SUPREME COURT OF THE UNITED STATES
No. 142, Original

STATE OF FLORIDA,)
)
Plaintiff,)
)
V.) VOLUME XV
)
STATE OF GEORGIA)
)
Defendants.)

TRANSCRIPT OF PROCEEDINGS

The above-entitled matter came on for HEARING before SPECIAL MASTER RALPH I. LANCASTER, held in the U. S. Bankruptcy Court, at 537 Congress Street, Portland, Maine, on November 29, 2016, commencing at 9:00 a.m., before Claudette G. Mason, RMR, CRR, a Notary Public in and for the State of Maine.

APPEARANCES:

For the State of Florida: PHILIP J. PERRY, ESQ.
JAMIE L. WINE, ESQ.
ABID R. QURESHI, ESQ.
DEVIN M. O'CONNOR, ESQ.
GEORGE C. CHIPEV, ESQ.

For the State of Georgia: CRAIG S. PRIMIS, ESQ.
DEVORA W. ALLON, ESQ.
BRITNEY A. LEWIS, ESQ.
ANDREW PRUITT, ESQ.

Also Present: JOSHUA D. DUNLAP, ESQ.

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PROCEEDINGS

MS. ALLON: Good morning, your Honor. Georgia calls Dr. Sorab Panday.

THE CLERK: Please raise your right hand.

Do you solemnly swear that the testimony you shall give in the cause now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?

THE WITNESS: I do.

THE CLERK: Please be seated.

Pull yourself right up to the microphone and please state your name and spell your last name.

THE WITNESS: My full name is Sorab, S O R A B, last name is Panday, P A N D A Y.

MS. ALLON: Dr. Panday is an expert in groundwater modeling.

And may I hand up a copy of his direct to the Court?

SPECIAL MASTER LANCASTER: Sure.

DIRECT EXAMINATION

BY MS. ALLON:

Q. Dr. Panday, you recognize what I have just handed out as your prefiled direct testimony?

A. **Yes, I do.**

Q. And do you adopt it as your sworn testimony in this matter?

A. **Yes, I do.**

MR. QURESHI: Good morning, your Honor.

SPECIAL MASTER LANCASTER: Good morning.

MR. QURESHI: Before I begin, I would like to introduce my colleague, Ms. Devin O'Connor, who is instrumental in assisting me today.

SPECIAL MASTER LANCASTER: Good morning and welcome.

MS. O'CONNOR: Good morning, your Honor.

MR. QURESHI: Your Honor, we have cross-examination binders for Dr. Panday.

SPECIAL MASTER LANCASTER: Surprise.

MR. QURESHI: There are actually two volumes. There's only 20 documents; but because of the size of the documents, we split it into two binders.

SPECIAL MASTER LANCASTER: Fine.

CROSS-EXAMINATION

BY MR. QURESHI:

Q. Good morning, Dr. Panday.

A. **Good morning.**

Q. Sir, I would like to begin by discussing the geology and the groundwater hydrology of the ACF Basin. And to do that, I would like to turn to tab 1 of the first binder that was provided to you. That should include a copy of your direct testimony in this matter.
A. **Yes, it is.**
Q. May I request that you please turn to page 12 of your direct testimony.
A. **Yes, I'm there.**
Q. And I would like to begin by focusing on the map that you have depicted on page 12. You have the ACF Basin highlighted with five different aquifers in the area. Is that correct?
A. **Yes. That's correct.**
Q. I would like to walk through the identity of those five aquifers starting with the one that is at the southern tip of the ACF Basin. Do you have -- can you identify them and work our way up.
A. **Yes. The southernmost aquifer that we see there is the Upper Floridan Aquifer.**
Q. And that's depicted in the blue color?
A. **That is depicted in the blue color.**
Q. And above that in the turquoise color, is that

the Claiborne Aquifer, sir?
A. **The lighter blue color is the Claiborne Aquifer, yes.**
Q. And above that in the purple, that is the Clayton Aquifer?
A. **Yes. That's correct.**
Q. And above that in green is the Cretaceous?
A. **Yes.**
Q. And the one at the top in the pink or salmon color is Crystalline Aquifer?
A. **Crystalline, yes.**
Q. Okay. And what you have depicted on this figure are the outcrop areas; is that correct?
A. **Yes. That is correct.**
Q. And by outcrop you mean the area where each of the depicted aquifers is closest to the surface of the earth?
A. **Yes.**
Q. Okay. So you would agree, sir, that putting aside the Upper Floridan Aquifer for the moment, the Claiborne, the Clayton, and the Cretaceous, they reach the surface in the middle and upper portions of the ACF River Basin?
A. **Yes.**
Q. Okay. And while you explain in your direct

testimony that these particular aquifers have lower connectivity, lower transmissivity than the Upper Floridan, you acknowledge that they do directly intersect with the streams in the ACF River Basin in the depicted areas?
A. **Yes.**
Q. And if we're just focusing on the Claiborne, Cretaceous, and Clayton, there is approximately 136 acres -- sorry, 136,000 acres in Georgia's portion of the ACF River Basin that are irrigated with water from the Claiborne, Clayton, and Cretaceous Aquifer?
A. **I do not recall the numbers off the top of my head.**
Q. I understand. Perhaps you can turn to page 46 of your direct testimony, and you will see a table on page 46.
A. **Yes.**
Q. Does that table refresh your recollection that there's about 136,000 acres that are irrigated with water from the Claiborne, Clayton, and Cretaceous?
A. **In the outcrop area as well as underlying the Upper Floridan, yes.**
Q. And in evaluating the groundwater hydrology, you

did not exclude those acres?
A. **No, I did not.**
Q. And in your direct testimony, you calculate that at a peak summer month, the maximum impact that groundwater withdrawals from those three aquifers, the Claiborne, Clayton, and Cretaceous, have about a 21 cfs impact on streamflow?
A. **That is correct.**
Q. Okay. Do you know Dr. Wei Zeng of Georgia EPD?
A. **Yes.**
Q. Did you work with him in connection with this matter?
A. **I have been on the phone with him with the attorneys present, but I haven't worked with him.**
Q. Did you review the direct testimony he submitted in this case, sir?
A. **I was looking at it briefly yesterday.**
Q. And prior to yesterday, had you reviewed it?
A. **No, I had not.**
Q. And were you in court when Dr. Zeng was testifying?
A. **No, I was not.**
Q. Did you have an occasion to review Dr. Zeng's transcript from his trial testimony?
A. **No, I have not.**

Q. Okay. But you would disagree with anyone who says that the Claiborne, Clayton, and Cretaceous are not connected to any streams in the ACF River Basin?
A. **The Claiborne -- these other aquifers are not connected when they are underlying the Upper Floridan Aquifer; that is correct.**
Q. What about in the outcrop area?
A. **In the outcrop areas they are incised by the streams in the basin.**
Q. And when you say incised, what do you mean?
A. **That means the streams do cut through these aquifers.**
Q. Okay. So let me go back to the question I asked. If someone were to tell you that the Claiborne, Clayton, and Cretaceous do not connect with any of the rivers or -- the streams or rivers in the ACF River Basin, would you disagree with that?
A. **I would agree with that if they are talking about the aquifers when they are underlying the Upper Floridan Aquifer.**
Q. What about if they're talking about the basin in its entirety, sir?
A. **Well, then in the upper portion, it is connected; and in the lower portion it is not. So I cannot**

just answer yes for the entire basin.
Q. Okay. So let's talk about the outcrop areas. Are they connected in the outcrop areas?
A. **Yes.**
Q. But you would disagree with someone that says they are not connected in the outcrop areas?
A. **Yes.**
Q. Sir, may I request that you turn to tab 3 of your binder.
A. **Yes.**
Q. Okay. Do you recognize the document behind tab 3?
A. **No, I do not.**
Q. Okay. This document is designated as FX-933. And it's a 1983 report titled Hydrogeology of the Clayton and Claiborne Aquifers in Southwestern Georgia. Are you familiar with the Georgia Geologic Survey?
A. **I know that there is a Georgia Geologic Survey.**
Q. Okay. And did you review any reports or publications that they issued in this matter -- I'm sorry. Did you review any reports that they issued in connection with the work that you did in this matter?
A. **I may have. I don't recall.**

Q. But you don't recall looking at this particular one, sir?
A. **No. I don't.**
Q. May I direct you to page 1 of FX-933 and ask you to read the first paragraph under scope of study. If you would kindly read that to yourself, sir.
A. **Just the first paragraph?**
Q. I think the first paragraph would be fine.
A. **Okay. I read that.**
Q. Okay. When you prepared your direct testimony, were you aware that in 1983 the Georgia Geologic Survey had commissioned a study to evaluate water level declines in the Clayton and Claiborne Aquifers in southwestern Georgia because of increases in industrial, municipal, and agricultural water use?
A. **No, I was not.**
Q. And if you now turn to the left-hand column on the page, there's a paragraph that begins, measurements of water levels. And it carries on over to the right-hand side of the page. If you might take a moment to review that, I'll have a question about the last sentence of that paragraph.
A. **Yes. I read that.**

Q. Okay. Were you aware when you prepared your direct testimony that in 1983 the Georgia Geologic Survey had concluded that the outcrop areas of the Claiborne Aquifer -- that increases in withdrawals from that outcrop area could cause declines in baseflows?
A. **I wasn't aware that -- of this document; but if you are withdrawing water, that could cause a decline in baseflows. That's not surprising to me.**
Q. And the decline will vary depending on where you're withdrawing water from. Is that correct?
A. **Sure. It would vary where you're withdrawing water from.**
Q. And as a general matter, the closer you are to the stream, will it have a greater impact?
A. **The closer you are to the stream, you will have a greater impact on the groundwater flow to streams.**
Q. And that term is -- the groundwater flow to streams, is that called baseflow?
A. **Yes. That is baseflow.**
Q. Thank you, sir.
Okay. And in evaluating the impact of groundwater withdrawals in the -- from the Upper

Floridan Aquifer, you relied on a particular model to do that analysis?
A. **That is correct.**
Q. And the particular model you rely on is associated with two scholars, Jones and Torak; is that right?
A. **Yes.**
Q. And if you turn to tab 4, sir, you will see a USGS report written by Jones and Torak. Can you please take a moment to flip through tab 4. And the document is designated as Joint Exhibit 18, and confirm that this is the document you looked to to prepare your 2006 Jones and Torak model.
A. **I believe this is the report that was produced by the Jones and Torak model -- for the Jones and Torak model.**
Q. And I notice sometimes the model is referred to with different names. Sometimes it's called the MODFE model, but I'm going to try to refer to it as the 2006 Jones and Torak model so you will know what I'm talking about.
A. **Very good.**
Q. Sir, if you can please turn with me to page 70 of JX-18. And you will see a section entitled Model Limitations.

A. **One-seven or seven-zero?**
Q. Seven-zero.
A. **Yes.**
Q. And within this section on model limitations, I would request that you please turn to the paragraph that begins at the bottom of the left-hand column. And it starts with lack of accurate hydrologic data. Can you please read that to yourself, sir, as well as the paragraph that follows that one.
A. **Yes.**
Q. Okay. Were you aware of these model limitations when you determined that you used the 2006 Jones and Torak model?
A. **Yes. All models do have limitations. However, they finally do conclude that this model is accurate for the purposes that they have used it for.**
Q. Okay. Sir, in that paragraph -- the second paragraph I asked you to read relates to the adequacy of the irrigation pumpage details that are used in the model. Is that correct?
A. **Right.**
Q. Okay. And in order to obtain details on irrigation pumpage, you relied on information

that was provided to you from Georgia EPD?
A. **Right.**
Q. And the EPD data that you relied on, it doesn't contain details on crop type; does it?
A. **The data I believe does contain details on the different crop types. I had developed my irrigation estimates using metered pumping information, and that's what he's referencing here that every agricultural plot was not metered and that there was a statistical sample that was metered. And that was used for developing my irrigation depths.**
And I used irrigated acreage databases to evaluate the irrigated areas. And different crops would have used different amounts -- different irrigation depths; but we averaged that over the whole basin.
Q. Okay. So you used an average rather than specifics associated with each particular meter; is that right?
A. **We used an average because there is rotation of crops, so you cannot really consistently say that a certain crop was grown on a certain acreage. So that's the -- that's the way we did it.**
Q. Okay. Sir, can you please turn to page 46 of

JX-18. There is a section on page 46 entitled Parameter Uncertainty.
A. **Yes.**
Q. Okay. What does that mean? What does parameter uncertainty mean?
A. **Parameter uncertainty means that there would be uncertainty in the parameters of the model.**
Q. Okay. And what particular parameters exist in this 2006 Jones and Torak model?
A. **The parameters, I believe, are the aquifer parameters, which is the transmissivity of the aquifer which determines how quickly the water can flow in the aquifer, is the storage coefficient of the aquifer which determines, I would say, the size of the voids within the aquifer which holds that water. So that would be another parameter.**
Q. Sir, can you please review the last two paragraphs of the parameter uncertainty section.
A. **Yes. I have read that.**
Q. Sir, when you prepared your direct testimony, you knew that Jones and Torak had noted particular parameters in the model were, quote, little better than educated guesses, end quote. You knew that?

A. **Yes. That's what's written here.**
I do want to point out that these -- these parameters are the -- what he talks about here, the overlying semiconfining unit heads are part of the hydrology and that the impact of pumping does not depend on the hydrology itself. It depends on the actual pumping.
Q. I understand that, sir.
A. **So as far as my evaluation is concerned of the impact of pumping, it did not make a difference if I did not have the absolute correct hydrology for the system.**
Q. Okay. When you prepared your direct testimony, you also knew that Jones and Torak had noted that particular parameters in your model were, quote, subject to large uncertainty?
A. **That is correct. But they also finally noted that this model is accurate for the purposes of figuring out how much baseflow occurs in the basin.**
Q. Okay. Sir, can you please turn with me to tab 5.
A. **Yes.**
Q. Tab 5 is a document designated as FX-49r. Have you seen this document previously, sir?
A. **No, I have not.**

Q. Okay. The portion of the document that I want to focus on is a March 29, 2013, e-mail from Mr. Woody Hicks. Do you know who Mr. Woody Hicks is?
A. **I heard the name.**
Q. Okay. Have you heard of the Jones Center?
A. **Yes.**
Q. Okay. What does the Jones Center do?
A. **I'm not sure what they do. I have heard the name.**
Q. And when you heard Mr. Hicks's name, is it in connection with the work on the ACF River Basin?
A. **Yes.**
Q. Okay. Can you please take a moment and review the e-mail from Mr. Hicks. It's at FX-49r.
A. **Yes, I have read this.**
Q. Okay. And I understand that you haven't seen. FX-49r previously, but had you previously heard any criticisms of the 2006 Jones and Torak model?
A. **No.**
Q. Okay.
A. **It's the best available model to evaluate the impacts of pumping in the basin. And even Florida's experts agree with me on that.**
Q. Okay. So you had never heard any scientist

explain that the 2006 Jones and Torak model does, quote, only a fair job at best, end quote, of predicting the impact groundwater withdrawals have on surface flow?
A. **No. Even the scientists who are on Florida's team have said that this is the best available model.**
Q. And you would agree with me that Mr. Hicks criticizes that model in this e-mail?
A. **I see that here, yes.**
Q. Let's turn back to tab 4, the USGS publication at JX-18.
A. **Yes.**
Q. Now, the model is used to evaluate groundwater impacts on streamflow in a certain portion of the ACF Basin; is that correct?
A. **This model has been developed for the Lower ACF River Basin, but the Upper Floridan Aquifer -- yes, it's for the Upper Floridan Aquifer.**
Q. And as you pointed out, it's for the lower portion of the basin where the Upper Floridan Aquifer exists.
A. **Yes.**
Q. And if you turn to page 2, I think it will show a map of exactly what you described.

Is that correct?
A. **Yes. That is the domain.**
Q. Okay. And do you know how much of the ACF River Basin falls outside the model domain, as you described it?
A. **A large portion falls outside as well, but most of the pumping occurs in the Upper Floridan Aquifer. Most the connectivity is in the Upper Floridan Aquifer. So as far as the model is concerned -- and that is what even Jones and Torak have done -- they have modeled the Upper Floridan Aquifer to evaluate the impacts because that is most significant. Other impacts are not significant.**
Q. And we'll certainly get to the significance of those impacts as well as the impacts here, sir.
But my question for you is when you were evaluating groundwater impacts on streamflow in areas outside the model domain, you did not use the 2006 Jones and Torak model?
A. **I did not model the areas outside of this domain that we see here. I did evaluate what the impact of pumping could be to the streams. And since that impact was so small, I -- and same with Jones and Torak, they did not spend the effort of**

developing a model for that.
Q. Okay. And instead, you relied on work that others had done, including a consultant for Georgia EPD called CDM; is that right?
A. **For the areas outside of this model area, I looked at the hydrogeology. I looked at the transmissivities of those aquifers. They are significantly smaller than the transmissivity of the Upper Floridan Aquifer. And as I mention in my direct testimony, it's 25 to thousandths times higher, the Upper Floridan Aquifer transmissivity. And for the connectivity is so much higher.**
So when you look at these things, you can see that the impact of pumping in this upper region of the basin was negligible. As you pointed out in my direct testimony, we saw that it was around 12 to 20 cfs.
Q. Okay. I believe you said 21 cfs in your direct testimony.
A. **I believe it was 21 cfs then, yes.**
Q. But my question, sir, was in order to look at these areas outside the model domain, one of the things you relied on was a study by Camp, Dresser & McKee, CDM; is that correct?

A. **I also looked at the report by CDM.**
Q. I want to focus now on the model itself, the Jones and Torak model, and some of the outputs from that model. One of the things that you evaluated is the impacts in dry years versus the impacts in what you call normal years; is that correct?
A. **Yes.**
Q. And when you say a dry year, is that synonymous with a drought year? Are you talking about the same thing?
A. **Yes.**
Q. Okay. And when we think about baseflow, the amount that groundwater is contributing to the stream in a dry year, is that lower than it would be in a normal year?
A. **Yes. That is correct. In a dry year, you have less rainfall, so your water -- groundwater levels are lower; and, therefore, you're going to have less groundwater flow to streams. In a wet year the groundwater levels themselves are higher; and, therefore, you have more of that groundwater flow to streams.**
Q. I see. So when you have lower groundwater because of a drought, for example, you will have

less baseflow, less contribution to streams?
A. **That is correct.**
Q. Sir, can you please turn to tab 6.
A. **Yes.**
Q. Do you recognize this document?
A. **Yes.**
Q. This is designated as FX-934. And this was part of the materials that you provided to Florida when you submitted your expert report in this case; is that correct?
A. **This was part of my discovery material, yes.**
Q. And the spreadsheet reflects outputs from the model runs that you had performed?
A. **The spreadsheet reflects the baseflows that the model provided.**
Q. Okay. And it provides baseflows in three different months -- 1992, 2011, and 2013, normal conditions, and dry condition. Is that right?
A. **It provides baseflow for four different year -- well, for three different years, 1992, 2011, and 2013. And it also provides baseflow values for no irrigation pumping at all and also the Georgia EPD 2011 simulation that they had conducted.**
Q. Okay. And my question was for each of the years that you ran, 1992, 2011, and 2013, you compared

a dry scenario, a drought scenario with a normal scenario; is that fair?
A. **No. That is not right. What I did here -- this is an intermediate step. And from this I calculated the baseflow reductions. And that is what I compared.**
Q. Okay. But I want to focus on --
A. **I did not compare the baseflow values themselves.**
Q. I understand that, sir. But I want to focus on this particular document on this intermediate step before we get to the other step.
In this intermediate step, this document depicts the normal year and drought year conditions as produced by the model that you ran; is that correct?
A. **Yes. This document -- this shows me the baseflow values that came out of the model that I ran -- the models that I ran.**
Q. And for a drought versus normal year condition?
A. **For drought year conditions and normal year conditions. I don't know what you mean by versus.**
Q. I -- if I used versus, I apologize. I didn't mean to.
A. **I wasn't comparing drought and normal years here.**

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I was comparing drought years to drought years of pumping/without pumping, and normal years to normal years. So that's what I wanted to clarify.

Q. Understood. But if you look at each of those years, '92, 2011, and 2013, and you look at the months March through August, you have higher baseflow in the dry conditions versus the baseflow in normal conditions. The number for baseflow in a dry year is higher than the number for baseflow in a normal year; is that correct?

A. **Yes.**

Q. And that result is true for all three years, the '92, 2011, and 2013?

A. **Yes. It is consistent. I have always used the same hydrology for what I termed as the drought years, and I have used the same hydrology for what I have termed as the normal years.**

Q. And that's consistent with what you have done. But I think you described that baseflow in a drought year you would expect to be lower than baseflow in a normal year?

A. **Yes.**

Q. Sir, I would like to now talk about impact factors. And that -- that's another output from

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the model?

A. **We can compute an impact factor from the model, yes.**

Q. Okay. And you explained earlier today, in fact, as well as in your direct testimony that impact factors vary depending on a variety of factors, including the distance of an irrigation well from the stream?

A. **Let me clarify first. There are several different types of impact factors. The basin-wide impact factor for an annual average condition is what I was talking about specifically. I believe that's what you are referring to. And for that, that is the impact of pumping divided by the absolute pumping value throughout the basin.**

So in that sense, if you have pumping close to the streams, your impact is going to be larger. If your pumping is further away from the streams, your impact is going to be smaller.

Q. Yes. And we'll certainly talk about the annual average impact factor. But what I'm focused on now is the fact that impact factors will vary all throughout the basin depending on where you're pumping from, the relative impact that pumping

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will have on baseflow will vary. You said so yourself?

A. **Yes.**

Q. Can you please turn to tab 7, sir.

A. **Yes.**

Q. This is a document designated as Joint Exhibit 71. Have you seen this document before?

A. **Yes.**

Q. Okay. And the document is a publication by L. Elliott Jones. Is that the Mr. Jones from the Jones and Torak model?

A. **I believe so.**

Q. Okay. I want to focus on page 3 at the map on JX-71.

A. **Yes.**

Q. Okay. Can you tell us what this map shows?

A. **Yes. This is the location-dependent impact factor. So essentially what this shows is that if at any point in this map, if you are pumping, then the color indicates what that impact would be of pumping from that location on the streams.**

So when you see the color is red, it's closer to the streams; and the impact is larger. And when the color is blue, that is further away from the streams; and the impact is less.

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Q. And the areas where there's dark red, the impact factor would be close to -- or somewhere between 90 to 100 percent?

A. **That's what is shown on this map.**

Q. Okay. And how would you describe the 90 to 100 percent? What does that number represent?

A. **That is the percentage of pumping which is captured from the baseflow. So that would be the reduction of the baseflow to streams as a result of pumping. And that value is the percentage of that pumping value.**

Q. Okay. And the little red dots throughout the map, what do those represent?

A. **Irrigated acres by node in the model.**

Q. So you understand that to be the location of the irrigation that's done in the model domain?

A. **I believe so.**

Q. Okay. You have reproduced this particular graphic in your expert testimony; don't you?

A. **I believe so.**

Q. All right. So you are familiar with it?

A. **Yes.**

Q. Okay. Sir, would you agree that as depicted in the map we're looking at, the impact factors will vary anywhere from, you know, .1 all the way to

90 to 100 percent?
A. **That is correct. This is the steady-state impact factor.**
Again, there are so many different impact factors that I do want to clarify which impact factor we're talking about because that can get confusing.
Q. I think it is important to clarify that because one of the things you do in your direct testimony is you criticize Florida's expert for what you call abandoning the impact factor. Do you recall that testimony?
A. **I don't think I said that he abandoned the impact factor. If I recall, he's changed his number for the impact factor. That's what he did from his expert report to his direct testimony.**
Q. Okay. And we'll certainly look at that, but I want to first direct you to paragraph 86 of your direct testimony. That's behind tab 1. And paragraph 86 is page 49, sir.
A. **Yes.**
Q. Okay. And you will see in the middle of the paragraph you actually state that Florida has now abandoned the opinion?
A. **This is paragraph 86. Right?**

Q. That's correct, sir, on page 49.
A. **Yes.**
Q. Okay. So you do recall using those words?
A. **Yes. And, again, that's exactly what I was saying. They have abandoned the 40 percent number, and now they're using a 60 percent number. That's what I was saying.**
Q. Yes. And that's exactly what I would like to explore next, sir. The 40 percent number, the 38 to 40 percent that you ascribed to Florida's expert, Dr. David Langseth, it's not in his expert report. Correct?
A. **He has the 40 percent number in his expert report the. The 38 percent number or around 38 percent is what I had obtained through all my model simulations.**
Q. And the 40 percent number that you're associating with Dr. Langseth, he actually says that that's the number that Jones and Torak had derived in their 2006 model. He doesn't adopt it; does he?
A. **Dr. Langseth never ran any groundwater model. He used the report of the Jones and Torak model -- 2006 model; and he extracted impact factors from that.**
Q. My question for you, sir, is Dr. Langseth never

adopted the 40 percent impact factor that's associated with Jones and Torak as his own. He never said, this is the impact factor that I'm endorsing. In fact, he always proposed a range; isn't that true?
A. **He use the 40 percent impact factor value in his conservation scenarios in the multiple scenarios that he provided in his expert report. That 40 percent value was, I believe, also used then by other Florida experts when they were evaluating their scenarios of conservation for Georgia's agricultural pumping.**
So the 40 percent value was adopted by them. They used it in all their calculations.
Q. Okay, sir. Perhaps we can refresh your recollection if we go to tab 8. That is Dr. Langseth's expert report.
A. **Yes.**
Q. Tab 8 is FX-795. And you recall reviewing this; don't you, sir?
A. **Yes.**
Q. And it's a lengthy expert report, so I'll direct you to particular pages; and you can let me know if you recall reviewing these previously.
I would like to first turn to page 54. On

page 54 is a section entitled Conservation measure scenario, 50 percent reduction in agricultural withdrawals in the Georgia portion of the ACF Basin. Do you see that?
A. **I don't see that.**
Q. Okay. That's my fault because I should have referred you to the prior page for the heading. The heading appears on page 53, section 5.2 titled Conservation measure scenario, 50 percent reduction in agricultural withdrawals in the Georgia portion of the ACF River Basin.
A. **Yes.**
Q. And then on page 54, the paragraph right before the table, perhaps you could read that to yourself, sir.
A. **Yes. I read that.**
Q. Okay. And you will see that he lists an average annual impact factor for the cells that he's selected in his conservation scenario of .56; isn't that right?
A. **This is the impact factor -- the impact factor that he selected for his conservation scenario. And this is not the basin-wide impact -- these, again, are different impact factors.**
Q. I understand, sir. If we could now turn to page

SS7.
I think SS stands for summary statement, so it should be in the front.
A. **Thank you.**
Q. And I want to focus on a paragraph where Dr. Langseth discusses the Jones and Torak model. And it's a paragraph that begins, for my evaluation.
A. **Yes.**
Q. And my question is really you understand that Dr. Langseth had characterized the Jones and Torak model as conservative?
A. **That's what he says, yes.**
Q. Right. And you understood that that was his position when you prepared your direct testimony?
A. **I have referenced each of his concerns about the model in my expert report.**
Q. Okay. And my question, again, was you understood that he was characterizing it as a conservative model and that he further characterized it at the bottom of this paragraph I just directed you to as a model that was designed to produce biased, low results. Did you understand that?
A. **Yes. I know that that's his position. And I have refuted his position in my expert report.**

Yes.
Q. But to the extent that you are ascribing to him as endorsing a 40 percent impact factor, you knew that he had these beliefs with respect to the 2006 Jones and Torak model? You knew that?
A. **He stated this, yes. But he still also stated that it is the best model available to determine the impact of pumping. And he has used the 40 percent value, too, in his report -- in his expert report for the conservation scenarios.**
Q. Dr. Panday, did you review Dr. Langseth's deposition transcript?
A. **I was there for a couple of his -- days of his deposition. But I don't believe I have reviewed his deposition transcript.**
Q. He was deposed for four days, as you know.
A. **That is right. But I wasn't there for his other -- other depositions.**
Q. Okay. Were you there for the last deposition in August?
A. **No. I was there for the depositions before -- before mine was -- before my deposition occurred.**
Q. Did you ever become aware that at his August deposition, he explained that the impact factor is a range between 40 to 60; and it could be

higher? Did anyone ever tell you that?
A. **I see that in his direct testimony; but I -- and in Dr. Hornberger's direct testimony as well. But that's all I know about that.**
Q. And did you ever follow up to see if he said that at his deposition?
A. **No, I did not. I don't have his deposition.**
Q. All right. So before you wrote down Florida has abandoned this opinion, you didn't go back and check to see if they ever talked about it at their depositions?
A. **In the direct testimony and in Dr. Hornberger's direct testimony, they start using 60 percent instead of 40 percent. So that's why I say that they have abandoned the 40 percent because this -- all the expert reports used 40 percent; and when the direct testimonies come, they all started using 60 percent.**
Q. But you understand that the depositions occurred before the direct testimony was submitted?
A. **Yes.**
Q. And did you ever review all of Dr. Langseth's deposition?
A. **No, I did not.**
Q. I want to stay on this topic of abandonment. I

want to move on to a different document. Can you please turn with me to tab 9.
A. **Yes.**
Q. Okay. Sir, you previously worked for a company called Hydrogeologic?
A. **Yes.**
Q. Okay. And Hydrogeologic was retained by the Northwest Florida Water Management District in the late 1990's to conduct groundwater modeling?
A. **Yes.**
Q. Okay. And in particular, the groundwater modeling that was performed for the Northwest Florida Water Management District, it involved the ACF Basin; did it not?
A. **We had several projects with them, and I believe one of them was for the ACF River Basin.**
Q. Okay. And the document that is behind tab 9, FX-594, that relates to the ACF Basin; does it not?
A. **Yes.**
Q. And you worked on that project?
A. **Yes.**
Q. Okay. When you were working on that project, did the Northwest Florida Water Management District pressure you to reach a certain conclusion?

