



Criteria Assessment Protocol (CAP) Workgroup Meeting

March 9th, 2026

1:30 PM – 3:30 PM

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

Purpose: This is the monthly meeting of the Criteria Assessment Protocol Workgroup (CAP WG). In this meeting, CAP WG Leadership hosted a brainstorming discussion as a continuation of the February WG meeting. This discussion followed various topics outlined in the [supporting document](#).

Minutes

I. Welcome, Introductions & Announcements

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

Upcoming Conferences, Meetings, Workshops and Webinars

- [Choose Clean Water Conference](#) – May 18-20, 2026. Lancaster, Pennsylvania.
- [Chesapeake Community Research Symposium](#) – June 1-3, 2026. Annapolis, Maryland.
- [Restore America's Estuaries' 2026 Coastal & Estuarine Summit](#) – September 22-25, 2026. San Francisco, California.

II. Brainstorming Session: Planning for Next Steps within the Criteria Assessment Protocol Workgroup

Lead: Peter Tango (USGS), Matt Stover (Maryland Department of the Environment, MDE), and Tish Robertson (Virginia Department of Environmental Protection, VA DEQ)

Actions:

1. Work with the Data Integrity WG to answer the questions laid out in the discussion document and find a standardized approach that will be suitable for each agency.
2. Continue to think about whether the assessment methodology decision documentation should be in a “Blue Bible” or a Chesapeake Bay Program publication and make a decision as a group soon. Both Maryland and Virginia representatives have stated that they would prefer utilizing a Chesapeake Bay Program publication.
3. Discuss what criteria and designated uses will be analyzed when the 4-d interpolator is used on phase 7 model results with the Clean Water Goal and modeling team.
4. Revisit the discussion on the changing pycnocline in the 4-d interpolator and decide on how the 4-d interpolator should measure the pycnocline.
5. Ask the modeling group if, in using the 4-d interpolator, are they planning to adjust the allocations/target loads based only on the 30-day mean Open Water, 30-day mean Deep Channel, and instantaneous minimum in Deep Channel DO criteria or base their loads on meeting all DO criteria.

6. Define the 30-day mean. Will it continue to follow calendar months, or will it analyze 30-day periods in the interpolator?
7. In the April meeting, focus on the 30-day mean and pycnocline definitions.

Discussion Notes:

Discussion notes follow along with the supporting discussion document.

Comment: *Matt Stover:* Perhaps we should start with or focus on our DO assessment questions because any decisions we make on that will need to be input into the 4-d interpolator.

- **Response:** *Peter Tango:* That's spot on. I think there are also questions in the chlorophyll world given we have a lot of narrative applications and should talk about quantitative criteria. That's a secondary priority. We have the very complicated dissolved oxygen criteria with five designated uses and multiple seasons. Thus far, we've been focused on summer 30-day mean and instantaneous minimum. That leaves a lot of room to gain ground on the long-standing gaps we've had.

1. Continuous Monitoring Data Integrity

Comment: *Peter Tango:* We've been hearing great presentations from Leah Ettema and Tish Robertson on continuous monitoring (common). In these high temporal or spatial density datasets, we are asking whether each one has a quality assurance plan. For EPA approved monitoring programs, the data collectors need to have a Quality Assurance Project Plan (QAPP) before beginning. Sometimes when they aren't EPA funded, they aren't held to the same level, but it should be comparable if we are using it for regulation.

Comment: *Tish Robertson:* One thing that makes DEQ lucky is that we partner with Virginia Institute of Marine Sciences (VIMS). VIMS handles all of the QA/QC (quality assurance/quality control) and data management for our continuous monitoring. That would be an enormous amount of work for us. They have a great process and I never have to worry about the integrity because they have a robust program for identifying errors. They have different descriptive flags. It streamlines the data analysis process so I can focus on that without worrying about whether the data is valid. If we move towards arrays, we need to have a standard approach for handling those data.

Comment (in chat): *Breck Sullivan:* For number 1, I would encourage any of those discussions to be joint meeting discussions with the Chesapeake Bay Program (CBP) Data Integrity Workgroup (DIWG).

Comment: *Matt Stover:* It would be good to have a common methodology for dealing with that data, if it doesn't already exist. The Data Integrity WG would be an appropriate forum for that. I know much has been made for common data collection and issues with drift. It would be good to make sure we're all handling that the same way, especially across state boundaries.

Q: *Peter Tango:* I know in the past anything that was uploaded to the data hub was screened and highlighted for data integrity issues. This way everyone used the same application to address issues. Perhaps that is still standard practice. If we need to do something specific for commons, is that something Cindy and the WG have already dealt with? Do we need to create that as a new pipeline?

