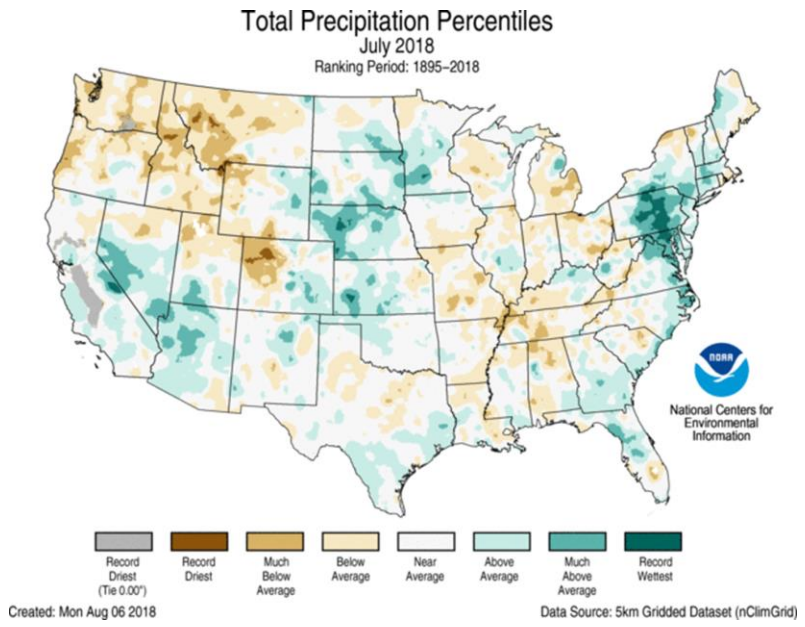
Summer Storms 2018: Chesapeake Bay watershed conditions and early monitoring results



Management Board, 2018

Peter Tango and Scott Phillips, USGS

on behalf of STAR

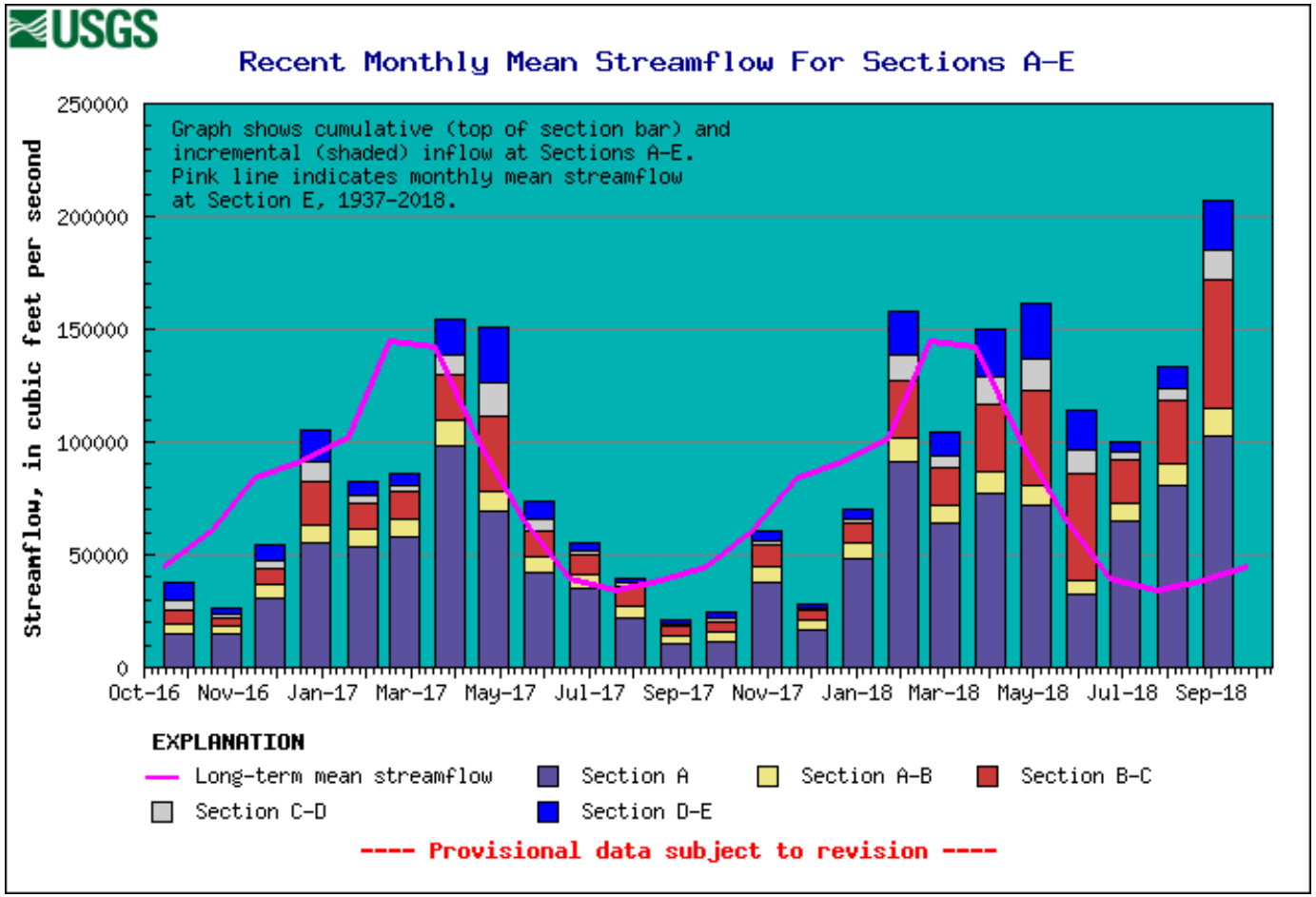
Chesapeake Bay Program
Science. Restoration. Partnership.

Outline

- River flow into the Bay during 2018
- Initial monitoring results of Bay conditions
- Potential impacts compared to other high-flow years
- Implications for nutrient and sediment management

2018 River Flow: A Very Unusual Summer

- Above normal since May
- Monthly records: Aug and Sept
- Multiple storms
- WY: Oct-Sept



