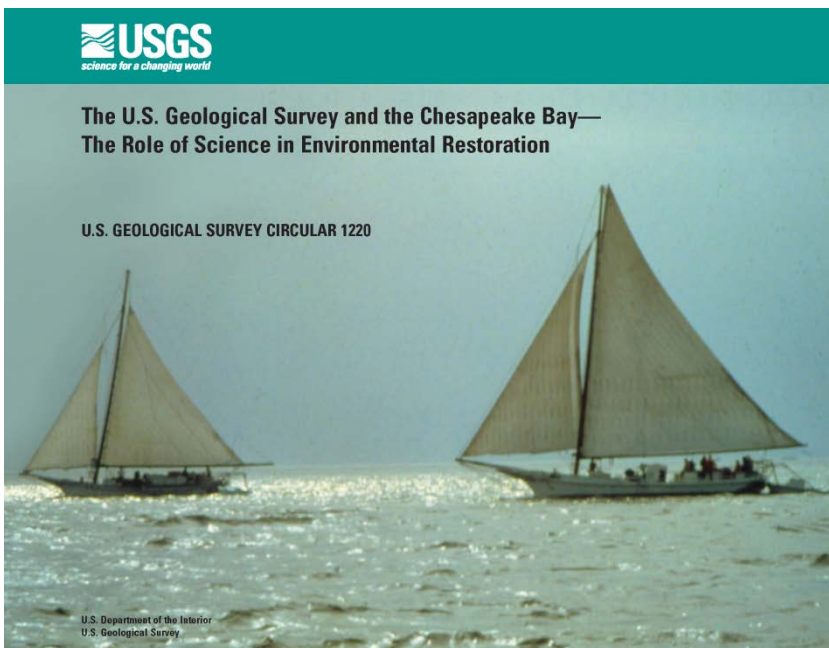
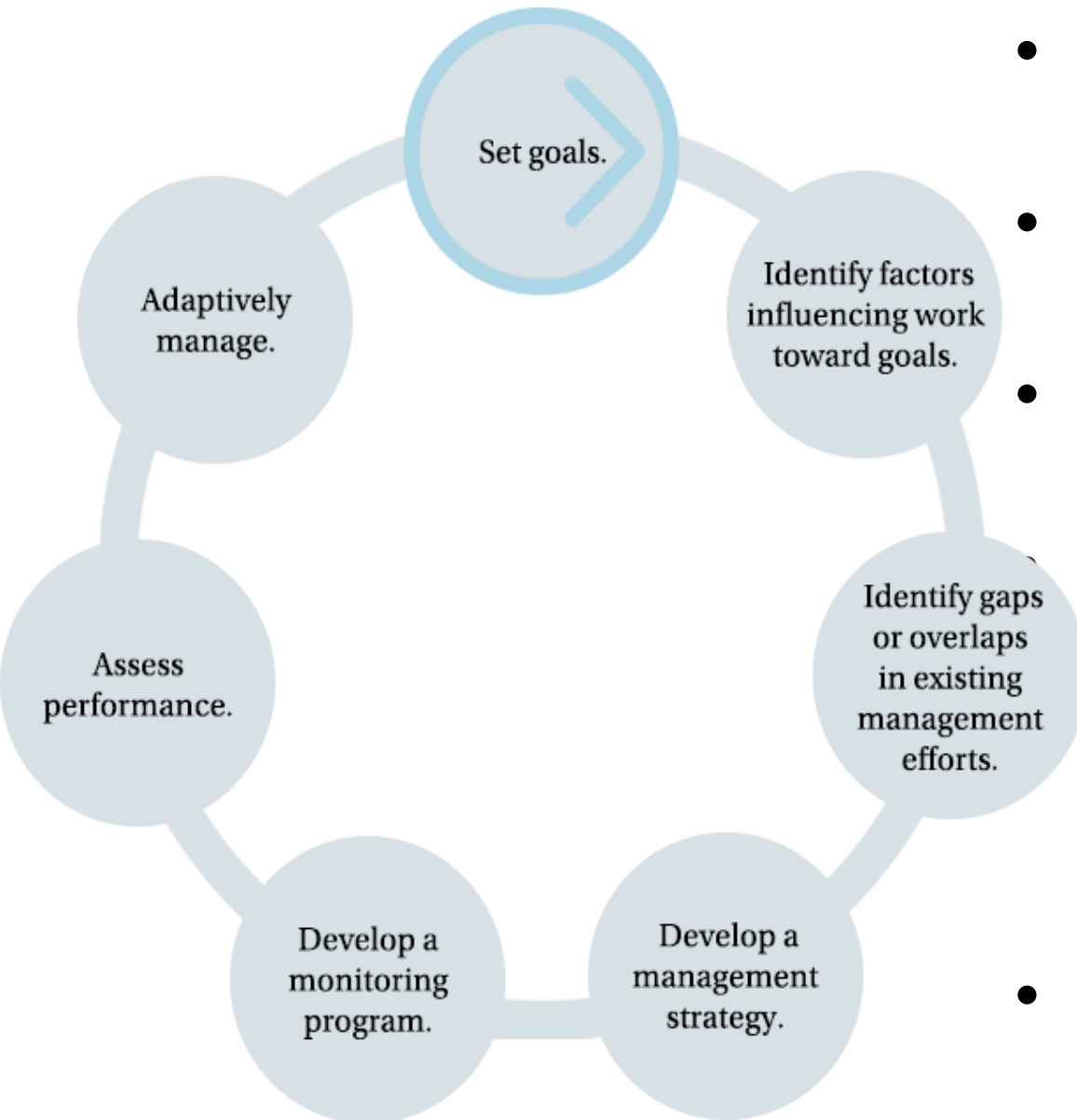


Science to Support Adaptive Management in the Chesapeake Bay Program: Approaches and Challenges



Scott Phillips (USGS)
On behalf of many others
NCER
April 2016

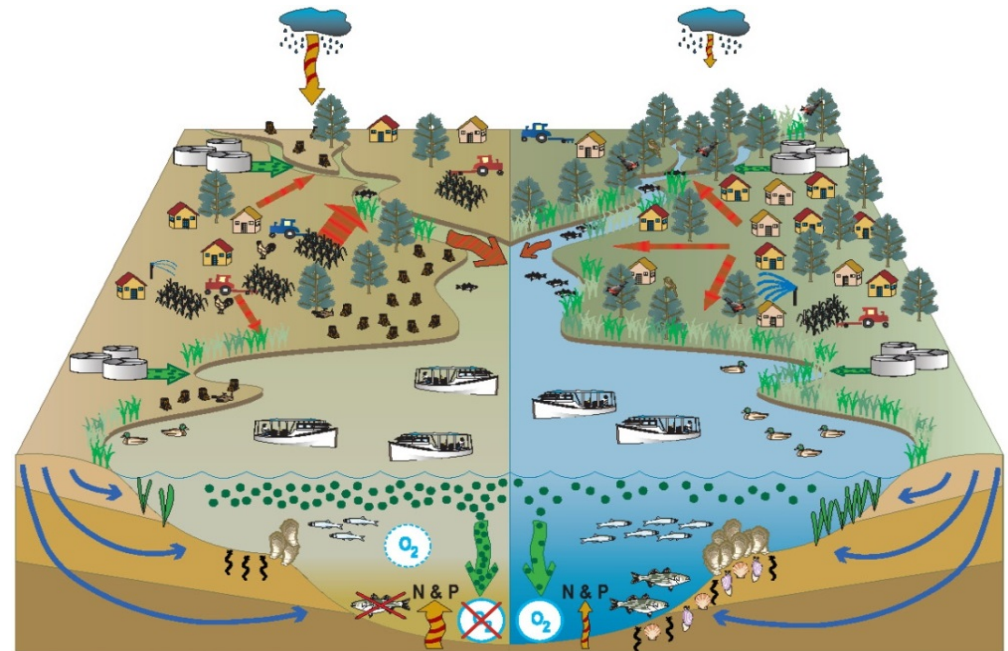
Decision Framework



- **Goals**
 - Populations/habitat
- **Factors**
 - Ecosystem stresses
- **Management strategies**
 - Models
- **Monitor**
 - Indicators
- **Assess**
 - Status and trends
 - Explain change
- **Adapt**
 - Implications

