



The North Carolina
FORUM
ON NUTRIENT
OVER-ENRICHMENT

Question & Answer Sessions Day 1

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TRANSCRIBED FROM AN AUDIO RECORDING

The North Carolina Forum on Nutrient Over-enrichment was conducted on May 29 and May 30, 2012, at the Sheraton Imperial Hotel & Convention Center, Durham, North Carolina, commencing at 8:30 a.m. The following is a transcript with minor editing of the first question and answer session conducted on May 29th, including the following speakers: Ellen Gilinsky, Rich Batiuk, and Rich Gannon. Richard Whisnant is the Moderator.

MS. JARRELL: I have a question for **DR. GILINSKY**. Since EPA is committed to scientifically sound approaches -- I'm looking at a combination of things to come to the numerical nutrient criteria -- is there additional guidance that EPA is going to provide as far as models and approaches to states to help them to develop that and help them understand what that combination can really be?

DR. GILINSKY: Thank you for that question. We are working on that, but, at the same time, we don't want to dictate to states how to approach this maybe multi-parameter way to look at a nutrient standard. But that's why we started out with these guiding principles and the goal of this scientific workshop that we're going to have this fall -- and it's still being formulating. But the idea is to get science experts together to help us do exactly that, point to certain models or ways to develop scientifically-based criteria. And then we will share that with the states. But the whole point is to involve the scientific community and the states all together to get something we can all use.

MS. JARRELL: Let me ask a follow-up to that.

DR. GILINSKY: Sure.

MS. JARRELL: Is there a timeline that EPA is looking at as far as getting states to the point of what EPA is -- where EPA wants to get everyone to the numeric nutrient criteria? Is there some timeline that you're working towards that if we don't have these models and how are we going to get there?

DR. GILINSKY: There is not a specific end date. We want to show that progress is being made, again recognizing that right now with, you know, the huge layoffs in state staff, that, you know, we can't expect people to do something with nothing. And funding -- you know, our congressional funding is less. So what we're looking at is what's reasonable for that particular state given the amount of information they already have and the progress they've made.

MS. JARRELL: Thank you.

MAYOR MOSS: Good morning again. My name is Darryl Moss. I'm mayor of Creedmoor. How is everybody holding up up there?

DR. GILINSKY: Great.

MAYOR MOSS: Great. Well, I'm going to --you give an elected official a microphone and crazy things happen, so I'll give you that disclaimer up front. So I'm going to get my community question out of the way first. One hundred percent of my community sits in the critical area of the Falls Lake. In fact, NC 50, Creedmoor Road, actually bisects, and we are in both the upper and lower falls. So I'm just giving you kind of a context of where my question is going to go. From a dollars and cents standpoint, in 1980 pre-Falls Lake, in that time frame, Creedmoor sewer budget was \$300 a year - \$300 a year. We had a sewage lagoon. We dropped in a couple chlorine tablets and nature took its course. Life was good. Today our sewer budget is over \$1.1 million because we had to abandon that and hook onto another treatment facility.

My question is, from a big picture standpoint -- you know, every day I have to ask my citizens to do more, to pay more. In a couple weeks we're going to implement a new storm water fee as it relates to the storm water regulations that we're now hit with. So when you look at that, you look at all the other things that we are having to deal with, global warming and all those things, where does nutrient management kind of fit in to the grand scheme of things? If we have to make some difficult decisions, from a national perspective, where do you see that conversation going?

DR. GILINSKY: If I may address that first and then if our other speakers want -- that's an excellent question. I don't think we can afford not to look at nutrients. All the studies that I've read have shown that the cost of treating for nutrients can be more than the cost of controlling nutrients at the source. And I was just reading on the way down here. There was a recent report by ACWA, the Association of Clean Water Agencies -- and talked about the cost of treatment versus the cost of removal, and we need to look at all the different sources to make sure that the costs aren't just borne by the utilities.

And I think Pete mentioned earlier that, you know, everybody in the watershed should participate to the percentage that, you know, their particular source is contributing. And I think that in order to keep your utility rates reasonable, we've got to look to the non-point source community, the agricultural non-point source, not the -- not storm water and -- to make some of these improvements. And it's been shown that the cost per pound of nitrogen removal is actually cheaper for the non-point source controls on agriculture than to do advanced treatment to get down to the last molecule in your treatment plants.

MAYOR MOSS: Thank you.

MR. BATIUK: Certainly in the Chesapeake. If you've been to Washington, D.C., you're drinking Potomac River waters. You're talking about from the headwaters up in -- up in the Shenandoah, up in the Highlands section of West Virginia. So we are asking folks to do that. What I've seen increasingly is elected officials like yourself stepping up and saying, "How can these folks bear it, particularly folks that are disadvantaged and don't have the ability to do it?"

Washington, D.C. has got a billion-dollar combined sewer overflow bill that they've got to pay, in addition to their portion of a large sewage treatment plant there as well.

Maryland just recently -- the legislature and the governor just doubled what they call the flush fee, flush tax, depending on what -- which part of the spectrum you come on. I pay now sixty bucks, in addition to thirty, covering 56 wastewater treatment facilities. So they're spreading the cost.

West Virginia recently passed legislation to tap into their lottery funds to cover their small township, some pretty disadvantaged communities out there. [Inaudible] Commonwealth, they use a surplus on their budget, which actually has actually come through, to again co-share across their 100-plus wastewater treatment facilities. So that I think others have recognized that the burden can't go on the backs of only your ratepayers. It is a resource that has got to be spread across because it is a source of drinking water, a source of recreation.

Not everybody's got a boat, or crabs on the Chesapeake Bay, but they certainly drink. They certainly take showers, we hope. I think you guys did this morning. It's smelling okay up here. So making that connection to people, and one of the issues, as you're putting 17 million people under a pollution diet, is "I'll do my fair share; they need to do their fair share." And how do you define that equitably? I know you run right into it, and as I've said, we -- we've got over 1,600 local municipalities that are coming to us and saying, "How do we get this job done?" Excellent question.

MAYOR MOSS: Thanks.

MR. GANNON: And I would just add if I could, Mayor Moss, I think we recognize that communities are where the people make their contributions. We recognize that in the form of wastewater, in the form of landscape modifications and storm water runoff. And so as that happens, the communities do contribute significantly, and we recognize the long-term nature of these things, as I said. And modest contributions via storm water utilities and that sort of thing over time, I think we all need to contribute.

MR. McCALLIE: Good morning. I'm Grady McCallie with the North Carolina Conservation Network. And, Dr. Gilinsky, I wanted to ask you a question. It's been a long time since EPA has updated its effluent limit guideline for nutrient discharges from wastewater treatment plants. We're concerned that the chlorophyll-a standard that North Carolina uses may be too loose, but it's a huge political lift at the state level to go either to numeric nitrogen criteria or tighter chlorophyll-a standards. That political lift would be substantially reduced if EPA would update the effluent limit guideline. What is the agency's thinking about that?

DR. GILINSKY: Well, I hate to give this answer, but we are under litigation right now on -- it's basically to redefine secondary treatment to include nitrogen removal, and that would then change what the effluent guideline is for nitrogen and phosphorus. I assume that's what you're asking me.

MR. McCALLIE: I appreciate that.

DR. GILINSKY: We're deliberating it right now in response to petition.

MR. BATIUK: Well, my headquarters colleagues litigate out there, and the Chesapeake Bay watershed has six states in the district. By 2014, 483 significant municipal and industrial facilities -- those around 0.4, 0.5 MGD, will have numerical limits in there for nitrogen and phosphorus, some of them going down a slow as three milligrams per liter for nitrogen and 0.01 for phosphorus. That brings us from there to around six milligrams per liter for nitrogen, depending on where you are on the system. So the states, the municipalities that the mayor's representatives and others and your utilities got together, knew that there was a TMDL coming, made the decisions about how to allocate. Virginia alone, they don't have the same number across their five major basins. It actually varies depending on their pollution diet and their contributions out there as well.

So one doesn't need to have an effluent guideline per se to do that, but it was tied back, in our case, to dissolved oxygen, water clarity, chlorophyll-a and grasses. So there was that connection and the competence that those numeric nutrient enrichment and sediment enrichment criteria described healthy waters and then translating that back to the individual treatment plants. So, again, if you're in Oswego, New York-- I pick on those guys because they're upping their rates and they're saying, "What's the benefit for me? I've got downstream folks here, and we're trying to figure out actually how to get some more money up there to pay for that." They're looking at five milligrams per liter. They're now at 18.

DR. GILINSKY: And, again, I just want to emphasize what Rich said earlier. The reason those facilities did that in the absence of an effluent guideline was they had the TMDL and they got funding from state and federal sources to do it.

MR. BATIUK: The tune changed over a decade. We had people that -- we call them the sewage wars. They were fighting us on advanced treatment. All of a sudden they saw that writing on the wall 10 years later on the TMDL, and they turned and said, "We need the funding."

When the funding came, they're now -- actually, we're getting sued on the TMDL from the agricultural sector, the national agricultural lobby. The municipalities are actually friends of the court. They intervened on behalf of EPA. I'm still looking at it, going, "Oh, my God. Life has certainly changed out there."

CHAIRMAN SMITH: How much time do we have left?

MODERATOR: Fifteen.

CHAIRMAN SMITH: Okay, good. Do y'all want to ask another question each, and then I'll take a couple follow-ups.

MAYOR MOSS: Sure, I'll go. Rich, I guess just a quick follow-up on what you just said. How many state -- federal and state dollars were budgeted for the Chesapeake program, just out of curiosity?

MR. BATIUK: Overall, if you look at the federal side, probably around \$300 to \$400 million, talking about from the Corps of Engineers to defense to EPA to NRCS and USDA. On the state side, actually the state eclipses that. They were up on around \$500 to \$600 million. So, all total -- and you're looking at all the different elements of it in terms of cost share. There were state revolving funds, et cetera -- it's a significant amount of dollars.

