CONNECTING THE DOTS TO INNOVATION

CONOWINGO RESERVOIR MODELING STUDY UPDATE

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OVERVIEW JUL 2026

Background
- Objectives of the effort
- Team and Partnerships

Modeling approach
- Hydrodynamics
- Nutrient water quality
- Sediment transport

Data Acquisition
- Physical sediment characterization
- Biological sediment characterization
- Other data

Model applications
- Dredging scenarios
- Extreme event scenarios

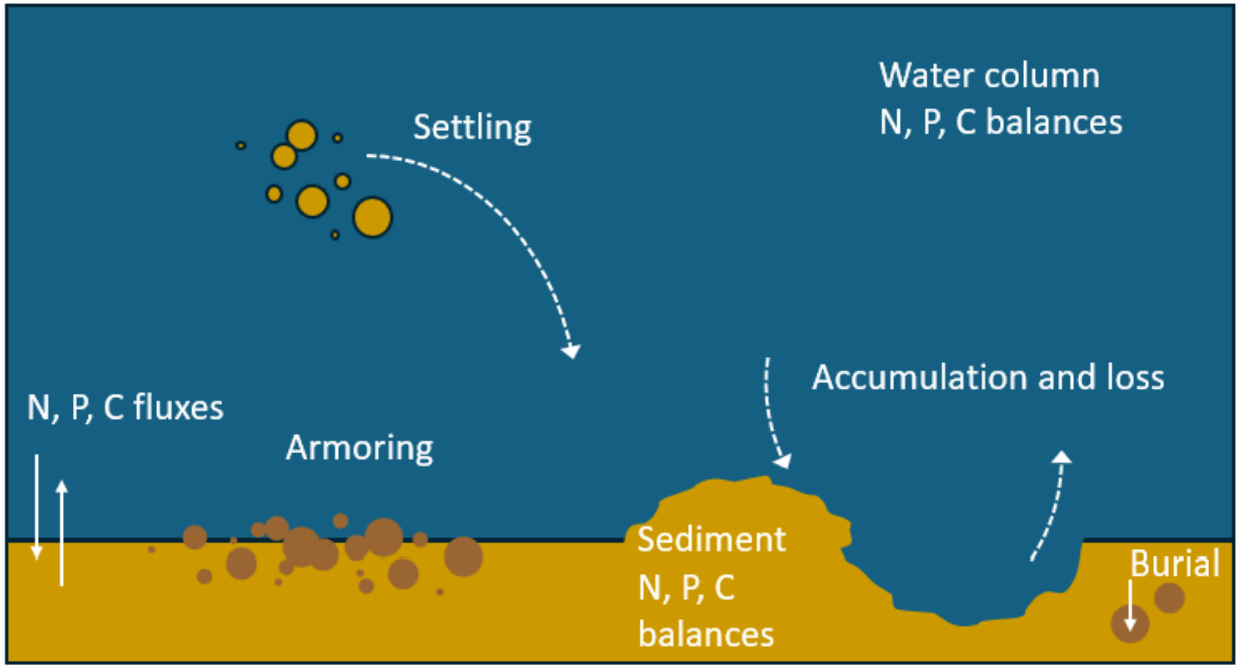
Project and reporting schedule

Questions

Regional View of Conowingo Reservoir

MODEL REQUIREMENTS

- Continuous simulation of the reservoir pool including selected hydrometeorological events; (1991-2000)
- Change in hydrodynamics from reservoir infill of sediments from the CR watershed, and removal of material through dredging
- Biogeochemistry in the reservoir pool, responding to the amount and speciation of nitrogen, phosphorus, and sediment inputs from upstream and bottom sediment
- Biogeochemical changes in sediments, including burial, species changes, and water column exchanges
- Physical changes in sediment characteristics due to erosion, bed armoring, and deposition of sediment and the resulting morphological changes in the reservoir
- Dredging of the reservoir.



PROGRESS SUMMARY NEW JULY 2026 IN BLUE

Project components

Hydrodynamics
Sediment transport
Nutrient water quality

→ Dredge scenarios
Climate scenarios

- EFDC+ selected as model code
- EFDC+ installed on ERDC & NAVY HPC systems
- ERDC team trained and consulted on WQ modeling with DSI
- Updates made to EFDC+ vHPC to achieve agreement with EFDC+ vPC

Hydrodynamics Development

- Fine grid used to develop coarse grid (~86,490 cells)
- Boundary conditions, met conditions developed
- Preliminary test runs (PC)
- Model moved to HPC

Sediment Transport Development

- Collection and physical characterization of samples
- 6 layers / 7 size classes enacted in each grid cell
- 3 mo. trial run (1 mo. spin up) on coarse grid
- Identification of flow and stage data
- Bulk density method reconciliation

Water Quality Development

- Biological characterization of samples
- Development of parameterization strategy
- Link watershed HSPF to boundary conditions
- Identification of WQ calibration data