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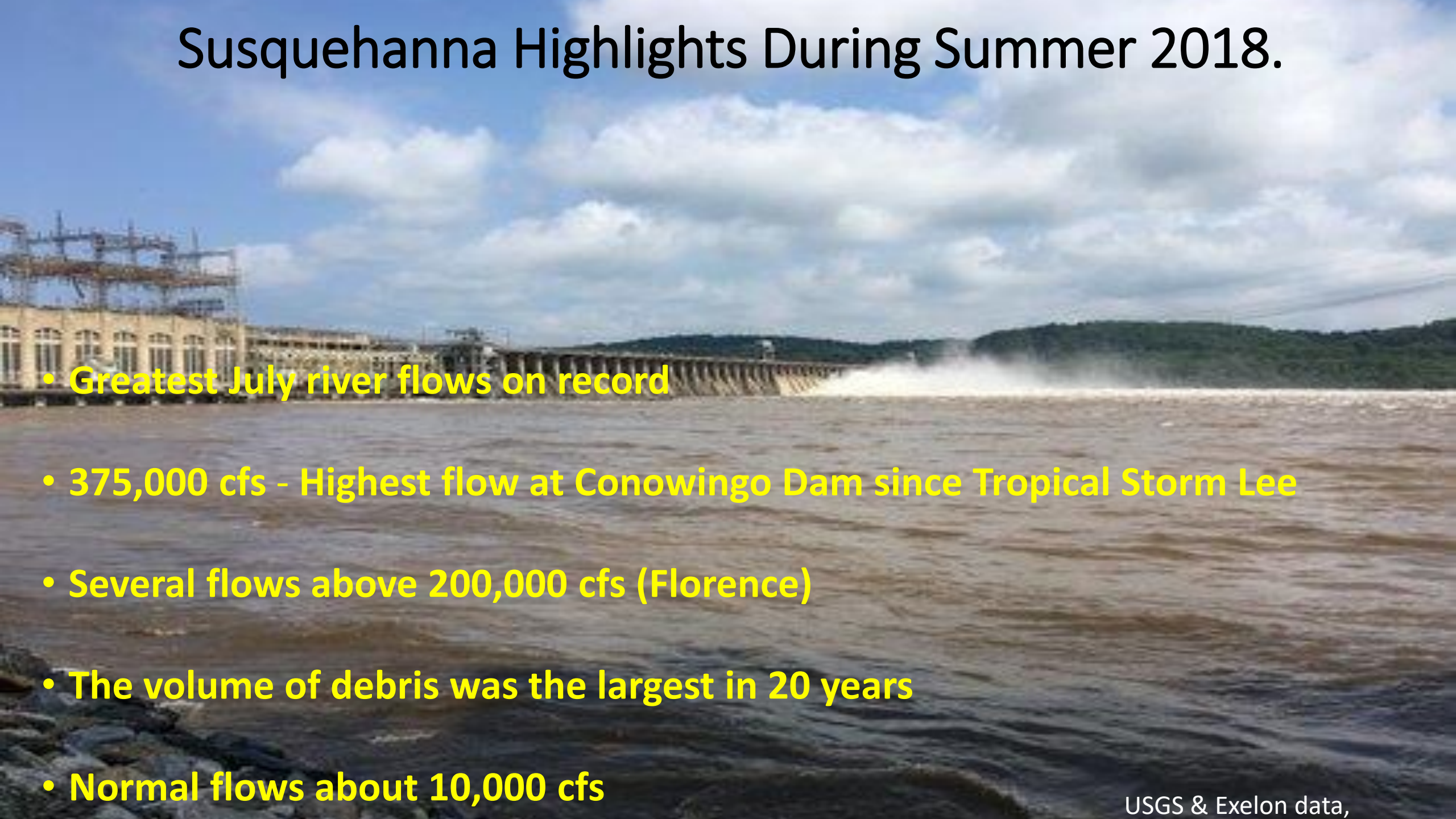
https://md.water.usgs.gov/waterdata/chesinflow/

USGS
science for a changing world

Susquehanna Highlights During Summer 2018.

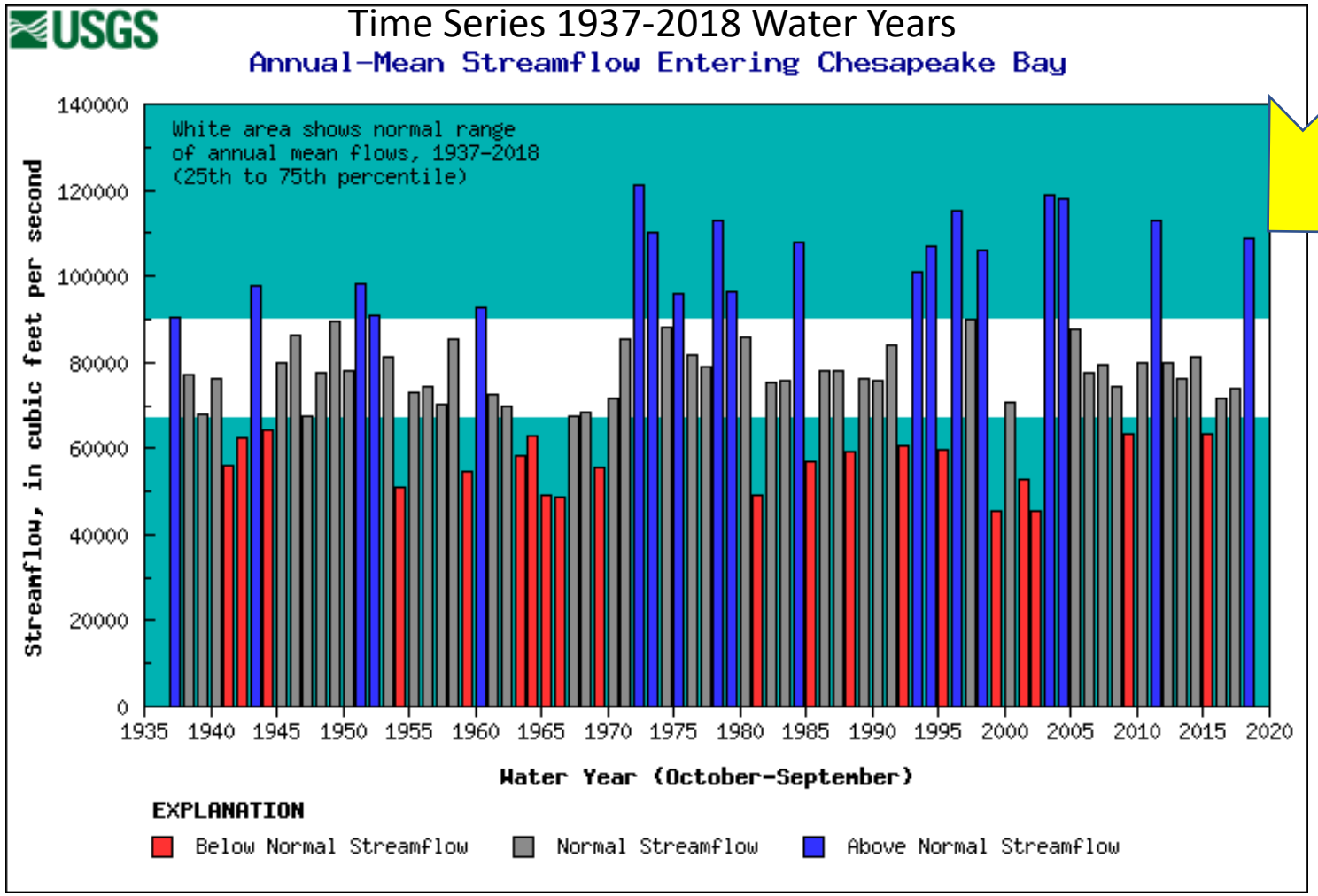


- **Greatest July river flows on record**
- **375,000 cfs - Highest flow at Conowingo Dam since Tropical Storm Lee**
- **Several flows above 200,000 cfs (Florence)**
- **The volume of debris was the largest in 20 years**
- **Normal flows about 10,000 cfs**

USGS & Exelon data,

2018: Above normal for the Water Year.

