2013 State Nutrient Reduction Strategies Web Series

Nutrient Trading in the MRB:
Possibilities for Improving Gulf Water Quality and Ideas
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Instructors:

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Cynthia Curtis
All right. Welcome to the twelfth webisode. Today, May 29th, 10:00 Central, we have Michelle Perez from World Resource Institute here to talk about nutrient trading in the Mississippi River Basin. If you're having any technical issues -- I notice some people are already using -- you can start a private chat with me as the host, and we can work through any of your technical issues. Or if you're not sure how to do that, just use the chat box there, and I'll work through some things with you. Now, Michelle has a lot of material to cover with us, and I want to hand things over to her. And I'm going to just switch gears because I think she's got a couple things to keep us on our toes throughout the presentation. So Michelle, why don't you take it away?

Michelle Perez
Great. Thank you, Cynthia. It's a pleasure for me to be able to give you this technical version of this Nutrient Trading Feasibility Study. Some of you might have heard about it because I promised to give the Hypoxia Taskforce an opportunity to hear the details and the weeds other than the 20-minute talk I gave back in Louisville a month ago. So hopefully, you're interested enough to stick with it. I'm going to through a lot of details at you and basically walk you through the most important highlights of our findings. And that will turn you on to thumbing through the 130-page report to find the sections that you're most interested in, because there are so many different issues and topics related to nutrient trading. You'll see there's a prep question for you to answer at the beginning of this webinar, and then there are six follow-up questions that will pop up at the end of the webinar as we transition to Q and A. And per EPA's webinar approach, you'll get to see me on video, answering the Q and A, and Cynthia will be leading the questions that you can type in into the chat box. So I can't hear you, but I'll read your questions, and Cynthia will read them out. Let's see. We've got a lot of people answering the question already, and we've got quite a number of participates. I only recognize a few names there, so welcome, everybody. I guess, by way of a little bit more background, this is a feasibility study for what happens when -- for answering a big picture question about can nutrient trading be helpful to states as they grapple with the concept of trying to do their share of reducing the dead zone in the Gulf of Mexico? Cynthia, do you think I should get started?

Cynthia Curtis
Absolutely, go ahead.

Michelle Perez
All right. And remind me about advancing the slides. Is it my right arrow, left arrow, or my mouse?

Cynthia Curtis
Yes, the arrows down at the bottom of the screen will navigate you through everything.

Michelle Perez
Great. I see them. And then you can see my mouse moving, so I can point?

Cynthia Curtis
Use the arrow at the top of the screen. Do you see that if you click on it and activate it as a pointer -- there you go.

Slide: Nutrient Trading in the MRB: Possibilities for Improving Gulf Water Quality and Ideas for State Nutrient Reduction Strategies

Michelle Perez
Okay. Thank you. I'll park it over here for now. Super. All right. So the study is about nutrient trading, and our focus, our water body of concern was the Gulf. But because the policy activity right now is focused on the State Nutrient Reduction Strategies, I'd like you to be all thinking about how nutrient trading can also be useful for cleaning up local water quality issues and in so doing, perhaps, if the goals are tied right, having some sort of a -- making a difference for the Gulf, as well.

Slide: WRI's Nutrient Trading Feasibility Study Team: Michelle Perez, Sara Walker, Cy Jones

So this is our trading feasibility team. I'm on the left, Sara Walker is in the middle, and Cy Jones is on the right. Many of you might know Cy Jones from the wastewater treatment plant community. He literally wrote the book on trading and has since retired but works on a part-time basis with us.

Slide: Outline

So I'm going to go through our policy methods and assumptions. I'll quickly jump to what many think is, you know, the topic du jour, that of TMDLs and local numeric nutrient criteria, and let you know what we see about their impact on trading if the water body of concern is the Gulf. I'll go into what we found from our wastewater treatment plant cost analysis, our agricultural cost analysis, and some surprising findings about the profitability of conservation, even without trading, on selected acres. Even though it's not the goal of trading to get all the acres in a watershed to achieve the water quality goal of trading, we thought it would be neat to ask that question anyway, and I share some findings about that. And then wrap up -- and here's the bottom line first -- we did find that trading can be economically and environmentally a feasible tool for helping achieve Gulf of Mexico clean-up. Finally, I'll end with some next step ideas for the State Nutrient Reduction Strategies and share some highlights from the interviews we had with the wastewater treatment community, the regulatory community, and the agricultural and environmental communities.

Slide: The Project

So to back up, we couldn't have done this without an EPA Targeted Watershed Grant and a small grant from the Wells Fargo Foundation. We were one of nine groups that received a grant from EPA to study nutrient trading, and I believe we chose a scale that was the largest of all the projects, that being the entire MRB and the Gulf of Mexico. We hired two very excellent wastewater engineering and water quality consulting firms, Symbiont for the wastewater utility cost analysis and HydroQual for our nutrient criteria and our delivery factor analysis. We had pro bono partners in two utilities who shared with us their master plan data for 20-year horizons, the Metropolitan Water Reclamation District of Greater Chicago, or short, MWRDGC, and Sanitation District Number 1 of Kentucky, SD1. And we were stumped for quite some time as to how to proceed on the agricultural credit supply analysis until we were lucky enough to land a partnership with the USDA Natural Resource Conservation Services Conservation Effects Assessment Project team, CEAP for short. And they lent us their expertise, their data, and their models, kept them all in-house, but worked with us to design the project analysis and conduct analysis and share with us the modeling output. So again, we asked a very big question: Is large scale interstate nutrient trading an economically and environmentally feasible tool to help reduce Gulf of Mexico hypoxia?

Slide: Project Approach

So how do we do this? Well, it's a case study approach, right? We had to create a trading framework that was hypothetical because there is no driver currently that is leading -- getting the attention of wastewater utilities. We conducted an economic and a modeling analysis. We used data from these wastewater treatment plant utilities from '06 to '09. We used farm conservation data from the USDA Natural Resources Inventory CEAP survey of real farmers from -- asking them about their crop years 2003 to 2006. And we just had to say, you know, we're going to ignore the source of runoff from urban and suburban sources to make our lives a little bit easier. And to reiterate, no farmers were interviewed in this project, but many others were. So in the wastewater treatment community, of course, our two utilities were interviewed before during and after this project.

Slide: Interviewed Stakeholders

And the state regulatory agency in Illinois was interviewed. We didn't get around to interviewing Kentucky's agency, so we regret that and we apologize for that. We also touched base with several staff at various EPA regional offices. And in our two project watershed areas, Arkansas and Mississippi -- I'll be showing you a map of where everybody is located in a little while -- we hoped to get everyone, all the likely suspects, to the table, not only the agricultural community but also -- let's use the pointer here -- the environmental community, the Departments of Environmental Quality in both states, the State Conservation Commissions in both states, the federal representatives of NRCS in both states, the Farm Bureaus of both states, as well as a conservation trade association called Delta Farm in Mississippi and the Land Grant extension community in both states.

Slide: What is Nutrient Trading?

So just to make sure everyone is on the same page, I wanted to briefly go through what -- the basics. What is nutrient trading? And it's a voluntary approach that is a relationship between regulated point sources and other regulated point sources or unregulated nonpoint sources. It focuses on harnessing the powers of the market to find cost effective opportunities for achieving goals. So what do you have to have? You have to have a specific water quality goal that you want to make progress towards, and trading allows you to identify the most cost effective nutrient reductions and go after those first. So for credit buyers, it's the regulated wastewater treatment plants who want to satisfy their permits via purchase of credits or a combination of credits and on-site upgrades, and credit sellers are other regulated wastewater treatment plants who have more expensive on-site upgrades than the -- less expensive than the credit buyers and unregulated farmers who may have cheaper nutrient reduction costs than the buyers.