- **Response:** *Mark Trice:* We developed a standardized shallow water monitoring QAPP in terms of methods and rules, with Ken Moore, Britt Anderson, Ricky Bonner, and folks from Virginia. For continuous data, we had certain common error codes and procedures to check

that. We may not use the exact same tool, but it was standardized from the start. We don't do drift correction in terms of changing the data. If things fall out of a calibration tolerance, we note that in the code and data. We are in the business of providing the raw data and the QA tools for people to do what they want with them.

- **Response: Leah Ettema:** I was going to suggest a starting place is summarizing the procedures in the existing QAPPs for continuous data. What instrumentation is used? How is it calibrated? What are the common flags for removing data? That could be good to see how different the procedures are. If there are data from external organizations, it's often not clear what is required in a QAPP. At EPA, we are trying to develop best practices of what should be included in a QAPP. I have seen a wide range of QAPPs for continuous data.
- **Response: Peter Tango:** I think there is a document by USGS with quality checks for continuous monitoring. A comparison of the content and requirements would be a project.
- **Response: Clifton Bell:** The USGS procedure is something I want to invoke. We know it as the Wagner document. It's considered the gold standard for the QA of continuous monitoring data. In addition to looking for errors or outliers, it has very specific procedures for drift correction and biofouling. It treats them as two different things with different correction procedures. It is a pain. When we've worked with USGS, we've found that they aren't using this procedure. They just do a basic scan. I tried using a spreadsheet for a project, which I will never use again. One thing to consider when thinking about the diversity in procedures is to ask whether they are actually doing calibration for biofouling and drift or if they are just checking for bad numbers. That could be a decision point for us to determine whether we feel like that needs to be done.
 - **Comment (in chat): Clifton Bell:** USGS Wagner document: <https://pubs.usgs.gov/tm/2006/tm1D3/>
- **Response: Peter Tango:** That is an excellent point. This also plays into the issue below it of addressing gaps. Do you adjust the data and what is that procedure or is it another process?

Comment (in chat): Amanda Shaver: The monitoring QAPP should cover data collection. Not clear if data formatting/storage/etc. would be part of the QAPP.

- **Response (in chat): Leah Ettema:** Should be discussed somewhere. Exactly where can be flexible (QAPP, SOP etc).

Comment (in chat): Cindy Johnson: This also concerns the data upload (for the QA data at least) and would normally go through the DIWG.

Comment: Tish Robertson: I'm glad the conversation went towards USGS. When we were coming up with our common assessment methodology, I wanted to see how USGS handles continuous monitoring for its analysis. This isn't a QA/QC type thing, but it's more like if you had data gaps because the monitor was offline. That can have an effect if you're trying to characterize diurnal cycles. In our assessment, we have a rule that at least 75% of the diurnal cycle must be represented by valid observations. If you don't meet that, you don't use that day because it's not representative of the 24-hour period. There are ways to handle the data gaps that don't involve the QAPP but are more on the assessment method side.

- **Response: Peter Tango:** That sounds like a whole meeting unto itself. That was a good example, Tish. What do we do if we're expecting a 90-day period and don't have 90 days? We've been doing trend analysis for years, even when a cruise or two are missing in a year. It hasn't invalidated our ability to do analysis but relative to the specifics for the DO assessment, it's important we understand the minimum data needs, the data gaps and how we fill them or don't fill them.

- **Response:** *Rebecca Murphy:* We need the high frequency data to have good quality, but we are filling in these gaps with the 4-d interpolation. When we fit daily cycles to parameterize that part of the model, we have said that we need 20 out of 24 hours to have data in a day to use that day for a cycle, which is close to 75%. We can adjust that. That is the biggest parallel.
- **Response:** *Tish Robertson:* I'm not wedded to 75%. I saw it in a USGS guidance document and went with that. It makes sense to have a threshold, but I'm ok with 20/24 hours.

Comment (in chat): *Jon Harcum:* It might be useful for CAP to consider which data quality codes can be used for assessment as not all codes are 'reject'

Comment: *Matt Stover:* This is where data review bleeds into assessment methodology. Because of CAP's mission, maybe we shouldn't take on the QAPP and data review side of things, which is for the DIWG. In the next few years, maybe we should focus the efforts of this group on the assessment methodology side. How few samples are we ok with assessing a particular criteria for a particular time period? It sounds like there is still a need to make sure Virginia and Maryland's processes are the same. Mark, I'm not sure if they already were. I don't know whether that is still something we are looking into to compare methods. Maybe that isn't for this workgroup to hash out. I'm suggesting we focus on the assessment methodology stuff.