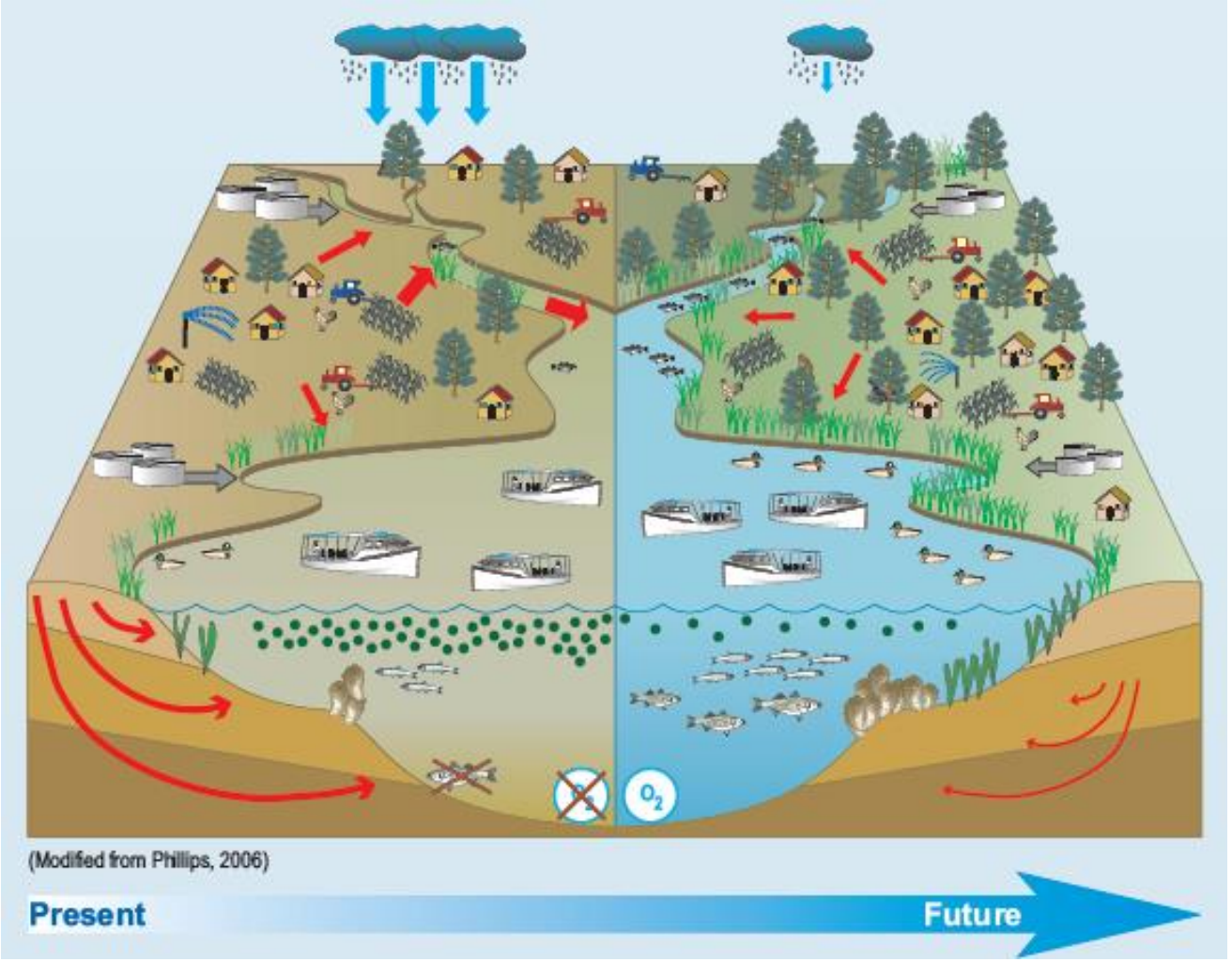
- Only 2nd year above normal in over a decade
- Last was 2011
- Negative impacts on Bay



10/16/2018 https://md.water.usgs.gov/waterdata/chesinflow/

Potential Bay Impacts

- Greater pollutant loads:
  - Poorer water clarity
  - Loss of SAV
  - Lower dissolved oxygen
- High amounts of fresh water
  - Oyster morality
  - Migration of crabs and fin fish
- Monitoring providing early results



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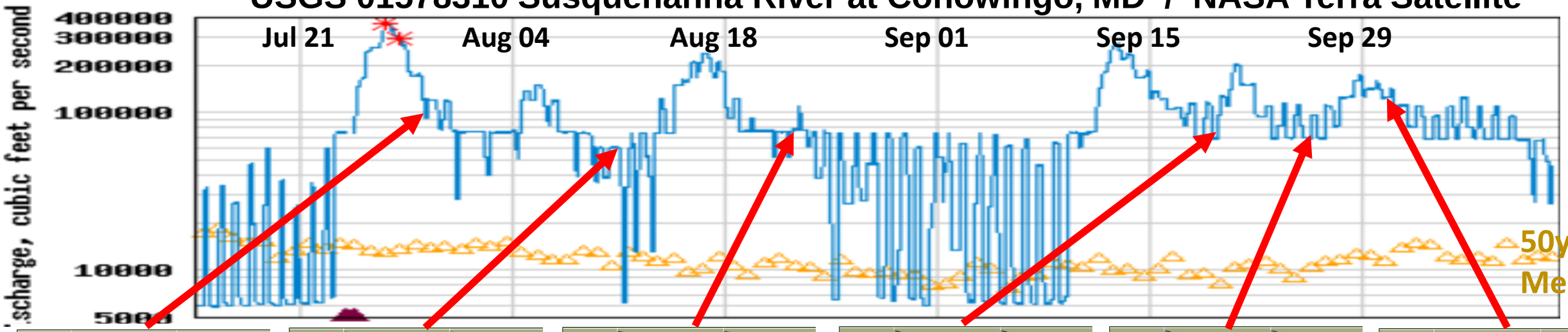
Outline

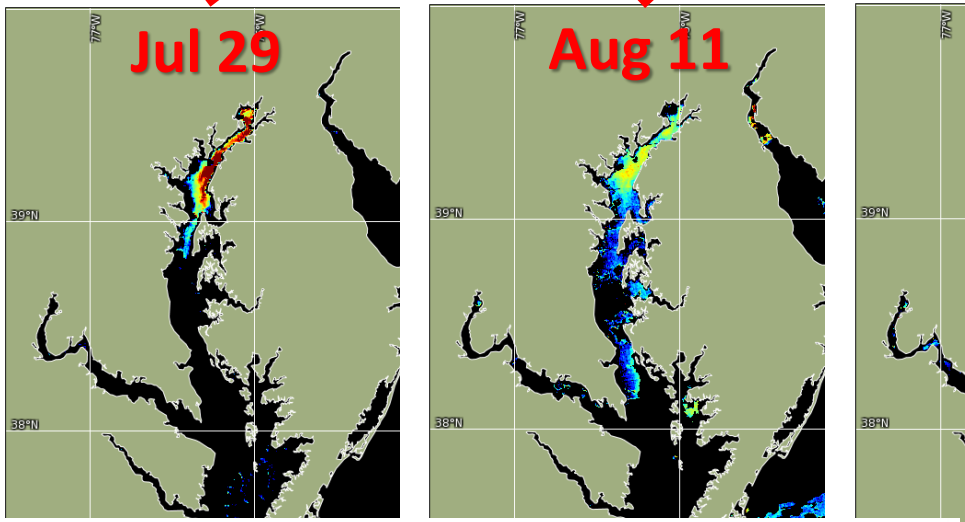
- River flow into the Bay during 2018
- Initial monitoring results of Bay conditions
  - STAR: Multiple-agency monitoring effort
    - Clarity
    - SAV
    - Hypoxia
    - Fresh water and fisheries
- Potential impacts compared to other high-flow years
- Summary and implications

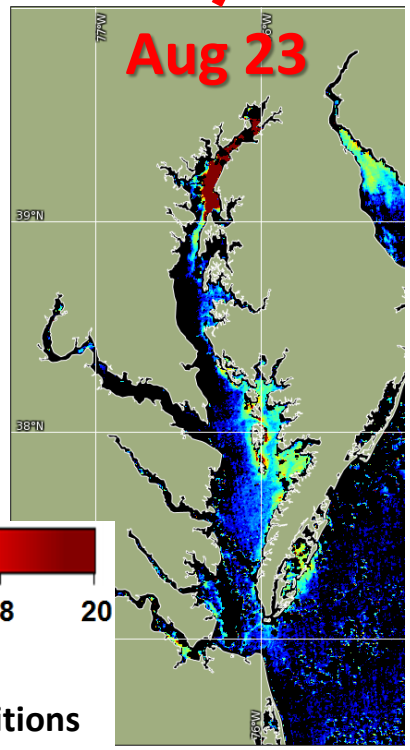
2018 Sediment plumes per peak discharge event

