Responding to the PSC Request to Improve the CBP Monitoring Networks

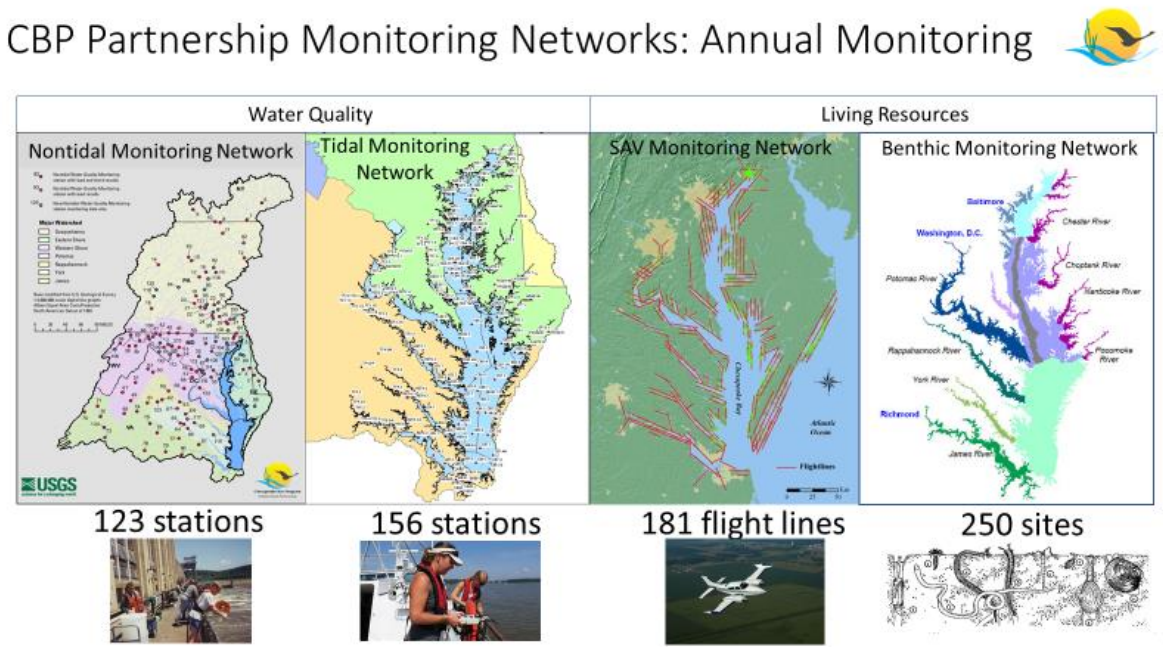
Peter Tango, Scott Phillips, Lee McDonnell, Breck Sullivan

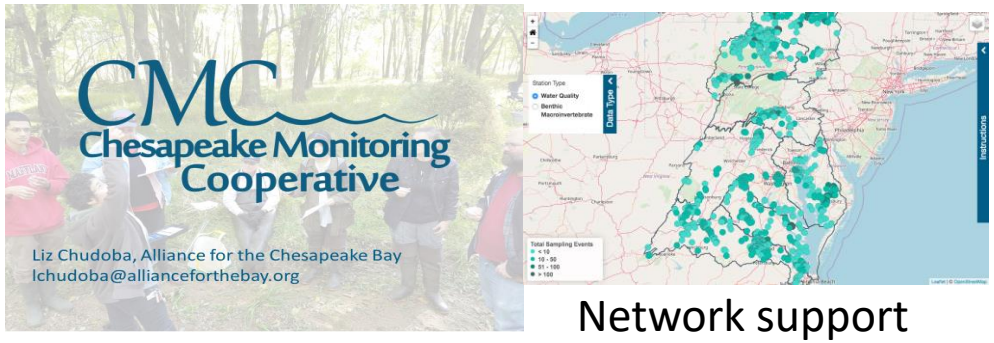
DIWG Presentation 1 of 2

April 13, 2021

March 2021: Monitoring Presentation to the Principal Staff Committee

- Lee McDonnell provided monitoring presentation on March 2
- Help them better understand CBP budget and funding for monitoring
- *CBP World Class Monitoring Networks*:
  - Tidal water quality
  - Nontidal nutrients and sediment
  - SAV
  - Tidal Benthic organisms
  - Citizen Monitoring
- Current Funding:
  - CBP $5M and partners >$7M