- **Response:** *Tish Robertson:* I cosign on that, Matt.
- **Response:** *Peter Tango:* It's good that we have DIWG folks on. I think we can effectively crosspollinate there. We can recognize that these are questions we might need to revisit. Are there new questions? DIWG can reflect on that in their workgroup. We continue with questions, like the minimum sample size. We hit the QAPPs, addressed data gaps, and talked about multi-agency QAPP procedures. We didn't get to when these decisions should be made. It seems like that should run in parallel to the work we're doing. Historically, as we make an update with new technologies, these are evolving tasks that never end. We are in the process of incorporating new technologies, like the array system. It is important to make these front and center to us. If you find that there is something that you feel is influencing or holding back the assessment, we would like to work with those at the DIWG on that decision.
 - **Action Item:** Work with the Data Integrity WG to answer the questions laid out in the discussion document and find a standardized approach that will be suitable for each agency.

2. General Dissolved Oxygen Assessment Methodology

Comment: *Peter Tango:* We have two years to put something in place that is agreed upon and available in the preliminary assessment, as written in the Watershed Agreement. We are building towards 2030, but 2028 is the deadline given in the Agreement.

Q: *Matt Stover:* Is that the end of the calendar year or for 2028 integrated reports (IR)?

- **Response:** *Peter Tango:* I thought that was having a set of protocols ready for use. We would be prepared for the next assessment.
- **A:** *Amanda Shaver:* When we were adding the dates to that language, we thought that by the 2030 integrated report, we would be able to assess all criteria. By 2028, we would hope to have it ready to use in the data compilation and assessment.
- **Response:** *Leah Ettema:* Then you could meet the public notice requirements for the state as well.

- **Response: Matt Stover:** That sounds a lot more reasonable than having to do it by the 2028 IR. We've talked about using the 4-d interpolator or having an alternative method, which is probably more realistic to have by the 2028 IR potentially.
- **A (in chat): Breck Sullivan:** Yes, it is established in 2028 and reported by 2030 but that is only for DO, not all criteria.

Q: Peter Tango: We were recently talking with Leah about establishing methods and documenting decisions. I was speaking to Lew Linker and asking about the Phase 7 documentation and cover sheet. We have lived in the "Blue Bibles," which is one form of documentation. The Phase 7 work, which comes out of the modeling community and creates allocations for the total maximum daily load (TMDL), lives in another form of documentation. One example is "Chesapeake Bay Restoration Goals, 1994 Benthic Goals," which is a Chesapeake Bay Program publication. There are dissolved oxygen restoration goal documents from the 1990s like that. What parts would be necessary to publish in a Blue Bible, or can we put the bulk of what we're doing in a Chesapeake Bay Program cover document, like the Phase 7 documentation? Is that referenceable for our state partners? We want to make sure we get the right documentation for the right use while also allowing the flexibility to reference that material.

- **A: Kelly Gable:** I'm not giving legal advice. I'm just speaking from a historical perspective. The partnership put out documents that have the EPA number at the top right, which would be the 2003 and 2017 documents. Some of those weren't actually true for a recommended criteria, but they were akin to and they set out water quality criteria and designated uses that the states adopted. My understanding was that there was value in doing it that way, as an official EPA publication. Back then, it was also not clear if assessment methodology was part of water quality criteria or not. That got teased out in later years. That could be in those documents as a function of the historical merging or confusion. We're not talking about water quality criteria or standards and not revising them. I don't see why this stuff couldn't be in a partnership document. That is my opinion factoring in the history I am aware of.
- **Response: Leah Ettema:** For whatever document is produced, we would expect states to reference in their assessment methodologies. It would be up to Maryland and Virginia whether having an EPA document would carry more weight or be better in an assessment method, if that matters.
- **Response: Kelly Gable:** Consider the time frame as well. When Virginia and Maryland are chewing on that, especially giving the pace set by the Executive Council, a partnership document might be procured faster than an EPA document.
- **Response: Peter Tango:** I can assure you that because I wrote one of the chapters of the 2017 document in 2015. It was about three years in the making. We are talking about two years to get the protocol worked out. There is a time lag there knowing that there is a lot of work to get to the decisions and present them the way we want to. That's helpful insight given the path we have gone down to have documentation referenceable.

Q: Peter Tango: We are talking about the protocols. The interpolator work was outlined in the 2003 document. I can't remember if an appendix lists the code. That would be part of the assessment procedure package and Phase 7 evaluation of modeling data and supporting their allocation assessment. It becomes a question of whether the states feel the need to have that in a Blue Bible or can we couple along with how the modelers are working on their documentation and having it as a partnership publication. Because the 3-d interpolator is published in the 2003 document, is there a need for it to be a supplement? Can we have that partnership document at the same level when we put those technical support pages together?