Slide: Trading Takes Advantage of Cost Differentials

And this is an example of a study we did in the Chesapeake Bay, and we reviewed the literature on the various nutrient sources, stormwater, septic, wastewater, new practices, in-stream, and agriculture. And you can see that there's huge orders of magnitudes of difference in these nitrogen reduction measures, stormwater being the most costly, followed by septic, then wastewater, then a variety of agricultural conservation practices having a big range of cost effectiveness, dollars per nitrogen pound reduced, and you have in here the in-stream treatments using oysters and algae turf scrubbing. So note that, you know, studies are constantly updated, and location, location, location. These -- this was the average estimate of nitrogen reduction upgrade costs here in the Chesapeake Bay, and if you remember that dollar value, around 50, you'll see that in our study, with these two utilities in the MRB, we found costs that were a lot smaller.

Slide: Project Policy Framework

Okay. So again, whenever anyone mentions nutrient trading, one of the first questions I want you to ask, if you aren't already asking, is, "Well, what's the water body of concern that nutrient trading is being used to help address?" Our water body of concern was the Gulf of Mexico hypoxic zone. And then the second question you need to find out is, "Well, what's the water quality goal in that water body that nutrient trading is helping to facilitate?" And we looked around and, like everyone else, saw the 2007 Science Advisory Board recommendation that a 45 percent nitrogen and phosphorus delivered load reduction to the gulf is what is needed to achieve a smaller, safer hypoxic zone. So we adopted that as our project framework.

Slide: Demand and Supply Locations

And we decided to look to partner with two utilities as our case study buyers, and this is the Des Plaines watershed in greater Chicago for the MWRDGC utility, and it turns out to have the second, seventh, and 11th largest discharges in the country, so an example of the very largest of the large utility facilities. Our other utility is an example of a medium-sized utility with the 47th largest discharge in the Middle-Ohio River Laughery -- I'm covering up my complete name here of the watershed -- in Kentucky. And we had three watersheds that we chose in the delta areas, meaning the flat, alluvial plain areas, of Arkansas, amounting to 2.8 million crop land acres, and three delta watersheds in the alluvial areas of the state of Mississippi, amounting to 1.9 million crop land acres. These are our credit buyers and our credit sellers in our hypothetical framework.

Slide: Project Policy Framework

So what do we do? We have to take this water quality goal and figure out what that means for these potential buyers. So we thought, well, what it means is that the wastewater treatment plants would be expected to reduce nutrient reduction discharges by 45 percent delivered to the Gulf or achieve an equivalent amount of reduction from credit purchases, or do some combination. And so how do we do that? Well, we used the standard engineering approach to this. You found out what the design flow capacity -- not today's flow, not yesterday's, not tomorrow's -- but the design flow capacity, so being very conservative, and then you take the latest available nutrient concentration data -- and there are the years for the two utilities -- and then you find out, well, what is 45 percent N and P reduction from those loads and concentrations?

Slide: Project Policy Framework (2)

For the farm credit suppliers, we said, well, it's all about achieving water quality. So we had to put in an additionality principle here, which is, before selling credits, individual suppliers must first achieve their project area's per-acre trading eligibility standard, okay? So what does that mean? It means -- here's an example. The nitrogen trading eligibility standard measured in pounds per acre was found by summing up or finding the average baseline nitrogen load coming off of these project areas in Arkansas and project areas in Mississippi during the timeframe of available data that is actually reaching the Gulf -- so not just edge of field, but all the way reaching the Gulf -- removing 45 percent out of that, and dividing what's left into the number of crop land acres. And that was our approach that we thought, and after consultation with many folks in the environmental community and the agricultural community, really makes sense because you're trying to have individual farmers know where their baseline loads are at in relation to the average baseline load of their watershed. And they have to reduce, if they happen to be higher, more emitting of nitrogen or phosphorus than that average amount reflecting the water quality goal. They have to reduce that amount before they can reduce even more -- and so the even more, the excess -- as credits because they have to do their fair share first, right? Otherwise, you would be trading away the water quality goal, and clean-up would

not occur. Trades would occur, but clean-up would not make -- would not occur. And I'm going to go into that with a couple of diagrams later. So if it's not clear now, hopefully it will be a little clearer later.

Slide: Additional Trading Ratios

A lot of folks get hung up on trading ratios, rightly so, given the uncertainty involved in nonpoint source nutrient reductions. They also want to include retirement ratios and reserve ratios to account for, you know, catastrophic weather events that blow out the conservation practices and for various crises that might come along. We definitely reviewed the literature on that, but at the end of the day, we decided we were creating this hypothetical trading study that was so complicated already we did not want to add an unnecessary layer of complication. So we decided -- and because of our experience in the Chesapeake Bay, where the EPA watershed model and the water quality model already has a built-in level of, margin of safety and already accounts for uncertainty, we didn't want to layer on another level of a trading ratio to account for uncertainty yet again, potentially being redundant with any of the models that we'll develop for the Mississippi River Basin. So if and when a trading program occurs for the Gulf, for the MRB within states, everyone should be asking questions about, well, does the model account for uncertainty? How does it account for uncertainty? Do we need to apply a trading ratio to account for more uncertainty? So you all need to be aware of that, but for our study, we decided not to do it.

We do have a nice discussion in our uncertainties section of the report and analyzed what would the effect be if you applied the uncertainty ratio to the buyer, where most folks think, say, it's a two-to-one ratio, every buyer has to buy two credits for every one that they actually need? What happens when you put that burden on the seller, and what happens when you share that burden equally between both buyer and seller? So a really neat section that my colleague Sara Walker took the lead on, and I encourage you to go check that out.

Slide: Unaddressed Costs that Could Affect Trading

Other unaddressed costs were we couldn't figure out how to deal with cost-share. So everyone, as trading programs have materialized, everyone follows the usual course of action, which is to seek out federal or state conservation financial assistance and technical assistance to help farmers get through the first stage, which is getting to that trading eligibility standard starting line. And then, once you're part that starting line, that trading eligibility standard, then the dollars that come in are from the regulated wastewater utilities, from the credit buyers themselves, to pay for the reductions beyond that trading eligibility standard. But we couldn't figure out how to ask the model to do that, and there's a variety of cost-share, 50 percent, 75 percent, payment rates on different percentage bases, et cetera. So we just said, you know what? We're going to make it simple, straightforward, transparent. The entire cost to get a farmer below the trading eligibility standard and generate credits will be assumed by our credit buyers. And we thought, oh, this could be trouble. But it turns out there's such a big cost differential that it's very affordable for our hypothetical credit buyers. And also, we ignored the reality that trading programs will likely charge administration fees. And aggregators, who will work with many groups of farmers and be the go-between between the farmer community and the wastewater community, they will likely charge fees. We have a nice little discussion there on the order of about ten percent of the trading contract could be what an aggregator solicits in terms of fees. So just know that all of these things are not in our study and will have to be accounted for if and when trading programs materialize. But I think you'll see that there's sufficient cost differential between buyers and sellers to account for these additional costs.

So let's go right into the Local Numeric Nutrient Criteria and TMDLs. You know, everyone is rightly concerned about nutrient trading and the potential for sacrificing local waters for downstream water quality goals.