There are six states and, yes, we're fortunate we have an extra boost from the farm bill over the last five years as well. So not that he or she who is the squeakiest wheel out there, but there are resources. But going back, our budget now is -- at least on the EPA budget that we bring to the partnership is around \$50 or \$60 million. It started out \$3 million. The partnership then said, "This is an important place." It helps to have Washington, D.C., in your watershed with those summer homes on the eastern shore, but it takes work. You have to continue to do it. You have to earn that funding every single year back and forth again. The total bill, it's been estimated between around \$15 to \$25 billion, so that -- that annual piece is still not going to get us there. We don't have the sufficient funds to carry out the work that the governors are committed to make happen by 2025.

CHAIRMAN SMITH: Let me ask a follow-up on that. This is one from the floor, and that is -- sort of a combination of questions -- how are the costs allocated, that is, the restoration cost allocated? And a piece of that, who pays and who agreed on behalf of municipalities?

MR. BATIUK: There are a couple answers to that. At the big scale, I would have to go back to how the allocations were done for the TMDL. That was actually state partners. EPA agreed, working with the six states. We made allocations to the major river basins, for example, the Susquehanna, and Pennsylvania's portion of the Susquehanna based on the science it agreed to. Pennsylvania -- or in the case of Virginia, they took their allocations for their five major river basins and divided it down further to 38 small watersheds.

So it was the state working with their local elected officials, working with their stakeholders, with their utilities and others and the dischargers that made that allocation decision down there. Some states took their pie and sort of broke it up based on how the loads were. Others did what you're describing, that is, tried to do cost effectiveness. What's the best way to do it and tailor it to each river system as well? EPA's allocation of our grant funding actually now follows what the TMDL is. In other words, "New York, what's your level of reduction that you need to do? You get funding associated with that." The same thing is done with the other jurisdictions. So now the money previously was sort of a third, a third, a third and 10 percent for the district. Now across all six states and Washington, D.C., now follows the actual allocation of the responsibility.

CHAIRMAN SMITH: And the question about municipalities, that is --

MR. BATIUK: Their involvement?

CHAIRMAN SMITH: -- who agreed on behalf of them for this strategy?

MR. BATIUK: In this case, it was the states that brought theirs to the table, to the governor -- at the governor and secretary level. So it was depending on which jurisdiction. How much did they involve their municipalities? Some of them extremely so; others not as much.

DR. GILINSKY: In Virginia -- since I was in Virginia at the time, they were very involved in each watershed. And we went to each discharger to find out their capacity, their current discharge and looked at tradeoffs and such. So they were part of the stakeholders group. And then, as you said, the governor was the one who made the final decision.

MR. BATIUK: Also the conservation districts, I don't want to leave that out. Farming is a very important part of the local economies and the regional economy as well. So I know state partners involved those conservation districts, not only the farm bureaus but the actual folks that are out there working with the producers.

MS. JARRELL: I have a question somewhat related to what you were just talking about. How you have -- you had your neighbors that -- from around the Chesapeake Bay that all could see the reasons for why they needed to work together. But within North Carolina we have different basins also that aren't necessarily connected. So even though they might be a neighbor, there may not -- may not see the same purpose for following through to work together. How do you get everyone together to work together towards that same purpose?

MR. BATIUK: I think there are two things. When you head up to New York, you don't talk about Chesapeake Bay. You talk about the Shenandoah River. You talk about the local landscape. You talk about their concerns with dirt roads. You talk about their economy. You talk about the fact that they're losing parts of their industry out there, and you make the connections there. But you also talk about the fact that they're drinking water comes from the north branch of the Susquehanna.

So we had to -- every time we went out for public meetings and interactions you had to change your presentation. You actually had to change your dress. You had to change your approach to then connect up with what the issues were. And at the same time, you know, you do that on one side. It's not all happening good. You also had to say, "Folks, there are downstream neighbors in this case that the federal government is here to say it crosses boundaries, and there's an expectation that you will send that cleaner water down there."

So there's always going to be an upstream, downstream neighbor. Even though you may have adjacent basins, you need to tailor your issues and your criteria, your standards, your approach to that particular basin and those waters and then describe upstream, downstream neighbors. People understand neighbors. They may not like their neighbors per se, but they understand the connections in that. And there's always somebody downstream that's collecting their load or having to do something else because somebody else didn't take care of their own back yard. It's not a direct parallel, you're right. Ours is sort of looking downstream, but there is a way to tailor it at that local scale. It's tough to do. You have to think differently. You have to crawl out of your shoes and step into theirs, but it does work.

MS. JARRELL: I have one other question about the numeric nutrient criteria for the Chesapeake Bay and that you were looking at the oxygen, the clarity and the algae. And utilizing chlorophyll-a to a certain degree but not completely, are there some recommendations or advice that you would give North Carolina as related to chlorophyll-a, which is what we use now? Is there any advice that you would offer?

MR. BATIUK: I think a couple quick things. One is you saw the dissolved oxygen. That's maybe our parallel to you all. We have lots of oxygen issues. You didn't see a single number applying across all the habitats. When you have a 40 that applies up in a reservoir out to an estuary, I scratch my head and say, "Okay, is that really" -- I mean, we humans love those rounded off numbers and stuff. So you first look at, "What's the science behind that?" So you'd have to understand that. There's got to be that science. Folks may not need to understand it, but they intuitively say, "Okay, rockfish, worm, different oxygen levels. Okay. Deep water up in the spawning beds and stuff." So it's go back, re-look at your science. It is okay to change criteria.

Our standards have evolved over time as well, so it's looking at that piece but then connect up that chlorophyll-a not just as an algae number, et cetera. Connect it up to something that people care about, the look, the taste of the water, the connections, whether you want your kids in there to do something or not, or algae as a connection to something that's happening on the land as well. So I think there are lessons that -- in parallels that you all can take the science piece tailored to the different river systems, to the estuaries and make the connection, but also make the connection to what's important to that locality.

MS. JARRELL: So more site specific?

MR. BATIUK: Yes, ma'am.

DR. GILINSKY: And if I can add to that, you might -- a lot of states are looking at chlorophyll-a as one component of a suite of factors, including things like periphyton density, you know, scraping the rocks, how much periphyton is on the rocks. This is especially for flowing waters versus lakes, because in lakes the chlorophyll is a better predictor. And then also they are looking at the benthics or the oxygen as well as the nutrient concentration. So I think it's tough to regulate just on chlorophyll alone in flowing waters.

MS. JARRELL: Thank you.

MR. McCALLIE: So this is a question for Rich Gannon but also for the other panelists, and it kind of meshes together a couple different questions from the floor. Rich, in your presentation you listed a number of ways that the nutrient management packages have become increasingly complex and dealt with more sources. There were some sources that don't have reductions allocated to them in those packages. For example, CAFOs, air deposition and biosolids being put on land. And so the question is, what are the things that are not allocated reductions in those packages that you're most concerned about? And for the other panelists, having seen what North Carolina has done in those packages, are there sources that you are concerned about that you didn't see tools to reach?

MR. GANNON: Well, Grady, I would say that CAFOs and biosolids in fact are regulated under the designs that we have from the perspective of the nitrogen application rates that go on the land. And this annual county level accounting identifies the nitrogen application rates for each different crop and re-totals the crop acres each year. And the biosolids get applied to land and produce a crop, and the --they are regulated in that way. The CAFOs, the houses, the facilities themselves, the lagoons are not directly regulated under these rules. But, of course, we do have the state CAFO regulations.

I suppose there is the potential for losses from those facilities themselves and, certainly -- probably indirect answer to your question, maybe one of the biggest sources that is unregulated from the nutrient strategy standpoint is the ammonia emissions from the various CAFOs. And so that's -- that's, perhaps, one of the biggest sort of holes in the net. Existing development is now, you know, in place and I think that's going to evolve and develop in the coming years.

Air deposition is important. I think that the connection between air emissions and not just human health effects but water quality effects needs to be made, and I think CAFO emissions in particular are a prime source for future regulation.

MR. BATIUK: In the case of the Chesapeake, I remembered nine -- I mean, I remembered eight of nine how we allocated, because one of the things we heard talking to literally thousands of municipalities, elected officials, farmers and others was, "Show me the science. Show me the monitoring data. I understand I need to do my piece, but also show me how those others impact it."

When we talked to the farmers, those turf farmers that are across those three million acres out there, we did wastewater, significant/non-significant facilities. The significant facilities got actual allocations; regulated storm water versus non-regulated storm water, on-site treatment systems or septic systems.

Atmospheric deposition did get a formal allocation within the TMDL itself. It's a significant piece, and agriculture. The states had the option of taking that further. I can't remember the ninth one there. So those are how we broke it out so that somebody could take a look at that pie. States could divide it down further if they wanted to. That was their opportunity.

Things that didn't get allocated and that folks raised included our growing -- our urban settings and illicit discharges. Big concern in the Washington, D.C., area, around Baltimore, et cetera, when you see a high nutrient load coming out and you haven't had a rainstorm for a while. Stream and shoreline erosion, we blame our farmers still in our modeling systems, etcetera, for a lot of that shoreline -- that dirt that comes down there. It's actually in our floodplains already. We have things that we -- we sort of look at legacy sediments, so we've got to actually continue to build our understanding of that [inaudible] again. And then the finer you can allocate, the finer you can do it, the more people said, "Okay, this is my piece, and here's what everyone else is doing out there." People want to play fair.

Now, defining equity and defining fairness. That took us about five years and a lot of politics. Good underpinning of science, but that's where-- that's where our elected officials earn their stripes.

MODERATOR: Panel, maybe time for one last question.

CHAIRMAN SMITH: How about this one then? This is to Dr. Gilinsky. One of your slides said to consider limits on phosphorus for septic systems. The question is how would that be done?

DR. GILINSKY: Oh, yeah, that was on there. I'm pretty sure by that some of the, you know, advanced septic treatments, they're not your traditional septic tank, but adding on nutrient treatments to septic where you have areas that are phosphorus sensitive.

CHAIRMAN SMITH: And not speaking to existing septic systems that might have been in the ground for decades?

