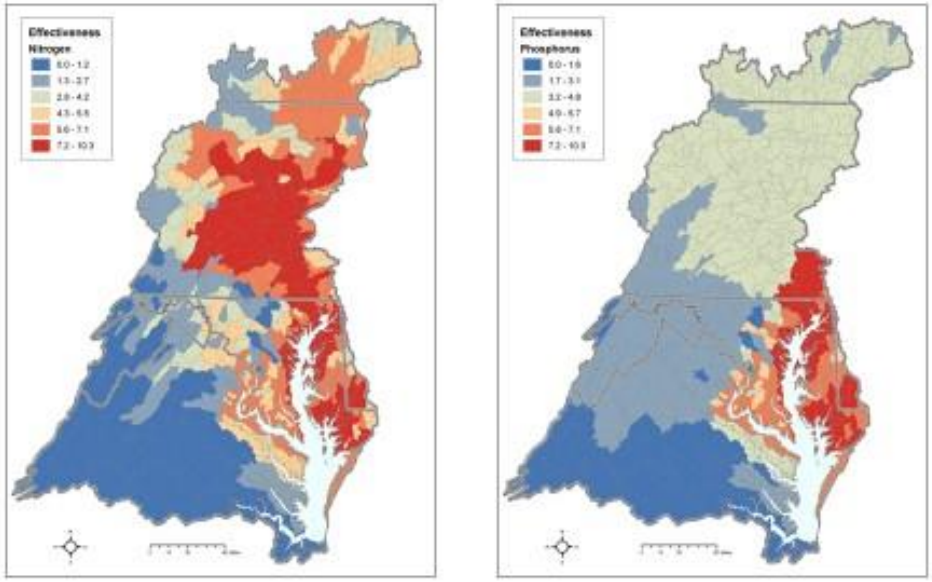
- New Watershed Model Loads
  - Higher coastal plain loads
  - Change in seasonality
- New Estuarine Model
  - Biogeochemical changes
  - Wetland and shoreline
- Climate Change



Changes

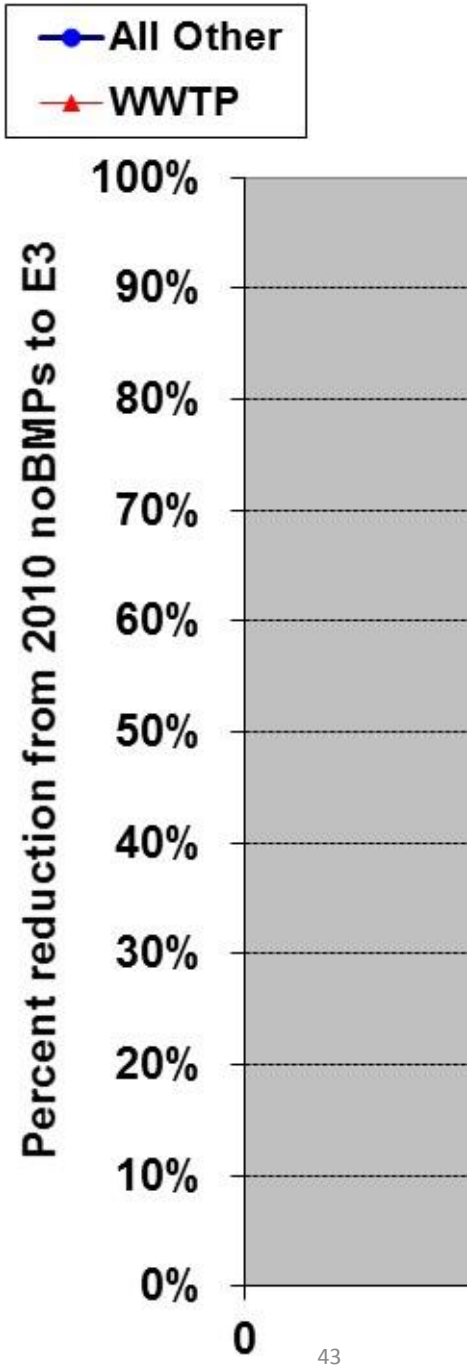
- New Watershed Model
  - Change in delivery factors
- New Estuarine Model
  - Biogeochemical changes