Water Quality and TMDL

- Declining fisheries
- Poor DO
- Loss of SAV
- TMDL
 - WQ standards
 - Nutrients and sediment
 - Actions by 2025
 - WIPs: States and federal agencies
- Decision framework

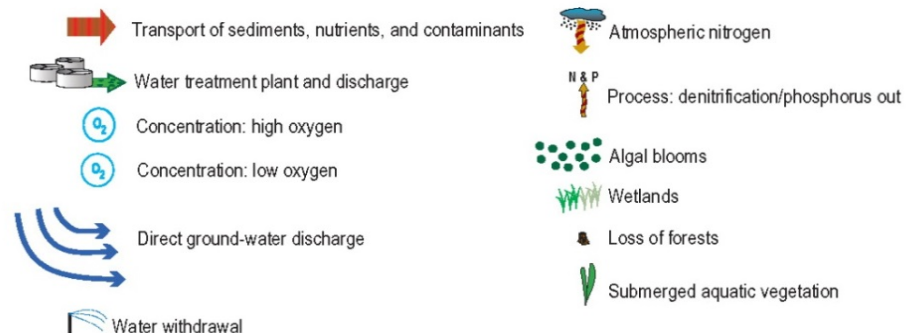


(Modified from CBP and IAN, 2005)

Present

Future

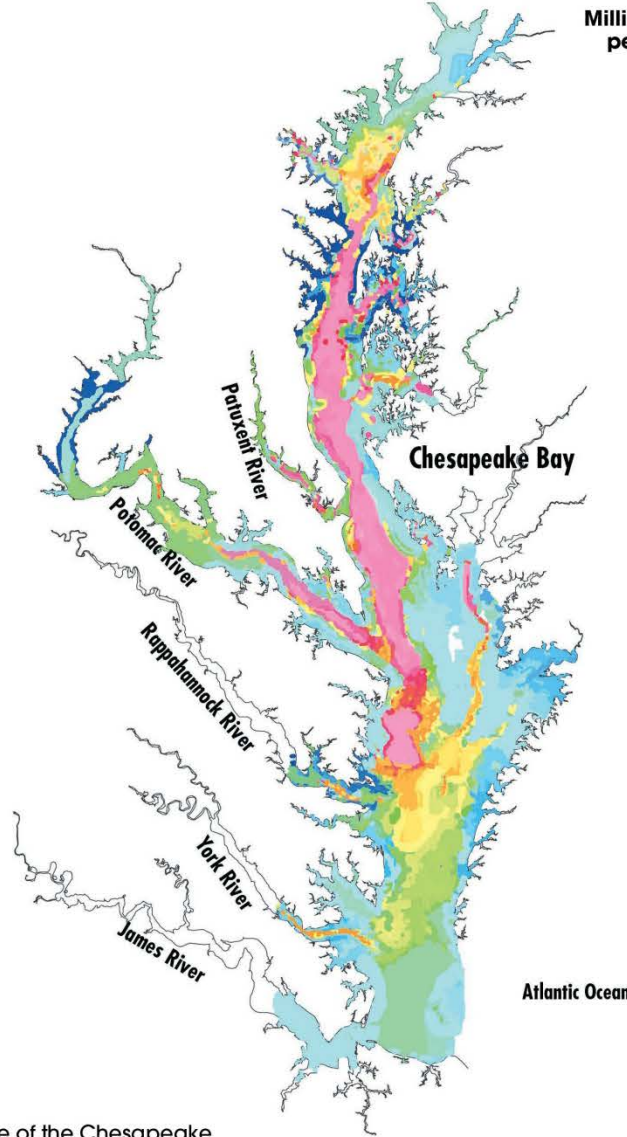
Explanation of Selected Symbols





Goal: DO for fisheries

July 2004
Source: Chesapeake Bay Program



Milligrams of Oxygen per liter of water:

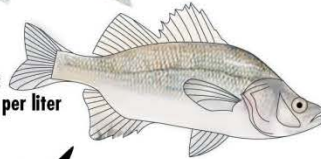


STRIPED BASS:
5.0 milligrams per liter



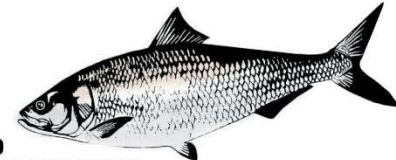
7.5

WHITE PERCH:
5.0 milligrams per liter



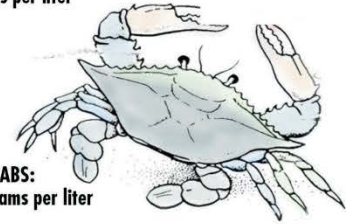
5.0

AMERICAN SHAD:
5.0 milligrams per liter

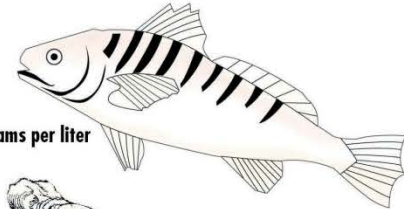


2.5

BLUE CRABS:
3 milligrams per liter

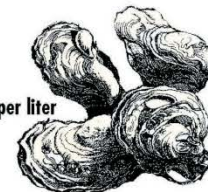


SPOT:
2 milligrams per liter



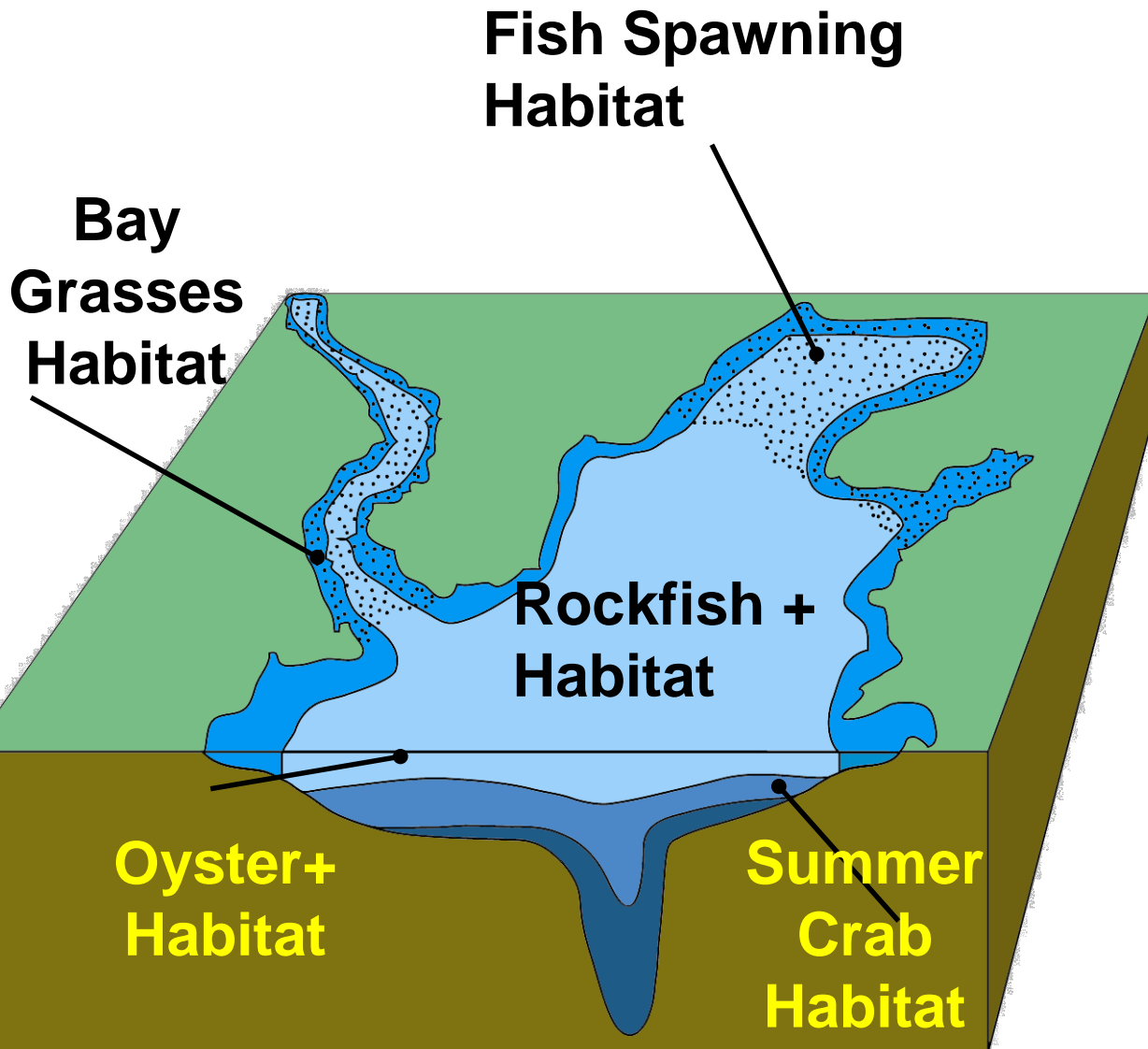
Dead Zone

OYSTERS:
0 1.0 milligrams per liter



In July 2004, 35 percent of the volume of the Chesapeake Bay was considered a Dead Zone.