Slide: Effect of Local Numeric Nutrient Criteria and TMDLs on Trading for GOM

Nobody wants that to happen, and the Clean Water Act will likely not allow that to happen. And reviewers of NPDS permits will likely not allow that to happen. And one way we make sure that doesn't happen is to first check, well, what are the water quality conditions in the receiving waters of the wastewater treatment community in our study? So none of our project watersheds for either of the utilities had numeric nutrient criteria, though Illinois EPA is focusing on the likely of the two, phosphorus, which is the nutrient that causes local water quality conditions while nitrogen is more of a downstream condition. And I'm talking in very big generalities here. So they are talking about developing numeric P criteria, and if that should happen in a receiving water body that the utilities, MWRDGC, discharges into, well of course that criteria would have to be met first before reaching a water quality goal for the Gulf if that local criteria is stricter than the one for the Gulf, right? So that makes sense. And that's how you ensure you can trade, you continue to be able to trade, but you restrict geographically the market for trading to upstream and within that local watershed affecting that water body with the numeric P criteria. So trading is still going to be in the policy toolkit for MWRDGC for phosphorus, and they just have to decide whether they have sufficient supply to make it worthwhile, or they're going to have to rely on on-site technology upgrades to satisfy those numeric P criteria.

In our credit seller watersheds, we did find one sub-watershed in the Mississippi project watershed that did have a TMDL for a very large, large reduction, 85 to 95 percent of the N and P was attributed to -- of the reduction needed in the TMDL was attributed to agricultural nonpoint sources. So again, the Clean Water Act says that this TMDL would have to be met before this project tries to trade to achieve a Gulf of Mexico water quality goal. At this high rate of called-for reduction, it is a little difficult to see how they would have to first meet this, and then beyond 85 and 95 percent would be the allowable credits to be sold. So this is a bit of a big hurdle for those farmers in this sub-watershed.

Slide: Trading Market (Orange) When Gulf is Water Body of Concern

So here's a geographic representation of what happens when you have numeric nutrient criteria. Here's the MRB and the project watersheds in the Gulf of Mexico depiction there, with the hypoxic zone. The trading market, when the Gulf is your water body of concern, is in orange, meaning the entire MRB is your oyster. You can -- as a buyer you can find sellers in the entire MRB when the Gulf of Mexico is your water body of concern.

Slide: Trading Market (Orange) When Local River is Water Body of Concern

If you were the wastewater utility MWRDGC in the Des Plaines watershed, and now there's a tiny little red line here -- let me bring my cursor over here -- reflecting a numeric nutrient criteria, now your trading market opportunity, when you have a local river that is your water body of concern, is now geographically constrained to all sources within the watershed that is deemed to be contributing to the local impairment with the numeric nutrient criteria. So this is an important thing to keep in mind about the tension between local concerns and Gulf concerns and the importance that all of the right stakeholders are at the table -- environmental, agricultural, point source, and regulatory -- have to play when reviewing the state of the science and reviewing the political decisions that have to be made about local water quality policy and regional water quality policy.

Slide: MWRDGC's Planning Levels Similar for N but More Stringent for P than Project's Goal

So let's go into it. What do we find about our wastewater treatment plants? So MWRDGC has seven plants, but we liked the data that we saw from two out of the three that gave us data. This happens to be the seventh and the 11th largest discharging plants in the country. They were discharging at about ten and three milligrams per liter of nitrogen. Their master planning data suggested that they thought

in the future they could receive an NPDS permit requiring them to only emit six to eight milligrams per liter, and to get to our project's policy goal of a 45 percent reduction, they would need to get down to 5.6 milligrams per liter. In loading amounts, that translates from 58,000 pounds per day to about 32,000 pounds per day. So their master planning data, what they were anticipating they'd need to do, we used all of that information because it was roughly exactly what we had to achieve for our project policy goal. The story is a little bit different for phosphorus. We actually -- they are currently emitting around this much phosphorus, milligrams per liter. They thought they would have to get a lot lower than this project's 45 percent P reduction goal. And so we actually had to back out and remove some of those phosphorus reduction technologies from our cost estimate and our reduction estimate to get to our project's policy goal.

Slide: SD1's Planning Levels Similar for N but More Stringent for P than Project's Goal

The same story is true for SD1, and they have two out of three plants that we focused on here. They have a third plant coming online very soon that we also analyzed. But for available current effluent concentration, it was about 14 and seven. They thought the planning level would require them to get to eight and three. Our project's policy goal meant around seven. So we used all of their information about nitrogen upgrade technology costs, and then we did not need to go as far as where they thought they might need to go for phosphorus, when you have a 45 percent reduction goal, and we backed out some of those phosphorus costs, again.

Slide: Utility Price Ceiling for Credits

All right. Here's the bottom line, that to get to the project's goal on an average annual basis, the MWRDGC, at these two utilities, would have to roughly spend around $47 million in nitrogen technologies and $47 million in phosphorus technologies to reduce by 45 percent delivered to the Gulf. I want to quickly jump you to the 20-year present value. We used EPA's standard engineering approach to account for present value costs with a discount rate of three percent. You know, it's not just capital costs, but also annual operations and maintenance costs here. So over 20 years, this is $696 million, roughly about $700 million for phosphorus, as well, is the bill that utilities, the rate payers, and policymakers are going to need to look at. And this is the dollar value I want you all to try to remember. So it takes about $4.50 for MWRDGC to install nitrogen on-site technology upgrades to achieve a 45 percent reduction delivered to the gulf. The dollar value for SD1 is a lot higher, around $12 per pound of end reduced. And that -- you know, it's difficult to say why there's such a big discrepancy. I'm sure volume has something to do with it, tank capacity. You know, the engineers, we have a nice little description there, but note that there is a range here. There is much smaller of a range about phosphorus. It's much more expensive to reduce phosphorus, and there's a lot less phosphorus to be reducing. But those technologies are more expensive, and they're around the order of 26 and 30. Okay? So these are the prices that the two utilities likely want to investigate, vis-a-vis trading, to see if they can meet some or all of their permit requirements via trading at a cheaper price.

Slide: Credit Demand Assumptions

So without knowing what they would do and how they would react to these findings, we said, well, they could conceivably say, "I'll be interested in trading if I can find credit costs that reflect 25 percent of my on-site cost, 50 percent of my on-site cost, or 75 percent." And of course, lo and behold, the utilities said, "Yeah, 25 percent would be more on the average of what we'd be interested in. We need that kind of a savings, 75 percent savings, to be able to convince our rate payers and our tax payers and our policymakers that trading is economically justifiable as an option for us."

Slide: 6 Agricultural Credit Supply Project Watersheds

So moving on to the agricultural credit supply analysis, this is just a zoomed-in view to show you where these two project watersheds are. Three of them are in Arkansas. They make up the majority of the four-digit watershed 0802. Three of them are in Mississippi, making up about half of 0803. Distant crop sizes, farmland in total about 4.7 million acres.

Slide: Credit Supply Data and Models

We partnered with CEAP again, and we used their CEAP NRI Farm Watershed Survey. If you've ever seen these surveys, it's amazing. It takes about three hours for an interviewer to go through with the farmer. It's about 40 or 60 pages and asks you under the sun you could imagine. What you grow? How did you grow it? How was your rotation? What did you apply? And what are your conservation practices from these crop years? And so this really reflects the baseline field conditions for existing crop management and conservation practice adoption for those field years, all right? So obviously, you know that we heard that a lot has changed since then. And so any nutrient trading program going forward, any effort to quantify costs, needs to reflect the best available and more current information, of course, but this was the best available that we had at our hands.

And so you take all this information from 400 interviews in these six watersheds, and the model statistically extrapolates it to areas outside of those fields that are of similar crop and hydrologic conditions. That's how modeling works. And it's the agricultural policy -- I think I dropped the word environmental -- extender model, the APEX. It's one of the most famous, widely used, widely recognized, calibrated, and published models in the US, as well as the world, to model these nutrient loads at edge of field, EOF, before and after the model then did all these hypothetical conservation what-if scenarios, you know, what is it going to take to get these sample points and the extrapolated acres below the trading eligibility standard? And then the NRCS used both their APEX delivery factors and the USGS SPARROW delivery factors to move those nutrient loads from the edge of field all the way to the Gulf.