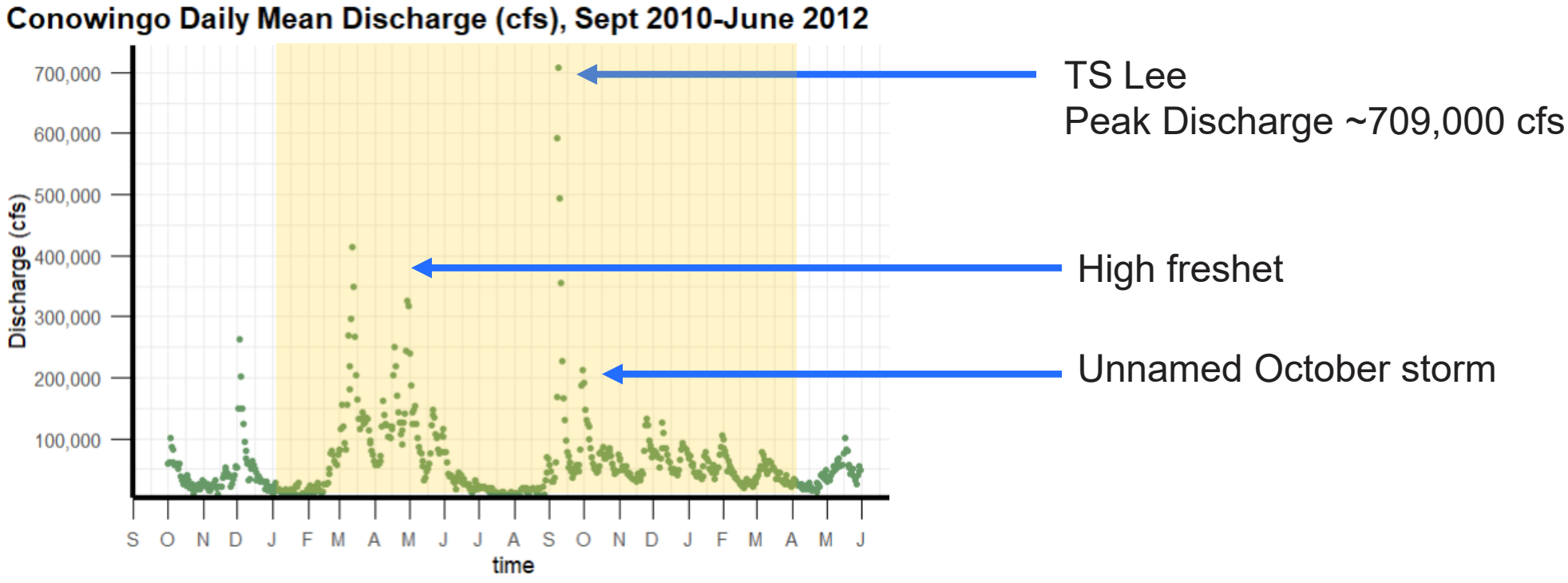
Dredge and Climate Scenario Development

- 5 discussion sessions with PDT and technical review panel
- Climate scenarios close to finalization
- Dredge scenarios to be informed by climate results

CLIMATE SCENARIO PLAN NEARING FINAL SELECTION

Baseline Time Period	Included Storms	Scenario Time periods
January 2011-Spring 2012	• High freshet spring flows • Tropical Storm Lee (September 2011) • Unnamed tropical storm (October 2011)	2025 2055

Run under WIP 3 conditions in anticipation of their achievement by 2055



DREDGING SCENARIO SELECTION TO BE FINALIZED AFTER CLIMATE RUNS

Scenario	Volume	Location	Geometry	Flow conditions and time period*
1	3 MCY	Upper Reservoir	Deep hole	• Average flow conditions • Dredge once • Simulate 18 months
2	6 MCY			
3	3 MCY	Lower Reservoir		
4	6 MCY			

Hypothesis to be tested with the dredging model runs

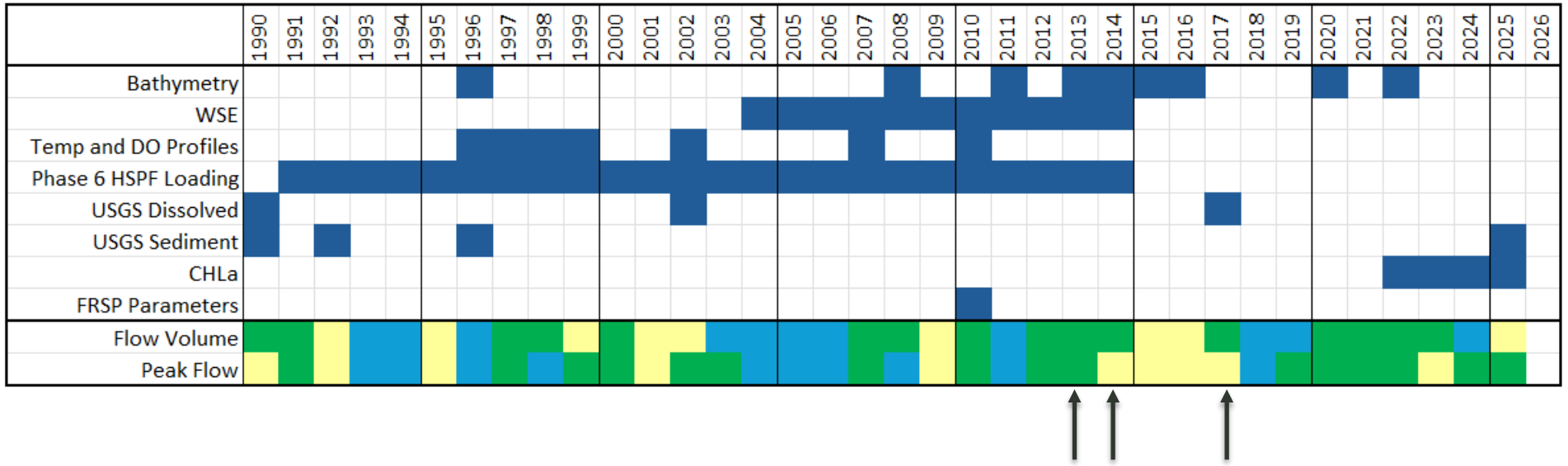
- Dredging a greater volume of sediment will result in higher reductions in nutrient and sediment loads in both the upper and lower sections
- Dredging in the lower reservoir will result in greater nutrient reductions to the bay at each volume

