# Portland Area Nitrogen Group

# Meeting Summary

Virtual Meeting No. 3 | October 14, 2021 | 9 AM – 12 PM ET

## Meeting Objectives

On October 14, 2021, the Portland Area Nitrogen Group (PANG) held its third meeting. The objectives of the meeting were to:

- Share results of the NSTEPS technical work and modelling
- Provide input on key aspects, such as reference locations
- Consider implications of this analysis on our next steps

*To view meeting materials, please click here.*

## Welcome

David Plumb, CBI Facilitator, opened the third meeting of the PANG, and Angela Brewer, Section Leader of the Marine Unit at the Bureau of Water Quality in the Maine Department of Environmental Protection (DEP), then provided welcoming remarks, shared an overview of the agenda and goals for the meeting, and highlighted that the timeline of the PANG work has shifted back slightly to accommodate some of the technical work that's been done. Ms. Brewer also noted that Pete Clark (Town of Falmouth POTW) has retired and his seat on the PANG is now held by Dan Marks. Paul Collins (City of South Portland WPCF) has also retired and now Brad Weeks and Tom Wiley are representing. Don Witherill, DEP Division of Environmental Assessment Director, has been replaced by Wendy Garland.

## Presentation: Conceptual Model of Technical Work

Mike Paul, Tetra Tech N-STEPS contractor, shared the first of three presentations at the meeting, focused on the big picture of the technical work and exploring the spatial frame, conceptual model, and an overview of the general analysis in that work. Within the conceptual model, he highlighted the risk hypotheses, assessment endpoints and measures, and N-STEPS approach using distributional analysis and reference modeling. *Presentation slides are available to view here. No PANG member questions and comments followed Dr. Paul's presentation.*

## Presentation: Modeling Results & Reference Points

Following Dr. Paul's presentation, Rob Mohlar, Senior Environmental Engineer in the Division of Environmental Assessment at Maine DEP, presented on the results of his modeling efforts from Model My Watershed to determine watershed loading estimates for West Casco Bay. Mr. Mohlar shared the different components of the model, the model's outputs for land use quantifications and load estimates, and some brief comparisons of the West Casco Bay watershed to others, noting that it is challenging to make direct comparisons due to the unique hydrodynamic characteristics of each system. *Presentation slides are available to view here.*

Below are member questions and comments that followed Mr. Mohlar's and Dr. Paul's presentations. PANG member questions are **bolded**, answers are attributed and *italicized*, and any further comments or questions made by members are in regular text.

- **How do watershed comparison results square with work done by other groups, like Friends of Casco Bay, Casco Bay Estuary Partnership, or EPA? Should we try to compare these results with others' work?**

- *DEP: Comparison has happened to an extent, and the results are comparable, though there are variations. This shows that the Fore River is the most heavily influenced, both anthropogenic and natural, of the reference systems, and these results are consistent with other estimates.*
- *CBEP: What's being shown on slide 9 is a summary of the anthropogenic impacts, both point source and non-point source. Previous slides include charts that more clearly delineate between point source and non-point source. These results don't appear out of line with other formats, but there are many research variables (e.g., year of data, permitted totals versus actual discharges, etc.) that make a big difference (e.g., the loading estimates chosen for the watershed can change the watershed loading by a factor of 20-30%). Noting that, historical models give you a wide range. Recognize that we are now working to put together consistent, comparable modelling exercises for the watersheds across all the reference watersheds and watersheds of interest.*
- This preliminary model confirms that Western Casco Bay is the most heavily influenced for anthropogenic loading, and we still haven't had a full discussion of, if we are going to rely on models, what we want the models to answer and what else we need to do to fully develop the model.