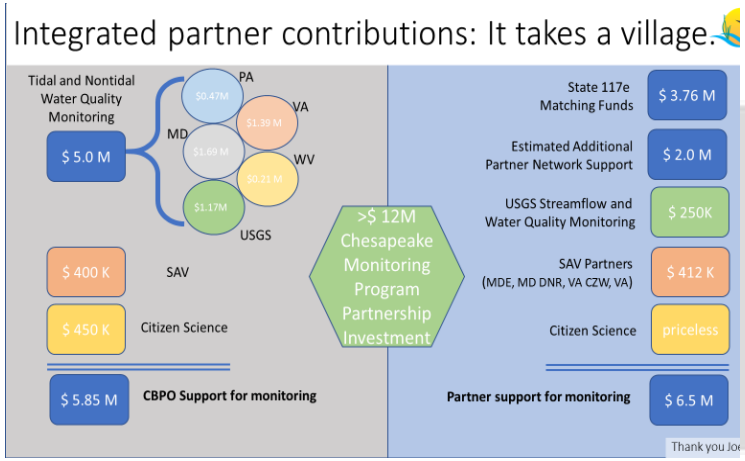


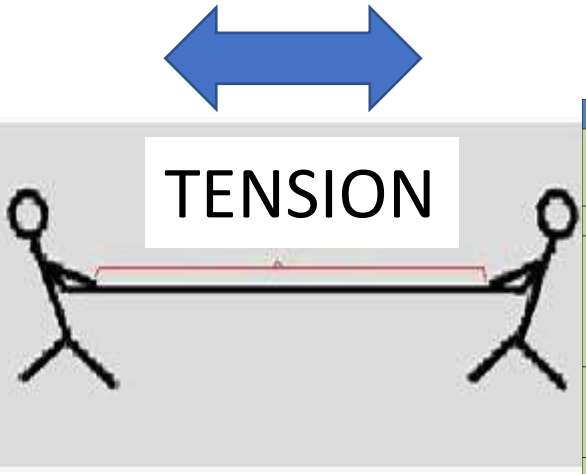


Network support

Overcoming the tension

Traditional Resources



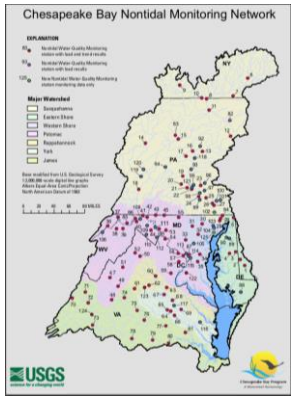


Assessment and Reporting Expectations

Designated Use	Dissolved oxygen Criteria Concentration/Duration		Temporal Application
Migratory fish spawning and nursery use	7-day mean ≥ 6 mg/L tidal habitats with 0-0.5ppt salinity		February 1 – May 31
	Instantaneous min ≥ 5 mg/L		
	Open water fish & shellfish designated use criteria apply		June 1 – January 31
Shallow water Bay grass use	Open water fish & shellfish designated use criteria apply		Year-round
Open water fish and shellfish use	30-day mean	≥ 5.5 mg/L Salinity: (0-0.5ppt)	Year-round
		≥ 5 mg/L Salinity: >0.5ppt	
	7-day mean	≥ 4 mg/L	
	Instantaneous min ≥ 3.2 mg/L		
Deep-water seasonal fish and shellfish use	30 day mean > 3mg/L		June 1 – September 30
	1-day mean >2.3 mg/L		
	Instantaneous min ≥1.7 mg/L		
	Open water Fish and shellfish designated use criteria apply		October 1-May 31
Deep channel seasonal refuge use	Instantaneous min > 1 mg/L		June 1 – September 30
	Open water F & S applies		October 1 – May 31

Criteria Assessment Coverage

- U.S. EPA 2003 U.S. EPA 2004 and more...
- Umbrella Criterion – Summer Season assumption
- Umbrella Criterion or measure it.
- Umbrella Criterion - testing (or measure it).
- TMDL basis: Meet summer and protect other seasons.



- We have long standing gaps in criteria assessment, watershed load and trend assessments
- We recognize a history of resources stresses to sustain and grow the monitoring program
- Coincidentally, research developments and innovations are providing options to address capacity gaps

PSC request:

- In response to the status report, they requested information be provided on what is needed to improve the CBP monitoring networks, including:
  - (1) an overview of current status and threats to the networks, and
  - (2) what is needed to address the monitoring networks capacity shortfalls.

Process

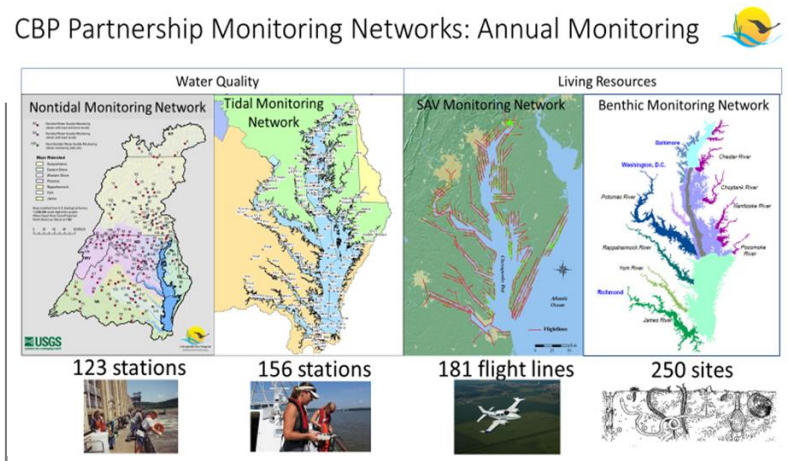
9 months start to finish

8 questions to answer

Provide a short synthesis to address the questions, vision going forward.

8 Questions to address in this 9-month review

- **NETWORK STATUS?**
- **VULNERABILITIES?**
- **PROGRAMMING STRATEGY?**
- **INFORMATION GAPS TO FILL?**
- **MONITORING PROGRAM OPTIONS TO FILL GAPS?**
- **WHAT INNOVATIONS ARE AVAILABLE?**
- **WHO - PARTNERS FOR ADDRESSING INFORMATION GAP DATA & PROODUCTS?**
- **DETAIL ON FINANCIALS FOR SUSTAINING AND GROWING NETWORK TO MEET INFORMATION NEEDS?**



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- **WHO - PARTNERS FOR ADDRESSING INFORMATION GAP DATA & PROODUCTS?**
- **DETAIL ON FINANCIALS FOR SUSTAINING AND GROWING NETWORK TO MEET INFORMATION NEEDS?**

- What is the status of the network (including number of stations, sampling frequency, funding partners for tidal assessment and nontidal stream flow and water-quality monitoring at stations) and current assessment methodologies as it pertains to its stated purpose?
- How have the networks and assessment needs of the CBP partnership changed over time past 5-10 years and what are future threats?
- What needs to be done to sustain the current networks (i.e., stop the loss of stations and nu… to inflation over the past 5-10 years, address infrastructure challenges, manage the pr… databases), and what are the future benefits of doing so?
- What gaps need to be filled to improve the CBP monitoring n… …ent information and decision-support needs?
- How can existing monitoring data an… …these gaps?
- What are some of t… …proaches that can be considered to improve the networks to address cap… …anagement relevant data analysis products?
- …er partners can help expand the monitoring capacity through adoption of existing data …nalyses beyond the traditional Clean Water Act 117e grant funded monitoring programs?
- Assign a financial need if necessary to each recommendation that addresses sustaining and growing the networks

See PSC-request white paper for question details

Actions: 8 Questions to address in this 9-month review

- **EXISTING NETWORK STATUS?**
- Action – Edit available summaries.

