LOWER SUSQUEHANNA RIVER WATERSHED ASSESSMENT
QUARTERLY TEAM MEETING

CBP, Fish Shack, Annapolis/Eastport, Maryland
February 11, 2013

Meeting Agenda

		<u>Lead</u>
10:00	Welcome and Introductions	All
10:05	Review of Action Items from Prior Meetings Communication and Coordination Updates for Situational Awareness	O'Neill
<u>LSRWA Technical Analyses</u>		
10:15	Review of Modeling Scenarios and Schedule	O'Neill
10:20	CBEMP Modeling Update	Cerco
11:00	Conowingo and Hurricane Sandy Rapid Assessment	Dennison
11:15	Update on Reservoir Sediment Management Strategies	Aloisio
12:00	Update on Reservoir Operational Strategies	Balay
12:10	Update on Watershed Sediment Management Strategies	Rowe/Michael
12:20	Budget Update	O'Neill
12:25	Wrap Up Action Items/Summary Next Meeting	O'Neill

Call-In Information: (877) 336-139, access code = 6452843#, security code = 1234#

<u>Expected Attendees:</u>

MDE: Herb Sachs; Tim Fox, Matt Rowe, Stacy Boyles
MDNR: Bruce Michael, Bob Sadzinski
MGS: Jeff Halka
SRBC: John Balay, Andrew Gavin, Dave Ladd
USACE: Anna Compton, Bob Blama, Chris Spaur, Claire O'Neill, Ashley Williams, Danielle Aloisio, Tom Laczo, Dan Bierly
ERDC: Carl Cerco, Steve Scott
TNC: Mark Bryer, Kathy Boomer
USEPA: Gary Shenk, Lewis Linker
USGS: Mike Langland, Joel Blomquist

Exelon: Mary Helen Marsh, Kimberly Long, Bob Matty, Gary LeMay
Lower Susquehanna Riverkeeper: Michael Helfrich
PA Agencies: Patricia Buckley, Raymond Zomok

Action Items from November Quarterly Meeting:

A. Michael Helfrich will coordinate with MD, CBP and the MD county coalition to set up a meeting to present dam implications to TMDL to MD counties. *Status:*

B. Mike Langland will let Claire know if his final report will be a stand- alone document or if it will be written collaboratively with Steve Scott to be included with the ADH modeling report. *Status:*

C. Carl Cerco will have CBP WSM modeling runs of existing/baseline conditions completed by mid-December. *Status:*

D. UMCES report entitled *Effect of Timing of Extreme Storms on Chesapeake Bay Submerged Aquatic Vegetation* will be saved on LSRWA website. *Status: Complete.* Document saved at: http://mddnr.chesapeakebay.net/LSRWA/Docs/Wang%20and%20Linker.pdf

Ongoing Action Items from Previous Meetings:

A. The MDE FTP website will be utilized to share internal draft documents within the team; Matt will be the point of contact for this FTP site. *Status: Ongoing. Sharing of future documents will go through the MDE ftp website.*

B. Shawn will notify team when most recent Exelon study reports are released. *Status: Ongoing.*

C. Anna will update PowerPoint slides after each quarterly meeting to be utilized by anyone on the team providing updates to other Chesapeake Bay groups. *Status: Ongoing.*

D. Anna will send out an update via the large email distribution list that started with the original Sediment Task Force (includes academia, general public, federal, non-government organization (NGO), and state and counties representatives) notifying the group of updates from the quarterly meeting. *Status: Ongoing.*

E. Matt will keep team informed on innovative re-use committee findings to potentially incorporate ideas/innovative techniques into LSRWA strategies. *Status: Ongoing.*

Action Items –

a. Michael Helfrich will coordinate with MD, CBP and the MD county coalition to set up a meeting to present dam implications to TMDL to MD counties.
b. Mike Langland will let Claire know if his final report will be a stand- alone document or if it will be written collaboratively with Steve Scott to be included with the ADH modeling report.
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5 February 2013

Lower Susquehanna River Watershed Assessment
Initial Modeling Runs to be Conducted

Discussions:

- Carl Cerco with the assistance of Steve Scott and Mike Langland put together a white paper discussing the various modeling input options for his CBEMP/WQSTM model (enclosure 1).
- After reviewing the options, it was agreed that using the Chesapeake Bay Program's watershed model (WSM) input would provide a big picture or macro view of the problem right now. This input can be done relatively simply and in a short timeframe. The primary focus of this work is to assess the sediment impacts to the Chesapeake Bay.
- Once the AdH/HEC-RAS models are up and running and fully calibrated/validated, a more detailed "micro" view of the problem can be evaluated. More specifically, the model runs with the AdH/HEC-RAS input can forecast sedimentation and deposition rates from the watershed to the reservoir system and the corresponding effects of that erosion and sedimentation to water quality in the Chesapeake Bay.
- Carl has agreed to accomplish four scenario runs (schedule still to be determined) with the CBEMP/WQSTM model:
    1. 2010 land uses with 1991-2000 flow values and 1991-2000 Conowingo capacity
    2. Watershed implementation plans (WIPs) in place with 1991-2000 flow values and 1991-2000 Conowingo capacity
    3. 2010 land uses with 1991-2000 flow values and Conowingo storage full
    4. WIPs in place with 1991-2000 flow values and Conowingo storage full
- For the purposes of evaluating the effectiveness of alternatives, the HEC-RAS/AdH input is required. The input is focused on 2008-11 flow values and current bathymetry so it is a more accurate representation of the existing conditions. Using this input will result in more detailed information about the geographic distribution of sediments as well as the impacts to the Chesapeake Bay.
- These modeling runs have been coordinated with MDE (Sachs, Rowe), MDNR (Michael), ERDC (Scott, Cerco), and USACE-Baltimore (Compton, O'Neill)
- For the WIP effects, the modelers have determined that the AdH model cannot be used because the hydrology doesn't match with the CBEMP/WQSTM and WSM model. As such, a surrogate will need to be used. The exact methodology is still to be determined but the thought is that the watershed inputs to the CBEMP/WQSTM model could be adjusted proportionally using information from AdH/HEC-RAS regarding erosion and deposition.

- Table below summarizes the macro runs and micro runs:

Question to be Answered by Modeling Run	MACRO		MICRO		Notes
	WSM Input	**Schedule to Complete?**	**HEC-RAS/ AdH Input**	**Schedule to Complete?**	
1. What is the system's current condition?	√	CBEMP/ WQSTM = completed (Dec 12)	√	AdH/HEC-RAS = **Completed** CBEMP/WQSTM =**Completed**	Establish baseline for comparing alternatives
2. What is the system's condition if the WIPs are in full effect?	√	CBEMP/ WQSTM = completed (Dec 12)	No specific AdH run; adjust loads to CBEMP based on AdH results	CBEMP/WQSTM = **Completed**	Watershed management alternative; TMDL focus; establish an alternate baseline for comparing alternatives
3. What happens when the reservoir fills?	√	CBEMP/ WQSTM = completed (Dec 12)	√	USGS/HEC-RAS **Feb 8** AdH/HEC-RAS = **Feb 15** CBEMP/WQSTM = **Feb 23**	Establish future without-project condition (i.e., no WIPS in place and reservoir is full)
4. What happens when the reservoir fills and WIPs are in full effect?	√	CBEMP/ WQSTM = completed (Dec 12)	No specific AdH run; adjust loads to CBEMP based on AdH results	CBEMP/WQSTM = **Feb 23**	Establish an alternate future without-project condition
5. What is the system's condition if a large scour event occurs?			√	AdH/HEC-RAS = **Completed** CBEMP/WQSTM = **Completed**	Establish an alternate baseline condition for comparing alternatives; assess erosion and deposition following large flow event using historical geometry/ bathymetry (post-January 1996 scouring event)
6. What is impact of alternative TBD?			√		
7. What is impact of alternative TBD?			√		
8. What is impact of alternative TBD?			√		
9. What is impact of alternative TBD?			√		
10. What is impact of alternative TBD?			√		
Hydrology / flow values	1991-2000		2008-2011		
Reservoir condition/bathymetry	1991-2000		2008-2011 for existing		

Recap

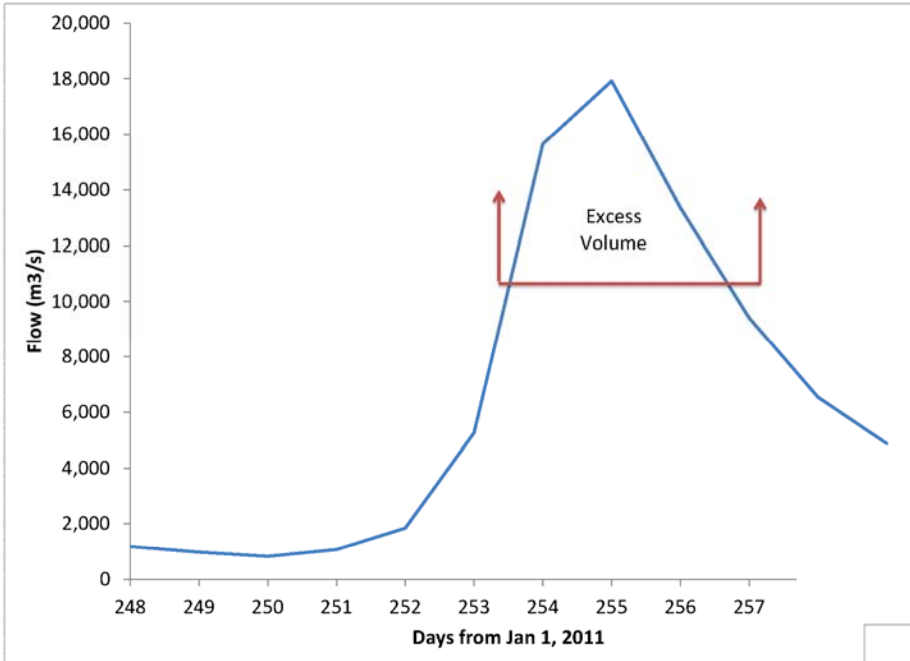
- Previous results presented to this group were based on model simulations which eliminated Conowingo Reservoir.
- Analogous to a situation with Conowingo filled such that there is no net erosion or deposition.
- The hydrology contained no major erosion events. Flows in January 1996 were sufficient to cause erosion but HSPF, as calibrated, computed little net erosion during this event.
- We want to simulate the effects of an erosion event on Chesapeake Bay water quality.

Background

- ADH is the premier tool for computing sediment erosion, deposition, and transport in Conowingo Reservoir.
- The ADH application period, 2008 – 2011, contains two erosion events: Tropical Storm Lee and a small event in March 2011.
- ADH is not presently applied over our water quality simulation period, 1991 – 2000. We need a way to map computed erosion from 2011 to 1996.

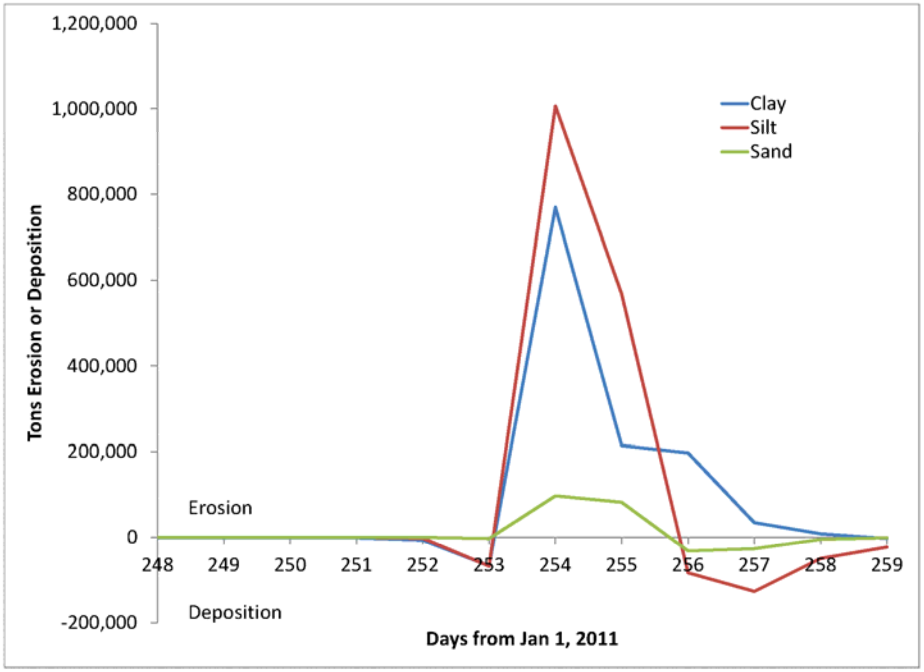
The Micro Runs

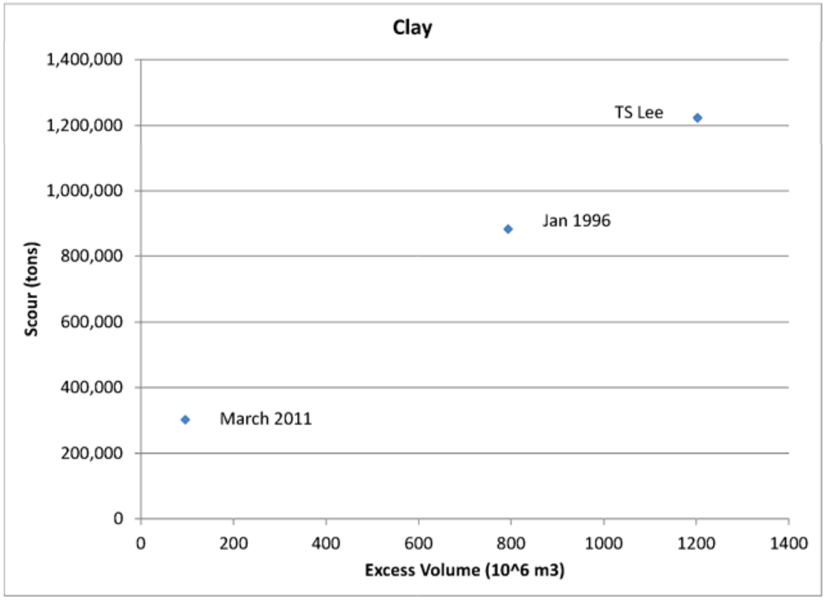
1. What is the system's current condition? 2010 Progress Run with scour event from ADH
2. What is the system's condition with WIPs in effect? TMDL run with scour event from ADH.
3. What happens when the reservoir fills? Repeat 1 with revised bathymetry.
4. What is effect of reservoir filling on WIPs? Repeat 2 with revised bathymetry.
5. What is the system's condition following a large scour event? Repeat 2 with bathymetry as surveyed following 1996 scour event.