- Upper and lower reservoir sites differ in sediment characteristics
- 3 MCY ~ annual deposition
- 6 MCY ~ annual feasibility limit
- Deep hole geometry to optimize trapping and retention
- Average flow conditions
- Specific locations limited by no-dredge zones
- Climate scenario runs will be used to make final location selections

NEW DATA SINCE APRIL 2026

Item	Source	Application
Baltimore Water Supply Intake	MDE	Water Balance
Bedrock Elevation	PASDA	Sediment thickness limits for dredging
Water Quality Observations	USGS	Calibration/Validation
Sediment Quality Observations	USGS	Calibration/Validation
2014+ Bathymetry	Constellation via Gomez and Sullivan	Dredging development
Chlorophyll-a Observations	Constellation via Gomez and Sullivan	Validating seasonal dynamics

BASELINE YEAR SELECTION POTENTIALLY 2014



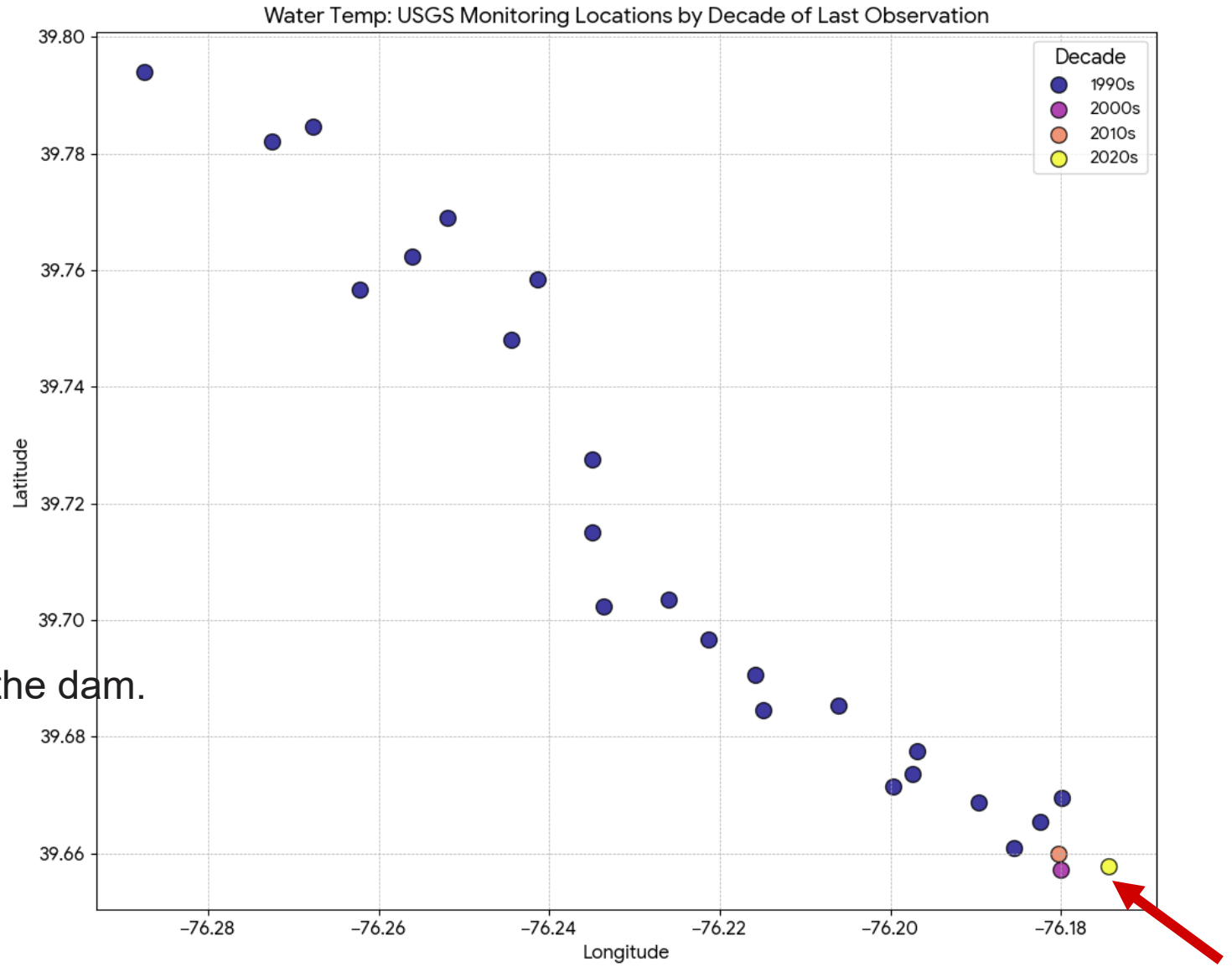
1996 is the best Pre-TS Lee year in terms of applicable data for calibration/validation.