A. **No.**
Q. The document designated as FX-594 was authored by you?
A. **Yes.**
Q. And it's dated June 1998. Did you prepare it in or around that time?
A. **Yes. Yes.**
Q. Can I ask you to review the last two sentences of the first paragraph on page 1.
You're certainly free to read the entire paragraph, but my questions are going to focus on that.
It's the first page of FX-594.
A. **Yes.**
Q. Okay.
A. **I have read the last two sentences, too.**
Q. At the time you wrote these two sentences that there exists a high degree of hydrologic interaction between the aquifers and the streams and floodplains and estuaries of the basin, did you believe it to be true?
A. **Yes.**
Q. And do you believe it to be true today?
A. **Yes.**
Q. And the focus of the work you were doing was to

quantify the net groundwater discharge and the fluctuations in the streams and rivers that discharge in Apalachicola Bay?
A. **I believe this work was to build upon an earlier model by Torak and McDowell, which was just a steady state model. And we evaluated sensitivities to certain parameters in this project, and we converted the model from a steady state model to a transient model. So we looked at the behavior of the system for transient cyclic conditions.**
Q. Okay. My question was just really designed to go at the last sentence on the page to see if the whole work was intended to quantify the impact that the groundwater fluctuations would have on the river and the bay. Is that why you did this work?
A. **Can you repeat your question, please.**
Q. Sure.
A. **I did not quite follow you.**
Q. The last sentence on the first page --
A. **Yes?**
Q. -- did that accurately describe the work you were doing for the Northwest Florida Water Management District?

A. **The last sentence is the entire hydrologic system, therefore, needs to be quantified to examine the effects of the various water uses upon each other and upon discharge to streams that flow into Apalachicola Bay. It's -- it really does not describe the work we did.**
The work we did was run the model for sensitivity simulations and run the model for transient simulations. So that is the work we did.
Q. And, actually, I meant to direct you to the last sentence on the bottom of the page. And that describes the work. So I apologize for that.
A. **That is correct.**
Q. Okay.
A. **The last two sentences actually talk about the work that was done here. Okay. The current study expands on these previous modeling efforts by examining a cyclic transient behavior of the system for monthly varying current and estimated future pumping rates.**
And then it says the focus of this work is to quantify the net groundwater discharge and its fluctuations to streams and rivers that discharge into the Apalachicola Bay.

Q. Okay. Thank you, sir.
Can we now turn to the conclusions of this work on page 25.
A. **Yes.**
Q. And the conclusions actually run onto page 26, but I'm interested in the two paragraphs on 25. So if you might read those to yourself.
A. **Yes.**
Q. I'll have a couple of follow-up questions after you finish.
A. **Yes. I have read that.**
Q. Okay. There's a reference in the first paragraph to the Newton, Bainbridge, and Woodruff reaches.
A. **Yes.**
Q. What does that represent?
A. **Those are reaches on the Flint River.**
Q. Okay. And when you wrote the Newton, Bainbridge, and Woodruff reaches are the most affected by pumping, did you believe that was a true statement at the time?
A. **Yes.**
Q. And when you wrote that the effects of the individual reaches result in a cumulative effect in flow reduction of the Apalachicola River, did you believe that was a true statement at the

time?
A. **Yes.**
Q. And in the conclusion section, you write that the total reduction in streamflow is approximately 60 percent of total groundwater pumped during one annual cycle. Do you see that?
A. **Yes.**
Q. Okay. And did you believe that was a true statement at the time?
A. **Yes. We used that on the model at the time. And at that time we did not have very good estimates of agricultural irrigation in the area. And for that model, we did get the 60 percent number.**
And that model has been updated by the Georgia EPD, by the USGS. They have looked at irrigation. They have tried to be a lot more accurate with their irrigation estimates. And there is a new model now.
Q. Okay. And in this report, do you advise the Northwest Florida Water Management District that the information you're presenting them might be inaccurate?
A. **We have -- at that time we used the best information that was available.**
Q. I understand.

I want to move on to a different topic now, sir; and that is your opinion that the groundwater pumping in the Lower ACF Basin has a minimal impact on streamflow at the Florida-Georgia line.
A. **Yes.**
Q. Okay. And you testified that that relationship holds even in drought conditions and peak irrigation in the Lower ACF Basin; is that right?
A. **Yes.**
Q. If you turn to page 27 of your direct testimony, you have a graph that looks at groundwater pumping in the Upper Floridan Aquifer and compares it to streamflow at the Chattahoochee Gage.
I'll give you a moment to get there.
A. **Yes. Yes.**
Q. And for this figure, you estimate that the total streamflow reductions, because of groundwater pumping in July 2011, amount to about 511 cfs?
A. **The total pumping in the Upper Floridan Aquifer in Georgia provided a baseflow reduction -- maximum baseflow reduction of 511 cfs, yes.**
Q. And, again, we're just looking at the model domain; we're not looking at the entire basin?

A. **We're looking at the Upper Floridan Aquifer; that is correct.**
Q. And you then compare that to what are the observed flows at the Chattahoochee Gage; is that correct?
A. **That's what this figure compares, yes.**
Q. Okay. So you're comparing modeled results to observed flows; is that right?
A. **That is correct.**
Q. Okay. But you're just looking at groundwater; isn't that right?
A. **This impact is just from groundwater, what we see in this figure, yes.**
Q. Okay. And do you know what the total Georgia withdrawals -- I'm sorry, the total Georgia estimated reductions to streamflow were in July of 2011?
A. **I have provided an estimate of the net -- I can point you to it; it's in my direct testimony -- of the net impact of all of Georgia's pumping on baseflow in the basin, yes.**
Q. I'm actually not asking about just groundwater pumping. I'm asking about everything.
A. **Right.**
Q. Groundwater pumping, plus surface water

irrigation, municipal and industrial use. Do you ever compare that to the flows at the Chattahoochee Gage?
A. **I have not compared the municipal and industrial. I have not included the municipal and industrial pumping from surface waters. I have included agricultural pumping in the basin. I have included agricultural withdrawals from surface waters also in the basin.**
Q. Do you know what the total number that Georgia estimates -- Georgia EPD estimates that it reduced streamflow by in 2011? Do you know what that number is?
A. **No, I don't. My number that I have for all of agricultural irrigation pumping in the basin is less than a thousand cfs.**
Q. But you agree, sir, that groundwater, surface water, it all has a cumulative impact on flows that Florida receives?
A. **Every impact is added up; so you have a cumulative impact, yes.**
Q. Okay. And if you want to figure out what that cumulative impact is, we can go to -- as estimated by Georgia, we can go to Dr. Zeng's testimony. And that's behind tab 10 of your

binder.
In particular, I'll direct you to a figure that's on page 7 of his testimony.
A. **Yes.**
Q. Okay. And you will see that in July 2011, the total consumptive use as estimated by Georgia is roughly 1800. Do you see that?
A. **Yes.**
Q. And if you compare that to the state line flows during that month, do you know what the impact is? 1800 divided by 5,000?
A. **I can do the math.**
Q. Okay. 36 percent, right?
A. **I'm not sure. I don't have a calculator with me.**
Q. Okay. Sir, I'm ready to move to another topic. And for this, I think we're going to rely principally on the second binder; but we may come back to the first one, because that's got your prefiled direct in it. So just keep it handy.
The focus of these questions is going to be whether you evaluated Georgia EPD documents when you rendered your opinion that groundwater withdrawals only have a minimal insignificant impact. Did you ever compare that against documents that Georgia EPD itself had published

on this topic? That's going to be the focus of this line of questioning.
Did you review the Flint River Basin Regional Water Development and Conservation Plan, sometimes called the Flint River plan, from 2006 in your work?
A. **I have looked at documents which talk about state water planning. I'm not -- if you can point me to the exact document, I'll tell you if I have reviewed that one.**
Q. Certainly. And that's going to be the document behind tab 11. This is JX-21. It's dated March 20, 2006, and entitled Flint River Basin Regional Water Development and Conservation Plan.
Now, do you recall reviewing this in the course of your study, sir?
A. **I believe I saw this yesterday or day before yesterday. And I was trying to recall if I had seen it earlier.**
There are some figures in there which are similar to what I have seen before.
Q. Okay. If you might turn to pages 19 and 20, you will see a list of Stakeholder Advisory Committee members and Technical Advisory Committee members.
This is 19 and 20.

A. **Yes.**
Q. Take a moment to look at those names. Do you recognize any of those people?
A. **I know some of the names. I know the name of -- I have seen the name Dr. Golladay. I have seen the name Woody Hicks, Mark Masters. And that's it.**
Q. Okay. We just talked about Mr. Woody Hicks earlier today. Did you talk to any of these people in connection with doing your work here, sir?
A. **No, I have not. But I have spoken a little bit with Mark Masters because I have run into him during the course of this work.**
Q. Okay. I want to look at particular statements in this plan and ask you if they're consistent with the conclusions that you have reached in this matter.
We can start by looking at page 15 of JX-21. And there's a paragraph that begins, water use in the Flint River Basin. And if you might read that paragraph to yourself.
A. **Yes. I have read it.**
Q. Okay. Sir, do you agree that groundwater withdrawals can reduce streamflow and, therefore,

degrade aquatic habitats?
A. **Yes. Groundwater withdrawals can reduce streamflow, and locally there could be habitats that could be affected by that.**
Q. Okay. And we're certainly going to address that issue, whether the impacts are local or more regional; but you do agree with the statement?
A. **Yes.**
Q. Now, can you please turn with me to page 21; and we'll review a series of technical findings.
A. **Yes.**
Q. And we're going to focus on technical finding 2 and 3 in particular.
A. **Yes.**
Q. Have you had a chance to look at 2 and 3?
A. **I will read them now.**
Q. Okay. Thank you.
A. **Yes. I have read that.**
Q. Okay. Is technical finding 2 consistent with the conclusions that you reached in this matter, sir?
A. **I do not know the full context of this document. But I can confirm that in some sub-basins, the impact of pumping to streamflow can be large; and in some sub-basins, there is barely an impact. And that's pretty much what I take from this**

technical finding 2.

Q. Okay. The same question with respect to technical finding 3, is that consistent with the conclusions you reached in this matter?

A. **Again, over here I don't know the context of the entire document. But he says that the data he has provides evidence that agricultural irrigation compounded the effect of climatic drought on streamflow. So essentially he is saying that both the drought and pumping can have these impacts which -- and, again, he's talking about local aquatic habitats.**

Q. Okay. He writes -- the authors write that the data provides the clearest evidence that agricultural irrigation compounds the effect of drought on streamflow. Isn't that right?

A. **That's what he says here.**

Q. All right. And he goes on to say that that effect is more pronounced during drought. Do you agree with that?

A. **Yes. There will be less baseflow during droughts. I agree with that.**

Q. Okay. And do you agree that irrigation compounds the impacts of drought on groundwater discharge into streams?

A. **Pumping of groundwater will reduce the flow of groundwater to streams. But how much, the quantity, is what I have evaluated in my evaluation.**

And he -- he's -- this is a general statement. And it does. I agree. If you pump groundwater, you're going to affect streams.

Q. Do you -- do you know who put this together, this particular document?

A. **No, I don't.**

Q. Well, if you look on the cover page, that might give you --

A. **Yes.**

Q. -- some insights.

A. **I was just going there.**

Yes. It says it was produced by Georgia Department of Natural Resources Environmental Protection Division. Carol Couch, director; Robin J. McDowell, plan coordinator.

Q. Okay. And we'll look at their quantification of amounts in other documents. But the technical findings 2 and 3 are consistent with the conclusions you reached in this matter?

A. **I agree with what he says in technical finding 2 that when you pump, some watersheds could have**

larger impacts; some watersheds could have less impacts. I agree with technical finding 3 inasmuch that if you are pumping groundwater, it will impact streams. And that if you are in drought conditions, the baseflow is going to be even less.

Q. Sir, did you evaluate the impact of agricultural irrigation on blue hole springs in Georgia?

A. **No, I did not.**

Q. All right. Do you know what blue hole springs are?

A. **I believe these are springs which get water from groundwater.**

Q. That's right. And if you -- that's exactly right. And if you turn to page 67 and 68 of JX-21, there is some discussion of this topic.

Do you recall reviewing this in the course of your work here, sir?

A. **I don't know if I read this very document. But I recall that Florida had brought up blue hole springs, so I had looked at that as well.**

Q. And is that discussed in your direct testimony?

A. **I'm not sure I have referred to blue hole springs in my direct testimony. I have looked at the local impacts that Florida has discussed.**

Q. The -- the particular blue hole spring that's referred to here is -- referred to here is Radium Springs. Have you heard of Radium Springs before?

A. **Yes, I have.**

Q. And you know it's the largest natural spring in Georgia?

A. **I don't know about that.**

Q. You were unaware of that?

A. **No, I don't know if that's the largest spring in Georgia, no.**

Q. Okay. It says here on page 67 that the flow in Radium Springs has been measured at 49,000 gallons per minute. Do you see that?

A. **Yes.**

Q. And, sir, were you aware that Georgia EPD says that Radium Springs went dry for the first time in recorded history because of drought and increased withdrawals?

A. **I have done a little analysis of Radium Springs. I looked at the flows in Radium Springs and minimum flows during droughts in past years, earlier years. And I don't recall the exact numbers, but they were small. They were, I believe, less than 10 cfs, if I recall. And if**

that became dry, so your -- the difference is 10 cfs. And I don't think that has much of an impact flow into Florida.

Q. Okay. So the answer to my question is, yes, you were aware that it went dry?

A. **I have reviewed the data, yes. And it had gone dry recently. But the flows were very low in previous droughts as well.**

Q. And according to JX-21, the flow was measured at 49,000 gallons per minute. That's approximately 70.6 million gallons a day?

A. **I see that. I don't know the context of that. I don't know whether this is an annual average. I don't know which year this was in.**

Q. Okay. Sir, do you know what a 7Q10 value is?

A. **I have heard of that, but I don't -- I'm not too sure what it is.**

Q. Okay. Did you associate it with being a low flow metric?

A. **I believe it's some sort of flow metric. I'm not sure whether it's a low flow metric.**

Q. But as a groundwater hydrologist, you haven't come across that before?

A. **I don't use this often in my work, no.**

Q. Can we please turn to page 134.

A. **Yes.**

Q. Okay. I'm interested in the table at the top of the page, this table 6.8. Do you recall reviewing that previously?

A. **No, I haven't. I haven't seen this.**

Q. Okay. If you will follow along with me, you will see that the table represents the streamflow at three different locations along the Flint River.

Ichawaynochaway Creek, do you know where that is?

A. **Yes.**

Q. Okay. Flint River at Bainbridge, do you know where Bainbridge is?

A. **Yes.**

Q. And Spring Creek near Iron City; do you know where that --

A. **Yes.**

Q. Okay. And the first row talks about the 7Q10, the low flow measurement pre-1970's. And you will see that for Ichawaynochaway Creek, that's at 140 cfs. For Flint River at Bainbridge, that's at 2500. And at Spring Creek, it's 15. Do you -- are you following me?

A. **I see those numbers. I don't know what they represent. I don't know what the 7Q10 is.**

Q. It's a low flow metric, sir.

A. **That's what you represent to me, but I don't understand what the metric does.**

Q. The metric represents the lowest seven-day average over a 10-year period.

Go down to the column that talks about -- the row that talks about current model. This is referring to the current level of agricultural irrigation as of 2006. And Georgia EPD is evaluating the impact it has on streamflows in the Flint River at these three locations. And under the current 2006 conditions, the level of agricultural irrigation reduces the streamflow 7Q10 value from 140 to 20. Do you see that?

A. **That's what this table says. Yes, I see what it says here.**

Q. And at Flint River Bainbridge it goes from 2500 to 1500. Do you see that?

A. **This table says that the number 2500 for pre-'70's data shows -- went down to 1500 for the current model data.**

Q. Okay. And the current model data was as of 2006; is that right?

A. **Where does it say that? Could you please point me to that?**

Q. It's the cover page. We just looked at it. Right?

That's when this report was issued.

A. **This document was written in March of 2006, so I'm not sure. The model could have been another year model.**

Q. Okay. You never studied this table, sir, before rendering your opinions on groundwater withdrawals?

A. **No.**

This is not relevant to my case. I don't know what 7Q10 is. I don't know what that metric is.

I have evaluated the net flow or the impact of pumping within Georgia on the net flow in the basin into Florida -- to Lake Seminole, I would say. And --

Q. And -- sorry.

A. **And that's what I evaluated. So I didn't need to -- and I don't know what 7Q10 metric is.**

Q. So was it important to you as part of your analysis to see what Georgia EPD had determined the impact of agricultural pumping would have been?

A. **I have looked at Georgia EPD's work for overall**

impact of groundwater pumping in the basin. There were a lot of documents that came my way which have little local impacts, and I did not look at those documents.
Q. Because you didn't think that they were material to your analysis?
A. **That is correct. They were not material to my analysis because these are small and local impacts. And I add them all up because finally the objective is to add up, to look at the net impact. So that is what I was done.**
Q. Okay. So a reduction of Flint River flow from 2500 to 1500, a reduction of a thousand cfs is not material to your work?
A. **I don't think it's the same as a reduction of a thousand cfs. This is some metric which is a 7Q10 metric. And I'm not sure what that is. And you're representing to me that that is an actual reduction. It is some metric that is reproduced, and that is what this table says.**
Q. Okay. And that's what Georgia EPD prepared?
A. **The state -- this report was prepared by Georgia EPD, yes.**
Q. Okay. Let's go on to a discussion on what Georgia EPD determined with respect to the

Clayton Aquifer. And if you will turn with me to page 76, please.
A. **Yes.**
Q. And the section I'm interested in is 5.1.2. It's fairly lengthy, but the provisions that I'm interested in begin in the sixth line down. And it's a sentence that starts with, in the coastal plain the heavily used Clayton Aquifer.
A. **Yes.**
Q. Okay. Do you agree with Georgia EPD that the Clayton Aquifer is heavily used?
A. **That is a relative term, I guess. It may be heavily used. But the most-used aquifer is the Upper Floridan Aquifer.**
Q. Do you agree with Georgia EPD that the Clayton Aquifer has experienced, quote, extreme head declines?
A. **I cannot know.**
Q. Do you agree with Georgia EPD that groundwater withdrawals from the Clayton Aquifer, quote, caused adverse effects on other water users where the Clayton Aquifer is being used, end quote?
A. **I do not know what the context of this is.**
Q. Okay. Sir, when were you engaged in this matter?
A. **I believe April of 2015.**

Q. And have you been working on this matter continuously since that time?
A. **I have been working on this, yes.**
Q. Okay. Can we please turn to page 145, sir.
And I would request that you read the paragraph at the bottom of the page that begins, the most severe drought conditions. It continues on through on page 147.
A. **Yes. I have read that.**
Q. Okay. Do you agree with Georgia EPD that groundwater withdrawals significantly impact streamflow in drought years when irrigation is intense and the aquifer has not recharged from the previous year?
A. **I do not know the context of this, but groundwater withdrawals will have some impact; and drought-related impacts are definitely there in Spring Creek, yes.**
Q. Okay. But you're unable to say whether those impacts are significant in the way that Georgia EPD has characterized it?
A. **We have not quantified what is the impact of drought versus what is the impact of pumping. And that is what I have been focusing on. There is no evaluation or analysis saying this much**

percentage was the drought impact and this much was the pumping impact.
Q. Okay. If we can jump ahead to tab 22 -- it's the last tab in the binder -- the document designated as FX-82. Actually, a September 6, 2011, memo from Dr. Wei Zeng to Georgia EPD director Allen Barnes. Have you seen this before, sir?
A. **I'm not sure. I know of some of this information, but I don't think I have seen this before. So --**
Q. Okay. Let's focus on the first page for a moment, the section entitled Groundwater Conditions. And in that section Dr. Zeng notes a clear lack of recharge and replenishment of groundwater storage after the conclusion of the 2011 growing season. Do you see that?
A. **Yes.**
Q. Did your model results indicate a clear lack of recharge and replenishment to groundwater discharge storage in 2011?
A. **That is not what I was modeling. My modeling was focused on the impact of pumping. So I did not evaluate what recharge does to the system. I was specifically looking at how much reduction in baseflow occurs because of pumping within**

Georgia.
Q. So you didn't look at recharge after a winter season when it's generally wet?
A. **I have looked at water level data. I have looked at streamflow data. But I have not modeled recharge or wet -- I have not modeled -- I have not modeled less recharge in 2011 or more recharge in other seasons, as you are asking me.**
Q. So when you conclude that a multi-year drought doesn't have any greater impact on streamflow, you haven't modeled it; but you just looked at data?
A. **I modeled the impact of pumping in a multi-year drought. I have analyzed that.**
So what I did is I looked at the impact of pumping in the first year. I looked at what residue remains going into the following year. So, again, I have specifically looked at the impact of pumping. I have separated that out from the impact of all these other factors.
Q. Including groundwater recharge?
A. **Including groundwater recharge; that is correct.**
Q. All right. Did your model lead you to conclude that the lack of groundwater recovery in 2011 was, quote, stunning?

A. **I did not model the 2011 conditions of the change in the last -- in the two drought years. I only modeled the impact of pumping. And recharge would have dropped, and that would have dropped the baseflow itself. But I did not model the effect of recharge. I just isolated out the impact of pumping, and that was small.**
Q. So if there's a multi-year drought and recharge is small, you can't tell us how much that will reduce baseflow?
A. **I can tell you how much the pumping has reduced the baseflow.**
Q. That's not my question.
A. **Right. But that's what I analyzed.**
Q. So you can't tell us how much the absence of recharge will impact streamflow --
A. **I have --**
Q. -- is that right?
A. **I have not modeled that. But I can certainly look at the streamflow information; and we can see that if there is lack of recharge, then you're going get less streamflow. And we have seen that in the signature.**
Q. Okay. In the course of your work, sir, did you review EPD's March 2011 groundwater availability

assessment?
A. **If you show me the document, I could recall.**
Q. Certainly. And it's behind tab 12.
It's designated as JX-160.
A. **Yes, I believe I have seen this document before.**
Q. Sir, you're aware that this March 2010 report focused on the availability of groundwater in select priority aquifers?
A. **I don't know the entire purpose of this document. But I have evaluated from this document the safe -- the safe yield issues that Florida brought up.**
Q. Dr. Panday, you said safe yield. Might you mean the sustainable yield criteria?
A. **That's what I meant. Sorry. The sustainable yield.**
Q. That's fine. The select aquifers that are considered in JX-160 include three that are in the Georgia portion of the ACF Basin, sir. And if you look at page S-2, it will list those.
A. **Yes. I see it.**
Q. And the three that lie within the Georgia portion of the basin that are considered here are the Upper Floridan Aquifer in the Dougherty Plain, the Claiborne Aquifer in the Coastal Plain, and

the Cretaceous Aquifer in the Coastal Plain; is that right?
A. **Those three aquifers do lie in the ACF River Basin; that is correct.**
Q. Okay. And when you reviewed this document as part of your analysis, did you also review the comments the U.S. Fish and Wildlife Service made to the State of Georgia about its groundwater availability assessment?
A. **If you point me to those comments, I would probably recollect.**
Q. Certainly. It's behind tab 13. And the comments are in the form of a letter that's the second page of FX-320.
A. **No, I have not seen this.**
Q. Okay. You're welcome to read the entire letter, sir. It's only three pages.
I'm going to direct you to the section on the groundwater availability assessment at the bottom of the second page and carrying over to the third page. I'll request that you review that section.
SPECIAL MASTER LANCASTER: Counsel, while he's reviewing that, do you have an estimate of how much longer you think you will be?