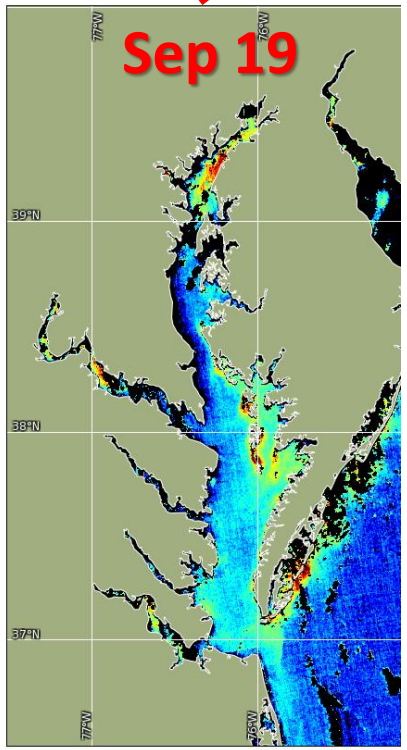
– as seen by satellite

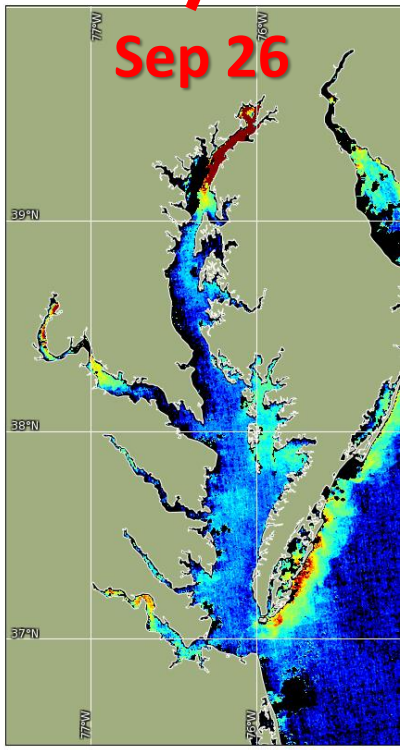
USGS 01578310 Susquehanna River at Conowingo, MD / NASA Terra Satellite

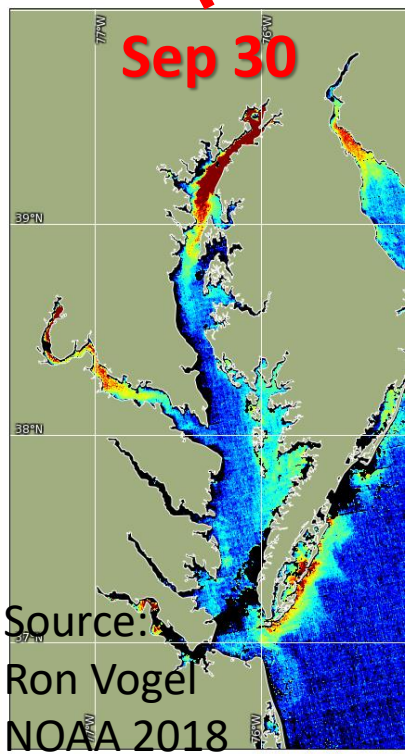


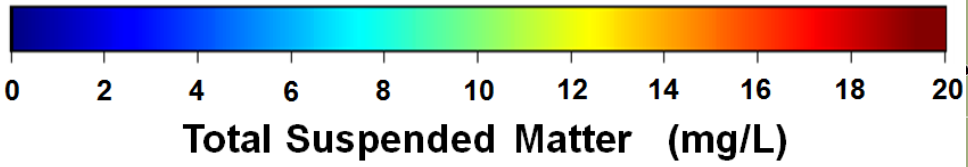










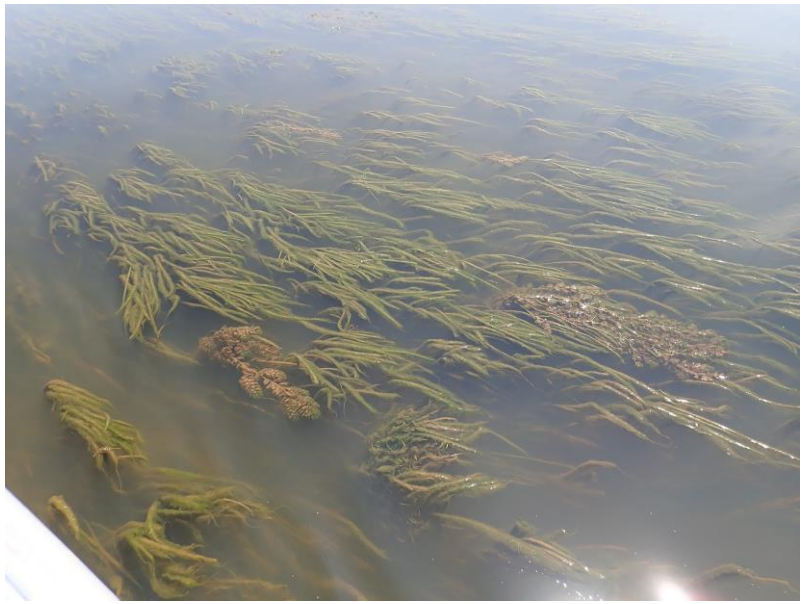


Note: satellite view only available in cloud-free conditions

Source:
Ron Vogel
NOAA 2018

SAV: Poor Water Clarity in Upper Bay but Grasses Still Present in the Susquehanna Flats

Turbidity 8-10-2018
out in the channel



Bay Grass 8-10-2018
Perimeter of beds with epiphytes

Bay Grass 8-10-2018
Clear water in the beds

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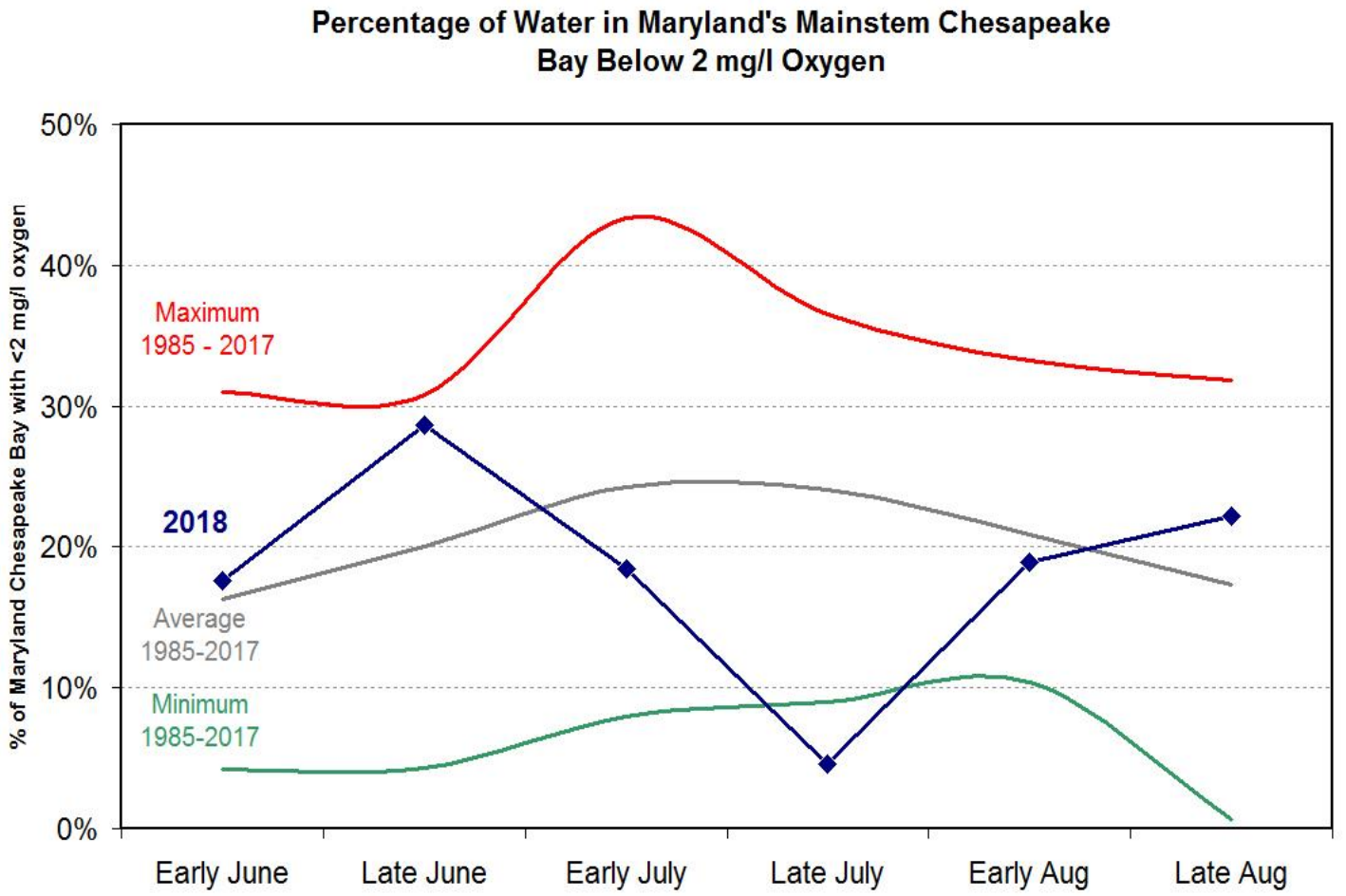
Photos by Brooke Landry, MD DNR