Slide: Delivery Ratios

And -- this is pretty funny -- there we go. One more click. All right, that works. So in terms of delivery factors for the wastewater utility watersheds, we used the best available USGS SPARROW data from 2009 that said because Chicago's utility is so close to the main stem of the Mississippi, surprisingly, eight-tenths of every pound of nitrogen makes it all the way to the Gulf of Mexico. And, you know, on the same order, seven-tenths, pretty much eight-tenths of a pound of nitrogen from the SD1 facilities make it all the way to the Gulf of Mexico. Phosphorus is a little bit different story. You know, Mother Nature should be thanked for removing four-tenths of every pound before it makes it all the way to the Gulf. Down here, for the agricultural loads, you see that APEX has edge of field delivery factors to the mouth of the eight-digit watershed; SPARROW takes it from the eight-digit watershed to the Gulf. Multiply the two, you have a delivery factor from edge of field all the way to the Gulf. So this is -- you have to account for these delivery factors when you're trying to clean up a particular water body of concern. All right.

Slide: Credit Supply Modeling Approach

So in addition to the APEX models, CEAP lent us the use of two economic models. They used a cost minimization model to select the least cost treatment for each sample point to achieve the TES, meaning what's it's going to take, what suite of conservation practices is going to be the cheapest for farmers to get to their trading eligibility standard in their project watershed? And then, when we introduced credit prices into our hypothetical market, now farmers can react to those prices and say, "Well, which now is my best selection of conservation practices to maximize my profits?" Now they're

not just caring about minimizing costs but maximizing profits. So we went a little bit overboard with the NRCS team. We said even though we know the Science Advisory Board recommends both an N and P reduction goal, states and regions could decide, well, we're going to set a nitrogen-only trading eligibility standard before farmers get to trade for either nitrogen or phosphorus, we're going to set a phosphorus only standard, or we're going to set both standards. So we analyzed the effect of all three options. We know that additionality is a very politically contentious, socially, mathematically, and scientifically difficult issue to grapple with, and a lot of trading programs have dealt with them differently. So we analyzed what will happen when additionality is enforced and when it's not enforced, and I'll go into more detail about what that means. And then finally, we don't know whether wastewater utilities are going to be in the market for both N and P credits or they're only going to be in the market for nitrogen or only in the market for phosphorus. And just a little heads-up, what we heard from the utilities is very likely that nitrogen is going to be more attractive to them for nutrient trading because they don't see water quality, local water quality concerns with that. So if they get a Gulf goal for nitrogen, it's far more likely they will be interested in nutrient trading for nitrogen while they may be more interested in investing in on-site technology upgrades for all or some of phosphorus goals given they're likely to see, in the near future, phosphorus numeric criteria.

Here is the range of prices that we used to model the nitrogen credits, and if you recall, you know, $4.50 and $11 were the price ceilings for the utilities. These were the dollar values that we focused most of our time on. And here are the phosphorus prices, and remember the $30 range was the utility price ceiling for our two utilities. So we spent most of our time looking at these phosphorus prices.

Slide: Baseline, TES, Credits, Oh My!

All right. So here is the promised graphical description of what baseline and trading eligibility standard looks like. In our Mississippi project watersheds, all three combined and averaged, the average amount of nitrogen coming off of the farm fields in these three Mississippi project acres was 60 pounds of nitrogen per acre. This is very high. This is -- nobody wants that. The farming community doesn't want that. That is wasted fertilizer and nutrients that is not helping any crop grow. So on average, that's the baseline load for '03 to '06. So what is 45 percent less of that? That means that average farmers, if you're an average farmer -- and nobody thinks they are, of course -- need to get down from 60 to 34 to get to the trading eligibility standards starting line. So the conservation cost minimization model comes along and says, well, what's my choice of one, two, three, seven, et cetera conservation practices to get me below that trading eligibility standard? This first one came up -- it did not get me below the standard. I need to jump to the next, more expensive suite of conservation practices. This one worked. It got me below the trading eligibility standard, the model counts these reductions to achieve the standard, but then only counts the reductions below the trading eligibility standard as credits that can be given to the buyers when you're below this trading eligibility standard, right? So nutrient trading facilitates excess reductions from the farming community because they're doing their fair share here first to count for their contribution to the Gulf of Mexico, and they're doing extra to sell to higher cost wastewater utility buyers. This is how we achieve additionality in producers that are above the trading eligibility standard, okay.

Slide: Farmers Have Different Baseline Conditions So Will Experience Different Levels of Reduction to Get Beyond TES

Now, what happens when you are a producer that is way above average? Well, you have a lot longer way to go. You have a lot more work to get to the trading eligibility standard before you can sell credits. There are going to be farmers who are a lot closer, and there are going to be farmers who are already below the trading eligibility standard. And you know, we don't know why that is. A, it could be they're excellent farmers. They are so-called, quote unquote, good actors. Or it could be that they just got lucky and inherited a farm that has low slopes, has non-highly eroding soils, maybe is not a

livestock operation -- and by the way, we didn't focus on livestock in this project because it's mostly a crop production. You know, there's a whole slew of reasons why farmers are above, far above, or far below -- trying to move my arrow here. There we go -- far above, just a little bit above, or below. So it's either due to merit or to luck or to some combination of both.

Slide: Additionality?

So what do you do? How do you deal with these so-called good actors already? Well one way is you do not enforce additionality, and you allow them to sell as credits the reductions between the TES and their baseline load as a thank you. You know, thank you for your investments in the past, or thank you for just being, through no effort on your own, just having a farm that, you know, already has very low emissions. You're not part of the problem. We've identified you. We've counted you. Thank you for that. Folks -- of course, you're going to think that folks in the agricultural community are, by and large, wanting this world vision to materialize. Folks in the environmental community are concerned about that because the model is already counting them, and yes, we want to thank them, but if they want to participate in nutrient trading and receive those scarce resources that are coming from the conservation programs or coming from the wastewater utilities, they should be, yet again, part of the continuing solution. And they should have to install new conservation treatment that is additional, and those immediately, right away, can count as credits. So they don't have any, you know, starting line to get to because they're already below the starting line. So this is a very political and mathematical and scientific hot potato, but as you can see -- I'll show you some slides later -- it affects a minority of farmers, and, you know, maybe the communities can think of alternate ways than spending the very limited conservation dollars to thank these farmers, maybe farm signs, you know, that say, "I'm not part of the problem" or, you know, "I gave at the store today" or "at the bank." "I'm already part of the solution." "I already met my pollution reduction goal," something like that to recognize their efforts or some kind of compromise about how much of the limited budget they get to request.

Slide: CEAP Modele4d Six Conservation Treatments

So these conservation treatments -- well, we basically had six of them at our disposal. So this is -- drainage water management is an annual practice; cover crops, an annual practice. And then structural erosion -- and I'll show you the list -- there are about six of them that can, you know, take the annual practices or up to ten, 20 years. When you combine that erosion control suites of practices with nutrient management, we called it erosion and nutrient management. When you combine erosion and nutrient management with drainage water management, we called it that. And then when you combine it with cover crops. So it's a limited, very common suite of conservation practices -- pardon me -- that we had at our disposal, so just need to be aware of that. There are far many more practices that are in play in both of these states, as we were informed by the agricultural community who also thought that those practices were more expensive than the practices shown here. So all of this has to be updated in moving forward and recognizing the current conditions.

