



Bay Oxygen Research Group (BORG) Meeting

August 17th, 2026
12:00 PM – 1:30 PM

[Visit the meeting webpage for meeting materials and additional information.](#)

Purpose: This was the August monthly meeting for the Bay Oxygen Research Group (BORG) Action Team. This meeting started with an update on changes with BORG membership led by Peter Tango (USGS). Next, Jon Harcum (TetraTech) shared his analysis of the impact of different numbers of simulations run with the 4D interpolator. Lastly, Rebecca Murphy (UMCES) presented on the preliminary analysis of Fishing Bay's dissolved oxygen.

Minutes

I. Welcome, Introductions & Announcements

Lead: Peter Tango (U.S. Geological Survey, USGS)

Upcoming Conferences, Meetings, Workshops and Webinars

1. [Restore America's Estuaries' 2026 Coastal & Estuarine Summit](#) – September 22-25, 2026. San Francisco, California.
2. [Chesapeake Watershed Forum](#) – November 13-15, 2026. Shepherdstown, West Virginia.
3. [National Water Quality Monitoring Council Virtual Gathering](#) – March 9-11, 2027. Virtual.

Announcements

- With the updated structure and governance, the Bay Oxygen Research Group Action Team is moving into the Clean Water Goal Team. To stay up to date with the Clean Water Goal Team and their monthly meetings, please join the mailing list by emailing Allison Welch (awelch@chesapeakebay.net). You can also join the list for the Clean Water Goal Team Newsletter by following [this link](#).

II. Membership Discussion and Update on Changes for BORG

Lead: Peter Tango (USGS)

In this presentation, Peter shared the updated ask on action team membership from the Governance and Operations (GO) Team and the Clean Water Goal Team. He began by explaining the voting structure for the Goal Teams which includes the leadership, the voting members and the non-voting members. Then, he covered the workgroup voting member structure, which includes the leadership and the 15 voting members, signatory and at-large. For Clean Water, the action teams are asked to follow a similar structure to that of the workgroups.

Next, Peter shared the current membership list for BORG. This includes the current leadership structure, the signatory representatives, and open at-large membership spots. The signatory

members are filled by each signatory. Some signatories may choose not to have a voting member; therefore, an additional at-large position will be open. The at-large members will be selected soon. Those interested in becoming at-large members will need to nominate themselves. Further instructions on how to do this will be sent over email. If you have any questions, please contact Allison Welch (awelch@chesapeakebay.net).

Action Items:

1. Peter Tango will be reaching out to the GO Team to gain clarity on the question of whether additional state representatives can serve as at-large members and the question about the conflict of interest.

Discussion:

Q: *Jim Hagy:* How do you self-nominate?

- **A:** *Peter Tango:* By sending an email to Allison and the coordinators.
- **A:** *Allison Welch:* I will send out more details on the self-nomination soon.

Q: *Rebecca Murphy:* We have a lot of state representation in our group. The state will have a signatory representative, could members from that state also be an at-large member?

- **A:** *Kaylyn Gootman:* Yes, I believe there is no limit. If West Virginia submits someone to be a signatory, that doesn't preclude another person from West Virginia to be nominated for those at-large positions.
- **Comment:** *Amanda Shaver:* That was the question I had. Can we confirm that it is the case? We still have spots to fill out for our workgroup members.
- **Response:** *Kaylyn Gootman:* I will work to get that confirmed.

Q: *Elgin Perry:* Are there any guidelines on conflicts of interest with membership? I feel like I wouldn't qualify to be a voting member for things I get paid to do.

- **A:** *Peter Tango:* I don't have much information on that. I think you bring up an important point about who the members are and whether they would get approved with the Goal Team leadership.

Comment: *Rebecca Murphy:* BORG has a purpose and goal to develop the 4-d interpolator. We are pretty close to having that completed. How do we make that clear to the Goal Team as we decide who will be members? It's confusing to me that we would go through this while the work is wrapping up.

- **Response:** *Peter Tango:* My understanding is that we may vote on when to take the tool forward with the Goal Team. That's as much explanation as I have right now. We have the Development Team, but they'd like to be consistent across groups with voting structure. We are nearing the end of our goal and provided that to the Goal Team but have received guidance to move forward with the voting member structure.