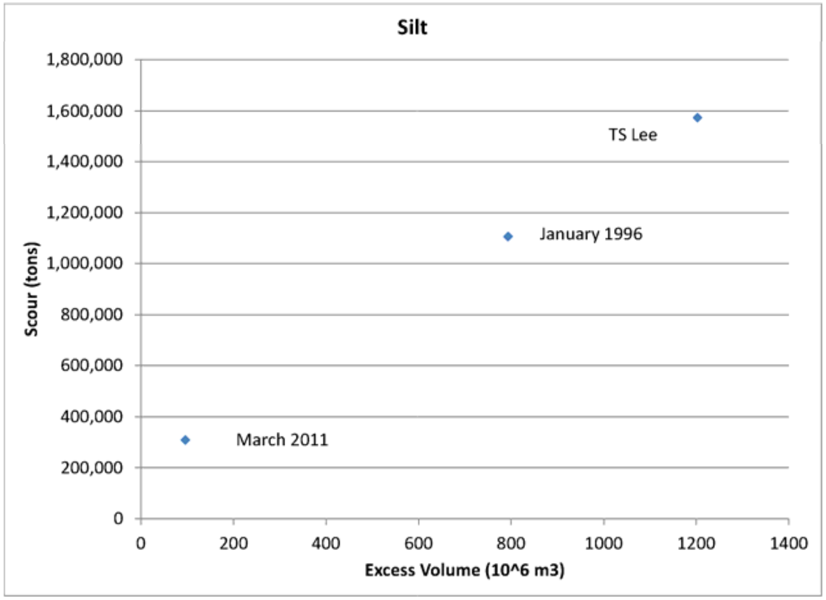


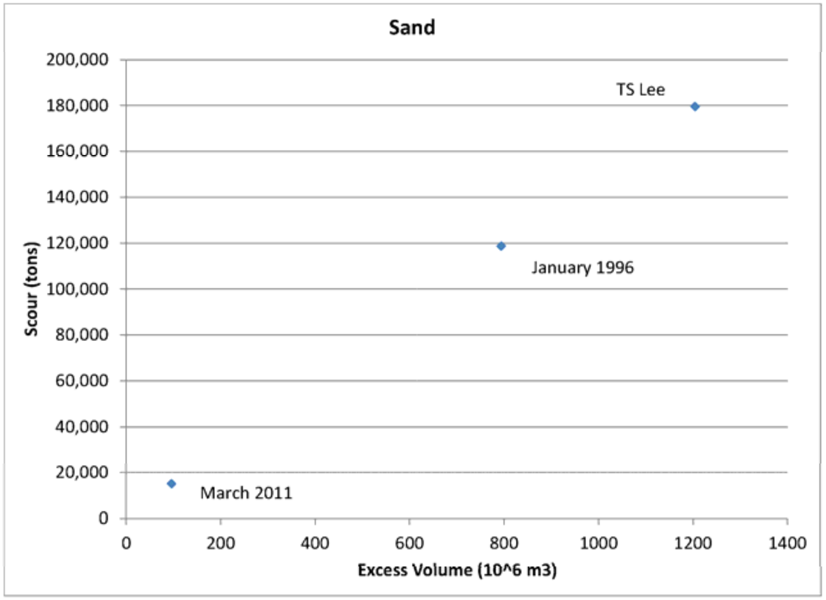
The greatest flow during TS Lee occurs on Day 255, the second day on which flow exceeds the criteria for scour: 11,000 m^3/s.

The greatest scour occurs on Day 254, the first day on which flow exceeds 11,000 m^3/s. After that, the bed armors.

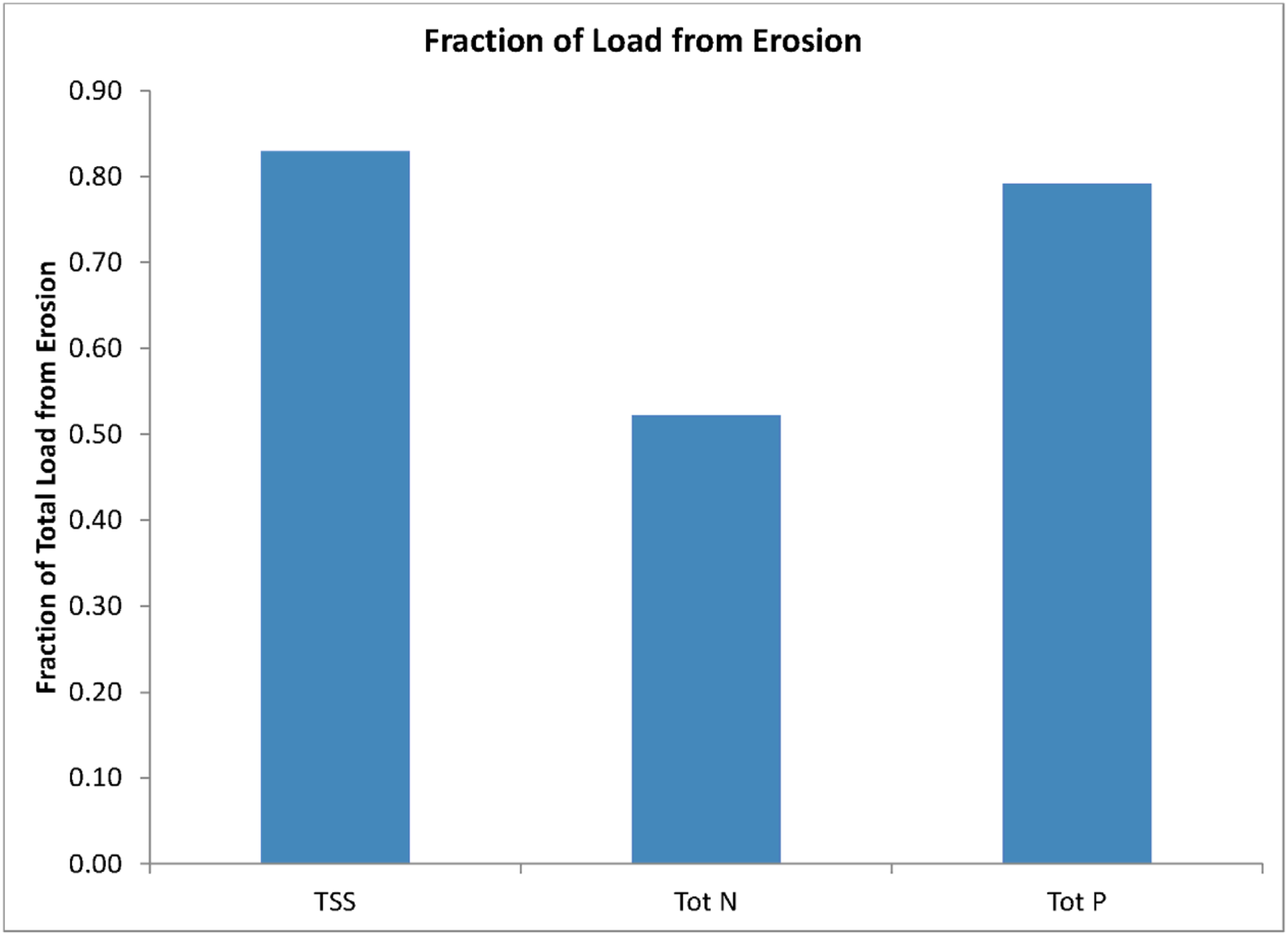


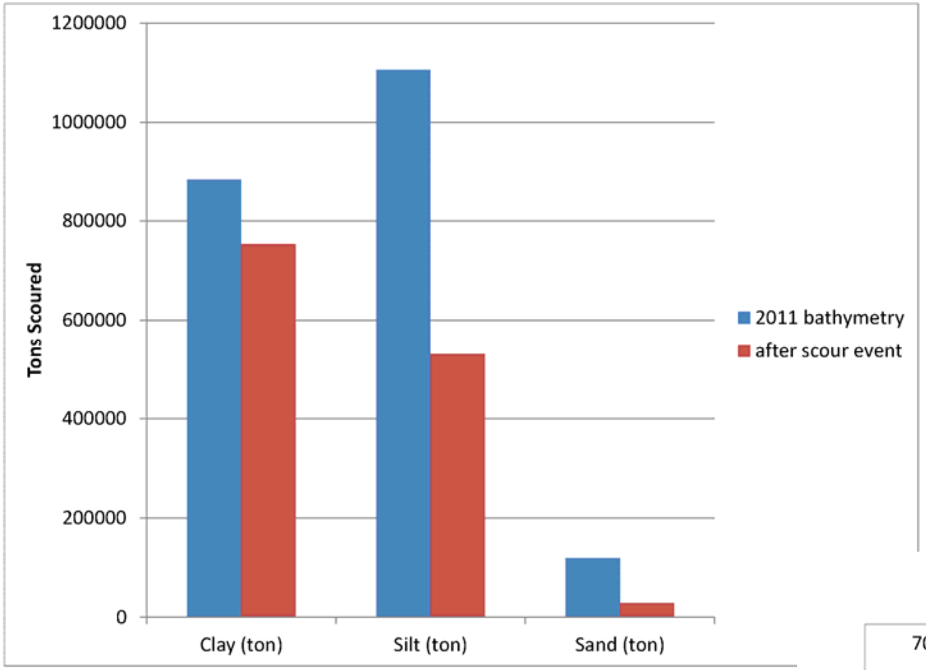


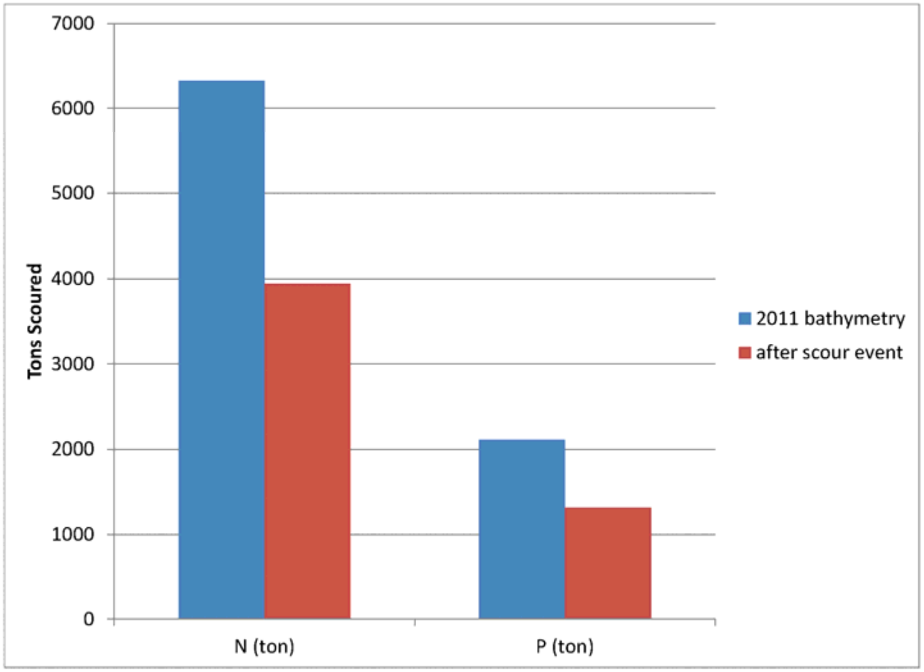




- Solids loads for January 1996 are based on excess volume. Interpolate between two events calculated for 2011.
- Nutrient and carbon loads based on bottom composition: 5% C, 0.3% N, 0.1%P.
- Add the scour loads to the WSM loads. No other adjustment to the WSM loads.

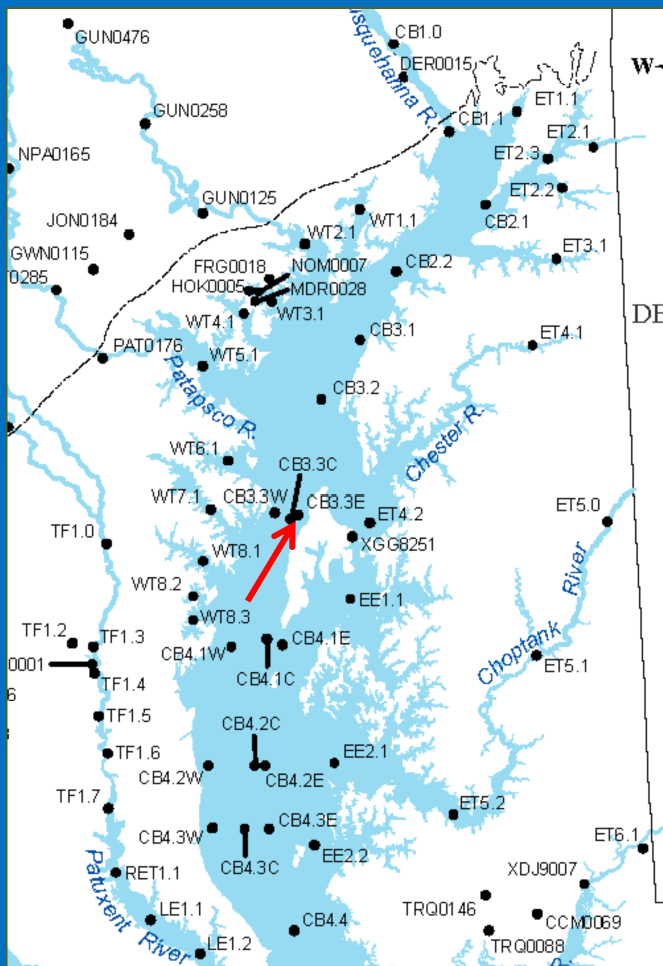

Fraction of Load from Erosion
Fraction of Total Load from Erosion
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
TSS
Tot N
Tot P



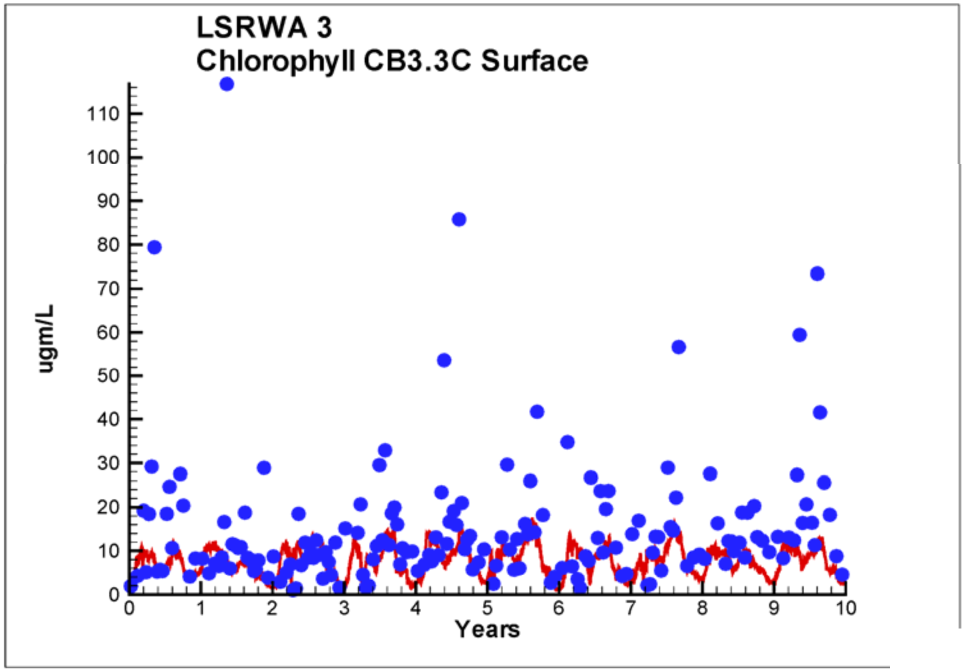


- The loads estimated to take place after a scour event are computed by the same process as the existing loads. ADH erosion is from a new run with scoured-out bathymetry.
- The loads are less than with existing bathymetry.
- No evidence of additional retention during non-scour periods.