DR. GILINSKY: No.

CHAIRMAN SMITH: And then may I say one other thing? I think it's -- this is a housekeeping thing. I think it's correct that -- there are a number of questions that you all have passed up that we have been unable to ask because of time. I believe it's correct that the record of proceedings is going to include all questions that anyone handed up so that they go forward with what we've had here left unanswered today but not unanswered down the road. And then the second thing is, it would help us if you would write your questions in a way so that they are legible, that is, legible to us, not just you.

MAYOR MOSS: Richard, this is not question but just a comment. I thought you all might be interested to know I tweeted this morning what I'd be up to today, and as of right now I've got 16 e-mails back about how I'm going to lower people's water bills in Creedmoor. So I thought you'd want to know that.

MODERATOR: Join me in thanking our great panel this morning, and please be back. [APPLAUSE]

[END OF Q&A SESSION 1]

The following is a transcript with minor editing of the second question and answer session conducted on May 29th, including the following speakers: Ken Wagner, Ryan King, and Hans W. Paerl.

MAYOR MOSS: Okay gentlemen, thank you again for great presentations. This question is for Ken and this question came from the floor. In NC we get a lot of out-of-town developers that who ask "We don't have to do that in my state. Why do I have to do that for my project here in North Carolina?" My typical response is "Well, it is a North Carolina standard." That usually doesn't go over well. Can you suggest a better approach to explain why we have different standards and thus different requirements for development from other states?

DR. WAGNER: Again not all lakes are created equal, not all aquatic systems are created equal. There could in fact be an argument that, gee, we don't have to do, I don't know what that was, some sort of best management practice or whatever, and here it won't help us. But the onus has to, and this is where the standards will help us, the onus has to be on the developer or practice component to show why; not to simply make the statement that they don't do that over there. Over there is different from over here.

Frankly, if you are sitting in the Piedmont versus out near Asheville or over in the Smokies, the systems are totally different as well. You have to understand the local conditions. We have a bunch of processes and we all talk about processes and the end result is not always the same because of other factors, some of which we don't control, some of which we do.

It is never wrong to management the watershed for lower nutrient inputs. There's no way that you can claim that higher nutrient inputs are going to be good unless you just want to produce a lot of fish and you don't care if it is carp or trout. A vast majority of cases the answer is you have got to look at each specific case and the blind statement of, well it doesn't apply to us doesn't cut it.

You got to do the research, and I favor standards that are a bit lower than some people would like with the process to let them go the other way if they can prove it.

PANELIST: Thank you.

MS. JARRELL: I also have a question from the floor for Ken, and it kind of goes along with what you were just talking about with the developers. But kind of just looking in general, if you could write regulations to protect waters from nutrient problems, what kind of requirements would you include? Because you mentioned protection was at least as important as restoration.

DR. WAGNER: Yes. The protection part goes with anti-degradation clauses, which most states have. And I actually don't know what the one for North Carolina says specifically, but you would have to establish some sort of average or distribution for whatever it was. And I like chlorophyll and I like water clarity a lot because they really relate to uses. There are other ones that are just as good, but those are two well known ones that you do get a lot of data for relatively inexpensively.

If you use those and you were able to establish "this is the baseline condition and we like it," then you simply establish statistically what would represent a significant increase, you're not allowed to do that. Now, you're going to hear from folks from Maine about how they do it there, and they have a pretty good system. So I'll leave that part to them. So that's the protection part.

In terms of going the other direction, you've got to figure out what standards go with what uses and decide what you want to get. If you've already got a heavily urbanized or agricultural area, your 40-microgram-per-liter chlorophyll standard is actually a pretty good one, because if you think of that as being the high end of the distribution -- again, it's a little tricky because what's truly the high end. The tail could go out a long ways.

But that means the average should be probably down somewhere between 10 and 25, depending upon other circumstances. And that's not a bad number for fish production. If you have an average of 10 micrograms per liter of chlorophyll in the system, an average, you're not going to have a whole lot of serious oxygen problem. There could be exceptions, but generally that's a good number.

So having a maximum of 40 is not a bad number. Having a maximum of 10 in trout water, boy, your average is going to be down around three or four. That's wonderful.

So I would use chlorophyll and water clarity. I have no problem with phosphorus or nitrogen sort of as secondary standards knowing that they feed into that, and if those numbers are high, we might have problems. But you have to have the flexibility of approach. Okay, that doesn't really matter here and here's why, but somebody's got to prove that.

MS. JARRELL: I guess that's my question, too. My other question is that you are using those other indicators. So at what point can you really determine what that P and N number should be, or if you-- if it's necessary to have that numeric nutrient criteria for N and P other than -- if you have the chlorophyll-a and you have the clarity, do you really need to have those other?

DR. WAGNER: Well, if you've got the clarity, you're meeting the standards that truly match up with the use. You know, if I've got water clarity of 109 feet, not too many people are going to be upset with that if they're going swimming or even using it for water supply. If you've got water clarity of 10 inches, we're not real happy about this. Then we go look at the nutrients. Is that the reason why? It's possible it's nothing more than sediment coming off the watershed, which probably still has high phosphorus and nitrogen since it's bound up with it, but it's really the sediment that's the problem, and you've got to deal with erosion. As Hans pointed out, you've got to have that monitoring. You've got to have the real data. So when somebody comes in and says, "I don't really think that applies here, I don't actually have any data," wrong answer.

You know, you've got to have the data, and that's why those long-term monitoring programs are so important. They let you look at it over time and things that were shown. Here's what went up, here's what went down. Those are real. You can say, "Look, this is why we believe this is an issue." If you don't have those data, then you defer back to the concepts and the theory and here's how it relates, and that's what you go with. If somebody wants to do something differently, show me the data. It's just like show me the money.

MS. JARRELL: Okay. Thank you.

MR. McCALLIE: This is question for Dr. King. You had sort of highlighted 20 micrograms per liter of phosphorus as sort of a key inflection point in your curves. But looking at some of those slides, it looked as though, particularly for the sensitive species, fish species, that you lost most of them by the time you got there. And it reminded me of some of the curves that we've seen for stream health connected to impervious surface cover percentages whereby 20 percent impervious surface cover, the streams essentially dead. And so you start seeing significant impacts at seven percent or nine percent. I'm wondering if I was reading that right and how you think states should balance that, because it looks as though the impacts start right away.

DR. KING: No, that's a really valid point and, you know, I think that, yes, you were interpreting those graphs properly. I will add that those were sort of the fitted value of those, not like the upper confidence limit of those relationships, which would shift things up somewhat more. But the general conclusion that, yes, indeed we're seeing pretty large responses. So, you know, ultimately it comes down to taking all these numbers and sitting down and starting to think about ultimately the weight of evidence and bringing stakeholders in and so forth. It sort of gets a little bit beyond my area of expertise, you know, in terms of how you actually deal with those numbers. But, yeah, I agree that we were indeed seeing responses, and that sort of was the bottoming-out point.

If you notice like particularly with those carbon phosphorus relationships with the periphyton, you know, they were really -- by then, you know, you could have 20, 25 micrograms per liter TP in the water and you'd have a C to P ratio of 150 or 200. And you could have 2,000 micrograms per liter, and it's the same C to P ratio. It's just sort of like saturated with phosphorus at that point. So -- those thresholds were sort of like where things really had bottomed out, and you saw from the stream experiment that we got that big response with 20. So from a conservative perspective, I would say that it's probably lower.

CHAIRMAN SMITH: Any follow-up?

MR. McCALLIE: No. I got a different one.

CHAIRMAN SMITH: I'll combine two questions that came from the floor, and they're related and they are addressed to Dr. Wagner, but I think they could go to all three of you. So don't limit it to freshwater lakes even though the questions are. And they are, first, what role/value can vegetative buffers play in protecting/restoring freshwater lakes? And then how can you reduce nitrogen while also reducing phosphorus with one type of BMP, keeping a ratio of 15 to one? Is replanting riparian buffers a great example?

DR. WAGNER: It does relate to buffer zones and having vegetation. Buffer zones are an outstanding way to protect water quality. The problem is we're not talking about five or 10 feet. About the minimum is 25, and in many cases it's over 500 feet of buffer. That's pretty much the whole person's property in some cases, so it becomes an issue.

You can engineer buffer systems to do a better job than just whatever might grow there would do, and if we had buffer systems and you're essentially disconnecting the impervious surface or the other land uses from the water course, it's a great idea. I actually had it in one of my slides, but there wasn't time to go into it, and it just came up.

Impervious surface is probably one of the best indicators of what's going to happen. It feeds into development and wastewater. It feeds into what actually runs off. It feeds into fertilizer use, all these things that figure into it. You could actually create a standard for impervious surface that might do a lot of good. I haven't seen anybody pull that one off yet, but it's doable. Buffer zones would, of course, be the anti-impervious surface, and therein lies part of the problem, is that, again, it's not all created equal. If you have an urbanized area with great buffers, the same land use in an urbanized area without those buffers will likely have more impact.

So you can't just say, hey, that urban areas are going to give us this much. Again, Maine approach actually does some signing like that, and it's kind of interesting. But I'm a big fan of buffer zones. It's just retrofitting them to get what you need is very difficult.

DR. PAERL: Yeah, well, I certainly agree with everything Ken's saying, but I want to point out that climate -- we're getting changes in our climate. And one of the big changes occurring is the occurrence of episodic big events, in storm events and intensity of those storm events. And, you know, we can only buffer-- we can only protect with buffers to a certain point.

When we have a massive gully washer that is putting lots of sediments through the buffers into a receiving water body, buffers simply cannot absorb the nutrients and sediments associated with that. So we need to think, you know, progressively here or -- yeah, I guess progressively is the word in terms of how to protect the receiving waters beyond just using buffers these days. I'm not saying that buffers are not effective. They are very effective, but they can only buffer up to a certain point. If they get overwhelmed with massive storm runoff -- and I'm -- probably everyone here in this audience has experienced that in North Carolina.

