Lower Susquehanna River Watershed Assessment

"Sediment Behind the Dams"

Parallel Studies

- Baltimore District, State of MD, Other Partners
  - 2008 – 2011 application period.
  - ADH hydrodynamic and sediment transport model for Conowingo Reservoir and Susquehanna Flats
  - HEC-RAS hydrodynamic and sediment transport model for Lakes Clarke and Aldred.
  - CBEMP for Chesapeake Bay.

Parallel Studies

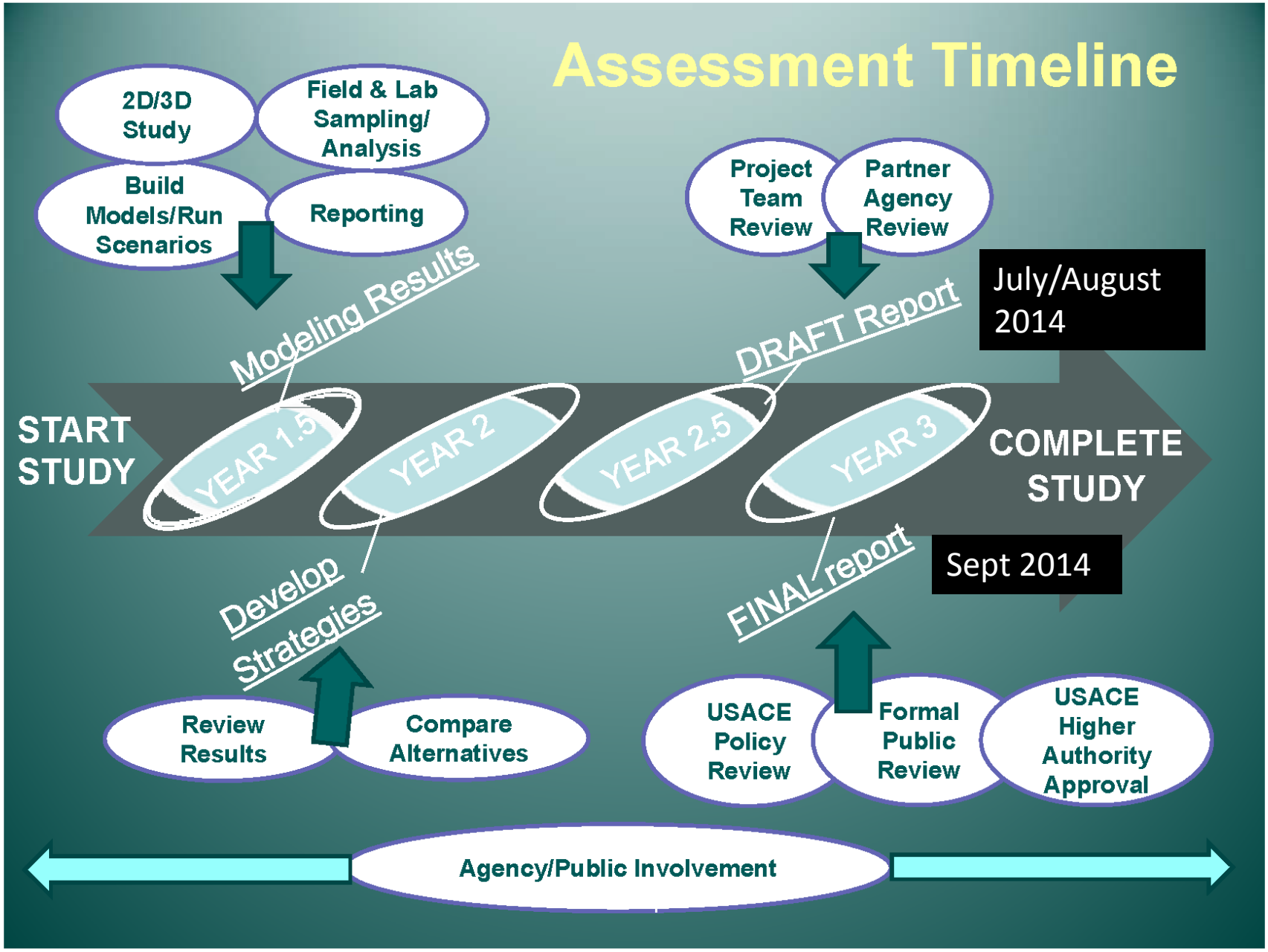
- Objectives
  - Evaluate strategies that will maintain or decrease sediment and associated nutrient delivery to Chesapeake Bay.
  - Prioritize strategies that will reduce the volume of sediment and associated nutrients available for transport during high-flow storm events.
  - Determine the impacts of the loss of sediment and nutrient storage capacity behind Conowingo Dam to the Chesapeake Bay.

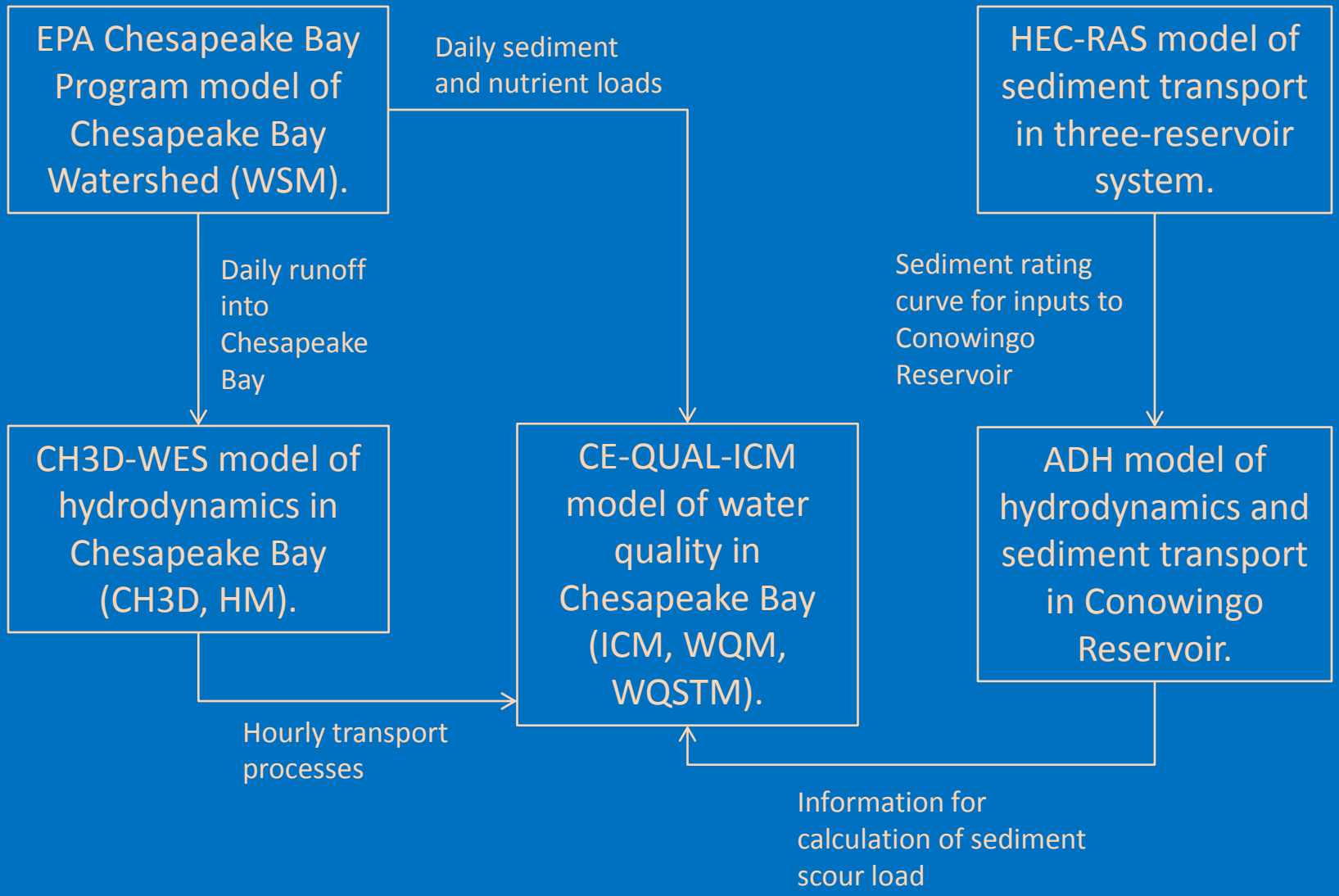
Parallel Studies

- USEPA Chesapeake Bay Program
  - 1991 – 2000 application period.
  - HSPF model for Conowingo Reservoir.
  - CBP Watershed Model for remainder of watershed.
  - CBEMP for Chesapeake Bay.
  - Objective
    - Assess impact of reservoir filling and scouring on Chesapeake Bay following implementation of TMDL's.