Model Results

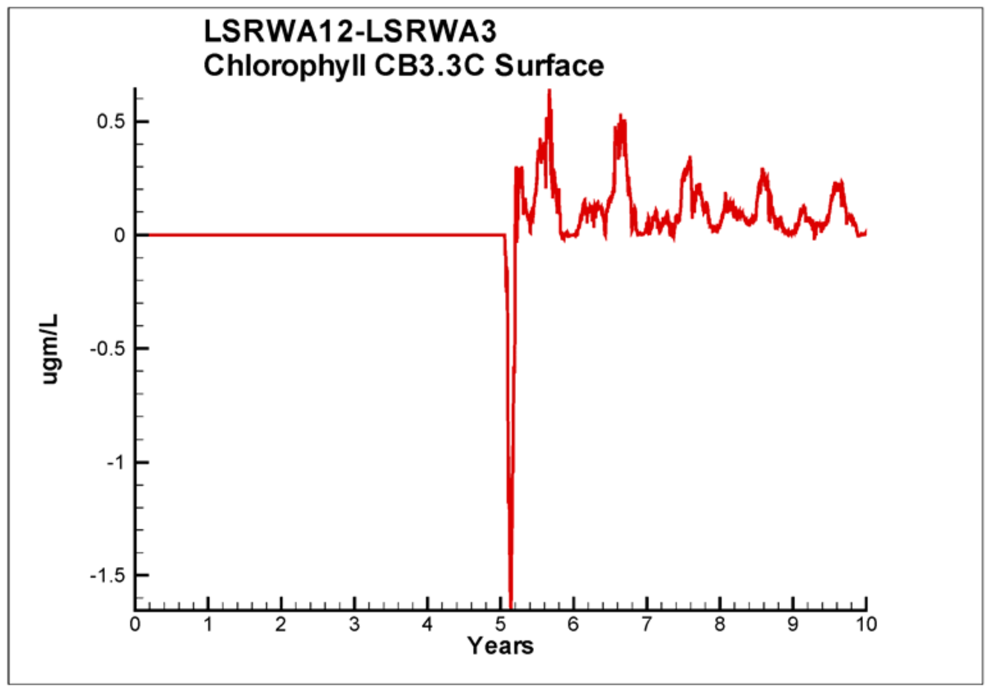


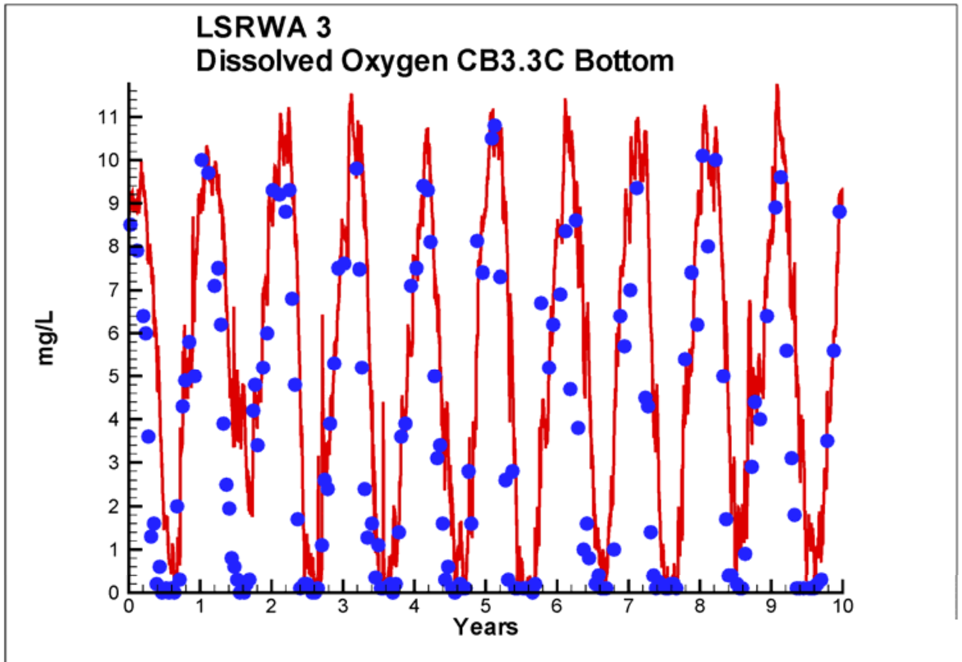
- Let’s concentrate on the TMDL (WIP) run.
- We’ll look at time series at CB3.3C and at longitudinal plots in summer 1996 (first summer after storm).
- Time permitting, we’ll look at scoured-out bathymetry and compare to previous results.



Base TMDL simulation shown in red.

Difference plot showing effect of storm scour.





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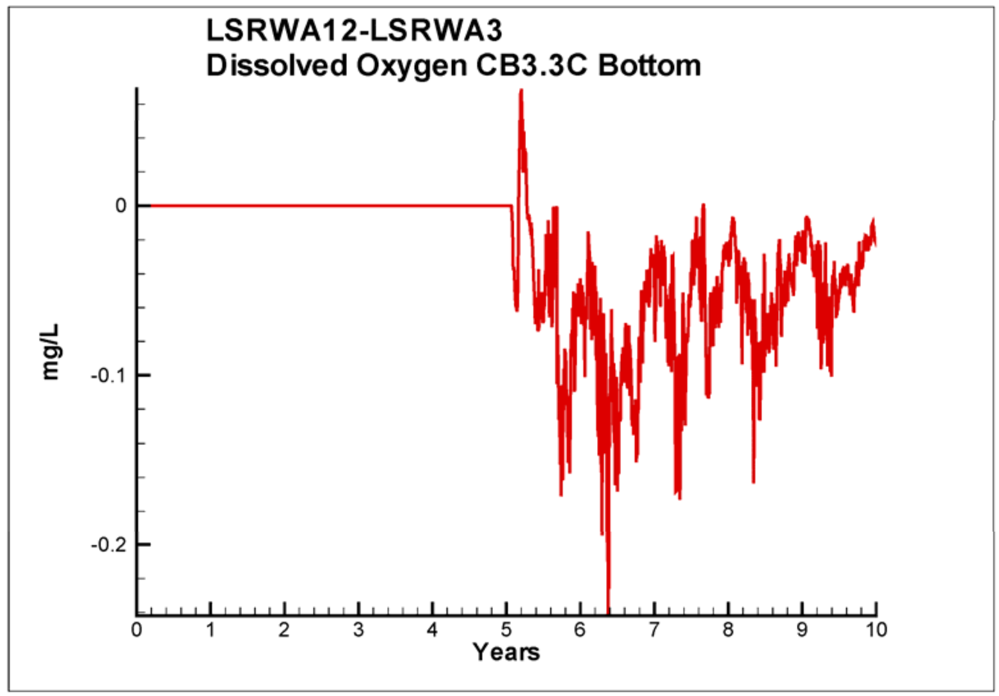

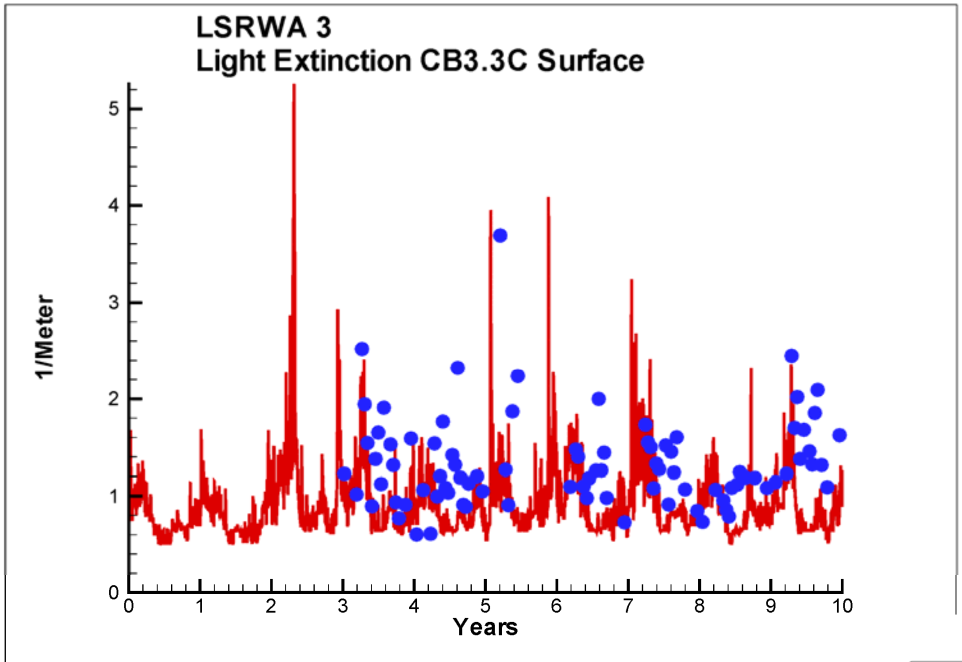

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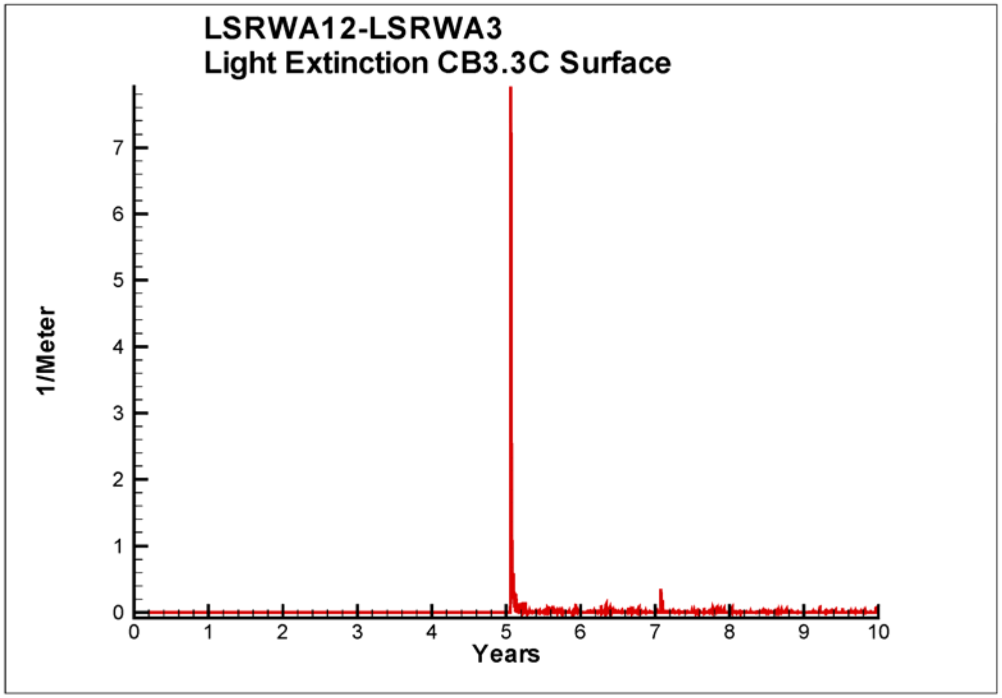
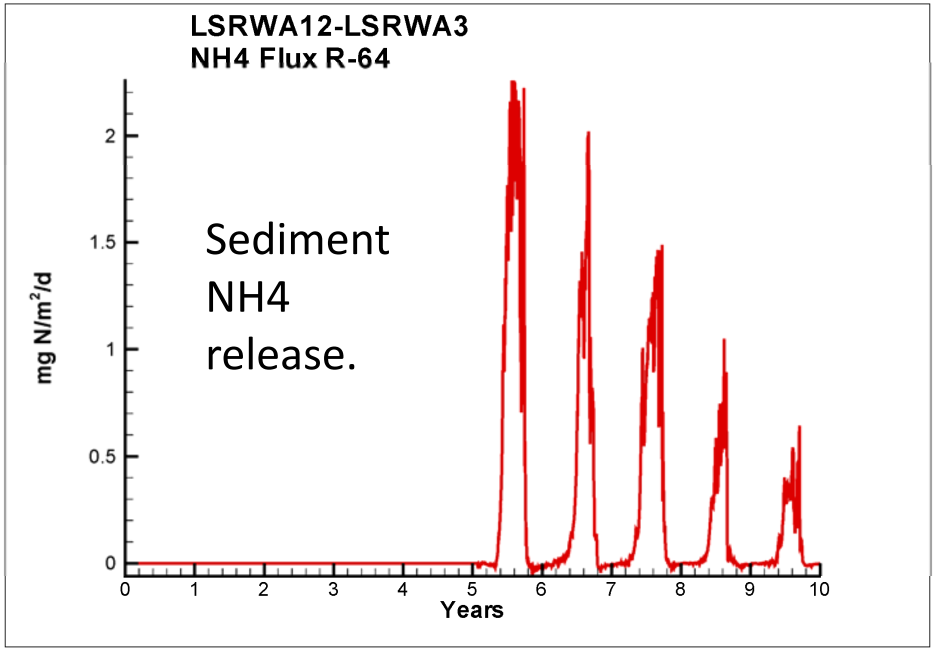
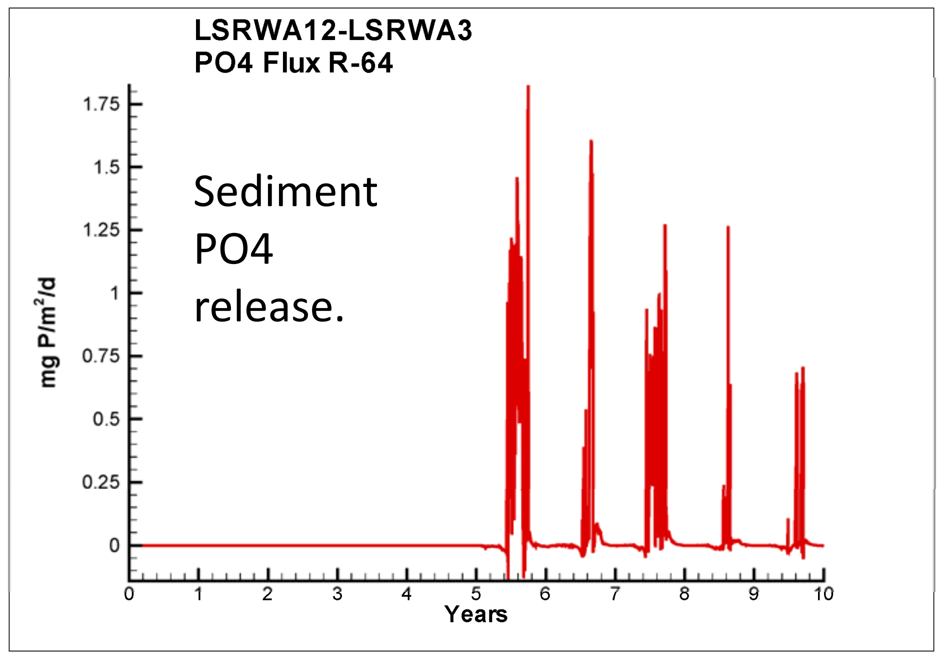
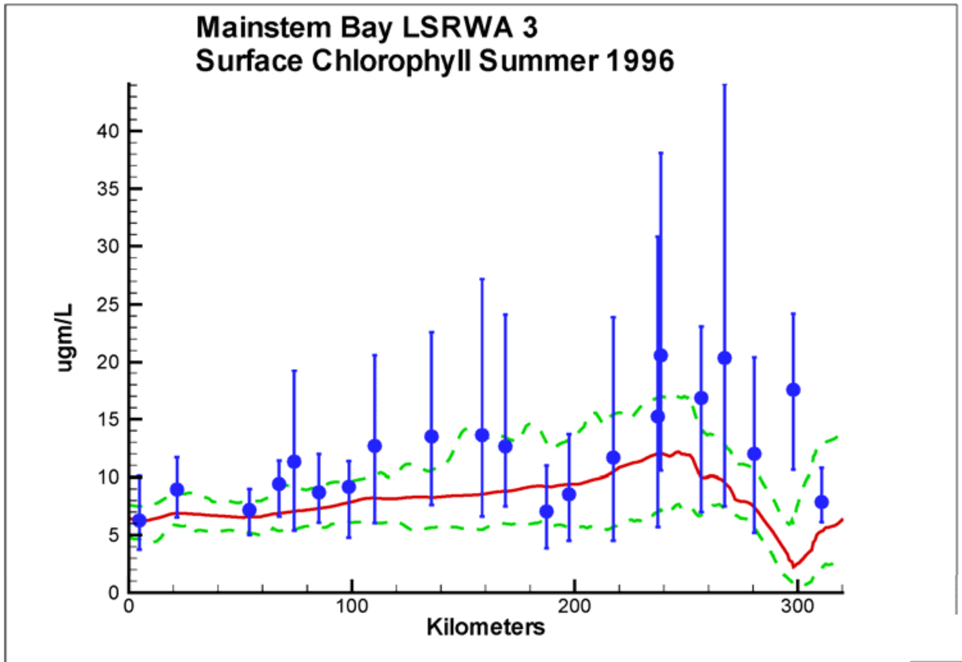