- *A: Matt Stover:* From Maryland's perspective, no, we don't need a Blue Bible. It's an assessment methodology, not criteria. The 3-d and 4-d interpolator are methods of assessment. EPA's interpretation on what is criteria vs. assessment methodology has gotten a lot clearer. We know that we don't need to put our assessment methodology into regulation. What gives it authority is through the public comment period, which is usually part of the integrated report. Whatever the partnership comes up with for the assessment methodology, we would prefer not to have it in regulation, but have it linked or within our integrated report. That's how we treat all of the other assessment methodologies.
- *A: Amanda Shaver:* Same with Virginia. We are trying to get the language out of our standards regulation because we do make frequent changes to our assessment guidance document. We would plan to include the methodology by reference or in the document itself. We're required to put our assessment methodology out for public comment. We prefer to do that in an odd number year before releasing our integrated report in an even number year.
- *Response: Peter Tango:* Super! I don't think we've had such intimate discussion on publishing. This is super helpful.
 - **Action Item:** Continue to think about whether the assessment methodology decision documentation should be in a "Blue Bible" or a Chesapeake Bay Program publication and make a decision as a group soon. Both Maryland and Virginia representatives have stated that they would prefer utilizing a Chesapeake Bay Program publication.

Q: *Matt Stover:* What was the original reason to publish the Blue Bibles in hard copy and with fanfare? Why were they done so formally?

- *A: Peter Tango:* They wanted to codify the criteria. They wanted to get something standardized, agreed upon by the community, and published that represented the best available information at the time. I wasn't on the deciding panel for setting up the 2003 document. If Rich was here, he might have a solid explanation. They wanted community consensus which would can see through the acknowledgements of all of the teams. This was eventually the basis for the TMDL allocations. This was used as the standard by which Bay Restoration was judged.
- *A: Kelly Gable:* It was trying to get all of the tidal Bay states on the same target page. The partnership was not yet talking about TMDL, which came in 2006/2007. 2003 was the era of tributary strategies. The idea was that you have these big tributaries that would be given one target so everyone is shooting for the same thing. If you look at the fine print in some of those documents, it's not 204a of the Clean Water Act that is cited, but 117d. That provides for EPA and the Chesapeake Bay Program EPA Office to provide technical assistance. That was the purpose. The tidal Bay states all get on the same page and have the resources to do that under a statute. There had been reductions in nitrogen and phosphorus that all the Bay tidal states were aiming for since the 1990s. There were a couple rounds where we missed it and redoubled the efforts. Once we got to the 2000 Bay Agreement, it was clear that we needed to do something more, which is when that stuff started coming in.
- *Response: Tish Robertson:* I think what Kelly said is 100% true. If Rich was here, he would say he wanted all of the Bay jurisdictions to have this compendium of our thoughts out there. If you look at the acknowledgment page of the 2003 document, it's not just the tidal Bay states. It is cutting across all of the Bay jurisdictions. In Rich's mind, he felt like we needed full transparency and needed the whole world to know what the Bay, as a unified body, would do for Bay restoration. I think it was the gravitas of the Bay at that time. In his mind, he felt like it needed to be an EPA publication.
- *Response: Matt Stover:* In those days, Rich was insistent that we incorporate by reference the blue bibles in Maryland's regulations. We've been thinking about taking it back out because it

is an assessment methodology. We would still point to it in our integrated report. We want to keep criteria and assessment methodologies as separate regulatory tools and make that consistent with everything else we do. Not that we wouldn't use those documents and follow the protocols listed within, but we'd be treating them appropriately. We'll see what can of worms we want to open at our next triennial review.

- **Response:** *Tish Robertson:* In Virginia, we've made the decision that if there are more group publications that are put up, we wouldn't be adopting them into the regulation. We would just reference them in the assessment guidance. When we put things into the standards, it restricts us in a way. Implementation language that is as copious as the publications we put out isn't appropriate for water quality standards regulations because you want it to be legally enforceable. That's harder if you have a million pages you are referring to. We are trying to streamline our regulation.
- **Response:** *Peter Tango:* It would be interesting to have two panels – one that says criteria and assessment belong together and one that says they belong separate. I think there are some strong arguments for keeping them together, which is part of why that was put in there before it was decided against. Unless we have overwhelming evidence, that doesn't seem like something to put in our two-year timeline. It was super important to talk about our documentation and how we want to present that. We have some good guidance. Coming up, we could vote on whether we have the Blue Bible or not. It sounds like our initial recommendation is to present it in partnership publications unless someone says they want to see it in the older style publication. You've all given good understanding about why that has created more challenges and how you're handling that going forward, given the decades of experience you have with using them and knowing how not to be constrained while still doing an effective job of making the assessment.