2014 is the best Post-TS year to use as a baseline for Post TS Lee calibration/validation.
2014 will let us directly leverage bathymetry, water surface elevations, and Phase 6 loading.
2014 and 2017 are very similar letting us use dissolved nutrient data from 2017 for validation.
1997 is similar to 2014 and 2017 so may use the temp and DO profiles from that year as well.

*Excludes USGS-01578310 located immediately downstream of the Conowingo Dam

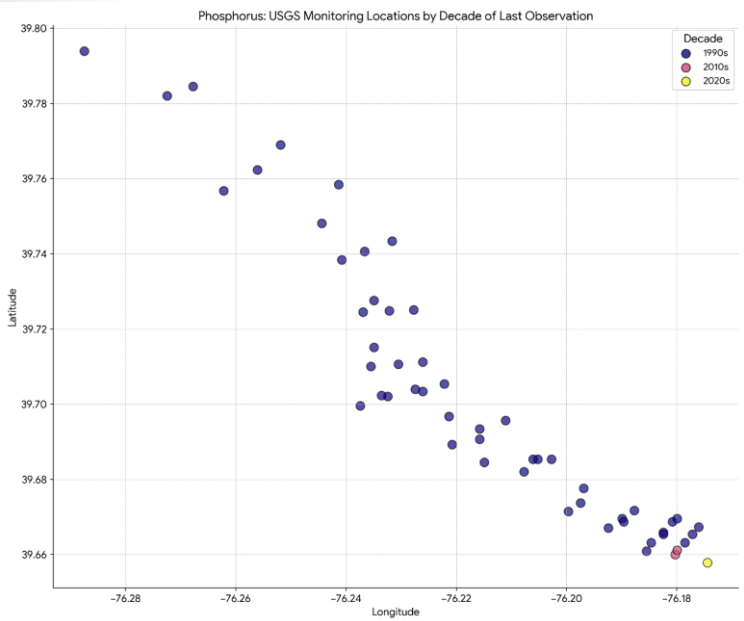
THE FOLLOWING PLOTS SHOW THE MOST RECENT DATA RECORDED FOR EACH SITE BY PARAMETER.

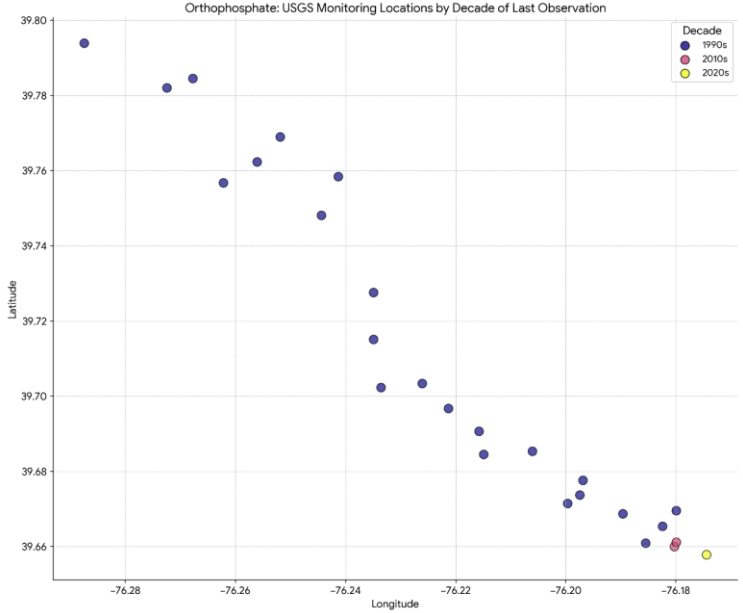
There are 25898 recorded values
But only 1046 are not downstream of the dam.