Summer MD Hypoxia: Variable Conditions

- June: above average
- July: Below average
  - Due to winds
- August: near average



M. Trice. MD DNR

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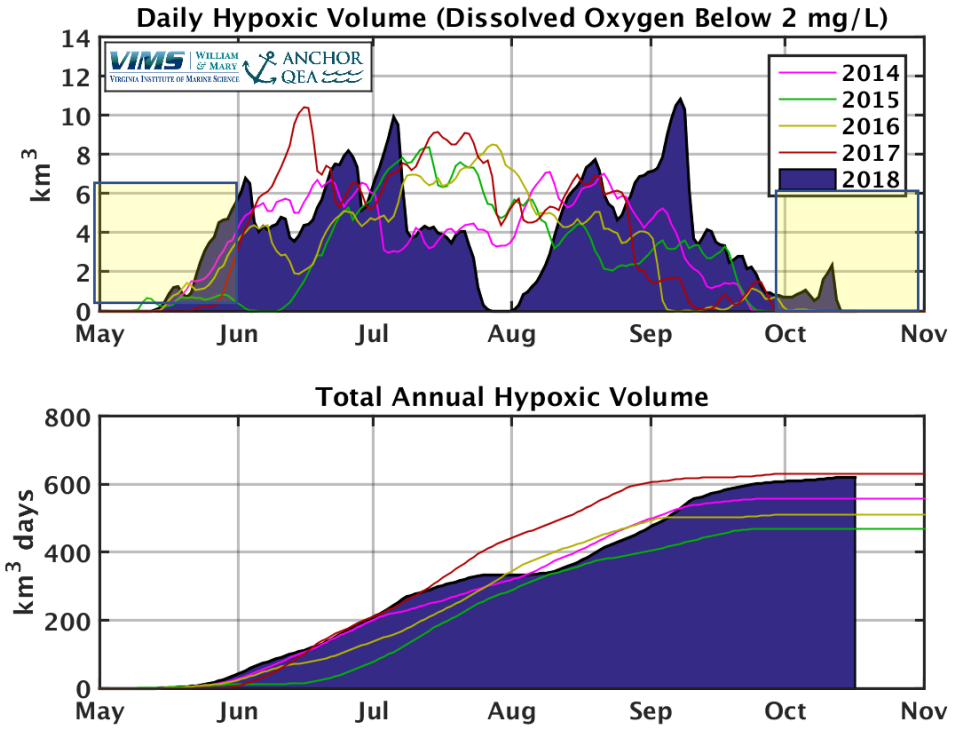
2018 Hypoxia – May to October (VIMS)



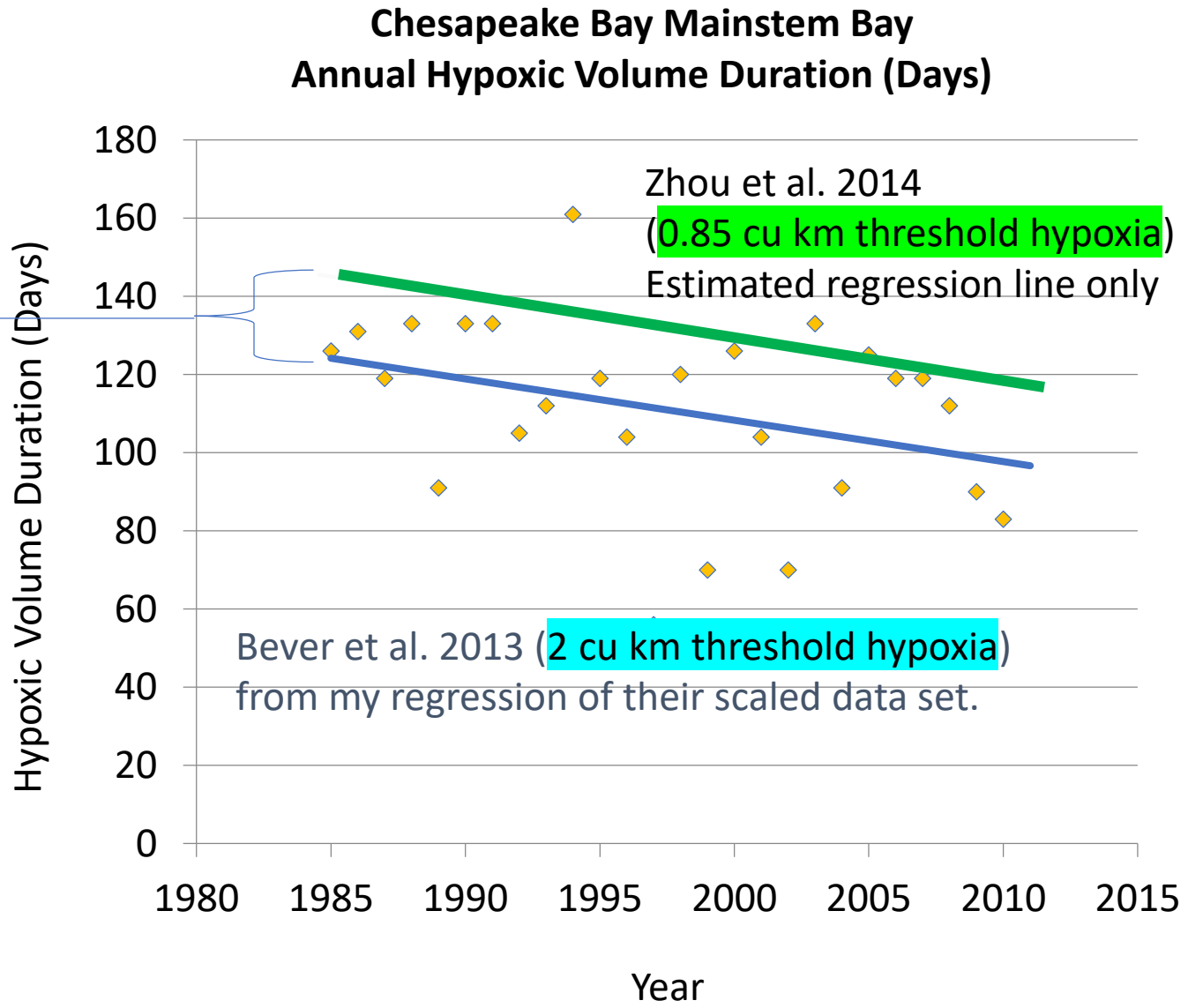
Hypoxic Volume (HV) Metrics for Recent Years for Comparison to 2018 Forecast