Comment: *Breck Sullivan:* My comment goes back to when we were discussing the dates in the Watershed Agreement, specifically for dissolved oxygen. I thought it might be helpful if I provided an update on the 4-d interpolator timeline, in conjunction with those dates in the Watershed. As a reminder, within the Chesapeake Bay Program, the 4-d interpolator has the role of helping us assess all DO criteria at the moment. It will also help us with our planning targets for the Phase 7 model. The 4-d interpolator has a deadline where output from the model scenarios need to be run through the 4-d interpolator. That means we will hopefully be able to share documentation of the fully developed interpolator with the Scientific and Technical Advisory Committee (STAC) and the BORG members around November of this year. There will be time after for suggestions to be incorporated after that review period. We are building the infrastructure of the 4-d interpolator to help assist with criteria assessment. Because this group will not have a method established for all DO criteria until 2028, there might be some parts that our current interpolator might not fully address. There's been a 20-year difference between when we made the 3-d interpolator and now making the 4-d interpolator, but that doesn't need to be the case next time. Even though there will be decisions made after we're fully developed, that doesn't mean we can't come back to it and enhance the 4-d interpolator to help meet those new method decisions you will establish.

Q: *Tish Robertson:* When you say, "November of this year," do you mean that the science aspect of the tool will be under review or the decision rules in addition to the 4-d interpolator? When the 4-d interpolator is used to interpret the simulations from Phase 7, don't we need to have those decisions in place? Don't we need to know how to evaluate a seven-day mean or 30-day mean? It seems like those decisions would be just as important for the modeling as it is for the assessment.

- **A:** *Peter Tango:* Your allocations are based on the 30-day mean in the open water and instantaneous minimum in the deep water. That's what they considered as the umbrella of

how the TMDL functioned. To my knowledge, it didn't evaluate every criteria in every designated use. I know there is a 2010 Schenk and Batiuk report which states that what they used as the minimal set to set the allocation was the umbrella for everything else there.

- **Q:** *Tish Robertson:* What you're saying is that even in model world, we won't be assessing all of the criteria with the 4-d interpolator?
- **Response:** *Peter Tango:* You'd have to ask Lew.
- **Response (in chat):** *Kelly Gable:* Lew would be better than I on that; the TMDL document also explains in detail what was done and why.
- **Response:** *Tish Robertson:* That was my understanding because other wise why wouldn't we just use the 3-d interpolator?
- **Q:** *Breck Sullivan:* Tish, when you say, "model world," do you mean the watershed and estuary model?
- **A:** *Tish Robertson:* Yeah. I mean the output from the phase 7 being scenario modified and then run through the 4-d interpolator to see if we're attaining the water quality standards. I know that with the phase 6 model we used the 3-d interpolator, 30-day mean, and for deep channel, instantaneous minimum. I was thinking that with phase 7 we'd be able to look at all of criteria and designated uses. If that's not correct, I need to know that so I can relay that message.
- **Response:** *Peter Tango:* I think that is a good question for our new Clean Water Goal Chairs. I'm not at that level of detail, but I could bring that up in the next phase 7 discussion. I haven't heard that question at that level of detail anywhere.
 - **Action Item:** Discuss what criteria and designated uses will be analyzed when the 4-d interpolator is used on phase 7 model results with the Clean Water Goal and modeling team.
- **Response:** *Breck Sullivan:* I haven't heard that outside of the ad hoc meeting, but that should be elevated.
- **Response:** *Tish Robertson:* The answer to that question will help us figure out what our priorities are. If we need to make the decisions for the other criteria, we'll need to get started on that right away.

Comment: *Peter Tango:* The STAC Report would be asking "Is it operating as an interpolator should? Is it well calibrated? Is it giving proper assessment over space and time? How is it performing?" If we come to consensus on what a 30-day mean calculation should look like, then can we compare the 3-d and 4-d output? If it's putting all of the correct information into the correct cells across time, then it's an output evaluation to see whether they are in or out of attainment. That is separate from the science of getting the numbers right in space and time within the framework of the 4-d tool.

- **Response:** *Tish Robertson:* There is the interpolation part, which is science, but I think the development and interpretation of the cumulative frequency diagram (CFD) is an intersection between science and policy. If I were reviewing it from a technical perspective, I would want to see it through the whole process because it's all science. The decision rules that we come up with to interpret the interpolator are going to hinge on the uncertainty. I would think it would hinge on how well the tool predicts. I see science and policy as being married together.
- **Response:** *Peter Tango:* During the Blue Bible years, I went in front of STAC several times with protocol updates and recommendations. We've done a lot of reviews, for example, with designated use adjustments. From what I remember, the 3-d interpolator was on hold and we had STAC reviews of whether or not the protocol finds that the assessment was valid and supported by the best available information. I could see where you want to see them together, but at the same time our experience got us through the 2003 set-up and the 3-d interpolator

and continued to work with STAC for updates like designated use decisions and protocol recommendations. I think they are ok seeing it that way.

- **Response: Tish Robertson:** I remember the STAC report on the 3-d interpolator. There were recommendations about the type of interpolator model. I remember them saying that kriging is the recommendation. They also looked at the CFD. I am seeing it the same way with the 4-d interpolator. If we decide to go down that path, the CFD is an output of the 4-d interpolator. That is important decision that I think this group would be tasked with. That's the one we care about the most. It's how the interpolations are going to be processed.