Slide: CEAP Assembled State Practice Costs

Here's drainage water management. You know, we not only did installation costs, but also technical assistance costs, and so it's about $9 per acre -- per unit, sorry -- on a protected acre or about a whopping $73 -- cover crops are very expensive -- that these groups of practices are the structural erosion control practices, and I ordered them in smallest to largest costs involved. And here's nutrient management planning to the tune of about $40 per acre. So those are some of the state costs as reflected in the '03 to '06 data in both states.

Slide: Focused on Net Costs

And another thing for you to all realize is that most trading program analyses will focus only on the conservation practice installation, maintenance, and technical assistance costs. But because we had access to the CEAP NRCS model, they could also tell us about fertilizer application costs. Some cases fertilizer bills went down, and we were able to count that as a net cost. Sometimes crop revenue yields went up. Sometimes they went down. So we were able to account for that fluctuation. And whenever the cover crops were used, you always saw a corresponding rise, a small rise, in the diesel fuel costs because of the additional passes over the field. So every time we saw a net cost in our study that was negative, we got very excited because that meant a net savings to the producers -- profits from conservation practices alone.

Slide: Apportioning Net Costs into Lbs Reduced

And how did we attribute to the reductions to the costs to come up with cost effectiveness? Well, unlike most technologies in the wastewater utility, where it's a nitrogen technology, has a nitrogen associated cost, you know, we have practices in the farming community that yield both nitrogen and phosphorus reductions. So after a lot of consultation, we didn't see any way around it. You take all the costs associated with those suites of practices, ignore phosphorus for just a little bit, and divide it by all the nitrogen pounds to come up with your dollar per pound average estimate for that effort. Then you ignored nitrogen, you took all the costs, divide them by all the phosphorus pounds, and came up with your dollar per pound of P reduction. So what you should know is that both of these are valid estimates of the costs to sell your minimum willingness to accept prices for nitrogen, and then if you're lucky enough to find a market also for phosphorus, you can choose to sell them for something other than this averaged-out amount because you're already selling nitrogen costs. So these are very conservative estimates of the costs to the farming community.

Slide: Even Without Trading, Conservation Pays on 12–19% Project Acres

Okay. So right away, here are some -- the neat surprising finding we found with some conservation on some acres, that even without trading, before we even introduced credit prices, we found that conservation pays on 12 to 19 percent of these project acres in both states because farmers were able to lower fertilizer purchases and crop yields increased. So those benefits outweighed the costs of the conservation practices and the technical assistance and the small increases in diesel fuel costs. We were very excited to see this. And when very low credit prices were offered, this signaled that even more conservation could be found to be profitable on about one out of four acres in the project watersheds. So if anything, you know, it might be a long time for nutrient trading to materialize in the Gulf or materialize for local water quality, but here is an opportunity for the Land Grant University agronomic economists department to start, you know, doing a lot more analyses. I know they already are, but to help figure out how to find the farmers and the acres and the conditions where there's a lot of savings to be had from investing in conservation. That's my hope in the short term, and I'd love to be part of that conversation. So contact me via e-mail, or give me a call to talk about how we can make -- help move that forward.

Slide: Findings About Ag's Achieving the Trading Eligibility Standards and Ability to Participate in Trading

Slide: Differences Between AR and MS Watersheds Baseline Conditions ('03 – '06)

All right. So what do we find about the trading eligibility standard? You know, big and scary, 45 percent reduction. Well, let's start with what did we find about the baseline conditions? And we thought that we would find a lot of similarities between our three Arkansas watersheds and our three Mississippi watersheds because they were right across the river from each other. They were basically

growing the same things. But we saw very different conditions that some are in control and out of control of the farmers' hands. And Mississippi seemed to really get the short end of the stick. It is wetter in Mississippi. The rainfall is more intense in Mississippi. The field slopes are longer in Mississippi. And therefore, the sediment loads coming off of the fields are a lot higher in Mississippi. Use of the conventional tillage is more dominant, and on the flip side, use of no till, a conservation practice, is higher in Arkansas. Unfortunately, both states have very low use of conservation practices except for drainage, so they're not taking advantage of those structural erosion control practices that we identified. And very few acres in both states have control of overland and concentrated nutrient flow. So huge opportunities for improvement, and again, this is '03 to '06, and we know that the Mississippi River Basin Healthy Watersheds Initiatives are operating in all these project watersheds, and we hope to hear good things about the significant rise in conservation practice adoption in both of these areas.

Slide: Differences (cont'd)

As of 2003, when you looked at all crops together and you added up all the nutrients applied to all those crops, you found that, on average, a lot more nitrogen was being applied on an average per-acre basis in Mississippi than in Arkansas. And a lot less of the nitrogen was coming from nature's nitrogen miracle, that being soybeans and other legume nitrogen fixers. So Arkansas has definitely gotten the message about incorporating more soybeans into their rotations. As these yields suggest, for all the minor conservation increases and efficiencies in Arkansas, they're not suffering for it and, in fact, their yields are a little bit higher than in the Mississippi watersheds for corn, wheat, and cotton. So they're having good conservation results and good crop yield results.

Slide: Higher Baseline Loads and TES in MS Areas

So this is an edge of field -- so what do we know, is that -- remember the number 60 from that slide? So on average, the baseline load at the edge of field for nitrogen for the Mississippi project acres is about 60 pounds, and they need to get to about 34 pounds. This uncontrollable load allocation here is our way of incorporating what SPARROW identified as uncontrollable loads forest land, barren land, something land -- I can't -- shrub land -- I don't remember what the third category is -- that had a very, very tiny effect. So, you know, we could have almost ignored it and not done anything about it, but since we were trying to clean up the Gulf, we wanted to account for all of the sources. And you can see a huge difference, 68 pounds of nitrogen per acre on average coming off of Mississippi fields versus about 23, 24 pounds in Arkansas, about 5.6 pounds of phosphorous coming off edge of field versus three in Arkansas, okay?

Slide: Higher Baseline Loads and TES in MS Areas (2)

So now we move to looking at this same information from delivered to the Gulf. Now it's just about 49 pounds that are making it all the way to the Gulf. They've got to reduce to 27 before they can sell credits. Arkansas is around 18. They've got to reduce to about ten before selling credits, 2.6 for phosphorus, get to 1.45; 1.84, get to one.

Slide: Lots of Acres Have a Ways to Go

So as you would not be surprised, a lot of acres have a long way to go. So about 87 percent of the Arkansas project acres are not meeting the nitrogen and phosphorus 45 percent reduction standard just yet, and 79 percent of the project acres in Mississippi are not yet meeting that project standard.

Slide: Lots of Acres Can Get There

Well, the really good news is that with this limited suite of conservation treatments that we modeled, 69 percent of them can get there. And even better news is that 16 percent of all of these project acres, 44.7 million of them combined, are already below the trading eligibility standards for both nitrogen and phosphorus. So these are the good actors or the lucky actors, however you think of them and see them, that are not part of the problem. And you have to figure out what to did with them vis-a-vis additionality. And these folks can make it to the trading eligibility standard and participating trading. These folks with this sixth suite of available conservation treatments cannot get there. They can get to N or they can get to P, but they can't get to both N and P. So these folks would need more intensive treatments than the six available that we modeled.

Slide: Least-Cost Solution to Achieve TES is Different for Each State

So what is the solution set to get those able acres, the 69 percent, to the trading eligibility standard? Well, you see it's different. In Arkansas, the majority of those 1.8 million acres would find that installing structural erosion control practices is what makes the most -- is the least cost solution to get them to both the N and P 45 percent reduction goal. In Mississippi, the largest group of acres out of 1.4 million acres that represents their 69 percent that can make it would have to do something more intensive. They would have to do both erosion and nutrient management, plus cover crops, okay. But overall, the largest group of acres is doing structural erosion control, when you're looking at it overall in both states. So this is really nice to know, you know. So even if trading doesn't materialize having, you know, these watershed scale and edge of field models helping to calculate baseline loading values and solution sets for each different project area would really mean a lot. You know, this could really help set policy in the right, most cost effective step forward.