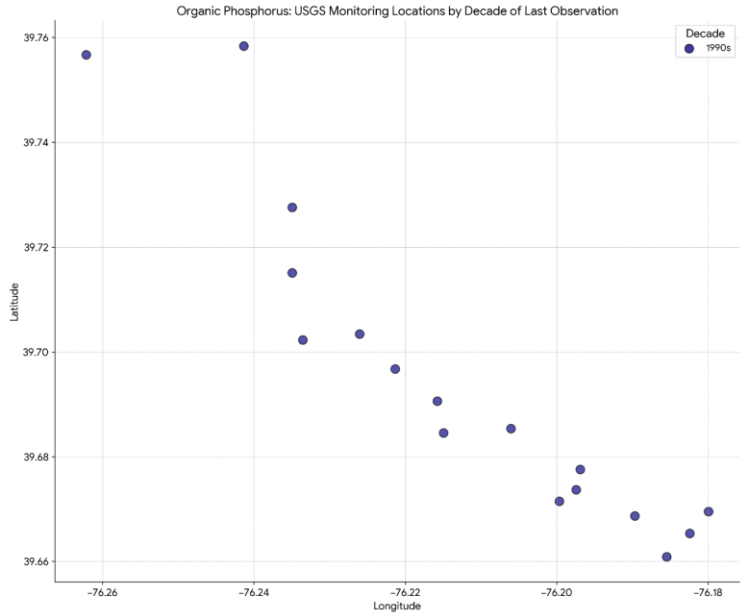


This site is downstream of the dam so not particularly useful

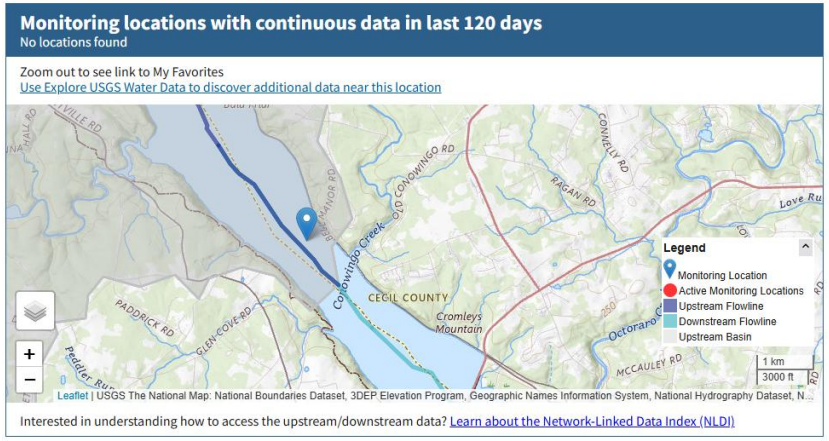
TOTAL PHOSPHOROUS, ORTHOPHOSPHATE, AND ORGANIC PHOSPHOROUS



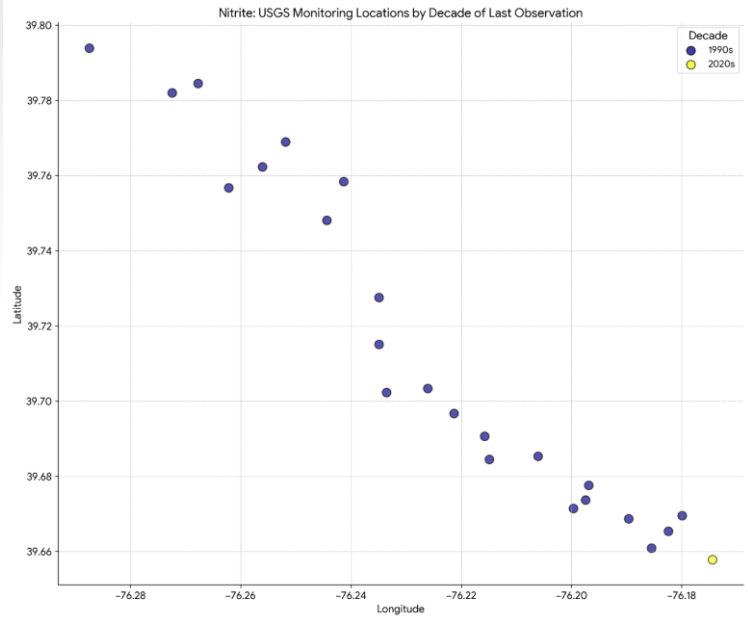


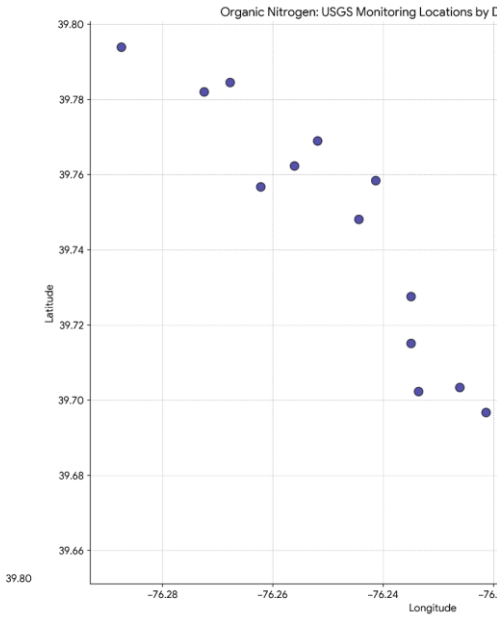


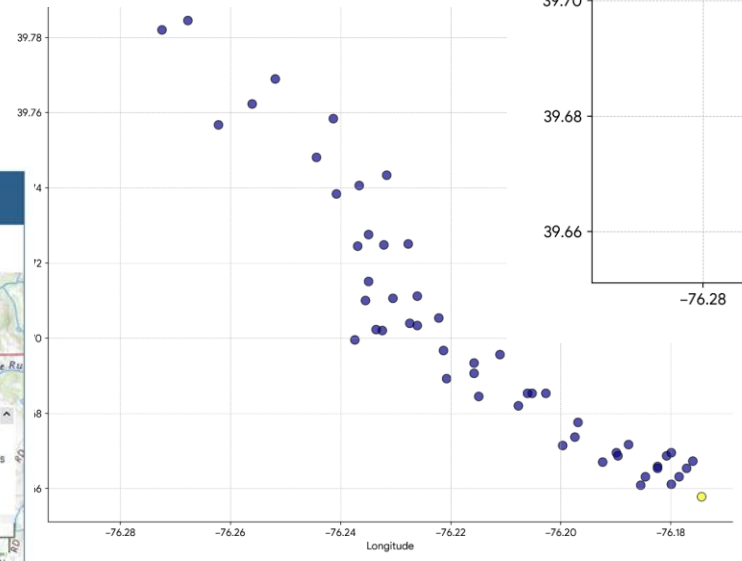
The pink dot is a series of bank measurements made in 2017 at site USGS-393936076104901
There are also lots of data at this site in 1990.