Today's Program

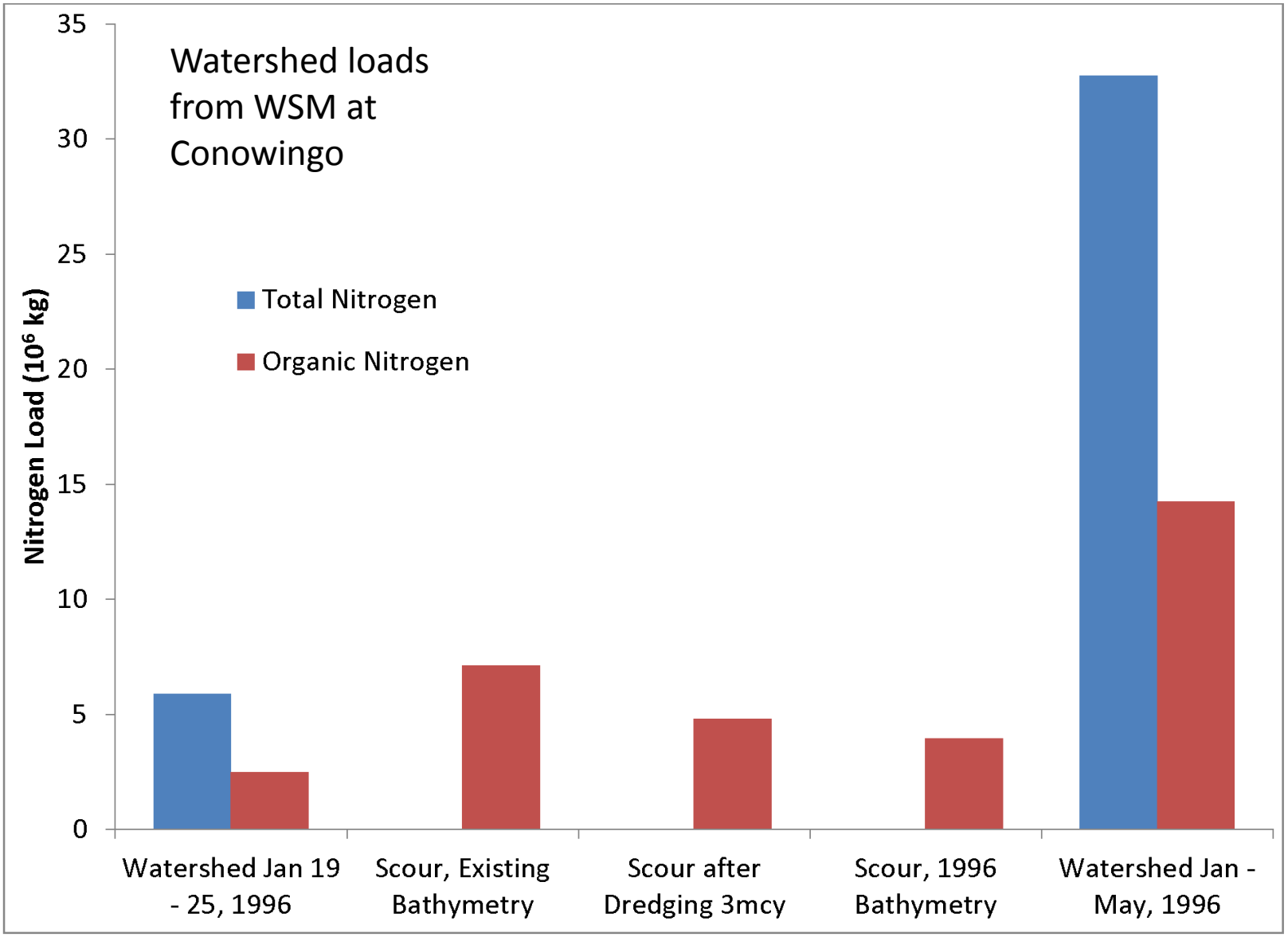
- Focus on work conducted for LSRWA with CBP cooperation.
  - Examine impact of a single major erosion event.
- Work conducted by and for CBP focuses on smaller loading events at greater frequency.
  - Reporting on this work expected in January.
  - Written report, MARS presentation.

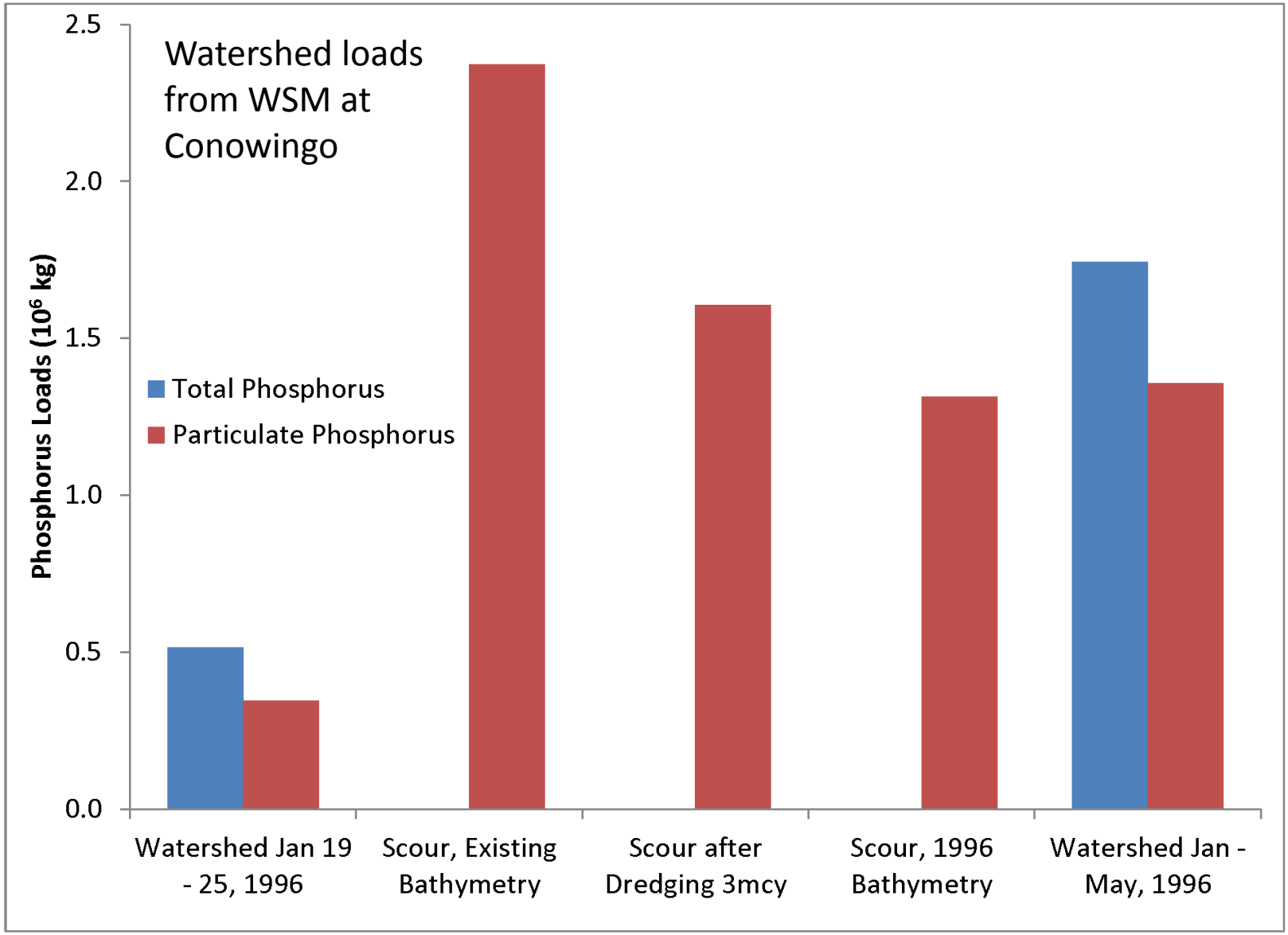

Assessment Timeline
2D/3D Study
Field & Lab Sampling/ Analysis
Build Models/Run Scenarios
Reporting
Modeling Results
Project Team Review
Partner Agency Review
DRAFT Report
July/August 2014
START STUDY
YEAR 1.5
YEAR 2
YEAR 2.5
YEAR 3
COMPLETE STUDY
Develop Strategies
FINAL report
Sept 2014
Review Results
Compare Alternatives
USACE Policy Review
Formal Public Review
USACE Higher Authority Approval
Agency/Public Involvement