What's happening? Nutrients from the scour event deposit in bottom sediments and persist for years. Solids from scour event are inert after deposition.





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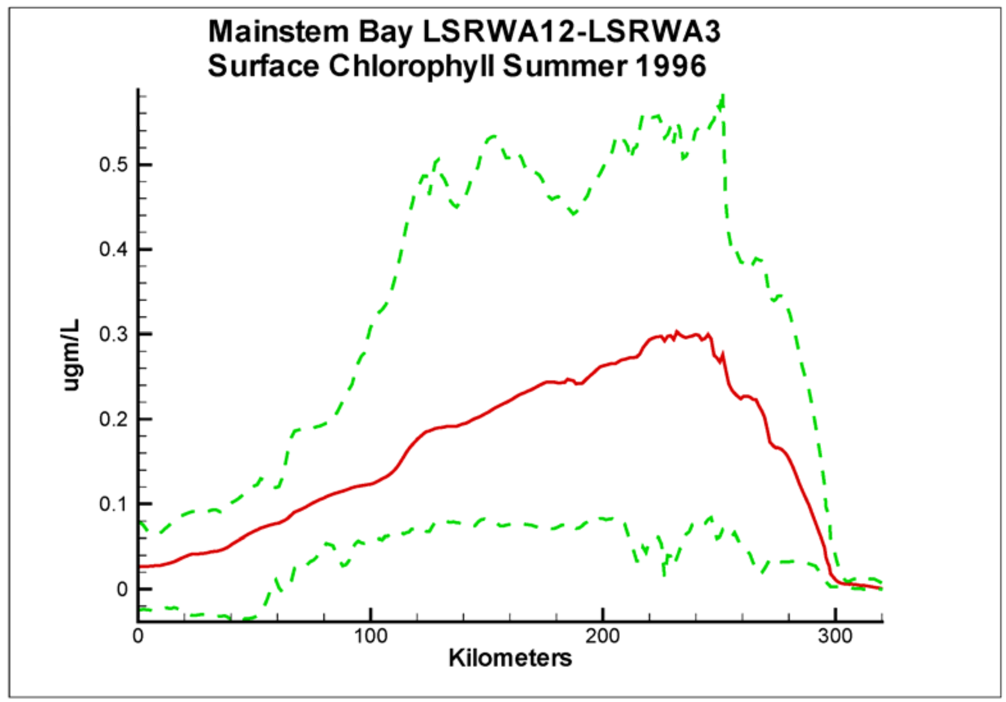

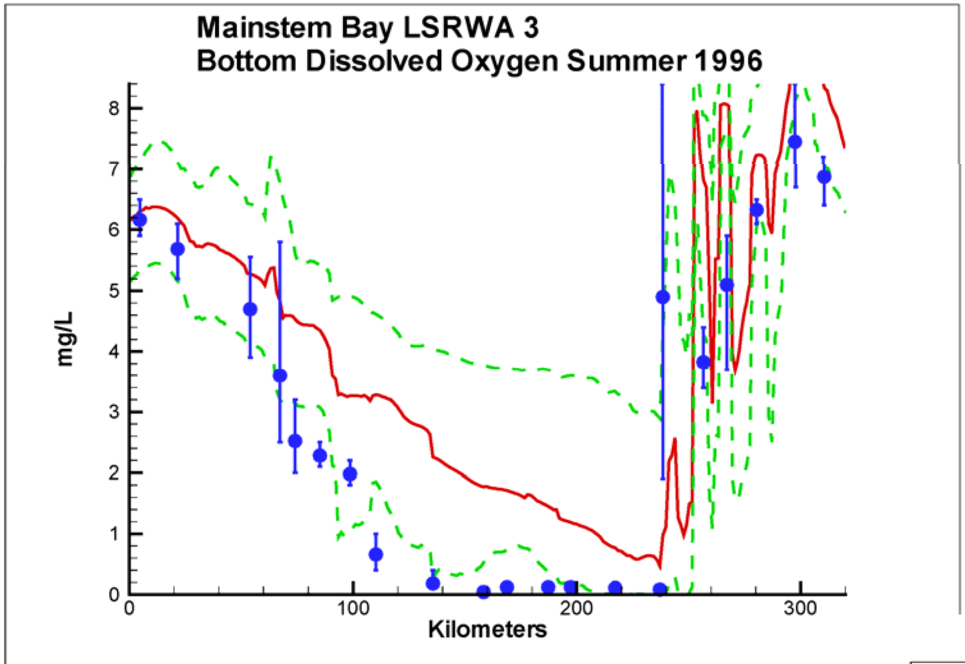

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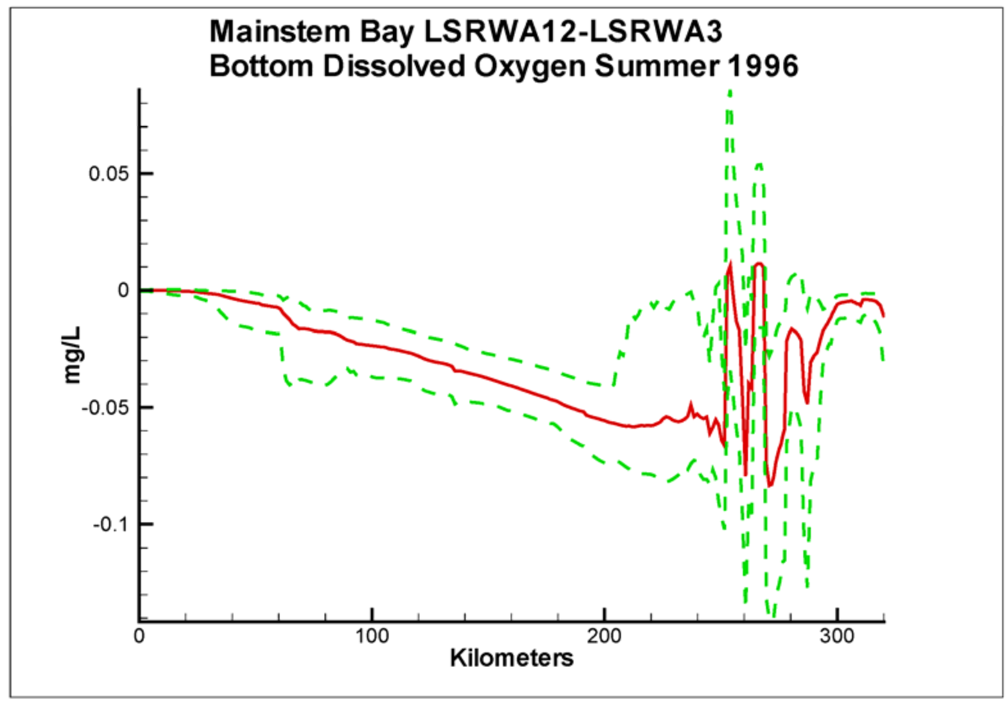