Q: Melinda Cutler: It sounds like the 4-d interpolator is on track to capture what the phase 7 model needs. If it is only going to focus on the 30-day mean and instantaneous minimum, like we have in the past, then we decided to add the other criteria, like seven-day mean, later. What level of support would the 4-d interpolator development continue to have? What kind of gap would there be between getting it finished for phase 7 versus what we would need for assessing criteria? Would there be continued support and development for the other decision rules?

- **A: Breck Sullivan:** I can't speak to support in terms of funding past this year, but I am never able to do that. If we have not been able to provide the full support needed to assess all criteria once we turn in the methods document, we would stress that it is a need and would require additional resources to move it forward. I would foresee it still being a major priority within the Chesapeake Bay Program, but I can't say with certainty that we would have resources for that in the future. We're still developing the 4-d interpolator to be able to assess the instantaneous minimum and seven-day methods. We're having conversations around sub hourly results because that could answer questions around the instantaneous minimum and seven-day methods. For the other role of the 4-d interpolator, which is the watershed and estuary model, it might still be for the 30-day mean and instantaneous minimum, but that doesn't mean that the 4-d interpolator would not be able to assess the other criteria.
- **Q: Melinda Cutler:** Will there be developments at some point to do the seven-day mean, as well? Is the push to just capture the 30-day mean and instantaneous minimum for the phase 7 model. I question if we will be able to get it all done by November. Is that the push we are going to go for given the fact that we might not be able to pick it back up after this year? I think this timeline has larger implications for this group considering we need to be able to assess all criteria by 2028. I don't know if that's a misunderstanding or there is clarification on the timeline.
- **A: Breck Sullivan:** These are very good questions. The push is still to do the seven-day minimum and instantaneous minimum. Based on what we know now and the questions we are able to answer, we will incorporate that. There might be some nuances that this group decides on in 2028 that may change. We would need new resources to incorporate that. Yes, our push is still to help you and the Bay Program assess all criteria.
- **Response: Peter Tango:** The work here is to support having the capacity to assess all criteria. The 4-d interpolator will cover the minimum of what the phase 7 model would require and more. It is a good question to ask if they are intending to make a more complete evaluation than what they used historically. I don't have an answer, but I'd be happy to bring that question forward.
- **Response: Breck Sullivan:** This is why we're grateful to have these interconnected meetings with CAP and BORG.

Q: Matt Stover: November is the target date for the 4-d interpolator being operational for phase 7. In this first version, if we're hoping to have assessments for all of the different DO criteria, we should probably have the decisions for the assessment methodology items listed in the discussion document wrapped up before then?

- **Response: Breck Sullivan:** Yes, I would say that your priorities should be focused on that, but if those answers are not made at that point, there may be methods in the coming years that we need to incorporate in enhancements to the 4-d interpolator.

Q: Becky Monahan: To confirm, the 4-d interpolator coming out in November will not assess all criteria.

- **Response: Breck Sullivan:** I'm not saying it isn't. We are producing the interpolator so it can, based on the criteria protocols we have now.
- **Response: Rebecca Murphy:** The 4-d interpolator is interpolating the oxygen and giving us an estimate of oxygen everywhere at all times. We're trying to think about how that output could be used in criteria assessment, but the interpolation itself is not the criteria assessment. There are decisions that have to be made about how to do these assessments. We want to help as much as possible but there is a fuzzy line between the interpolator and the assessment. The output should be able to be used in all of the criteria assessment but how that is done will be determined when these decisions are made. We need to decide where it is being done in a tool.

Q: Becky Monahan: The decisions we are talking about now are decided for the 3-d interpolator. We can get the stoplight chart from the 3-d interpolator because these decisions have been made and taken into account for the 3-d interpolator. We're now deciding how we want to handle them for the 4-d interpolator. We won't have the complete output of criteria using the 4-d interpolator because we need to make these decisions. Is that accurate?

- **Response: Matt Stover:** I don't think we've made some of these decisions for the 3-d interpolator. The 3-d interpolator doesn't assess most of the DO criteria because we've never gone down the road of how to interpret the instantaneous minimum, seven-day, or one-day in some segments.

Comment: Peter Tango: The interpolator has oxygen in space and time for the entire assessment period. For the 3-d model, there is an equation in the 2007 Blue Bible for taking temperature and salinity to calculate the density distribution for pycnocline decisions. That's programmed as a decision for how to get those boundaries. The dissolved oxygen cells within each habitat are accumulated for their impairment or non-impairment status. Tish made some recommendations for how to do the pycnocline measure, but we haven't agreed as a team on which one should go forward. That would be a helpful decision in the short term to allow the 4-d team to think about how to output the right cell information to accumulate that for a probability of impairment evaluation. That is a fundamental decision, just like our definition of an hour.