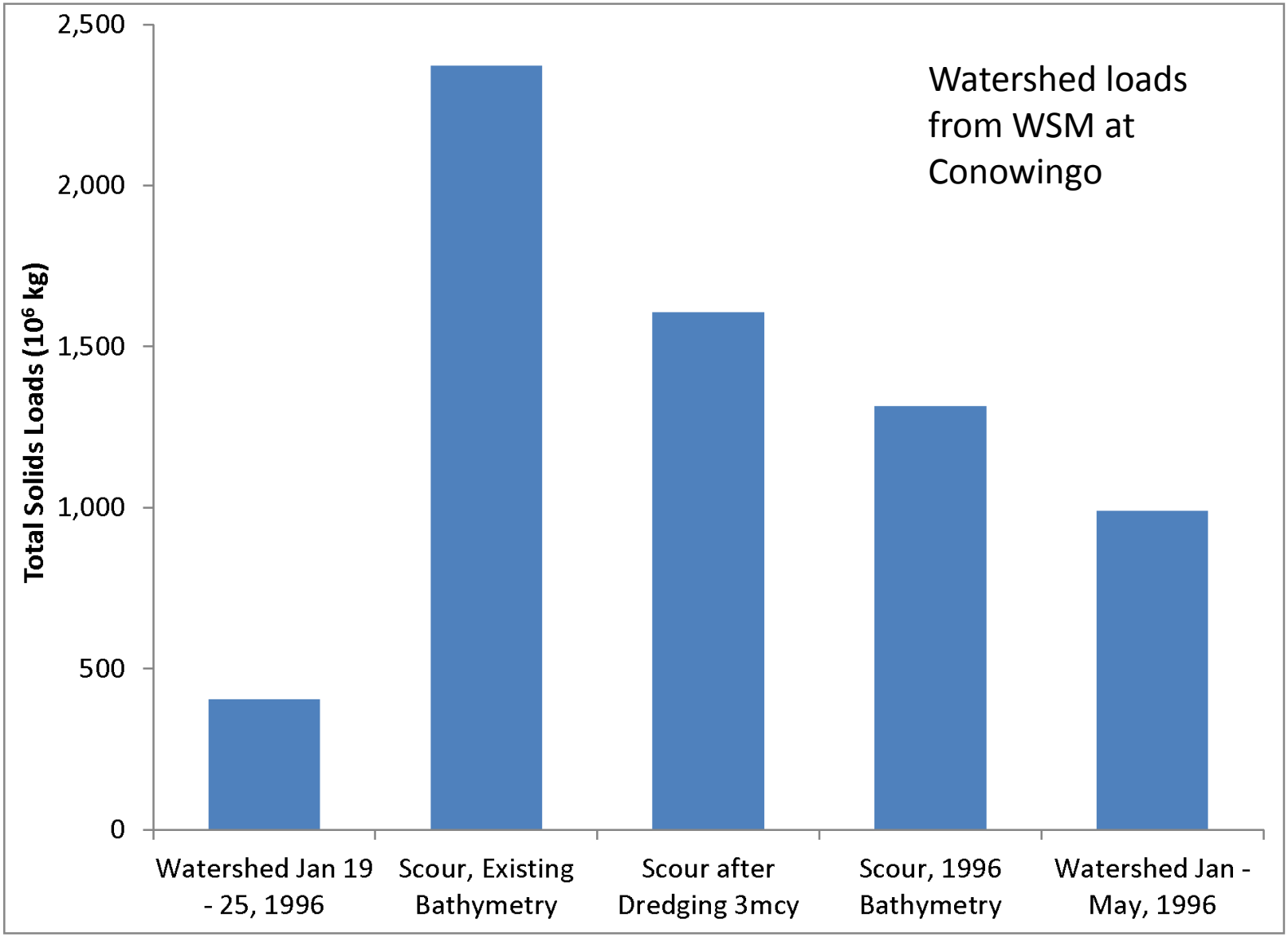

EPA Chesapeake Bay Program model of Chesapeake Bay Watershed (WSM).
Daily sediment and nutrient loads
HEC-RAS model of sediment transport in three-reservoir system.
Daily runoff into Chesapeake Bay
Sediment rating curve for inputs to Conowingo Reservoir
CH3D-WES model of hydrodynamics in Chesapeake Bay (CH3D, HM).
CE-QUAL-ICM model of water quality in Chesapeake Bay (ICM, WQM, WQSTM).
ADH model of hydrodynamics and sediment transport in Conowingo Reservoir.
Hourly transport processes
Information for calculation of sediment scour load

Work Completed

- Effect of a scour event on existing conditions
- Effect of a scour event on TMDL ★
- Effect of storm timing (season) on TMDL
- Alternate compositions of scoured material
- Potential for sediment management by dredging of Conowingo Reservoir ★
- Impact of sediment bypassing around Conowingo Dam


Watershed loads from WSM at Conowingo
Total Nitrogen
Organic Nitrogen
Nitrogen Load (10^6 kg)
35
30
25
20
15
10
5
0
Watershed Jan 19 - 25, 1996
Scour, Existing Bathymetry
Scour after Dredging 3mcy
Scour, 1996 Bathymetry
Watershed Jan - May, 1996

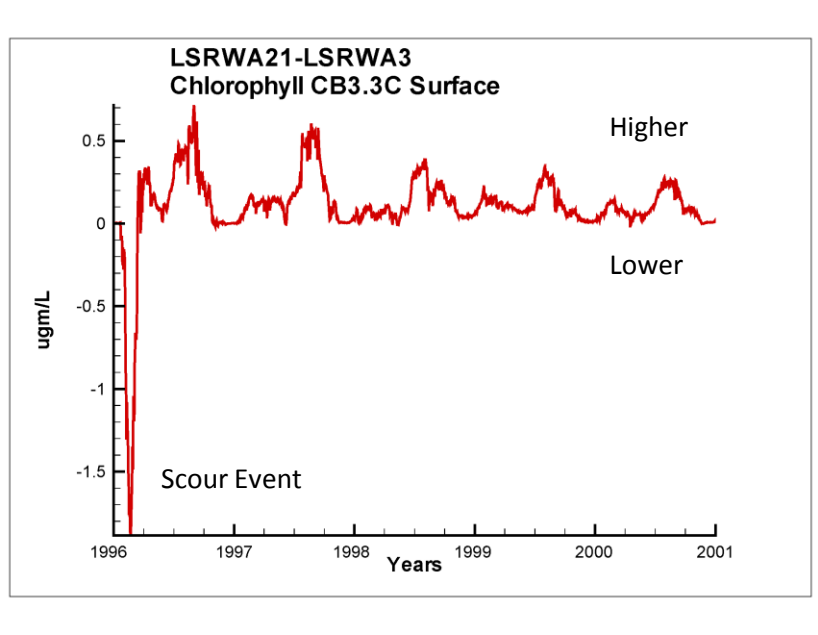

Watershed loads from WSM at Conowingo
Phosphorus Loads (10^6 kg)
2.5
2.0
1.5
1.0
0.5
0.0
Total Phosphorus
Particulate Phosphorus
Watershed Jan 19 - 25, 1996
Scour, Existing Bathymetry
Scour after Dredging 3mcy
Scour, 1996 Bathymetry
Watershed Jan - May, 1996