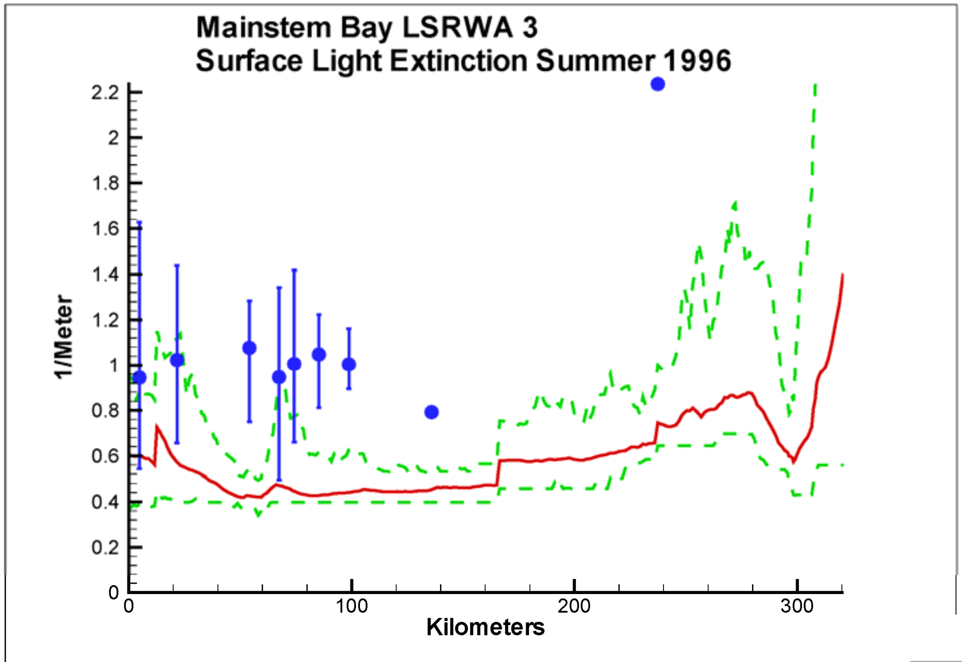

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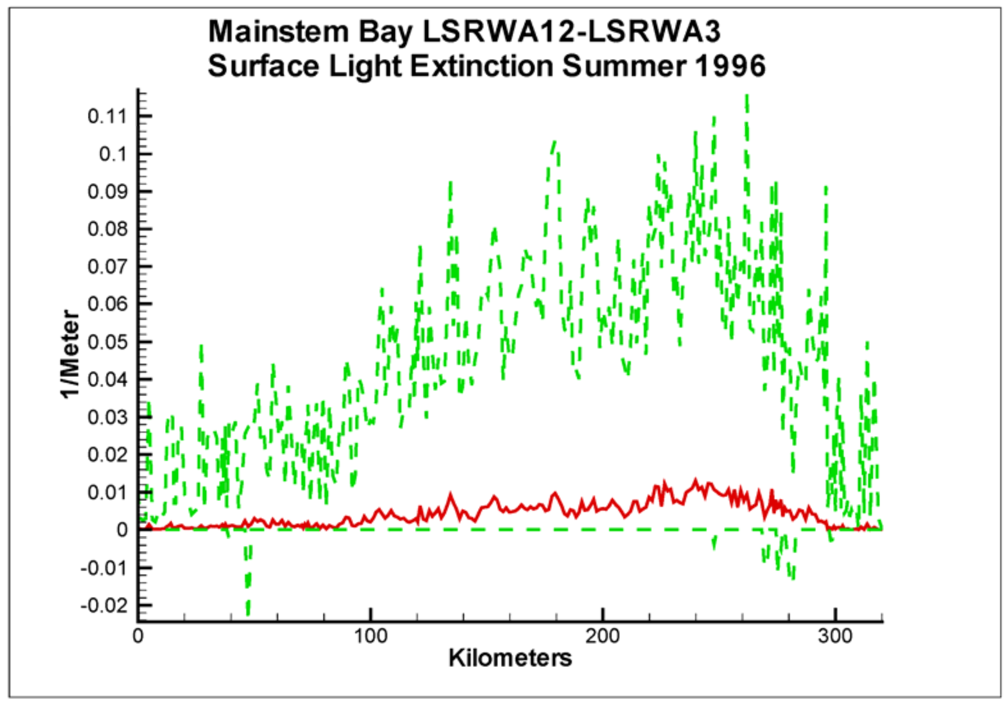
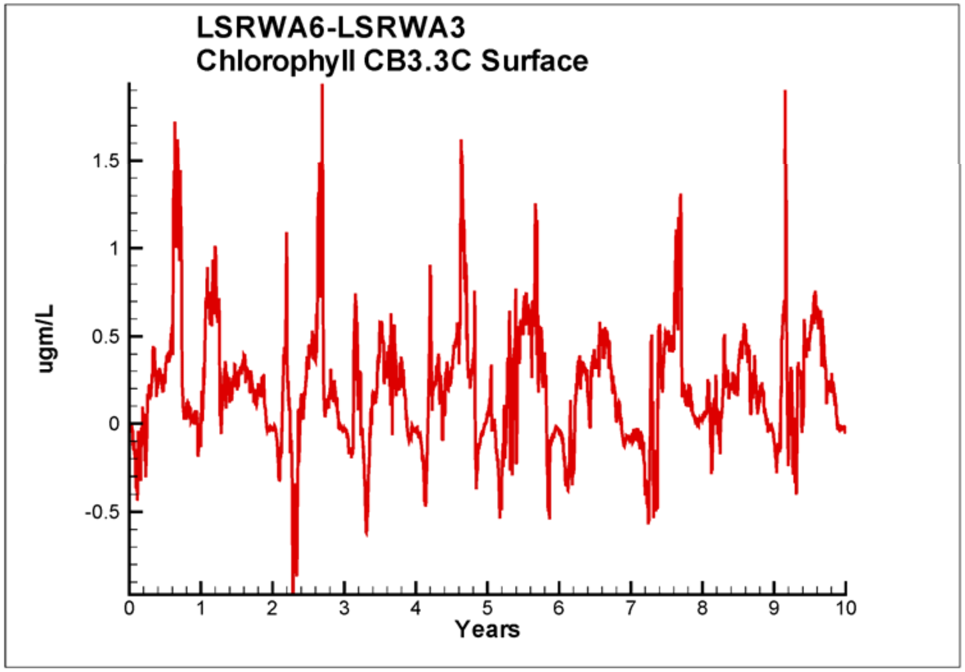
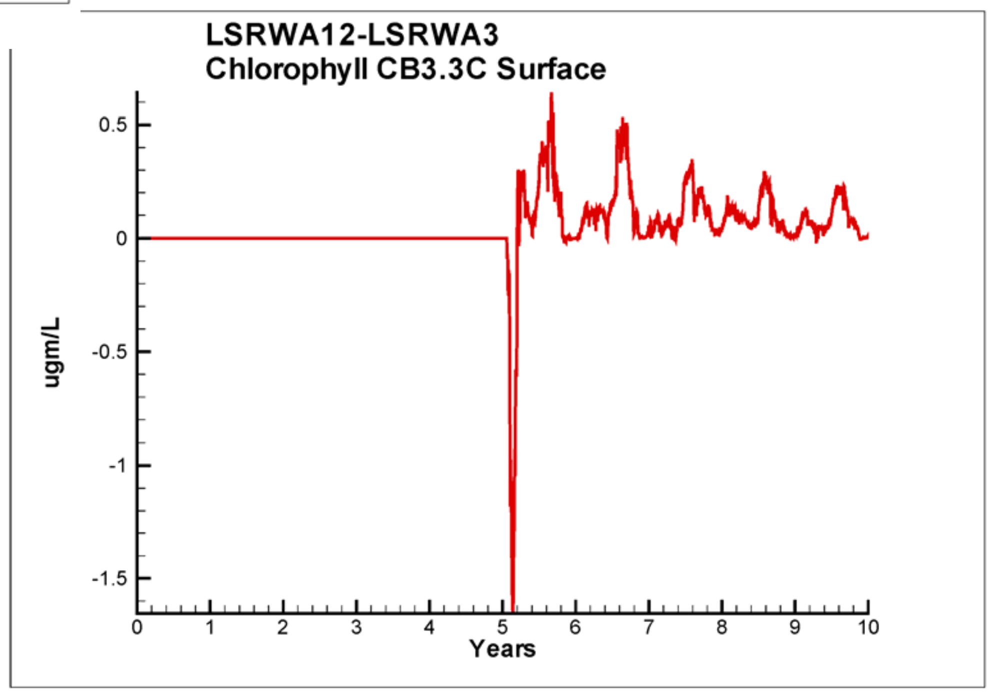
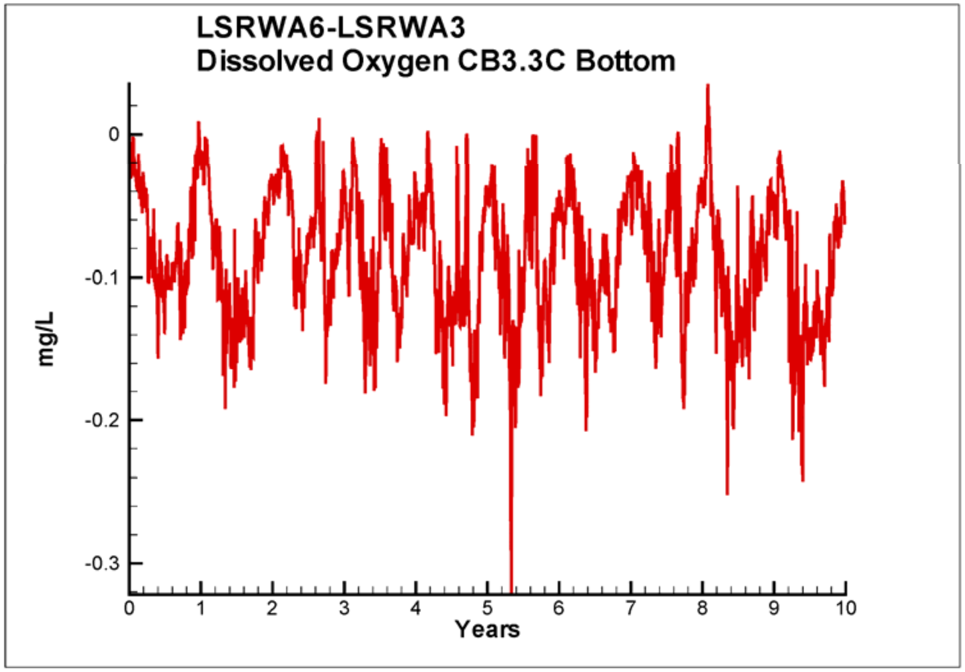




Difference plot showing effect of eliminating Conowingo.

Difference plot showing effect of storm scour.





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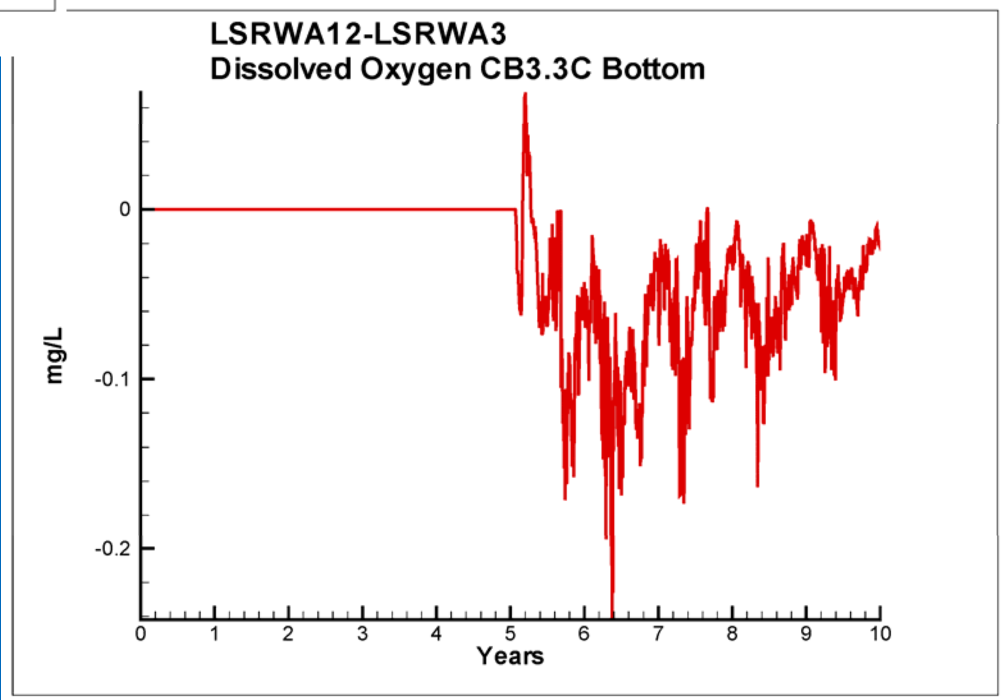

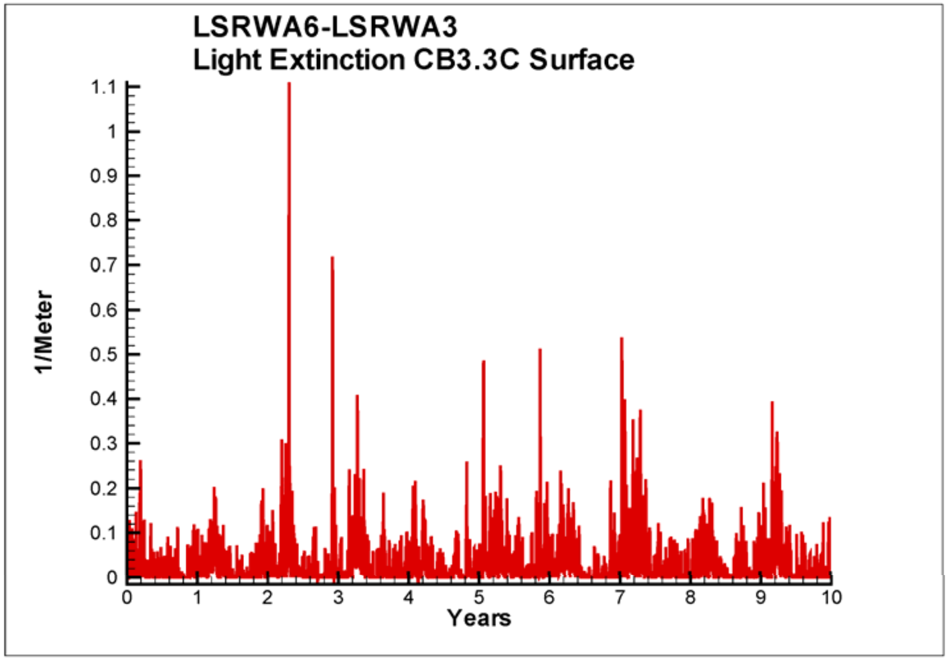

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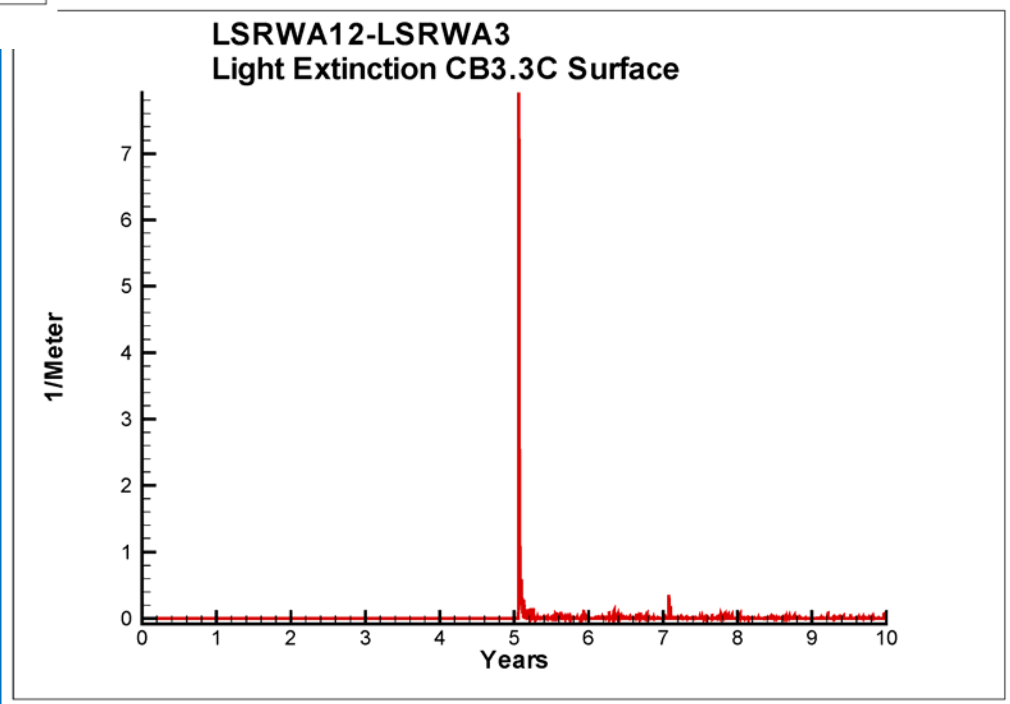


Summary and Conclusions

- Scour contributes substantial quantities of solids, nitrogen, and phosphorus relative to storm-loads descending through the watershed.
- The effects of solids scoured during a winter storm pass quickly and are barely visible by the following summer.
- The effects of scoured nutrients persist for years due to deposition in bottom sediments and subsequent recycling. The effects diminish over time.

Summary and Conclusions

- Maximum summer-average effects of a winter scour event on TMDL conditions are ≈ 0.3 μg/L Chl, 0.05 mg/L DO, 0.01 /m KE.
- A winter scour event has no computed impact on SAV. Effects such as burial or physical damage are not computable.
- Our findings of negligible impact on SAV are consistent with previous results obtained BY EPA CBP.

Summary and Conclusions

- I am seeing two potential patterns for the future. One is a filled reservoir in the absence of scour events. Deposition is minimized and solids and nutrients flow continuously to the bay.
- A second pattern involves one or more scour events.
- The acute impact of a scour event is comparable in magnitude to continuous overflow. The impact of the scour event diminishes with time while the overflow is continuous.

Summary and Conclusions

- Scour events are self-mitigating. Scour from a subsequent storm is diminished following a major event which scours the reservoir and increases volume.
- The increased volume has little effect on solids retention during non-storm periods.

Upcoming Events

- ADH runs are planned based on a reservoir-full bathymetry. These will tell us a lot about overflow from a filled reservoir and about scour of a filled reservoir.
- Our colleagues at EPA CBP are active and interested. HSPF has been modified to produce storm scour consistent with USGS estimates.
- More important, EPA has produced hydrodynamics and WSM runs that move the 1996 storm to different months.

Upcoming Events

- The following runs are planned in addition to a run with scour from the January 1996 storm:
  - No winter storm
  - Storm moved to June
  - Storm moved to October

Reservoir Sediment Management Strategies…
or How I Learned to Stop Worrying and Love Dredging

U.S. Army Corps of Engineers, Baltimore District

LSWRA Quarterly Meeting

February 11, 2013

LSRWA Scope

- Develop Sediment Management Strategies including concept design and costs
  - 1. Watershed Strategies – reduce sediment from watershed (i.e. BMP's, etc.)
  - 2. In-reservoir strategies
    - **A. Dredging/bypassing/innovative re-use**
    - B. Alter reservoir operations

Purpose

- Conduct an initial investigation to identify sediment removal and placement options for sediments behind Conowingo, Holtwood, and Safe Harbor Dams and provide recommendations.