The major storms we've had since the mid-nineties that were responsible for many, many water quality problems, including the fish kills that we've seen in the Neuse that were pictured, we need to think of sources even prior to the buffers now because of this episodicity and large-scale events that are occurring. And they're more frequent.

MR. McCALLIE: So I have a question. I think this one is for Dr. Wagner and Dr. Paerl, and it's keying off Dr. Wagner. In your presentation talking about the distinction between artificial and natural lakes and also the concern about feasibility, particularly for controlling nutrients from existing development. I'm curious. If you set aside for a minute the frame of analysis from the Clean Water Act about attaining uses -- and I'm interested to hear you talk about this from the perspective of sustainability and equilibrium.

If you have a landscape contributing nutrients to an artificial water body -- and then I'm also interested in what happens when it gets down to the estuary eventually -- for a certain contribution it would distort it but then you would see -- or push it out before it starts, but then you would see it reach an equilibrium. But if the contribution of nutrients keeps happening and it goes into a sink or you just keep adding more nutrients than the system can process, I'm curious whether there is an equilibrium that it reaches and how you -- when you think about it from that question, about reaching an equilibrium, how do you -- what do you think we do about artificial lakes and the landscape contributing to them?

DR. WAGNER: The short and easy answer is there's no such thing as equilibrium in lakes. That's probably not really true, but everything's processed where they're all changing over time. A natural lake, manmade, whatever, sitting there over time is going to change.

The general rule of thumb is that after you build a reservoir, 40 years later you're going to start seeing water quality problems even if it's all natural in the landscape. That's, again, not always true, but it takes time for the stuff to build up and come in and make a difference.

The process whereby lakes age and become fertile is a completely natural one. It probably takes eons if we're not around helping it along, and it may take only years when we get involved. And you've hit on what's the concept of assimilation capacity. How much can the system tolerate and process before it gets all out of whack really quickly, and for different lakes the number is different. I mean, generally, it's like a fraction of a milligram of phosphorus per square meter per year. And you can do similar things with nitrogen and even other factors, but each one will respond somewhat differently. And what was the last piece of the question?

MR. McCALLIE: I suppose just what -- what do you do about it?

DR. WAGNER: Pray -- no. You have to manage in the watershed or in the lake and realize that both of those matter, and this is -- this is a sensitive area. In fact, I'm going to convene a session on this at the North American Lake Management Society conference this November in Madison, is keeping the lake in lake management. We are pushed so hard by federal programs to manage the watershed, and I don't think that's wrong, but we've forgotten about the in-lake options we have to clean things up. And I don't want to give a long lecture on that, but there are a lot of things you can do in the lake to enhance that assimilation capacity without doing anything in the watershed. It's not an excuse for inactivity in the watershed, but it may be a faster interim measure to get us back towards where we want to be.

DR. PAERL: Let me just -- I totally agree again, but I wanted to also stress that over time-- and this is being accelerated by human nutrient input-- is that lakes and reservoirs and rivers and estuaries store nutrients to some extent. So they have a legacy of the nutrients that have been loaded into them. This is one reason why it often takes two -- dual nutrient removal instead of just single nutrient removal.

The Tai Hu, China, example is a really good one, but there are many lakes that are not as bad as Tai Hu but approaching it, where the legacy of phosphorus or nitrogen loading has been so high that if you just reduce one nutrient, you're not likely to see a very rapid or acceptable from a cultural perspective response. Again, it's the storage and the legacy that is really important here. So nutrient ratios, for example, aren't going to matter a whole lot in these systems because you're already saturated with nutrients in these systems.

MR. McCALLIE: I think I'll just leave it at that.

DR. PAERL: That's right.

MAYOR MOSS: This question is for Dr. Paerl. These are, again, two nutrient reduction related questions, and the writer says what about the lake in the Catawba or Yadkin Basin? Do we still need to control nitrogen there as well? And then the second part of that was many actions have been taken to meet the 30 percent total nitrogen reduction. Does the data show any improvement? If not, why not?

DR. PAERL: The first one, I want to beg some ignorance about the Yadkin, but I think if any system is connected to the ocean, you probably should deal with nitrogen or at least be concerned about it, because it's ultimately going to impact the downstream waters.

I think, you know, it's easy to manage a system in isolation, and we do that all the time. And I showed you for the Neuse there was a success story upstream, but downstream the enhanced nitrogen loading due to removal of that filter basically negated the effects of the P only reduction in the estuary. And the second question, could you just repeat that really quickly?

MAYOR MOSS: That was many actions have been taken to meet the 30 percent nitrogen reduction.

DR. PAERL: Yes.

MAYOR MOSS: What does the data show there?

DR. PAERL: Okay. Well, here's the good news. The good news is that we have reduced certain forms of nitrogen coming down the Neuse pretty effectively, particularly from wastewater treatment plants and to some extent non-point sources. For example, nitrate loading has gone down. At the same time, it looks like the particulate loads, that is, the particle-associated loads of nitrogen and including organic nitrogen, have actually gone up a bit, particularly downstream where there's more development going on.

So upstream we seem to be doing well with urban reductions and reductions of nitrogen. Downstream, where there's more development and to some extent upstream, too, the organic nitrogen has gone up. So this organic nitrogen thing is biting us in the tail right now. The net effect is that we haven't met the 30 percent reduction. We removed part of that nitrogen, but there's another part that's creeping up. We think that's associated with things like stormwater runoff, sedimentation from development, potentially removal of vegetation that could filter out that -- those nitrogen sources.

So we've got work to do, but I think overall we're heading in the right direction. We are holding the course right now, but we need to find out where this organic nitrogen source is coming from so that we can help manage it as well.

MODERATOR: Time for one more question and then Grady after that.

MS. JARRELL: You all have talked about and we've heard about a lot this morning about the variability in different water bodies and the different stressors that they have, and so that further reinforces the need to look at site specific studies and research for those water bodies. How can we manage that? How can we do that in a streamlined manner? Because as you -- I think we've been trying to do that in North Carolina, and I think it's a good way -- a good approach to take. But how can we continue to reinforce that approach and not overwhelm everyone that's trying to collect the data, trying to get the information and be able to really look at the different data according to those different water bodies and those different stressors?

DR. KING: I'll take this and for streams, that would be a huge challenge. I mean, you think about the number of stream miles, and I think that it's large impractical unless you've identified special waters of concern that you might want to monitor separately. Alternatively, the approach that I presented today was stratifying it by, you know, a physiographic or eco-region and doing a study to kind of identify is there a real common pattern among all these things. And then that -- that way, in a sense, you're viewing it as a regional specific stream criterion, but you're not having to actually monitor every single stream in the same way that you might with reservoirs, which are much fewer in number and larger and more manageable.

DR. WAGNER: I'd go along with that, and the answer to your question is you can't. I mean, if you set a site-specific criterion for each and every water body, knowing there is that variability, it's a huge amount of data, a huge amount of work and it will overwhelm our capacity, which is why they want us to establish numeric nutrient criteria in the first place. But there has to be a process.

You come up with the numbers that look best, and Ryan's example was a great one where you got this 20-microgram per liter threshold. Start with that, or maybe it's a little bit lower than that to be more protective. Okay, if somebody feels it should be different here, there's the burden of proof. Go to it. And that takes a little of the pressure off the government on having to do everything, and the folks that really want to do something different, okay, go get the data, put the science behind it and let's see what happens, as opposed to just pulling levers in the voting polls to get politicians that will go along with them.

DR. PAERL: Yeah, I would just add that site-specific targeting is a moving target. As we do a better job at some sites, others are changing. And part of it is the interaction with climate, climatic changes, but also human activities in the watershed are changing. For example, downstream in the Neuse estuary or in the Neuse watershed, we've got a lot more development downstream. And this is one reason why we're trying to identify some of these nitrogen sources in relation to changing human activities, and that's going to lead to more site specific types of reductions in places.

MS. JARRELL: Thank you.

MODERATOR: Is there a final word before we go get some nutrients?

MR. McCALLIE: If I may, this is a question for

DR. King. In 2005 North Carolina, I think, committed to EPA to develop a periphyton standard, and the state hasn't done that largely because of lack of resources. But you had mentioned in your presentation that the area you cover was, say, roughly the size of the Piedmont. And I'm curious. With that as a reference, how long do you think it takes and about how much money do you think it takes to develop a decent eco-region based nutrient standard?

DR. KING: Well, I think -- I think you'd have to stratify considerably, like, say, we're only going to focus on a certain size stream, probably a larger one like I mentioned, trying to avoid a lot of confounding influences of light and doing some reconnaissance work, getting into a database and try to identify a gradient of condition that's relatively unaffected by lots of other potential confounding stressors, which is also problematic. But I think one could go about it in the course of -- I mean that was a two-year study that I presented. It was actually a fairly small budget, from the EPA, and I'd probably never do it for that again. But -- but, at any rate, I mean, I think that-- you know, I can't give you a number on how much it would cost because I don't know enough about agencies and how that works. The university level, you know, quarter-of-a-million-dollar kind of project, I think could be done.

MODERATOR: Let's thank our panel for a great provocative session and our panelists as well.

[END OF Q&A SESSION 2]

The following is a transcript with minor editing of the third question and answer session conducted on May 29th, including the following speakers: Michael Paul, Robert Miltner, and Thomas Danielson. In addition, Dave Courtemanch with Maine DEP assisted Mr. Danielson with answering some questions.

MODERATOR: Mike and Bob, if you could join us back up front for the panel discussion, and, Tom, I think you know what's coming. We have a distinguished panel that's been receiving questions from the audience

and has some of their own. So for the next 30 minutes or so, we'll just have a question and answer session with the panel. And I'll turn it over to whoever wants to lead off.