MR. QURESHI: Your Honor, I believe I have about 40 minutes.

SPECIAL MASTER LANCASTER: Why don't we take a recess.

MR. QURESHI: Certainly. Thank you.

(Time Noted: 10:28 a.m.)

(Recess Called)

(Time Noted: 10:38 a.m.)

SPECIAL MASTER LANCASTER: I forgot to tell you that Devon has an L. L. Bean catalog. You can look at that to see, if you want to. They're predicting that they're going to have 350,000 pair of boots for Cyber Monday. So I think they didn't hear the weather report because it's going to be rain.

But, anyway, if you want to look at it, feel free.

MR. QURESHI: Thank you, your Honor.

BY MR. QURESHI:

Q. Dr. Panday, do you -- going back to Exhibit FX-320, do you agree with the U.S. Fish and Wildlife Service's opinion that the groundwater availability assessment was of minimal use?

A. **I do not know the context of this document. I believe the context of this document is local.**

And once you get into that local level, I don't know what they're arguing there.

Q. On page 2 of the letter, right in the section that talks about groundwater availability assessment, U.S. Fish and Wildlife explains that performing a groundwater assessment independent of a surface water availability assessment is of limited utility. Do you agree with that?

A. **You can always add the two impacts and see the net impact. So I don't agree that if you do them separately and look at the net impact that it is of limited utility.**

Q. Okay. And you referenced earlier the local impacts. Are you referring to your conclusion that violation of the sustainable yield criteria that Georgia EPD set itself only has local impacts?

A. **They are exactly that. They are local impacts. That's, in fact, what this document -- the earlier document you showed me presented.**

It showed the whole map. They were pumping throughout the aquifer. And then they noted where that local impact occurred as a result of pumping throughout the aquifer. That is correct.

Q. Okay. And in your direct testimony when you

render that opinion, you refer to a specific report that was prepared by CDM; is that correct?

A. **Yes.**

Q. If you can turn to tab 15, you will see that document marked as JX-57.

A. **Yes. Yes.**

Q. So this is a document that was prepared by a consultant on behalf of EPD that led you to conclude that violations of the sustainable yield criteria only have a local impact; is that right?

A. **This document showed me that the impact was local. If we look at figure 5, it shows the top line -- up at the top of the basin where the impact had occurred, the sustainable yield criteria were met.**

And I had the MODFE model, so I could actually go into the model and see what the baseflow was for that stretch of the stream. I could see what -- the base for unpumped conditions and that 40 percent reduction is what the impact is supposed to be, which would violated. So that 40 percent was really negligible.

So I looked at this document as well as looked at the Jones and Torak model to determine

that the impact was negligible.

Q. And do you know if the consultants who prepared JX-57 relied on the Jones and Torak model in performing their analysis?

A. **I believe they did.**

Q. Okay. And that's the same model you rely on?

A. **That is correct.**

Q. Okay. And you read the entirety of JX-57, sir?

A. **I may have at some stage.**

Q. Okay. Sir, if you look with me to page 4, and in the paragraph under section 2.2 there is a discussion about total withdrawals within the modeled domain as 157 million gallons per day. Is that right?

A. **That's what it says here, yes.**

Q. Okay. And so to understand what occurred here, what the authors of this report did is they compared that 157 million gallons per day against a sustainable yield criteria to see what the impacts would be; is that right?

A. **I'm not sure that is correct. I believe what they did is that they had certain criteria. One was the -- one was a 30-foot drawdown within the aquifer. The second was a 40 percent reduction of streamflow.**

So what they did then was to pump in different sub-areas to figure out how those criteria could be met. So they kept increasing the pumping.

I don't clear how they did it, but finally they came up with a basin-wide pumping level. And they upped that until any of these reaches' sustainable yield criteria -- those two criteria we talked about -- were violated. And the criteria that got triggered was the 40 percent reduction in streamflow.

And there were two simulations they had done. For one of them, that occurred in Muckaloochee Creek, which is the top corner of the basin; and that was a negligible amount. And for the second simulation which they did which gave them the range, the violation occurred in Mosquito Creek which is, again, a small section. It's a small stream which flows into the Lake Seminole.

Q. And as you describe in your direct testimony, the impacts at Muckaloochee -- Muckaloochee Creek are about 1.7 cfs and at Mosquito Creek it's about .7 cfs. And you say those are negligible local impacts; is that right?

A. **That's correct.**

Q. But you realize that the 157 million gallons per day number that CDM relies on was not the total agricultural water withdrawals in this region. You're aware of that?

A. **CDM did not rely on this 157 million gallons per day, I believe, in their modeling simulations. As I mentioned, what they did is they had their criteria; and they stopped simulating pumping and increasing the pumping. And then at a certain level of pumping, they noticed certain criteria were triggered. So that's what I believe they did.**

And then they compared it to the net pumping in the basin and say, oh, the net pumping in the basin was larger than what this model told us for that sustainable yield criteria. That's what I believe they did.

Q. Right. The net pumping was greater than 157 million gallons per day. If you looked at page 16, sir, in the conclusions section, if you take a moment to review that and review the paragraph that begins during 2010, and read that to yourself.

A. **Yes. I read this paragraph.**

Q. All right, sir. So you agree that CDM explains

that after their modeling was complete, Georgia EPD received information noting that 157 is not the right number; the actual withdrawals are somewhere in the range of 450 to 590 million gallons per day. Isn't that what it says?

A. **That's what it says here, yes.**

Q. Okay. And, in fact, that range is what's used by the regional council for the Lower Flint-Ochlockonee water region; isn't that right?

A. **I have no idea about that.**

Q. You didn't look at this sustainable yield criteria assessment that is in the Lower Flint-Ochlockonee plan?

A. **No, I don't know about Ochlockonee.**

Q. Let's turn to that, sir. It's behind tab 14. Have you ever seen this regional water plan before?

A. **You know, the front page looks familiar; but I don't believe I have seen this before. A lot of documents came across my desk. And, again, I would have flipped through the documents and determined that this is not for the entire basin; and so I didn't look at it further.**

Q. Okay. And the model domain that you relied on is the Lower Flint region; isn't it?

A. **It's the Upper Floridan Aquifer. It's the Lower Flint as well as the Chattahoochee -- Lower Chattahoochee River as -- which has parts of it is in Alabama; and as well the model extends slightly into Florida also.**

Q. But -- okay. But your testimony is that you didn't spend time reviewing FX-24 because it didn't deal with the whole basin; is that what you said?

A. **I guess so. I don't -- I -- this is just not familiar to me.**

Q. Okay. Sir, I direct you to page 3-7. There is a section on groundwater availability. And the section runs through 3-10. My questions are really going to focus on the table that is on page 3-9. And it's labeled table 3.3, Groundwater results for assessed aquifers in Lower Flint-Ochlockonee region, current conditions. Do you see that?

A. **Yes. I see that.**

Q. Okay. Have you ever seen this table before?

A. **No, I don't believe so.**

Q. Okay. This table compares the current groundwater withdrawals against the sustainable yield criteria that Georgia EPD set by itself.

And it does that for three different aquifers that are in the ACF Basin, the Claiborne Aquifer, the South Central Georgia Upper Floridan, and the Upper Floridan Aquifer in the Dougherty Plain. Are you with me?

A. **Yes.**

Q. Okay. And you will see that the estimated groundwater withdrawals from the Upper Floridan Aquifer range from 450 to 587 million gallons per day. Right?

A. **That's what it says here.**

Q. All right. But the sustainable yield for groundwater withdrawals in the Upper Floridan Aquifer in the Dougherty Plain is between 237 to 328. Isn't that right?

A. **That's what it says here. And, again, the sustainable yield criteria was the 40 percent reduction in any streamflow; and that was triggered with these numbers in small upper reaches of the basin which had low flow itself. So when that low flow of 1.7 cfs that you mentioned, for example, when 40 percent reduction of that is an even smaller reduction.**

Q. So you're referring to --

A. **So it's a local impact, and I did not evaluate**

this any further.

Q. You're referring to JX-57, the document we were just looking at?

A. **No. You mentioned the number 1.7 from my direct testimony, which I looked -- took from Muckaloochee Creek.**

Q. And you derived that number by relying on JX-57; isn't that right?

A. **I derived that number by relying on the model. I looked -- I had the Jones and Torak model. I had a run without any pumping. So for that run without any pumping I could go to the streams and add up what baseflow is occurring to those streams. And this document which you mentioned did show which reach was violated. So I went to that reach and calculated what the flow was for that reach.**

So I relied on the model as well as the document to show me where the reach was violated.

Q. But the document we were talking about, JX-57, used a number of calculated withdrawals that was much lower than the actual number that Georgia EPD itself provided?

A. **That is correct. The number that they have for the sustainable yield which they're showing me on**

this table is between 237 and 328 mgd. And that is a case, as I explained to you, what they did is they took the model; and they kept ramping up pumping to see when any reach was -- violated that 40 percent criterion.

Q. So it's your testimony that the difference between the current groundwater withdrawals and the sustainable yield criteria, if we look at it in cfs, it's roughly 122 -- I'm sorry, 188 to 540 cfs difference?

A. **I haven't done the math. From this table, if your math is correct, that's what it may be.**

But, again, as I mentioned, the sustainable yield criteria is something local within Georgia. And if you can add up that 1.7 with what happened at Mosquito Creek, it's still negligible compared to the flow into Florida.

Q. If you rely on JX-57 that uses outdated agricultural withdrawal information?

A. **JX-57 never used agricultural withdrawal information in the model. Like I mentioned, in the model what they did is they pumped, and they kept increasing the pumping until that criterion was violated. Then what they did is they compared that to what they believed was the**

estimated groundwater withdrawal.

So they never used that number in their calculations. That's comparing that to the number that they came up with in the modeling scenarios. And that modeling scenario had, I believe, these numbers on the right-hand side of the table, and those numbers violated the criteria which we discussed which were in the upper reaches of the basin in Muckaloochee Creek and in Mosquito Creek.

Q. And you realize that this is the Lower Flint-Ochlockonee Regional Plan; it has nothing to do with the Upper Flint?

A. **This is the Lower Flint. And as you mentioned, it's the Ochlockonee region as well. And so that is, I believe, outside of the Flint River Basin also.**

I don't know what analysis they have done for this. But it seems they are talking about another basin here, the Ochlockonee --

Q. Okay.

A. **-- region.**

Q. Was it material to your conclusions that Georgia EPD determined that the groundwater withdrawals from the Upper Floridan Aquifer were between 188

to 540 cfs in excess of the sustainable yield criteria? Was that important to your conclusions?
A. **It is totally irrelevant to my conclusions because I am not looking at local impacts. I have been studying the net impact of pumping within the basin.**
Q. Sir, are you familiar with a Georgia law called the Flint River Drought Protection Act?
A. **I have heard of that.**
Q. Okay. You know that was passed and signed into law in Georgia in 2000?
A. **No, I do not know that.**
Q. Okay. Have you ever seen the document behind tab 16 previously?
A. **No, I have not.**
Q. Okay. May I request that you take a moment to read the paragraph at the bottom of page 30 that continues onto the top of page 31.
A. **Yes, I have read that paragraph.**
Q. Okay. Did you ever review any studies by EPD that evaluated whether the high use of irrigation would dramatically reduce the flow of the Flint River?
A. **Georgia EPD has conducted modeling studies for**

various years, and I have seen those modeling studies. They have done a modeling study for 2011 conditions. They have done a modeling study for 2007 conditions. They have done modeling studies for 2001 conditions. So I have seen those.
Q. Okay. And the Flint River Drought Protection Act was passed in 2000. So did you see any studies during that time frame that talked about the high use of irrigation potentially dramatically reducing the flow to the Flint River?
A. **No. I have not seen any studies. And if it was before 2000, they probably did not have a very good handle on the agricultural irrigation. A lot of the agricultural irrigation studies were done -- and I believe a lot of them were -- some of them were concluded in 2005. And that was published by Dr. Hook. And then they were doing more metering, and I believe in 2008 they had an even better handle on what the agricultural irrigation was.**
Q. Do you have any understanding as to why the Flint River Drought Protection Act was passed?
A. **No, I do not.**
Q. You didn't look into that issue?

A. **No, I do not -- did not.**
Q. Okay. Your conclusions in this matter, sir, are that groundwater withdrawals have a minimal impact on streamflow in Florida. And you go on to say that climatic changes are the principal causes of reductions in streamflow to Florida. Is that right?
A. **I say it's weather patterns. When you're in a drought, you're going to have less flow. When you're in a normal or wet conditions, you're going to have more flow.**
Q. And as we looked at earlier, irrigation during droughts will exacerbate the reduction in flows?
A. **Irrigation during drought has an impact on the baseflow, but the quantity of that impact is what I have quantified.**
Q. Okay. Have you performed a literature review to determine whether there are any scholars who disagree with your conclusions?
A. **I don't know any scholars who have reviewed my conclusions and are disagreeing with them.**
Q. Have you reviewed -- have you conducted a literature review to evaluate the work of other scholars who look at the impact of river flow into Florida and whether that's caused by

irrigation or whether that's associated with changes in weather patterns?
A. **I have reviewed the Jones and Torak model. That's what I have reviewed.**
Q. And you didn't look at anything else?
A. **I looked at data. I looked at precipitation data. I looked at streamflow data. I looked at groundwater level data.**
Q. Let's turn to a document behind tab 17 or FX-49d1. It's entitled Impacts of agricultural pumping on selected streams in southwestern Georgia by David W. Hook -- I'm sorry, David W. Hicks and Stephen W. Golladay. Do you recall looking at this report, sir?
A. **No, I did not. I haven't seen this -- I don't recall seeing this before.**
Q. But you recognize the name of the author David W. Hicks as Woody Hicks?
A. **Yes. I recognize the name of both authors.**
Q. Can you please turn with me to page 27, sir. And take a look at the middle paragraph that begins, with our analysis of climate data.
A. **Yes.**
Q. Have you had an opportunity to read that to yourself?

A. **I'll read it.**
Yes. I have read that.
Q. Okay. Do you agree with the conclusion that there's no climatologic indication that more recent droughts were more severe or persistent than those in the past?
A. **I do not know about that. I have looked at the precipitation data from 1975 through 2015. I have looked at water level data from '75 through 2015 and streamflow also for the same time period. And what I have found is that there are more severe and multi-year droughts occurring after 2000. 2000-2001 was a severe, multi-year drought. 2006-2007 was a severe, multi-year drought. 2010-'11, going into '12 -- pushing a little into '12 was a severe, multi-year drought. And when we compare that to similar droughts from the 1975 period we don't see such multi-year, severe recurring droughts.**
Q. So is the answer to my question, yes, you disagree with the conclusion here?
A. **No. The answer is I haven't studied climate since the 1930's to now. That's what my answer is.**
Q. Okay. What about the conclusion that the primary

factor that's causing record low streamflows and other alterations to the regional hydrology is water use? Do you disagree with that?
A. **I do not know the context of this. He may be talking about some specific context where it might be critical to him. But as far as I'm concerned, I don't believe that the impact to the entire basin is substantial compared to the flows that are going into Florida.**
Q. Did you know that Georgia EPD had funded this project in FX-49d1?
A. **No. I don't know about this project.**
Q. No one ever mentioned it to you during your work on the case?
A. **No.**
Q. Let's talk now about your opinion that the Sumatra and Chattahoochee Gage flows show an increased loss of water over time. Do you recall giving that opinion?
A. **Yes.**
Q. And in order to reach this conclusion, you looked at flows at the Chattahoochee Gage as well as the USGS Sumatra Gage; is that right?
A. **Right. The Chattahoochee Gage shows how much flow is coming across the state line, and the**

Sumatra Gage is the gage just upstream of -- is the last gage upstream of the Apalachicola Bay. So I looked at flow differences between those two gages.
Q. And over what time period did you conduct your analysis?
A. **I looked at this, again, from 1975 through the current time period, the data that was available.**
Q. Are you aware of any measurement errors associated with either of those USGS gages?
A. **During my deposition it was brought up that there were possible errors in those gages.**
Q. And prior to it being raised at your deposition, were you aware of that fact?
A. **I don't remember the time lines, but I believe there was some memos following our expert report which did talk about the Sumatra Gage and the difference in flow between the Chattahoochee and Sumatra Gages.**
Q. Are you aware of a USGS letter from July 2016 that highlights these anomalies in measurements at the Sumatra Gage?
A. **At my deposition I was shown two correspondences from the USGS. The first one with an earlier date was from, I believe, a field person who does**

this work, the professional who does that work. And that one indicated -- did not indicate that there were any errors in there.
And, again, I do not -- I wasn't sure of the correspondence from Florida to the USGS asking whatever they were asking. So I don't know how that went.
But then later on, I believe there was another correspondence; and this came right from the top. And, again, I don't -- I didn't see the correspondence from Florida to the USGS; but from the USGS to Florida the correspondence did indicate that there were errors in the Sumatra Gage between, I believe, 1990 and 2002. So if I look at the period before 1990 and I can look at the period after 2002, then I believe the USGS had no problem with that.
Q. Okay. Did you ever talk to the USGS about the Sumatra Gage?
A. **No, I did not.**
Q. Other than looking at the letter that was shown to you at your deposition, what independent investigation did you do on the accuracy of the Sumatra Gage?
A. **I did not.**

Q. You just presented it in your direct testimony to this Court?
A. **I'm -- there are professionals at the USGS who create this data and put it on their website. I am not a professional who looks at streamflow gaging data and quality assurance, that and then publish it. I'm not that professional. I'm a groundwater modeler.**
Q. Okay. So looking at stream gage is not part of your expertise; is that your testimony?
A. **I do not go and look at stream gages; that is correct.**
Q. But you --
A. **I do pick up data from the USGS from stream gages for precipitation, for water levels; and we use that in our modeling analysis.**
Q. Okay. And when is the last time you were on the USGS website?
A. **Probably a couple of months ago.**
Q. Okay. Were you on there before you submitted your direct testimony?
A. **Let me clarify. I have been on the USGS website for my other work. I don't believe I have been on the USGS website specifically for this after my direct testimony.**

Q. Okay. What about before your direct testimony; did you go on there to get the Sumatra Gage measurements?
A. **We had got that at my -- during my expert report time.**
Q. So you didn't go back and see if that data is still live, is still available?
A. **No, I didn't go back.**
Q. All right. Did anyone tell you that -- other than lawyers, that because you saw this letter suggesting there may be measurement errors, you ought to go back and check yourself to see if it's still there?
A. **No. But I believe yesterday I heard that some of that data was removed in the USGS website.**
Q. Okay. Does that cause you to reconsider your opinion on the Sumatra Gage?
A. **No, it does not. The letter from the director of that section of the USGS indicated that the gages were wrong between 1990 and 2002, I believe. So I can look at data pre-1990 and post-2002, and I come to the same conclusion.**
Q. Okay. How do you know that?
You haven't been on the website; right?
A. **The letter from the USGS mentioned specifically**

that the data errors possibly were between 1990 and 2002.
Q. I'm not talking about the letter. I'm talking about the website. You haven't been back on there, and you presented this information to this Court. Right?
A. **I haven't been back on there. I was on there previously for my expert testimony. And that's where I originally got my data from. Yes.**
Q. Sir, in your testimony you point to a comparison between the work that Dr. Sunding has done against work that Dr. David Langseth has done for Florida. And you recognize that Dr. Sunding is Florida's economic expert, and Dr. Langseth is Florida's groundwater expert; is that right?
A. **That's correct.**
Q. Okay. And you explained that the peak summer streamflow benefits that Dr. Sunding talks about in his conservation scenarios are not possible to achieve. You make that assertion; is that right?
A. **Yes. That's correct.**
Q. And you point to Dr. Langseth's work as the support for this assertion?
A. **I look at several things to support my assertion.**
Q. Did you look at Dr. Hornberger's testimony?

A. **I have looked at portions of Dr. Hornberger's testimony.**
Q. Do you realize that Dr. Langseth is the groundwater expert for Florida?
A. **Right. That is correct.**
Q. And Dr. Hornberger is the hydrologist expert for both groundwater, surface water, and consumptive use for Florida?
A. **I believe Dr. Hornberger was the surface water expert; that's what I was given to believe.**
Q. Right. But you didn't compare Dr. Hornberger's analysis and assessments with Dr. Sunding's; did you?
A. **I'm not sure that doctor -- and I may be wrong, that Dr. Hornberger had conservative scenarios in his testimony. I believe Dr. Sunding had that. And he relied, I believe, on Dr. Langseth's groundwater impact factors to provide him with the numbers that he could calculate his scenarios.**
Q. And you recognize, sir, that Dr. Sunding has things in his conservation scenarios that aren't mentioned in Dr. Langseth's analysis. Do you appreciate that fact?
A. **Dr. Langseth's direct testimony and expert report**

did not mention some of the scenarios which Dr. Sunding had in his report, yes.
Q. Okay. And you also realize that they're looking at different things. Right?
A. **I believe Dr. Langseth was looking at certain conservation scenarios, and Dr. Sunding was looking at some other conservation scenarios.**
Q. Right. And Dr. Sunding's conservation scenarios involved a -- one of them at least involved a 2000 cfs conservation scenario using a peak summer month of 2011 drought. Do you recall looking at that?
A. **Yes. I recall that. And I disagree with his calculation itself because he, again, used impact factors to do his calculations. And these are the seasonal impact factors. And there are many different impact factors. And the seasonal impact factors that were originally developed were developed using the Jones and Torak model. Then he uses a different pumping from the Jones and Torak model. So there's a discrepancy there.**
And then in the conservation scenario, he says you can eliminate pumping just within a certain month or within a certain time period. And if you eliminate that, then that also changes

the impact factor. That changes the seasonal impact factor.
So essentially you need to run a model if you want to see such specific impacts.
Q. In the comparison you did between Dr. Sunding and Dr. Langseth, you're comparing two different things. You're comparing a peak summer month in the 2011 drought, which is what Dr. Sunding did for his conservation scenario, against what Dr. Langseth evaluated, and that was a representative drought year that consisted of six different years, not 2011. Did you appreciate that?
A. **Dr. Langseth's analysis for the net pumping during drought were for several drought years. However, when Dr. Langseth did his conservation scenarios, he did not look at that. He only looked at how much he could reduce. And, again, when he did that, he reduced things in a hydrologically efficient manner, as he calls it. So he removed agricultural pumping from right near the streams. And that is where your impact factor is largest. So when you remove that, then that is not the model with which the impact factors were developed. So now, the impact**

factors have changed.
So even Dr. Langseth's analysis, he changes the impact factors. He changes the spatial distribution, while I believe Dr. Sunding changes spatial as well as the temporal distribution of pumping, in time.
Q. Because they're looking at different things. Right?
A. **I believe they're looking at different conservation scenarios.**
Q. And you compared them against one another?
A. **I haven't compared them against one another. I have looked at each of them separately.**
And when you talk about Dr. Sunding's scenario of 2000 cfs conservation, I specifically addressed that. When we talk about Dr. Langseth's scenarios, I specifically addressed those.
MR. QURESHI: Nothing further, your Honor.
SPECIAL MASTER LANCASTER: Thank you.
MS. ALLON: Your Honor, may I just hand up two exhibits for the redirect examination?
REDIRECT EXAMINATION
BY MS. ALLON:
Q. Dr. Panday, I want to just start by clearing up

one issue from the cross-examination. Do you recall on your cross there was some discussion about whether Dr. Langseth, Florida's groundwater expert, had initially adopted a 40 percent impact factor. Do you recall that?
A. **Yes.**
Q. Okay. And Florida's counsel said during cross-examination that Dr. Langseth had never adopted 40 percent as his impact factor. Do you recall that?
A. **I believe he said that. Yes.**
Q. And you had said that you had recalled some deposition testimony from Dr. Langseth. And I would like to turn to Dr. Langseth's deposition transcript, which I have handed up.
And I want to look specifically at page 356 of Dr. Langseth's transcript. Are you there?
A. **Yes. I'm there.**
Q. And do you see on line 14 I asked Dr. Langseth, so 40.6 is your annual impact factor for pumping just from the Upper Floridan Aquifer?
And he answered, average annual impact factor, transient impact factor for pumping just for the Upper Floridan.
Was that the deposition testimony that you

were referring to when you testified that Dr. Langseth had, in fact, adopted a 40 percent impact factor?

A. **Yes.**

Q. Now, Florida's counsel also said during your cross-examination that on his last day of deposition, Dr. Langseth had switched and adopted a 60 percent impact factor. Do you recall that questioning?

A. **Yes.**

Q. Let's take a look at some testimony from the last day of Dr. Langseth's deposition. It's on page 1079 of Dr. Langseth's transcript.

A. **Yes. I'm there.**

Q. And do you see that on line 22 I asked, are you changing the opinion in your first report as to the proper impact factor?

And Dr. Langseth testified, I consider -- in the context of doing this work, I consider 40.8 percent versus 40.6 percent to be essentially the same thing.

And is this the testimony you were referring to when you said that Dr. Langseth had used a 40 percent impact factor in his work?

A. **I'm sorry. You said page 1078?**

Q. 1079.

A. **And on line?**

Q. Line 22 through line 4 of the next page.

A. **Essentially the same number, that is correct.**

Q. Now, Florida's counsel also walked you through a 1998 hydrogeologic study which they claim supported a 60 percent impact factor. Do you think using that study with respect to the analysis in this case is appropriate?

A. **No, it is not. That study has been updated, and that study is outdated.**

Q. Let's take a look at what Dr. Langseth had to say about the hydrogeologic reports. And if you turn to Dr. Langseth's report, which I handed out, and you look at page 37 of Dr. Langseth's expert report.

A. **Okay.**

Q. And I want to start the paragraph that starts, I also screened out. Do you see that?

A. **Yes.**

Q. Okay. And can you just read that paragraph to yourself and let me know when you have had a chance to do that.

A. **Yes. I have read that.**

Q. And how do you interpret what Dr. Langseth is

saying in that paragraph about the hydrogeologic report that Florida is now relying on?

A. **There's nothing to interpret, really. He said it in clear words, I also screened out use of the model developed by Hydrogeologic, Inc., 1998, since it was based on the Torak and McDowell -- it should have been 1996 -- and Torak and McDowell 1996 models.**

And previous statement was, this consideration screened out the following models developed by Torak and McDowell 1996.

So they have screened out that model, and they have screened out the hydrogeologic model.