Example:
Chesapeake Bay Benthos Monitoring. The current Bay-wide benthic monitoring program, initiated in Maryland in 1984 and in Virginia in 1985, now consists of fixed and random site components (Weisberg et al. 1997; Dauer and Llansó 2003; Llansó et al 2003). The fixed site monitoring program has 53 stations traditionally sampled annually in spring and summer to monitor changes over time (trends). All fixed sites in Maryland and Virginia are sampled using three replicate bottom grabs. The probability-based, random strata sampling was initiated in Maryland in 1994. Since 1996, the probability-based sampling program has become the standardized approach in Virginia as well, providing for a Bay-wide regulatory assessment estimating impaired habitat conditions. The impairment assessment relies on approximately 200 sites sampled between July 15 and September 30 each year

Actions: 8 Questions to address in this 9-month review

- **VULNERABILITIES?**
- Action - States/USGS – use the already generally identified understanding on near term challenges provided annually in grants/IAGs. Add insights.

Example:
We just spent 3+ years addressing long-term funding needs to continue NTN operations at Conocheague Creek. New EPA support has been developed.

Example:
SAV program risks due to contractor ownership and unusual weather conditions promoted evaluations of alternative image sourcing.

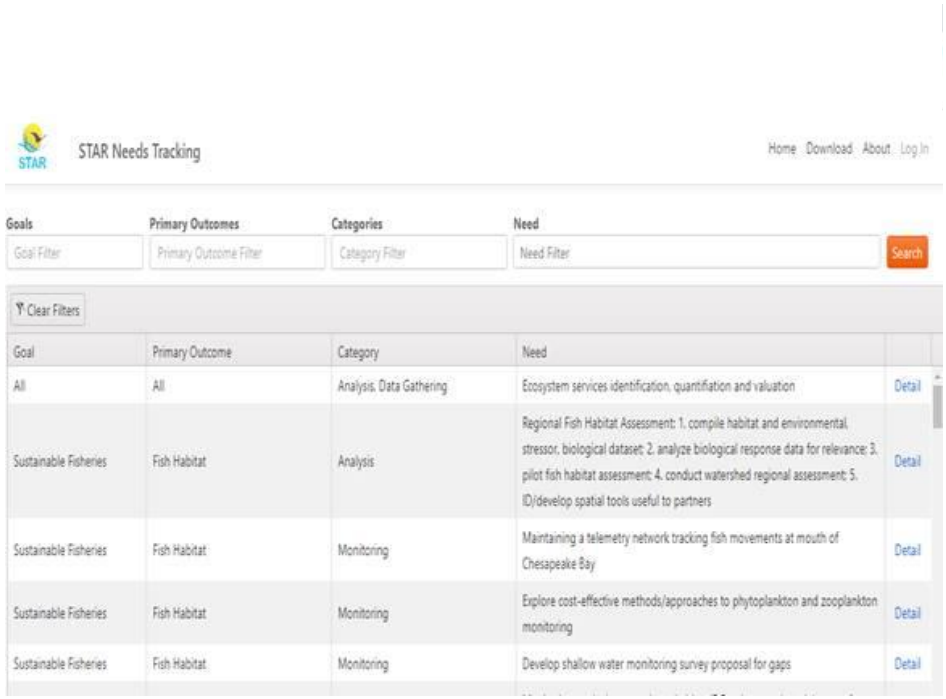
Actions: 8 Questions to address in this 9-month review

- **PROGRAMMING STRATEGY?**
- Action - What is the cost of sustaining existing operations the next 5 years – some insights already available.

Example:
117e grant/IAG 5-year cost projections often provide adaptations/reductions for working with level Federal and State funding as a resource for estimating costs to maintain existing operations.

Actions: 8 Questions to address in this 9-month review

- **INFORMATION GAPS TO FILL?**
- Actions – extract gaps highlighted in the CBP Strategic Science and Research Framework database



Actions: 8 Questions to address in this 9-month review

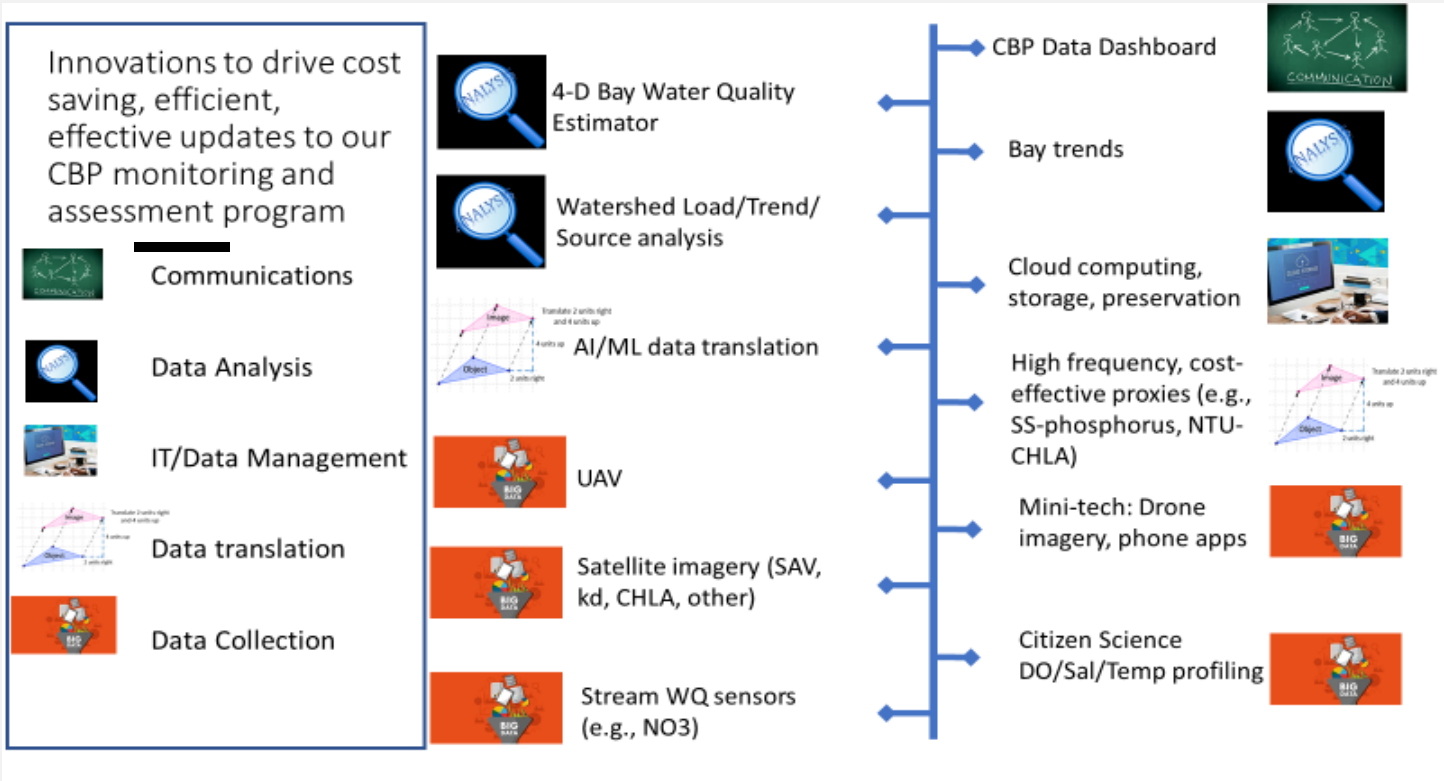
- **<u>MONITORING PROGRAM OPTIONS TO FILL GAPS?</u>**
- Action - Healthy discussions planned in many forums these next 6 months including STAC Workshop.