- **Action Item:** Decide on how the 4-d interpolator should measure the pycnocline.

Comment (in chat): Rebecca Murphy: Some decisions will still need to be made on how to use the 4D interpolator output in the currently assessed criteria (as Peter is mentioning about the pycnocline). But I think there are fewer decisions for those ones that are currently being assessed, so we can address those ones first.

Q: Tish Robertson: Would the interpolator be ready to do the modeling work? I know that November is the date that was given to us for the documentation and STAC review.

- **A: Breck Sullivan:** I would say mid-2027 because we turn in method documentation in November 2026. In January 2027, the modeling group will be turning their phase 7 method documents into STAC. We are trying to space it out. By the time we get the response back, we could revise, edit, incorporate or remove things while the phase 7 documentation is being

reviewed. Then, once they've done their edits, they can use their output in the 4-d interpolator. I know they need to be done by December 31, 2027. Right now, we are having conversations about incorporating that with the 4-d interpolator, how it would look, who is involved in that, and how long it would take. I don't have specific dates but I would say mid-2027 would be when we should be finalized to start utilizing their output.

- **Response:** *Tish Robertson:* Ideally, we would want what is done to the assessment to be done in model world. To me, they are not supposed to be different.

Q: *Tish Robertson:* For the instantaneous minimum criteria for the deep channel, is the plan to keep the same procedure we do with the 3-d interpolator. I ask because right now the two-week cruise is being treated as the duration for the criterion. It's not a one-hour duration, which is what we've been talking about for the other instantaneous minimum criteria. That's a decision that we need to make as a group. What is the deep channel instantaneous minimum criteria?

- **Response:** *Peter Tango:* The criterion is still 1 mg/L.
- **Response:** *Tish Robertson:* Yes, but the duration is a part of that. For the past 20 years, we've been treating it as a two-week period because the unit of interpolation is a cruise. The data are aggregated on that scale for the interpolation. If we go to a one-hour duration, which I think makes sense for a water quality standard, we already have a big difference. That is the assessment method influencing the interpretation of that criterion. We haven't spent a lot of time thinking about the deep channel criterion because it's the simplest one out of the toolbox. That's something this group needs to decide before it goes to the modeling workgroup because the deep channel and deep water uses are the critical uses driving the TMDL allocations. If it's going to be the same criteria being used, why not just stick with the 3-d interpolator?
- **Response:** *Breck Sullivan:* In the 4-d interpolator, we are using so much more data that are not included in the 3-d interpolator. We're able to have a better understanding and capture the patterns in the same area as the 3-d interpolator.
- **Response:** *Tish Robertson:* I totally agree with you and that's why I'm questioning why we wouldn't use it to assess all designated uses and criteria. It doesn't make sense to me that we'd be limited to those three basic criteria. Why not use the full capability?
- **Response:** *Peter Tango:* We can ask the modeling group to see what they are thinking and circle back to this. That's a great question and I haven't spoken with anyone on that yet.
- **Response:** *Breck Sullivan:* I don't know if the person I talked to has talked to the Clean Water Goal so it would be good to make into a broader conversation.
 - **Action Item:** Ask the modeling group if, in using the 4-d interpolator, are they planning to adjust the allocations/target loads based only on the 30-day mean Open Water, 30-day mean Deep Channel, and instantaneous minimum in Deep Channel DO criteria or base their loads on meeting all DO criteria.

3. Instantaneous Minimum DO Criterion

Comment: *Matt Stover:* We were thinking about what our near-term needs are. Given our November deadline that Breck mentioned, maybe it would be good to talk about the 30-day mean, instantaneous minimum, and assessment methodology questions we have. I think we're still interested in developing a method for IR assessment in addition to the 3-d and 4-d interpolator.

- **Response:** *Tish Robertson:* I feel similarly. This timeline is concerning to me. I appreciate that STAC will be reviewing the science of the 4-d interpolator, but to me, that includes the

very scientific decision-making process that goes into it – not just the interpolation part. We need to figure out how that is expressed in the documentation.

- **Response:** *Peter Tango:* That's fair and something we will need to highlight to the partnership. The science underpinning the tool is a strong piece and we're building in the assessment side. There is a good reason why we've looked at a range of different assessment approaches throughout the last 20 years that haven't been agreed on. Is there enough commonality between the assessments for different criteria? Can we simplify what it means to apply the CFD to that? Is there some rule that is mutually inclusive across the scales of time needs? We don't know yet, but I'd like to have us think about it. Are there simple rules or is everyone an individual case study, which would be more challenging? As Matt said, we can focus on the 30-day mean and instantaneous minimum. We can ask ourselves if the rules we agree on for that have global applicability or are situationally dependent. Would different seasons and designated uses get different CFDs? At the upcoming Clean Water Goal Team meeting, we are reviewing the 4-d tool development and reference and bioreference curves. How much time should we devote to the bioreference curves and whether or not we can apply our data to create an updated bioreference curve? It may be too daunting in this two-year window, but it'd be a helpful discussion. We could take an hour and noodle on it. There is also Claire's work on chlorophyll recommendations. We can ask if there is a quick path to a new bioreference curve.