MR. McCALLIE: Great. So I'll start with the first question, and that's that box -- decision box. It looks like a really interesting tool. This is a little bit complicated question. But if North Carolina had adopted the threshold rule that Commissioner Peterson was talking about in his charge this morning, I imagine it was intended to be proactive. I imagine that we would have a lot of waters showing up in our box -- in that box at the top right, which is the box where you're over certain limits but you're not seeing the response -- you're not seeing the response problems in the stream. And there would be a question about whether particular water bodies are just hanging out there and were never going to get any worse, or whether they were on their way to impairment and you were seeing the nutrient levels but not the response yet. And that rule was designed to run a prophylactic approach. It is to keep the conditions from getting worse.

And so my question --this is for the whole panel -- is both for Maine and for Ohio. When you're in that box where you're seeing nutrient levels above a number but you're not seeing the aquatic life criteria problems or you're not seeing the response variables, what management measures do your states kick in? And for Dr. Paul, for other states that would use an approach like that, what management measures kick in at that point to prevent the water from becoming fully impaired?

DR. PAUL: Your first management measure is a good monitoring program. If you have that, then you know what the status of your water body is. You've got some information, probably historic, to know where it was in the past so you can compare it to where it is now. And the other part of that is, when in developing the criteria, is to have a suite of indicators like Maine has or Ohio is proposing so that you know. We all know that, as you can tell from all the variety of the talks, looking simply at a phosphorus or a nitrogen level is going to be misleading just in and of itself. So you have to have other --these other indicators, and those will tell you where you are along that continuum. And once you know that, then you can be proactive or you can say, "Yeah, this system is close to being pushed over the edge if we add any more nutrients or if we, you know, let development come in and destroy the buffer and open up the can of beer," what have you. So that's -- that's how we deal with it.

MR. McCALLIE: I'm sorry; I think I probably didn't ask that quite clearly. That makes a lot of sense. I guess what I'm wondering is once you know that you've got something in that box, what management measures on controlling sources of nutrients do you --once you decide you're in that box, it's not a TMDL. So you don't have the driver of reduction --

DR. PAUL: Right. That box can -- for us, what we want -- what we think that box could do is potentially trigger a reasonable potential. We could say that that should be -- that gives us reasonable potential to implement a limit in the plan. Okay? So that's a practical lever right there.

DR. DANIELSON: Yeah. Do you hear me? Yes, so we have -- let me turn my volume down. Okay. So, yeah, we have a similar answer to Ohio. The monitoring is a real key, and it's once we have a water body in that box, the generic targets that were set for that class are still in effect for any permit decisions for -- if we're going to have a discharge limit for a facility. And, Dave, do you want to add anything?

DR. COURTEMANCH: No -- well, just that --being in that upper right-hand box essentially puts the department or the state in a position of setting site-specific criteria which become kind of the ceiling for -- that we would manage against. It's just a way of finding a new goal for that water body, a new phosphorus goal. And at the same time, if the nutrient response indicators are becoming close to their thresholds, then, you know, we'd want to take steps to make sure it doesn't slip into a lower level of non-attainment.

MAYOR MOSS: I've got two questions. This is for Bob and Tom. Is there any move in your respective states towards more holistic water management focusing on geography and quality, not source, for example, raw stormwater or reclaimed water?

DR. MILTNER: We have a couple of initiatives -- nutrient reduction initiatives right now. They're not necessarily that specific to what your question was just about, individual components. But it's -- we've got an urban and stormwater task force that's bringing together some of the major stakeholders in the state in trying to develop strategies to reduce nutrients, and we also have a parallel group that's looking at primarily agricultural sources for nutrients and trying to identify which BMPs would be most effective. And that's -- right now that's our strategy.

MR. McCALLIE: The next one is to Tom. Did you hear the question? I'll just move on to the next one. This one's also for Bob. Bob, how much of your index is based on monitoring or empirical data versus water quality modeling?

DR. MILTNER: It's empirically derived, all of it. So it's empirical studies where those numbers came from.

MR. McCALLIE: Gotcha. Thanks.

MS. JARRELL: Okay, I have just one question about the monitoring for both Bob and for Tom. And I don't know if you can hear me or not, but, really, who is completing all the monitoring and how -- what would you recommend in North Carolina as far as being able to complete the amount of monitoring? It's pretty impressive the amount of monitoring that you're doing. But how does it all get done and how do you maintain it? How is it managed and what advice could you give us?

DR. MILTNER: Right. Well, we -- we have a staff. There's about 10 or 11 biologists and we have a -- basically, we get to about four watersheds, so it would be -- if you're familiar with the HUC 8 level, it's fairly large. It would be like a half of the Cape Fear River Basin. You know, Cape Fear is what, about 9,000 or 12,000 square miles, or something like that. And so we would tackle maybe not something quite that big, but we try to do a basin, and we can usually get about 100 sites within a basin per survey. So we're getting in the neighborhood of 400 to 500 sampling locations a year. The cost of that, we've compared it. Chris Yoder, when he was with our unit, did a lot of that kind of cost breakdowns. So it's out there in the ether somewhere. I don't know the numbers off the top of my head, but those -- the monitoring program compares -- it's cheaper in a lot of ways than doing toxicity studies, or as cheap. But it buys you real information, and the take-home point is that monitoring keeps you -- gives you the ability to make smart decisions.

MS. JARRELL: Is any of the monitoring done by others, like municipalities that --

DR. MILTNER: Yes. Our regional sewer districts, some of them -- our bigger regional districts like Northeast Ohio Regional Sewer District, they have quite a bit -- they built the infrastructure up over the last couple of years. They've got some real good staff and they're able to, more or less, do that same level of monitoring that we do at the state.

MODERATOR: Tom, I'm not sure whether you're hearing us. Do you hear me? We had a question about whether the monitoring -- are you carrying out the monitoring just by the state or are there also dischargers or others who are helping you monitor?

MODERATOR: Is your monitoring being carried out by the state only or do you have help from dischargers or other groups who are providing the resources for your monitoring?

DR. DANIELSON: The state does the bulk of the monitoring, but we do have some dischargers that hire contractors to do some water quality testing, including the bio-assessments when they're properly trained staff. And we also have partners, several of the tribes and some municipalities.

CHAIRMAN SMITH: I'll lump several questions together and ask them this way. Once Maine goes through its decision framework and comes to a conclusion about whether or not a water body is impaired or in that top right-hand block, whether there's -- has phosphorus, beta decision is made that the water body is not impaired, what does Maine do with that? How is that implemented? Is it limited to point sources? How do you set permits and then what do you do about non-point sources? That's a collection of questions that have come from the floor.

MODERATOR: Tom, did you catch that or do I need to repeat it?

DR. DANIELSON: I heard it. So we generally do a watershed analysis of point and non-point sources, and we determine the loadings, where the loads are coming from. And so it's not -- we don't put the burden just onto point sources. We also look at the non-point sources.

CHAIRMAN SMITH: I think the question -- some of the questions related to -- and I know this is not the focus of his talk, but some of the questions related to implementation. I understand about point sources. But the non-point sources, what are the sorts of things they do when they see that there is an impairment determination?

DR. DANIELSON: Yeah, so for non-point sources, we do a stressor ID and evaluation to find out what the likely sources of impairment are. And we do -- we look to see what types of stressors are in the watershed, and then we use a lot of load allocation models, that sort of thing, to find appropriate remedies. We also have a division of watershed management that works cooperatively with municipalities and agriculture and other groups to find some solutions. Sometimes there's cost sharing opportunities, so we can fence cows out of a stream, and activities like that.

CHAIRMAN SMITH: And then this question is not addressed to anybody in particular. And that is, why is trophic index not used more frequently as a water quality guide as opposed to, for instance, chlorophyll-a?

DR. COURTEMANCH: Well, that was developed really for -- like Carlson's Trophic Index was for lakes. At least what I was talking about with streams, and we did kind of appropriate the term trophic index criteria in what we're calling our -- but it's not really what Carlson had developed. It's just simply the -- a multi-metric index based on those numbers that I showed in -- for ranges of phosphorus, nitrogen, benthic chlorophyll, DO, because we weren't clever enough to come up with a better terminology for it.

CHAIRMAN SMITH: If I understand the question, I think that answers it.

MR. McCALLIE: Another question. It looked in Ohio as though you had the slide where you said that there was reasonable potential if there's a 50 percent chance of I think violations or of algae showing up. I'm not sure how often it had to pass that, and I didn't catch a percentage chance in Maine. I wondered how do you -- why 50? Why not 40 or 30 if you want to be risk adverse? How do you handle risk in both states?

DR. COURTEMANCH: Well, that one slide in particular, that was -- what I was trying to do is compare phosphorus -- a phosphorus concentration that would be analogously high to an ammonia concentration, where invoking independent application, reasonable potential was clear. So if ammonia concentration is one milligram per liter, it is killing things. An analogously high concentration of phosphorus, about .3 milligrams per liter -- I mean it's not perfect. It's just sort of roughly analogously high, so to speak.

We don't have direct lethality. Based on logistic regression, that's the point where you've got about a 50 percent chance of seeing impairment. So that -- saying that I was going to invoke independent application at that point wasn't necessarily the be-all and end-all of where we're going to do it. Basically, where are you going to use those trophic index criteria to know where we are? That was -- that slide was simply just to say how do these -- what's the -- how are these two nutrients versus a traditional toxin analogous or not analogous. That's all I was show on that one.

MR. McCALLIE: So to make sure I understand that right then, would you say -- if you're concerned about reasonable potential, it could be 30percent in some case or 50. How do you decide what risk is right?

DR. MILTNER: Right. For us, for Ohio-- I can't speak for Maine. But for Ohio we would be looking at the performance of each of the individual metrics based on our monitoring data. So we would be looking at what's the condition of our fish and macroinvertebrates, how wide are the DO swings, what's the level of benthic chlorophyll that we're seeing. And so, if we have high -- say high phosphorus or nitrogen, or both, and yet our biology is pretty much attaining but it's just barely attaining and we're seeing fairly wide swings; that would be where we would say we got a good chance of slipping into non-attainment if we don't do something. So it's a weight of evidence. It's very much a weight of evidence approach. We're trying to meld in that weight of evidence to be amenable with kind of an algorithm.

MODERATOR: Tom, I'm still not sure whether you're hearing questions from the floor or not.