- **What is the difference between the septic load and the sub-surface load?**
  - *DEP: The septic load is based on development and is separated out as a more distinct component. The sub-surface load is a watershed-wide base load that is primarily a representation of atmosphere deposition on that entire watershed. Atmospheric deposition is a significant component of this model.*
- **During the Nutrient Council meetings convened by CBEP, Matthew Liebman, EPA Region 1, gave a presentation on the reduction in load from atmospheric deposition. Matthew, could you add more context regarding atmospheric deposition?**
  - *DEP: The watershed boundaries used in this analysis did not include the bay for the most part, but rather looked at the watershed and included atmospheric deposition in the Presumpscot Estuary, Back Cove, and surface waters within the upgradient area. The atmospheric deposition component in this analysis is primarily referenced in the subsurface flow category, though there is a runoff component.*
  - *EPA: Report from 2012 that used a USGS SPARROW Model that also included atmospheric deposition to the watershed, not the bay directly. Analysis was a similar approach, and atmospheric deposition accounted for ~26% of the total estimate of the relative contribution of different sources of nitrogen to Casco Bay. Total nitrogen deposition has decreased over time due to the Clean Air Act.*
  - *CBEP: This number was just calculated for the state of the Bay using the Wolfe's Neck station, and the total nitrogen component deposited through deposition has gone down 20-25% over the last 25 years.*

## PRESENTATION: N-STEPS TECHNICAL ANALYSIS

Building on his presentation in September on the N-STEPS technical analysis, Mike Paul, Tetra Tech N-STEPS contractor, explored the data collected to date as well as various approaches for the analyses. Speaking to the data, he highlighted that there is a wealth of data to explore and work to be done to identify the cleaner reference points, characterize dissolved oxygen profiles, and dig into irradiance, temporal effects, circulation and mixing, salt lenses, and non-algal turbidity interactions. N-STEPS is currently missing data on macroalgae and paired sampling density. Regarding the analyses, Dr. Paul noted that total nitrogen (TN) concentrations in

distributional analysis reference sites are within the expected range and asked PANG members to reflect on if the reference locations make sense and any strengths or weaknesses to the approach. After reviewing initial work on the stressor-response models, Dr. Paul asked for PANG member feedback on the approach. He highlighted that next steps include processing PANG feedback; implementing the full set of classification, distributional, and stressor-response analyses; and iterating as needed. *Presentation slides are available to view here.*

Below are member questions and comments that followed Mr. Mohlar's and Dr. Paul's presentations. PANG member questions are **bolded**, answers are attributed and *italicized*, and any further comments or questions made by members are in regular text.

- **Ultimately, how is the reference used? Once you get the difference in TN between the reference and the impacted sites, is that the actual number that you are really interested in?**
    - *Tetra Tech: The goal is to develop a target concentration to protect the use, and that would then be used in any ensuing regulatory applications. This is one line of evidence, and it can be developed by combining findings from reference bodies, stressor response analysis, and mechanistic modeling. I've not seen this target used to describe the difference in TN concentrations per se, but ostensibly the consequence is that you evaluate the focus area's existing TN condition as well as a typical TN condition that is sufficiently protective, and then develop strategies to lower the TN concentration to approximate that protective condition. How the target gets incorporated into a load or other implementation value is at the discretion of the implementing agency.*
- **When comparing these sites, does it matter where the samples are taken? We've talked about missing samples from near-shore area in Fore River. How are you smoothing or comparing data depending on how it was collected?**
    - *Tetra Tech: Sampling location does matter; an ideal monitoring program should incorporate locations where you expect the most stress to occur. That's why we sample streams in late summer as an index period, when we expect to see the most stress. The spatial equivalent to that temporal consideration is to find locations where we expect nutrients to manifest their worst problems. We are constrained by the data we have available now, but these efforts can inform future monitoring design to cover problematic areas if we don't have data there yet. Sampling location does matter for developing empirical and mechanistic models. We hope that in systems that are well-mixed, there is some relationship between how things are shifting in the middle as well as some of the more critical areas. Due to water mixing and moving, there should be some reflection of changes across the system.*
- **Is DO the best other indicator for usage in the Fore River?**
    - *Tetra Tech: We haven't dug into the DO data yet. DO has been very valuable in lake systems, Mass Bays, and less valuable in empirical models in the Long Island Sound, as the chlorophyll trying to pair to DO is not the chlorophyll that matters to DO in constantly moving water. Mechanistic models in Long Island Sound were able to capture DO as they are able to simulate movement better than empirical models.*
- **What does it imply if the four potential reference watersheds are already pushing at the impacted eel grass target or above it?**
    - *Tetra Tech: If eel grass protection is your goal, an ideal reference location would be embayments that are supporting eel grasses, and we don't have that*