Methodology

- Desktop analysis of study area (100-mile radius by road)
  - Google Earth search
  - Internet search for sites
  - Previous placement sites
- Phone calls to potential sites
- Site visits to see facilities

Mechanical Dredging

- *In Situ* removal of material
- Clamshell or bucket
- Material removed and placed on barges or in trucks
- Moved to upland or open water site

Hydraulic Dredging

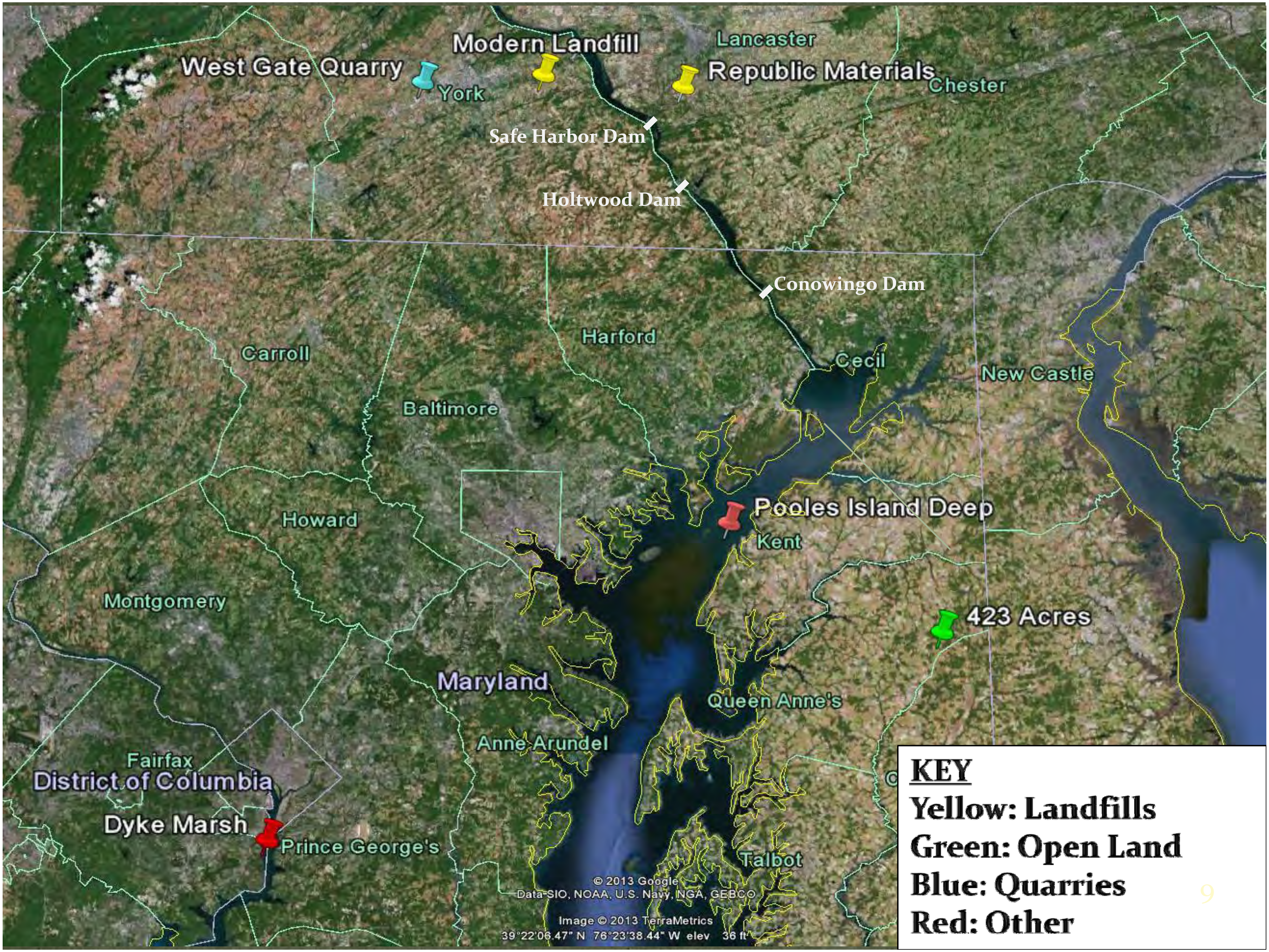
- Hopper or cutterhead

- Pipeline to transport to upland location

Potential Material Placement Options

- Beneficial Use
- Open Water
- Upland Placement


PENN/MD Materials Quarry
50 Acres
Scarboro Landfill
Conowingo Dam
55 Acres
Port Deposit Quarry
Mason Dixon-Cecil
Mason Dixon-Belvidere
62 Acres
Harford
Mason Dixon-Perryville
Stancill Quarry
Cecil
74 Acres
52 acres
© 2013 Google
Image U.S. Geological Survey
Image © 2013 TerraMetrics
39°34'41.03" N 76°06'26.96" W elev 8 ft
Imagery Date: 9/11/2012
KEY
Yellow: Landfills
Green: Open Land
Blue: Quarries
Red: Other


Modern Landfill
Lancaster
West Gate Quarry
York
Republic Materials
Chester
Safe Harbor Dam
Holtwood Dam
Conowingo Dam
Harford
Carroll
Cecil
New Castle
Baltimore
Pooles Island Deep
Kent
Howard
Montgomery
423 Acres
Maryland
Queen Anne's
Anne Arundel
Fairfax
District of Columbia
Dyke Marsh
Prince George's
Talbot
© 2013 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2013 TerraMetrics
39°22'06.47" N 76°23'38.44" W elev 36 ft
KEY
Yellow: Landfills
Green: Open Land
Blue: Quarries
Red: Other


Smith Island
Richmond
Rappahannock Shoals
Shirley Plantation
Wolf Trap
Newport News
Norfolk Ocean Site
Portsmouth
Virginia Beach
Albemarle Shelf Valley
KEY
Yellow: Landfills
Green: Open Land
Blue: Quarries
Red: Other
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Google
Image © 2013 TerraMetrics
37°27'39.28" N 76°02'28.20" W elev -20 ft
©2010 Google
Eye alt 134.18 mi

Beneficial Use Options

- Harbor Rock
- Island Creation
- Smith Island Restoration
- Fringe Wetland Creation
- Manufactured Soil
- Dyke Marsh (Potomac)

Harbor Rock

- Using dried material to create aggregate for building
- Previous presentation by Jeff Otto

Island Creation

- Teardrop islands in the Susquehanna River
- Creation in the Susquehanna Flats

Smith Island Restoration

- Smith Island on MD/VA border in the Chesapeake Bay is eroding
- Would be used in conjunction with wave attenuation program
- Sandier materials only

Fringe Wetland Creation

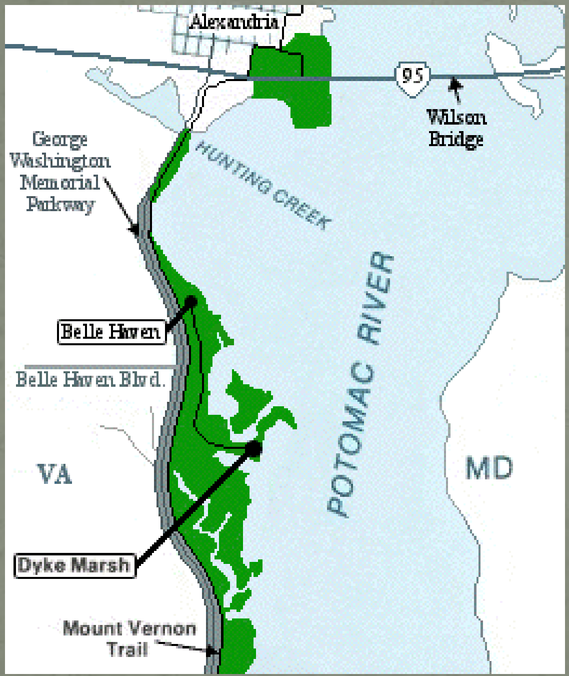
- Material used to create wetlands along Susquehanna River
- Used for sediment already behind dam and to prevent further sediment build-up
- Common USACE practice

Manufactured Soil

- A blend of soil and organic material that is used in horticulture/landscape applications and site restoration.
- The process is completed in coordination with Engineer Research and Development Center (ERDC), division of USACE
- Has been used successfully on previous dredging projects performed by USACE

Dyke Marsh (Potomac River)

- Create marsh from dredged materials near Alexandria, VA



Open Water Option

- Release Downstream
- Pump Downstream
- Pooles Island
- Ocean Placement
- Wolf Trap and Rappahannock, VA

Pump Downstream

- Bypass option
- Allows sediment to relocate to starved areas of the Upper Chesapeake Bay
- Hydraulically pump material past dam and into Susquehanna Flats and northern Chesapeake Bay

Pooles Island

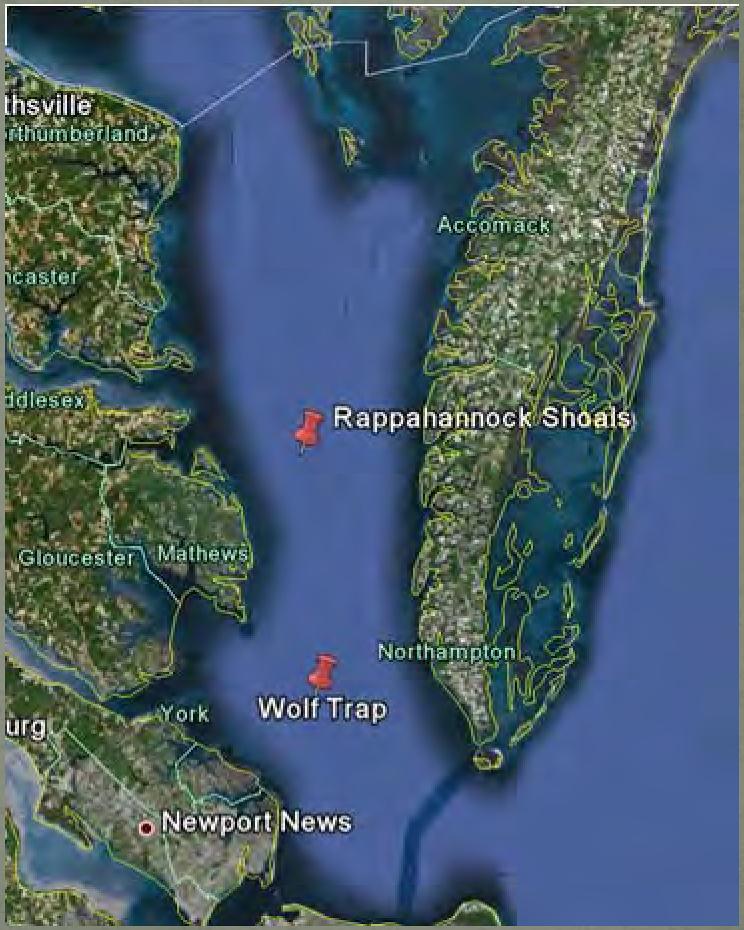
- Previously used for dredged material placement
- Last open water disposal location in MD

Open Ocean Placement

- Undetermined high capacity of material allowed
- Acceptable material
- 17 miles offshore from Norfolk

Wolf Trap and Rappahannock Shoals, VA

- Large quantities allowed
- Virginia environmental regulations must be met



Upland Placement Options

- Purchase land for upland placement
- Shirley Plantation
- Landfills
- Quarries/abandoned mines

Purchase of Land

- 100+ acre sites for dike creation
- Approx. 156 acres = 1 million cubic yards
- Allows for multiple options after material dries


01/30/2013


01/31/2013

Shirley Plantation

- Thousands of acres available
- Abandoned mine reclamation possibility on site
- Mechanical or hydraulic dredging opportunities

Landfills

- Daily and final fill cover options
- Many opportunities throughout PA
- Clean fill versus waste
- Tipping fee
- Potential to store at site

Abandoned Mines

- Similar process has been completed by rail in past
- Multiple locations available in Pennsylvania

Quarries

- Ability to take large quantities of acceptable material (clean fill)
- Long life spans of availability
- Material used as part of reclamation process
- Tipping fee
- Many opportunities locally (reduce transportation costs)

Mason Dixon-Perryville

Mason Dixon-Perryville (Reclamation)

PENN/MD Materials

PENN/MD Materials

Mason Dixon-Westgate

Port Deposit Quarry

COSTS

- Costs based on quantity and distance

- Mechanical with trucking --- $40 to $70/cy
- Hydraulic pumping downstream --- $6-$18/cy
- Hydraulic pumping up to 5 miles --- $15-$25/cy

- Tipping fee --- $4-$35/cy

Overall Assessment

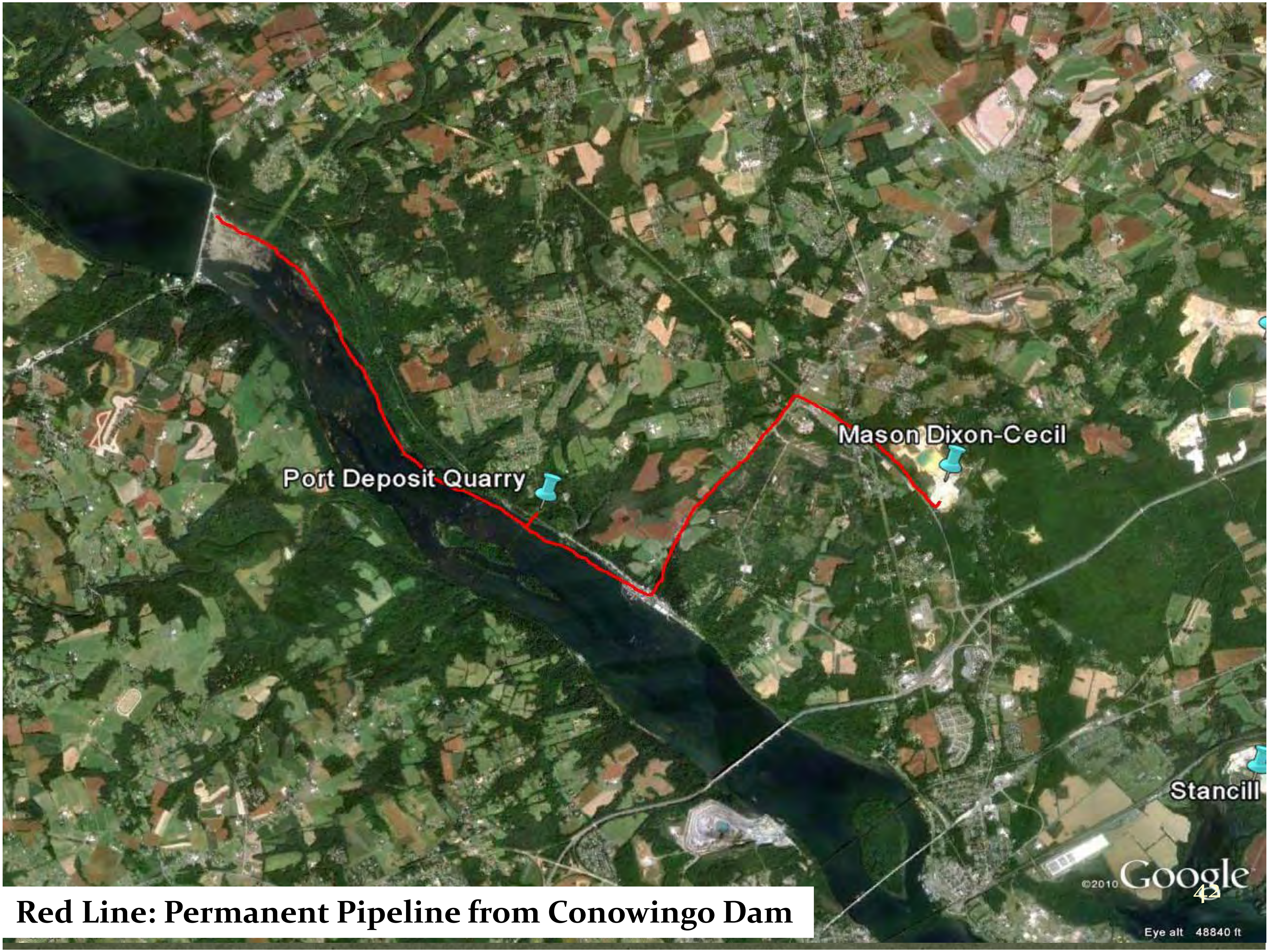
- Quarries best option
  - Wet or dry material
  - Large quantities
  - Several nearby can have material pumped
- Landfills have many qualifiers (Cost, transportation, quantities, environmental regulations)
- Island restoration has many environmental regulations
- Transportation costs to purchase land can be high

Implementation Considerations/Limitations

- More up-to-date chemical analysis needed for placement
- State environmental standards need to be met and approved
- Grain size of material
- Accessibility and distance to placement sites
- Tipping fees

Questions to LSRWA Agency Group

- How much material is planned to be removed?
- How often will material be removed?
- When would removal begin?