Q. So Dr. Langseth himself screened out use of the hydrogeologic model; is that right?

A. **That is correct.**

Q. Taking a step back for a minute, I want to ask a very basic question which is what is groundwater?

A. **Groundwater is water under the ground that exists in the voids or crevices between the soil or rock.**

Q. And we also talked a lot about aquifers. What is an aquifer?

A. **An aquifer is the soil or rock under the ground that contains and transmits groundwater.**

Q. And what does groundwater have to do with the issues in this case?

A. **Groundwater feeds the rivers and streams in the ACF River Basin. And pumping of groundwater can impact that flow to the streams. And that is what I have done is to evaluate the impact of that pumping on the groundwater flow to streams.**

Q. Why is groundwater pumped in the ACF Basin?

A. **Groundwater is pumped in the ACF Basin for agricultural use as well as for municipal and industrial uses. Most of the groundwater use in the ACF River Basin is for agricultural use with very little use for municipal and industrial purposes. And also at the same time, most of the agricultural use is through groundwater with a less amount of water from surface water sources for agriculture.**

Q. You said that groundwater feeds the rivers and the streams. What are the factors that influence how groundwater flows into rivers and streams in the ACF Basin?

A. **The flow of groundwater to rivers and streams in the ACF Basin is governed by multiple factors, including weather and pumping. When the weather is wet, the groundwater levels are higher; and**

you have more baseflow to streams. When the weather is dry, the groundwater levels are lower; and you get less baseflow to streams.

With regards to pumping, pumping also affects the groundwater levels and the baseflow to streams; but there are many variables involved with that. And what I mean by that is if you're pumping close to the stream, the impact is going to be larger. If you are pumping away from the streams, the impact is going to be smaller.

The aquifer properties also determine how pumping would impact the baseflow, the flow of groundwater to streams. And, for instance, if the aquifer is more transmissive, then you have a higher impact factor. If the aquifer is -- has -- the storage spaces are larger, if the storage capacity of the aquifer is larger, then you're going to have a larger time lag effect before that impact reaches the streams. You can be pumping in several locations, so there is the interaction of pumping between those several locations as well.

So you really need a groundwater model to be able to resolve all these interactions and to be able to then just isolate and separate the impact

of pumping from all these other impacts.

Q. And as a part of your analysis in this case, did you conduct groundwater modeling to quantify the impact of groundwater pumping on flow into the streams and rivers in the ACF Basin?

A. **That is exactly what I have done. My modeling was to evaluate the impact of pumping on the groundwater flow to streams.**

Q. And what groundwater model did you use for your analysis?

A. **I used the Jones and Torak 2006 MODFE model for my analysis.**

Q. Why did you decide to use that model?

A. **Because that model, the Jones and Torak MODFE model, was specifically designed to evaluate the impact of pumping to baseflow in the Lower ACF River Basin. And that is exactly what I did is to evaluate the impact of pumping.**

Also, as we saw here, Florida's experts also believe it's the best model available to do this impact calculation.

Q. Did Florida's experts also run the Jones and Torak model?

A. **Florida's experts did not run any groundwater model. They used published results from the 2006**

report of Jones and Torak; and they extracted impact factor, scaling factors from that. And they used those scaling factors in their analysis.

Q. Do you think that scaling approach is as reliable as actually running the model?

A. **No, it is not. When you are doing scaling, you are relying on the pumping distribution that was -- that was there in the model.**

First thing is you have to have a model to even develop those scaling factors. So they used the model that was run by Jones and Torak, the reported results. And they used those results to create the impact factor.

Now, when you use those impact factors, as long as the pumping distribution doesn't change, you can scale things up and down. But Florida has not done that. They have changed the distribution of pumping. They have changed the timing of pumping. And if you're doing that, you need to run a groundwater model to accurately describe the impact.

Q. So when you actually ran the model yourself, how did you use the model to quantify the impact of groundwater pumping on streamflow?

A. **The first thing I did was to evaluate the groundwater pumping that was going on in the basin. So I evaluated agricultural irrigation pumping as well as municipal and industrial pumping. Once I had the pumping distributions and timing, I implemented that into the MODFE model; and I ran the MODFE model for that case. I ran the MODFE model for the same hydrologic situation, but without any pumping. When I take the difference between those two, I get the impact of pumping.**

So that is how I used the MODFE model.

Q. And what were the different hydrologic simulations that you had?

A. **I had done hydrologic simulations for what I call normal conditions and what I call dry conditions. So there were two different hydrologies. And I used those to evaluate my pumping impacts.**

Q. Now, on cross-examination, counsel for Florida was asking why your dry hydrologic conditions actually modeled more contribution to streamflow than your normal scenario; and you had said it doesn't matter. Why is that?

A. **Right. It does not matter, because the impact of pumping to streamflow is not dependent on the**

actual baseflow itself. The impact is just a certain percent of the pumping value regardless of that baseflow.
Q. I want to actually turn back to the exhibit that Florida's counsel used with you. So it's in the binders that they handed out at tab 6. And it's FX --
A. **Yes, I'm there.**
Q. -- 934. Do you see that?
A. **Yes I see that.**
Q. And can you describe how you used the data in this chart.
A. **Right. We can see what I have done is I did simulations for the different years -- for the acreages for the different years, and the different years being 1992, 2011, and 2013. And for those years, I evaluated the pumping for -- the pumping requirements for normal conditions as well as for dry conditions. For dry conditions you need more irrigation depth than for normal conditions.**
Once I did that, I ran the model. You get the results of the baseflow from this model; and you can subtract out the no pumping case for the same hydrology from the pumping case for the same

hydrology. And the hydrology impacts go away, and I'm left with the impact of pumping on baseflow.
Q. So if there was an error or miscalculation or an inaccuracy, as a hypothetical, in your hydrologic conditions, would that impact your conclusions about the impact of pumping?
A. **No, it does not. The hydrology does not affect the impact of pumping. Your impact factors also are developed without concern of hydrology. They are developed because of the -- it's the portion of the pumping that matters.**
Q. Let's turn in your written direct to page 25, and I would like to look at demonstrative 13.
A. **Yes.**
Q. Does demonstrative 13 show some of the results of your groundwater modeling?
A. **Yes. It does.**
Q. Okay. And can you describe what demonstrative 13 shows.
A. **Demonstrative 13 shows the impact of groundwater pumping for normal and dry conditions from my modeling analysis for 2011 irrigated acreages. And we can see that for dry conditions, the impact was slightly over 500 cfs. The impact of**

pumping within Georgia was slightly over 500 cfs. And the number is 511 cfs that the model gave.
Q. And that's the maximum impact?
A. **And that is the maximum monthly impact. And that occurred in July.**
Q. Now, in your direct testimony, you characterize the impact of groundwater pumping, this impact, as minimal or negligible. What's the basis for that opinion?
A. **I compared this impact of groundwater pumping to the actual flow occurring at the Chattahoochee Gage into Florida. And in that respect, I say that this impact is negligible.**
Q. Let's turn to page 27 in your direct and take a look at demonstrative 15. Is this the comparison that you were just referring to?
A. **That is correct. This is one of the comparisons I was referring to. This is for the dry conditions.**
Q. And can you describe what demonstrative 15 shows?
A. **Right. This is a chart showing the baseflow and the impact of pumping over an annual cycle. The blue line shows the impact of pumping over the annual cycle. And the maximum of 511 cfs in July is part of that blue line there. And then the**

red line shows the actual streamflow occurring into Florida at the Chattahoochee Gage. And we can compare these two lines, and this is where I say that the impact of pumping is negligible compared to flow into Florida.
Q. Now, you testified earlier that one of the factors that influences how groundwater flows into the rivers and streams is weather or precipitation. What analysis did you do to reach that conclusion?
A. **Yes. What I did was I -- since this case is about flow of water into Florida, I evaluated the flow of water into Florida at the Chattahoochee Gage. And from looking at the flow signature, I evaluated that most of the baseflow impacts are weather related and not pumping related.**
Q. Let's turn to page 30 in your written direct. And I would like to focus on demonstrative 18. Can you describe what the graph in demonstrative 18 shows?
A. **Yes. This graph shows the streamflow at the Chattahoochee Gage, which is into Florida, between 1975 and 2015. The lowest line, the purple line, shows the minimum flow. So for every month we can see the average. We can take**

the monthly flows for every month, and that was plotted for every month. The monthly minimum flow, the minimum flow that month, was plotted for every year in the purple line.

When I look at that minimum flow, you can see that it really isn't a declining trend. You can see that, yes, the minimum flow goes lower during dry periods. And the dry periods I indicated with the red bars. But they are slightly higher in the wet periods or normal periods. The wet periods I indicated with the blue bars. And normal periods are the white, the blank bars.

I also plotted the maximum flow -- maximum monthly flow of every year in the blue line. And we can -- the difference between that minimum flow and the maximum flow is the variation of flow every year. And we can see that that variation of flow every year is in the tens of thousands of cfs.

Finally, on this chart I also show in the orange line the annual flow at the Chattahoochee Gage. And from this what I see is that the annual flows can be lower in dry year and higher during the wet years. And, again, when I look at the difference between a dry year flow and a wet

year flow, that difference is in the tens of thousands of cfs.

So I wanted to evaluate these are the impacts of climate, of -- I should say weather.

Q. And what --

A. **Dry periods or wet periods.**

Q. What did you conclude from this analysis about the relative impacts of groundwater pumping and weather?

A. **Right. The relative impacts of groundwater pumping are negligible compared to the weather-related impacts.**

Q. Let's turn to page 31, the next page in your written direct. And I want to look at demonstrative 19. Can you describe for the Court what is shown in demonstrative 19.

A. **Yes. This is where I have compared the impacts of pumping within Georgia to the weather-related impacts. There are eight bars on this figure. The first two bars show the impact of all of pumping within Georgia during 2011 dry conditions. And we can see that the average impact, which is in the blue line with the number 304 there, and that is the average impact of pumping. And the maximum impact -- monthly**

impact is 538 cfs of all pumping within the basin.

And we can compare these two to the red line in the weather-related impacts, which is -- the minimal flow across the state line is 5,000 cfs, and we can compare that to the 500 cfs of maximum impact; or we can compare the annual average flow of 300 cfs with the annual average flow at the Chattahoochee Gage of 19,000 cfs. And that is also negligible.

Finally the middle two bars, which are the 60 cfs annual average baseflow reduction from 1992 conditions. So if Georgia were to curtail its pumping to 1992 conditions, the benefit would be 60 cfs average annual or 112 cfs monthly maximum baseflow.

And we can compare those again to the 5,000 number and to the average 19,000 number flow.

Finally, the last two bars on the chart indicate -- the second last bar indicates the average fluctuation within a year. So within a year the average fluctuation of flow at the gage is more than 36,000 cfs. And on the last bar we can see the fluctuation between a dry year and a wet year. And we can see that difference is

27,000 cfs.

So we can see all these weather-related impacts here. And we -- what -- I needed to present this so we can compare that with the impacts of all of Georgia's pumping as well as with the impacts of curtailing Georgia's pumping to 1992 levels.

Q. And what conclusion do you reach from this comparison?

A. **Yes. The conclusion I reach from this comparison is that the impact of pumping is negligible compared to the weather-related impacts.**

Q. I want to talk a little bit about groundwater levels in the ACF Basin. Now, Dr. Hornberger has testified that Georgia's groundwater pumping has altered the natural hydrology of the basin by lowering groundwater levels. Do you agree with that conclusion?

A. **No, I do not.**

Q. Why not?

A. **First off, I have evaluated groundwater levels at several wells in the basin. And that showed me that some water levels are increasing. Some wells have stable, we feel, levels. And some wells have declining water levels. So there is**

no basin-wide trend of decreasing water levels.

Secondly, I have also looked at how agricultural irrigation has increased within Georgia from the '70's through the 1990's; and the largest increases had occurred in that time period. And I look at water levels during that time period, and water levels seem to be generally stable during that time period or even slightly increasing. So when you see that increase in agricultural irrigation within Georgia and compare it to groundwater levels, you don't see groundwater levels decreasing as a result.

Q. Now, in your direct testimony on page 62, in demonstrative 37 you actually show groundwater information for a well that is in Florida, not in Georgia. Why are you showing groundwater information from a well in Florida?

A. **Yes. Demonstrative 37 is groundwater level -- shows groundwater levels from a well in the Upper Floridan Aquifer right adjacent to the ACF River Basin, but not within the ACF River Basin. And the reason I show this is because the -- this water level signature that I see in this graph is very similar to the water level signatures that**

we see in wells within the Upper Floridan Aquifer in Georgia.

As you can see here, water levels decline in the dry season and rise back up every year in the wet season. However, if you look at 2011 and 2012 -- and this is a well in Florida -- you see that the rise has not been complete. But then when you get back into 2013, you see that the rise in water levels is pretty much full compared to previous.

And this is the same signature we see for wells in Georgia. So what I understand from that is that this could be regional precipitation or weather-related issues. And you cannot have the same signature here in Florida in a different basin because of pumping in Georgia.

Q. Now, you said before that another analysis you had done was you compared pumping to groundwater levels to see if there was a correlation or an inverse correlation between the two.

And let's look at demonstrative 38 in your direct testimony on page 63. And does that show the results of your analysis?

A. **Yes. That is correct.**

Q. And can you describe what you found?

A. **Yes. As we see in this graph, the largest increases in pumping within Georgia occurred -- within the basin occurred between 1975 through the 1990's. And the blue -- that's the red line. And the blue line shows the water levels at the well in the basin in the Upper Floridan Aquifer. And we can see that the water levels are not declining as a result of this increased pumping.**

The gray bars show the annual precipitation at the gage within the basin, and the water levels generally follow that trend.

In fact, Dr. Langseth in his expert testimony also said that water levels generally follow precipitation, recharge trends, though they may lag in time.

Q. Now, the last piece of analysis that you had mentioned with respect to groundwater levels was an analysis that you did of long-term trends in different wells. And if you turn to page 60 and you look at demonstrative 35, is that the analysis you were referring to?

A. **Yes. Demonstrative 35 shows the trend analysis that I have done in Upper Floridan Aquifer water wells.**

Q. And what did you find in that analysis?

A. **I have done two different trend analyses. The second to last column shows my results from my linear trend analysis. And that shows that some wells indicated a declining trend, some wells indicated an increasing trend, and some showed a generally stable trend.**

I also did this Mann-Kendall statistical trend analysis, and that also shows that all wells are not decreasing. Some are stable. Some are decreasing, and some are increasing in the basin.

Q. And based on all these analyses that you have done with respect to groundwater levels, what have you concluded about the general health of the aquifer in the Upper Floridan?

A. **The general health of the aquifer in the Upper Floridan is good.**

We see, if you look at the monthly water level changes also, that water levels drop in the dry period and rise back in the wet period. They may not rise back fully during droughts or multi-year droughts; but once there is a return of normal precipitation or wetter periods, you see that the water levels bounce right back up and that the aquifer gets fully recharged.

Q. Now, during your cross-examination you were asked about a variety of local issues including the sustainable yield analysis in Spring Creek. And I think if you go to demonstrative 46 in your direct testimony -- it's page 76 -- you have a chart that summarizes your analysis as to all of those.
A. **Yes. That is correct.**
Q. And can you describe the analysis that's reflected in demonstrative 46.
A. **Yes, I can. Again, the last four bars are the same bars that we saw earlier which indicate the weather-related impacts. Now, starting from the first of those bars, the first one shows the maximum agricultural withdrawals from surface water irrigation in the basin; and that is 333 cfs. And then average -- the second bar there shows the impact of a 10 percent error in Upper Floridan Aquifer pumping estimates. So if there were errors in the pumping estimates and if there was a 10 percent error, you would get 54 cfs impact into the 10 percent error throughout the basin.**
Around 54. I say 538 cfs is the entire impact of pumping; so 10 percent of 538 is 53.8,

so 54 cfs.
The next, third, bar indicates the water level impacts. What I had done is I conducted a model simulation in steady state -- by steady state I mean long-term impacts -- to see if there was a 2-foot decline basin-wide in water levels everywhere, then you could get an impact of 39 to 217 cfs.
Then I go to the sustainable yield issues or the local issues which we talked about. And when I evaluated that sustainable yield criteria at Muckaloochee Creek, that was less than 1 cfs.
I evaluated flows at the Iron City Gage. And in the earlier period of record, before there was irrigation also, when there were droughts, those flows could be as less as -- as low as 10 to 20 cfs. I -- I believe as less as 10 cfs. And Iron City Gage showed no flow in the current drought. So the difference between 10 cfs off a previous drought and no flow for the current drought is around 10, which is what I'm indicating here.
The next one is Mosquito Creek, which also came up in the sustainable yield study. And that had an even minor impact. It was less than a fraction of a cfs.

And finally, the blue hole springs which were referred to was Radium Springs. So I evaluated against the flows at Radium Springs. And minimum flows could be as low as 4 cfs in previous droughts.
So, again, when we compare all these numbers to the weather-related factors on the right, the minimum flow or the annual average flow or the fluctuation in flow every year, or the fluctuation in flow between wet and dry years, you can see that these numbers are negligible.
Q. The last topic that I would like to cover is Dr. Sunding's conservation scenarios. Now, you talked a little bit about this on cross-examination; but are you aware that Florida's economist has said that Georgia can increase flows by 1700 cfs just from a reduction in agricultural irrigation?
A. **I believe he said that, yes.**
Q. And do you have an opinion about whether it's possible to achieve 1700 cfs from a reduction in agricultural irrigation?
A. **Yes, I do have an opinion of that.**
Q. Okay. And what is your opinion?
A. **It is not possible.**

Q. Why do you say that?
A. **First thing is Dr. Sunding has used impact factors to do his calculations. And those impact factors change when you change your distribution of pumping or when you change your timing of pumping. He needs to have run a model to evaluate that.**
Technically, if you look at the impact of all agricultural pumping within Georgia, which I have shown, it is around -- it's less than a thousand cfs. That's my calculation.
Also, Dr. Langseth had done a calculation during his deposition. And in that calculation, he was -- he got less than 1700 cfs.
And even if you now take his 40 percent impact factor and change it to 60 percent impact factor for groundwater pumping and add what he claims is the impact of surface water flows, surface water withdrawals, you still get less than 1700 cfs.
Q. So you're saying that whether you use your numbers or Dr. Langseth's numbers, it doesn't matter. If you stopped all pumping -- groundwater pumping in the ACF Basin, you still would not get the 1700 cfs that Dr. Sunding says

you can conserve?
A. **All agricultural pumping, yes. I agree.**
MS. ALLON: I have nothing else, your Honor.
Thank you.
SPECIAL MASTER LANCASTER: We'll take a noon recess now.
Counsel, you can -- can you give me an estimate of how long you think you will be -- guesstimate?
MR. QURESHI: Less than 30 minutes.
SPECIAL MASTER LANCASTER: Pardon?
MR. QURESHI: Less than 30 minutes.
SPECIAL MASTER LANCASTER: Terrific. Thank you.
(Time Noted: 11:58 a.m.)
(Recess Called)
(Time Noted: 12:52 p.m.)
SPECIAL MASTER LANCASTER: Thank you again, counsel, for the rain.
MR. QURESHI: You're welcome.
RECROSS-EXAMINATION
BY MR. QURESHI:
Q. Good afternoon, Dr. Panday.
A. **Good afternoon.**

Q. Sir, I want to start with discussing the 511 cfs streamflow impact associated with groundwater pumping according to your model.
A. **Right. In Georgia?**
Q. In Georgia.
A. **Yes.**
Q. Now, to be clear, that's just groundwater pumping?
A. **That is correct, just the impact of groundwater pumping in the Upper Floridan Aquifer.**
Q. And you're not considering total amount of consumptive use by Georgia when you say that that's a negligible amount compared to state line flows?
A. **I have not done the analysis of the total consumptive use in Georgia; correct.**
Q. Do you know what the total agricultural estimated use was in July of 2011 according to Georgia EPD?
A. **No, I do not know the values that Georgia EPD has for the July 2011 calculations. But I do have estimated irrigated -- estimated irrigation from agricultural irrigation pumping for 2011 conditions, which I got from Georgia EPD's databases; and I have that for groundwater as well as surface water for agricultural**

irrigation.
Q. Okay. So for agricultural irrigation in July of 2011, the maximum impact of streamflow is 511 cfs?
A. **For pumping in the Upper Floridan Aquifer within Georgia, that is correct.**
Q. Okay. Let's look at what Georgia EPD says is the total agricultural consumptive use on an average basis in July of 2011. If you will turn with me to tab 10 of your first volume, please. And you will recognize tab 10 as the direct testimony of Dr. Zeng. Right?
In particular, please go to --
A. **Yes.**
Q. -- page 23. You can see a figure 9 there.
A. **Yes. I see that figure 9.**
Q. All right. So for July 2011, the total monthly average agricultural consumptive use, according to Dr. Zeng, is about 1400 cfs.
A. **I'm not sure which year it is, but the largest one there near the end is around 1400 cfs.**
Q. Okay. And let's assume that 511 cfs of that is associated with agricultural irrigation. Where is the other 900 cfs coming from? Who is using that?

A. **I do not know what this consumptive use is. This is not the agricultural. I don't know if this is the agricultural pumping or whether this is the impact to baseflow.**
Q. Does the label at the bottom of the chart help you, total monthly average agricultural consumptive use?
A. **It doesn't, because consumptive use has been used in different ways. Consumptive use could be just the water that was used, or it could be the reduction in baseflow. So there were two different definitions for consumptive use.**
Q. And you have no idea how Georgia EPD used it?
A. **I believe they have used it in both ways, if I'm not mistaken.**
Q. And do you know how Dr. Zeng used it in his direct testimony?
A. **I'm not sure.**
Q. All right. If we assume that the 511 cfs of the total 1400 is the work you did, the withdrawals associated with agricultural pumping, do you have any idea as to where the remaining 900 cfs is being used or consumed in the agricultural sector?
A. **No, I do not know about this.**

Q. Okay. Dr. Panday, during redirect, you talked a little bit about groundwater levels. Do you recall that?
A. **Yes.**
Q. In fact, in your direct testimony in section 9, you state that, quote, there is no evidence of groundwater pumping in the ACF River Basin causing long-term depletion of the Upper Floridan Aquifer.
Do you recall making that testimony?
A. **Yes.**
Q. Okay.
A. **Specifically basin-wide declines.**
Q. Basin-wide declines. But you do acknowledge that individual wells have declined?
A. **Yes. Some wells have declined, some wells have increased, and some wells have been stable. Correct.**
Q. Let's take a look at the particular table you were reviewing with counsel for Georgia. I believe that was on page 60 of your prefiled direct. That's behind tab 1.
This is the trend analysis for the 20 wells.
A. **Yes. I'm there.**
Q. And the time period that you have looked at here

is 1975 through 2015?
A. **That is correct. Any data that was available within that time period has been analyzed.**
Q. Okay. And of these 20, 11 are decreasing or potentially decreasing?
A. **From the linear trend analysis, I see one, two, three, four, five, six showing a declining trend. And from the Mann-Kendall statistics, it shows one, two, three, four, five of them with a decreasing trend, with one, two, three, four, five, six of them with a probably decreasing trend.**
Q. Okay. So it's a total of 11 that are either decreasing or probably decreasing?
A. **From the Mann-Kendall statistical analysis, that is what it shows.**
Q. All right. And from the Mann-Kendall statistical trend analysis, it shows five as being stable?
A. **And it shows five as being stable; correct.**
Q. And three with no trend?
A. **And three with no trend, yes.**
Q. And one that's increasing?
A. **Yes.**
Q. And you actually looked at this -- these 20 wells pre-1992 and post-1992 as well; didn't you?

A. **I have -- this trend analysis is for the entire record of -- period of record from '75 through 2015. But when I looked at the individual wells, I do have statistics, I believe, for pre-'92 conditions and post-'92 conditions.**
Q. And those statistics, if you recall, showed that 18 of the 20 wells are declining post-1992; isn't that true?
A. **I do not recall. But I do recall that Florida had done a trend analysis for post-1992 conditions and pre-1992 conditions. And in that, a lot of those wells showed declining water levels post-1992, yes.**
And I'm not surprised about that because you're starting off with high water levels in 1992 through 1998. There were either normal or average weather conditions -- precipitation conditions. And then after that, we start getting into these multiple multi-year severe droughts. So the water levels started off high in 1992 and dropped after that. So that's not surprising.
I, myself, have done an analysis starting from 1998, which is just before those droughts hit. And when you look at the water levels

pre-1998, they do not show a declining trend. And that was, in fact, when agricultural pumping increased. The most increases occurred in Georgia during that period of time. And then when you look at the post-1998 -- also in my direct I have that -- there is no declining trend again, because we started off low; and we are staying low.
Q. Sir, is your testimony that agricultural irrigation increased in 1998, not in the '70's?
A. **No, I did not say that. I said maximum agricultural increases occurred from the '70's through the '90's. That's what I said.**
Q. Sir, can you please look at tab 21 of your binder. Tab 21 is JX-83. It's a USGS report entitled Groundwater Conditions in Georgia, 2010-2011. Have you seen this report previously, sir?
A. **Yes. I believe I have seen this report previously.**
Q. Okay. Can you turn with me to page 12. On page 12 there's a discussion that begins on a paragraph that starts with groundwater pumping is the most important human activity that affects -- do you see that?

A. **Yes, I see that.**
Q. Can you read that paragraph to yourself.
A. **Yes, I read that.**
Q. Okay. And you agree with the statements in that paragraph; don't you?
A. **It says that the most important human activity that affects groundwater storage and the rate of discharge from an aquifer is groundwater pumping.**
So he's specifically talking about human activity, and I guess that is the case. I mean, there could be other human activities like dredging or something that could impact the groundwater flow to streams. But I guess that's not a common daily activity, and groundwater pumping might be.
So I agree that from human activities, groundwater pumping can affect the storage as well as the discharge from the aquifer.
Q. Okay. And then there is a hydrograph of a particular well in Randolph County. Do you see that?
A. **Yes, I see that.**
Q. And that shows a trend line; doesn't it?
A. **Yes, it does.**
Q. And that's decreasing, sir?