Relative Effect of a Pound of Pollution on Bay Water Quality



Changes

- New Watershed Model
  - Definition of E3
  - Effectiveness of BMPs
  - Loading rate of land uses



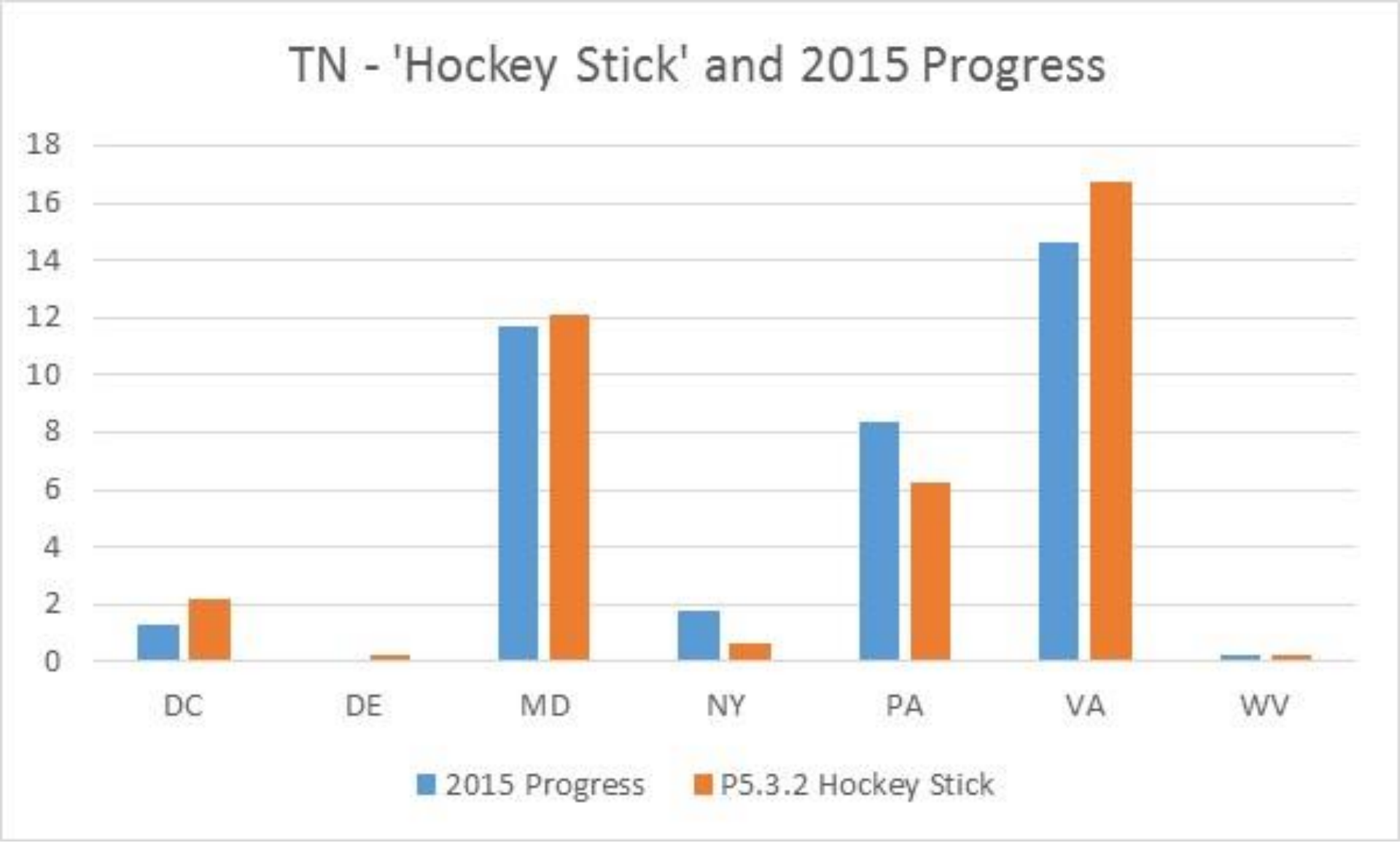
Default Target Method

- Plot effectiveness vs percent effort
- Use 2010 as the base year
- Set upper half of WWTP line at 3 mg/l equivalent; intercept at 8 mg/l
- Most effective basin is 20 percentage points higher than least effective for ‘all other’ line
- Special cases
- Hydro Period
- Critical Period