Example:
NTN considerations with NRCS-EPA-USGS partnership work

Example:
Strategic collaborations with Citizen Science engagements

Actions: 8 Questions to address in this 9-month review

- **<u>WHAT INNOVATIONS ARE AVAILABLE?</u>**:
- Actions: Discussion in many forums these next 6 months including STAC Workshop to discuss utility and readiness of innovations, their data, and their products.



Actions: 8 Questions to address in this 9-month review

- **WHO - PARTNERS FOR ADDRESSING INFORMATION GAP DATA & PROODUCTS**:
- Action: List. That should be obvious from answers from the previous question. Self explanatory.

Actions: 8 Questions to address in this 9-month review

- **<u>DETAIL ON FINANCIALS FOR SUSTAINING AND GROWING NETWORKS TO MEET INFORMATION NEEDS?</u>**
- Action: Reflect costs to address COLAs, new partners with available products, build out and maintenance of new networks, data management, QA, analysis, reporting.

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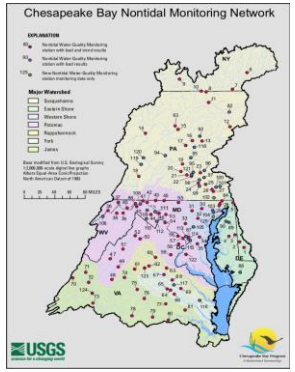
Watershed loads

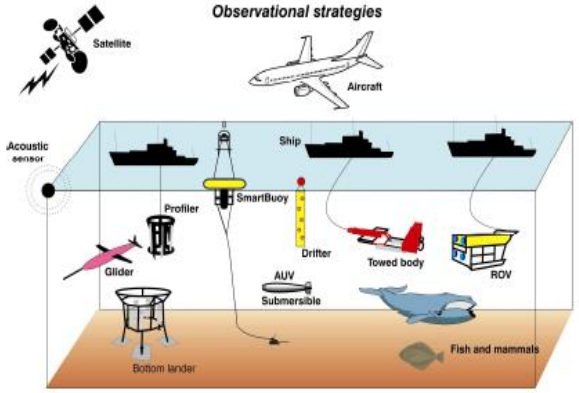
Nontidal Network

Lead – NTN WG

(Coordinator: Peter Tango)



Network & Workgroup leadership developing recommendations to the PSC



STAR/Integrated Monitoring Network WG

STAC: 2021-22 Workshop

Living Resources - Tidal

SAV Network Lead – SAV WG

(Chair – Brooke Landry)

Support by Citizen Science Network

Benthic network Lead – CAP WG

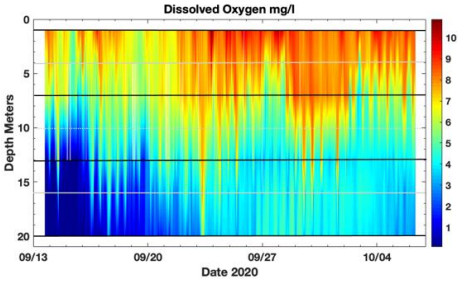
(Chair – Peter Tango)

Fish Habitat

Tidal Network

Lead – Hypoxia Collaborative

(Coordinators: Bruce Vogt, Peter Tango)



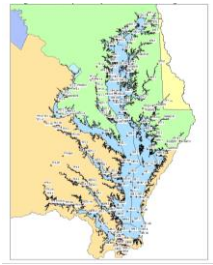
Water Quality Standards

Tidal Network

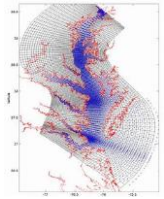
Lead – CAP WG

(Chair – Peter Tango)

Support: Citizen Science Network



Tidal Water Quality Standards/Habitat Analysis



4-D Water Quality Estimator Team

4D BORG

(Coordinators – Peter Tango, Rebecca Murphy)

Supporting group consultations

Data Integrity WG – All Network update considerations	Climate Resiliency WG – All networks	Fish Habitat Action Team – Tidal network, Hypoxia Collaborative, 4D BORG links	Forage Fish Team – Benthic Network	Black Duck Team – Benthic Network
Healthy Habitats – outputs of 4-D analysis	Modeling WG – 4D water quality estimator	Water Quality GIT	STAR	STAC

General path of recommendations development for PSC: 9 months

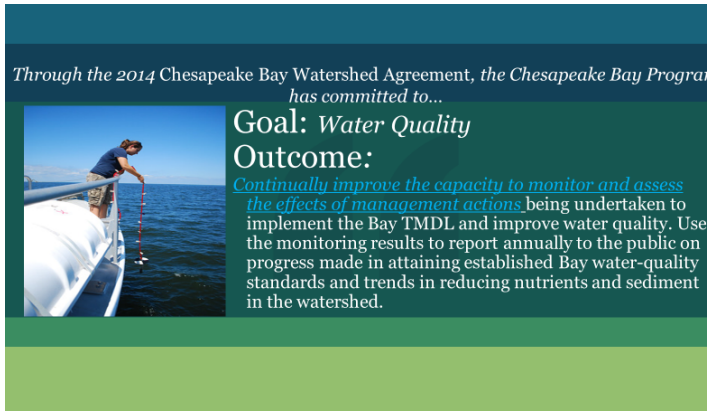
Teams/Groups	April 2021	May	June	July	Aug	Sept	Oct	Nov	Dec	2022
										Winter
NTN	**SPRING** **Status and vulnerabilities of existing network**			**SUMMER** **Innovation Assessment, Financials of Sustaining networks**			**FALL** **Evaluate limitations, Financials for adopting innovations, recommendations**			Consolidate recommendations, financials for PSC Presentation
CAP WG with DIWG										
Hypoxia Collaborative										
Cit Sci										
Fish Forage/Black Duck/117e grants										
Fish Habitat										
SAV										
4-D Interpolator										
STAC Workshop	Pre-planning work		Planning and organizing phase				Early Themed Workshop meetings			Continue
STAR/WQGIT updates	Presentation prep		Input from all GITs	Presentation prep		Input from all GITs	Presentation prep STAC Workshop panels, meeting support as targeted		Early PSC material PPT and review	
PSC Presentation										X