Comment: *Rebecca Murphy:* It might be helpful to bring the moving pycnocline discussion back to the agenda. We need to discuss whether we are getting daily pycnocline estimates and assess the 30-day mean. Tish had a presentation last summer about how to split up the daily estimates of oxygen and average them if the pycnocline is moving. It would be good to circle back to that as we realized there are a few residual questions. We want to make sure we are aligned with the approach you've decided on.

- **Action Item:** Revisit the discussion on the changing pycnocline in the 4-d interpolator.

Comment: *Peter Tango:* It seems we need more specific questions than the 30-day mean assessment. Right now, we have two cruises, monthly, four months out of the year for two years. We have 12 data points across a 10% reference curve and an evaluation of attainment based on whether the curves cross. What are the specifics you are asking now? I understand that part of that is because we are looking at hourly timesteps instead of biweekly. Is it still monthly mean based on higher temporal frequency data to get those same 12 data points compared to that 10% reference curve? Is it that simple or is there something significantly different besides the data density? What are we changing and what questions are we asking? We can think about those questions to prepare that.

- **Response:** *Amanda Shaver:* There are questions on the document that are laying out how we're treating the criteria now. It is focused on how what we are currently doing can define what the period is for the seven-day mean or determine the exceedance rate for open water. To me, it's troubling that we are treating the 30-day mean and instantaneous minimum in the same way. Is it appropriate? A framework could be to lay out what we know based on what we've been doing, determine if it's appropriate, and then inform the others.
- **Response:** *Tish Robertson:* This is a good starting point because this is a perfect example of how we've been evaluating the 30-day mean in a way that is not consistent with water quality standards. We've been assessing it as a monthly mean based on calendar months, not 30-day periods. If we have a 4-d interpolator, why wouldn't we have 30-day blocks – either sequential or rolling? We don't have to be constrained to a calendar month. If I was looking at 6a in the discussion document, that would be what the definition of the 30-day would be – to

either be literal to 30-days or follow the calendar months. For the modeling, if we want to keep doing the same criteria, 30-day mean and deep channel instantaneous minimum, those would be the decisions we would need to work out for the 4-d interpolator. Are we defining the 30-day mean as a monthly mean or calculating them from 30-day periods?

- **Response:** *Peter Tango:* I would like to see that plotted out. I am thinking that if we have hourly data, you could do 2,280 sequential hourly assessments throughout the summer. Let's work through that. We need to make sure all of our definitions are tightened up and procedures follow that.
- **Comment (in chat):** *Leah Ettema:* You can add target data sizes as something to decide for 30-day mean. For the 3D interpolator, it seems to be two discrete samples plus a vertical profile? What should it be for 4D interpolator?
 - **Action Item:** Define the 30-day mean. Will it continue to follow calendar months, or will it analyze 30-day periods in the interpolator?

Comment: *Peter Tango:* Will this 30-day mean discussion be our next meeting topic?

- **Response:** *Matt Stover:* Sounds good!
- **Response:** *Peter Tango:* We can return to work through the 30-day mean question. It would be good to understand the habitat separation to help inform the interpolator team.
- **Response:** *Matt Stover:* Not only is it important to nail down these definitions for the 30-day mean for the 4-d interpolator, but also for our alternate assessment method we will adopt.
- **Response:** *Peter Tango:* In the April meeting, we can dive into the 30-day mean details and come back to the pycnocline definition. That will put us in a good place to address the other criteria.
 - **Action Item:** In the April meeting, focus on the 30-day mean and pycnocline definitions.

IV. Adjourn

Next Meeting: [May 11, 2026](#)

Attendees:

- Allison Welch, CRC
- Amanda Shaver, VA DEQ
- Becky Monahan, VA DEQ
- Breck Sullivan, USGS
- Carl Friedrichs, VA DEQ
- Cindy Johnson, VA DEQ
- Clifton Bell, Brown and Caldwell
- Dave Parrish, VIMS
- Elgin Perry
- Joe Morina, VA DEQ
- Jon Harcum, TetraTech
- Juan Vicenty-Gonzalez, EPA
- Kelly Gable, EPA
- Leah Ettema, EPA
- Mark Brickner, PA DEP
- Mark Trice, MD DNR
- Matt Stover, MDE
- Melinda Cutler, MDE
- Peter Tango, USGS
- Rebecca Murphy, UMCES
- Suzanne Trevena, EPA
- Tish Robertson, VA DEQ