Goals: Fisheries Habitats



-Designated
uses

-DO, Clarity

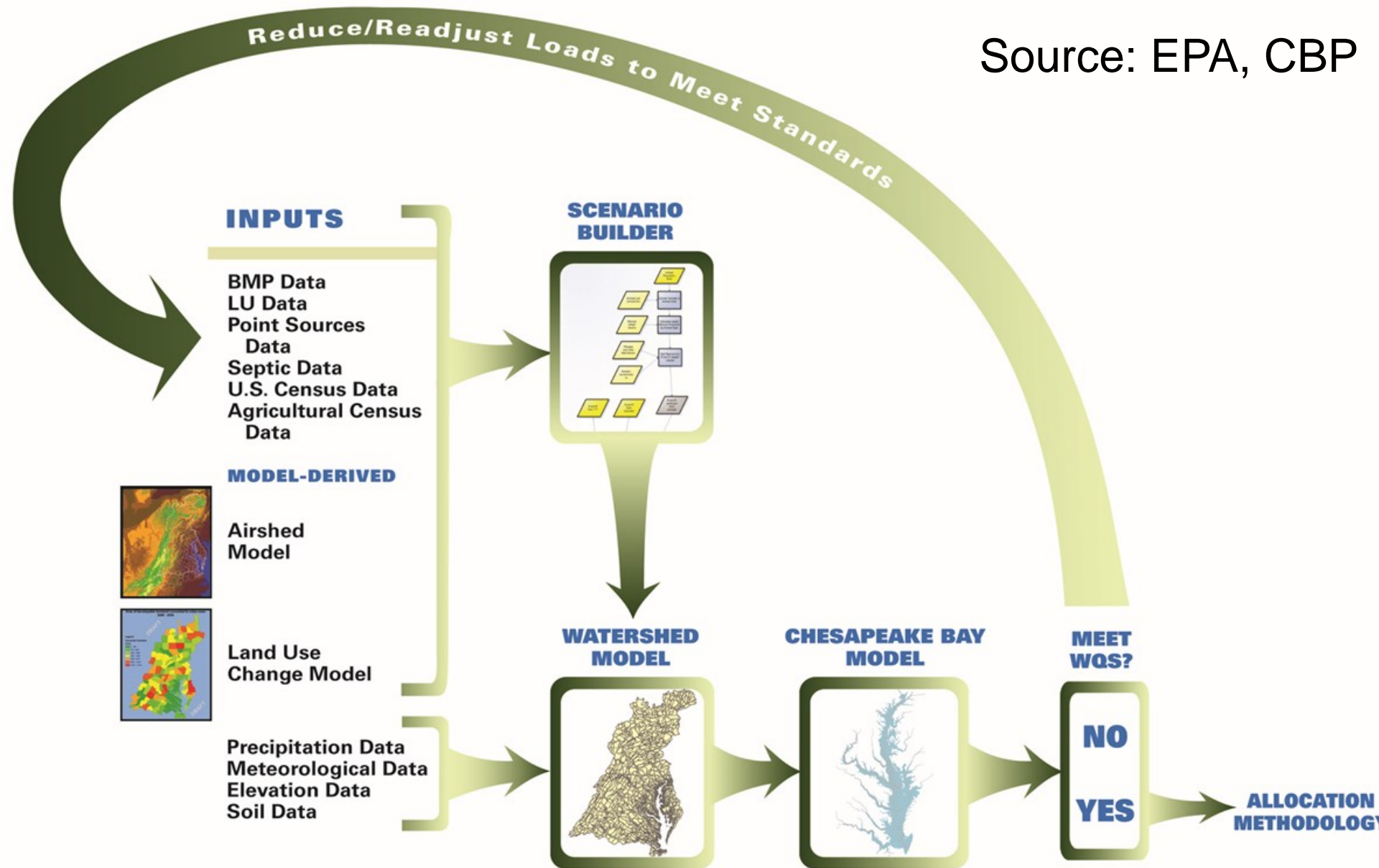
-Nutrients
and sediment
allocations

-Model
scenarios

Source: EPA, 2009

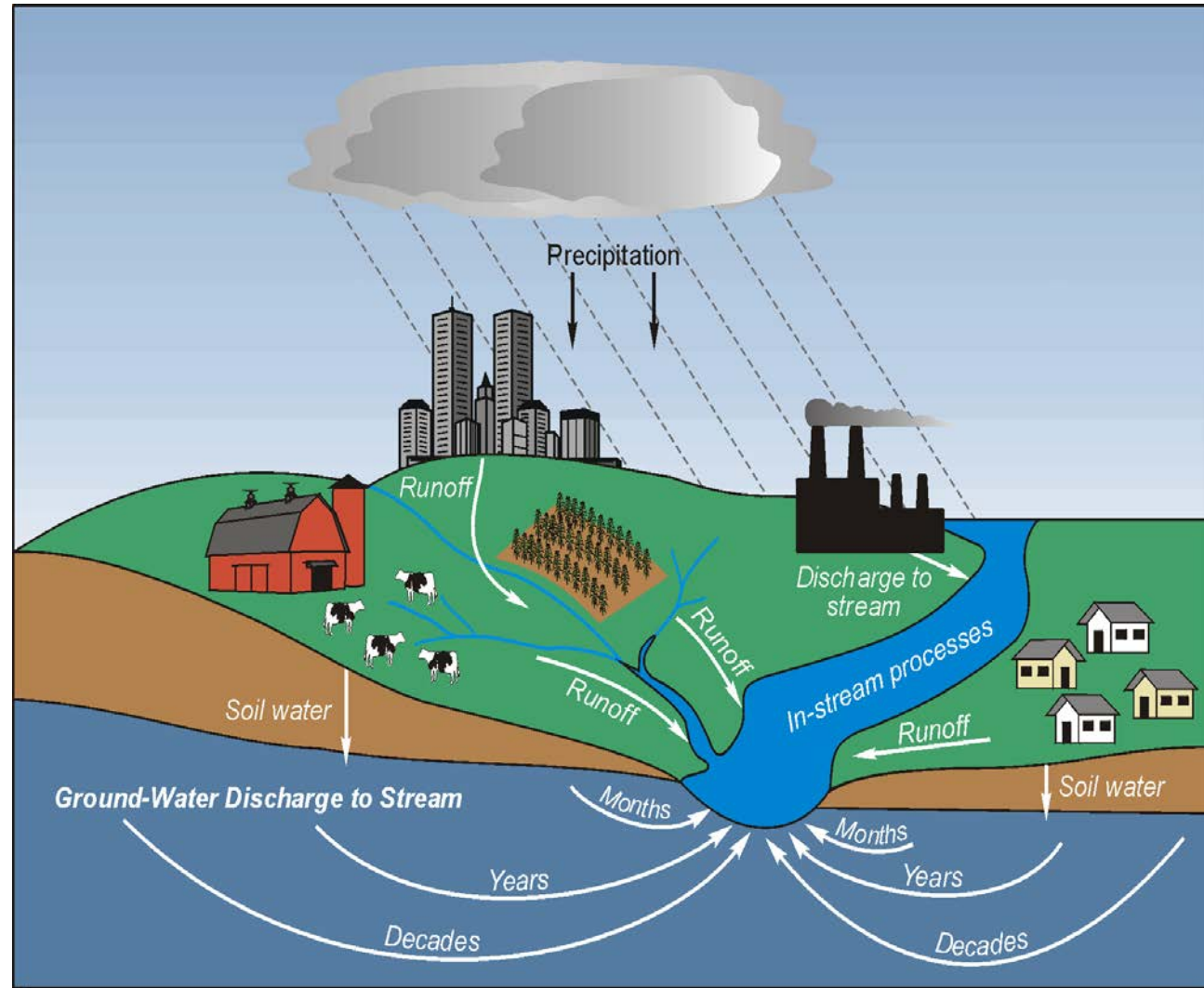
Models: setting allocations

Source: EPA, CBP



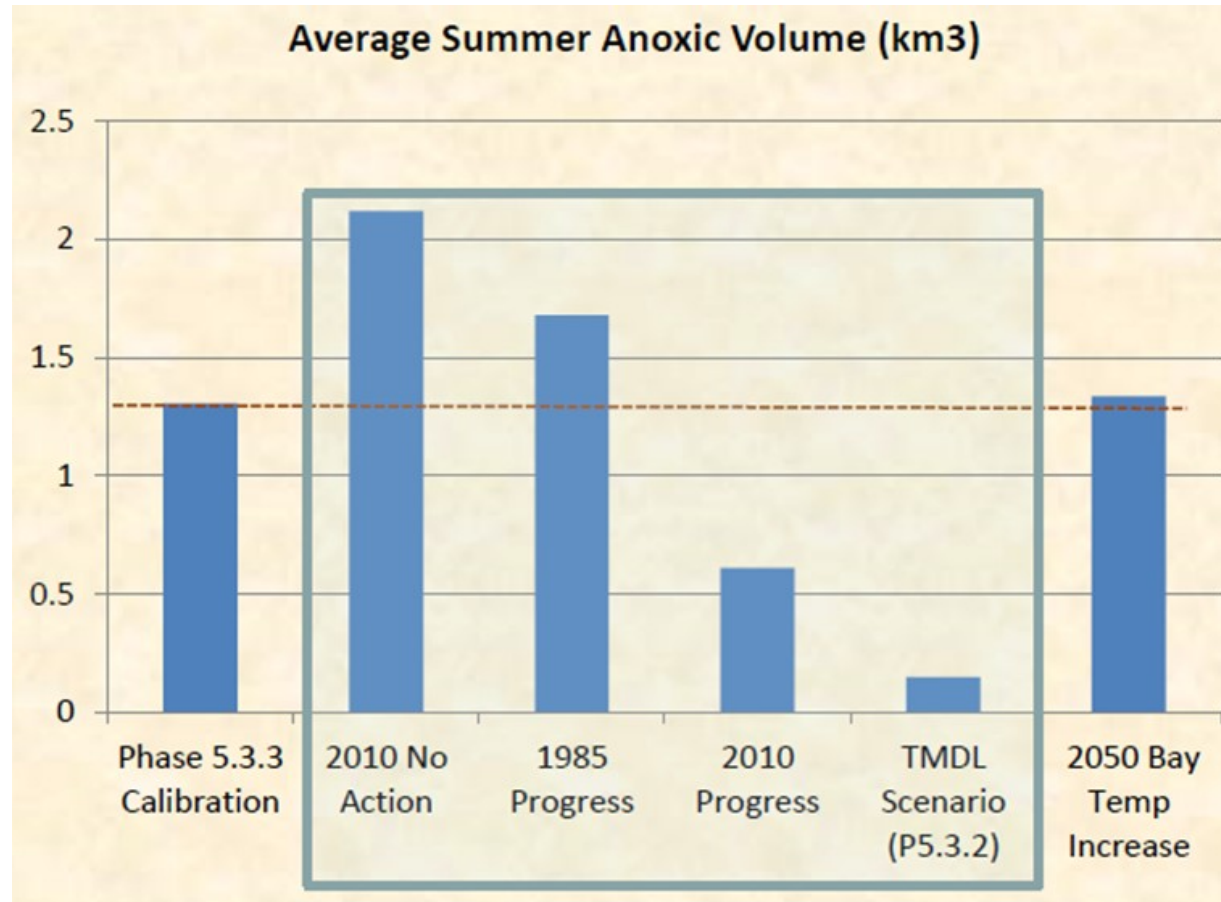
Factors affecting goal

- Population growth and land use
- Climate change & variability
- System Response