DIWG guidance during the review process and beyond

- Status on Citizen monitoring and labs collecting citizen samples
- Review and guidance on existing data sources feeding the new 4-dimensional interpolator
  - E.g., Fisheries-based data collections that are already being used in fish habitat-climate interaction analyses
- New innovations and new data sources to bring into the program
  - E.g., Direction on QA, calibration needs (e.g., satellite-based kd evaluation was tuned to mainstem measures, we would need to consider tributary kd calibration needs)
  - E.g., Data integrity for vertical water quality profiler data – support for QA and data management program development of this network

In closing:
9 Months to a concise issue and recommendation summary with financials. (December 2021).

- Over a decade since the last CBP monitoring evaluation
- Address CBP Outcome: Standards Attainment and Monitoring Outcome
- Address selected monitoring needs of other CBP outcomes
- Consider new technologies and innovation
- Identify priority improvements and gaps

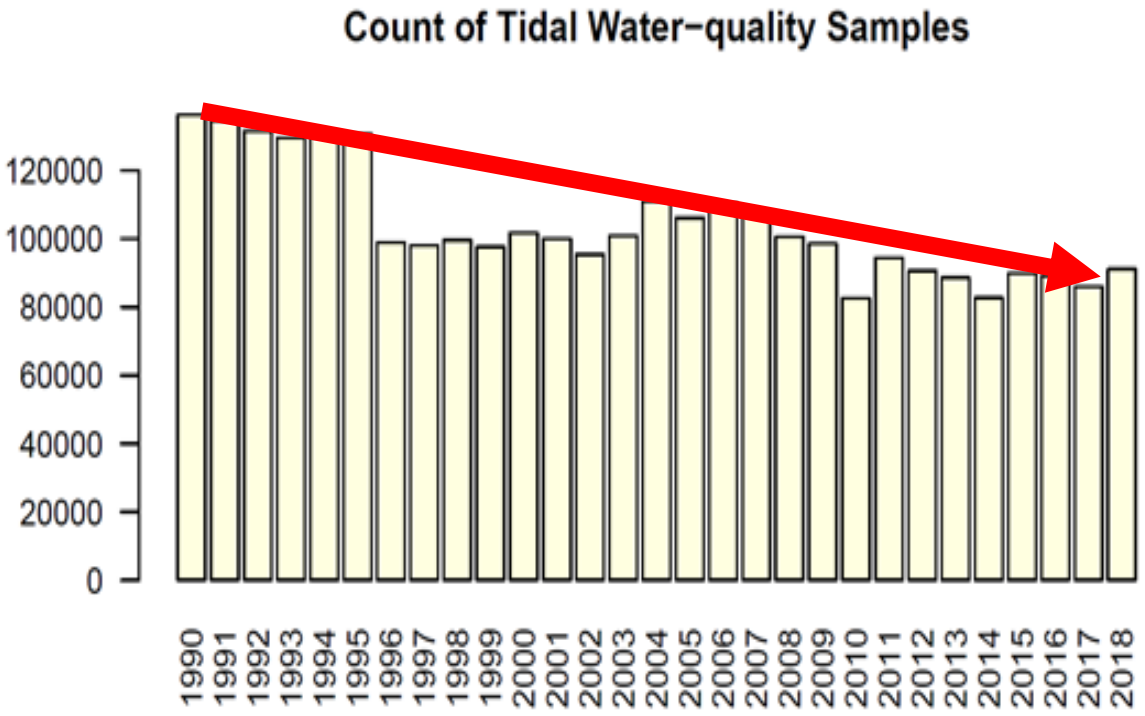


2021-22 STAC Workshop on Advanced Monitoring Options and Recommendations

STAC ACCEPTED ☺

Peter Tango
USGS@CBPO
IMN WG Coordinator
DIWG Presentation 2 of 2
April 13, 2021

Chesapeake Bay Monitoring Program Capacity Status?



Traditional Monitoring Program Capacity: Good/Fair/Poor

- Traditional capacity is highly stressed and declining

~20 years: Tidal data monitoring remains "marginal" to address management needs

Nontidal data collection "adequate" for the watershed load estimates, station losses ahead

Flat funding ignores inflation/COLAs translating to station and data losses.

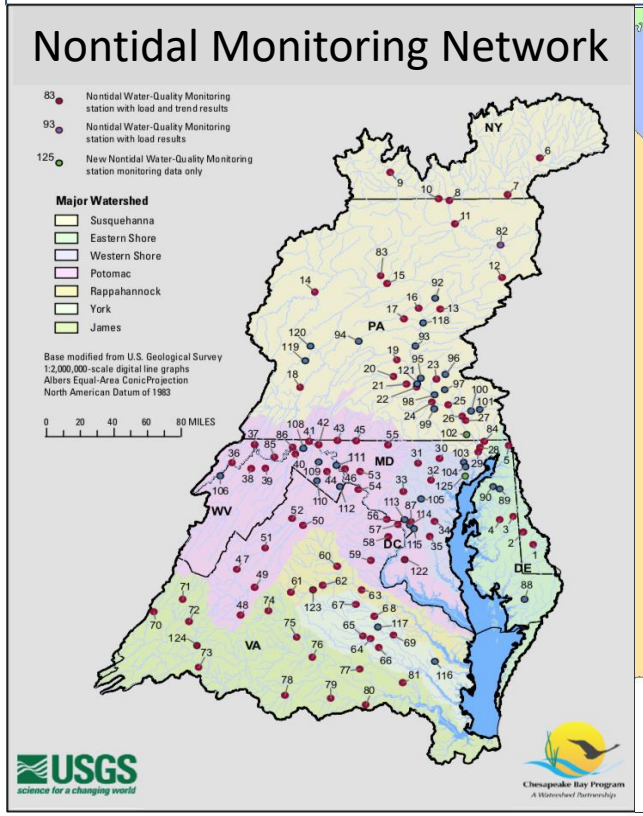
Impending SAV program cost increases may challenge program after 2021