Red Line: Permanent Pipeline from Conowingo Dam

Lower Susquehanna Placement Options

Name	Acreage	Lifespan (yrs)	Capacity (CY)	Accessibility	Tipping Fee ($)	Limitations	Distance from Conowingo (mi)
Beneficial Use							
Harbor Rock	N/A	Indefinite	500,000/yr	Road, Pipeline, Barge	0	Limited Annual Amount, Dry Only	Variable
Island Creation	Variable	Indefinite	Variable	Pipeline, Barge	0	Env. Regs., Erosion, Sandy Material Only	Max. 75
Smith Island Restoration	Variable	Indefinite	Variable	Barge	0	Env. Regs., Erosion, Sandy Material Only	128
Fringe Wetland Creation	Variable	Indefinite	Variable	Pipeline,Road, Barge	0	Smaller Quantities, Erosion, Env. Regs., Confinement necessary	Max. 75
Manufactured Soil	Variable	Indefinite	Variable	Pipeline, Road, Barge	0	Dry only	Variable
Dyke Marsh (Potomac, MD)	245	Indefinite	5.7 million	Barge, Pipeline	0	Env. Regs., Erosion, Confinement necessary	90
Open Water							
Release Downstream	N/A	N/A	Variable	N/A	0	Env. Regs/Impacts	N/A
Pump Downstream	N/A	N/A	Variable	N/A	0	Env. Regs/Impacts	N/A
Pooles Island	1,700	Indefinite	5,000,000/year 50-100 million total	Barge	0		32
Ocean Placement	N/A	Indefinite	Unlimited	Barge	0	Must pass bio assays	240
Wolf Trap and Rappahannock, VA	N/A	Indefinite	1,000,000+	Barge	0	Needs VA approval	155
Upland Placement							
Purchase Land	Vairable (100+)	Indefinite	Variable	Road, Pipeline	N/A	Cost, Contamination, Zoning	Variable
Shirley Plantation	1,800	Indefinite	1,000,000 +40-60 mil. in mine reclamation	Barge, Road	50/cy	Must meet VA chemical criteria	270
Abandoned Mines	Variable	Indefinite	Variable	Barge, Pipeline, Road	Unknown	Env. Regs	Variable
Landfills							
Modern Landfill (York, PA)	80	8	240,000	Road, Rail	30/ton	PA DEP Regs., Dry only	37**
Republic Materials (Conestoga, PA)	80	26	240,000	Road, Rail	30/ton	PA DEP Regs., Dry only	46
Scarboro Landfill (Aberdeen, MD)	106	Unknown	318,000	Road, Pipeline	Unknown	Dry Only	13*
Quarries							
Stancil Quarry	70	Unknown	9,000,000	Road, Pipeline	4/cy		13*
Port Deposit Quarry	68	Indefinite	3,250,000	Road, Rail, Pipeline	0		3.5*
Penn/MD Materials (York, PA)	60	25-30	9,000,000	Road, Pipeline	Unknown	PA DEP Regs.	5*
Penn/MD Materials (Skippack, PA)	100	Unknown	300,000	Road	Unknown	PA DEP Regs.	72
Mason Dixon Materials (Belvidere Plant)	565	40	113,000,000	Road, Pipeline	Unknown		12.5*
Mason Dixon Materials (Perryville Plant)	107	40	21,400,000	Road, Pipeline	Unknown		12.3*
Mason Dixon Materials (Cecil Plant)	150	40	16,050,000	Road, Pipeline	Unknown		10*
Mason Dixon Materials (Westgate Plant)	21	Indefinite	3,060,000	Road, Rail	Unknown	PA DEP Regs.	38

* Acceptable Pumping Distance
** 11 Miles from Safe Harbor, Acceptable Pumping Distance

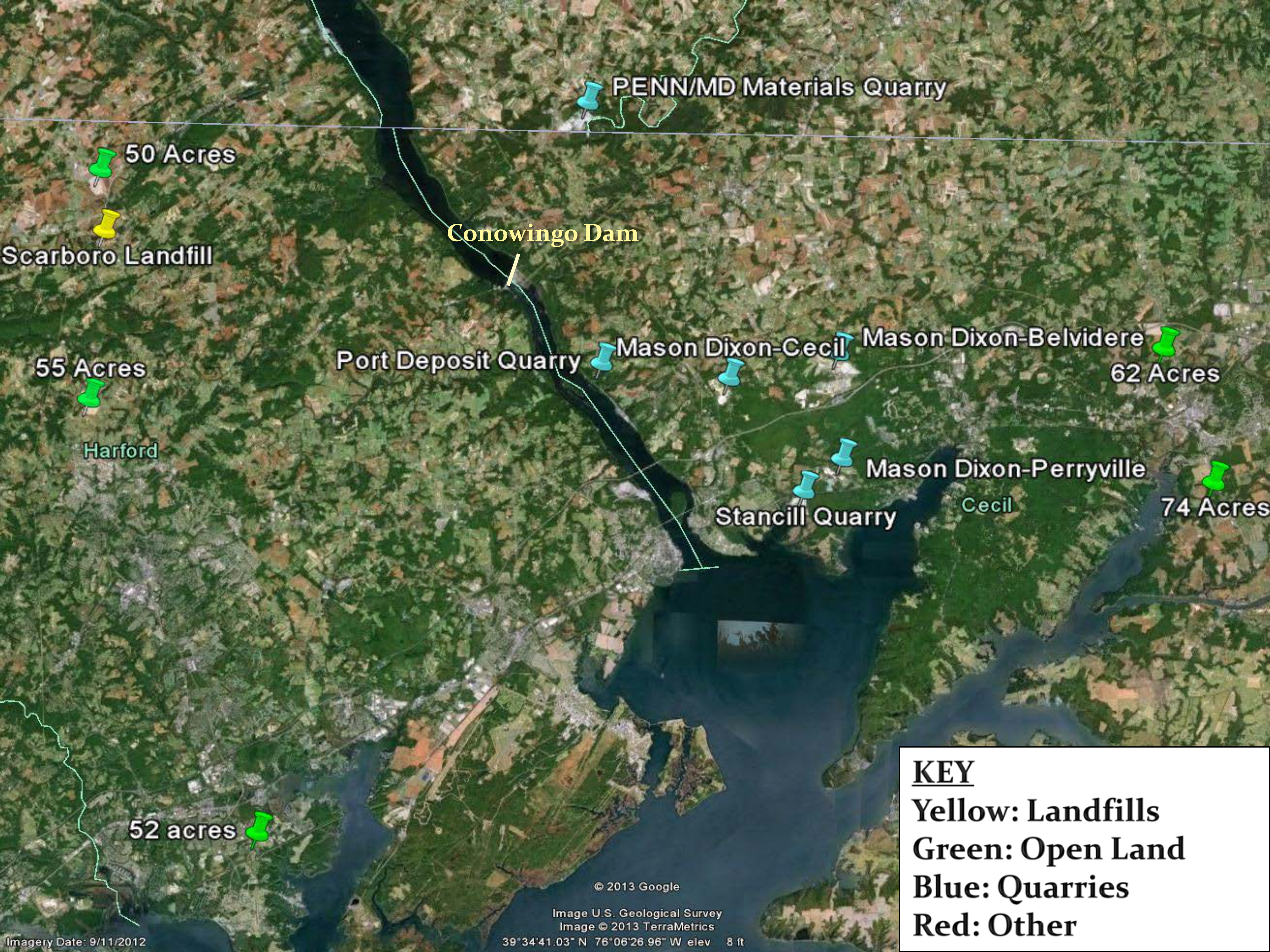

PENN/MD Materials Quarry
50 Acres
Scarboro Landfill
Conowingo Dam
55 Acres
Port Deposit Quarry
Mason Dixon-Cecil
Mason Dixon-Belvidere
62 Acres
Harford
Mason Dixon-Perryville
Cecil
74 Acres
Stancill Quarry
52 acres
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Image U.S. Geological Survey
Image © 2013 TerraMetrics
Imagery Date: 9/11/2012
39°34'41.03" N 76°06'26.96" W elev 8 ft
KEY
Yellow: Landfills
Green: Open Land
Blue: Quarries
Red: Other

Modern Landfill
Lancaster
West Gate Quarry
York
Republic Materials
Chester
Safe Harbor Dam
Holtwood Dam
Conowingo Dam
Harford
Carroll
Cecil
New Castle
Baltimore
Pooles Island Deep
Kent
Howard
Montgomery
423 Acres
Maryland
Queen Anne's
Anne Arundel
Fairfax
District of Columbia
Dyke Marsh
Prince George's
Talbot
© 2013 Google
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2013 TerraMetrics
39°22'06.47" N 76°23'38.44" W elev 36 ft
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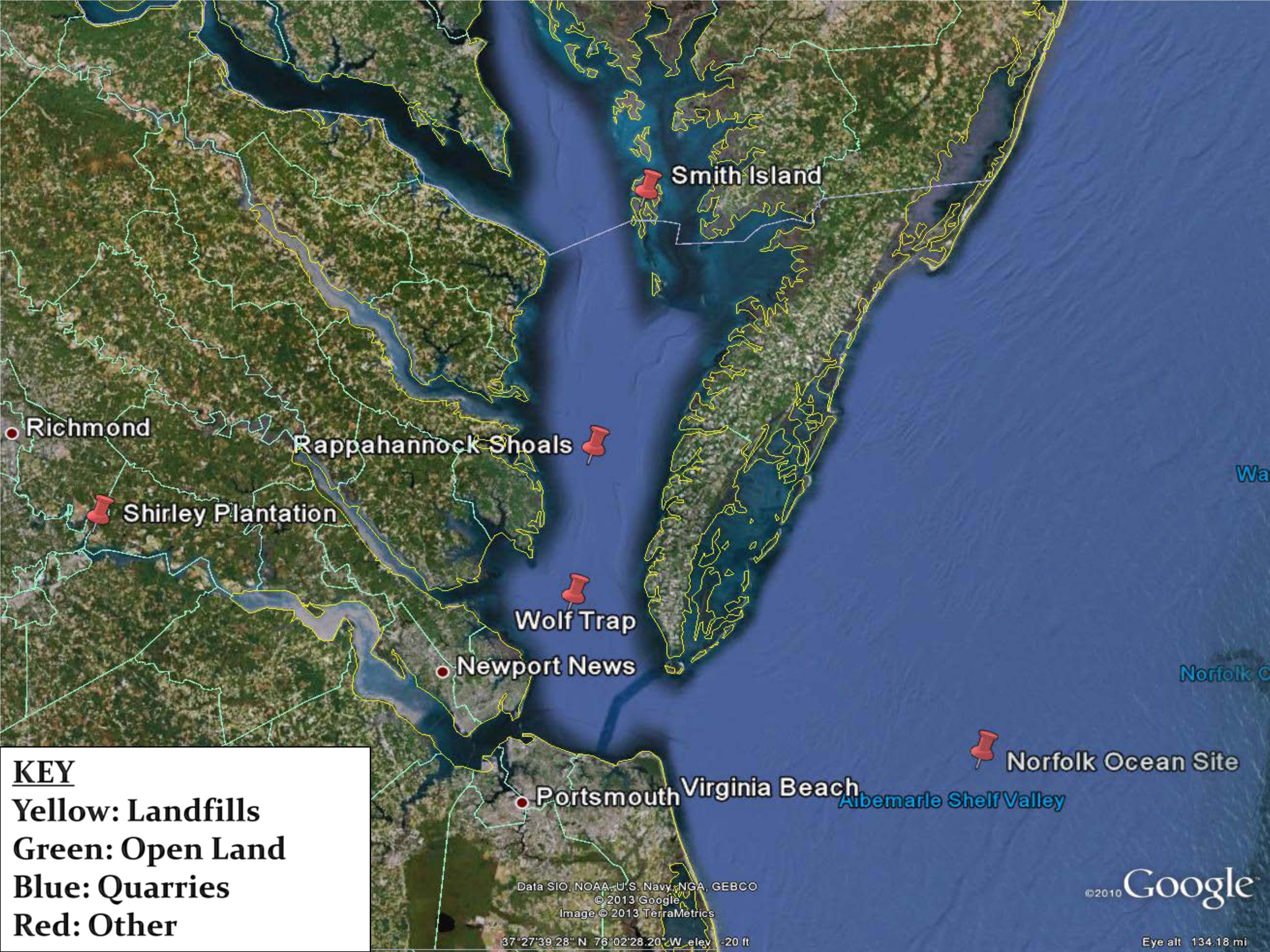
Smith Island
Richmond
Rappahannock Shoals
Shirley Plantation
Wolf Trap
Newport News
Portsmouth
Virginia Beach
Norfolk Ocean Site
Albemarle Shelf Valley
Wa
Norfolk C
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2013 Google
Image © 2013 TerraMetrics
37°27'39.28" N 76°02'28.20" W elev -20 ft
©2010 Google
Eye alt 134.18 mi
KEY
Yellow: Landfills
Green: Open Land
Blue: Quarries
Red: Other

Lower Susquehanna River Watershed Assessment
Quarterly Team Meeting
February 11, 2013

<u>Update On Reservoir Operational Strategies</u>

1. Existing Operations – Conowingo Hydroelectric Station
    a. Hydraulic capacity = 86,000 cfs
    b. License pond elevation range = 101.2 - 110.2 ft. Normal range = 104.7 – 109.2 ft
        i. Recreation level (Memorial Day to Labor day) - 107.2 ft
        ii. Muddy Run can't pump - 104.7 ft
        iii. PBAPMS cooling problems – 104.2 ft
        iv. CWA can't withdraw – 100.5 ft
        v. PBAPS NRC shut down – 99.2 ft
        vi. Baltimore can't withdraw – 91.5 ft
    c. Min flow requirements
        i. Vary seasonally, ranging from 3,500 - 10,000 cfs (or $Q_{Marietta}$)
    d. Estimated leakage = 800 cfs

2. Outlet Infrastructure
    a. Turbines
        i. Francis turbines (7) = 6,700 cfs/each (west side)
        ii. Kaplan turbines (4) = 9,700 cfs/each (east side)
    b. Crest gates
        i. Flow over ogee spillway sections controlled by 50 stony-type crest gates
        ii. Each crest gate has discharge capacity of ~16,000 cfs at pond elevation of 109.2 ft. and are 22.5 feet high.
        iii. Two regulating gates have discharge capacity of ~4,000 cfs per gate at pond elevation of 109.2 ft. and are 10 feet high.
        iv. Each gate lifted vertically by crane and is either fully open or closed; no intermediate setting.
        v. Total discharge capacity of gates is ~808,000 cfs.