A. **Yes, it is. But this line is not in the Upper Floridan Aquifer, and it's just one well.**
Q. Your testimony is that Randolph County is not in the ACF Basin?
A. **No. It said over here that this is a Clayton -- completed in the Clayton Aquifer in Randolph County. It specifically says that in the last sentence of this paragraph you made me read. So --**
Q. My question is is this in the ACF Basin?
A. **It is in the ACF Basin, yes. It's not in Upper Floridan Aquifer is what I said.**
Q. Let's look at the Upper Floridan Aquifer on page 24.
A. **Yes. I'm there.**
Q. Okay. And you can read the paragraph right before the reference section.
A. **Yes. I read that sentence.**
Q. Okay. And do you agree with the statements there?
A. **I do not know the context of this. It says here during 2010 and 2011 water levels in all wells declined at some particular rate, which reflects drought conditions that existed in 2010 and 2011.**
So I do agree that water levels dropped in

those wells during the 2010 to 2011 period by as much as he says. I don't know these numbers, but they would decline because of the drought.
Q. Okay. And did you -- did you study this data in connection with issuing your direct testimony?
A. **I don't believe I have looked at this.**
This is a local impact, again. There are wells where it says that the impacts are higher. There are wells where it says that the impacts could be lower.
And, again, I was evaluating the impacts of baseflow due to pumping. So my specific objective was not to look at water levels, but to look at how much the -- there is a reduction in baseflow because of pumping in Georgia.
Q. But you rendered an opinion that there is no evidence that groundwater levels are declining?
A. **That is correct. In the Upper Floridan Aquifer.**
Q. But that's not what you looked at?
A. **I looked at the data for different wells in the Upper Floridan Aquifer to evaluate that.**
Q. Sir, you're not a climate expert?
A. **No, I'm not.**
Q. Okay. And you're not a hydroclimatologist?
A. **No, I'm not.**

Q. So, in fact, at your deposition you weren't aware as to what that meant?
A. **Right.**
Q. All right. Do you know now?
A. **Someone who looks at the hydrologic impacts of climate. I believe that's what it would be.**
Q. And when you examined precipitation data in this case, you had not done that type of analysis previously; is that correct?
A. **What kind of analysis are you specifically referring to?**
Q. The analysis that you did in this case, and that is evaluating trends in precipitation.
A. **I looked at the precipitation data across the basin. And I looked at how much the average precipitation was pre-'92, and I looked at the average precipitation post-'92. That's what I have done.**
Q. I understand that, sir. I'm talking about outside of this engagement, outside of this project, did you ever have any other project where you looked at precipitation trends?
A. **I have used precipitation data in other models. In this modeling I haven't even used the precipitation data for my model. I have looked**

at the precipitation data to see what it tells me about the basin.

This is like my due diligence which I do to understand the system. So that is when I looked at precipitation data. I looked at streamflow data. I looked at water level data for that purpose.

Q. Okay. And when you looked at precipitation trends, you looked at select rain gauges in the ACF Basin?

A. **I selected -- yes, rain gauges across the ACF River Basin.**

Q. And how many rain gauges did you look at, sir?

A. **I don't remember the exact number; but there were a few, I believe.**

Q. Okay. And if you look at -- I think it's figure C-2 in your report. It's demo 20 of your prefiled direct.

I think there's seven. Does that sound right to you?

A. **What am I looking at, please?**

Q. I'm trying to understand how many rain gauges you looked at across the entire basin. Does the number seven sound correct to you?

A. **It may be -- I thought eight or 10, yes. A small**

number. But I don't know the -- I don't recall exactly if it was seven.

Q. Why don't we get the exact number.

If you look at page 33 --

A. **Of my direct?**

Q. Yes, sir.

A. **Yes. Yes.**

Q. I count eight. Is that what you get?

A. **Yes. There were eight stations, but -- that is correct.**

Q. Do you know how many stations exist throughout the entire basin?

A. **No. But there are several more.**

Q. Okay. Do you know that climatologists typically rely on a gridded precipitation data in formulating precipitation trends?

A. **I don't know what climatologists do. But we use gridded data if needed. We use the point measurement data as well.**

Q. What did you use here?

A. **I have looked at the point measurement data. I haven't looked -- used this in a model.**

Gridded data is good when you have to cover the entire region; and you put that -- those numbers in a model. So you need coverage

overall.

What I have done here is just to examine what the precipitation was between 1975 and current conditions across the basin. So I just selected data -- I selected gauges which had a long -- a period of record that existed between 1975 and 2015, as much as was available.

Q. Do you know who Dr. Dennis Lettenmaier is?

A. **Yes, I know who he is.**

Q. Have you read his prefiled direct testimony in this matter?

A. **No, I have not read his prefiled direct testimony.**

Q. Okay. Did you read his deposition transcript?

A. **No, I have not. I have seen his expert report briefly when it had first been put out.**

Q. Okay. And you understand that he's a hydroclimatologist?

A. **I don't know exactly what he does. I believe he's a professor.**

Q. Okay. Sir, we talked a little bit about Dr. Sunding; and then you were asked some questions about that on redirect. You're aware that his conservation scenarios include eliminating evaporation from farm ponds?

A. **I believe he was looking at all agricultural reductions of pumping in his conservation scenarios.**

Q. Right. I'm not talking about pumping now. I'm talking about reducing evaporation from farm ponds. Do you realize that that was a component of his conservation scenario?

A. **I do not recall that.**

Q. All right. So when you said that the 2,000 cfs that he's proposing is not achievable, you didn't consider that?

A. **Essentially the farm ponds are also filled by groundwater pumping or by surface water stream when the weather is wet. So those farm ponds are not taking away anything from dry weather. In fact, in dry weather they have collected water so you don't have to pump as much.**

So the farm ponds was part of the database that was given to me. And I approximated that 70 percent of that water -- the farm ponds water came from groundwater, and 30 percent came from surface water. So the farm ponds were accounted for in the water consumption.

Q. And do you know that Dr. Sunding explained that you could save 271 cfs from reducing evaporation

from farm ponds? Do you know that?
A. **I do not know what Dr. Sunding has done in this regard.**
Q. Okay. Have you heard about the Georgia Water Resources Institute?
A. **I'm not sure.**
Q. Okay. Have you heard of Dr. Georgakakos?
A. **I have heard the name, yes.**
Q. How about Dr. Martin Kistenmacher?
A. **I'm not sure.**
Q. Okay. Were you in court at all last week when we were discussing the UIF report issued by GWRI?
A. **I was in court for a short period during Dr. Hornberger's testimony.**
Q. Okay. Sir, if you could turn to tab 19 of volume 2 of your binder, I'm going to ask you if you have ever seen this document before.
A. **No, I have not seen this document before.**
Q. Okay. So in your work on this, you're not familiar with criticisms by the Georgia Water Resources Institute of the agricultural water consumption numbers provided by Georgia EPD?
A. **I don't know if there was a criticism. You're telling me that there was a criticism. I don't**

know that there was.
Q. I'm asking you if anyone has ever told you that there was a criticism?
A. **No. I don't know that.**
Q. Okay. Has anyone ever told you that GWRI estimated that up to 1200 cfs a year is lost to evaporation from farm ponds? Did you ever hear that before?
A. **Not before now, no.**
Q. Okay. Sir, you were shown a portion of Dr. Langseth's testimony during your redirect examination. Do you recall that?
A. **Yes. I do.**
Q. Okay. And it was for a particular day. I believe Mr. -- Dr. Langseth was deposed for four days. Does that sound correct to you?
A. **I believe he was deposed for four days, yes.**
Q. Okay. I'm going to show you a transcript for another day. I don't think you were at this particular day of his deposition, but I want to see if that relates at all to your understanding of the impact factor range that Dr. Langseth provided.
MR. QURESHI: Your Honor, may I provide the deposition transcript?

BY MR. QURESHI:
Q. I may have asked you this previously, Dr. Panday. Have you read the entirety of Dr. Langseth's transcript?
A. **No, I have not.**
Q. Okay. Well, I'll direct you to page 1028, line 24, through 1030, line 3.
A. **Okay. I read this.**
Q. Okay. The next section I want you to read is on the following pages, page 1032, line 3, to 1033, line 9.
A. **Yes. I read this.**
Q. Okay. Does this inform your understanding of Dr. Langseth identifying a range of potential impact factors from 41 all the way up to 87 percent?
A. **I have not seen this before.**
Q. Okay. So when you said that he had abandoned his opinion, it was not based on reading this transcript?
A. **That is right. They were -- Florida has been using the impact factor of .6 in the direct testimonies that were submitted. That's why I said that. And previously they used the impact factor of .4. And that is why I said that they**

had abandoned the .4 impact factor and selected .6 impact factor instead.
Q. You understand that this deposition that you are looking at was given before the prefiled direct was submitted in August?
A. **Right. It was in August.**
Q. And you hadn't read this when you wrote your prefiled direct?
A. **No, I have not.**
Q. Okay.
MR. QURESHI: Nothing further.
SPECIAL MASTER LANCASTER: Redirect?
MS. ALLON: Yes, your Honor, very briefly.

REDIRECT EXAMINATION

BY MS. ALLON:
Q. Dr. Panday, I just want to go back to one exhibit that counsel for Florida was asking you about just now. It was behind tab 21 in your binder on page 24, the USGS report.
A. **Yes. I'm there.**
Q. Page 24?
A. **Yes. I'm there.**
Q. And counsel for Florida had asked you about five wells that are discussed on page 24, and he said

that there were declining trends in those wells. And he asked you had you ever considered these trends when you formed your opinions about groundwater trends in the ACF Basin. Dr. Panday, are all of these wells even in the ACF Basin?
A. **I'm not sure that they are.**
Q. And, in fact, if you go back to your direct testimony on page 71, for example, you can look at the map there. And if you just put it side by side --
A. **Yes.**
Q. -- you can see, for example, if you look at Thomas County, it's in the bottom right-hand corner of your demonstrative 42. And it's in this map that counsel for Florida was showing you. That's outside the ACF Basin; isn't that right?
A. **Yes. That is correct. In fact, looking at this map at the bottom of page 24 of Exhibit 21 here, it shows the blue area shaded where these wells are. And these wells are outside of the ACF River Basin.**
Q. Are wells outside of the ACF Basin relevant to your analysis of groundwater trends inside the ACF Basin?

A. **No, they're not.**
MS. ALLON: Thank you, your Honor. Nothing further.
SPECIAL MASTER LANCASTER: Anything further?
MR. QURESHI: May I just ask one question?
SPECIAL MASTER LANCASTER: Sure.
RECROSS-EXAMINATION
BY MR. QURESHI:
Q. Dr. Panday, sticking with page 24, the well on the left-hand side next to where it says Flint River, is that in the Flint River Basin?
A. **When I look at the little map with it, it shows it to be at the edge of the Flint River there.**
Q. And Thomas County that Georgia's counsel highlighted for you, how many wells are in Thomas County there?
A. **None. But the point I believe she was trying to make is that most of the wells are further east of Thomas County. So now, they're even further away from the ACF River Basin.**
Q. But there is one on the Flint River; isn't there?
A. **There is one that -- which seems to be on the Flint River, yes.**

Q. Okay.
MR. QURESHI: Thank you, you Honor.
SPECIAL MASTER LANCASTER: Redirect?
MS. ALLON: Nothing else, your Honor. Thank you.
SPECIAL MASTER LANCASTER: Doctor --
THE WITNESS: Yes, your Honor?
SPECIAL MASTER LANCASTER: -- you have heard the old saying there are lawyers and there are lawyers; and there are doctors and there are doctors. Yes?
THE WITNESS: No, I haven't heard it before. But it's quite funny.
SPECIAL MASTER LANCASTER: In the same token, are there models and there are models?
THE WITNESS: There are models and there are models, yes.
SPECIAL MASTER LANCASTER: And it -- does it make a difference as to which model you pick?
THE WITNESS: It can make a difference as to which model we pick and also what the objectives of the modeling are.
SPECIAL MASTER LANCASTER: And does it -- can it make a difference as to what you

put in the model?
THE WITNESS: It makes a difference as to what you put into the model, again, depending on the objectives of the model, your Honor.
And if you want, I can explain a little. What I meant was that if you put in weather-related conditions which could be different, then you could get different answers. But if the objective of the model was the impact of pumping, then that -- what you put in with regards to the weather-related impacts do not make a difference on the impact of pumping.
SPECIAL MASTER LANCASTER: So if somebody picked a model and put certain things in, they might get certain results?
THE WITNESS: Right.
SPECIAL MASTER LANCASTER: Let me ask you this. Have you heard of the Battle Bend?
THE WITNESS: I heard about this yesterday, your Honor.
SPECIAL MASTER LANCASTER: Do you know where it's located?
THE WITNESS: I Google-Mapped it, and I

saw that the Google Map showed it right in the middle of a lake somewhere in Florida along the Apalachicola River, I believe.

SPECIAL MASTER LANCASTER: So if the United States Supreme Court were to order that the Battle Bend be disengaged, what effect would that have?

THE WITNESS: I'm not sure I understand your question.

SPECIAL MASTER LANCASTER: Well, suppose that the Supreme Court said get rid of Battle Bend; disengage it so it doesn't connect anymore. What effect would that have?

THE WITNESS: I'm not sure, your Honor.

SPECIAL MASTER LANCASTER: Okay. Suppose the Supreme Court ordered that a canal be created between the Tennessee River and the Chattahoochee River. What effect would that have?

THE WITNESS: I'm not sure, your Honor.

SPECIAL MASTER LANCASTER: There are, I think, some 300 sloughs in this area?

THE WITNESS: I do not know, your Honor.

SPECIAL MASTER LANCASTER: Well, suppose the Supreme Court ordered that they all be

blocked. What effect would that have?

THE WITNESS: I would not know, your Honor. I have been analyzing the groundwater effects on pumping.

SPECIAL MASTER LANCASTER: Right. And I understand that. I understand your testimony. I just thought I would take a chance that you might be able to answer.

Somebody else will be able to -- they're going to get asked the questions, too.

You probably don't know the answer to this one either. Oysters are male and then they become female?

THE WITNESS: I do not know, your Honor.

SPECIAL MASTER LANCASTER: Okay. I think I'm going to strike out, but let me ask you a couple of more questions. What would happen if below Bainbridge and above Sumatra, the gages -- what would happen if all of the water flowing in were stopped?

THE WITNESS: I believe it would be very difficult to stop all the water flowing downstream, your Honor. You could build a dam, but then water levels would rise and flow over. So --

SPECIAL MASTER LANCASTER: Okay.

THE WITNESS: I don't think we can stop the water at Bainbridge.

SPECIAL MASTER LANCASTER: Let me ask you another question, which will indicate my ignorance even further.

If it rains and rains and rains and rains, are you going to get more groundwater?

THE WITNESS: Your Honor, I believe right now you know more about this case than I do or a lot of us do. But -- so when you say forgive my ignorance, I think you know a lot more than we do.

But at the same time, if it rains and rains, the water levels will rise up to the maximum. And once the aquifer is fully recharged, it cannot rise anymore. You're going to get runoff.

SPECIAL MASTER LANCASTER: So -- and if it doesn't rain at all, you get a drought.

THE WITNESS: Yes, your Honor. And the groundwater levels will drop because of the drought.

SPECIAL MASTER LANCASTER: It seems

to me, as a layman, the more rain you get, the more water you get; the less rain you get, the less water you get.

Is that right?

THE WITNESS: That is correct, your Honor.

SPECIAL MASTER LANCASTER: Thank you.

MS. ALLON: Nothing else, your Honor.

MR. QURESHI: Nothing further, your Honor.

SPECIAL MASTER LANCASTER: You're off the hook.

THE WITNESS: Thank you, your Honor.

MS. ALLON: Georgia is ready to call its next witness, Dr. Phil Bedient.

SPECIAL MASTER LANCASTER: Thank you.

While he's taking the stand, I just got an e-mail from my legal assistant -- we don't have secretaries anymore -- from my legal assistant saying that Governor Deal was making a talk about something. Do you know what he's talking about?

MS. ALLON: I don't, your Honor.

SPECIAL MASTER LANCASTER: Okay. Just curious.

MS. ALLON: I can check.
SPECIAL MASTER LANCASTER: If you find out, let me know if it has anything to do with us.
MS. ALLON: I will, your Honor.
SPECIAL MASTER LANCASTER: Thank you.
THE CLERK: Please raise your right hand.
Do you solemnly swear that the testimony you shall give in the cause now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?
THE WITNESS: I do.
THE CLERK: Please be seated.
Pull yourself right up to the microphone and please state your name and spell your last name.
THE WITNESS: Philip Bedient, B E D I E N T; Philip, one L.
MS. ALLON: Your Honor, Dr. Bedient is a hydrologist and an expert on reservoir operations.
May I hand up a copy of his direct testimony?
SPECIAL MASTER LANCASTER: Please.

DIRECT EXAMINATION
BY MS. ALLON:
Q. Dr. Bedient, do you recognize this as your prefiled direct testimony?
A. **Yes, I do.**
Q. And do you adopt this as your sworn testimony in this matter?
A. **I do.**
CROSS-EXAMINATION
BY MS. WINE:
Q. Good afternoon, Dr. Bedient. My name is Jamie Wine, and I'm counsel for the State of Florida.
A. **Good afternoon.**
MS. WINE: Your Honor, we have a cross binder, as you might expect. May we approach with it?
SPECIAL MASTER LANCASTER: Certainly.
MS. WINE: I got it into one though. I excerpted some documents, but it was my goal to keep this in one.
SPECIAL MASTER LANCASTER: Thank you.
BY MS. WINE:
Q. Dr. Bedient, I would like to start out by asking you about your offset theory. Okay?
A. **Sure.**

Q. Now, you believe that to the extent Georgia were to reduce its consumption on the Flint River, the Corps would hold back water on the Chattahoochee in order to offset the increased flows from the Flint. Correct?
A. **Yes. That is correct.**
Q. And you refer to this in your prefiled direct testimony as the Army Corps, quote, offset operation. Correct?
A. **Yes.**
Q. And your opinions depend heavily on this. Correct?
A. **My opinions are related to the offset, but that's just part of the operations that go on within the ACF Basin by the Army Corps.**
Q. Okay. I think you said that the offset operation was at the crux of your report. Do you recall saying that?
A. **Well, especially during low flows and drought times; that is correct.**
Q. Okay. And you're familiar with the RIOP, which is the Revised Interim Operating Plan for the Corps. Correct?
A. **I am.**
Q. And the RIOP establishes minimum release

requirements from Woodruff Dam to the Apalachicola River. Correct?
A. **It sets minimum release standards for the maintenance of fish and wildlife and endangered species.**
Q. So it is the RIOP that establishes these minimum release requirements. Correct?
A. **That is correct.**
Q. Okay. And you were in the courtroom last week when Dr. Zeng testified; is that correct?
A. **When doctor who testified?**
Q. Dr. Zeng, Wei Zeng.
A. **Oh, yes. Yes.**
Q. I might be mispronouncing his name.
A. **No.**
Q. So if I am, I apologize.
A. **That's okay.**
Q. Okay. And you were here?
A. **Yes.**
Q. Do you recall when he came over to the big screen, and he put up a table from the RIOP that set forth some of the minimum release requirements; and he was explaining the RIOP to the Court?
A. **I do.**

Q. And he explained the different circumstances under which the minimum release requirements are determined. Correct?
A. **Correct.**
Q. And he talked about three factors, time of year, basin inflow, and composite storage. Do you recall that?
A. **Yes. Those are the three main drivers that sort of, if you will, dictate the outflow and all of that from Woodruff Dam.**
Q. And he also noted that there was a 5,000 cfs minimum release requirement when the Corps is in something called drought operations. Correct?
A. **Yes.**
Q. Okay. During this explanation, Dr. Zeng did not ever use the term offset operation. Correct?
A. **I didn't listen to it that closely.**
Q. Okay. Did you look at his prefiled direct testimony?
A. **I have -- I have glanced through it; but I have not studied it.**
Q. Okay. From your glance through of his prefiled direct testimony, do you recall whether Dr. Zeng ever used the term offset operation?
A. **No, I don't.**

Q. Or even the term offset?
A. **No, I don't.**
Q. And you didn't use the term offset operation in your expert reports; did you?
A. **I would have to go back and -- and carefully look or study those reports. They're fairly extensive.**
Q. Okay.
A. **It's a -- it's a term that I have used simply because it -- when we say offset, it's something that's fairly easy to understand.**
Q. Well, we looked for the term offset operations in your two reports which are in your binder. I'm not suggesting that you look through them right now, but we couldn't find that term anywhere in your two expert reports. But we do see it when we get to your prefiled testimony. Correct?
A. **Yes. And I believe that there's a graphic that sort of demonstrates the offset.**
And we call it the offset because, again, we're trying to simplify a fairly complex phenomenon. And by calling it offset, we think that's an easily understandable definition.
Q. Are you the one who made up the term offset operation?

A. **I'm not sure if it was something that I came up with or if it was something that we determined within the group.**
Q. Okay. Well, you're familiar with the Corps October 2015 Draft Environmental Impact Study for the Water Control Manual update. Correct?
A. **I'm familiar with it. Yes.**
Q. Okay. And that represents the Corps' most comprehensive description of its reservoir operations in the ACF Basin?
A. **I believe so.**
Q. And it totals over 4200 pages?
A. **I know it's extensive.**
Q. Don't worry. I didn't put the whole thing in front of you.
A. **Please don't. Thank you.**
Q. And are you aware that the term offset operation is nowhere among those 4200 pages?
A. **If you're telling me that, I wouldn't be surprised. It -- again, it's a term that is used in my demonstrative No. 12 in my direct testimony to offer up, if you will, a concept so that it's easily understandable.**
Q. And you know that offset operation is not actually an operating protocol of the Corps.

Correct?
A. **Well, no; that's not true at all. I believe we have got plenty of information, plenty of data, plenty of plotted, if you will, hydrographs and response curves from the reservoirs that clearly show that offset is taking place, especially during drought conditions.**
Q. It's not a term that's defined like drought operations is in any of the Corps materials; correct?
A. **I will agree with what you just said, yes.**
Q. And this is precisely why the U.S. Government says that you and Georgia are speculating when you assert that the Corps will offset any water conserved on the Flint. Correct?
A. **Well, now, that statement comes out of the -- the U.S. Government position, I recall reading that. And while they go on to talk about that, they were also mainly talking about annual flows and all sorts of flows. And they also say in that exact statement that a lot of this is subject to a lot more study, and there's more data that needs to be evaluated.**
Q. Sir, you recall reading the Government's brief? It was an amicus brief that they filed in

opposition to Georgia's motion to dismiss in this case?

A. **I recall seeing it, yes.**

Q. Okay. And do you recall that in that brief the United States responded directly to the argument put forth by Georgia and you that the Army Corps would increase impoundsments upstream to offset increased flows from the Flint River; didn't it?

A. **You would have to show me the document before I could --**

Q. Okay. We can pull that up.

MS. WINE: Let's put that up on the screen.

BY MS. WINE:

Q. We have got it here. I think it's in tab 4 of your binder as well, if that's easier for you.

A. **Sure.**

MS. WINE: Mr. Walton, if we could turn to page 19 of that brief.

Let's put 18 and 19 on the screen, actually.

BY MS. WINE:

Q. Dr. Bedient, the section on page 18 that starts under the heading B is the section that I'm referring to where the Army Corps is responding

to this offset argument.

MS. WINE: And if we could now, Mr. Walton, let's just blow up 19 -- page 19. And we have got some language already highlighted there.

BY MS. WINE:

Q. Sir, is this the brief that you recall reading from the United States Government?

A. **Yes.**

Q. And you recall that the United States first recognized that a cap on Georgia's consumption, particularly on the unregulated Flint River, as they call it, could increase the amount of water flowing into Florida. Correct?

I'm just looking at that first highlighted sentence, sir.

A. **Well, it's difficult with these types of documents to simply look at a single sentence and pull it out of context.**

Q. Okay. I'm going to read on; but for now, I'm just wondering if you see right there in that sentence that the government says that it's at least plausible that a cap on Georgia's consumption, particularly with respect to the Flint River, which is unregulated by the Corps,

would increase the basin inflows and thereby increase the amount of water flowing into Florida.

A. **I see the sentence. I do.**

Q. And, sir, the Government goes to say that Georgia gives Flint River short shrift by suggesting that the Corps in this circumstance would just offset the increased flows from the Flint. Correct?

A. **Right. I see that.**

Q. And then they go on to say that the offset theory is actually entirely unwarranted speculation. Do you see that?

A. **I see what they're saying in this brief. But they also go on to say that we cannot say at this juncture without further factual development that Florida would not be able to receive any minimum flow that might be adjudicated entirely through other caps and other issues. And in addition, we have done extensive studies as part of this work that clearly shows that there are many, many times with respect to the way that the Army Corps of Engineers operates under the RIOP, especially in drought conditions.**

Q. Sir --

A. **There are many, many times when Florida will not**

receive any additional flows in the system.

Q. Sir, you're not trying to suggest to this Court that you know more about how the U.S. Army Corps operates than the U. S. Government itself; are you?

A. **No. I would not.**

Q. Okay. Now, your offset theory depends on the assumption that the Corps is only going to release the minimum amount and no more. Correct?

A. **Well, the offset theory -- first of all, this is -- this is -- it's within the RIOP; and the RIOP is a very complex document. And under certain conditions -- under certain conditions -- there are periods where this offset will occur, especially when flows are below 5,000.**

Q. So during a low flow period?

A. **Well, or during a drought-type period, yes.**

Q. All right. If we can put that brief back up and keep reading --

MS. WINE: Jon, can you pull that back up?

Thanks.