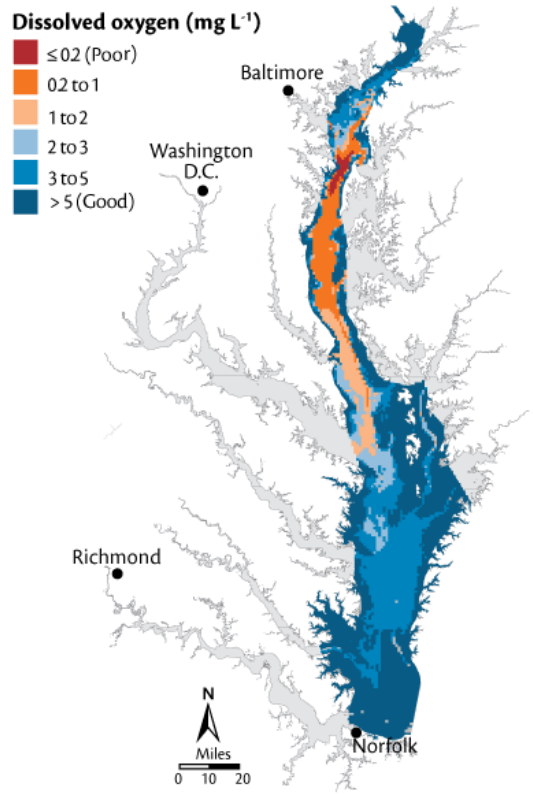
Year	Maximum Daily HV [km³]	Total Annual HV [km³ days]	Duration [days]	Summer Average [km³]
2014	7.1	557	107	4.4
2015	8.4	468	94	3.7
2016	8.5	511	98	4.0
2017	10.4	630	92	5.1

http://www.vims.edu/research/topics/dead_zones/forecasts/cbay/hypoxic-volume/index.php

Duration: It depends on your threshold volume definition for when hypoxia exists in the bay

About a 20 day difference





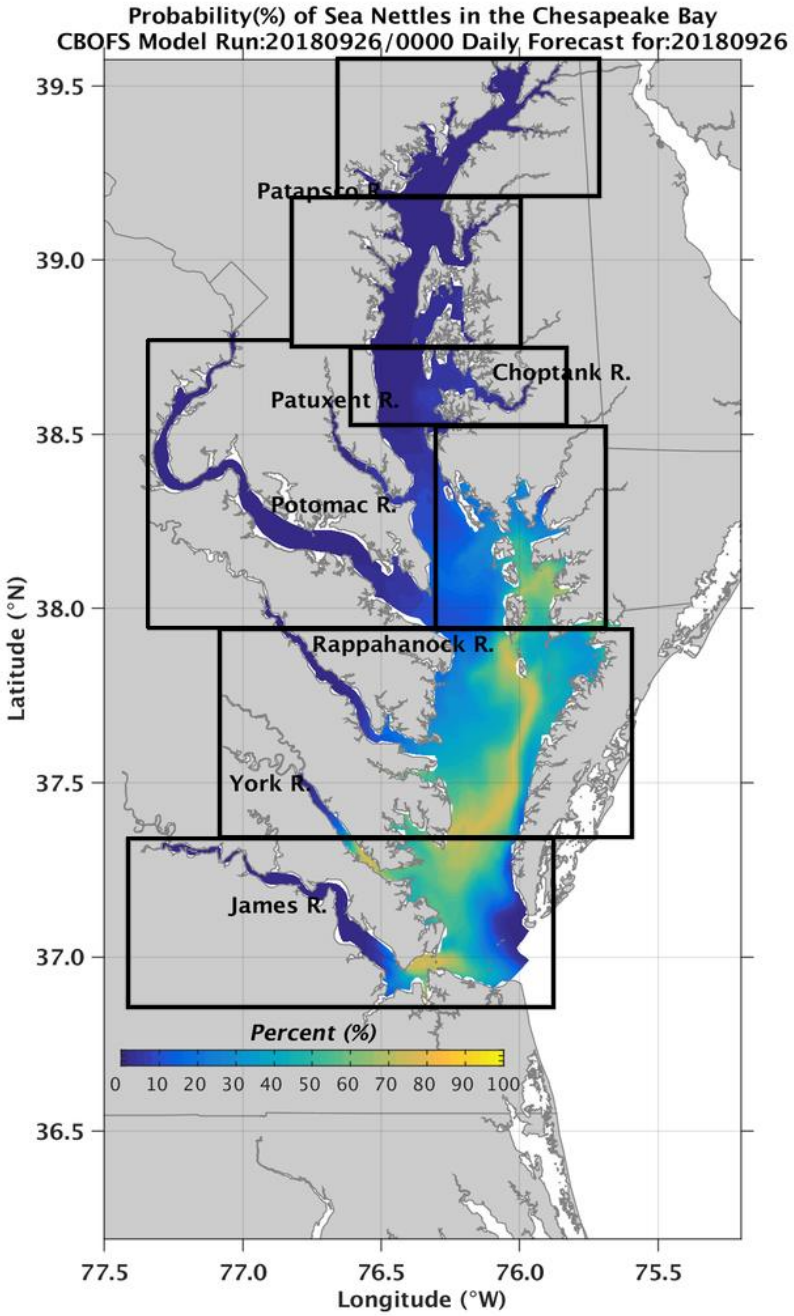
Chesapeake Bay Hypoxia Summer 2012

USGS science for a changing world

Chesapeake Bay Program
A Watershed Partnership

Freshwater flow impacts

- Mortality of some oysters (-)
  - Less disease down bay (+)?
- Crabs migrating south
- Fin fish moving to stay in salinity ranges
- Fewer jellyfish in the northern bay