*information captured here. These reference locations may be good for DO, but we may need to layer on more data and identify reference locations for eel grass. We would like any support on that PANG can offer.*

- **The TN consists of many different things; do we have the capacity to partition different components, like DON, out of it?**
    - Sampling completed by a PANG member with a submersible UV nitrate analyzer shows that Gulf of Maine incoming water on the ocean boundary has higher concentrations that are consumed as it comes down the eastern and western coastal current, so there is less nitrate on the boundary conditions of a place like Cobscook Bay or Damariscotta River anything in the western part of the state. TN concentrations are likely more hooked into the offshore boundary conditions Downeast than most other places.
    - *Tetra Tech: The nitrogen loading information we have does not describe what's coming from the ocean side, an area where we have zero control and is also important. We started with TN here, and now we will experiment with different ways of partitioning or slicing up the data to see if we could isolate the ocean signal.*
- **How does something like temperature of the references get factored in, as it will affect respiration? Low respiration could impact factors like DO or phosphorous (pH) or chlorophyl.**
    - *Tetra Tech: We would want to factor in the temperature environment into the question of physical, chemical, and/or biological similarities. The hope is that, as you get closer to the Portland region, you're getting more climatologically and physically similar. We will need more expertise to rank reference watersheds, which is challenging in estuary environments.*
    - *CBEP: Hydrodynamic differences jump out, and particularly the degree of freshwater inflow. It may be that certain watersheds are better references for sub areas of our waters, rather than references that are universally used across the region.*
- **We have talked in the past about how a hydrodynamic model could help us understand how a tracer of a point source of other source of nitrogen may travel. Is this something that a hydrodynamic model of the bay and nitrogen sources might help with?**
    - *Tetra Tech: A model like that would be helpful, and it would also contribute to building a water quality model. In Long Island Sound, there was a hydrodynamic model that informed some of the classification. In Florida, they use hydrodynamic models and water quality models which allowed us to split some of the larger estuaries into high demand with distinct units. Here in the Portland region, we are using surrogates, like median summer temperatures and salinity. Those are the not the same as full hydrodynamic estimates of residence time at every location.*
- **What if the data were segregated by typical water depth, separating out all sites with an average or max water depth of minus 10 feet mean low water?**
    - *Tetra Tech: That's a good point and gets more to the question of classifying by habitat. In the Long Island Sound work, there was an eel grass habitat suitability index, which incorporated more than depth, which was used to create a GIS layer of where the suitable habitats were. From a habitat perspective, more factors than depth would be needed to create those layers of analysis.*
    - *EPA: Another way to classify is residence time, which could maybe be estimated through methods like tidal prism models.*