DR. DANIELSON: By using multiple indicators, we're hoping that we can track all the potential effects that might happen from nutrient enrichment in the river or a lake. Also, we try to use conservative numbers and targets, and many of those were based on percentiles of reference conditions or based on weights of evidence in setting those numbers and using things like conditional probability and change-of-point analysis. So we tried to mitigate our risk by using weight of evidence throughout the whole process, and then later, when we implement it, too.

MS. JARRELL: I have two questions from the floor, and I think these are for Michael. But anybody can answer them, of course. The first one is how can spatial and temporal variability be incorporated into water quality standards instead of just picking a number? Like, for example, we have 40 here for chlorophyll-a micrograms per liter. How have other states incorporated this variability?

DR. PAUL: So when you talk about 40 micrograms per liter, that's just a magnitude. And criteria are supposed to have a frequency and duration component with them. So when you develop the criterion, ideally it goes into the standard as a magnitude value that has a duration, an annual average, a monthly average, you know, not be exceeded more than some frequency. So that got sort of the temporal variation aspect of the question. So adding that to a standard makes that more clear. The spatial variability issue is more an issue of the classifications. So if 40 micrograms is an appropriate standard in a coastal plain lake, it may be that that's inappropriate for a highlands lake.

And so ideally in that case, as you're developing the criteria, you're looking at differences in the response models between the two places to develop those different numbers. Georgia takes it even further. I mean there are parts of reservoirs in Georgia -- I think Ken was talking about it a bit. But it's commonly understood that the river and transitional and fore bay areas of reservoirs behave very differently in response to nutrients. And so some states have looked at developing either embayment specific or lake specific numbers -- or lake location specific values. So in terms of protecting spatial variability, they look at the degree to which that nutrient response varies by where you are in the lake.

MS. JARRELL: And I guess that would apply more to a very large water body --

DR. PAUL: I think so.

MS. JARRELL: -- as compared to a smaller --

DR. PAUL: Yeah. I mean smaller streams-- again; we are supposed to be doing watershed management. Right? So having numbers for headwater streams that are super well-shaded and light is clearly the limiting nutrient and nutrients may go astronomical ignores the very well-proven phenomenon of the river continuum concept, that rivers open up and eventually they're not light limited anymore. And so having a higher nutrient number in a headwater may set you up for problems that don't respect this watershed and longitudinal connectivity of river systems. So that has to factor into when you're setting the spatial numbers.

MS. JARRELL: Okay. And I have a second question from the audience. From the perspective of a regulated municipality, how do you craft a standard that does not result in non-compliance for regulated entities when climatic conditions affect water quality?

DR. PAUL: I don't understand that question.

DR. MILTNER: Could you say it again?

MS. JARRELL: Yeah. Sure. From the perspective of a regulated municipality, how do you craft a standard that does not result in non-compliance for regulated entities when climatic conditions affect water quality?

DR. MILTNER: Well, I would think that you'd be -- if you're in an estuarine system or discharging to the ocean or maybe one of the Great Lakes; that might be more germane. I think -- I think any time we're talking about nutrients, how do we craft a water quality standard that doesn't put them into non-compliance, that is sort of independent of climatic conditions. I think that's sort of the heart of the matter, and that's where we're saying up front you need to have a weight of evidence going into it so that you have confidence, when you know that you have impairment, that you're making the right call. And then I think the implementation of that, then, has to be somewhat iterative because there is a little bit of an uncertainty. And I think a lot of states have been bringing this up. Montana is an example. Maine I think has been talking about site-specific variance. Wisconsin for sure I know is talking about that. So there's some mechanisms that are there to deal with this issue of where do you have a discharger and are they always going to be able to meet that -- the criteria, which always seem to be fairly stringent, in relation to the practical treatment technology limits.

DR. PAUL: I mean if the response curves change with temperature, then it may be something that you have to revisit through the triennial cycle to set those numbers. I mean one of the common ones is that cyanobacterial - Cyanobacteria are very sensitive to temperature as well, and at higher temperatures they may elicit faster growth and higher toxin production for the same phosphorus concentrations. So it may be a function where that curve changes and temperature has to be in the standard.

MODERATOR: Time for one more quick question.

MAYOR MOSS: Okay, I'll throw it out then. This is for our folks in Ohio and Maine. Do either of you consider atmospheric nitrogen deposition in its framework approaches, especially given the agriculture and coal-fired utilities in Ohio?

DR. MILTNER: No. I think our biggest concern right now is tile drainage because tile drains --and I don't know how much of a problem that is in North Carolina.

But our tile drains basically circumvent the riparian zone, and so we have nitrogen and phosphorus just basically traveling unfettered into our stream courses. And our tendency is to marinate our agricultural lands in nitrogen, so it's applied ad libitum. So it's there in excess. And even our soil phosphorus levels in the upper soil horizon; we basically saturated the ability of that soil to bind phosphorus. So now we're getting it moved off of those fields in a dissolved form.

MODERATOR: Tom in Maine, any last comment on atmospheric deposition and have you considered it?

DR. DANIELSON: For our freshwater, well, we really haven't considered atmospheric deposition of nitrogen. Our freshwater rule primarily relates to total phosphorus. Our waters are pretty oligotrophic, and we think that we can work on controlling most of the problems we have by focusing on phosphorus. There are estuarine and marine systems that can be up to a third of the nitrogen budget, and we would consider it more then. But, again, we don't have many marine systems that are in really poor shape right now.

MODERATOR: Please join me in thanking our great panel. [APPLAUSE]

[END OF Q&A SESSION 3]

The following is a transcript with minor editing of the final question and answer session conducted on May 29th, including the following speakers: Scott I. McClelland and Douglas J. Durbin.

MAYOR MOSS: This one is to Scott. What is the new designated use for manmade systems you mentioned? How is it described?

MR. McCLELLAND: That is one that Doug brought out. It is called Class III Limited. It is basically for manmade systems, mostly canals. There's a more lengthy description in the rule itself, but in so many words, it's a manmade system that is used for storm water conveyance, like that. There are no criteria associated with it. It's just a designated use, so when you set the designated use, you also have to come up with some different protective criteria for the classic parameters.

DR. DURBIN: And the other tricky part is that they created the drawer called Class III Limited, but it currently has no water bodies in it. The idea is that if you have a canal that you're worried about, you would petition the state and say, "I want to put this canal into that class and these are the criteria that would go with it." So some people were kind of surprised at how easily it flew through approval, but right now it's a hollow regulation. It's just a name with nobody at home.

MR. McCALLIE: I appreciate all the nuances in both presentations, and this is a fairly simplistic question. But I'm curious if you all could talk about the extent to which in your personal judgment, the degree to which the different categories of waters actually suffer from nutrient over-enrichment, and do you think implementation based on the state and federal rule will solve that?

MR. McCLELLAND: In my opinion, lakes --many lakes in Florida suffer from nutrient over-enrichment. Many estuaries do, and many -- well, we're starting to see some springs that are the same thing. The regulatory response is different in springs, so let me not talk about that any longer.

I think that there are many, many regulatory tools in the state of Florida that they're currently dealing with today to try to deal with those things. They take time to have a consequence, and therein lay the problem. The problem occurred over 50 years. Well, it's not going to be fixed in five, and that's part of the -- I think the paradigm that we have to kind of build into this process.

The state of Florida, when the TMDL is approved, has a process called a basin management action plan. It is generally a 15-year implementation process to get the stakeholders to improve the system to meet the target of the TMDL. It's one of the few states that has that particular process. It's very formal. It's facilitated. The state orchestrates it, and the local stakeholders are the ones who volunteer -- not volunteer. They have to meet the target, but they work together to come up on how to fix it. And I think that the state has started to work in that direction as a result of the fact that the estuaries and the lakes are indeed impaired. I do not think there are many streams in Florida that are impaired. I may be looking at it from a policy point of view as opposed to a data point of view. And that was one point I wanted to make from a policymaker's point of view. Data just violate our preconceived ideas, so I'm not real excited about data. That's a joke, please. Please.

DR. DURBIN: Along those lines, what you said made me think about -- when you talked about implementation and things going on and you think about time frames and waters that we have that we know are impaired, because Florida knows it has a good number of impaired waters. It was ironic, I thought, that when the first draft of the EPA rule for Florida came out, it proposed and asked for comment on the idea of a restoration -- help me, some kind of a restoration schedule that could be as long as 20 years for a waterbody. And when I read it, I thought I don't understand.

Right now Florida has in place an impaired waters rule and a TMDL program that provides a five-year rotating cycle. And in that five-year cycle you have data collection and decisions and establishment of a management action plan and then restoration activities. And so the EPA rule proposed 20 years. Well, in that 20 years any given water body that we already knew was impaired has four turns of that cycle to get better. And I thought have we really sped up the process with this rule.

MS. JARRELL: Okay. I have a question about stakeholder process and how do you -- or how has Florida integrated the public in the stakeholders, the general public, about understanding of what's occurring in Florida and the fact that you're saying that, you know, it might have taken 50 years to get where you are now, we're not going to fix it in five years, but there's things that have to be done along the way? How are you helping the people of Florida to understand that?

MR. McCLELLAND: My impression is that the state of Florida has done a very good job in getting the public involved in the stakeholder process, certainly. They just said that this state regulation allows for an implementation program where stakeholders are involved. Obviously, every state has a triennial review of standards, so that's a very stakeholder specific type of a process that can happen. I really do think they do a good job of letting people know and letting people get involved in not only the regulations but also the technical advisory committee, actually there were 15 members -- 12, 15 members, but every one was attended by probably 50 people. And every one of the people in the room had an opportunity to speak as much as we did. Now, when the decisions were made or the policy advice was given, it kind of went to the technical advisory committee. So I thought that was a very open and robust stakeholder process, and I'm very encouraged by that.

MS. JARRELL: Thank you.

CHAIRMAN SMITH: I'm not sure if this question came in for the two of you or it came in previously, but I think it will probably work as well for you. As your implementation scenarios have been developed, how much training of permit writers have been provided?