Comment: *Kaylyn Gootman:* I reached out to Lee about the question on whether a signatory can submit an additional at-large member from the same agency. Lee isn't sure and recommended we ask the GO Team. There is the point that a specific agency could get multiple votes. However, our group has a lot of agency overlap. I will revise my answer and say that we need to follow up with

the GO Team. This will answer this question for other groups as we build our rosters for the Monitoring Workgroup and Data Analysis and Reporting Workgroup.

- **Action Item:** Peter Tango will be reaching out to the GO Team to gain clarity on this question and the question about the conflict of interest.

III. Number of Simulations Analysis

Lead: Jon Harcum (TetraTech)

In this presentation, Jon presented his analysis on how many simulations should be used for the 4-d interpolator. They want to develop a defensible balance between simulation stability and computation time. The Criteria Assessment Protocol Action Team (CAP AT) is still deciding how the 4-d interpolator is used for assessment. The endpoint of this analysis is not to replace those methods but to get something stable that can be used in the decided-on approach.

Jon began by explaining the components of the 4-d interpolator that result in the dissolved oxygen (DO) simulations.

To create a simulation, they work segment by segment. Segments are simulated in grids of varying resolutions. For CB4MH, the grid points are separated by 1km in the horizontal plane and 1m as they move through the depth of the water. In this simulation, Jon focused on the grid point closest to the West Gooses monitoring station and the CB4.2W monitoring station. Jon showed the observed data for these stations and the simulation results in the graph on slide 10. On slide 11, he added a second simulation. Then, a third on slide 12. Then, on slide 13, he showed the results for 100 simulations.

Next, they wanted to turn the simulations to an assessment end point. For this, they looked at the percentage of observations in an assessment that is less than 1mg/L. They plotted the percentages over the 100 simulations and calculated the mean, tenth percentile and ninetieth percentile. Then, they asked whether these values would change if there were 20 simulations or 40 simulations and which ones would be closer to the 100 simulation results. For this experiment, they randomly selected 20 simulations from the original 100, calculated the mean, tenth percentile and ninetieth percentile and repeated this process 100 times. These results will be summarized in an interval plot. These graphs displayed the median result for the 20-simulation tests and the original result from the 100-simulation test. They can also see how the range differs throughout experiments. As they repeat this with 30 simulations, 40 simulations, and so on, they expect the difference between median and original results and the range of results to decrease.

On slide 19, he dives into the results of these experiments and shows that their hypothesis was correct, as the number of simulations increases, the mean, tenth percentile and ninetieth percentile become closer to the original 100-simulation results. The mean quickly reaches a spot where it is unbiased by the number of simulations. This begins around the 20-simulation point. The range continues to decrease as the number of simulations increases. Unlike the mean, the results for the percentiles bias in a certain direction. The 10th percentile biases high and the 90th percentile biases low.

They performed similar tests for each of the interpolator segments based on the segment's deepest designated use. The segments with a deep channel designated use were analyzed using the method already described with the percentage of observations less than 1mg/L. For the 8 segments with deep water as the deepest designated use, they used the percentage of observations less than 1.7mg/L and for those with open water as the deepest designated use, they used percentage of observations less than 3.2mg/L. This isn't an attempt to replicate the criteria assessment but to ensure the data is ready to be applied to criteria assessment protocols.

On slide 21, Jon showed the results for all of the segments tested with the deep channel designated use. Results for the bias are similar to those found before. The range (5th percentile to 95th percentile) results reach stability around 20 simulations. They each improve slightly around 50-60 simulations but it's a small improvement.

On slide 22, Jon showed the draw ranges for each of the designated uses that were analyzed. These graphs have different x-axes. The conclusion was that 20 simulations give a good result, and a slight improvement is observed around 60 simulations. The ANATF_MD segment is an outlier with these ranges. Jon found that this segment has a different distribution from the simulation results, with several reasons contributing to the difference.

The final findings were that stability was reached at 20 simulations with a slight improvement around 50-60 simulations. Jon recommended using 21 simulations for testing and 51 simulations for production analysis. They may want to increase the sample size for sensitive segments, like ANATF_MD. He also recommended checking this again once the criteria assessment protocols are in place.

Discussion:

Q: *Leah Ettema:* Is the simulation for mean mid-day or hourly data?