Source: P. Tango USGS

CBP Partnership Monitoring Networks: Annual Monitoring

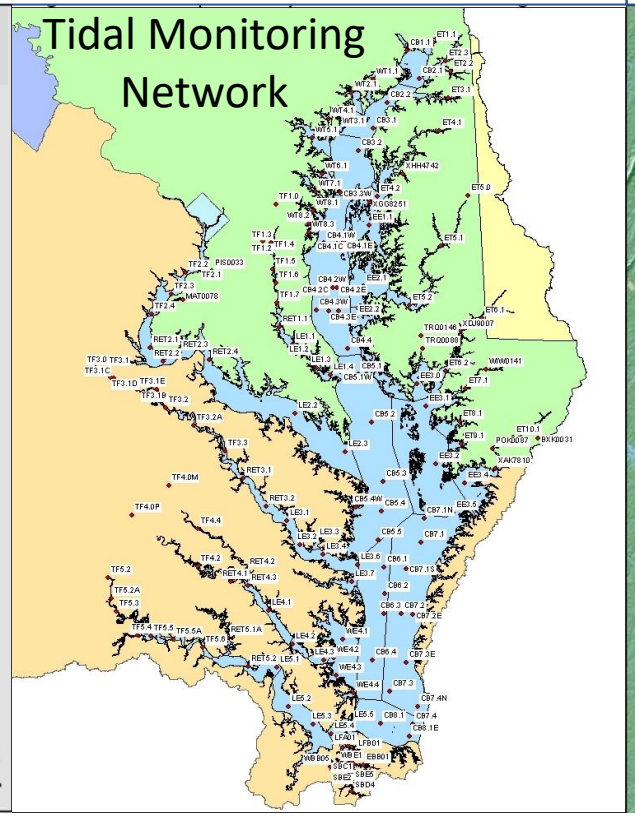
Water Quality

Nontidal Monitoring Network



123 stations

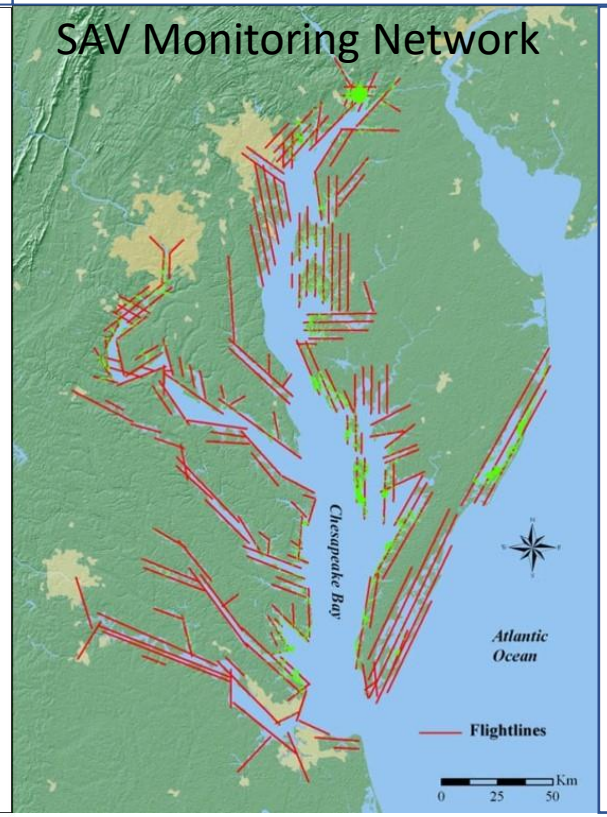
Tidal Monitoring Network



156 stations

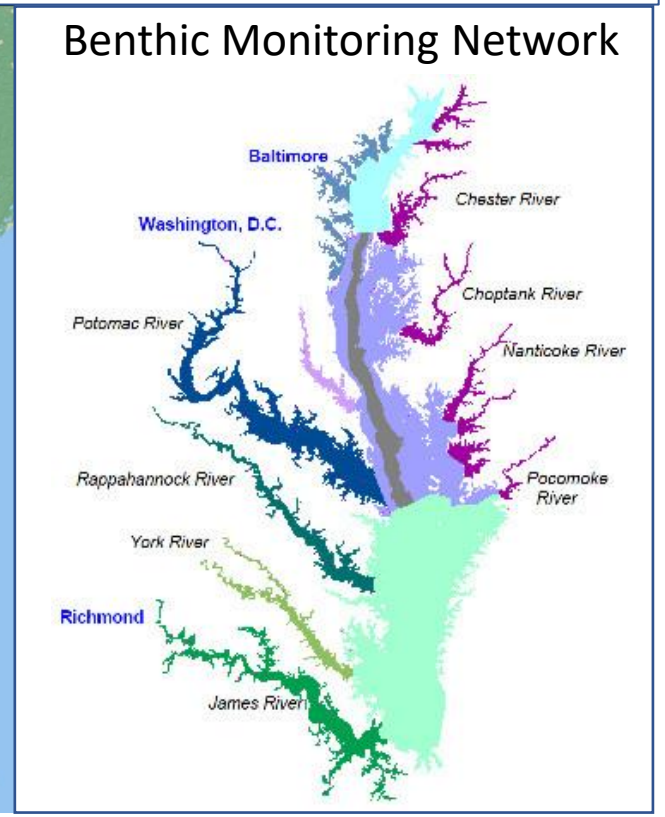
Living Resources

SAV Monitoring Network

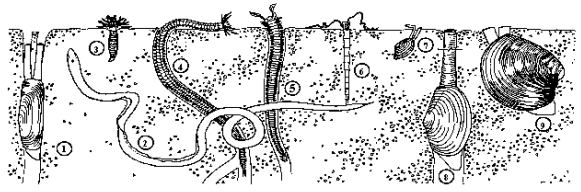


181 flight lines

Benthic Monitoring Network

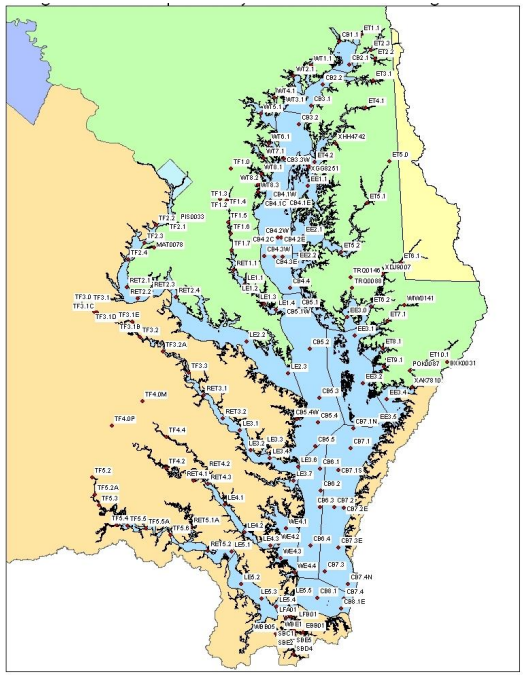


250 sites

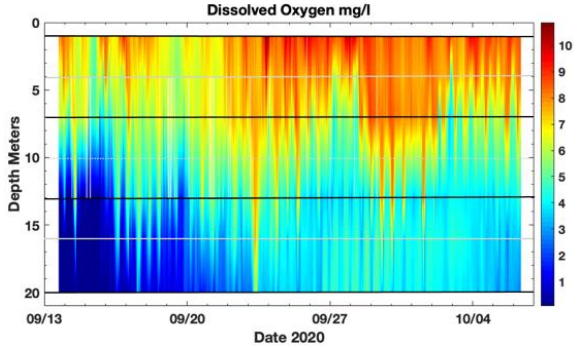


The future of water quality standards assessment is here

Dissolved oxygen measures
Supporting assessment at all criteria scales



Fixed station network:
Dissolved oxygen criteria
Nutrient/sediment factors



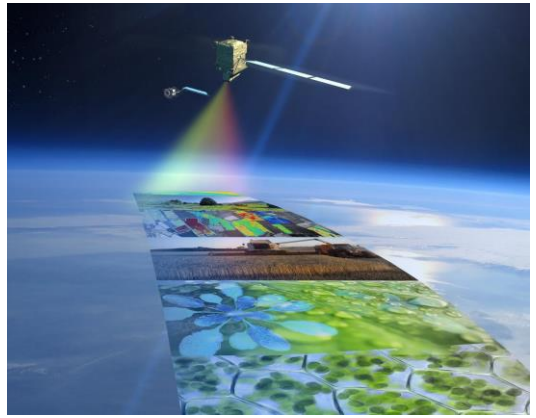
Vertical profiler network
Short duration DO criteria

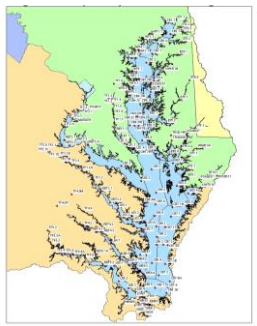
Nearshore
Con-Mon
Sentinel
Site
Network

Fisheries-based
DO profiles

Volunteer network
Enhanced spatial detail

SAV, kd, Chlorophyll
Satellite-based assessment
Intra-annual detail

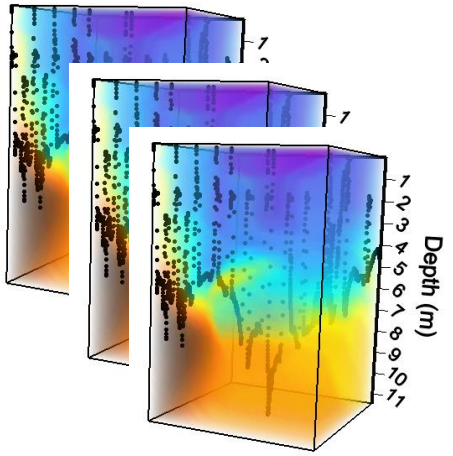




Fixed station
network:
CHLA calibration
CHLA verification

Volunteer network
SAV ground-truth

4-Dimensional
Water Quality
Estimator



Ingest diverse
data sources supporting
continuous fine scale
criteria assessment
across space and time

The water quality standards assessment future is now

Dissolved oxygen measures