MR. McCLELLAND: That's an interesting question. The permit writers have actually -- the state permit writers have actually been involved in the implementation process, so that when they get to the point of writing a permit, it's already been kind of collaboratively put together. The second part of that is the permit is not so specific to constrain the implementation process. The permit is written to say you must do what the implementation process comes up with, without putting the details in the permit itself. So at least those issues in the state of Florida, the basin management action plan, which is the implementation plan, and the permit are consistent because they refer to each other. That's the permits that are issued by the state of Florida.

MR. McCALLIE: I guess a question about how do you do proactive protection. I'm particularly curious in the case of alternative criteria -- in the site specific alternative criteria. It sounded as though what you're waiting for there is to see a hit in the response variables, but if you're waiting to see that, then how do you do proactive protection?

DR. DURBIN: That's something that has been a philosophical struggle from the beginning, because I think there are many people -- Scott mentioned that he doesn't know of a lot of streams in Florida that are impaired biologically. I agree with that. I think there are a lot of people who agree with that.

And so in the Florida rule, a stream or another water body can end up on what they have now called the study list. This is a new cubbyhole in the state rule that says if I know that there is a problem in a stream -- maybe it's biological, maybe it is invertebrates or it is plants --but I don't know why, I'll put it on this study list. It tells me I know I have a problem, I know I have an impairment, but I need to figure out what it is. And that provides you the time before something ends up needing a TMDL to figure out what's going on, but even that doesn't really address your question.

The problem there is having something that is entirely protective of what we want to protect, all the different colored words in my slide, but is not so overprotective that we spend a lot of time, energy and money worrying about it and fixing it, only to find out we didn't make a difference. And I think that's been the real problem all along, is all of us can look at the pictures and --and Dr. Gilinsky had pictures of several different waterbodies with dead fish or algae blooms and really ugly pictures, and we saw all those time and time again in the Florida meetings and hearings. If you trace all those back, those are water bodies that we already know have a problem.

It's the water bodies that we don't yet see a problem in that are on some trajectory; that this idea of a protective line is supposed to catch. And, frankly, I don't know that we have solved that in the EPA rule or the DEP rule, because as long as you don't have a negative response and you don't enough data to show that you have some trajectory of an increasing nitrogen or phosphorus number, the federal judge said, "For streams, you haven't shown me that any particular level tells me that you have crossed an impairment line." And so even the federal judge, after hearing EPA and others testify, said, "I'm not hearing it. I don't see where that line is."

Now, it may be different for lakes because, for better or for worse, in a lake you can say this amount of phosphorus has a 70 percent likelihood of giving me more than that amount of chlorophyll. And in that case, you can set a number based on a policy decision that says, "I think or I statistically predict that this amount of nitrogen causes this thing to happen most of the time." Having never found that in the streams in Florida, you can't set that number.

So that's the problem. Until you have that stressor response relationship, almost any criterion that you set is going to be either strongly overprotective or underproductive.

MR. McCLELLAND: Let me comment on that issue. That particular issue is taken care of not in the numeric nutrient criteria. There are three specific rules in the state of Florida that kind of address here. One is the water quality criteria, the numbers. The second is the impaired waters rule. That defines that the point at which the red flag of impairment goes up. That's different from the criteria. It's a little bit different process.

And then the third is -- in the impaired waters rule-- and I had the pleasure of being on that technical advisory committee as well -- what we put in there is that for these criteria, if you see a change, doubling, for example, of trophic state index in a lake or something like that, the red flag went up. It made you potentially impaired and put you on a study list whether you're above the number or not. It shows a drastic change to the worse, and we kind of defined what that drastic change meant. At that point the red flag went up. You may study it and say, nah; it's just a natural phenomenon. You may study it and say no, this is something that's happening before it happens and gets bad. At that point you put them on an impaired list and you have an improvement -- or an implementation process.

DR. DURBIN: And that's -- that concept I think really works well and there's great value in it, but it's tricky and you need to think about data and analytical approaches because, for example, in your trout waters, where the number is 15 micrograms per liter, you may have trout waters that have six micrograms per liter. If that number goes to nine, this process would tell you you're on a way to a problem. You need to fix it.

Well, go ask your consulting laboratories how confident they are at telling the difference between six and nine micrograms per liter in sample after sample after sample. You have to have a lot of numbers just to know that you're really talking about something being different.

MAYOR MOSS: To either of you, did the EPA develop a fiscal note in Florida for the recommended standards and, if so, how did that impact the average consumer utility bill?

MR. McCLELLAND: Well, okay, it's a difficult question to answer, and the reason being is that there were multiple fiscal responses. The first time the regulations came out there was a fiscal analysis that said that it would change -- it would cause, for wastewater treatment plants, a million-dollar increase per year for all of Florida. The second time it came out was a little more reasonable. It was -- if I remember correctly, it was a worse case, a 29 -- that's not right. I don't have the exact numbers in my head, but it was pretty significant. It was the millions of dollars of change in a year for wastewater and storm water and agricultural interests. But it was only based upon those waters that were not already impaired, so it was only for waters that would become newly impaired. It didn't say anything about the waters that are impaired today.

The state of Florida did the same thing, and, basically, their numbers were 50 times higher than EPA's. The effect on -- there are various different studies that said the effect of these criteria on utility bills, water, wastewater, so forth and so on -- you know, they range all over the place; the exaggerated ones maybe hundreds of dollars a month. But, again, I'm not good on -- I'm not good on data, but they were very, very significant to the point where there was great -- that's why the attorneys got very excited, in that they were going to use that as an economic statement that this was beyond reason. I can send you tons of information on those details. There were a lot of economic studies, and there was actually -- I think it was the National Science Foundation came out with something that reviewed those economic analyses and had a lot of questions for them.

MS. JARRELL: Okay. This is a question from the floor. Could the Florida reference sites be receiving atmospheric nutrients or groundwater nutrients that could result in higher numbers than they have experienced historically?

DR. DURBIN: Sure. Anything's possible. Atmospheric nitrogen, I will tell you that the Tampa Bay estuary program estimates and they do it by sort of subtracting out all the things they can measure and take the leftovers as the estimate. They estimate that about half of the nitrogen going into Tampa Bay is atmospheric deposition, so it can certainly be really high. Phosphorus not quite so much so because it just doesn't have that much of an atmospheric component. Some of the water bodies on that list that I showed are in the Bone Valley, which has a lot of phosphorus in the soil. It's just there.

So, yes, I think in part you can explain away some of those systems as saying possibly things that have happened outside of the basin have affected their nutrient regime. But in many cases, the issue is that you find similar values in both unaltered streams and highly altered streams, and the biology is always much better in the unaltered streams with higher nutrients than in the altered streams that may have lower nutrients, as I showed on that slide.

MR. McCLELLAND: I think the other thing to consider is that most of Florida, maybe two-thirds of it, the groundwater and the surface water are the same thing. So, yes, there are effects of groundwater all through the state of Florida, some places high -- high nitrogen, you know, certainly high phosphorus in the Bone Valley area. So, yes, you have to consider groundwater in all parts of Florida.

DR. DURBIN: And that brings up springs. Neither one of us mentioned a whole lot about springs. I will tell you that the work -- and it was work that was done by the state, and then EPA just said, "Hey, this looks good. We'll put it in our rule." And now it's still back in the state rule, is the work that set the spring criterion.

Now, a couple things on it. Remember, the guidance is you need criteria for nitrogen, for phosphorus and for a response variable. No, the federal rule and the state rule both have but one value, and it's not even for total nitrogen. It's only for nitrate -- nitrite, no response variable, and no phosphorus variable. However, in terms of a tight connection, stressor response connection, it's the best thing going in Florida because they did field studies, they did mesocosm studies and they did microcosm studies on nitrate and the growth of filamentous algae in very clear water at a very constant temperature with a very constant chemistry. And when you hold all those things constant and you use just -- you only vary one thing, science will usually show you that if there is a relationship to be found, it's a pretty tight relationship. And so they had three different metrics to triangulate in on the number, and there's all kinds of stuff on the DEP website about it.

But, basically, the values that came out of those three different approaches triangulated right in at that 0.35 value that is in the rule, and so it's a really well-founded number. Now, you could still say, well, does it apply to every spring in the state, because they did all the studies just in one part of the state? So what if you changed temperature or you changed groundwater chemistry. The rule could change, but it would be very easy to replicate the method and do a site specific alternative criterion in someplace else. And that's just the scientist in me saying the more that you can throw out the noise and really get into one thing, one stressor, causing one response, nitrate and filamentous algae, the better your number is going to be.

MS. JARRELL: Okay, I have another question. The North Carolina chlorophyll-a is a 40 micrograms per liter limit, not to be exceeded more than 10 percent of the time. What would the equivalent chlorophyll-a water quality standard be in Florida if based on a maximum versus an average?

MR. McCLELLAND: I don't know the answer to that one. I'm trying to think -- a lot of the stuff that we did on chlorophyll-a was done at the very beginning of the process. As I said, we kind of resolved the issues on the lakes very early on, so that was -- you know, that was seven years ago.

DR. DURBIN: Well, the rule that came out -- and we're airing all our dirty laundry, so we --

MR. McCLELLAND: Not all of it.

DR. DURBIN: We did all of the -- the DEP, under the sage advice of the advisory committee, did all of the analyses on lake water quality data, chlorophyll, TN and TP, and came up with those scatter plots that I showed you. And all of that work was sort of -- as Scott said, sort of done and -- over here, and we were ready to go write a rule with it. And then EPA sort of grabbed the -- the report or the -- you know, the final paper before the rule was issued and said, "Okay, we'll just work on this."

And one thing that got added in at EPA that the state hadn't really talked about was this geometric mean over a period of time. So what came back in the EPA rule was, okay, it's going to be 20 micrograms per liter of phosphorus and whatever nitrogen and whatever -- sorry, 20 micrograms per liter of chlorophyll and whatever nutrient levels that corresponds to, and we're going to look at it on a geometric -- an annual geometric mean basis, and you can blow the mean one out of every three years. So you can have an exceedance.