- Conowingo
- Climate Change

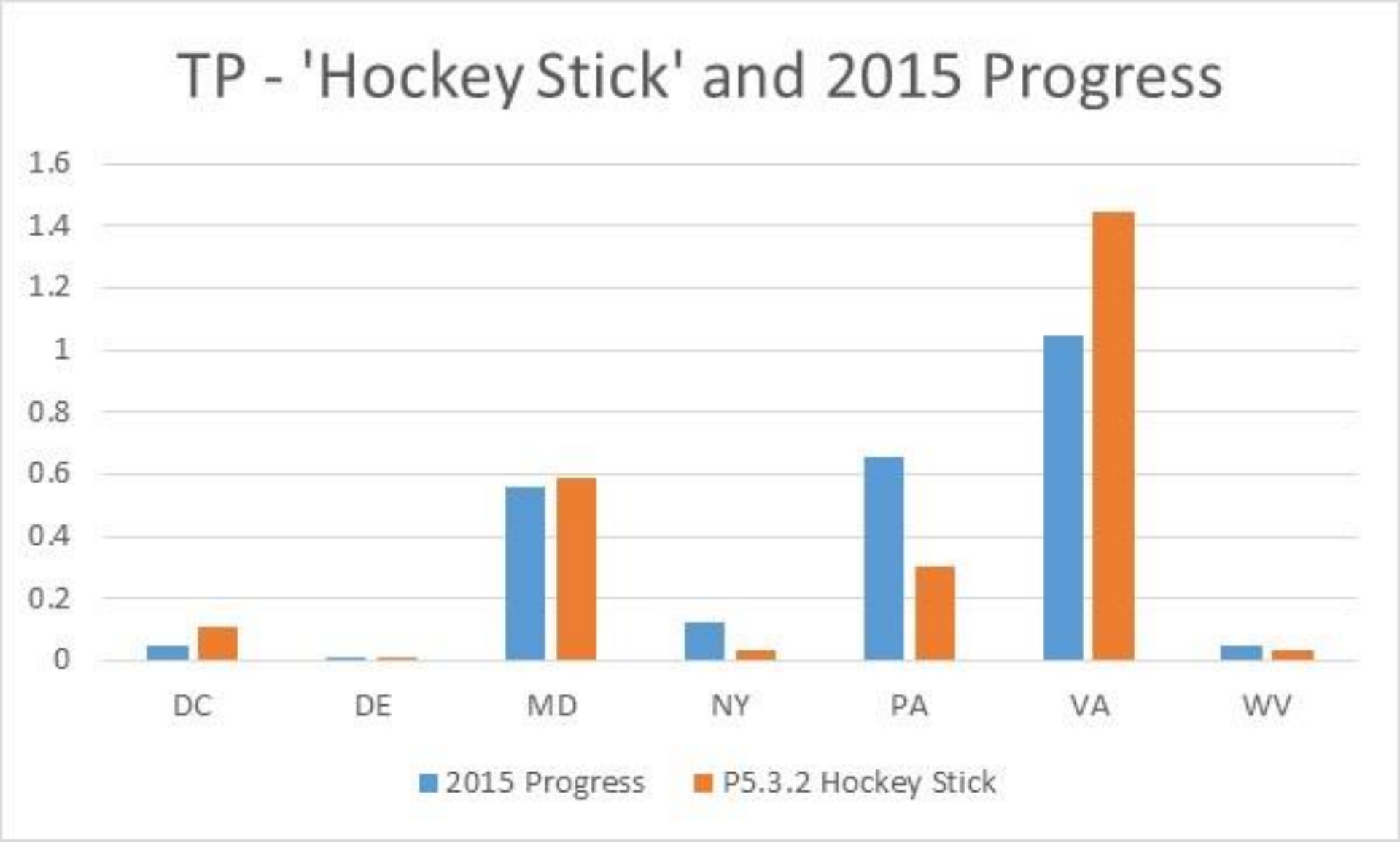
Special Request Topics

- How are we doing relative to the WWTP hockey stick?
- Why does historical data matter?
- What about monitoring trends?



Draft values – for WQGIT discussion purposes

Differences reflect jurisdictional choices on the source of reductions

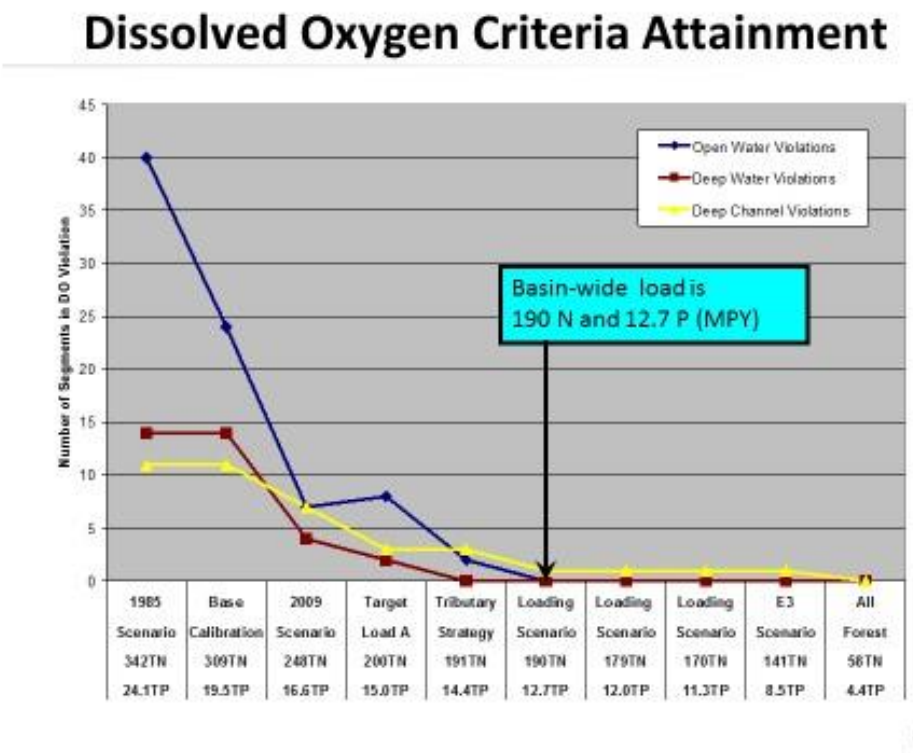


Draft values – for WQGIT discussion purposes

Differences reflect jurisdictional choices on the source of reductions

Historical Data Matters

Critical Period 1993-1995



One way to understand the TMDL question:
How much more do we need to implement in addition to what was already on the ground in the early 1990s to meet water quality standards