BY MS. WINE:

Q. So the Government also says here that an increased flow during wet times would provide a

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cushion during low flow periods so that the Corps could maintain a flow rate of greater than 5,000 cfs for a longer period of time without any alteration of the Corps' operations.
Do you see that, sir?
A. **I see that.**
Q. And, sir, by referring to a cushion, you understand that the U. S. Government is describing how water conserved under a consumption cap would add to the reserves that already exist in the Corps' reservoirs. Correct?
A. **Again, I see all of that. But they go on to say -- first of all, they said that this is plausible. That's all they said in both of the these statements. And then, lastly, they said that without factual -- further factual development, they really can't say much more at this point in time.**
Q. The Corps was -- excuse me, sir. The Government was noting that more water in the system from the Flint is a good thing. Right?
A. **They were making that statement. And, again, the way that the current system is operated based upon the way in which the Army Corps of Engineers has gone through the DEIS, the system is operated**

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such that they hit this minimum 5,000 cfs under a variety of conditions, low flows and drought flows. And that does help maintain a -- if you will, well above a minimum flow, minimum 5,000 that's contained well within the RIOP.
Q. Thank you, sir.
Sir, I have another question about your offset theory. Do you recall in your February 29 expert report you cited the deposition testimony of somebody named Steve Leitman?
A. **I think I vaguely remember that, yes.**
Q. And you characterized him as Florida's chief hydrologic modeler during the ACF Compact negotiations. Do you recall that?
A. **I do.**
Q. Okay. First of all, do you know whether Mr. Leitman is actually a hydrologist?
A. **Well, I said that in my -- I mean, I said that in my report. So I stand by what I said there.**
Q. Do you know that he does not have a Ph.D. in hydrology?
A. **One does not have to have a Ph.D. in hydrology to be a hydrologist.**
Q. Do you know that he's currently enrolled in a correspondence course at the Kwazulu University

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in South Africa attempting to get his Ph.D. in hydrology?
A. **No, I don't.**
Q. And, sir, you cited Mr. Leitman in your deposition -- sorry, in your expert report. And then at your deposition you were confronted with what Mr. Leitman said about water flowing uphill. Do you recall that?
A. **Yes. There was a discussion about that concept in my depo. I remember.**
Q. Okay. And Mr. Leitman had said that water can actually move upstream. Correct?
A. **He did say those words, yes.**
Q. Okay. And you said that's -- that's not correct. Water cannot literally flow uphill to the reservoirs. Correct?
A. **And if, indeed, that's what he meant, then that's what I said in my depo. Water can't flow uphill; that's correct.**
Q. Now, sir, I would like to explore further your assumption that the Corps will release only the minimum discharged amounts when those minimums are in effect. Okay?
A. **Okay. Sure.**
Q. So let's pull up first the RIOP table. This is

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the one that Dr. Zeng walked through as well. It's in tab 5 of your binder.
A. **Okay.**
MS. WINE: Mr. Walton, this is JX-72 at page 13.
A. **Okay. I see it.**
Q. Okay. Now, if we look at the fourth column over that's titled Releases from JWLD, do you see that?
A. **Give me just a second.**
Yes.
Q. And JWLD means Jim Woodruff Lock and Dam; is that correct?
A. **Right.**
Q. And the values that are listed under there represent the minimum releases for the various scenarios outlined. Correct?
A. **They do.**
Q. Okay. So if we look down at the bottom left where it says zone 4, do you see that?
A. **Yes.**
Q. Okay. So zone 4, if we go over to the column under Releases from JWLD, there is a 5,000 figure there. Correct?
A. **Yes. There's a greater than or equal to 5,000**

figure right there --
Q. Okay.
A. **-- within zone 4.**
Q. Oh, I'm sorry. I didn't mean to interrupt you.
A. **Within zone 4.**
Q. And zone 4 is when the Army Corps is in drought operations. Correct?
A. **That is correct.**
Q. And as you pointed out, there is a greater to or equal sign there before the 5,000. Correct?
A. **Yes.**
Q. And that means that the Corps must release the minimum amount of 5,000 cfs. Correct?
A. **That's what that table means, yes. It does.**
Q. But it could release more; couldn't it?
A. **Well, as a matter of fact, the operations by the Army Corps of Engineers with respect to this basin include meeting seven project purposes; fish and wildlife being just one of those, recreation being another, water supply, navigation, and a host of others that are listed in my expert -- in my testimony. So all of those have to be balanced with respect to the way this system is operated. That's how the Corps operates the ACF Basin. And it operates that**

with the reservoirs -- all of the reservoirs in place.
And, in fact, while they're meeting this minimum flow, while they're meeting the minimum, they're also trying to refill those reservoirs to the maximum level possible. And the only way they can do that during drought times is to keep it as close to the minimum as possible while they are refilling reservoirs.
If they start to try to release more than the 5,000 down here, then they are violating their overall management principles.
Q. Sir, I'm not sure if you answered my question or if you have given me one answer. But I was simply asking if under zone 4 under these circumstances in drought operations where it says greater than or equal to 5,000, we agree that the Corps must release at least 5,000 cfs. Correct?
A. **We do.**
Q. And all I'm asking is could the Corps release more?
A. **Under these conditions, there are -- first of all, if you look back at 2011 and 2012, if you look at the data, you find that they released very, very close 5,000 much of the time. The**

only time that they would potentially release more than 5,000 would be for some sort of emergency type situation that might be occurring downstream, some kind of a navigational issue or perhaps for a sudden need for hydropower, some sort of an emergency situation. Other than that -- other than that -- they are going to meet the minimum 5,000 discharge during the drought condition. And they are going to try to refill those reservoirs to the maximum possible.
Q. So, sir, the answer to my question, again, is that, yes, they could release more than the 5,000; that's what the greater than or equal to means?
A. **Under a few conditions they could do that, yes.**
Q. And in that sense the 5,000 minimum release amount is not a target. Right?
You know that?
A. **As a matter of fact, they -- based on the data that I have seen, especially from 2011 and 2012 -- and we had extensive conversations about targets and minimums in my deposition, I believe -- it's pretty clear that all through those serious droughts in 2011 and 2012, they were both targeting and hitting the minimum of**

5,000.
Q. Sir, the answer to my question is that, no, the 5,000 is not a target. It's just a minimum. Correct?
A. **I think in certain instances it's both a target and a minimum.**
Q. Okay. Sir, if you -- are you familiar with the DEIS where it talks about this very point and explains that minimum releases are minimums, not targets?
A. **I have seen statements to that effect, but I have also seen statements in the DEIS where it says it's a target and a minimum. So there are an equivalent number of statements.**
It's a huge document and --
Q. Right.
A. **-- it just depends on where you happen to be in the RIOP during which operation you're talking about.**
Q. Sir, have you looked at the statements that are tied to this table or tables just like it that say that the minimums are minimums, not targets?
We can walk through them. We walked through this last week with Dr. Zeng.
A. **I have no argument with your question.**

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Q. And are you familiar with the biological opinion?
A. I'm familiar with it.
Q. That's from the U.S. Fish and Wildlife Service?
A. Yes.
Q. And do you know that there's identical language in the 2012 biologic opinion warning that flow rates are prescribed minimums and not targets. Correct?
A. I have seen that, I believe, yes.
Q. Okay. Now, your prefiled testimony does not reference any of these DEIS or biological opinion warnings that the RIOP flow minimum is not a target; do you?
A. I don't think so.
Q. And to the contrary, you continue to describe the release minimum as a target throughout your prefiled direct testimony submitted in this court. Right?
A. Well, there was some discussion of that in my deposition. And, again, the way in which they operated this system during 2011 and 2012 from -- from my demonstratives 5 and 6 in my direct testimony clearly show to me that it was not only a minimum, but they were shooting for it. They were shooting for something close to 5,000 for

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much of the summer period in 2011 and 2012.
Q. And, sir, we'll get to those demonstratives; but it's correct though, isn't it, in your testimony submitted to this court you continued to describe the minimum such as the 5,000 cfs minimum as a target. Correct?
A. Yes.
Q. Now, I would like to look at some of the statements that you made about how the RIOP actually works. So --
MS. WINE: And we can take that down, Mr. Walton.
BY MS. WINE:
Q. In your February 29 expert report, which we can pull up -- it's at tab 1, the first tab in your binder.
A. Okay.
Q. And I'm going to go to pages 20 and 21 in that report. This is GX-860. I'm going to focus on the section that starts at the bottom of 20 titled Drought Operations.
A. Right.
Q. And, sir, in your expert report you said that for the entire period that the Corps is in drought operation, the Apalachicola River will receive

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only 5,000 cfs crossing the state line and no more. Correct?
A. That's what it says.
Q. Okay. And you say that the Corps will maintain the 5,000 cfs minimum throughout drought operations even if basin inflow exceeds 5,000 cfs. Correct?
A. Yes.
Q. And you also note that from December to February -- this is now going onto 21 -- actually, I'm sorry. It's on the top of 20, the winter refilling season.
A. On the top of where?
Q. Top of page 20, I'm sorry, winter refilling season.
A. Okay.
Q. You say that during this season, December to February, the Corps maintains the 5,000 cfs requirement into Apalachicola River at all times, and any additional basin inflow above 5,000 cfs is stored in the reservoirs until the system is full. Correct?
A. Right.
Q. Okay. Now, as of the time of your deposition in May of this year, you had not conducted any

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empirical evaluation of the actual state line flows to back up your claim that the Corps discharges only 5,000 cfs during drought periods or low periods or during the winter refilling season. Correct?
A. As of the time of my second report, is that what you said?
Q. As of the time of your deposition in May of this year.
A. Oh, the deposition in May.
That is correct. I have not.
Q. So, in other words, you had not compared observed flows on the one hand with the flows that you predicted would occur under the RIOP. Correct?
A. Give me just a moment to check this report.
Q. I'm talking about -- well, you can look at your report, certainly.
A. Well, that's what you're asking me about.
Q. Absolutely.
I think I can show you some excerpts from your deposition, if it would be helpful, where you were asked if you had done any of this --
A. No, that's fine. I just wanted to double-check for myself here based on what you're asking me. But I think you're correct.

Q. Okay.
A. Okay. No problem.
Q. So as of the time of your deposition, your assumption that the Corps would target 5,000 cfs during drought operations was just a hypothesis. Correct?
A. Well, it was based upon my reading of and my assessment of what I had seen in the DEIS and on the reading of the operations -- the operational systems for the -- for the basin -- for the ACF Basin.
Q. And do you recall that at your deposition you were presented with multiple examples where the state line releases exceeded the RIOP's minimum requirements, and you admitted that you had not studied the empirical data and did not know what was causing those additional releases?
A. I don't believe I said that I did not know what was causing those releases. I believe that I, somewhere in that multitude of questioning, suggested that some of those were related to discretionary type releases and/or could be related to flash rainfall events. I believe I said that in my deposition.
Q. You don't recall saying, I don't know exactly how

the Corps is generating these flows above 5,000. I don't know why they are doing that or what the cause of that is?
A. I may have said that at one time. But I believe that somewhere in that deposition -- are you talking about just the first deposition or the entire deposition?
Q. Well, I think what I'm reading from is from day one of your deposition.
A. I may have said that on day one of my deposition.
Q. Okay. In any event, you claim now to have analyzed these instances of flow above 5,000 at the state line. Correct?
A. I have analyzed a great deal of data since that first day of deposition one.
Q. Okay. And if we look at your prefiled direct --
MS. WINE: On page 4, Mr. Walton.
BY MS. WINE:
Q. -- the first sentence of the first bullet on page 4 in bold, you now say that the state line releases are very close to 5,000 cfs during low flow and drought conditions. Correct?
A. Yes, I do.
Q. And later, if we were to go to paragraph 28, you say that they are at or very close to 5,000 cfs.

Correct?
A. On page where?
Q. It's paragraph 28 on page 15.
A. Okay.
Q. Right at the top there. You say, as shown in Bedient demos 5 and 6 --
A. Yes.
Q. -- the Corps' releases --
A. I see it.
Q. -- were at or very close to 5,000?
A. Yes. I see it.
Q. Sir, let's look at demo 6 from your prefiled direct testimony, which is right on the page before, page 14.
A. Okay.
Q. In this demo you're showing a relatively flat line from May through December 2012, which appears on this demo to be right around 5,000 cfs. Correct?
A. Yes. I would say that -- and this is for 2012. Yes, it appears very, very close to the 5,000 mark.
Q. And drought operations began in May of 2012 and continued through the end of February of 2013. Didn't they?

A. They did.
Q. Okay. And so this is when the 5,000 minimum release was in effect. Correct?
A. This was when the 5,000 was in effect, yes.
Q. Okay. Now, were you here for Dr. Shanahan's testimony?
It was a couple weeks ago now, and I don't recall if you were here.
A. I was not.
Q. Okay. Well, Dr. Shanahan discussed a demonstrative that he prepared using the same data that you used to create demo 6.
MS. WINE: And let's put that up.
BY MS. WINE:
Q. It's in your binder. You should have a separate cluster of demonstrative exhibits.
A. Oh, yes.
Q. It might be in the front flap of your binder.
A. They are.
Q. And we're going to start with Bedient cross demo 1.
A. Okay.
Q. Now --
MS. WINE: Jon, can we put that on the screen, please.

BY MS. WINE:
Q. While we're getting it up, what Dr. Shanahan did was he took your data from demo 6 in your prefiled direct; and he just increased the resolution by adjusting the Y axis. And then he also broke it down by week whereas your demo 6 was by month.
A. **So let's -- let me confirm that. He adjusted the axis that used to be all the way up to 35,000 cfs?**
Q. Correct.
A. **He adjusted it to range from 4900 to about 6,000 or about a thousand. Correct?**
Q. That's correct.
A. **All right.**
Q. Now, Dr. Bedient, there aren't any instances on this chart, Bedient cross demo 1, where the Corps releases were exactly at 5,000 cfs, as you contend. Correct?
A. **That is -- well, that contention was back on day one of my deposition back in May; and it's from my first report.**
Q. Sir, I think you say that in paragraph 28 of your prefiled direct testimony submitted to this court. And you can look back at that. You say

that the Corps' recorded releases from Woodruff Dam are at or very close to 5,000 cfs.
A. **At or very close is what I said. Right?**
Q. Sure.
A. **Yes.**
Q. So all I'm asking here is none of them are at. Correct?
A. **Okay. Yes.**
Q. We'll break this down and make it very simple.
A. **I'll agree that we did not exactly hit the five-zero-zero-zero mark.**
Q. Okay.
A. **But if you will look across that dataset, you will see that it ranges from a low of 5050 -- and then there are, of course, some rainfall events in the middle that adjust these flows up to 6,000. And then it hovers around the 5100 mark.**
And, remember, the Army Corps of Engineers here is trying to hit a minimum of 5,000. They don't want it to drop below 5,000 at all. So in order to do that and in order to operate a large reservoir gate operation, as they do, they probably built in a safety factor here to make sure that they stay above 5,000 -- at or above. And I agree with you; they didn't exactly hit

5,000.
Q. Yes. Your language is at or very close to 5,000. And what we see here for this time period is a range from 5050 to over 6,000 cfs. Correct?
A. **Correct.**
Q. And the 5050 -- we'll get to that later.
You just mentioned a safety factor. The 5050, that is a safety factor that's prescribed under the rules. Correct?
A. **It's -- it's contained within the -- within the ResSim computer model that's used to operate, you know, and basically run analyses for this system.**
Q. Okay. Now, you haven't presented in your prefiled testimony or in any of your expert reports the differences between actual flows observed at the Chattahoochee Gage, on the one hand, and minimum flows under the RIOP, on the other hand. Correct?
A. **Ask that question one more time? I'm sorry.**
Q. Sure. I'm wondering if you presented anywhere, whether in your testimony here today or in your expert reports, something -- an analysis that shows the differences between actual flows observed at the Chattahoochee Gage, on the one hand, and minimum flows under the RIOP, on the

other hand?
A. **Well, are you asking me about minimum flows under the RIOP that the Corps of Engineers is attempting to meet on a day-to-day basis? Is that what you're asking?**
Q. I'm asking if you looked at what are the minimum flows supposed to be according to the RIOP at a particular time, and if you plotted that as against the actual observed flows at the Chattahoochee Gage?
A. **It's done -- I suppose one could say that on this demo 1, the minimum is 5,000. And you have got a plot of what the flows were. So there's a plot.**
Q. But this demo, which we took from the data that you used in your demo 6 in the prefiled direct, doesn't actually use the actual observed flows at Chattahoochee Gage. It uses provisional data, which we'll get to, but that you argue is the right thing to look at. Correct?
A. **I mean, yeah. There are two sets of data here. There is provisional data, the type of data, if you will, that the Army Corps of Engineers is relying upon on a daily basis to make their decisions. And then there's this other set of USGS data that I have been shown in my deposition**

and other places.
Q. Right. We'll --
A. **That is data that has been adjusted after a period of time by the USGS.**
Q. And we'll get to that, to the provisional data, in a moment; but let me just, to help you out -- because I think Dr. Shanahan put together a table that's getting at what I was asking you about. So if you can go to table 4 in Dr. Shanahan's prefiled testimony, you will find that in your binder at tab 33. And table 4 is found on page 32 of Dr. Shanahan's testimony.
Now, sir, do you recall that you reviewed a very similar version of this table at your deposition?
A. **That could well be. There were lots of tables.**
Yes, I recall something like this.
Q. And you see that Dr. Shanahan in this table calculated the differences between actual observed flows at the Chattahoochee Gage and minimum flows under the RIOP for the entire 2012 to 2013 drought operations period. Correct?
A. **He's created -- yes, I see that. And he's created it in such a way that the last column over there with the flow per day is showing up as**

an average for that whole month, yes.
Q. All right. The average difference between what was observed at the gage versus what you would expect if it were just a minimum release under the RIOP. Correct?
A. **Yes.**
Q. Okay. And do you see -- if we just focus on May of 2012 through December of 2012 for the moment.
A. **Yes.**
Q. So the last few months of -- last half of 2012.
A. **Right.**
Q. And if you just look down that column on the right-hand side, you can see that on average the releases ranged from 212 to 525 cfs per day above the minimum release. Correct?
A. **Yes. I see -- let me check something here.**
I think the table is wrong.
Q. Okay. I think your counsel can ask you about that. I don't think we believe that the table is wrong.
A. **Well, if you just look at my exhibit demo number cross 1 --**
Q. Yes?
A. **-- for the month of June 2012, you got an average difference there of 525 cfs.**

Q. Sir, the demo that you're referring to is using provisional data and not the actual reading from the Chattahoochee Gage. Correct?
A. **Well, let's back up.**
Q. What we're looking at here in table 4 is the actual readings from the USGS gage, not provisional data.
A. **So it's apples and oranges. Okay.**
Q. Correct.
A. **That's fine.**
Q. And we'll get into the provisional data issue.
But Dr. Shanahan felt it was appropriate to look at the actual USGS gage reading. Okay?
A. **That's fine.**
Q. Now, these state line releases above the 5,000 cfs minimum are not consistent with your assertion that during drought operation, the Apalachicola River will receive only 5,000 cfs crossing the state line. Correct?
A. **Well, again, that was an assertion that was made early on in my deposition back in day one of, I guess, the May time period. And since that time, and especially for 2012 when I have gone back and looked carefully at this data, there are a whole period of -- you can just see it from my demo**

cross 1 where there are at least half a dozen spikes in there all through July and August and into September that are clearly related to flash rainfall events coming through the system.
So I went back and confirmed that, indeed. And these flash events are not subject to control by the Army Corps of Engineers, and they're not subject to control by the RIOP because these are occurring below the reservoirs below Bainbridge on the Flint River. And so this is a pass-through that comes on through the reservoir. And because it's a pass-through reservoir at Lake Seminole, they're just going to move on through and then be recorded as increased flows.
Q. Sir, in your February 29 report you talked about flash precipitation events like this. And you said that the 5,000 cfs minimum or target, as you called it, would remain -- I think you said this is true even if basin inflow experiences short-term increases above 5,000 cfs such as during a flash precipitation event.
Do you recall saying that?
A. **I did. And some of these are -- some of these are bigger events. Some of these are day-long**

events with 3 inches of rain, as we went back and carefully looked at the rainfall events. So hydrology is a very dynamic science.

And, in fact, in this regard, if you look at that figure in demo cross 1 up in the top left, it really is quite close to 5,000 much of the time. And there are just these times where there are rainfall events that come through that elevate it.

Q. So, sir, these statements in your expert report are no longer correct. Right?

A. **They -- I didn't say that. They are shooting for values near 5,000. And in what we just read from my prefiled testimony, I said at or near 5,000. So I corrected that statement already.**

Q. Okay. Now, sir, let's focus on -- let's go back to table 4 from Dr. Shanahan that was tab 33, page 32, I think.

MS. WINE: Mr. Walton?

A. **Okay. And now, you're asking me to use some sort of different dataset -- different dataset for -- from Dr. Shanahan's table.**

Q. I'm asking you to look at Dr. Shanahan's table. We'll get into the differences in the datasets.

A. **Well, the difference --**

Q. I understand. We'll get to the provisional data.

He used the gage data from the USGS, okay. And we're going to go look at table 4 again.

A. **Okay. I'm there.**

Q. I'm waiting to get it up on the screen.

We looked at the last six months of 2012 before. And what I want focus you on now is the winter refilling season. So that would be December 2012 through February of 2013.

MS. WINE: Mr. Walton, I believe that's on page 32 of this exhibit.

BY MS. WINE:

Q. So now, focusing on this -- it's labeled winter refilling season. Do you see that?

A. **Yes, I do.**

Q. So, sir, not only are we now still in drought operations; but we're also in the winter refilling season, which is another time that you say the 5,000 cfs will not be exceeded. Correct?

A. **That's a stated policy in the RIOP. And, of course, we all know that what happened during this particular period of time -- and I have got to get --**

Q. Sir, I just asked you if those were -- if that is another reason that you assert that the Corps

would not go above 5,000 cfs for releases?

That's what you stated. Correct?

A. **Well, it's -- it is their policy. However, they are also operating these reservoirs, as I said earlier, to meet seven different project purposes within the basin. One of those project purposes is flood control.**

Q. Okay. And, sir --

A. **And, clearly, what's happening here in this time frame, especially in -- as we get into February and January, for that matter, there were large floods and large storms that moved through the system and refilled -- it refilled conservation storage in some of the reservoirs; and it started to then impact flood storage. And when you get into the flood zone, by definition the reservoirs have to be operated in such a way that they -- they release that floodwater downstream. They store a certain amount, and they release a certain amount. So there are rules according to that.**

And you can see that in my demonstrative No. 7.

Q. Sir, you know that the composite conservation flood storage did not fill all the way back up

until after February of 2013. Right?

A. **I do know that. Right.**

Q. Okay. So this was not an issue where the reservoirs had filled all the way back up. Correct?

A. **They had not filled all the way back up; that is correct.**

Q. Okay.

A. **But there were obviously massive rainfalls within the basin that were driving these flows.**

Q. Sir, you stated that until those reservoirs were filled up, the Corps does not exit drought operations; and it's still under the 5,000 minimum release. Correct?

A. **Yes. But we can't just look at --**

Q. Sir, I just asked you if that was correct under the rules?

A. **That is according to the rules, yes. But --**

Q. And you can see here --

A. **Can I finish my question?**

Q. I just asked you if that was connect, sir.

A. **Can I finish my question?**

Q. I would just like you to answer my question.

A. **I said yes.**

Q. You will have the opportunity --

A. **I said yes. However, clearly when you're going from 400 to 3800 to 32,000, something else very different is happening in the basin. And that something else, during this particular time of the year, was a major rainfall and a major flood moving across the basin. Once that moves anywhere upstream of Lake Seminole, it's going to come right on through Lake Seminole. And that's how it operates.**
Q. Sir, are you saying that your statement that the Corps will remain in drought operations and will retain the 5,000 minimum release until the reservoirs are filled back up and it exits drought operations, that that statement is not correct?
A. **No. It's a correct statement. But in this particular situation where you have this level of flow coming through the system, it's obviously flow related.**
Q. Right. And the Corps released a lot more in each of these months. Correct?
A. **I don't know whether they released a lot more. I haven't studied the reservoir operations from flood control standpoint. But I do know that there had to have been a lot of water moving**

through Lake Seminole to generate a differential of 32,000.
MS. WINE: Your Honor, I'm about to switch topics. Would this be a good time to switch topics, or would you like me to keep going?
I'm happy to keep going if you're not ready.
SPECIAL MASTER LANCASTER: Let's go a little longer.
MS. WINE: This is good. We're going to get into provisional data, which I know Dr. Bedient wants to talk about.
BY MS. WINE:
Q. So as we discussed, you contend that in table 4 and other analyses that Dr. Shanahan did, he has relied on the, quote, wrong data. Correct?
A. **He has -- well, data is data. Now, there are three different datasets here. So we can talk about those to the level that you would like to.**
Q. I just want to know if you recall saying in your prefiled direct testimony at paragraph 161 that he relied on the wrong data. Do you recall saying that?
A. **Oh, you mean for his analysis?**

Yes, I did say that.
Q. Okay. And that wrong data is the official USGS streamflow data recorded at the Chattahoochee Gage on the Apalachicola River. Correct?
A. **It is the official data that is adjusted after some period of time by the USGS. However, it is not the data on which the Army Corps of Engineers makes its day-to-day decisions to operate this basin. That starts with provisional data from the USGS. And then by the end of the day, it is adjusted by the Army Corps themselves; and it then becomes the Army Corps of Engineers release data.**
And they have to use that because they're standing there at the dam, at the gates, watching the outflow. And they're making day-to-day decisions. So they can't wait for the data to come back after it's been adjusted by the USGS.
Q. So what you're saying in essence is that even though the Corps did release above the 5,000 cfs minimum, they didn't intend to do that?
A. **They're basing -- they're basing their releases on their information that they have on a daily basis as shown in my demonstratives 5 and 6, which, as you will notice there, targets just**

above 5,000. That's what they're making their decisions based on.
Q. So if they released more than the 5,000 cfs minimum, they didn't intend to do that?
They were doing it based on provisional data that was presented to them that may have been telling them something different?
A. **Well, first of all, they -- there's a minimum of 5,000. That's a minimum. They're releasing just above 5,000 because, again, there's quite a bit of variability in that data, as you have shown me, actually, in Bedient cross demonstrative No. 1. There is quite a bit of up and down in the data. They don't want any of those down dips to drop below 5,000 because they're trying to hit that minimum.**
Q. Okay. Let's look at this provisional data. First of all, you had to get the data from Georgia EPD. Correct?
A. **I -- let's see. Which -- you're calling this provisional data. Are you talking about the Corps data or the USGS data?**
Q. Well, tell me what you looked at and what you relied upon.
A. **I looked at this Corps release data.**

Q. Okay. And the Corps release data itself comes from the USGS provisional data. Correct?
A. It comes from -- it's actually posted up on the U.S. Army Corps website. It is something that they compute themselves. The Army Corps of Engineers does it themselves at the end of each day. And that's what they make -- base their decisions upon as they operate on a day-to-day basis.
Q. And they're getting it from the USGS provisional data?
A. I think it starts there, and then they do some adjustments to it by the end of the day based upon what happens to be going on in the basin.
Q. And you had to get this provisional data from Georgia EPD. Correct?
A. I did.
Q. And that's because the provisional data doesn't exist anymore on any public source? No public website; you can't find it on the USGS website or on the Corps website. Correct?
A. I don't know that you can't find it on the Corps website. I mean, I have seen it up on the Army Corps website back to maybe 2007.
Q. Okay. But you got it from Georgia EPD?

A. I believe so. Just because we were working closely with them for data transfer.
Q. And it's no longer on the USGS website?
A. The data for the Chattahoochee Gage?
Q. Provisional data, correct.
A. That I don't know.
Q. Okay.
A. That I don't know.
Q. You weren't able to independently verify the provisional data that you got from Georgia EPD; were you?
A. I relied upon it. That is the official data used by the Army Corps of Engineers to operate the system. I assumed that if it came from Georgia EPD, they have a vested interest in that data. They download it each and every day as I -- or at least once a week, as I understand it.
Q. You just took it at face value?
A. I did.
Q. Okay. Now, are you aware of the various disclaimers that the USGS has issued with regard to this provisional data?
A. There are all sorts of caveats that come along with USGS data.
Q. Okay. If you could turn in your demonstrative

packet to Bedient cross demo 3.
A. Okay. I see it.
Q. And this is something that we just pulled from the USGS website. It says, provisional data statement. Do you see that, sir?
A. Yes.
Q. And if you look at the first few paragraphs there, do you see that the USGS is saying that the provisional data may be inaccurate?
A. Yes, I see that.
Q. And that it's subject to significant revisions?
A. Yes.
Q. And, sir, if you turn to the next page in your demonstrative packet to Bedient cross demo 4, there is a provisional data disclaimer from the USGS. Do you see that?
A. Oh, yes.
Q. And it says that the US -- it's in the paragraph starting, realtime data, which is the second paragraph.
A. Right.
Q. It says that the provisional data, which they have bolded here, may be subject to significant change and is not citable. Do you see that?
A. Yes, I see it.