And somebody asked earlier about what do you about climatic issues, how do you avoid having climate -- climatologically changes, a hurricane or a flood or whatever. Well, that's one way around it because a geometric mean, for one thing, is pretty forgiving on those peaks that come along. And when you get to throw out one every three years, you don't have to worry about when the hurricane hits, unless you get them two years in a row. So that piece got done -- that little piece of statistics got done at EPA and then migrated its way back into the DEP rule. And so if you're -- back to the question of how does the 20 down there relate to the 40 up here, I would have ask one of my statistics experts to do the math to get me out of the geometric mean. But I would say that you could -- you could have 40 micrograms per liter in a Florida lake every once in awhile and still make that 20 because of those two forgiving provisions.

MS. JARRELL: Okay. Thank you.

MR. McCALLIE: Question from the floor. What is the status of litigation over the Florida standard at this point?

MR. McCLELLAND: Well, we heard from the hearing -- well, we heard from the federal court, as I said in my speech, that they threw out the stream criteria from the federal criteria -- or a numeric nutrient criterion because of it was arbitrary and capricious. They kept the lake and the spring conditions. Right now the state, of course, promulgated its rules, and the legislature accepted it, and it was immediately sued by the environmental interests.

So what we're waiting for is the administrative hearing to happen on that one. Then if that gets approved, then it will be sent to the EPA for approval. And I think that's part of the reason why EPA pushed back its effective date to give us a process, and we've been waiting. The administrative hearing has already happened. We're waiting for the result of it. It was supposed to happen at the end of last month and we haven't heard. So we're kind of all waiting for this administrative law judge to come back and say it's good, it's bad, whatever, and then it can go to the EPA for approval. There are other lawsuits hanging out there. I'm sure that will happen, so we're just kind of going about our business.

DR. DURBIN: And speaking of how much fun it is when the lawyers get involved, at one point there was a challenge to the EPA rule at the federal level and to the state rule at the state level. And under at least one scenario, if the challengers to EPA had won at the federal level and the EPA rule with its numbers -- just EPA's rule only had the numeric criteria, if those had been thrown out and the federal rule went away and the environmental groups who sued at the state level had won their case, they objected to both the numbers in the state rule and to the narrative criterion. So if the EPA rule had gotten thrown out and the state rule had gotten thrown out including the narrative, there would be no numeric -- no nutrient regulation whatsoever in the state of Florida until somebody else did something about it. So the lawyers thought that was pretty funny, that it could end up with absolutely free rein on all the dischargers.

CHAIRMAN SMITH: This one goes back to natural conditions. To the extent that you're able to establish natural conditions, are there provisions for exempting a water body when the data show that the area has naturally higher values, even if those naturally higher values would put the area into the category of impaired?

DR. DURBIN: Yes. And the nuance of the way the state rule is written is such that in at least some situations you don't even have to go through the process of getting a site specific alternative criterion. If you go out to the stream and there's no algae problem and there's no nuisance plant problem -- duckweed, hydrilla, whatever it may be -- and you measure the invertebrates and the invertebrates score is really good, really high, then you can take your nutrient samples, a few samples over the course of a couple of years, and you may be above the criteria that are in the rule. But because the biology is healthy, those criteria then simply become the conditions that that stream is able to exist in, and you don't have to prove the need for a site specific criteria and have -- every site specific criteria is effectively, is a new state rule and a new federal approval. But under the scenario I just talked about, you can avoid all that simply by saying all the biology is healthy and the nutrients are just a little above the criteria, much like what was talked about for the state of Maine.

MAYOR MOSS: Okay. This is my last question, and I can't believe my fellow panelist gave me this one to read at this late hour in the day. It's a tough one. Has Florida used multi-variant statistics to see if their nutrients and urban index and other indices correlate to the biotic index scores? If so, what was the result?

MR. McCLELLAND: The answer is yes. And as Doug said -- and he'll go into a lot more detail, but from a policy point of view the answer was it didn't prove anything.

DR. DURBIN: It was -- again, as a scientist, I was always impressed and sometimes just astounded when we would go to these meetings that would be month apart, and we'd go back and they would have taken that historic database of tens of thousands of numbers and completely redone it, thrown out anomalous values, interpolated other values, all of this incredible data manipulation, and run sometimes six or eight different complex statistics both internally and using external statisticians at universities from here to Washington State. And so it would just be plot after plot after plot. And we looked for this, and no. Looked at it this way, and no. And the step change, we thought we had a step change, but when we took out the anomalous data, it went away.

So time after time after time they used parametric, non-parametric, multiple regression, anova, manova, everything you can think of. And the relationships, the ones that we knew were there, you know, just off the top of our heads just got reinforced. The ones that we didn't see at the very beginning never got any stronger.

MS. JARRELL: This question is more related to soils, and it really could apply to other parts of the country as well. But I know in Florida, just like as we have in North Carolina, we have a variety of soils.

And what the question is asking is that we have been taught the mobility of phosphorus to lower soil strata is negligible. However, soils in coastal North Carolina are granular and water tables are high. These conditions could favor phosphorus migration downward. Do you have knowledge of published papers on this subject, not only in North Carolina but in Florida or anywhere else to your knowledge?

DR. DURBIN: You talked about --

MR. McCLELLAND: Don't look at me.

DR. DURBIN: The easy answer is no, I don't know of papers like that. In Florida -- and North Carolina has phosphate mining as well. In Florida we have an entire institute that's a branch of the university system called the Florida Industrial and Phosphate Research Institute that has an incredible library. And so most of it is searchable online, so whoever asked that question should type in FIPR Florida and you'll come up with that institute. I don't know what else you'll come up with, but FIPR is what we refer to it as, and it has, like I said, a very sizeable library on all things phosphate. And I'm sure there's something there that would address the geology of phosphorus.

CHAIRMAN SMITH: I have two more here, and then I think we will have asked all of the questions that were handed up, unless some got lost in the shuffle, which is entirely possible. The first one is how is Florida integrating water quality and water quantity issues, and do you have any advice for North Carolina? That's one question.

MR. McCLELLAND: I don't think they're doing it well, and the reason why they're not doing it well is that water quantity is to a large degree controlled by the water management districts. As you may know, in Florida we have five water management districts, three of which are large, and they're all ad valorem based. So they generate a significant amount of revenue. They're responsible for water quantity. Water quality is to a large degree controlled by the Florida Department of Environmental Protection. Now, some people would say that the water management districts work for FDEP. Other people would say that they don't, but bottom line is they don't work well together. They tend to put them in a silo, and that's where that integration comment came from. That applies not only to local communities as well as regional, but to me it really applies to the state of Florida. It has to be done in an integrated process, water quality and quantity.

I think that half of the work to be done for TMDLs is related to quantity, not quality. And yet sometimes we forget that point, so I don't think that the state of Florida does well on that. The state of California does well on it. They kind of invented the concept of integrated water resource planning, and I would encourage all states to get involved in integrated water resources. The problem is who does it. In the state of Florida it should be, I think, the water management districts, but they don't have an interest in doing that. So the issue is I think it has to happen at a state level, mainly because it's watershed based; it's not municipal based. It's not county based. It's watershed based and, therefore, the state should have inactive hand in combining water quality and quantity integration.

DR. DURBIN: So the silver lining, though, is that every summer there's a large course, a symposium offered in south Florida -- everybody is invited -- that addresses all types of regulatory issues. I was invited -- I've been a speaker on nutrient criteria there for the last half dozen years, but I was invited this year to moderate a panel on exactly that topic, the ways to use water supply as a tool for improving water quality. And so I'm pulling together panelists for that who will address everything from water quality credit trading to urban storm water reuse, which is a great opportunity.

One of the ones that a water management district is doing now, the South Florida Water Management District, which is the behemoth, actually has millions of dollars available now for what they're calling payment for environmental services. And if you haven't heard of that -- I'm not sure how applicable it would be to North Carolina with the differences in land uses, but in the southern part of Florida there are vast tracts of range land, cattle rangeland, that's been ditched and drained historically. And the water management district will come in and pay the private landowner to put in ditch blocks, sometimes put in berms so that as the summer rains come, they hold backwater on their landscape, which causes less of a flooding problem for things like Lake Okeechobee and southern Florida. And as the water is sitting there, it's recharging the aquifers as it moves down, and it's filtering out the phosphorus and nitrogen as it goes through the soil. So that's a pilot project.

There have been two different pilots that have already been done, and they're into round two of identifying large landowners who will play that game. And if you can get all the legal stuff and the economic stuff worked out, it has a whole lot of promise in areas where you have large open tracts of land.

MR. McCLELLAND: I can tell you in Florida that that's not generally being driven by the water quality. It's generally being driven by the water quantity or the drinking water supply, which is very short. And they better deal -- they have to deal with something in Florida or we're in real trouble. So bottomline is the water quantity is going to drive the improvements to water quality.

CHAIRMAN SMITH: This last one comes in, I think, on behalf of the people in the audience who like to fish. Is it safe to say, to some extent, the higher nitrogen and phosphorus levels, the bigger the fish?

MR. McCLELLAND: Policy, no. It depends on the lake. I do think it depends on the lake, and, as I said before, I really think it's a balance. There's a balance of biology. There's a balance in nutrients. There's a right number for each system and, you know, one size doesn't fit all. But bottom line is you need to figure out what that is for your system. It's not the same for every place. I think we did, actually, some paleontology, and some of the lakes had very, very large chlorophyll numbers, you know, thousands of years ago. So, you know, is that a problem? Well, bottom line is the balance for the system, and I'll say that over and over again.

MODERATOR: Please join me in thanking our speakers from Florida. [APPLAUSE] And I do know one additional way they are integrating water quality and water quantity, and that is that with the tri-states litigation and all this litigation. They've given it to the lawyers anyway, so keeping hope alive, which I hope is not true for us here in North Carolina.

[END OF Q&A SESSION 4]