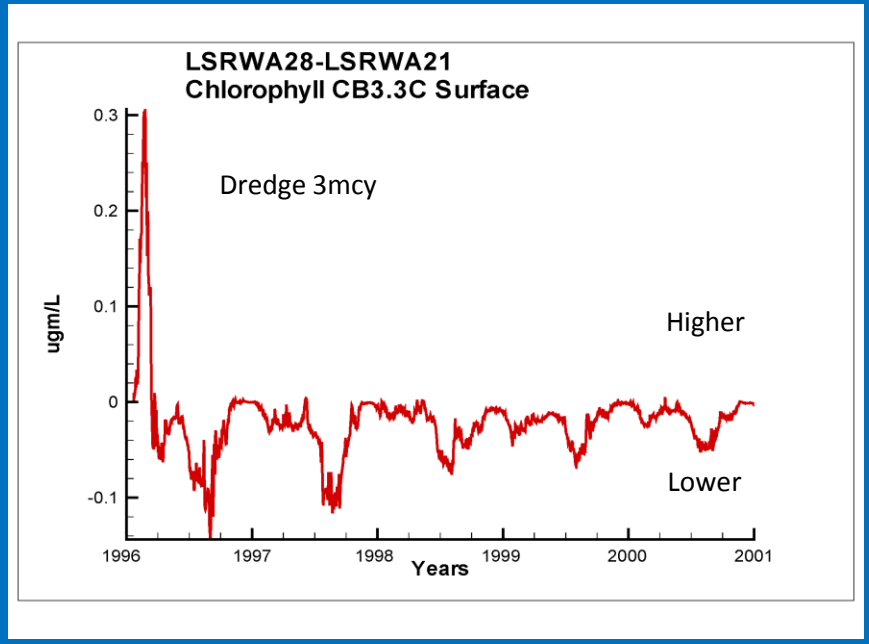

Watershed loads from WSM at Conowingo
Total Solids Loads (10^6 kg)
2,500
2,000
1,500
1,000
500
0
Watershed Jan 19 - 25, 1996
Scour, Existing Bathymetry
Scour after Dredging 3mcy
Scour, 1996 Bathymetry
Watershed Jan - May, 1996

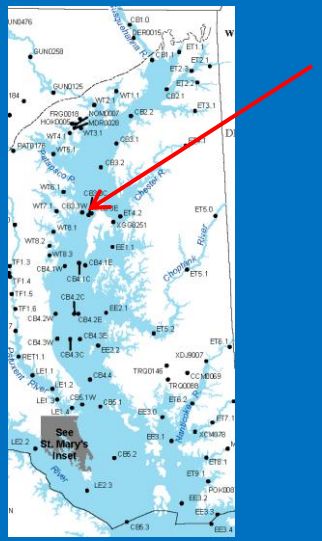
Some Insights for 1996 Storm

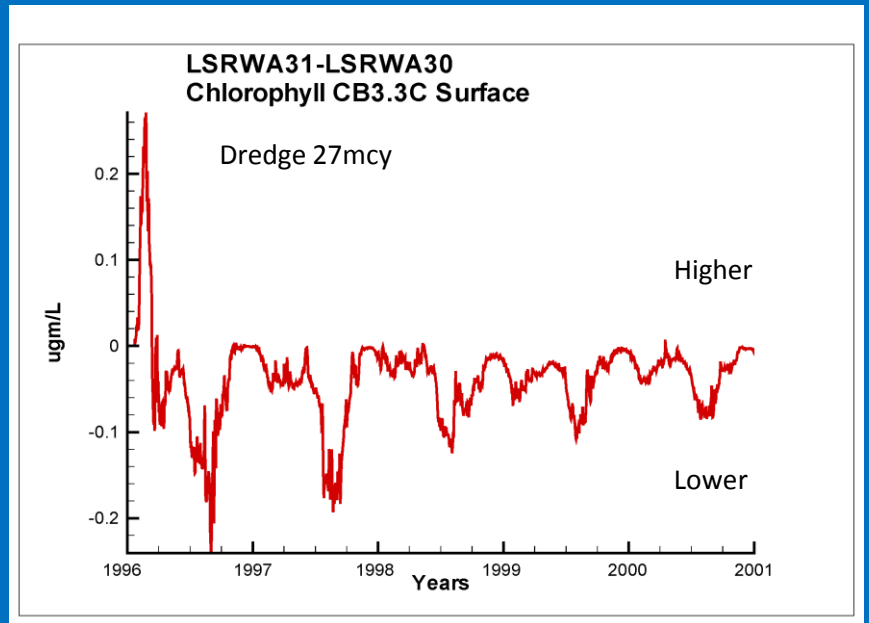
- Nitrogen scour load is small relative to watershed load over the winter spring period
- *However, the nitrogen scour load is three times the phosphorus scour load*
- The phosphorus scour load is large relative to watershed load over the winter spring period
- The total solids scour load is large relative to watershed load over the winter spring period
- Dredging 3mcy reduces scour loads of all materials by 32%. Dredging ≈27mcy reduces scour loads by 45%.
- The apparent importance of scour loads varies according to investigator and basis for calculations

Marginal Effects of Scour and Dredging









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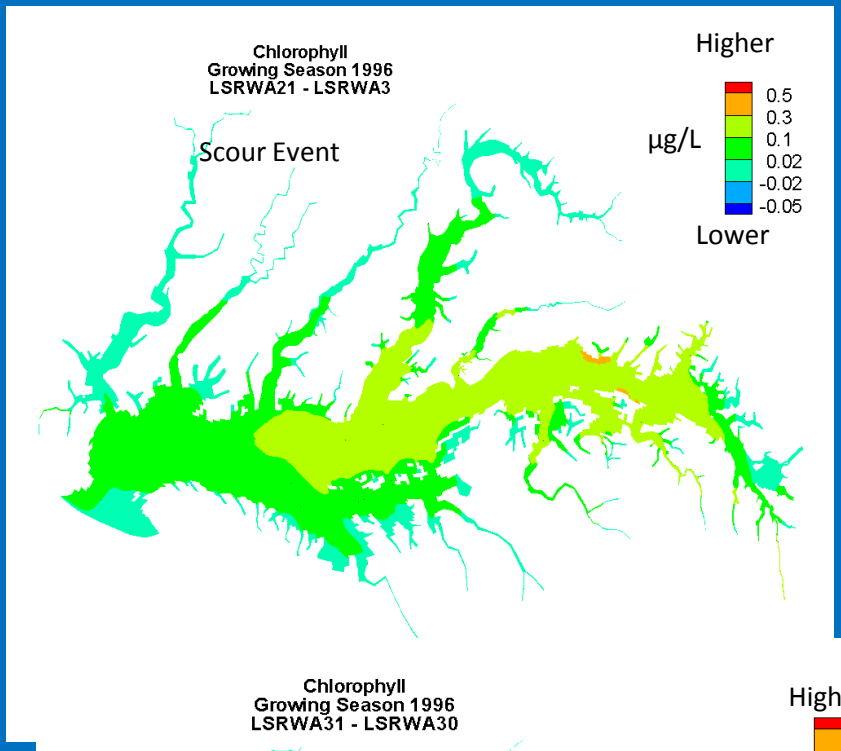