Slide: Net Costs Still Large for All Project Acres to Achieve the N and P TES

So at the end of the day, net costs are still very large, okay, for those 69 percent or so of the project acres to reach both N and P trading eligibility standard. Other studies would focus on this dollar value only. It would cost 90 million in Arkansas and 113 million. But because we accounted for this nice, sizeable reductions in fertilizer bills in both states and the nice increase in crop yield to the tune of $5 million because crop yields increase, crop revenue increased, Arkansas did suffer 18 million in crop revenue reduction because their yields went down, and both had a very small, minor increase in fuel costs from the cover crops. So when you add all this up at the end of the day, it's still very costly, a little less costly in the Mississippi watersheds, to reach both N and P trading eligibility standards. This is not required for them to reach this, right? You're a farmer. You just manage your own operation. You can begin trading right away when you satisfy your own portion of the trading eligibility standard. But this is just a look at, you know, if you were trying to get a whole heck of a lot of acres to reach this goal, how much would it cost?

Slide: Net Cost for 6 Project Watersheds to Achieve Gulf Goal is 4–5 Times Statewide EQIP Funds Received

To put these costs into perspective, this is how much the entire state of Arkansas, over similar timeframe as this, you know, prior to 2006 or so, used to receive every year from the largest working alliance program EQIP. So you know, our current voluntarily policy approach is under-funding these project watersheds of four to five times, and they are distributing these funds over the entire state of Arkansas while we're finding costs attributable to geographically constrained locations, right? So the bottom line here is that our voluntarily policy and program approach is working but is woefully under-funded to help us try to achieve Gulf of Mexico nutrient reduction goals. So until we muster the political power to raise those conservation program dollars, nutrient trading offers an interesting alternative source of funding from the wastewater treatment plant utility community.

Slide: When Getting All Able Acres to Achieve TES, Net Costs Per Lb are Cheaper in Mississippi

So when all is said and done, getting those able acres to achieve the TES, everything is much cheaper in Mississippi. So even if they have to do more, because they had significantly higher baseline loads, their credit costs are going to be much cheaper and more active than those in Arkansas. All right.

Slide: Findings About Trading's Economic Feasibility

Slide: Nutrient Trading in the MRB is an Economically Feasible Approach to Help Restore Gulf of Mexico Water Quality

So long story short, get to the findings du jour, we found that nutrient trading in the MRB is an economically feasible approach to help restore Gulf of Mexico water quality.

Slide: Both Utilities Could Satisfy all N Credit Needs by Offering Prices that are Just 25% of Onsite Costs

Here is a neat diagram focused on nitrogen. MWRDGC, here on the left, needs about 160 million or so nitrogen reductions over a 20-year timeframe. Their on-site reduction costs, remember, if you recall, were $4.50 per pound of nitrogen reduced. If they offered just 25 percent, a dollar, of their on-site costs, the project sellers in Arkansas and Mississippi would respond with over 150 million pounds of nitrogen credits. So this utility could reach -- satisfy 100 percent of their nitrogen demand. SD1, one being a much smaller utility, only needs about, what, 25, 30 million pounds over a 20-year time horizon. Their on-site costs are around $12 per pound, so if they offered just 25 percent of those on-site costs, and we rounded that to $2, they could also satisfy all of their 20-year demand. The market would respond with far more credits, you see, when a $2 price is in the market than when a $1 price is in the market. So farmers would hope that there would be other buyers out there offering that $2 credit price.

Slide: SD1 Could Satisfy all P Credit Needs from Project Watersheds at 25% of its Onsite Costs but MWRDGC Can't (Even if Offered 75% Onsite Costs)

Story is different for phosphorus. It always is. Turning to SD1 first, they need around 4 million pounds of phosphorus reduction over a 20-year timeframe. Their on-site costs were about $26. If they offered about 25 percent of that, they'd be offering a $5 credit price. The market in Arkansas and Mississippi would respond and easily satisfy their 20-year demand for phosphorus. Given the huge size of MWRDGC, they need just under 25 million pounds. But even if they offered 75 percent of their on-site costs, $20, they would still only be able to satisfy 37 percent of their demand from these six project watersheds. So for phosphorus, for such a high demanding utility like MWRDGC, they would definitely need a much greater market size to satisfy their phosphorus needs.

Slide: N Trading Could Save Utilities $900M to Meet N Gulf Goal and Earn $700M in Producers Net Profits

In the end, looking at nitrogen only, nitrogen could save the utilities about 900 million in avoided on-site costs, and they would have to spend around just under five -- about 500 hundred million on credits to satisfy their NPDS permits for nitrogen. And farmers responding to those prices would gain about 700 million over 20 years, not only from selling the credits, but also from the savings from just installing conservation practices alone that make them money.

Slide: Producer Profits from Trading Sufficient

So when we showed these profit margins to the farmers, both states said, "You'll get some takers." I thought that was a really neat way to say it. So in response to nitrogen credit prices, profits for farmers ranged between $25 to $60 per acre and, for phosphorus, ranged from $18 to $42 per acre. And farmer participation, depending on the prices offered, could occur on 12 to 40 percent of the project crop acres. And so we were trying to think, well, how do you put these dollar values -- is this a lot or a little, you know -- into context? And you should search the section on the interviews, but basically, some folks said, "Well, this amounts to one herbicide application cost for farmers that I know of." So engaging in nutrient trading could help pay for their fertilizer -- or for their herbicide cost. Another farmer said, "Oh yeah, you could go on a great vacation for this," so a different motivation. So there's a variety of ways to think about how enticing this may or may not be to some large, small, a variety of different farmers and their different motivations.

Slide: Sufficient Cost Differential Between Buyers and Sellers to Cover Transaction Costs and Program Fees

And this is one final chart here that I wanted to show. On average, if you combine both of these utilities, their average price for upgrading for nitrogen would be about $11 and they'd need about 8.7 million pounds. Well, if they offered that price in the market, the supply would easily be satisfied. There's 8.7 million pounds of supply, depending on all the different policy rules about trading standards and additionality. What I want to show here is that there's a big cost differential between their maximum willingness to pay and their cost to supply, the agricultural cost to supply these credits. And so it's in this cost differential where you could find ways to cover the transaction costs and cover the administrative fees and the aggregator fees. So there's room for negotiation, price negotiation, between the utility and the agricultural sectors.

Slide: Impact of Trading Scenarios on Credit Supply

At the end of the day, when you have both nitrogen and phosphorus trading eligibility standards, of course, as you would expect, you would generate more credits than with just one trading eligibility standard because farmers have to do more to get to those start lines. When you -- also as expected, your volume of credits is going to be larger if additionality is not enforced than if it is, though your water goal could be compromised. And when you have both nitrogen and phosphorus prices, that stimulates more acres to engage in trading. That generates larger volumes of credits, and farmers experience higher profits than when only one price is offered in the marketplace. If only one price were offered in the marketplace, a nitrogen price stimulates more credits than a phosphorus price.

Slide: Outcome

And the higher the price, the larger the volume of credits offered, as you would expect. So at the end of the day, we concluded large-scale interstate trading in the MRB is a cost effective option for helping to achieve potential future gulf hypoxia clean-up goals. The potential credit prices offered by utilities is likely to stimulate sufficient credit supply. And it's a triple win. Utilities can save money by purchasing credits, agricultural credit suppliers can generate money by selling credits, and if the trading program is well designed, all of this activity is making progress towards the specific water quality goal in this specific water body.