- Costs
- Uncertainty



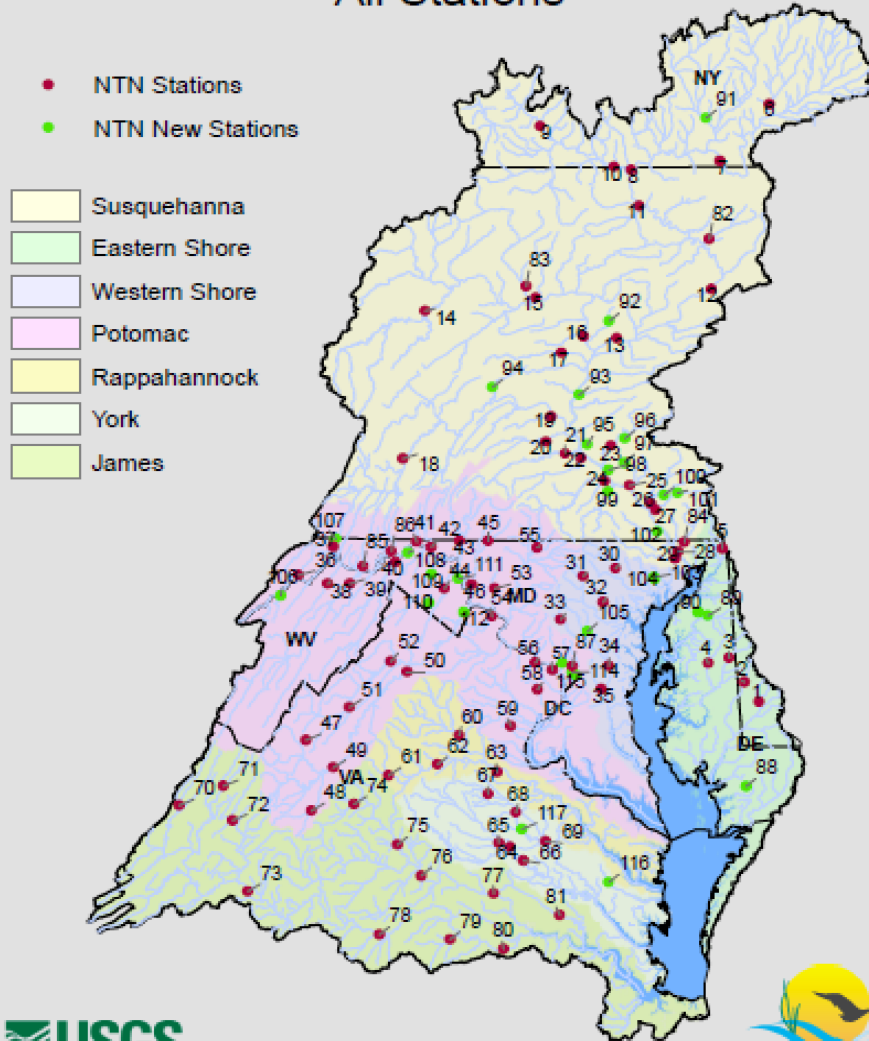
Management Strategies

- Allocations for each state
- Watershed Implementation Plans
- Programs and practices
- 2-year milestones
- MPA



Monitoring to assess progress

Chesapeake Bay Nontidal Network:
All Stations



- Practices
- Watershed
 - Nutrients and sediment
- Tidal waters
 - DO, Clarity, and Chl
 - Nutrients
- Flow adjustment