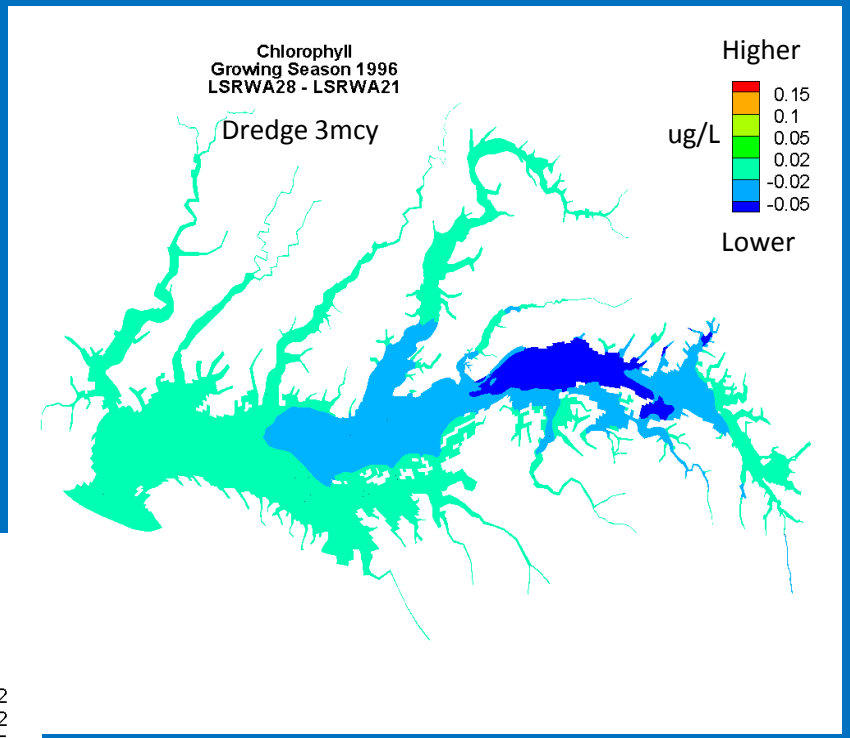

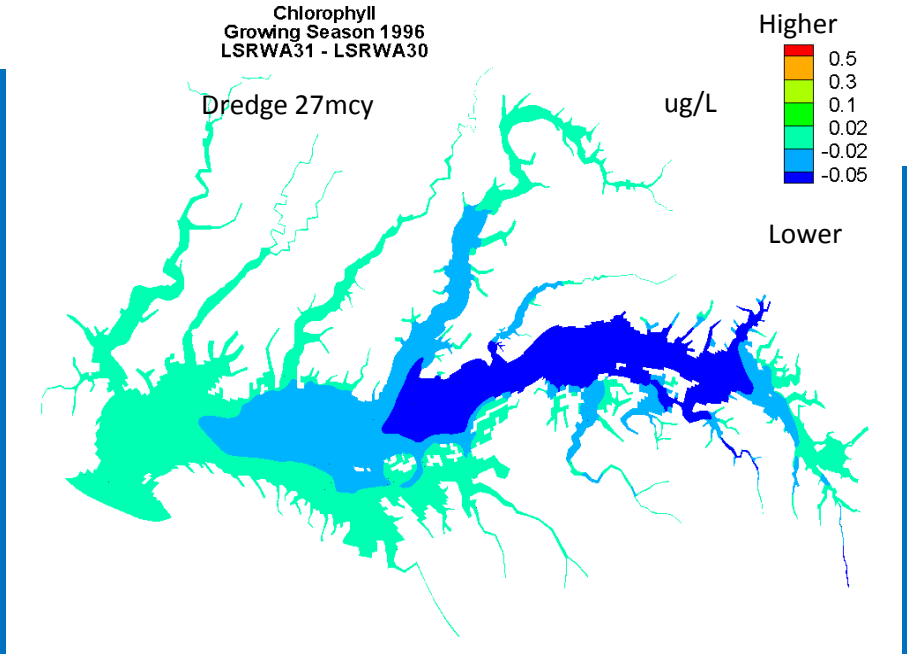

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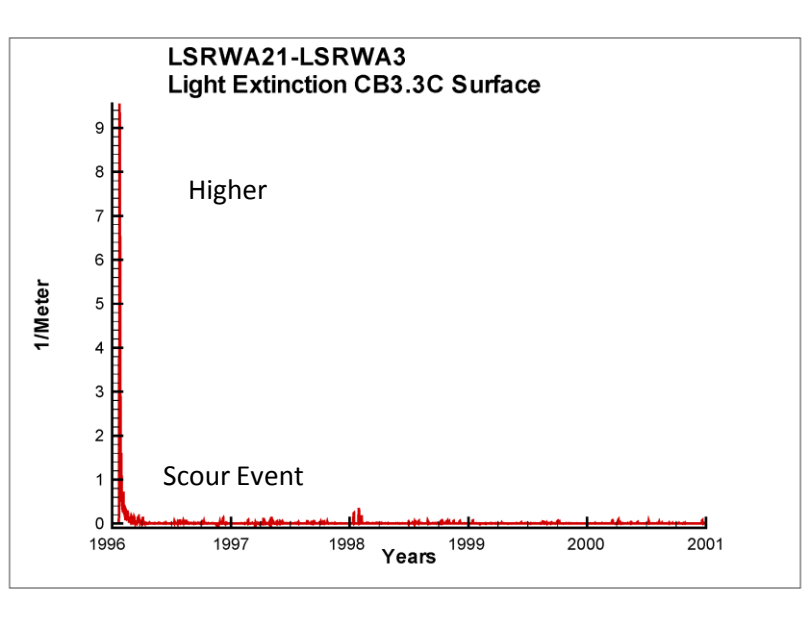