3. Potential Operational Alternatives
    a. Sediment Task Force Recommendations (SRBC 2002) dropped modified dam operations alternative
        i. Impact primary purpose of electric generation; potential benefits limited
    b. Limited hydraulic and storage capacities = run-of-river station during significant sediment transport events
        i. Operational storage behind dam is 33.8 kaf (assuming 4 ft pond elevation range, ~108.5 – 104.5 ft). To fill/drain this storage, it would take:
            1. 14.6 hrs of Muddy Run pumping (28,000 cfs);
            2. 12.8 hrs of Muddy Run generating (32,000 cfs)
            3. 4.8 hrs of Conowingo generating (86,000 cfs)

        4. 40 minutes for TS Lee flood (616,000 cfs)
    ii. No intermediate setting on crest gates - can’t use all gates to pass sediment unless flows extremely high
        1. Using a gate will only impact a bit more than a 38 ft (gate width) section of channel, but will use up 4,000 cfs of flow
    iii. For significant sediment transport events typical of high flows, we are talking about hours (not days) of effect from dam
    iv. Very limited options for sediment control via operational changes as station is run-of-river facility at flows greater than 86,000 cfs
c. Agitation dredging coupled w/ generation releases during non-critical months
    i. During winter months and avg/low flow conditions, conduct agitation dredging between peaking operations to suspend fines in water column for release during generation releases.
        1. Sediment releases would be limited, in terms of volume and, to fine material

Non-Point Source Best Management Practices and Efficiencies currently used in Scenario Builder
Values in parentheses are in progress of official approval

Agriculture BMPs		***How Credited***	***TN Reduction Efficiency***	***TP Reduction Efficiency***	***SED Reduction Efficiency***
Nutrient Management		Landuse Change	N/A	N/A	N/A
Forest Buffers (varies by region; see Appendix 2)		Efficiency, Landuse Change	19-65%	30-45%	40-60%
Wetland Restoration (varies by region; see Appendix 2)		Efficiency	7-25%	12-50%	4-15%
Land Retirement		Landuse Change	N//A	N/A	N/A
Grass Buffers (varies by region; see Appendix 2)		Efficiency, Landuse Change	13-46%	30-45%	40-60%
Non-Urban Stream Restoration		Mass reduction/length	0.02 lb/ft	0.003 lb/ft	2 lb/ft
Tree Planting		Landuse Change	N/A	N/A	N/A
Carbon Sequestration/Alternative Crops		Landuse Change	N/A	N/A	N/A
Conservation Tillage		Landuse Change	N/A	N/A	N/A
Continuous No-Till (varies by region; see Appendix 2)		Efficiency	(10-15%)	(20-40%)	(70%)
Enhanced Nutrient Management		Efficiency	(7%)	(N/A)	(N/A)
Decision Agriculture		Efficiency	(4%)	(N/A)	(N/A)
Conservation Plans	High-till	Efficiency	8%	15%	25%
	Low-till	Efficiency	3%	5%	8%
	All hay	Efficiency	3%	5%	8%
	Pasture	Efficiency	5%	10%	14%
Cover Crops (see Appendix 1)		Efficiency	Varies	Varies	Varies
Commodity Cover Crops (see Appendix 2)		Efficiency	Varies	Varies	Varies
Stream Access Control with Fencing		Landuse Change	N/A	N/A	N/A
Alternative Watering Facility		Efficiency	5%	8%	10%
Prescribed Grazing/PIRG		Efficiency	9%	24%	30%
Horse Pasture Management		Efficiency	N/A	20%	40%
Animal Waste Management Livestock		Efficiency	75%	75%	N/A
Animal Waste Management Poultry		Efficiency	75%	75%	N/A
Barnyard Runoff Control		Efficiency	20%	20%	40%
Loafing Lot Management		Efficiency	20%	20%	40%
Mortality Composters		Efficiency	40%	10%	N/A
Water Control Structures		Efficiency	33%	N/A	N/A
Poultry Phytase		Application Reduction	N/A	N/A	N/A
Swine Phytase		Application Reduction	N/A	N/A	N/A

Dairy Precision Feeding and Forage Management	Application Reduction	N/A	N/A	N/A
Poultry Litter Transport	Application Reduction	N/A	N/A	N/A
Ammonia Emissions Reduction (interim)	Application Reduction	15-60%	N/A	N/A
Poultry Litter Injection (interim)	Efficiency	25%	0%	0%
Liquid Manure Injection (interim)	Efficiency	25%	0%	0%
Phosphorus Sorbing Materials in Ditches (interim)	Efficiency	40%	0%	0%
Resource BMPs	***How Credited***	***TN Reduction Efficiency***	***TP Reduction Efficiency***	***SED Reduction Efficiency***
Forest Harvesting Practices	Efficiency	50%	60%	60%
Dirt & Gravel Road Erosion & Sediment Control – Driving Surface Aggregate + Raising the Roadbed	Mass reduction/length	0	0	2.96lb/ft
Dirt & Gravel Road Erosion & Sediment Control – with outlets	Mass reduction/length	0	0	3.6lb/ft
Dirt & Gravel Road Erosion & Sediment Control – outlets only	Mass reduction/length	0	0	1.76lb/ft
Urban BMPs	***How Credited***	***TN Reduction Efficiency***	***TP Reduction Efficiency***	***SED Reduction Efficiency***
Forest Conservation	Landuse Change	N/A	N/A	N/A
Urban Growth Reduction	Landuse Change	N/A	N/A	N/A
Impervious Urban Surface Reduction	Landuse Change	N/A	N/A	N/A
Forest Buffers	Efficiency, Landuse Change	25%	50%	50%
Tree Planting	Landuse Change	N/A	N/A	N/A
Abandoned Mine Reclamation	Landuse Change	N/A	N/A	N/A
Wet Ponds and Wetlands	Efficiency	20%	45%	60%
Dry Detention Ponds and Hydrodynamic Structures	Efficiency	5%	10%	10%
Dry Extended Detention Ponds	Efficiency	20%	20%	60%
Infiltration Practices w/o Sand, Veg.	Efficiency	80%	85%	95%
Infiltration Practices w/ Sand, Veg.	Efficiency	85%	85%	95%
Filtering Practices	Efficiency	40%	60%	80%
Erosion and Sediment Control	Efficiency	25%	40%	40%
Nutrient Management	Efficiency	17%	22%	N/A
Street Sweeping	Efficiency	3%	3%	9%
Urban Stream Restoration	Load reduction/length	0.02lb/ft	0.003lb/ft	2lb/ft
Septic Connections	Systems Change	N/A	N/A	N/A

Septic Denitrification		Efficiency	50%	N/A	N/A
Septic Pumping		Efficiency	5%	N/A	N/A
Bioretention	C/D soils, underdrain	Efficiency	25%	45%	55%
	A/B soils, underdrain	Efficiency	70%	75%	80%
	A/B soils, no underdrain	Efficiency	80%	85%	90%
Vegetated Open Channels	C/D soils, no underdrain	Efficiency	10%	10%	50%
	A/B soils, no underdrain	Efficiency	45%	45%	70%
Bioswale		Efficiency	70%	75%	80%
Permeable Pavement w/o Sand, Veg.	C/D soils, underdrain	Efficiency	10%	20%	55%
	A/B soils, underdrain	Efficiency	45%	50%	70%
	A/B soils, no underdrain	Efficiency	75%	80%	85%
Permeable Pavement w/ Sand, Veg.	C/D soils, underdrain	Efficiency	20%	20%	55%
	A/B soils, underdrain	Efficiency	50%	50%	70%
	A/B soils, no underdrain	Efficiency	80%	80%	85%

Appendix 2 **BMPs**	**Hydrogeomorphic Region(s)**	***TN Reduction Efficiency***	***TP Reduction Efficiency***	***SED Reduction Efficiency***
Forest Buffers	Appalachian Plateau Siliciclastic Non-Tidal	54%	42%	56%
	Blue Ridge Non-Tidal; Mesozoic Lowlands Non-Tidal; Valley and Ridge Carbonate Non-Tidal	34%	30%	40%
	Coastal Plain Dissected Uplands Non-Tidal	65%	42%	56%
	Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Piedmont Crystalline Tidal	19%	45%	60%
	Coastal Plain Lowlands Non-Tidal	56%	39%	52%
	Piedmont Crystalline Non-Tidal	56%	42%	56%
	Coastal Plain Uplands Non-Tidal	31%	45%	60%
	Piedmont Carbonate Non-Tidal	46%	36%	48%
	Valley and Ridge Siliciclastic Non-Tidal	46%	39%	52%
Grass Buffers	Appalachian Plateau Siliciclastic Non-Tidal	38%	42%	56%
	Blue Ridge Non-Tidal; Mesozoic Lowlands Non-Tidal; Valley and Ridge Carbonate Non-Tidal	24%	30%	40%
	Coastal Plain Dissected Uplands Non-Tidal	46%	42%	56%
	Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Piedmont Crystalline Tidal	13%	45%	60%

	Coastal Plain Lowlands Non-Tidal	39%	39%	52%
	Piedmont Crystalline Non-Tidal	39%	42%	56%
	Coastal Plain Uplands Non-Tidal	21%	45%	60%
	Piedmont Carbonate Non-Tidal	32%	36%	48%
	Valley and Ridge Siliciclastic Non-Tidal	32%	39%	52%
Wetland Restoration (Ag & Urban)	Appalachian Plateau Siliciclastic Non-Tidal	7%	12%	4%
	Coastal Plain Dissected Uplands Non-Tidal; Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Coastal Plain Lowlands Non-Tidal; Coastal Plain Uplands Non-Tidal	25%	50%	15%
	Blue Ridge Non-Tidal; Mesozoic Lowlands Non-Tidal; Valley and Ridge Carbonate Non-Tidal; Piedmont Crystalline Tidal; Piedmont Crystalline Non-Tidal; Piedmont Carbonate Non-Tidal; Valley and Ridge Siliciclastic Non-Tidal	14%	26%	8%
Continuous No-till	Coastal Plain Dissected Uplands Non-Tidal; Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Coastal Plain Lowlands Non-Tidal; Coastal Plain Uplands Non-Tidal	10%	20%	70%
	Appalachian Plateau Siliciclastic Non-Tidal; Blue Ridge Non-Tidal; Mesozoic Lowlands Non-Tidal; Valley and Ridge Carbonate Non-Tidal; Piedmont Crystalline Tidal; Piedmont Crystalline Non-Tidal; Piedmont Carbonate Non-Tidal; Valley and Ridge Siliciclastic Non-Tidal	15%	40%	70%
Cover Crop Early Drilled Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	45%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	34%	15%	20%
Cover Crop Early Other Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	38%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	29%	15%	20%
Cover Crop Early Aerial Soy Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	31%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	24%	15%	20%
Cover Crop Early Aerial Corn Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	18%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	14%	15%	20%
Cover Crop	Coastal Plain/Piedmont Crystalline/Karst Settings*	41%	7%	10%

Standard Drilled Rye (Low-till gets only TN efficiency)	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	31%	7%	10%
Cover Crop Standard Other Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	35%	7%	10%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	27%	7%	10%
Cover Crop Late Drilled Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	19%	N/A	N/A
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	15%	N/A	N/A
Cover Crop Late Other Rye (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	16%	N/A	N/A
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	12%	N/A	N/A
Cover Crop Early Drilled Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	31%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	24%	15%	20%
Cover Crop Early Other Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	27%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	20%	15%	20%
Cover Crop Early Aerial Soy Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	22%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	17%	15%	20%
Cover Crop Early Aerial Corn Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	12%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	10%	15%	20%
Cover Crop Standard Drilled Wheat (Low-till gets only TN	Coastal Plain/Piedmont Crystalline/Karst Settings*	29%	7%	10%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	22%	7%	10%

efficiency)				
Cover Crop Standard Other Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	24%	7%	10%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	18%	7%	10%
Cover Crop Late Drilled Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	13%	N/A	N/A
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	10%	N/A	N/A
Cover Crop Late Other Wheat (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	11%	N/A	N/A
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	9%	N/A	N/A
Cover Crop Early Drilled Barley (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	38%	20%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	29%	20%	20%
Cover Crop Early Other Barley (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	32%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	25%	15%	20%
Cover Crop Early Aerial Soy Barley (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	27%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	20%	15%	20%
Cover Crop Early Aerial Corn Barley (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	15%	15%	20%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	12%	15%	20%
Cover Crop Standard Drilled Barley (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	29%	7%	10%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	22%	7%	10%

Cover Crop Standard Other Barley (Low-till gets only TN efficiency)	Coastal Plain/Piedmont Crystalline/Karst Settings*	24%	7%	10%
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	19%	7%	10%
Commodity Cover Crop Early Drill Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	17%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	15%	(N/A)	(N/A)
Commodity Cover Crop Early Other Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	12%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	7%	(N/A)	(N/A)
Commodity Cover Crop Early Aerial Soy Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	15%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	12%	(N/A)	(N/A)
Commodity Cover Crop Early Aerial Corn Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	7%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	6%	(N/A)	(N/A)
Commodity Cover Crop Standard Drill Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	15%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	11%	(N/A)	(N/A)
Commodity Cover Crop Standard Other Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	12%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	7%	(N/A)	(N/A)
Commodity Cover Crop Late Drill Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	7%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	6%	(N/A)	(N/A)
Commodity Cover Crop Late Other Wheat	Coastal Plain/Piedmont Crystalline/Karst Settings*	13%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	11%	(N/A)	(N/A)
Commodity Cover Crop Early Drill Barley	Coastal Plain/Piedmont Crystalline/Karst Settings*	9%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	6%	(N/A)	(N/A)

Commodity Cover Crop Early Aerial Soy Barley	Coastal Plain/Piedmont Crystalline/Karst Settings*	6%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	5%	(N/A)	(N/A)
Commodity Cover Crop Early Aerial Corn Barley	Coastal Plain/Piedmont Crystalline/Karst Settings*	13%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	11%	(N/A)	(N/A)
Commodity Cover Crop Standard Drill Barley	Coastal Plain/Piedmont Crystalline/Karst Settings*	15%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	11%	(N/A)	(N/A)
Commodity Cover Crop Standard Other Barley	Coastal Plain/Piedmont Crystalline/Karst Settings*	12%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	10%	(N/A)	(N/A)
Commodity Cover Crop Standard Other Rye	Coastal Plain/Piedmont Crystalline/Karst Settings*	18%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	14%	(N/A)	(N/A)
Commodity Cover Crop Early Other Barley	Coastal Plain/Piedmont Crystalline/Karst Settings*	15%	(N/A)	(N/A)
	Mesozoic Lowlands/Valley and Ridge Siliciclastic**	11%	(N/A)	(N/A)

*Coastal Plain Dissected Uplands Non-Tidal; Coastal Plain Dissected Uplands Tidal; Coastal Plain Lowlands Tidal; Coastal Plain Uplands Tidal; Coastal Plain Lowlands Non-Tidal; Coastal Plain Uplands Non-Tidal; Valley and Ridge Carbonate Non-Tidal; Piedmont Carbonate Non-Tidal

** Appalachian Plateau Siliciclastic Non-Tidal; Mesozoic Lowlands Non-Tidal; Piedmont Crystalline Tidal; Piedmont Crystalline Non-Tidal; Valley and Ridge Siliciclastic Non-Tidal; Blue Ridge Non-Tidal