Supporting assessment at all criteria scales

Ongoing

Fixed station network:
Dissolved oxygen criteria
Nutrient/sediment factors

Ongoing

Nearshore
Con-Mon
Sentinel
Site
Network

Ongoing

Fisheries-based
DO profiles

SAV, Kd, Chlorophyll
Satellite-based assessment
Intra-annual detail

Ongoing

Fixed station
network:
CHLA calibration
CHLA verification

Cit Sci protocol
available (CMC)

SAV WG plan

Volunteer network
SAV ground-truth

4-Dimensional
Water Quality
Estimator

The water quality standards assessment future is now

Dissolved oxygen measures
Supporting assessment at all criteria scales

Ongoing

Fixed station network:
Dissolved oxygen criteria
Nutrient/sediment factors

VIMS + NOAA + DNR
Profilers active in 2021

Hypoxia Collaborative
Team kickoff 2021

Vertical profiler network
Short-duration DO criteria

Ongoing

Nearshore
Con-Mon
Sentinel
Site
Network

Ongoing

Fisheries-based
DO profiles

Full use of data
2021 WQS Indicator
underway

Volunteer network
Enhanced spatial detail

SAV, Kd, Chlorophyll
Satellite-based assessment
Intra-annual detail

SAV – Recent gap use in Ches Bay
STAC Workshop & pilot study
Rapid advances in research
New STAC Workshop 2021

Kd - Tomlinson et al. 2018
Ongoing research, STAC Wkshp

CHLA – approved for FL (2012)
pilot work Ches Bay, STAC Wkshp
Pahlevan et al. (2020) Remote Sensing of Environment

Ongoing

Fixed station
network:
CHLA calibration
CHLA verification

Cit Sci protocol
available (CMC)