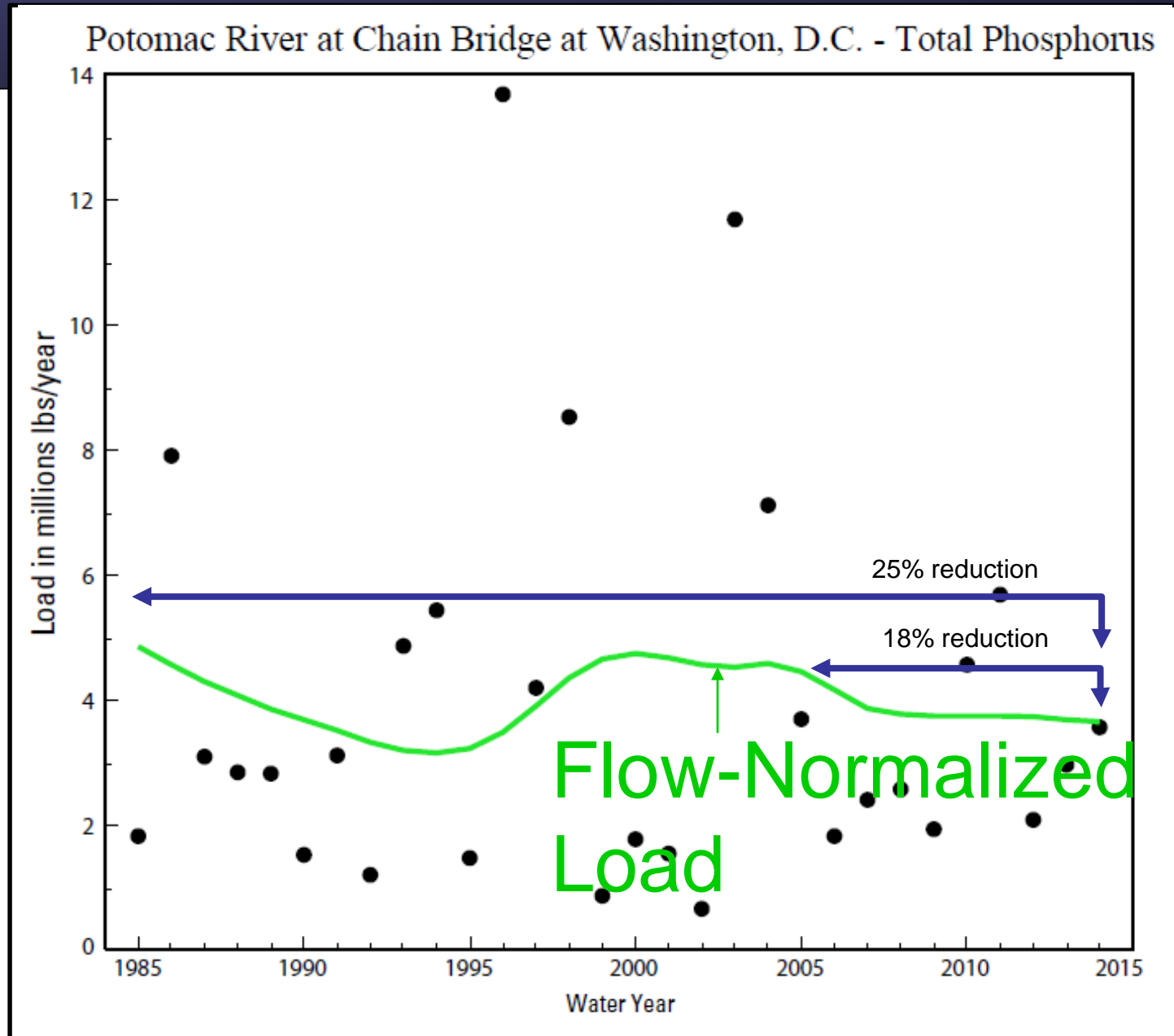
Source: USGS, 2016



Chesapeake Bay
Program

WRTDS Load and Trend

Total
reduction
nitrogen:
1985 to 2014
= -25%
2005 to 2014
= -18%



Total Nitrogen per Acre Loads and Trends: 2005-2014

Trend Direction

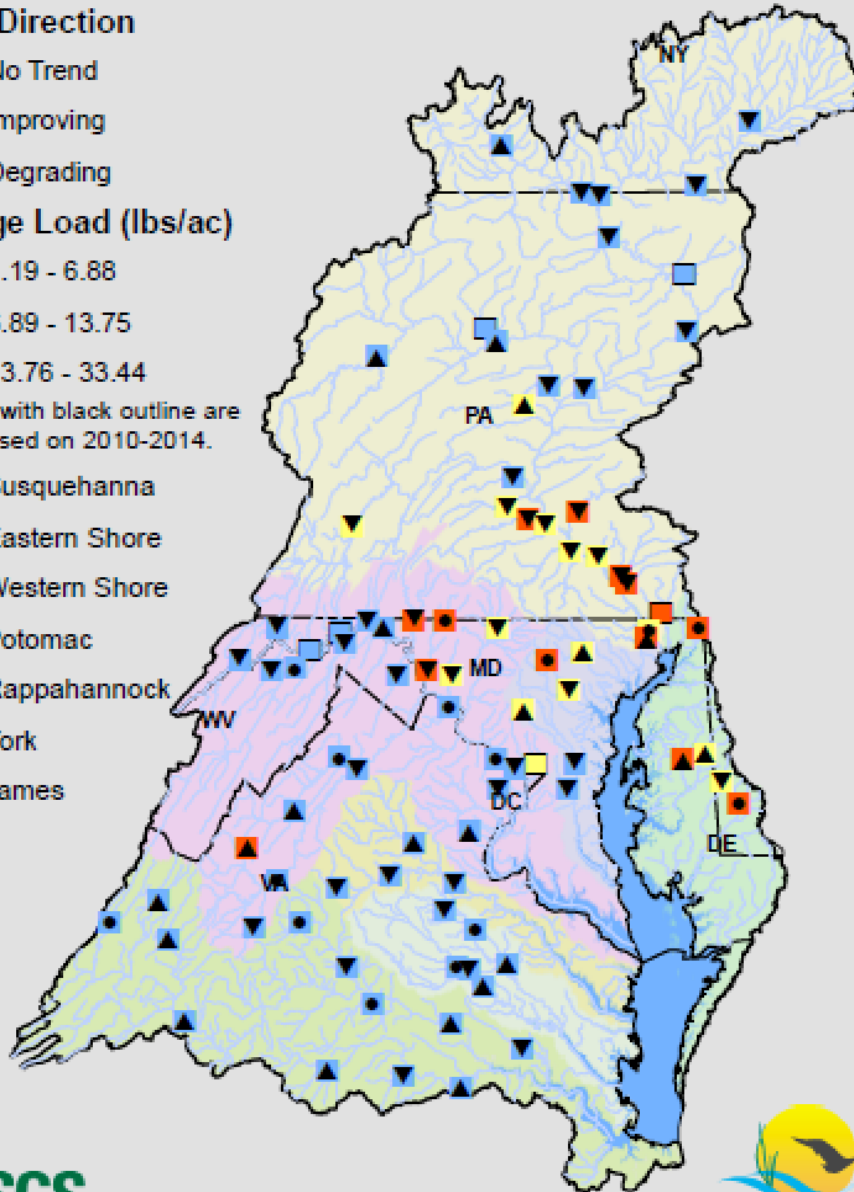
- No Trend
- ▼ Improving
- ▲ Degrading

Average Load (lbs/ac)

- 1.19 - 6.88
- 6.89 - 13.75
- 13.76 - 33.44

Squares with black outline are yields based on 2010-2014.

- Susquehanna
- Eastern Shore
- Western Shore
- Potomac
- Rappahannock
- York
- James