https://www.opc.ncep.noaa.gov/Loops/SeaNettles/prob/SeaNettles.shtml

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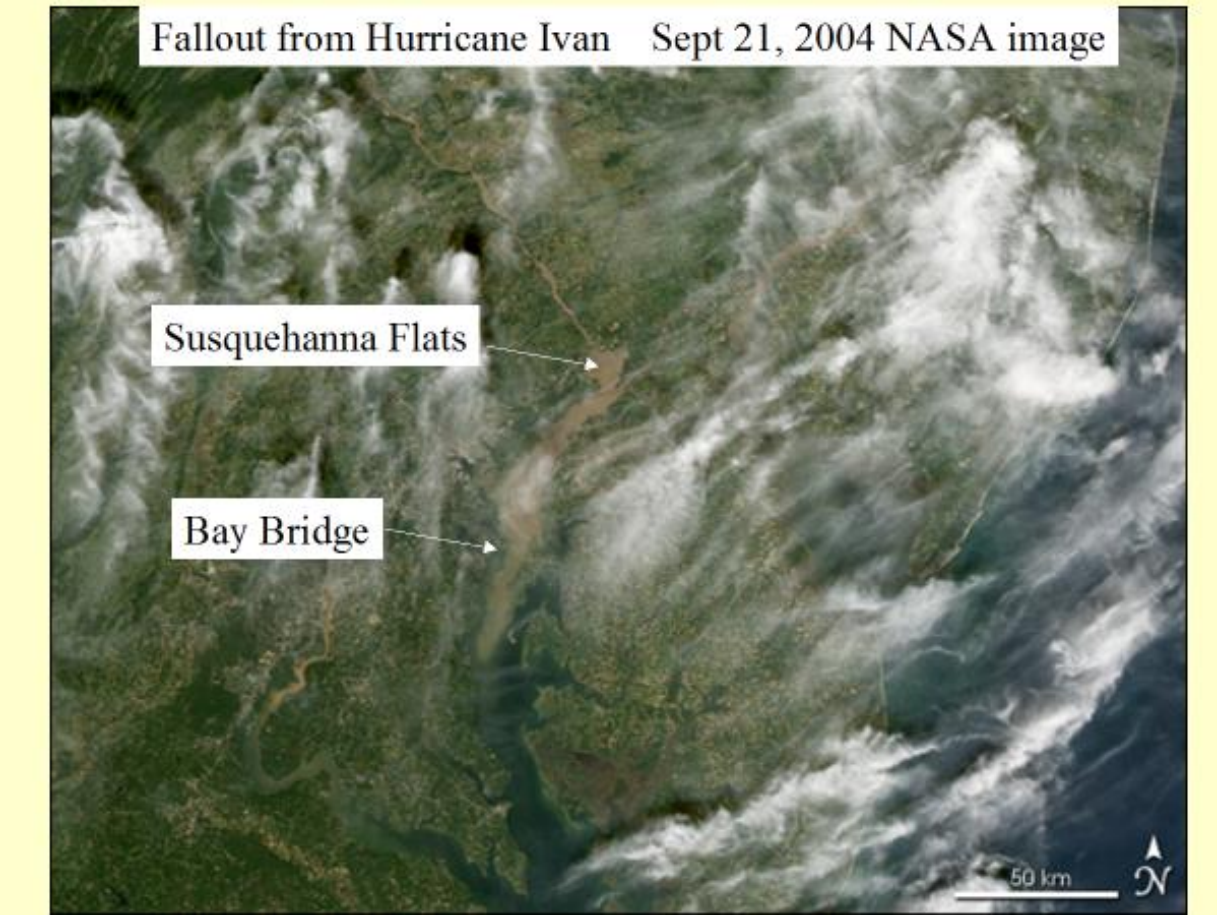
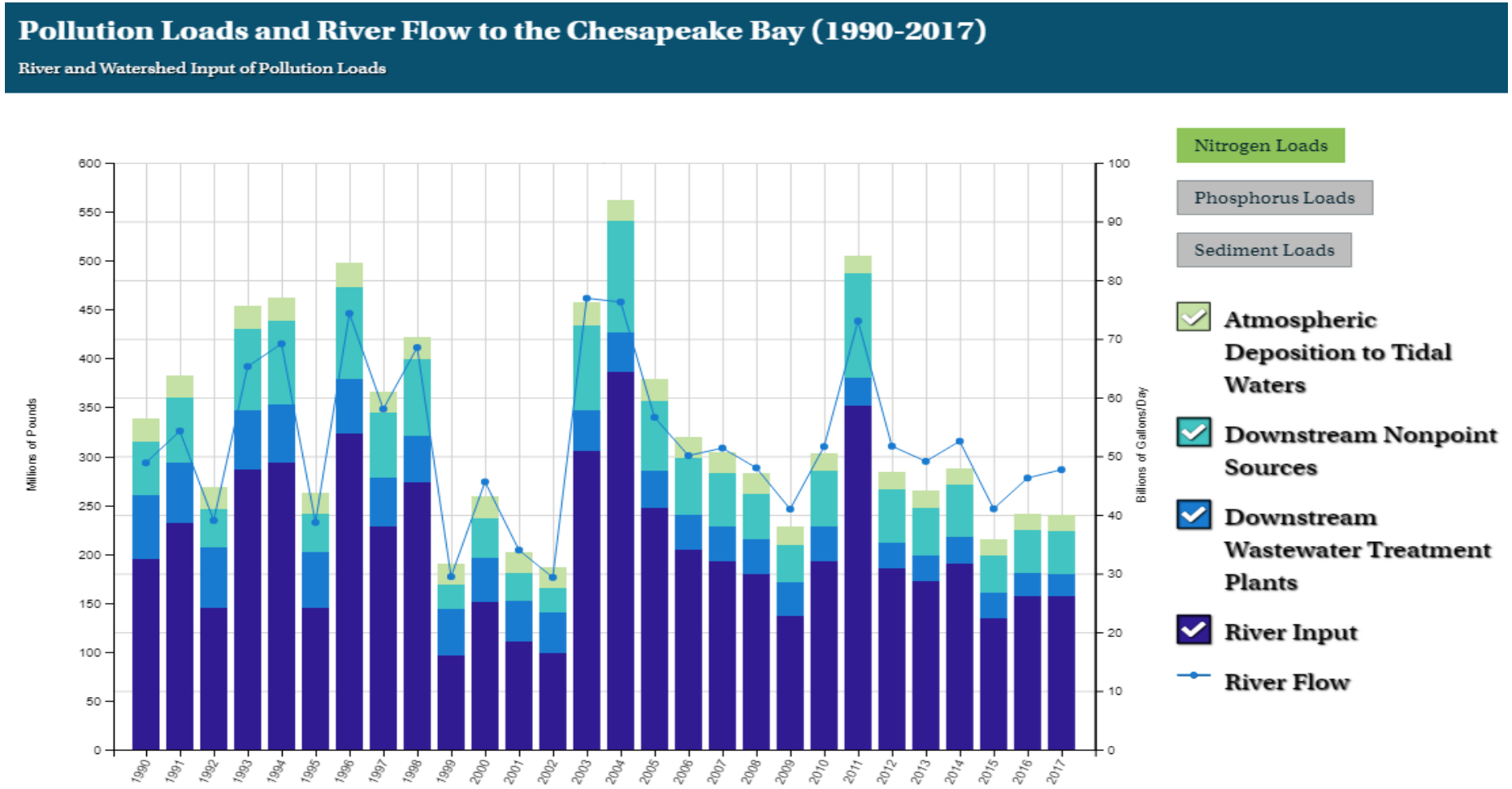
Outline



- River flow into the Bay during 2018
- Initial monitoring results of Bay conditions
- Potential impacts compared to other high-flow years
  - Loads
  - SAV
  - Oysters (+ and -)
- Summary and implications

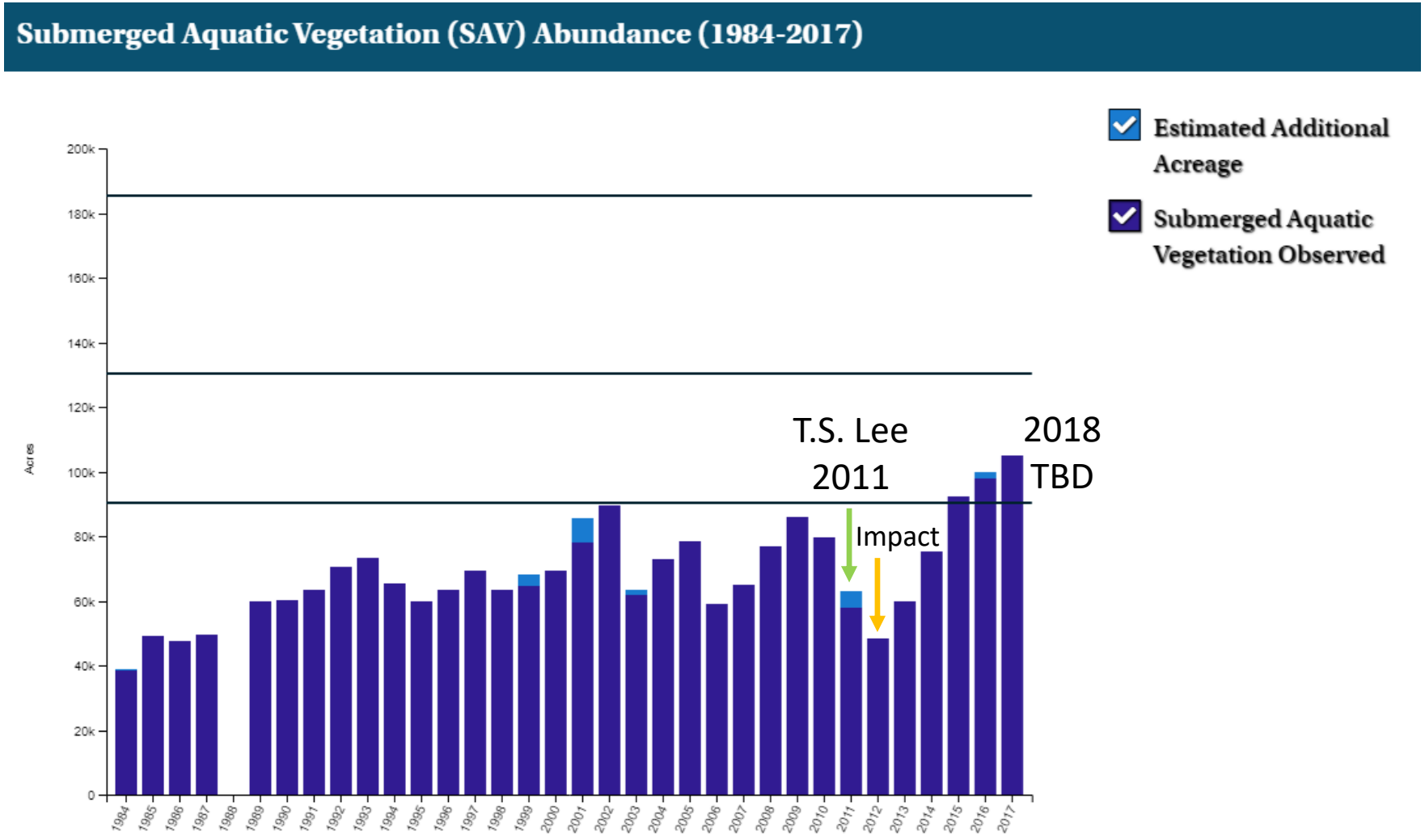
High Flows Deliver More Nutrients and Sediment

- High Flow years: 2011; 2003 & 2004
- Greater nutrient and sediment loads
- Usually lower DO
- May be near average in 2018
  - July wind events
  - More BMPs in place



Potential Loss of SAV

- 2011 High Flows
- Declines in SAV for two years
- SAV beds larger so may be more resilient
- More BMPs in place
- Less overall loss?