Q. And it goes on to list another -- a number of other warnings about the data.
Now, sir, you didn't cite these disclaimers in your prefiled direct testimony. Correct?
A. No, I did not. But then, again, this is data -- and because I run realtime flood warning systems, and I rely upon provisional data all the time. This is data that comes in on a day-to-day basis. And decisions are being made on a day-to-day basis in this system.
And if the Army Corps of Engineers were to wait for the USGS to finish their adjustments to data, which can take weeks or months, then we're going to have a real problem operating the system on a realtime basis.
Q. Sir, all I asked was whether you referenced these disclaimers in your prefiled direct testimony?
A. No, I did not.
Q. Okay. Now, sir, you're aware from Dr. Zeng's examination that in any event, we identified a series of errors in this provisional data that Georgia EPD provided to you. Correct?
A. Yes, I have seen that.
Q. And do you recall we presented him with a demonstrative identifying some of those errors?

A. **I have seen those.**
Q. Okay. And we don't have to walk through them all. They were shown with Dr. Zeng. But they are in your packet at Bedient cross demo 5. And it shows a number of missing records from that data?
A. **It does. And that's fairly typical for provisional data.**
However, for 2011 and 2012 it seemed to provide a fairly -- a fairly complete dataset.
Q. Can you explain how these errors occurred, sir?
A. **Oh, there's a variety of ways that -- I have got a lot of familiarity with USGS gages because I have helped put them in. You can get power failures. You can get maintenance issues. You can get clogging. You can get destruction of the gage for some period of time. There are all sorts of reasons that they go down.**
Q. So are you aware of whether there are any other errors in that provisional data dataset that you were provided that we didn't happen to find?
A. **No.**
Q. How would you know whether that dataset is accurate or not?
A. **Again, I relied upon EPD, who was in**

communication with the Army Corps, to provide that to me; and I just relied upon that dataset.
Q. Now, sir, in addition to that provisional data that Georgia EPD provided to you, you also cite another dataset that I want to ask you about.
A. **Sure.**
Q. So if you turn to your prefiled direct testimony on page 70 --
A. **Okay.**
Q. -- you will see that you have a demonstrative there. It's labeled demo 13.
A. **Yes.**
Q. And I just want to ask you. The -- in paragraph 50 the source cited is GX-949. Correct?
A. **It is --**
Q. Do you see right there in paragraph 50 it says, Bedient demo 13 is a true and accurate copy of the results of my analysis of RIOP flow thresholds and basin inflow for 2007. And it says --
A. **Excuse me. What page are we on?**
Q. We're on page 70, I believe.
Let me just make sure that's the right page. It's paragraph 50, for sure.

A. **No, it's not -- there is no paragraph 50 on page 70.**
Q. All right.
A. **That's wrong.**
Q. Hang on.
I'm sorry. Page 27.
A. **Okay.**
Q. I have got a little typo here.
A. **No problem. No problem.**
Q. Sorry about that. Thanks for correcting me.
A. **No problem.**
Q. Here we go.
A. **Okay.**
Q. Do you see that reference to GX-949 at the end of paragraph 50?
A. **Yes, I see it.**
Q. Right at the bottom there.
So I don't imagine you know offhand what GX-949 is based on that moniker?
A. **No, I don't.**
Q. Okay. So we were trying to figure it out ourselves, so what we have done is a spreadsheet. It's just a slip sheet in your tab that we're going to pull up a portion of GX-949 to see if you can help us understand where this data came

from.
And, actually, we have got a demo. These guys are way ahead of me.
Let's turn to cross demo 6-1.
A. **All right.**
Q. So this is just a picture -- we put it on the screen, too -- of just a portion of the GX-949 data worksheet.
A. **Yes.**
Q. And I'll represent to you that you have a bunch of worksheets in this file?
A. **Right.**
Q. But we pulled out this one that says data. And it looks like it identifies Woodruff Outflow Data. Do you see that?
A. **Yes.**
Q. Sir, do you -- based on looking at this, do you know what GX-949 is?
A. **I don't; but I suspect -- well, I know that this came to us from the Georgia EPD.**
Q. It looks like the provisional data that Georgia EPD provided you. Correct?
A. **But I don't know that for a fact. And this was also the same plot that was in my very first expert report dated in February.**

Q. Okay. Sir, if we turn to the next demo, this is a screen shot. It's demo 6-2 from GX-143, which is the provisional data that Georgia EPD provided to you.
A. **Okay.**
Q. Can you see they look the same, sir or relatively the same?
A. **Yes, they do.**
Q. Okay. And now, sir, if you could turn to the next one, which is Bedient cross demo 7-1. We have put these two spreadsheets side by side. They both look like they contain provisional data. And what we have done here is just shown a number of days where the numbers seem to match up, as one might expect. Do you see that?
A. **I see that.**
Q. Okay. Now, if you turn to the next demo, which is 7-2.
A. **Right.**
Q. Here, we found a number of instances where the numbers in these two spreadsheets don't match up. If you look at basically June 25 through June 30, do you see that?
A. **Yes, I do. They're close, but they don't match up. You're right.**

Q. And, sir, if you turn now to Bedient cross demo 8, which is next in the packet.
A. **Okay.**
Q. We went through, and we cataloged all the differences that we could find between these two provisional datasets in GX-949 and GX-143. And it goes on for several pages. There's about 250 instances where they're different.
A. **Okay.**
Q. Okay. And you will see that some of them are substantial. They go up to several thousand cfs difference, and one of them goes all the way up to 17,000 cfs difference.
Sir, do you know what accounts for the differences in these two provisional datasets?
A. **Not as I sit here. I could -- I can speculate that one might be from Army Corps adjustment, and one might be from USGS provisional. But I do not know.**
Q. Do you know which is correct?
A. **I do not as I sit here.**
MS. WINE: Do you want break yet? New topic.
SPECIAL MASTER LANCASTER: We'll take a 10-minute recess.

MS. WINE: Perfect.
THE WITNESS: Thank you, your Honor. I appreciate it.
(Time Noted: 2:40 p.m.)
(Recess Called)
(Time Noted: 2:50 p.m.)
BY MS. WINE:
Q. Sir, I would like to switch topics now and talk about some of the modeling work.
A. **Okay.**
Q. Okay. To support your theory that any reduction in Georgia's consumption would not result in increased state line flows during droughts or low flow periods you performed modeling work. Correct?
A. **I did.**
Q. And if we pull up your prefiled direct at page 33, paragraph 68 what you did was you simulated predictive state line flows under various consumption scenarios; is that correct?
A. **That is correct.**
Q. And you used the ResSim model to do this?
A. **I did.**
Q. And the ResSim model that you ran treated the minimum flow as a target. Correct?

A. **It did. It basically did that during drought and low flow type conditions. Of course, the RIOP is actually just built into the model.**
Q. And that's because ResSim is unable to account for any discretion the Corps has to release greater than the 5,000 cfs minimum. Correct?
A. **Yes. When you're in that drought condition, it targets -- I think the number is 5050.**
Q. Right. And the ResSim users' manual explicitly warns users about ResSim's limitations in this regard. Correct?
A. **It does.**
Q. Okay. And if we just quickly turn to tab 10, we have got an excerpt of the users' manual, JX-46?
A. **Right.**
Q. And right where that caution sign is, correct, there's where it's talking about how ResSim cannot be programmed to account for basically the greater than sign that we see on the RIOP table. Correct?
A. **Yes. I have seen the warning, yes.**
Q. Okay. And as you have alluded to, when a 5,000 minimum rule is in effect, ResSim assumes that the state line flow will be the 5,000 plus a safety factor of 50 cfs for exactly 5050 cfs.

Correct?
A. **That's correct. That's how it works.**
Q. Now, let's take a look at some of the ResSim modeling results that you produced in support of your expert report. And if you could turn to Bedient cross demo 9 in your packet.
A. **Okay.**
Q. Now, what we have done here is you had an Excel worksheet in your production, the -- sort of the definition of it is at the top of Bedient cross demo 9. And in this worksheet you included the results from a scenario that you modeled in ResSim where Georgia reduces both its M & I and Ag consumption by 30 percent. Correct?
A. **Right.**
Q. Okay. And the worksheet indicates what the state line flows would be under this scenario for every day between January 1 of 1975 and December 31 of 2011. We only have an excerpt here, but do you recall that your worksheet went all the way back to 1975?
A. **Yes. So you're just showing me an excerpt from --**
Q. From that worksheet.
A. **-- 2011 and --**

Q. Correct.
A. **-- forward?**
Q. What we have done here is excerpted August 1, 2011, to December 27, 2011.
A. **Yes.**
Q. Do you see that?
A. **I see it; right.**
Q. And based on this 30 percent reduction scenario, for every single day in this time period you have that the state line flows would remain at exactly 5050 cfs. Correct?
A. **Correct. Right.**
Q. Okay. Now, let's look at how these modeled results compare with the flows that were actually observed at the Chattahoochee Gage on the Apalachicola River. Okay?
So if you could turn now to cross demo 10.
A. **Okey-doke.**
Q. What we have done here is actually plotted the observed state line flows for the same time periods in blue. Do you see that?
A. **Yes.**
Q. And do you see that the observed flows during this period were always higher than 5,000 cfs, sometimes substantially so?

A. **Yes. A lot of time they hovered around the 5050 mark; and then there were some -- there were some increases in there as well.**
Q. There are several times that they go above 5600 cfs. Correct?
A. **Yes. Right.**
Q. And cumulatively, if we add up these differences for this time period, the observed state line flows exceeded your ResSim model flows by nearly 63,000 cfs?
A. **For this specific period, yes. I'll agree.**
Q. Okay. Now, in other words, ResSim predicted that if there were a 30 percent reduction in consumption, the state line flows would have been 63,000 cfs lower during this period than they actually were without any reductions in consumption. Correct?
A. **Well, again, during this particular period, I think, in 2011 there were some -- I think it was either rainfall related or there were some other issues that were causing this -- this movement away from the 5,000, as we have seen also in 2012.**
Q. Right. But, sir, your ResSim model predicted a substantially lower flow during this time period

than the actual observed flows show?
A. **For that particular period it did. However, we have run the ResSim model over a longer period of time to get a -- to get a kind of a better representation of how the model works. We ran it from 2008 through 2011, and not -- not with consumption caps, but just to see how the model would compare against measured data. And we did that, you know, fairly recently as part of this prefiled. And that's indicated in my demonstrative 17.**
Q. Now, sir, 2011 was a drought year. Correct?
A. **2011 was not a drought year.**
Q. 2011 was not a drought year?
A. **It was not a -- they had not moved into drought operations.**
Q. Okay. Was it a year of low flows?
A. **Oh, yes. Absolutely. Yes.**
Q. Now, sir, in addition to the limitation of ResSim and that it's not able to program the greater than sign on the greater than or equal to 5,000 cfs, your ResSim modeling also relied on the Corps' unimpaired flow numbers, their UIF's. Correct?
A. **It did.**

Q. And you took those Army Corps UIF's at face value; didn't you?
A. **We did.**
Q. You didn't evaluate the quality of those UIF's?
A. **No. This was the same UIF's used by the State of Georgia. They had been reviewed by them. And the Army Corps of Engineers uses these UIF's to make all of their runs with ResSim for the ACF Basin.**
Q. And as you just said, the UIF's are actually dependent on consumptive use data provided by Georgia. Correct?
A. **No. The UIF's are based upon -- yes. I mean, they have to go back and subtract those out; so I guess that's true.**
Q. Right. They get the consumptive use data from Georgia?
A. **Yes, they do.**
Q. All right. Now, I know you were here when Dr. Zeng testified. Were you also here when Mr. Masters testified?
A. **I was not, no.**
Q. Okay. Well, they were both asked questions -- but obviously you will only remember Dr. Zeng -- about some of the errors in the Corps' UIF's. Do

you recall that questioning?
A. **Yes. I'm familiar with that line of questioning. I am.**
Q. And you're aware of the criticisms that GWRI or Georgia Tech will sometimes refer to it as levied in its UIF assessment report?
You were aware of that before you filed your prefiled direct testimony. Correct?
A. **I'm aware of it, yes.**
Q. And were you aware of it before you submitted your expert reports?
A. **I don't know. It seems like I saw the document early on. But one of the -- there are criticisms there. However, the two gentlemen that authored that report also clearly stated that for the express purpose that ResSim is used in this basin for -- especially for comparative analysis on consumptive use, the UIF's are perfectly acceptable.**
Q. We'll get into that; but, sir, you did not alert the Court to any of the Georgia Tech critiques of the UIF dataset. Did you?
A. **No. Once -- once they basically said that for the express application that we're using the model for, they had no particular problem.**

Neither one of them, neither one of the authors had a problem with the approach. We went -- I mean -- and, again, the Army Corps of Engineers in this particular basin both operates the basin, manages the basin. And they ought to be the ones that best understand how that model works and how those UIF's need to be determined.
Q. And you know that Georgia Tech concluded that the UIF dataset included both random and systematic errors. Correct?
A. **Right. For their express purpose that they were -- that they were doing the analysis.**
Q. We'll get to the purpose, sir. I promise.
But for now, I just want to test your recollection about that UIF report.
And it found that those systematic errors affect both the long-term and daily flow calculations. Correct?
A. **Correct.**
Q. And that many of the errors are related to agricultural demand, including groundwater pumping. Correct?
A. **I believe that was correct.**
Q. And that many of the errors related to the fact that evaporation from farm ponds and other

impoundments was not accounted for. Correct?
A. **Well, they made that -- they made that statement. But, again, Army Corps of Engineers and others, including the State of Georgia, feel that the whole issue of small pond impoundment and the evaluation of evaporation by itself without consideration of size of pond and infiltration is -- is a very difficult and complex thing to compute and certainly highly inaccurate.**
Q. Sir, do you recall that Georgia Tech said that the error from that issue alone can be up to 1200 cfs. Correct?
A. **I recall that.**
Q. And that the systematic errors in the dataset create a false assurance regarding the amount of water available during periods of drought?
A. **Right. Yes.**
Q. Okay. And, sir, if we could, you will find the UIF report at tab 21 of your binder. And I want to turn to the page marked with a little Roman numeral iv -- I think it's actually the fourth page of the document. This is Exhibit FX-534.
A. **Okay.**
Q. Sir, are you at the page that says Executive Summary?

A. **Yes, I am.**
Q. Okay. If you look at the fourth paragraph that begins, the assessment demonstrates, do you see that?
A. **Yes, I do.**
Q. Okay. If you could just read the last sentence --
A. **The last sentence about systematic errors?**
Q. Of that paragraph, sorry, that begins systematic errors may affect. Do you see that?
A. **Yes.**
Q. Can you just read that to yourself, sir.
A. **Oh, okay. I have read it.**
Q. And, sir, do you see there that Georgia Tech is saying that the UIF's can lead to inaccurate estimates of reservoir drawdowns and releases?
A. **I see it.**
Q. And that they can lead to unrealistic representations of environmental flow regimes?
A. **Right.**
Q. And, sir, Georgia Tech said that the UIF's must be improved before they can support valid water management assessments. Correct?
A. **Well, they recommended their improvement. But, once again -- that they be improved. But, once**

again, they also went on to say that for the purposes that the UIF's are being used by the Army Corps of Engineers and by the State of Georgia for this application especially, comparing consumptive use scenarios, it's -- they're perfectly acceptable.
Q. Sir, can you stick to the executive summary and look at the second to last full paragraph on that same page that begins, the overarching study.
A. **Yes.**
Q. Do you see that?
A. **Yes.**
Q. The next sentence that begins, such improvements, can you read that and the next two sentences to yourself.
A. **I see it.**
Q. And, sir, do you see there that Georgia Tech is warning that the problems with the UIF's are particularly critical with daily time steps. Do you see that?
A. **Yes.**
Q. And that they concluded that these errors undermine the results of ResSim and other river basin simulation models operating on daily time steps. Correct?

A. **Yes, I see that.**
Q. Okay. And, sir, you also know that the U.S. Fish and Wildlife Service has warned about using the Corps' UIF dataset. Correct?
A. **I have heard that as well.**
Q. Sir, if you could turn to tab 13 in your binder.
A. **Okay.**
Q. This is a February 5, 2013, letter from the U.S. Fish and Wildlife Service. It's FX-530.
And if you could, just look under the heading Inappropriate use of the unimpaired flow dataset. Do you see in that second sentence that begins, although the Service is saying that the UIF dataset was not intended to accurately identify historic daily discharge or be a predictive model?
A. **Right. But as you read the rest of that sentence, which is actually quite important, it says the advantage of its use in comparative analysis is that the errors and biases within the UIF are uniformly applied to all alternatives, thereby enabling analysts to hone in on differences caused by various reservoir management strategies.**
And that's exactly what the authors of this

document from Georgia Tech also said. And, as a matter of fact, we have taken this model for the period of time 2008 to 2011 and run a careful analysis against measured values. And the ResSim model actually matched beautifully with a correlation essentially of .96 which says that the model, indeed, with its current UIF's in place is an accurate tool.
It's the tool relied upon by the Army Corps of Engineers for operating this basin. It's also the tool recommended by the Hydrologic Engineering Center Army Corps of Engineers research group. They assessed the model for three years before they selected it and applied it to the basin. So it's a fine tool.
Q. Sir, do you agree that the Service says that ResSim in the -- excuse me. That the service said that the UIF dataset should not be used as a predictive model?
A. **I see that. And we actually ran a test between '08 and '11 and found it to be an excellent predictive tool.**
Q. Right. You used it as a predictive model. That's what you said in your prefiled direct testimony. Correct?

A. **Yes.**
Q. Okay. Now, you also used the Corps' dataset -- the UIF dataset and ResSim to identify historic daily discharges at the state line and predict what those daily discharges would have been under various conservation scenarios. Correct?
A. **Yes.**
Q. Okay. And if you would, sir, just briefly turn to your prefiled testimony. And I'm looking at your demo 24, which is a page 41 of your testimony.
A. **Okay. I see it.**
Q. Sir, I just to want look at that briefly. Do you see at the bottom right you cite a source there, which is GX-911. Do you see that?
A. **Yes.**
Q. And now, if you could turn to your demonstrative packet, sir --
A. **Okay.**
Q. -- to demo 16.
A. **All right.**
Q. Which is, I think, the very last one.
A. **Okay. I'm there.**
Q. Sir, what we did here was we took a screen shot of GX-911, which was cited in this demo in your

prefiled direct testimony.
A. **Okay.**
Q. And, sir, do you see here that you are putting a baseline and then 1,000 cfs cap scenarios on a daily basis in this spreadsheet?
A. **Yes.**
Q. And you did that by running ResSim. Correct?
A. **I believe so, yes.**
Q. And so you were using ResSim precisely in the manner that Georgia Tech and the U.S. Fish and Wildlife Service warned you against as a predictive tool and with daily time steps. Correct?
A. **Well, we're doing a comparative analysis here between -- if you're talking about my demo, demonstrative 24, is that what we're referring to?**
Q. It is.
Well, I'm looking at --
A. **On page 41?**
Q. -- what you have here as support, which is GX-911, on demo 16.
A. **Okay. So we're actually running a scenario comparison between the baseline 2011, which is the 2011 sort of condition in the basin, which is**

a serious drought year, and we're comparing that against, I guess, Dr. Sunding's proposal -- proposed cap of a thousand cfs. And so we're doing a -- a direct, if you will, scenario comparison just like the Fish and Wildlife Service said was completely appropriate. And those are the results we got.
Q. Sir, you're running a predictive models, and you're using daily time steps; is that correct?
A. **That's correct.**
Q. Okay. Now, sir, are you also aware that Georgia Tech warned about the use of the UIF's for comparative analyses?
A. **Everything that I have seen from Georgia Tech, from both of the main lead authors there, were that for running sort of a -- this model in a planning mode, meaning sort of a comparison of consumptive use caps or whatever, or increases into the future -- and, of course, this is the exact same model that was run by the Army Corps of Engineers in consideration of Georgia's 2013 and 2015 request for sort of future uses.**
Everything I have seen, they said it's perfectly -- this model is perfectly fine. Yes, it's subject to a few issues and a few problems

that they solved for their specific application; but in general, the model is perfectly fine for comparative analysis.
Q. Sir, could you turn back for a moment to tab 21, which is Georgia Tech's UIF --
A. **Sure.**
Q. -- unimpaired flow, analysis.
A. **Sure.**
Q. And if you could, sir, please turn to page 124.
A. **Okay.**
Q. The numbers are in the box on the bottom of the page --
A. **Thanks.**
Q. -- yes, in the light gray.
A. **In the light gray. So I have to get three layers of glasses.**
All right. 124, you said?
Q. Correct.
A. **Okay.**
Q. The heading on that page says, Unimpaired flow uncertainty implications for --
A. **Yes.**
Q. -- FWMP?
A. **Yes.**
Q. And, sir, if you look at the paragraph that

begins, since unimpaired flows, do you see that?
A. **Right.**
Q. It's in the second paragraph under the (i), (ii), (iii), and (iv). Can you just read that to yourself, sir.
A. **I see that.**
Q. And, sir, do you see there that Georgia Tech is actually warning that use of the unimpaired flows and all of their uncertainty can actually be passed on in modeling and impact even when you're doing a relative comparison of various water management alternatives. Correct?
A. **I see that. However, again, I have already stated the model has been run in a predictive mode against the period 2008 to 2011 and found to be highly accurate. And, therefore, while this might apply to sort of specific applications that Georgia Tech had in mind, for this ACF Basin and what we're doing here in the modeling, I think it's the preferred tool.**
Q. Sir, are you aware of the ACFS Stakeholders Group?
A. **I am.**
Q. And have you reviewed the document they produced called the Sustainable Water Management Plan?

A. **I have seen the cover, and I think I have probably read the executive summary.**
Q. It's at tab 22, if you want to refer to it.
A. **Okay.**
Q. You know that after reviewing Georgia Tech's criticism of the UIF's, the ACF Stakeholders Group decided to use the UIF's and ResSim modeling anyway. Correct?
A. **Yes, I do know that.**
Q. And they acknowledged the errors and omissions in the UIF dataset. Correct?
A. **Yes.**
Q. Do you recall they called it an artificial dataset?
A. **Wouldn't surprise me.**
Q. And they said that it needed to be improved as soon as possible?
A. **It would not surprise me.**
Q. Okay. And if we could turn to page 128 in tab 22, I think it's at the very end of that document.
A. **Okay. All right.**
Q. Or almost the very end.
A. **Almost the very end of your --**
Q. Yes. Page 128 in tab 22.

A. **Okay. Now, I'm with you.**
Q. Which for the record is FX-883.
A. **Right.**
Q. And, sir, if you look in the third paragraph that begins, although questions have been raised.
A. **Right.**
Q. If you could read that, sir, just to -- the first two sentences there, to yourself.
A. **Okay.**
Q. And you will see that they cited time and funding constraints for why they couldn't fix the errors in the UIF --
A. **Yes.**
Q. -- dataset?
They agreed to go forward anyway, but recognized that they could not truly assess the environmental impacts and benefits associated with various water management alternatives. Correct?
A. **Let me just check something here.**
Yes. I see that. But, once again, the model has been tested; and it has been proven already for the years 2008 to 2011 to be accurate with the UIF's that are contained therein.
Q. Sir, did you do anything to attempt to refine or

improve the Corps' UIF's before conducting your own ResSim modeling?
A. **No, I did not.**
Q. Still not enough time and money to do that?
A. **Well, we tested the model from 2008 to 2011. And that is actually one way of evaluating the accuracy or the relative accuracy of UIF's.**
Q. But you --
A. **Since the model produced a correlation, kind of a coefficient of about .96 over that time period, that implies to me that the model is perfectly acceptable for this application.**
Q. And you know that Georgia Tech suggested some very specific improvements to the UIF dataset. Correct?
A. **Under their specific sort of set of objectives they did, yes.**
Q. And if you could just turn back to that one more time, tab 21.
A. **Sure.**
Q. Page, I believe, 193.
A. **Okay. 193?**
Q. Correct. 193.
A. **Okay.**
Q. And you see under the section Recommendations

they first suggest some recommendations to fix the monthly UIF's. And then as you go onto the next page, they say, thereafter, there can be an attempt made to try to fix the daily UIF's. Do you see that?
A. **Oh, yes. Oh, yes.**
Q. And did you know that Georgia Tech concluded that even if the UIF's were revised per their suggestions, it would still be challenging in a couple instances. And those are -- if you look at the bottom paragraph on page 193, there's a sentence right in the middle that says, the two challenging improvements relate to the effect of. Do you see that sentence?
A. **At the bottom of 193?**
Q. Yes. In the last full paragraph on that page. And there is a sentence in the middle there or about a third of the way down --
A. **Yes.**
With the exception of two errors, yes.
Q. Correct.
Could you just read that to the end of the paragraph.
A. **Right. I see it.**
Q. All right. So Georgia Tech says that the two

challenges that would remain are, one, human-induced groundwater changes.
A. **Yes.**
Q. And then the small and medium-sized impoundments, the farm ponds. These are the same two issues we talked about earlier. Correct?
A. **They are.**
Q. And do you see that in light of these persistent challenges, Georgia Tech concluded that the way to deal with it is to run rainfall runoff models. Correct?
A. **Yes.**
Q. And they said that rainfall runoff models could be developed to provide a realistic assessment of the collective groundwater and impoundment impacts. Do you see that?
A. **Yes. If -- if you had, again, the time and the money to do that.**
Q. Well, sir, are you familiar with the work that Dr. Lettenmaier and Dr. Hornberger did in this case?
A. **I am.**
Q. And you know that they ran rainfall runoff models for precisely this purpose?
A. **Well, I don't know about precisely this purpose.**

They ran rainfall runoff models in order to compare against measured flows in order to back out, if you will, consumptive use values.
Q. Right. So they ran these models -- Dr. Hornberger used the P R M S or PRMS model. Correct?
A. **Yes.**
Q. And Dr. Lettenmaier used the VIC model?
A. **Yes, I'm aware of that.**
Q. Okay. And that was a way for the two of them to deal with the challenges noted here by Georgia Tech. Correct?
A. **Well, but also Dr. Hornberger himself ran the ResSim model as well. So he ran a -- I mean, he ran the ResSim models and with a -- you know, with his own calculations on unimpaired flow. But he did run his own with the ResSim model.**
Q. He did a variety of modeling. He realized some of the challenges with ResSim. And one of the things he did was to run a rainfall runoff model. Correct?
A. **Yes.**
Q. All right. Now, sir, before we leave this topic, just coming back to farm ponds for a moment, have you seen the assessment that Georgia EPD did of

the consumptive use impact of evaporation from farm ponds?
A. **I have not seen it in detail, no.**
Q. All right. You recall Dr. Zeng testified that such an assessment existed. Correct?
A. **I think I remember that, yes.**
Q. And it was withheld from Florida as privileged?
A. **Say it again?**
Q. It was withheld from Florida as privileged?
A. **Oh, that -- I did not remember that.**
Q. Okay. But you haven't seen it?
A. **No.**
Q. Okay, sir. I want to switch topics one more time.
Sir, in addition to theorizing that any water saved by reductions in Georgia's consumption would not flow down to Florida, you also suggest that any cuts in consumptive use by Georgia would not be meaningful in any event because Georgia's water use represents a relatively small percentage of streamflow entering Florida. Correct?
A. **Well, it's -- you're talking about at the state line; and you're talking about mostly under drought conditions. The situation is that**

basically the offset kind of kicks into place. If you have consumptive use coming -- let's say, you know, increased flows coming down the Flint, and the offset sort of kicks into place, and the reservoirs were then used to store an equivalent amount of that flow on the Chattahoochee side. That's how they operate the system.