Nitrogen

River Yields

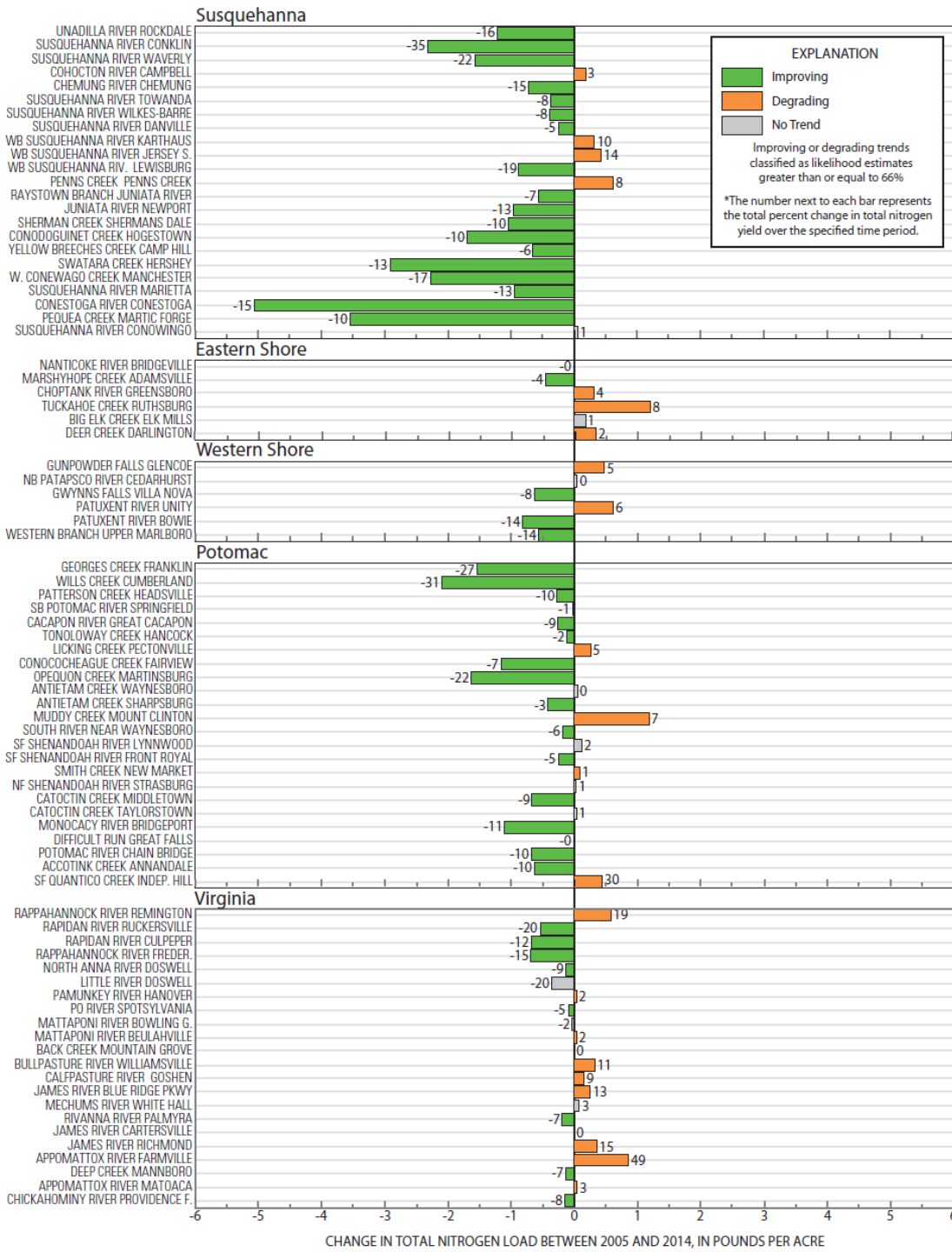
- Range: 1.2 to 33 lbs/acre
- Avg: 7.5 lbs/ac

Influenced by:

- Agriculture
- Urban lands
- WWTP
- Atmospheric dep.
- Practices

Source: USGS, 2016

Nitrogen Change (2005-2014)



-Trends

- Improving: 54%
- Degrading: 27%
- No Trend: 19%

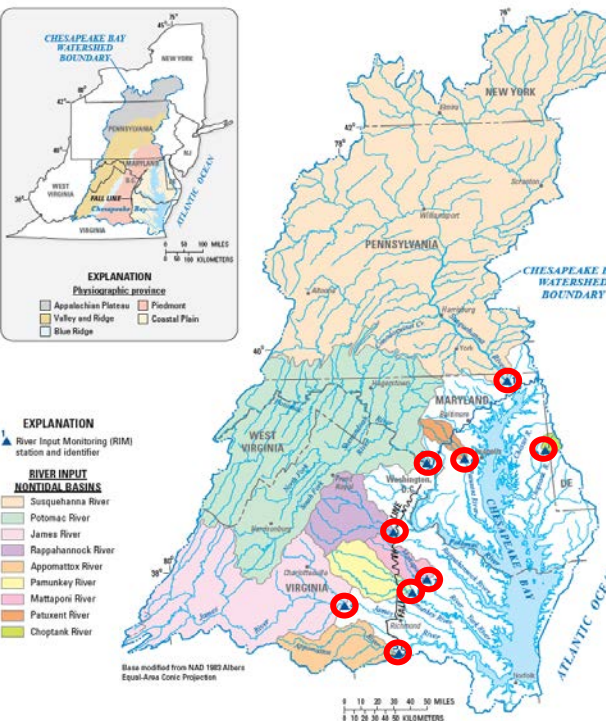
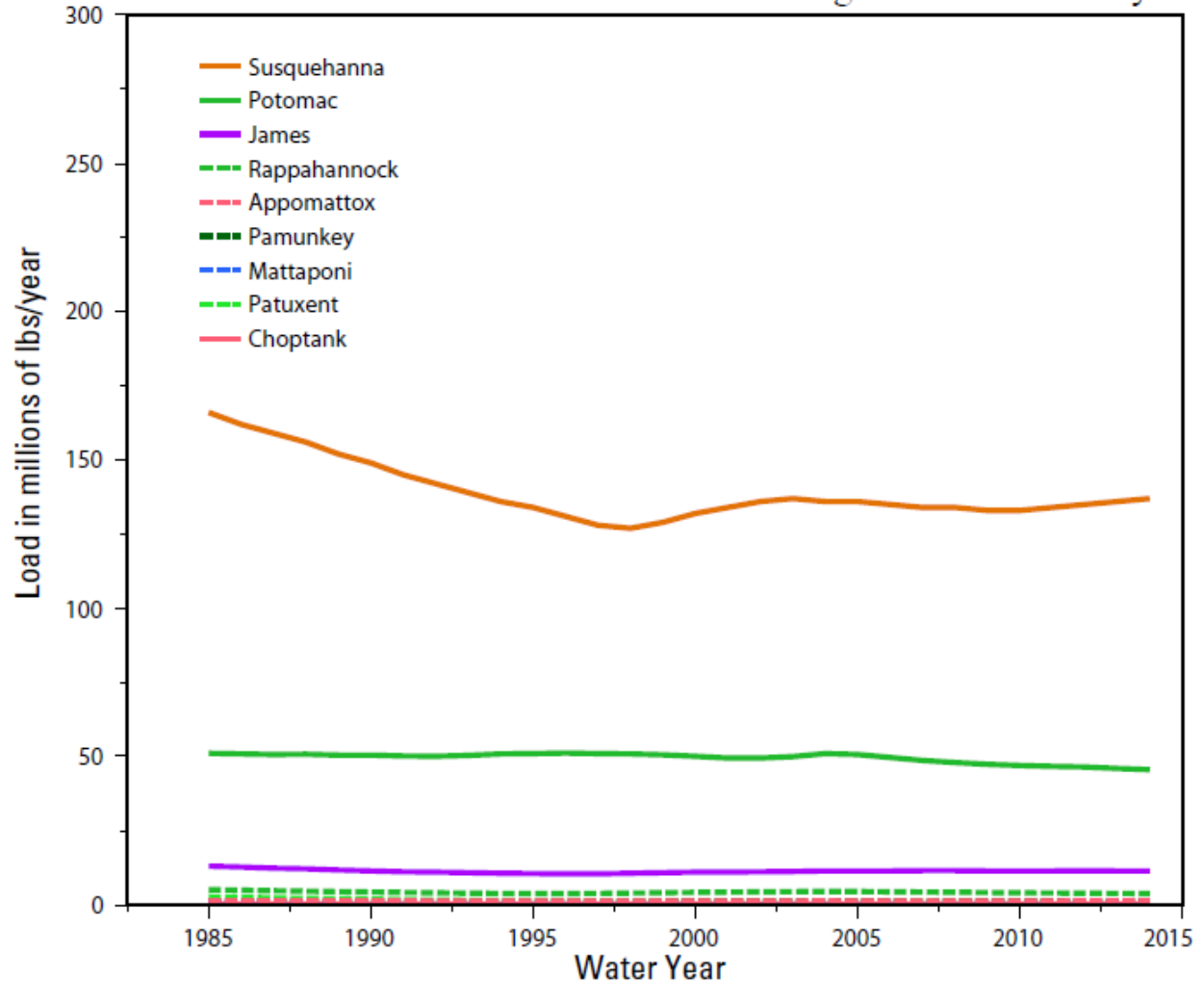
-Vary by watershed