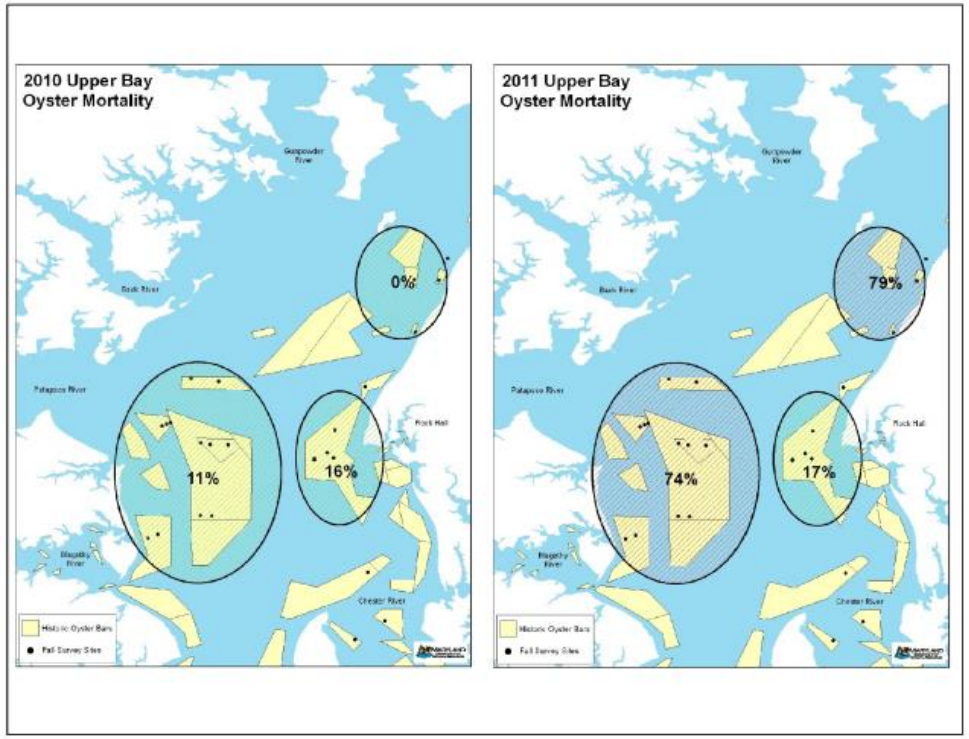


Living Resource Effects in High Flows: Historical inference for oysters and benthos

- Oysters 2011:
  - High mortality in the upper Bay
  - Excellent baywide survival

- Baywide benthos 2011
  - Showed little impact from the storms.

  (R. Llanso VERSAR Inc.)

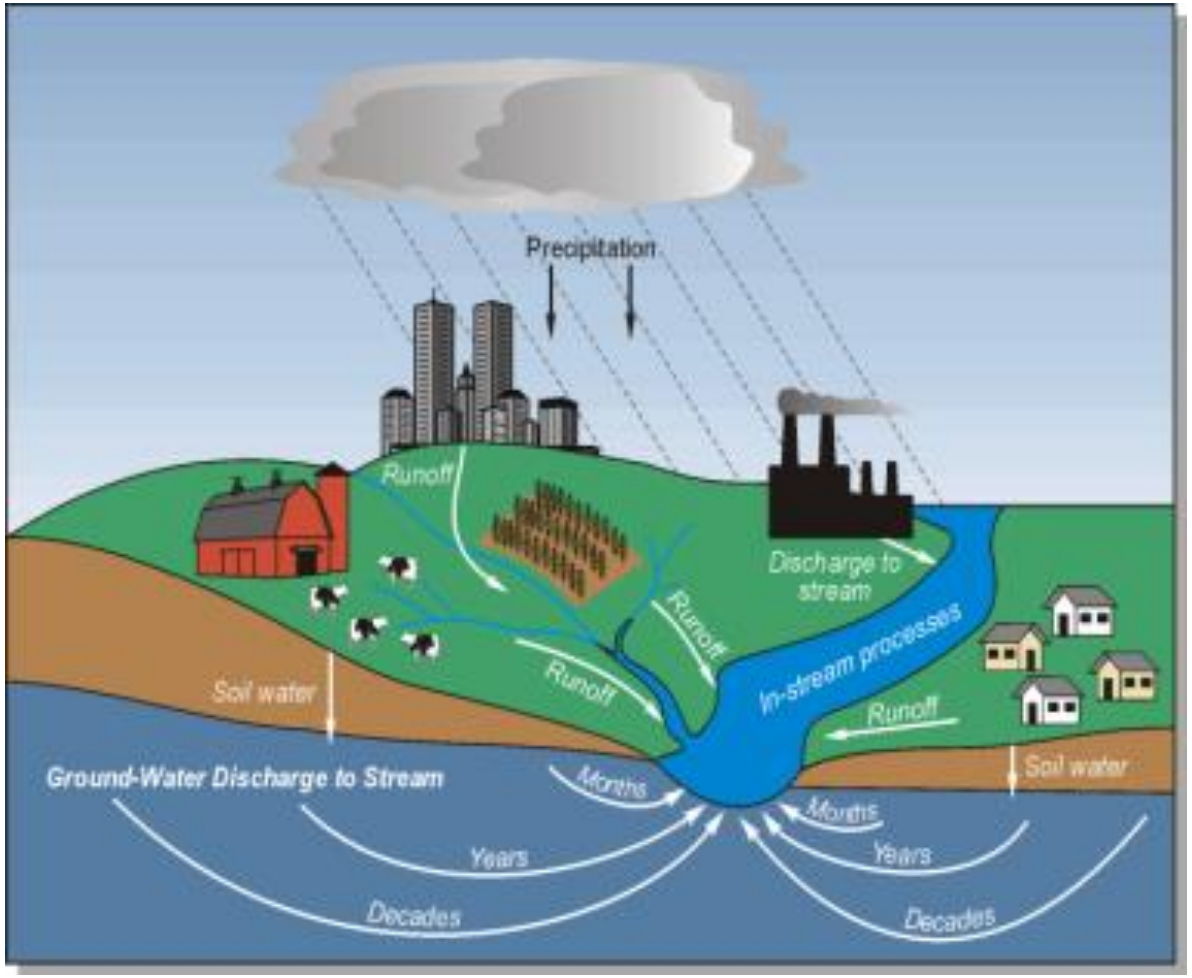


Flow impact to Oysters

- Highest overall oyster survival rate since 1985 (92%)
- More than double the survival rate of 2002
- 44% increase in oyster biomass in one year
- Dermo and MSX at all-time lows

(M. Naylor MD DNR 2011 results)

Summary and Implications



- More climate and flow variability
  - N, P and S loads from storms need to be mitigated
- More emphasis on water-quality practices to address storm events
  - Urban storm water
  - Runoff from ag lands
- Monitoring to explain watershed and estuary response
  - Assess changes from high flows vs. management practices
  - Resilience of SAV and living resources
- Many thanks to field and lab teams for the long hours and storm chasing!