Slide: Next Steps and Ideas for State Nutrient Reduction Strategies

So because trading for the Gulf of Mexico may be a long ways off, and because what's an action play right now of the State Nutrient Reduction Strategies, I wanted to just offer three, you know, next steps forward for all of you engaged in the State Nutrient Reduction Strategies effort. You know, you could

think about and figure out where, which of your local watersheds do you think the conditions are right with policy and the conditions are right with both buyers and sellers being located in the right positions in the watershed so that trading could help achieve those local TMDL goals or remove water bodies from the impaired waters list or achieve numeric or narrative nutrient criteria? Well, then get all the right people into the room, the wastewater utility community, industrial facilities, the environmental and agricultural stakeholders, to define and design that trading program and agree to trade to achieve a specific water quality goal. And along the way, harness all of the brightest minds possible from the universities, from the environmental water quality agencies, from the agricultural agencies, from USGS, EPA, and USDA to develop the needed datasets, models, and tools for quantifying baseline from ag, how much is coming off now or X to Y timeframe that we have the best available data for? What will it take -- which suites of practices and what combinations are the most cost effective for reducing nutrients? And what is that cost to get to the trading eligibility standard and, beyond, to sell credits?

Slide: Interview Highlights

And I've got two more slides here just to share with you some highlights of the interviews. The wastewater treatment plants were very gracious and shared with us very honest opinions. You know, they said that the project was very interesting. It was great for them to participate and learn about. They said, sure, trading is an option but there's no policy signal right now telling them to get interested in trading. So it is very hard for them to give us their opinion about how likely it is they would look -- engage in trading. They said, you know, we're kind of uncertain about our legal authority to engage in trading. You know, who would we need to go get permission from to engage in trading? And it's not going to be easy. We have a big political challenge before us to convince our rate payers and our policymakers to allow credit purchases outside of not only our wastewater utility jurisdiction but even outside of the state, as we have indicated in our study. So allowing those dollars to leave the state is going to be a big political hurdle that they're willing to engage in, and they also did make a big point of saying, you know, we're not going to proceed without serious consideration of the environmental community as well as local watershed groups who are going to be concerned about the effect on local water quality. And finally, one of the utilities was very frank about pointing out the perceived unfairness of the Clean Water Act and its lack of regulatory authority over nonpoint source agricultural pollution sources. And therefore, given this longstanding constraint about our national water quality policy, you know, they see trading as the latest ramification of that unfair policy, that trading is now coming along and is the new opportunity for state and federal water quality regulators to further clamp down on the point sources and make them become those credit trading buyers, although, you know, the flip side is, well, at least you have an option for meeting regulatory permits if you're not already permitted for nitrogen and phosphorus, which we were surprised to find our two utilities were not, by and large, and most of the utilities in the Mississippi River Basin do not yet have nitrogen or phosphorus permits. So at least if and when the regulators come along and say you do need to have nitrogen and phosphorus permits tied to either local water quality or regional water quality goals, at least trading becomes an option to weigh the cost effectiveness policy options for each facility.

The regulatory agencies said that they enjoyed reading the report as well, it was highly educational, and they were interested in being there at the trading program development and implementation policy table. But they expressed concerns that they are currently understaffed right now. They've got a lot of NPDS permits that are behind schedule. Folks are operating on expired permits, and so they're worried about their administrative capacity to effectively participate in trading program development.

Slide: Interview Highlights (2)

The agricultural community said the same thing, you know. "It's kind of hard for us to react to this study, Michelle, when we don't have any policy signal affecting us right now." But anything that achieves more conservation and brings more funding to farmers, they were interested in. So from that perspective, they were interested in trading. And they definitely highlighted the need for field-level credit calculation tools and watershed-level planning tools to help them figure out what their baseline loads were and their credit calculation costs. And they really emphasized that, "'03 to '06 was a long time ago, Michelle. And yes, that was the best available data then, but moving forward, we need the farming community to have their current farm and their current conservation practices reflected in these models and tools and calibrated to the local field conditions." And we couldn't agree with that more.

And then, of course, we need to have buy-in from the farming community into those tools and into trading. And one area that I think everyone needs to start talking about is, just like the wastewater utility, you know, pointed fingers at the farming community, the farming community pointed fingers back at the wastewater utility and said, you know, "What we're really concerned about it fairness. So trading, to us, although it's going to have upsides for some farmers who might make a profit at it, isn't there -- you know, it could be perceived as shouldering the burden for others, that it's the wastewater utility that have the permit concerns and are big contributors. They are huge point sources, and we are tiny, disbursed nonpoint sources across the landscape. You know, aren't we just giving them an out?" So there are significant finger pointing issues going on, and, you know, it's important to get folks to the table to work through the science, the economics, the technology, the political, and the cultural challenges that surround all things water quality policy.

Slide: Thank you!

So with that, I will end. And below, my contact information if you wanted to all jot that down. I would love to hear from you. If you wanted access to the report, you can go to our blog site which is insights.wri.org, and there is the title, Can Nutrient Trading Shrink the Gulf of Mexico Dead Zone? That's the title of my blog, and so it's a very short, concise summary of findings if you ever wanted to share it with somebody rather than this very long PowerPoint presentation. And then at the bottom of that blog is the link to the full 130-page report. So I think I'll take a breath and turn it over to Cynthia, and I think you've got some post-webinar questions as we transition to the video, and you can ask more questions.

Cynthia Curtis
All right. Thank you. Thank you for the presentation, Michelle. I did just recently put up for people a couple of questions just to kind of reflect in general what kind of impact did this presentation have. And if it had an effect, under question one, yes or no, and then question two, what kind of effect was that? And I'll start sharing -- you'll start seeing the numbers change as people go through this. And while people are entering in that, she has a -- Michelle has a couple of other questions for you. But in the interim, I see people are making use of the chat box and asking some questions. So Michelle, do you want to take a question now, or do you want me to go more through some of the other questions you have, just to get a general read?

Michelle Perez
Maybe let's stay on these post-webinar questions just yet before we turn to the technical questions.

Cynthia Curtis
All right. Sounds good. So next question: Do you think nutrient trading could be an effective policy option for making progress towards a smaller dead zone in the Gulf of Mexico? And while people are considering that one, question four: Do you think that nutrient trading could be an effective policy

option for making progress towards local water quality goals? And let's see -- the final for now, question five: Do you think that nutrient trading should be a policy option for states as they develop their nutrient reduction strategies? So Michelle, I hope, as you're watching the results, this gives you a sense of what people are thinking.

Michelle Perez
Yes, absolutely. And I'm also reading the technical chat questions to try to get a heads-up on what people are interested in.

Cynthia Curtis
All right. So I'm going to take us away from this screen and let you go ahead and fire up the video cam. I'm going to start going through the questions in the chat box, but if you have some specific things that you want to relay to Michelle about main concerns about nutrient trading, you can also input those under question six. And just so you know, those won't be broadcast across the webcast but, you know, depending if there are some specific questions that are relevant, if time allows we'll discuss them during this webcast. All right. So let's get started. Eloise Kendy: What would it take to rerun the models with different assumptions?

Michelle Perez
Oh, I didn't see that one. What would it take to rerun the models with different assumptions? It would take a lot, unfortunately. It would take somebody who has a very good working relationship with current Conservation Chief Weller to ask his permission to divert the CEAP project team away from their many other projects and rerun the model under different conditions. But I think NRCS was pretty pleased about our working relationship with them, and if your policy assumptions or your, you know, different conditions are of interest to NRCS, I think that you might have some luck. And, you know, offline, if you want to contact me about what those different policy conditions would be, I could be an advocate on your behalf if I was also, you know, very interested in seeing that.