-Practices and pressures

Source: USGS, 2016

Rivers entering the Bay

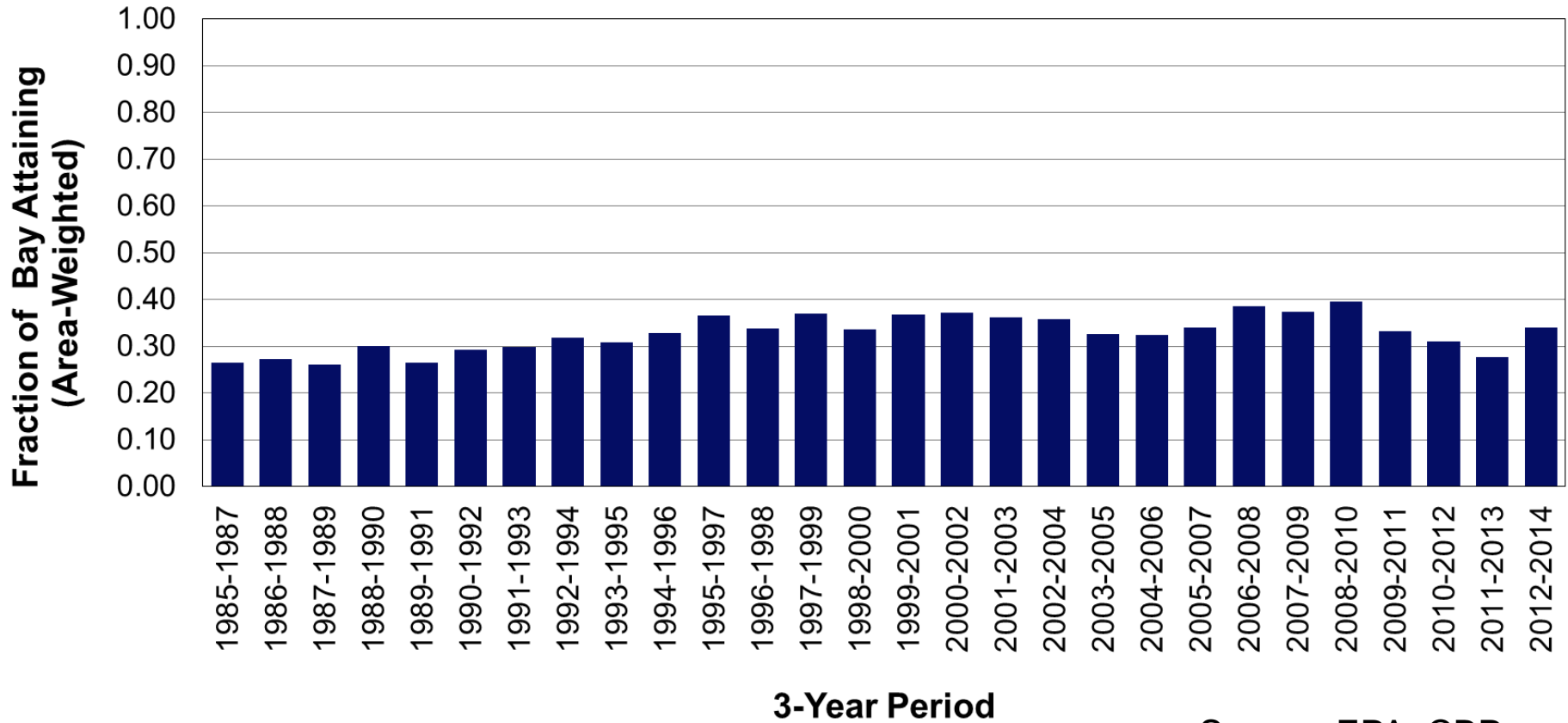
Individual river contributions of Total Nitrogen loads to the Bay



Source: USGS, 2016

Changes in tidal waters

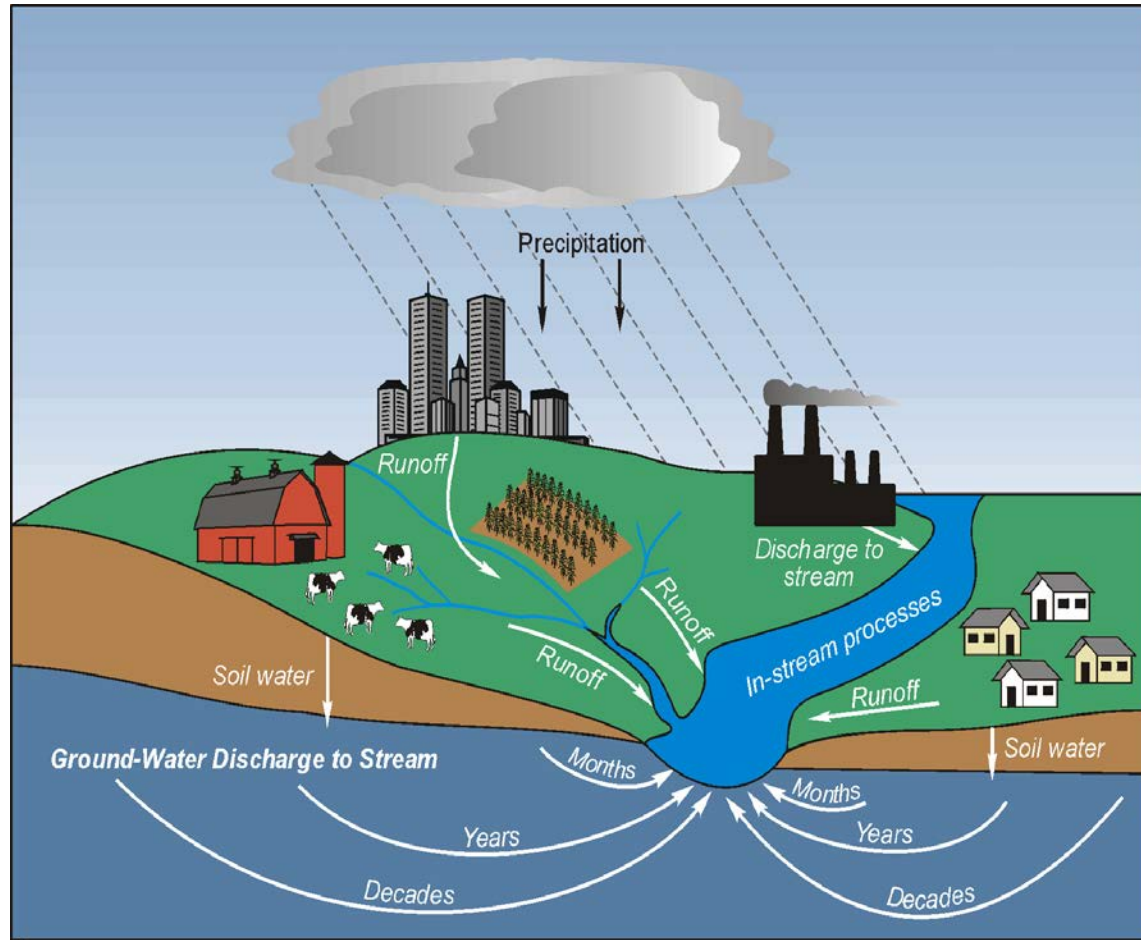
Water Quality Standards Attainment



Source: EPA, CBP

Assess and Explain

- Practices to water quality
- Sources and land use
- Management practices
- Climate
- Response times
- Case studies