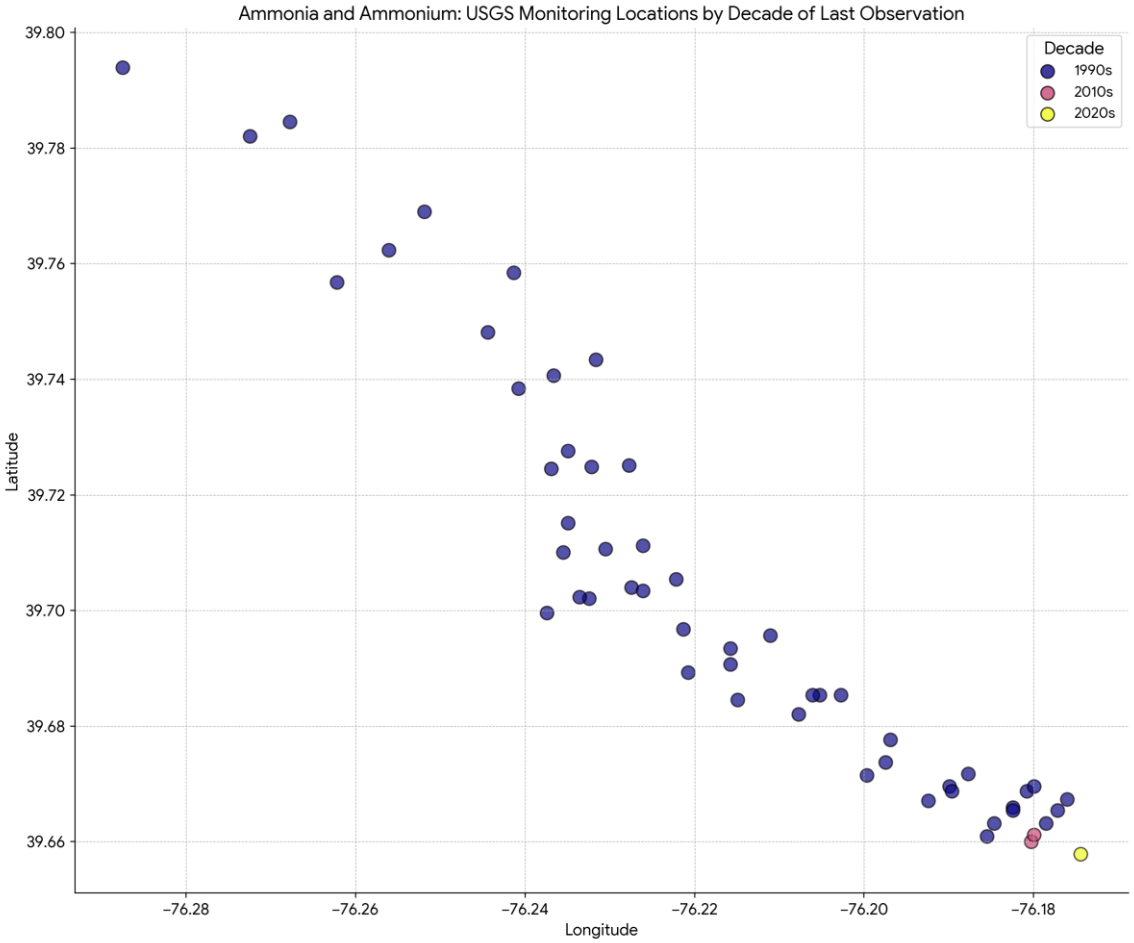


NITRATE, NITRITE, ORGANIC NITROGEN, AMMONIA AND AMMONIUM

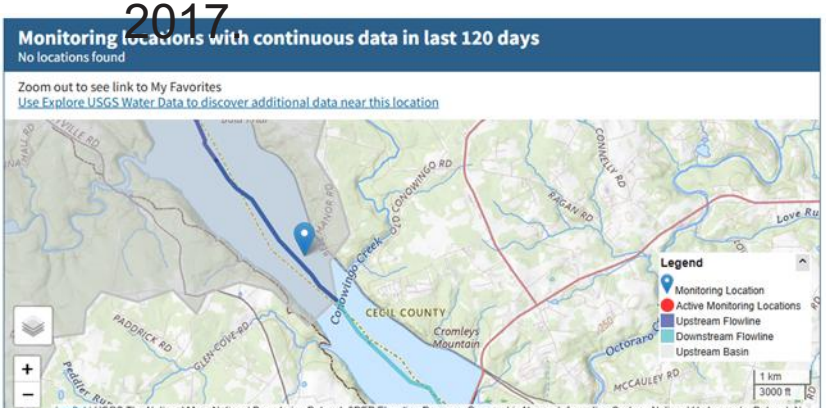




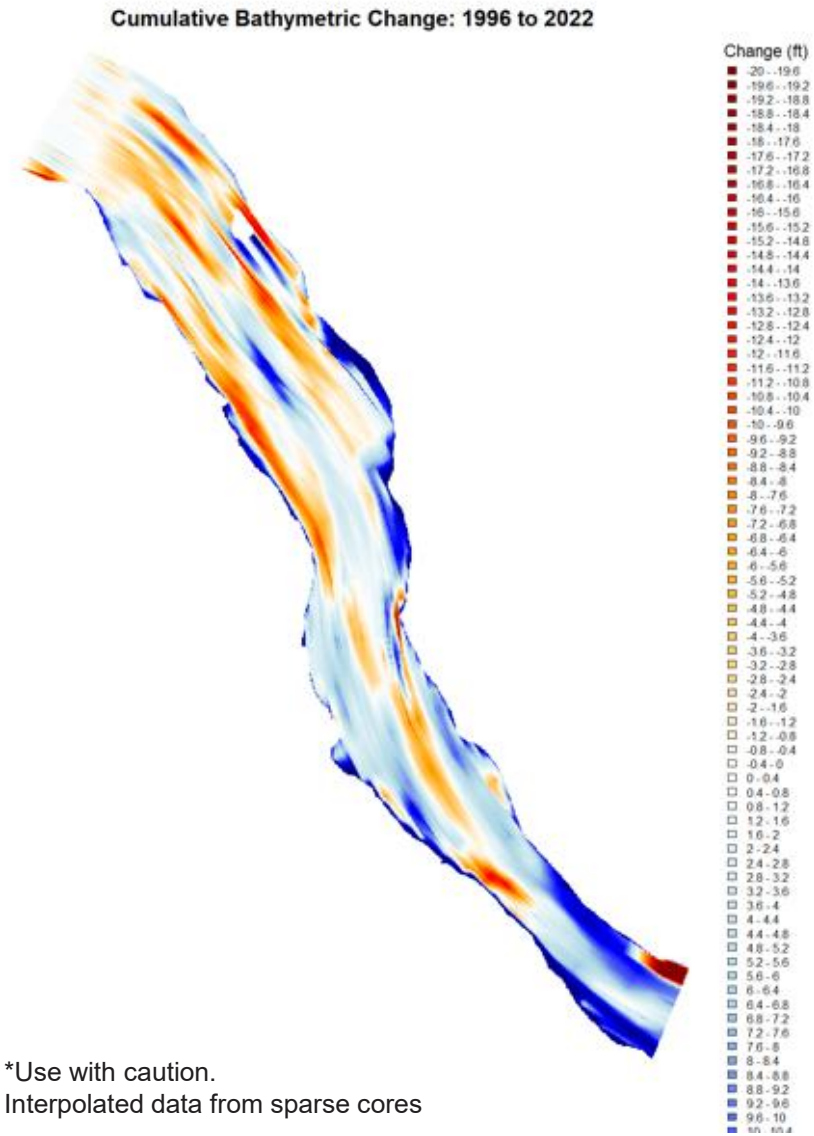




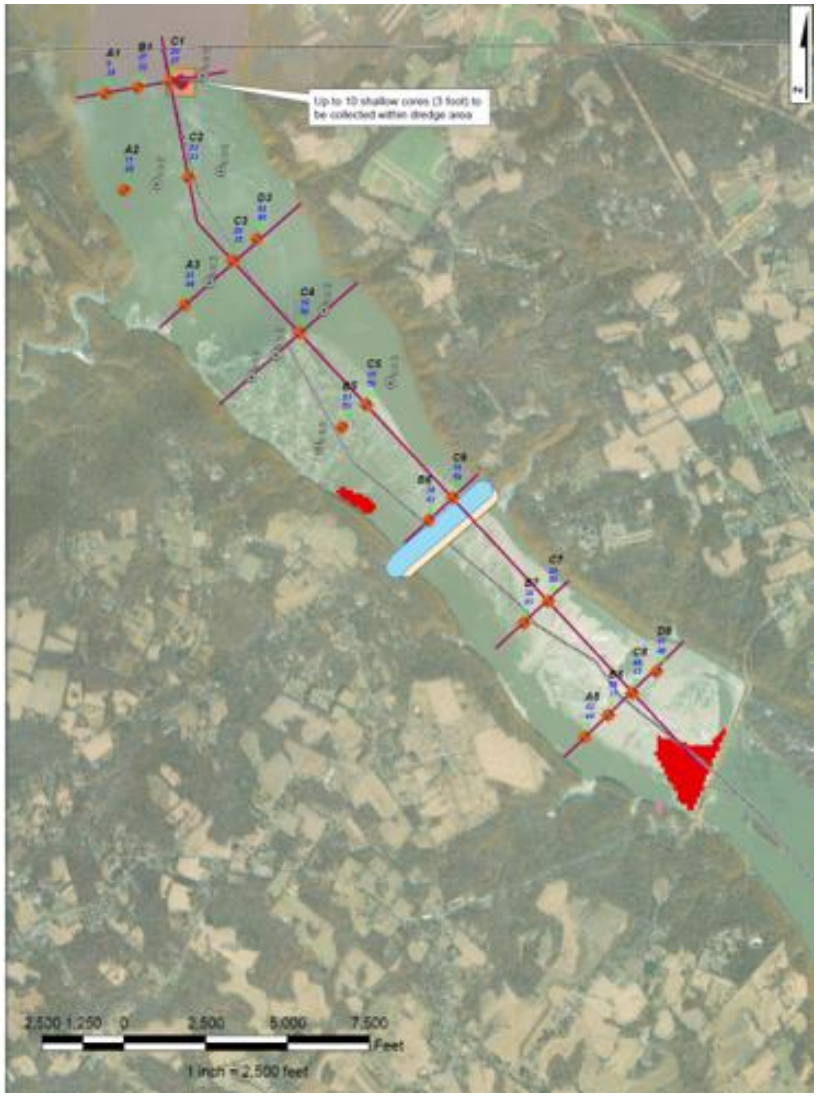
Most recent data is from same site in 2017



HISTORICAL BATHYMETRY AND SEDIMENT DEPTH

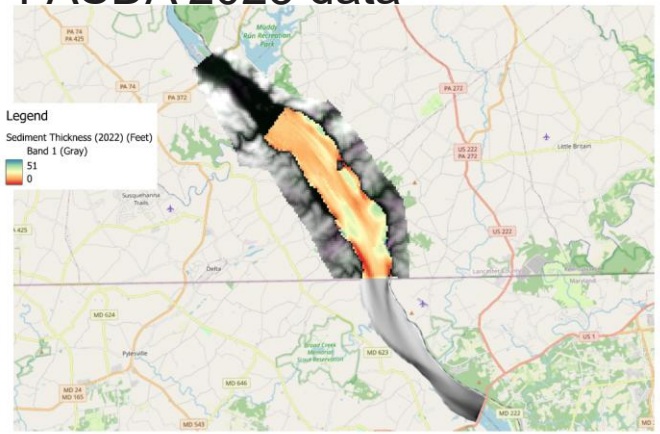


*Use with caution.
Interpolated data from sparse cores



- Currently working to determine bedrock limitation on dredged deep hole in various parts of reservoir

PASDA 2023 data



SEDIMENT CARBON ANALYSIS

Repeat 300 ml trial –
- Most have finished after 1 reoxygenation

2L BOD bottles
- Had to restart
- Reoxygenated 2X
- 3 of 4 sites agreeing will with 2025 tests

10 L Carboy