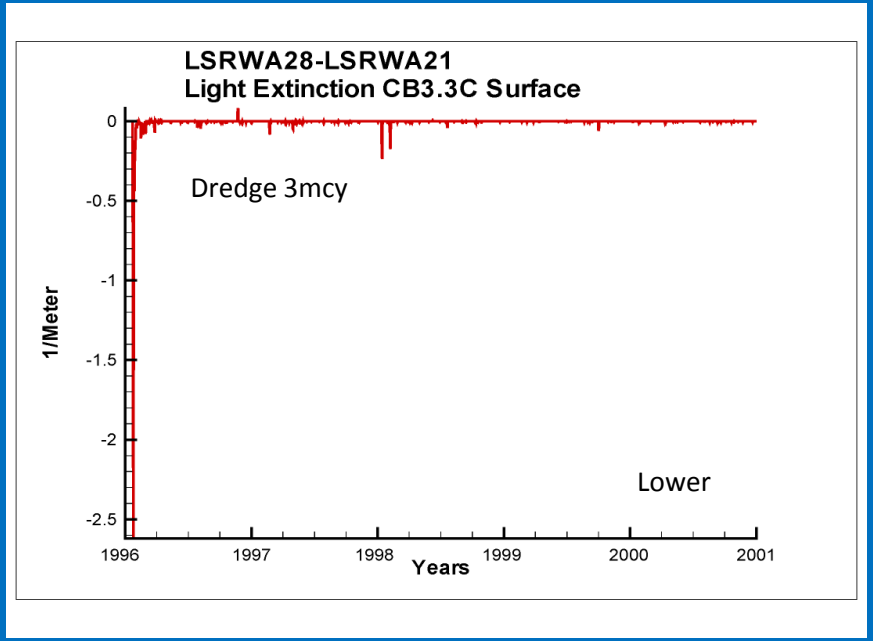

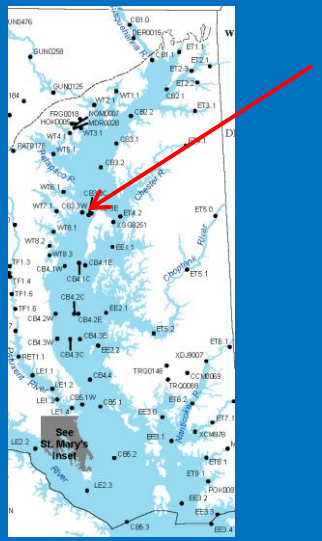

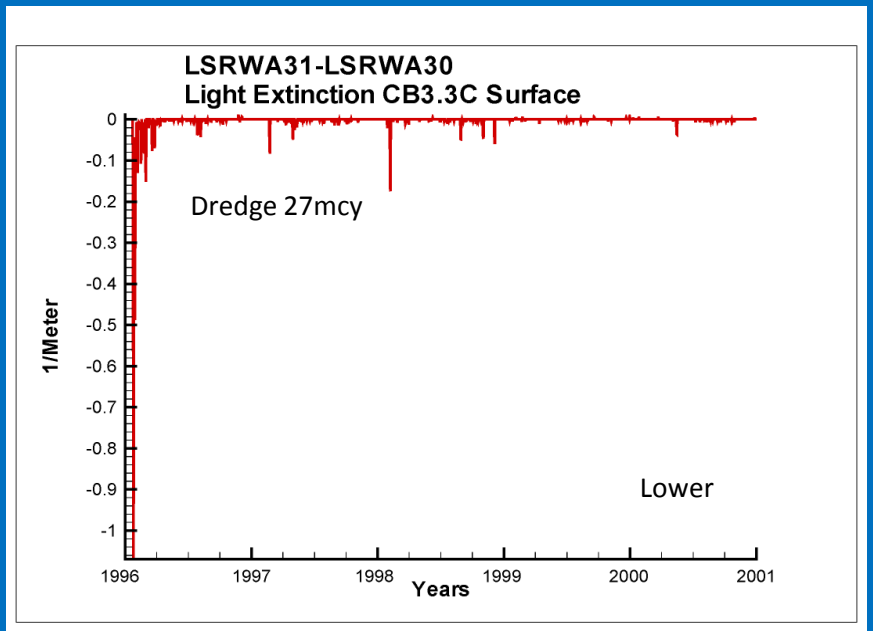

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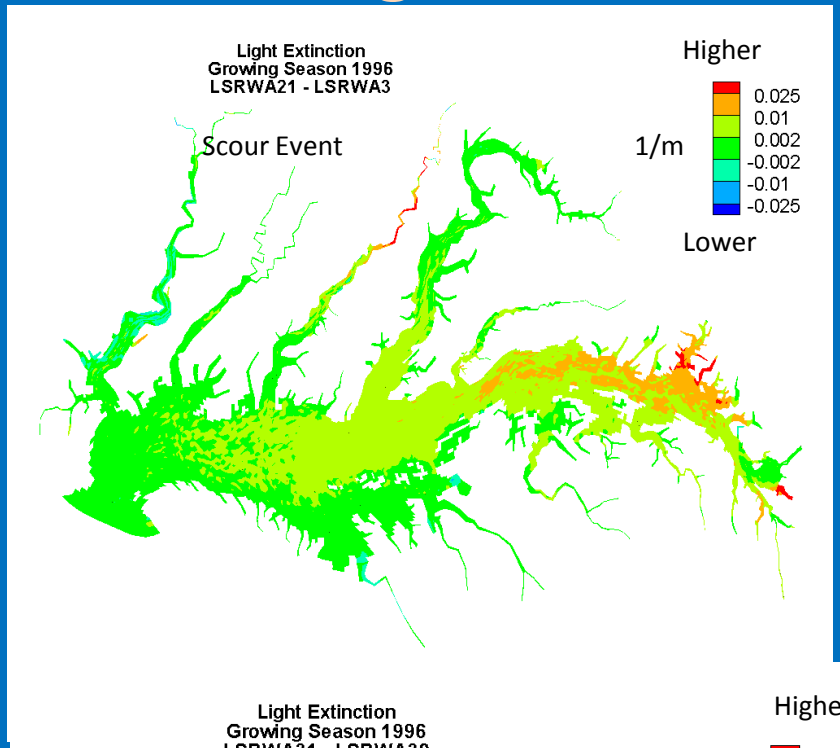