- **A:** *Jon Harcum:* That was for hourly data. The daily mid-day is the smooth line that was shown in the top graph on slide 4. They have to add the correlation and cyclic components onto the mid-day to get the results shown on slides 10-13.

Comment: *Tish Robertson:* This is a lot to take in. I might have to study the slides and get back to you with questions.

Comment: *Rebecca Murphy:* The report on this method is one of the documents we have sent out. It can be found on the webpage for this meeting (linked [here](#)).

IV. Fishing Bay 4D Oxygen Preliminary Analysis

Lead: *Rebecca Murphy* (University of Maryland Center for Environmental Sciences, UMCES)

In this presentation, Rebecca shared a preliminary summary of their Fishing Bay case study. They looked at the interpolator results for three years (2022-2024) using the recommended 50 simulations. This was compared to the Fishing Bay data collected by Maryland over those three years.

Rebecca began the presentation by showing the frequency of monitoring data per station. Because the high frequency stations had significantly more data, she had to consider this in her analysis. She compared the observed results to the 4-d interpolator results at 50 simulations. The 4-d results have a similar range to the observed data, but different distribution, which was expected.

Next, Rebecca shared an interactive time series that displays the 4-d interpolator simulations and the observed data. From this, she found that the data was similar over the three years and the interpolator did a good job matching the observed data.

Next, they wanted to look at how the initial 4-d interpolation results compared to the results from the 3-d interpolator. Rebecca gave a quick overview of the 3-d interpolator, which is currently being used to interpolate oxygen in the Bay. On slide 11, she compared the range of results for the 4-d and 3-d interpolators. There are less results from the 3-d interpolator, but both groups have similar ranges. They also compared the monthly average oxygen from each method, which has similar results. Rebecca found that each discrepancy between the two methods was because the data wasn't complete for one half of the month, making the 3-d results less accurate. She shared

one example of this for June 2022. This points out one of the issues that led to the decision to create the 4-d interpolator. Moving forward, the Development Team is working on using the 4-d interpolator with a cumulative frequency diagram (CFD).

Discussion Notes:

Q from chat: *Melinda Cutler:* Are the 4D interpolations for Fishing Bay using the continuous monitoring data?

- ***A: Rebecca Murphy:*** Yes. That is part of the blue observed data on the graphs.

Q from chat: *Matt Stover:* Lower because those stations monitored in late June are small poorly flushed tributaries?

- ***Comment:*** *Matt Stover:* That question was about slide 15. When reading the results of this analysis, is this outcome because the two stations happen to be in poorly flushed tributaries? Is there another rule that is driving it to a lower estimate?
- ***A: Rebecca Murphy:*** You have a better understanding of this station than I do. I don't know why it's low, but it is, which caused the interpolation results to be lower than average across the entire Bay because only these two data points were used. If just one of these other stations was included in the second two-week period, it would have increased all of the oxygen predictions. We don't know the truth with only the data we are looking at but it doesn't seem like this creek would have that impact across the whole Bay.
- ***Response:*** *Matt Stover:* When we looked at it with years where we had data for the mainstem the western creek was the worst offender. Thank you. I wasn't sure if it was a general rule where it would underestimate or if that's because of what the data looked like at Fishing Bay.
- ***Response:*** *Rebecca Murphy:* In January, it looks like the averaging artifact caused a higher-than-average result so it could go either way.

V. Adjourn

Next Meeting: [September 21, 2026](#)

Attendees:

- Allison Welch, CRC
- Amanda Shaver, VA DEQ
- Andrew Keppel, MD DNR
- Becky Monahan, MDE
- Cindy Johnson, VA DEQ
- Clifton Bell, Brown and Caldwell
- Efeturi Oghenekaro, DOEE
- Elgin Perry
- Gabriel Duran, CRC
- Jim Hagy, EPA
- Joe Morina, VA DEQ
- Jon Harcum, TetraTech
- Kaylyn Gootman, EPA
- Leah Ettema, EPA
- Mark Trice, MD DNR
- Matt Stover, MDE
- Melinda Cutler, MDE
- Peter Tango, USGS
- Sakinat Ahman, DNREC
- Sophia Grossweiler, MDE
- Rebecca Murphy, UMCES
- Tish Robertson, VA DEQ