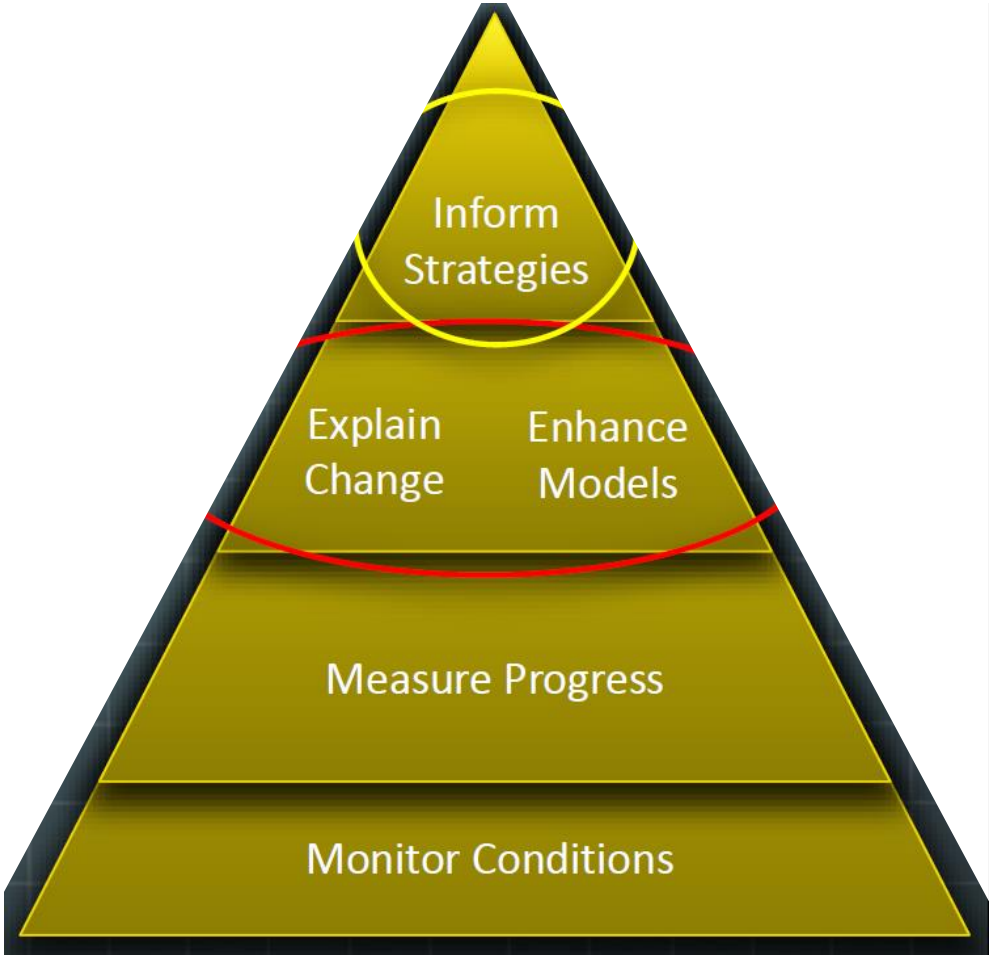
Historical Cleanup

- A lack of historical data during the calibration period (1985-2013) will result in a calibrated Phase 6 Model which does not accurately account for the effect of changes in implementation.
- However, states will have the opportunity to update their Phase 6 historical record each year as part of reporting progress to NEIEN.
- Accurate revisions to historical data will be beneficial in assessing progress during each progress year and milestone period.

Monitoring Trends

- As currently formulated, monitoring trends are not part of the formula for calculating planning targets.
- Monitoring concentrations and estimated loads are used in the calibration of the models.
- Monitoring generates new knowledge about the watershed which is incorporated into decision tools.
  - Conowingo
  - Phosphorus
  - Other Explaining Trends work
- Monitoring can be used to inform jurisdictional choices. For example:
  - Move implementation to areas where loads are climbing
  - Move implementation to areas with shorter lag times

Role of Monitoring



From Scott Phillips, USGS