SAV WG plan

New Cit Sci award
Engaging groups

Volunteer network
SAV ground-truth

4-Dimensional
Water Quality
Estimator

2008 STAC Workshop

2020 Proof of
Concept Gulf of Mex
Matli et al. 2020

2020 Proof of concept
GAMs: Perry/Murphy

EPA investment 2021

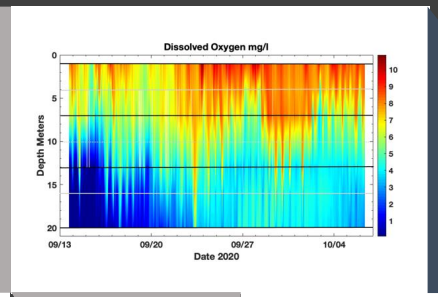
4-D Team kick-off
April 2021

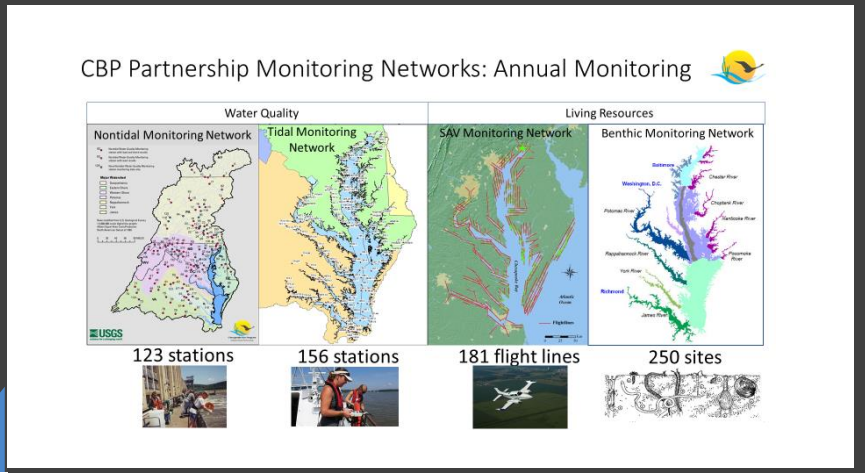
Ingest diverse
data sources supporting
continuous fine scale
criteria assessment
across space and time

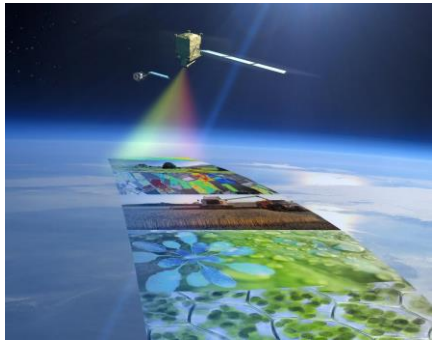
STAC Workshop Autumn 2021/Winter 2021-22

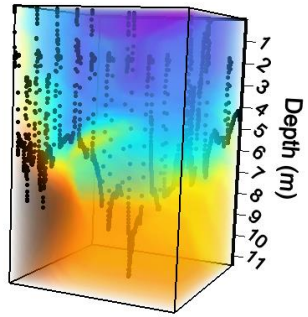
- Deeper dive on the assessment of options, their readiness for assessment support, identification of what questions/research needs might be required before adoption
- Tune recommendations on adoption of innovations and alternatives to address long-standing gaps in our assessment efforts
- Mini-meetings targeting topics build from our summer/autumn workgroup meetings:
  - E.g., AI algorithms for SAV assessment
  - E.g., Protocol for acquiring different satellite-based data
  - E.g., status and progress on satellite-based CHLA
  - E.g., 4-D interpolator development support needs
  - E.g., data interpretation options to address assessment

STAC Workshop
Autumn 2021/Winter 2021-22









Thank you!

Q&A

Chesapeake Bay Program
Science. Restoration. Partnership.

Teams/Groups	April 2021	May	June	July	Aug	Sept	Oct	Nov	Dec	2022
	SPRING **Status and vulnerabilities of existing network**			**SUMMER –** **Innovation Assessment, Financials of Sustaining networks**			**FALL** **Evaluate limitations, Financials for adopting innovations, recommendations**			Winter
NTN	Network support spreadsheet, vulnerabilities, financials, design options			Network revision proposals – BMP, climate, historical; financials of vulnerabilities next 5 years			Analysis innovation – target, timeline, investment. Formalize network & analysis revision recommendations			Consolidate recommendations, financials for PSC Presentation
CAP WG with DIWG	Tidal Mon program status, vulnerabilities, financials			Satellite SAV readiness, data management, QA needs	Satellite kd readiness, data management, QA needs	Satellite CHLA readiness, data manageme needs	Cit Sci targets, xpectations	STAC Wkshp: Knitting together innovations in monitoring and analysis for WQS attainment – do we have complete functionality now?		
Hypoxia Collaborative	Establish Team, kick-off mtg, provide Vision, input on stakeholder requirements, initial deployment targets			Network design, sampling de			AC Wkshp: High freq data interpretation, utility, network design implications			
Cit Sci	Award of contract.			Tier 3 document			STAC Wkshp: How much and what form of Cit Sci data can 4-D WQE use?			
Fish Forage/Black Duck/117e grants	Is Spring BIBI necessary?			D no			Formalize recommendations and financials of existing and proposed modifications to program			
Fish Habitat	Data sources – status and stability, product			on monitoring network design, data gement and QA needs			STAC Workshop panels support			
SAV	Track satellite contracting issues, work or acquisition of desired target areas			rep for STAC Workshop – sharpen financial assessment			STAC Wrkp: AI options, AI progress to improve efficiencies, comparability of method outputs, document path and financials			
4-D Interpolator	Establish Team, provide Vision, stakeholder requirements,			Guidance and development phase with monthly updates			STAC Wkshp: Shaping development, envisioning products to address WQ Stds reporting needs, fish habitat needs			
STAC Workshop	Pre-planning work		Planning and organizing phase				Early Themed Workshop meetings			Continue
STAR/WQGIT updates	Presentation prep		Input from all GITs	Presentation prep		Input from all GITs	Presentation prep STAC Workshop panels, meeting support as targeted		Early PSC material PPT and review	
PSC Presentation										X

Draft of the details