Explaining Trends

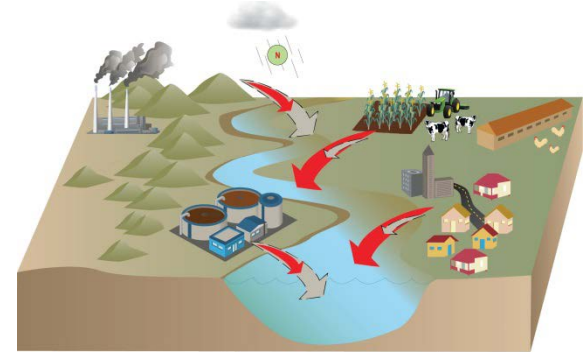
1. What Works

- Upgrades to WWTPs
- Reductions in air emissions
- Some agricultural practices



2. Challenges

- Response times
- Development and intensified agriculture



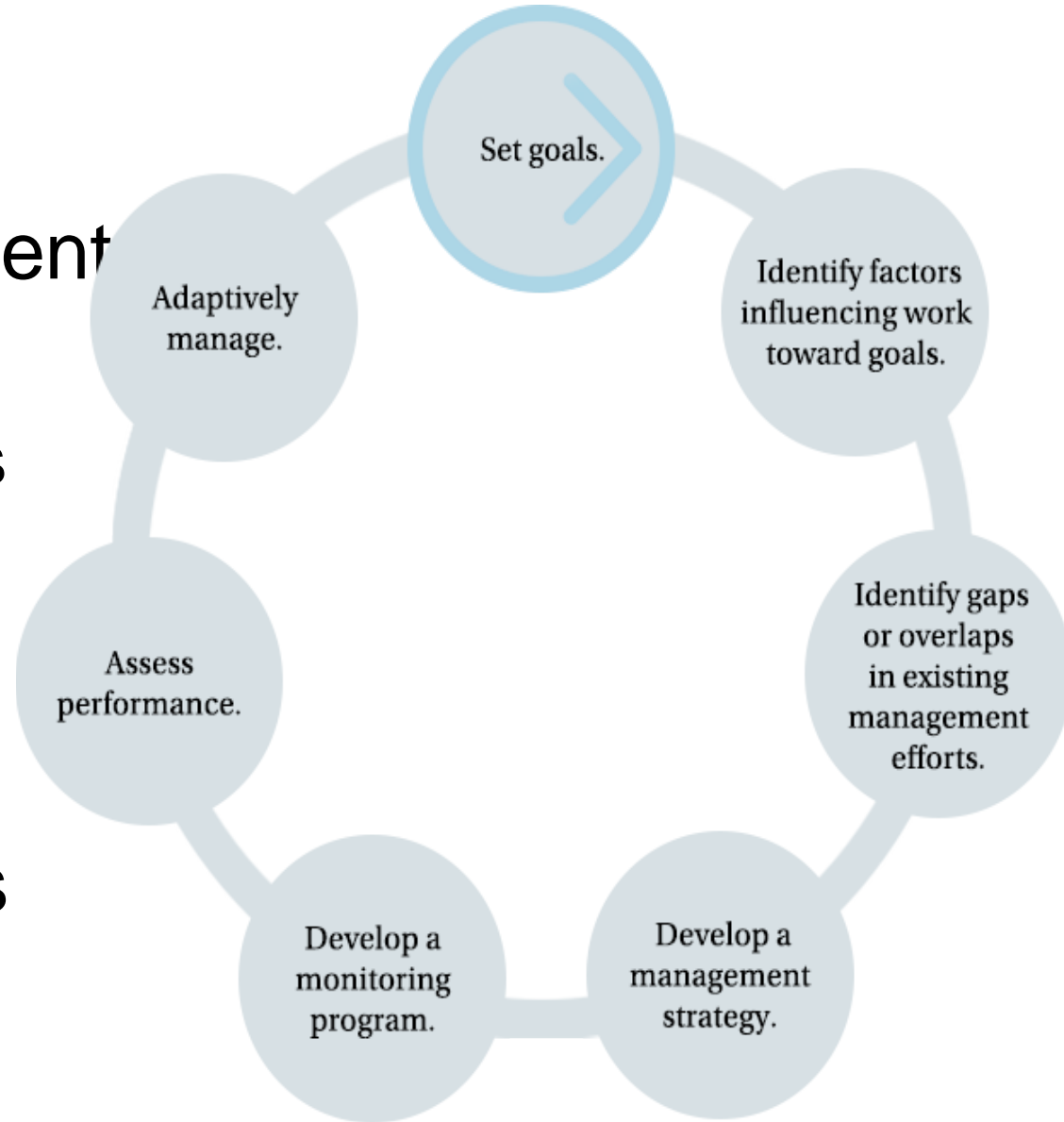
3. What We Need

- Targeting
- Stormwater management and monitoring



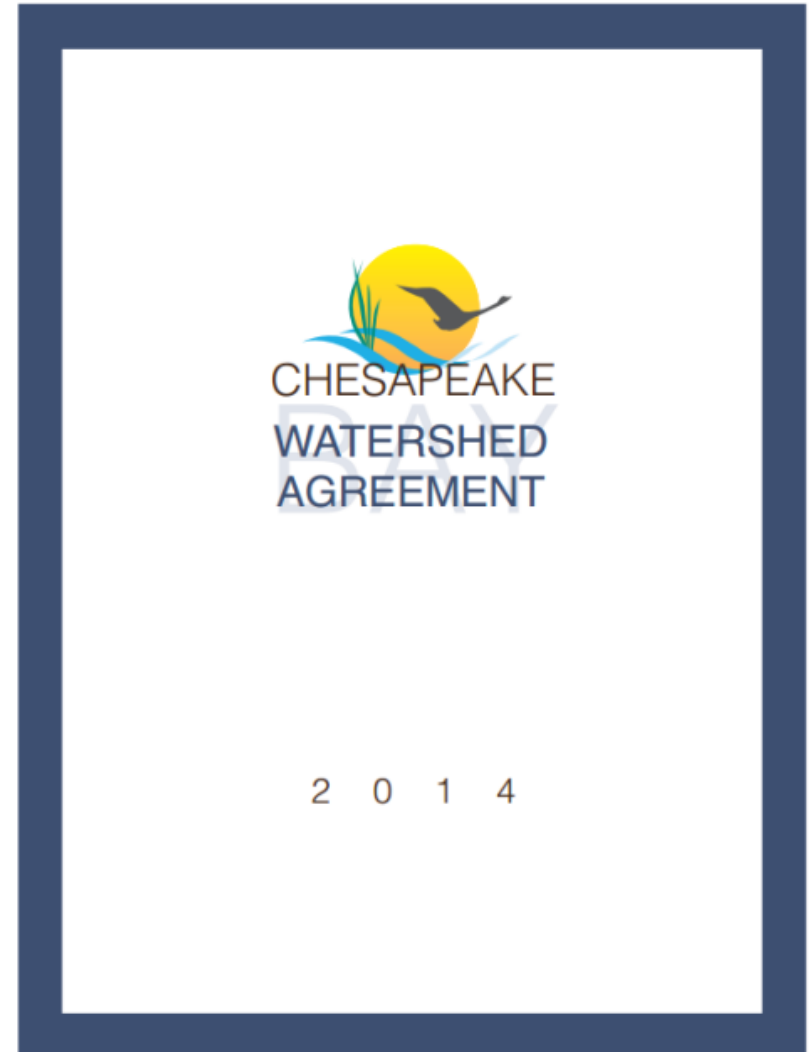
Adapt for Water Quality

- Implement WIPs
- 2-year milestones
- Midpoint Assessment
 - Enhance models
 - Assess allocations
 - Revise WIPs
- 2025: practices in place
- Meeting standards



Meeting Expanding Needs

- Bay Agreement
 - 10 goals
 - 31 outcomes
- Expanding Needs
 - Supporting AM
- Challenges
 - Beyond water quality
 - Prioritizing
 - Changing monitoring
 - Expanding capacity
- Approaches to address



CHESAPEAKE SCIENCE SUPPORT

GOAL IMPLEMENTATION TEAMS: SCIENCE NEEDS

FISHERIES

HABITAT

WATER
QUALITY

HEALTHY
WATERSHEDS

STEWARDSHIP

LEADERSHIP

STAC: Science Advisors

- GUIDANCE
- REVIEW
- ADVICE ON PROVIDERS

STAR: Science Coordination

- MONITORING
- DATA INTEGRITY
- STATUS AND TRENDS
- EXPLAIN AND PREDICT CHANGE
- MODELING
- CLIMATE CHANGE
- INFORMATION AND GIS SUPPORT
- SYNTHESIZE AND INFORM

Science Providers

CBP OFFICE

FEDERAL

STATE

LOCAL

ACADEMIC

NGOs

Expanding capacity

Short-term:

- Workshops on:
 - Aligning resources
 - Expanding monitoring needs
- Set priorities
- Better integrate ongoing efforts
- Modify existing monitoring

Longer-term:

- Multi-outcome approaches
- Collaborate with new partners
- Incentives and funding to build science capacity



Summary

- Adaptive management
 - Selected successes
 - Difficult for entire CBP
 - Multiple goals, outcomes
- Science support
 - Selected strengths
 - Increased needs
 - Integrate existing efforts
 - Expand capacity through new partners and incentives
- Sessions 35 & 38