- **If we settle on some classes, are the implications that we establish different thresholds for each of those? From a regulatory perspective, what are the implications for discharges into the Fore River, for example?**
    - Tetra Tech: There would be different targets or thresholds. You can use a water quality model or another tool to translate those different thresholds for different areas into what the load needs to be to meet uses.
    - DEP: Implementation depends on how the Department decides to assess, whether it's an ambient concentration or a load-based approach. This conversation about how to apply these findings is the direction we are moving towards after recommendations.
- **Habitats along the river are obviously connected to one another, so where are we seeing the highest nitrogen concentrations?**
    - *CBEP: We are seeing some interesting patterns where the highest nitrogen concentrations are often occurring in the mixing zones of the upper estuaries of these areas, so it wouldn't surprise if we are actually seeing some extra in circulation processes that are concentrating, especially organic nitrogen. The complexity of knowing exactly what's contributing to which nitrogen is an important question we don't have the answer for yet.*
    - We need to think collaboratively to identify data gaps and how to address them.
- **Are we discussing using response indicators in addition to nutrient criteria, like the pH rules currently proposed, or are we thinking about using response indicators in the model approach to develop nutrient criteria?**
    - *DEP: That is a conversation that we need to have, and we will have it with the PANG once we have recommendations from the N-STEPS process.*
    - *Tetra Tech: Our analysis will hopefully develop defensible levels of chlorophyll and nitrogen that protect valued ecological attributes in the system. Whether you decide to combine nutrients with response conditions is a decision for structuring the criteria. Our end product will include the stressor response model value and distribution model values, and we may have it for one or two management goals.*
- **In a stressor response model, could the stressor be the embayment? This could look like a gradient of embayments with response on y axis for which it's meeting designated uses. The threshold would be based on figuring out characteristics of embayments where designated uses are met and not met, so designated uses are evaluated independently.**
    - *Tetra Tech: I've not seen a gradient version of a reference approach; it's creative and may be a bit circular. I think it would likely require Maine to have nutrient criteria in place or at least response endpoints in place based on an assessment of all environments and know which are impaired.*

## WHAT'S NEXT?

To close the meeting, David Plumb, CBI Facilitator, asked Curtis Bohlen, Director of the Casco Bay Estuary Partnership, to share initial thoughts on the potential pathway forward for the PANG process. Dr. Bohlen highlighted that it is a big step forward for Maine DEP to start to use local information to set thresholds, in part due to lacking data that people have been working hard to gather. He notes that we are seeing evidence that TN levels in the bay are declining and changing, and we are seeing anecdotal responses to that. He also commented that the numbers that Mike shared aligned fairly well with the reasonable potential numbers that had been used before, providing some comfort that Maine has been on the right track. Dr. Bohlen highlighted a couple key discussion themes:

- What makes a great reference and how do we identify it?

- Do we have enough data to look at reference sites, and what is the quality of existing data? What data are missing?
- How complex is this response modelling and how many different choices have to be made between now and policy?
- What's next? We need hydrodynamic models, ecosystem models, and refocused collaborative monitoring to address data gaps.
- How do we integrate future science into criteria and standards and create a sustainable process? Decision-making in the near-term will include trade-offs between acting now and having perfect science.

Looking ahead, Angela Brewer, Maine DEP Bureau of Water Quality, shared next steps, echoing the need shared by many PANG members for deep conversations around the implementation side of this process. She noted that the technical subcommittee may have a meeting in mid-December with Mike Paul, Tetra Tech N-STEPS contractor, and that the next full PANG meeting would likely be in early 2022 focused on the full analysis with recommendations and discussion how to move forward into the implementation phase and how that impacts rulemaking. Ms. Brewer then closed the third PANG meeting, expressing gratitude for members' time and engagement.

## APPENDIX A: PANG MEETING PARTICIPANTS

Susie Arnold, Island Institute
Al Basile, US EPA
Marti Blair, Casco Bay Estuary Partnership
Curtis Bohlen, Casco Bay Estuary Partnership
Damian Brady, University of Maine
Angela Brewer, Maine DEP
Fred Dillon, City of South Portland
Cindy Dionne, Maine DEP
Mike Doan, Friends of Casco Bay
Scott Firmin, Portland Water District
Ivy Frignoca, Friends of Casco Bay
Nancy Gallinaro, City of Portland
Wendy Garland, Maine DEP
Galen Kaufman, US EPA
Kate Liberti, UMaine
Matthew Liebman, US EPA
Rob Mohlar, Maine DEP
Dan Marks, Town of Falmouth
Bill Needleman, City of Portland
Michael Paul, Tetra Tech (N-STEPS contractor)
Kristie Rabasca, Maine Water Environment Association
Jim Stahlnecker, Maine DEP
Brad Weeks, City of South Portland
Tom Wiley, City of South Portland
Wil Wollheim, University of New Hampshire
Gregg Wood, Maine DEP

David Plumb, Consensus Building Institute
Maggie Osthues, Consensus Building Institute