Cynthia Curtis
All right. Another question that's not up on the chats but came to me from this room is: Were there any assumptions -- or what were the assumptions related to climate change that were accounted in your -- in the modeling you described?

Michelle Perez
Yes we have a nice little section on climate change in our main report, and then our subcontractor, HydroQual, whose report is also available, as is the Symbiont report -- you can just e-mail me, request those two reports -- but we pulled the highlights of HydroQual's review of climate change and provided a nice summary in our report. You know, basically -- I'm not going to remember this correctly, but I think there is a whole range of how climate change may result in greater precipitation and greater nutrient runoff, so if that is where the trend is occurring, then perhaps if and when an updated goal from the Science Advisory Board or another scientific body comes, we might have to see greater nutrient reductions being called for. That having been said, please also turn to the section of the report where we talked about this mysterious 45 percent reduction goal. So we read the fine print in that Science Advisory Board, and that 45 percent reduction goal was based on the largest available series of data from, I'm going to say, '80 to '96 -- don't quote me. It's in the report. But if -- but they also calculated, well, what would the number percent reduction be if you used a different timeframe? And I believe it was a more recent timeframe, so I'm going to say the last ten years, '96 to '06, and they found that it would be more like a 35 percent nitrogen reduction and a 57 percent phosphorus reduction -- again, don't quote me. It's in the report. So at the end of the day, it could be a different number if and when we start trying to accomplish Gulf reduction goals. But then, you know, let's do the math. 35 and 57, on average, is about 45. So we'll see what materializes.

Cynthia Curtis
All right. The next question is from Ed Righter: Farmers are very interested in cost and yield. What are the reasons why conservation increases yields while also reducing nitrogen and phosphorus?

Michelle Perez
Yeah, so it is a really interesting finding, you know. Why -- farmers are so focused on yield. Why would they be giving up yield? Why would they not be aware of the opportunity to increase yield and lower fertilizer bills at the same time? And you know, this is a $60,000 question, or a $4 million question, something like that. You know, the University of Arkansas ag economists that we interviewed said, you know, "We're working on that. We have a crop budget approach. We are gaining a lot of information from farmers and using it in our outreach activities. And we are finding that they are very receptive to redoing the economics calculations in a new way and finding that they can achieve greater profitability with lower fertilizer bills." What we heard from the Mississippi community, and all of this is summarized in the report, was that, "Well, this is very interesting, Michelle, but, you know, farmers sit at the coffee shop, and they talk about crop yields. It's all they focus on. And yes, we concede that the farmer who is winning the crop yield conversation could be less profitable than the farmer who is having lower yields, but that's what they do." And so there is an opportunity there to revisit that culture of yield, to revisit the corn contests that may be driving that cultural focus on yields, and to turn people to the more appropriate -- and what everyone ultimately wants to focus in on is the issue of profitability. And it's harder to do that because people don't talk about their salaries, right? We do not talk about who is making what. And so it's harder for farmers to have conversations about profitability because that also could give away their secret recipe for success, and that's all very proprietary. And so I think there is tremendous opportunity for the agricultural extension, economics department, the science department, the yield guys and gals to all revisit this issue and figure out how to identify who can benefit from conservation profitability.

Cynthia Curtis
Okay. All right. The next question: Assuming a trading market aiming for the 45 percent reduction, how long would it take to see a 45 percent reduction at the Gulf of Mexico?

Michelle Perez
That's a great question. I don't know the answer to that question, but, you know, we have to know in the MRB the USGS SPARROW model tells us that when you look at the pie charts for nitrogen and phosphorus, we see that -- I think it's about 70 to 80 percent, and I'm going to forget which one, of the loads are currently being attributed to the agricultural sources. So they're in the Gulf of Mexico water body of concern conversation. There is an inherent ceiling that will limit the usefulness of nutrient trading based on this disproportionate amount of the pollution sources coming from the agricultural sector. So since trading relies, by and large, on the regulatory capacity to require reductions from the wastewater and industrial sector, it can -- trading will be helpful and the most cost effective solution currently available to engage the agricultural sector that on a level of implementation of conservation practices never seen before, that will catapult activity, education, implementation, make progress towards the 45 percent reduction goal. But if, you know, in a perfect policy world, 100 percent of all the possible permit holders receive permits, there will be an inherent ceiling on the effectiveness that trading can contribute to the policy options. But you know, right now we're along way from getting anybody -- getting a lot of folks regulated for N or P, and we're a long way from finding, you know, large-scale pots of money for implementing conservation practices on a very large scale given -- you know, we do receive a lot of funding from the Farm Bill, but as I had indicated, it's quite a long ways off from the amount of funding necessary to achieve such large policy goals such as 45 percent reduction.

Cynthia Curtis
All right. Well, we have three questions on the chat and a couple more in the question box and two minutes of time. So we will --

Michelle Perez
-- allow us to go to 1:00 o'clock -- I mean, to go 30 minutes more, Cynthia?

Cynthia Curtis
It was an hour and a half total. So let's see what we can do. Mary Ellen Vollbrecht asked: Have you looked in these areas for potential savings from long-term avoided nitrate reduction costs to public water utilities whose source water areas overlap with the lands where nitrogen input is reduced?

Michelle Perez
Not sure I follow that.

Cynthia Curtis
I think what she's looking at is the cost to public drinking water, so looking at --

Michelle Perez
No, excellent. I mean, I think in the realm of -- did I just lose you? Okay, good. In the realm of all of the potential buyers, you know, public drinking water utilities have a maximum contaminant level they have to reach, so it would just be a little bit of a different policy driver for them to engage farmers in either a nutrient trading policy framework or what's more commonly referred to as green versus gray so that they can avoid, like you said, their nitrogen reduction, nitrate utility upgrades, and pay farmers located upstream from them to install nitrogen reduction practices on a more cost effective basis than them. So I think a lot of the same principals would apply. It might be called something different. You might have different rules, but it's pretty much the same concept. But we didn't focus on wastewater utilities -- excuse me, water utilities. We focused on wastewater utilities.

Cynthia Curtis
All right. Wayne Anderson asks: Gulf-based point source nutrient standards and permits seem along way off to drive trading. Do you see a policy requirement offsets of new or expanding nutrient sources a more near-term application of the study approach?

Michelle Perez
I do see that it might be a long term off but -- that is probably -- and we have a lot of precedence for that approach, that we ask all new and expanding sources to be better than the grandfathered sources. That's certainly the case in the Chesapeake Bay policy arena where the Bay received a TMDL for nitrogen, phosphorus, and sediments and, therefore, it's a cap on pollution which is sort of the policy vision for this 45 percent N and P reduction goal cap on delivered load to the Gulf. And so anybody who wants to be and expend a new source of that N and P pollution or needs to expand their ability to pollute would have to 100 percent satisfy all of those additions to the nitrogen per-solution load through off sets, through credit purchases. So I would definitely envision that being the case. Unfortunately, you need the policy cap in place, either a TMDL or some other policy driver, to get the attention of those new or expanding sources.

Cynthia Curtis
All right. We had a couple other questions, but we have run out of time today. I want to thank everyone for joining us, and thank you so much, Michelle, for your time and your presentation on the report. I'm going to send Michelle some of the follow-up questions that came up that if she -- if you all are so inclined, you can follow up individually on them. Just so you know, next week, June 5th, we're going to have our next in the nutrient strategies webcast series. It's Using Interactive GIS to Plan Nutrient Reductions. So again, thank you very much, Michelle, for your time.

Michelle Perez
You're welcome. And folks who haven’t had their questions asked or answered, don’t hesitate to email me or give me a call and I’ll be happy to engage you on your questions.