- Agreeing well with 2L version

Differences from 2025
- After 7 days switched to ~3 day Temp, pH, DO
- Reoxygenating at 2mg/L DO
- Darkened lab
- Self-Stirring BOD instrument

CURRENT PROJECT AND REPORTING SCHEDULE

Task	Start Date	Due Date
Data Acquisition	**10/1/2024**	**5/30/2025**
Development of the CRMS		
Hydrodynamics	10/1/2024	7/31/2025
Nutrient Water Quality	1/1/2025	12/30/2025
Sediment Transport	1/1/2025	12/30/2025
First Meeting of Advisory Expert Panel		Nov-25
Indentify Description of Dredging and Extreme Event Scenarios		May-26
Development of the Simulation of Dredging Scenarios in Model		
Dredging 1	8/1/2025	12/30/2026
Dredging 2	8/1/2025	12/30/2026
Infill 1	8/1/2025	12/30/2026
Infill 2	8/1/2025	12/30/2026
Reduce Sediment loading to Chesapeake Bay	8/1/2025	12/30/2026
Development of Simulation of Extreme Event Scen	8/1/2025	12/30/2026
Project Deliverables		
Tech Note-lab	9/1/2025	9/30/2026
CRMS Presentation	12/1/2025	9/30/2026
CRMS User Manual	12/1/2025	9/30/2026
Tech Note-Dredging Scenarios	10/1/2026	3/31/2027
Tech Note-Extreme Event Scenarios	10/1/2026	3/31/2027
Model Code & Input Files will be delivered	10/1/2026	3/31/2027
CRMS User Workshop	4/1/2027	4/30/2027
DRAFT Tech Report	1/1/2027	5/1/2027
Review Draft Tech Report by Expert panel/PDT	5/1/2027	5/31/2027
Final Tech Report (Revise based on review comme	**6/1/2027**	**6/30/2027**
ERDC Management Review of Final Tech Report	6/1/2027	9/30/2027
Publication of Tech Report	10/1/2027	12/31/2027

Next 2 Quarters

→ Drafted

→ Outlined