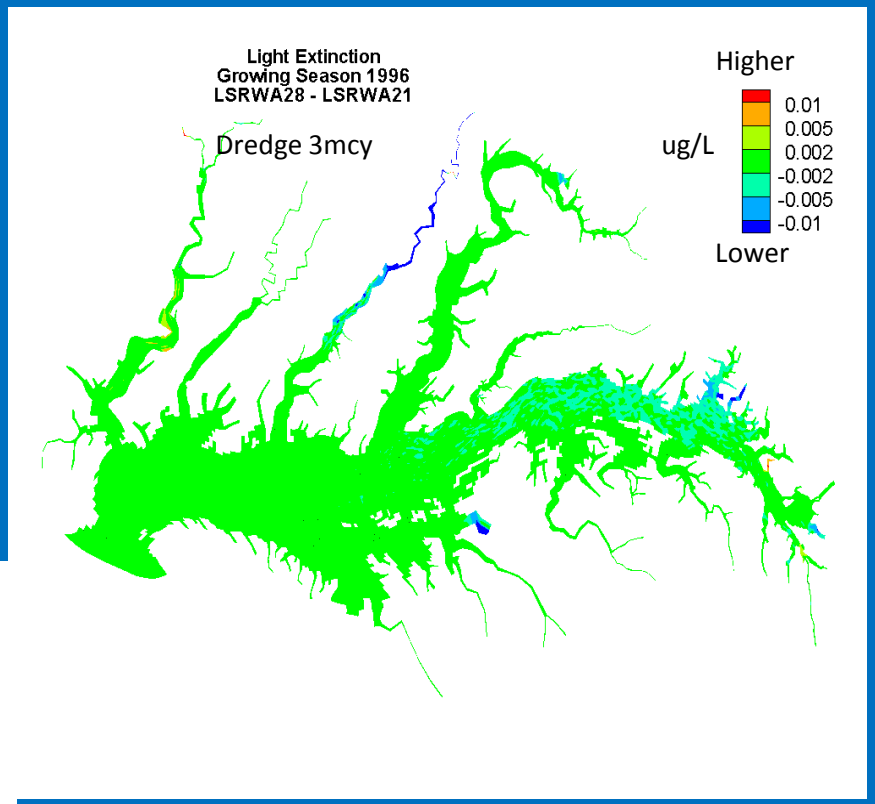

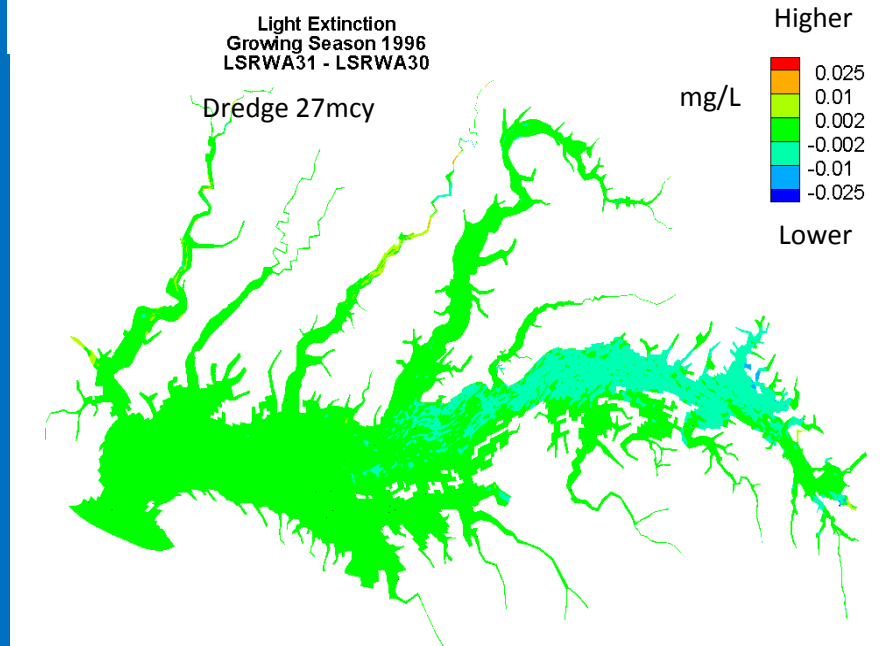

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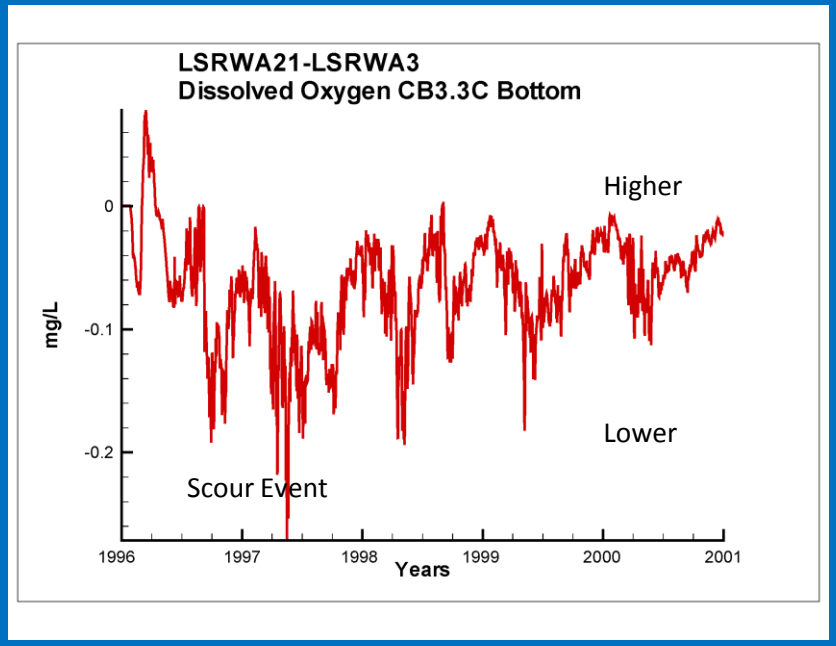
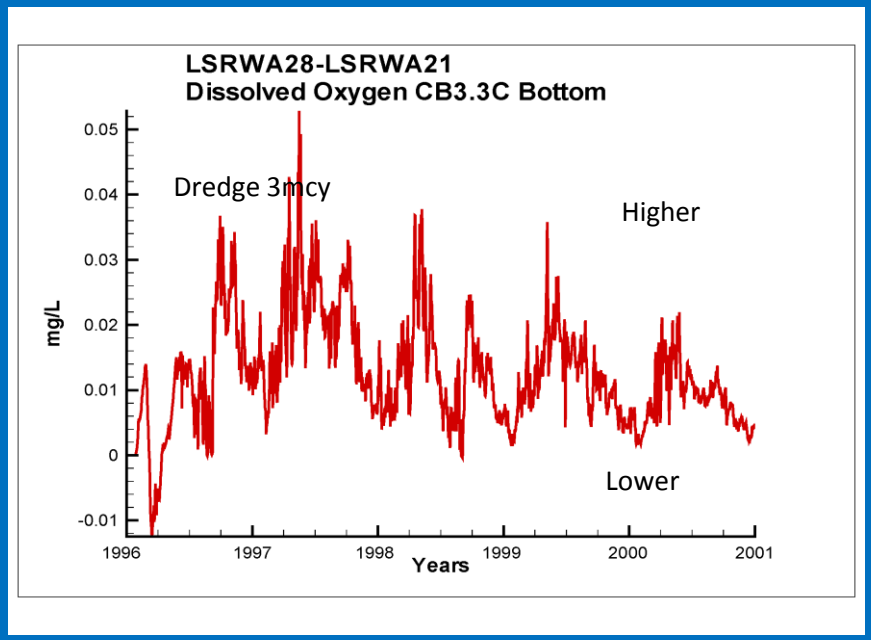
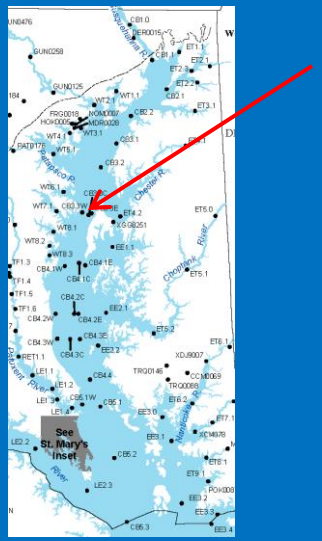
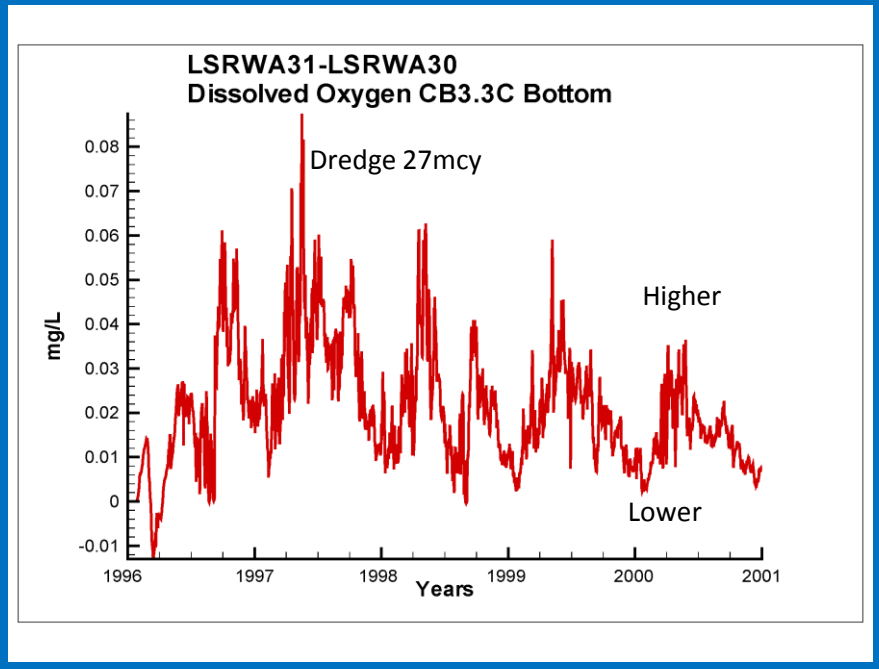
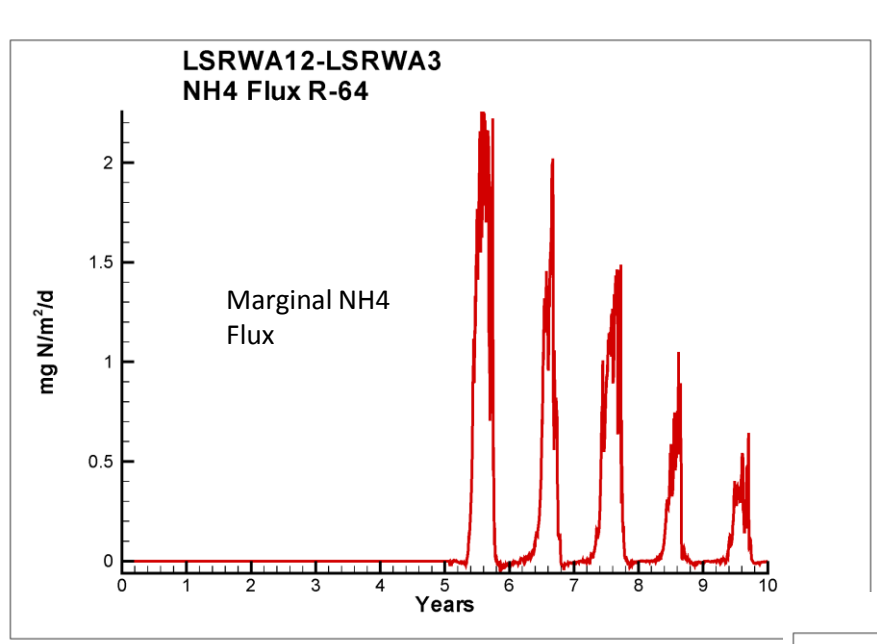


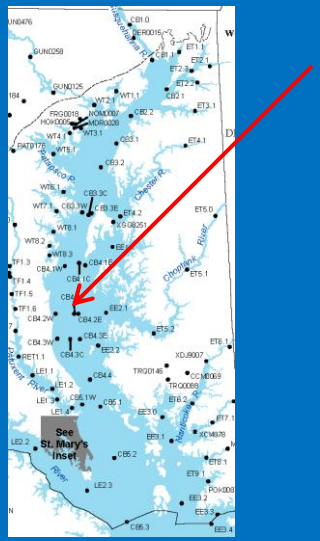


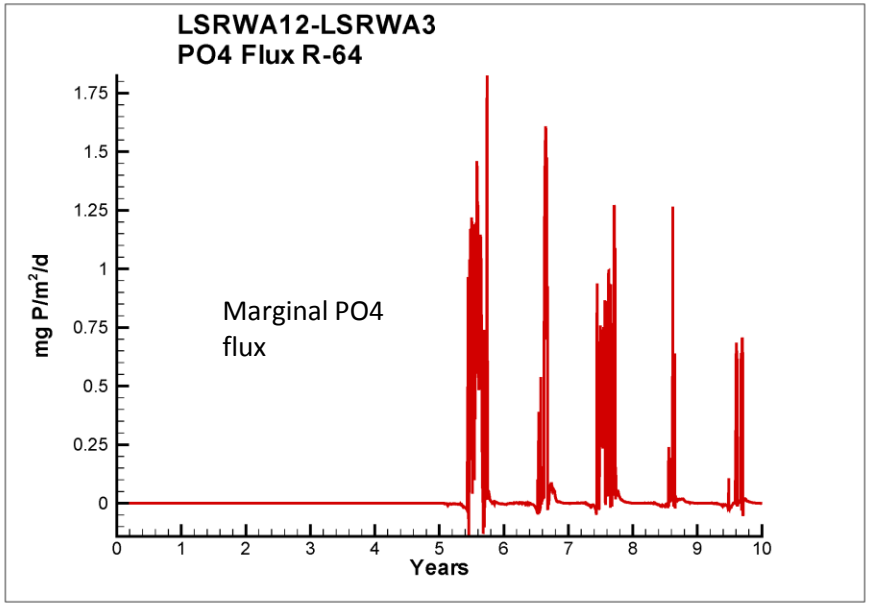




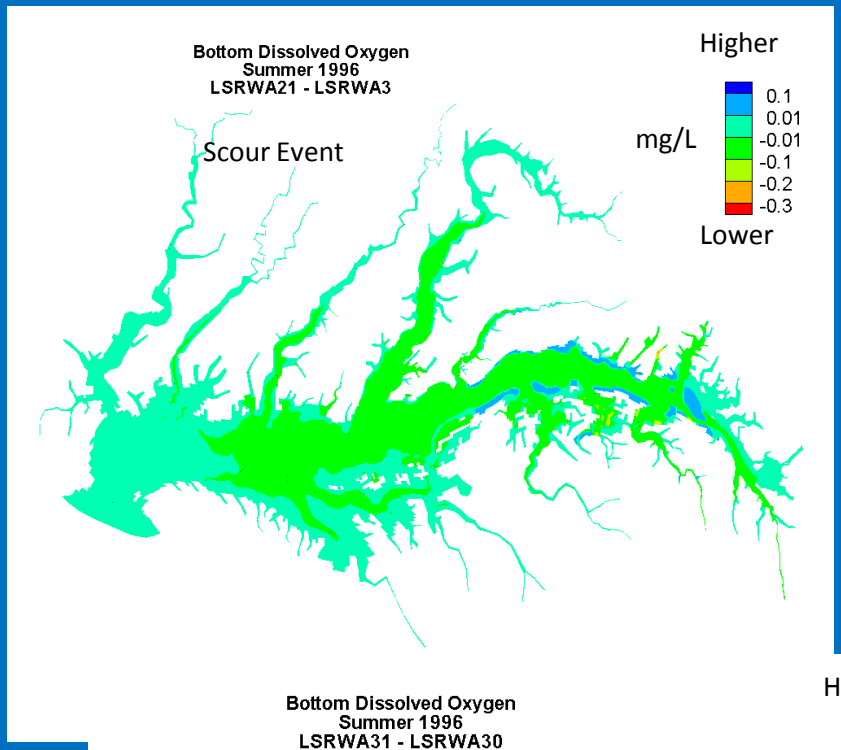
Enhanced Sediment Diagenesis due to Scoured Nutrients

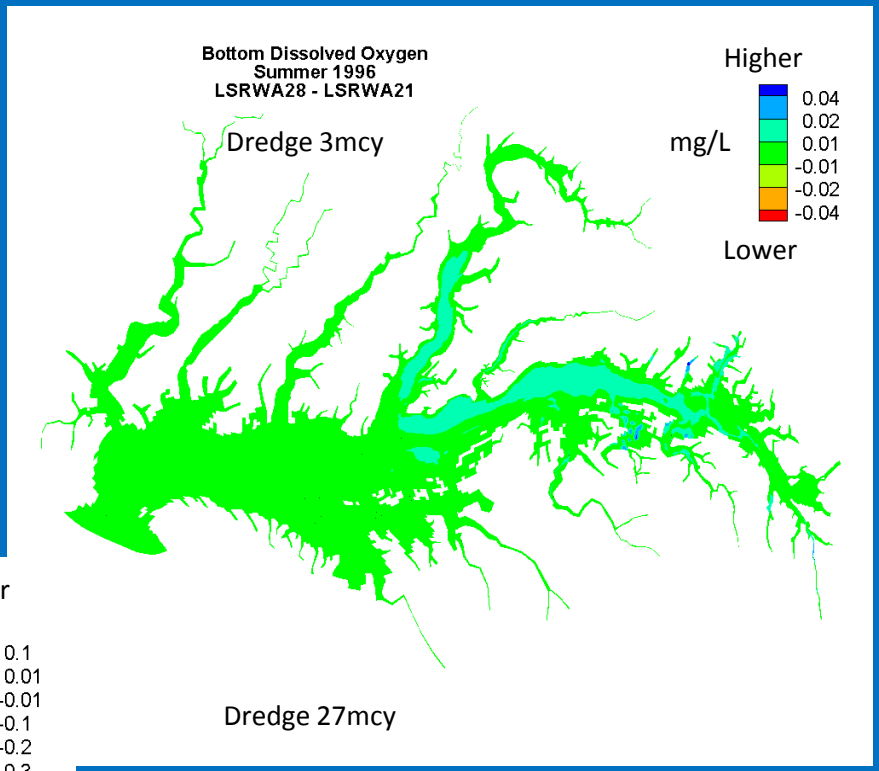


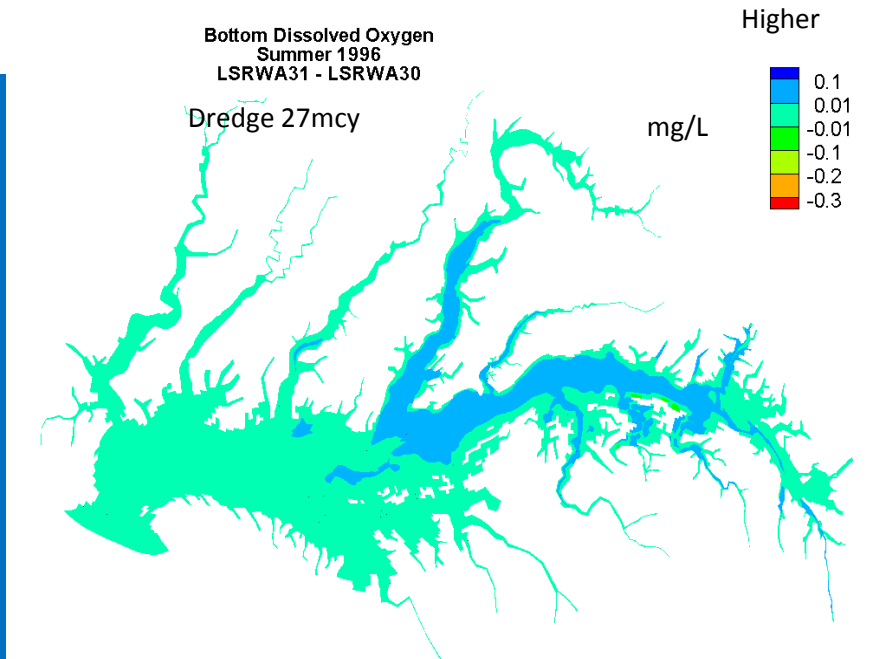




Marginal Effects of Scour and Dredging







Personal Insights (not Necessarily Consensus of Group)

- A scour event is not the end of the world as we know it.
- The amount of nitrogen scoured during an event is roughly three times the amount of phosphorus.
- The principal threat to water quality standards is to dissolved oxygen via scoured nutrient load.
- The computed dissolved oxygen decline during a scour event is small but can be significant to standards which are only marginally met.
- The impact of a scour event can be mitigated by dredging but not completely reversed.