Q. Sir, if you could turn to your prefiled direct testimony at page 44.

A. **Okay.**

Q. Paragraph 94.

A. **Yes.**

Q. Actually, just above that, while you're getting there --

A. **Sure.**

Q. -- there is a main heading in the middle of that page. Do you see that it says --

A. **Yes.**

Q. -- Georgia's water use will not have a significant impact on state line flows?

A. **Right.**

Q. And then at paragraph 94 you say, Georgia's water use represents a relatively small percentage of streamflow entering Florida?

A. **Yes.**

Q. Now, to support your assertion that cuts in consumptive use would not be meaningful, you compared Georgia's consumptive use values with state line flows measured at the Chattahoochee Gage. Correct?

A. **Right.**

Q. And if we could turn to your prefiled direct testimony to page 46, demo 28.

A. **Okay.**

Q. Are you there?

A. **Yes.**

Q. And just so we're all clear, when you refer to consumptive use throughout your testimony and in this demo, you're using the term in the same way that Dr. Zeng uses it, meaning the total amount of surface water reduction or streamflow depletion resulting from Georgia's water use. Correct?

A. **Yes. The sum of M & I and Ag use. And it was basically provided to me from the State of Georgia and other experts, yes.**

Q. Right. You actually relied on the consumptive use data that Georgia provided to you?

A. **I did, yes.**

Q. Okay. Now, in demo 28 you focus on the

relationship between Georgia's average monthly consumptive use for the months of May through September with average state line flows during those same months. Correct?

A. **Right.**

Q. And as you point out, water is in its greatest demand from May to September. Correct?

A. **Oh, yes.**

Q. And Georgia's consumptive use is highest during the months of July and August. Correct?

A. **That's correct.**

Q. The caption below your demo 28 has the years 1980 to 2013. Do you see that?

A. **Yes.**

Q. And this indicates that the demo is plotting Georgia's consumptive use data and state line flow data for all of the years between 1980 and 2013?

A. **Yes.**

Q. In other words, demo 28 is including average monthly consumptive uses and state line flow data during all years in that time period, including normal and wet years. Correct?

A. **It is. It's the whole -- it's the whole sequence, yes.**

Q. So I would like to turn your attention back to your demonstrative packet.

A. **Okay.**

Q. And if you could find Bedient cross demo 11.

A. **All right. No. 11. I'm there.**

Q. Now, what we have done here is focus on 2011, which I think you agreed with me earlier that it was at least a dry year, if not quite yet declared a drought year?

A. **Yes, it was definitely a low flow year.**

Q. Okay. And do you see that, like your demo 28, what we did in Bedient cross demo 11 is to compare state line flows in Georgia's consumptive use on an average monthly basis?

A. **Yes.**

Q. Okay. But this Bedient cross demo 11 is only looking at 2011?

A. **Correct.**

Q. Okay. Now, do you see that during the summer months of this year, Georgia's consumptive use came much closer to approaching average monthly state line flows than in your demo 28?

A. **Yes. I mean, you're plotting something completely different here.**

Yes, it's a true and accurate plot. I don't

disagree with it at all.
Q. And do you see that the average monthly streamflow depletion value for August 2011 was 1,777 cfs?
A. **Yes. Close to 1800, yes.**
Q. And that the average monthly state line flow for that month was 5,484 cfs?
A. **Yes.**
Q. And I'll represent that if you divide those numbers, it comes out to 32 percent. Does that sound right?
A. **Sure. I'll buy that.**
Q. Do you recall that in your written testimony, you say that even when water is in its highest demand, Georgia's consumptive water use still represents a small percentage of water as compared to the amount of streamflow that crosses the state line?
A. **Well, that's a general statement. When I made that statement, I wasn't necessarily talking about 2011.**
And, you know, if you plot 2011, yes, that's kind of a worst case. And, actually, 2011 is the year that we selected to do all of our baseline runs against because of its -- because of the

extreme nature of that year.
Q. Sir, if you could, just turn to your prefiled direct testimony at page 46 --
A. **Okay.**
Q. -- paragraph 97.
A. **All right.**
Q. And you will see at the end of that paragraph, sir, the statement that I just stated for the Court when you said Georgia's total consumptive -- sorry. Even when water is in its greatest demand, Georgia's total consumptive water use still represents a, quote, small percentage of water as compared to the amount of streamflow that crosses the state line.
Do you see that, sir?
A. **Yes.**
Q. Okay. 32 percent is not a, quote, small percentage; is it?
A. **Not for that one particular data point that you have selected. But this statement is with respect to this general graph that's on page 46.**
Q. Now, sir, if you turn to cross demo 12, which is the next page.
A. **All right.**
Q. You will see what we have done here is that we

have plotted the ratio of average monthly consumptive use for 2011 versus observed state line flow at the Chattahoochee Gage for the same year. Do you see that?
A. **Sure.**
Q. And we were just talking about the ratio of August, which is 32 percent. Do you see that in July and August, the months when you acknowledge that Georgia's consumptive use is at its highest percentage of Georgia's consumptive use as compared to state line flow, is 27 percent and then 32 percent respectively?
A. **Sure. But, again, during all of this time period in 2011, the -- you know, there's a lot of augmentation going on at this time. And so the system is being operated to shoot for or to at least hit the minimum of 5,000. And all other water, to the extent possible, is going back to refill those reservoirs.**
Q. So, sir, at least for this time period your statement that Georgia's total consumptive water use still represents a small percentage of water as compared to the amount of streamflow that crosses the straight line -- state line is not true. Correct?

A. **Well, that statement, again, was made in a general sense for average years. This is obviously an extreme year. And it is a high percentage, I'll absolutely agree with.**
Q. So we don't need to belabor it with the Court, but if you look at the next two demos in your packet, 13 and 14 --
A. **Sure.**
Q. -- you have done the same thing for 2012, sir. Would you agree that, once again, the ratios are much higher than what you present in the demo in your direct testimony?
A. **The ratios are higher. And, of course, 2012 is the back-to-back drought that came right after 2011. And, yet, you will also notice that with respect to the way that the Corps is operating the system, they are meeting the minimum 5,000 cfs as required under the RIOP.**
Q. And, sir, you realize that these charts are all using Georgia's consumptive use numbers. Correct?
A. **Yes.**
Q. And that Florida at least believes that Georgia has underestimated its consumptive use. Correct?
A. **I'm aware of that, yes.**

Q. Pretty substantially, according to Florida's experts. Correct?
A. **Yes.**
Q. And I know you won't agree with that, but would you at least agree that to the extent Georgia's consumptive use values are underestimated, Georgia's consumptive use will represent an even larger percentage of the state line flows than is shown on these cross demonstratives?
A. **Well, I think based on everything that I have looked at -- and, again, I have to rely upon consumptive use being provided to me; but based on the analyses and the discussions that I have had with team members, I would think that -- that those are pretty accurate numbers coming from the State of Georgia. And I --**
Q. Sir --
A. **-- think they're more accurate than what's being provided and being estimated by Florida experts.**
Q. I appreciate that. I didn't ask you if you agreed that they weren't accurate. I just asked if you would at least agree that to the extent those consumptive use values are underestimated, Georgia's consumptive use would represent an even larger percentage of these state line flows.

Correct?
A. **I'll agree with that.**
Q. All right. Thank you.
MS. WINE: I have no further questions.
SPECIAL MASTER LANCASTER: Redirect?
MS. ALLON: Yes. Thank you, your Honor.
REDIRECT EXAMINATION
BY MS. ALLON:
Q. Dr. Bedient, I want to start by talking about your opinion that reducing Georgia's water use would not typically lead to increases in state line flows during dry and drought conditions. So if you could turn to page 29 of your direct testimony. And I specifically want to look at paragraph 56.
Does paragraph 56 report the results of an analysis that you did in support of that conclusion?
A. **Yes.**
Q. Okay. And could you describe the analysis that you did?
A. **Sure. We basically -- for the year 2012 we essentially did a counting. We counted up how many days Florida would be expected to receive either additional water or no additional water at**

the state line. And we did this detailed analysis for the whole year. And the results were that for 307 days out of that year Florida would receive no additional state line flow, and for only 49 total days during the year would they receive the full benefit of that flow. And that would typically not be during the low flow months of the summer.
Q. And what do you attribute -- that 307 days when Florida would receive no additional state line flow, what do you attribute that to?
A. **That basically -- I attribute that to, first of all, they're in drought operations in 2012. And this is a scenario where they have -- they're following the RIOP; and they have gone into drought operations. They're augmenting flows. They're meeting the 5,000 minimum, and that's it. In other words, they're augmenting the flows. And other excess flows that come through are put back into storage in the reservoirs.**
Q. Now, on cross-examination you talked a little bit about your modeling. Did you model the impact of both increases in Georgia's consumptive use on state line flows and decreases in Georgia's consumptive use on state line flows?

A. **Yes. I looked at both.**
Q. Okay. And which model did you use?
A. **I used the HEC ResSim model that was provided. And, again, it's basically the Army Corps of Engineers' model with input data in there from the State of Georgia.**
Q. And before we get into the results of your modeling, I just want to briefly discuss, because it came up cross-examination, the issue of the UIF's.
MS. ALLON: Your Honor, may I hand up a demonstrative?
SPECIAL MASTER LANCASTER: Please.
BY MS. ALLON:
Q. Now, during cross-examination you mentioned that you had seen some testimony from the authors of the GWRI report that discussed when those authors themselves thought the UIF -- the use of UIF's was appropriate. And if you look at the demonstrative that I just handed out, is this the testimony that you were referring to?
A. **Yes, it is.**
Q. And could you just describe -- you don't have to read through it; but could you describe at a general level what your understanding of that

testimony is.
A. **Yes. This is essentially what I was referring to. Both Dr. Kistenmacher and Dr. Georgakakos from Georgia Tech are referring to their report; and they're basically saying that for comparison scenarios, in other words, if that's where you're running these scenarios to compare, for example, consumptive use caps or increases in whatever, you were doing that type of analysis, the magnitude and the results of these issues that they came up with really are no longer an issue.**
Q. And did you do anything yourself to test the ability of the ResSim model to accurately reproduce reservoir operations in the ACF Basin?
A. **Yes, I did.**
Q. And what did you do?
A. **Basically ran the model -- I mean, put it through a severe test between 2008 and 2011. So that basically includes a really serious drought year of 2011. And it runs with the RIOP rules in place. And so we ran that model over that period of time and found the comparison to measured flows coming out of Woodruff Dam to be excellent.**
Q. Now, with respect to the modeling that you did using ResSim, can you just provides the Court

with a general overview of how you isolated the impact of consumptive use.
A. **Yes. You're basically asking me kind of how I ran the model?**
Q. Right.
A. **So the ResSim model is this complex beast that has rivers, the Flint, the Chattahoochee, and reservoirs contained therein. And so all of those rules that the reservoirs are operated under, all those rules are contained within the computer model. And then what we do is we get rid of all the human influences to generate the unimpaired flows.**
So unimpaired flows are sort of like Mother Nature's flows from the original days back 100 years ago. All right. That's the unimpaired flow. So that is sort of how you start the model. Then you start putting in consumptive uses. And you put in all sorts of withdrawals and all of that. So the human influences are added back into the model.
So if I want to look at consumptive use changes, let's say by 30 percent, I would take a baseline run. And the baseline run we used was the year 2011. And then I would simply cut

consumptive use -- I would cap it or cut it by 30 percent, put that in, make those two runs, and then compare the results at the state line.
So that's what we did. And we did that 19 different times with 19 different scenarios.
Q. And I want to talk about both sets of modeling that you did, decreases in consumptive use and increases in consumptive use.
A. **Both, yes.**
Q. Let's start with decreases.
A. **Okay.**
Q. With respect to decreases in Georgia's consumptive use, what were the specific consumption cap scenarios that you modeled?
A. **We basically looked at 5 percent deltas all the way up to 30 percent. So we looked at 30 percent. We looked at 1992 levels, which is about sort of a 40 percent decrease. And we also ran Dr. Sunding's analysis of 1000 cfs.**
Q. And at a high level, what did your modeling show about the impact of decreases in Georgia's consumptive use on state line flows into Florida?
A. **And, again, we're running this under the 2011 baseline. And when we did that, we essentially found no material differences whatsoever at the**

state line during the -- during the drought -- serious summer months for any of those runs. No difference.
Q. Let's take a look at page 38 of your direct testimony. And I would like to focus on demonstrative 21.
A. **Okay.**
Q. And does the demonstrative 21 show the results of one of your ResSim model runs about the impact of consumption caps on state line flows?
A. **Yes. That's a fairly typical plot of all of these. We're plotting two different colors here, blue and orange, the blue being the baseline run. And the flow is plotted as a -- just a function of time through the year, January to December.**
So the blue is the baseline original run. And then when we cut, the orange represents what additional flows might or might not come across state line.
Q. Okay. And --
A. **You will notice in the month of January and in the month of May, there are additional flows coming through to Florida. And, actually, a little bit in July. But across the board for the bulk of that time through the summer it's just a**

flat line, and they're the same.
Q. What was the specific consumption cap that you were modeling in demonstrative 21?
A. **This one is a 30 percent cap on both M & I and on agricultural use.**
Q. And what was your conclusion about reservoir operations from the results of this modeling?
A. **Well, the conclusion is that the -- you know, the reservoirs that are in the system -- and there are these -- there are these five big reservoirs with three big storage reservoirs in place. They tend to smooth or dampen out any changes or any alterations that might take place in the system. And that's what they're designed to do.**
Q. Now, Dr. Bedient, I think you had said that you -- when you had looked at caps, you went all the way up to a 40 percent reduction in consumptive use; is that right?
A. **Yes.**
Q. And if you look at page 40, demonstrative 23 --
A. **Right.**
Q. -- in your direct testimony, does that show the results of your analysis with respect to the impact of a 40 percent reduction in consumptive use?

A. **Yes. This is essentially taking it all the way back to the 1992 level of consumptive use, a 40 percent difference or cap. And when -- again, you see very similar results here to what we got with the 30 percent.**
Q. And what are those results?
A. **And those results basically say no material difference of flows at the state line. A few little differences, but mostly in the wetter months, not in the dry months.**
Q. Now, let's talk about the modeling you did of increases in Georgia's consumptive use. What scenario did you look at for that modeling?
A. **There, we -- we ran the 2040 into the future use, I believe.**
Q. So you looked at projected increases in Georgia's consumptive use. Is that right?
A. **That's correct.**
Q. And what did your modeling show with respect to the impact of increases in Georgia's consumptive use on state line flows into Florida?
A. **And, again, going all the way to 2040 with the projected uses, we see no material differences especially, again, in the summer months.**
Q. Dr. Bedient, how does it make sense that

Georgia's consumptive use, whether we're talking about increases or decreases, is not having a significant impact on state line flows into Florida during the dry times and drought years?
A. **It's all related to two things, the reservoirs and the way in which the Army Corps of Engineers operates those reservoirs. They have the RIOP rule. They basically are acting as a smoothing mechanism or a dampening mechanism for any changes that might migrate through the system.**
Q. I want to move on to a different topic, and I want to talk about your analysis of the relationship between precipitation and streamflow in the ACF Basin. Have you analyzed that issue?
A. **I have.**
Q. Now, let's take a look at page 56 of your direct testimony, specifically demonstrative 34.
A. **Okay.**
Q. And does this show the results of your analysis of the relationship between streamflow and precipitation?
A. **It does.**
And I apologize; it's a fairly complex graph, but I can -- I can explain it, I think, in simple terms.

There are two things being shown here. The red is rainfall. And it's been converted over into cubic feet per second, but essentially it's inches of rainfall that's been converted. And you will notice how the rain starts over there in 1929 on the graph. It was actually a fairly high year, and then it bounces up and down quite a bit. There is a low year in 1954, another kind of low year in the '60's. And then you come across, and you will notice that over there in the 1999 and forward time frame, you see three sort of double-year droughts; '99 and 2000, '06 and '07, and then '11 and '12. And then you will also notice that the flows -- and these are flows at the Chattahoochee Gage at the state line -- the flows also show a marked reduction. And, again, these are in units of tens of thousands of cfs average annual flows. But they show a marked reduction, especially post-1999. So there's this correlation that appears to show up.
MS. ALLON: Your Honor, may I hand up one more demonstrative?
May I hand up one more demonstrative?
SPECIAL MASTER LANCASTER: Please.
BY MS. ALLON:

Q. Now, Dr. Bedient, this is a demonstrative that the Court has seen before. Florida's counsel actually used it in their opening statement. Have you seen this before?
A. **I have.**
Q. Okay. And can you describe what it shows.
A. **It's basically showing the -- and I choose to look at annual streamflow; it's easier to see, but you can also look at June to September streamflow. And what you're seeing is a comparison between droughts of '54 and '55 compared to today, 2011 and 2012.**
And the -- the effort here is to show that -- or the statement up here is that fewer inches of precipitation and higher temperatures in the past lead to -- or were considerably higher and produced sort of worst droughts in the future.
Q. Okay. And do you agree with that conclusion?
A. **No, I don't. I think there are a lot of other issues going on here.**
Q. Okay. Can you describe what you mean by that?
A. **Well, in particular two things have changed dramatically in the basin between '54 and '55. And that was shown on my earlier exhibit that we just looked at.**

In 1954, that was basically just a single-year drought. And all the -- all the earlier droughts were sort of single-year type drought occurrences.
Secondly, in 2011 and 2012 the reservoirs were in place; the RIOP was in place. So they were hitting or shooting to hit that minimum 5,000, which explains why you see the June to September streamflow in there around 5500.
Lastly, and more importantly than anything, the high annual streamflow during 1954 is kind of a false and misleading number because the end of 1953 had one of the largest rains on record. And it happened in the very end of the year, and then flows just carried over into 1954 generating a higher value, much higher than -- you will notice '55; the value there is 11,000. And you will notice it's 3,000 higher. And that's just not -- and I investigated that.
Q. Okay. And let's look at page 85 of your direct testimony.
A. **Okay.**
Q. And specifically at demonstrative 50.
A. **All right.**
Q. And can you describe what demonstrative 50 shows.

A. **That shows what I was just talking about for 1954 and '53. You will notice in January of 1954, the rainfall starts to really, really go down. And you will notice the flows also in '54 track down, but they start very high. They start at 40,000. And the reason they start really high at 40,000 is because look at that ginormous rain spike that comes in at the very, very end of 1953. It just carries over.**
This is a slow-moving, slow-responding basin. And those flows just carry over into '54 and register at the state line.
Q. Now, Dr. Bedient, based on your review of the precipitation data and streamflow data, what have you concluded about the relationship between precipitation and streamflow in the ACF Basin?
A. **Well, I think it's just common sense that higher rain, higher runoff, higher streamflow; lower rain, especially significantly lower rain, lower flow -- lower streamflow, lower flows measured at the gage.**
Q. Thank you.
MS. ALLON: Your Honor, nothing further.
EXAMINATION

BY MS. WINE:
Q. Sir, I just want to pick up where we left off with your counsel asking you about your analysis of rainfall.
A. **Sure.**
Q. You're not a climatologist. Correct?
A. **I'm not a climatologist.**
Q. And you're not a hydroclimatologist?
A. **I'm not one of those, no.**
Q. And were you here when Dr. Hornberger testified about this chart that you were just asked about comparing '54 to '11 and '55 to 2012?
A. **No, I wasn't here.**
Q. And were you -- so you weren't here to hear him say he compared 2010 to 1953, and that they were the same?
A. **No.**
Q. And did you hear him talk about looking at the effect of any kind of carryover analysis?
A. **No, I did not.**
Q. Sir, when you looked at the relationship between rainfall and streamflow for purposes of your expert report and your prefiled direct testimony, did you rely on gridded climate datasets?
A. **No. I relied on the data that basically came**

from the National Weather Service out of the EPD offices.
Q. And, sir, are you aware that NOAA has now published on its website and said elsewhere that the gridded datasets are the state-of-the-art datasets that are to be used these days?
A. **I am familiar with that.**
Q. Okay. And you haven't looked at the gridded datasets or done any analysis to see what the relationship would be -- between rainfall and streamflow would be if you used those datasets. Correct?
A. **Well, I haven't done a detailed analysis; but I have looked at some of Dr. Hornberger's annual rainfall totals. And I have compared those back against our annual rainfall totals. And they compare very, very well. They're very close.**
Q. Sir, have you looked at any of Dr. Lettenmaier's analyses?
A. **I have.**
Q. And have you looked at his analysis of the relationship between rainfall and streamflow?
A. **I have.**
Q. And he uses gridded climate datasets; does he not?

A. **He does.**
Q. And he comes up with very different conclusions than you do. Correct?
A. **He does.**
Q. Now, sir, I just want to make sure I'm clear on one thing. Going back to your ResSim modeling and your use of the UIF dataset, your counsel handed out this sheet that has some excerpts from testimony. Correct?
A. **Yes.**
Q. And I just want to make sure I heard correctly. Are you now conceding that your ResSim modeling work is of no utility if we want to know what absolute flows are at a particular time period?
A. **No, I haven't said that. In fact, I said just the opposite. The time period from '08 to '11 we compared and got a very, very good result. So I think it's an accurate tool.**
Q. So you're purporting to state what the absolute flows are on particular days?
A. **No. Over a period of time if you do a long-term analysis and see how well that model works, not necessarily day-to-day, but across a three-year period, it works very well. And that's the system, by design, is a -- is a multi-month,**

multi-year type analysis.
Q. So your modeling cannot give us absolute flow numbers going back in time or in the future if we want to look at a particular time period. Correct?
A. **At a particular day it's more difficult. For a particular time period, we can do a better job.**
Q. Okay. Thank you.
A. **Thank you.**
SPECIAL MASTER LANCASTER: Any redirect?
MS. ALLON: Yes, your Honor, very brief.

REDIRECT EXAMINATION

BY MS. ALLON:
Q. Dr. Bedient, counsel for Florida asked you if you were a climatologist or a hydroclimatologist, I think. Do you have expertise in studying rainfall and streamflow data?
A. **Yes. Extensive. I do.**
Q. About how long have you been studying and analyzing that data for?
A. **I have been looking at rainfall and runoff for 40 years in Texas, where we get really, really big storms, and all over the country, for that matter, as well. I have done it for a long time.**
Q. And do you have experience in applying that

knowledge in the real world?
A. **I do. I have developed and operate realtime flood warning systems that work off of radar rainfall and high-tech rainfall. So I'm quite familiar with rainfall databases.**
MS. ALLON: Nothing further, your Honor. Thank you.
MS. WINE: Nothing further.
SPECIAL MASTER LANCASTER: Doctor, you were here when Dr. Panday testified?
THE WITNESS: I was.
SPECIAL MASTER LANCASTER: I want you to think very carefully before you answer this question.
THE WITNESS: I will, sir.
SPECIAL MASTER LANCASTER: It's pouring rain out there. It's very cold. And it's getting dark.
Do you remember what Dr. Panday said when I asked him questions?
THE WITNESS: You asked him that question?
SPECIAL MASTER LANCASTER: No, no. I asked him questions.
THE WITNESS: Oh, yes. Yes.

SPECIAL MASTER LANCASTER: And he said you, meaning me, know more about this than I do.
THE WITNESS: And I agree with him.
SPECIAL MASTER LANCASTER: So we should quit?
THE WITNESS: That's the best news I have heard all day, sir.
SPECIAL MASTER LANCASTER: Well, let me ask you a couple questions.
Are you familiar with Battle Bend?
THE WITNESS: I have heard about it from you up on the stand asking the questions; but I have not -- I have not researched it.
SPECIAL MASTER LANCASTER: Well, if -- Battle Bend is south of -- of Bainbridge and north of Sumatra.
THE WITNESS: Right.
SPECIAL MASTER LANCASTER: If the United States Supreme Court were to order the disengagement of Battle Bend, what would the result be?
THE WITNESS: I haven't studied that problem. I don't know.
SPECIAL MASTER LANCASTER: Well, let's

suppose that the Supreme Court ordered a canal to be created between the Tennessee River and the Chattahoochee. What would the result be?
THE WITNESS: I haven't studied that either.
SPECIAL MASTER LANCASTER: There are, by my count, some 300 sloughs. What if the Supreme Court ordered them all cut off? What would the result be?
THE WITNESS: I haven't run that analysis either.
SPECIAL MASTER LANCASTER: You're making great progress.
Well, let me ask you one last question. Oysters are male and then become female. Do you know how that happens?
THE WITNESS: I used to think I was an ecologist, but I'm not. And I have not studied that problem.
And I don't like to eats oysters either, so I don't know.
SPECIAL MASTER LANCASTER: Let me ask you this question. If we get a drenching, drenching, drenching rain, what's the effect

going to be on groundwater and streamflow?
THE WITNESS: The groundwater levels, just like Dr. Panday indicated, will definitely come up; and the streamflow will increase. That's just the way a hydrologic system works.
SPECIAL MASTER LANCASTER: Now, you're not a climatologist?
THE WITNESS: No. That's rainfall runoff. That's hydrology.
SPECIAL MASTER LANCASTER: And that's common sense?
THE WITNESS: Yes, sir.
SPECIAL MASTER LANCASTER: Further cross?
MS. ALLON: Nothing else, you Honor.
MS. WINE: Nothing further, your Honor.
SPECIAL MASTER LANCASTER: Okay.
THE WITNESS: Thank you, sir.
SPECIAL MASTER LANCASTER: Thank you.
Yes, sir?
MR. PRIMIS: Your Honor, Georgia's next witness is going to be called by video designation. I don't believe we can finish it today given the length. So I propose we

start with Mr. Leitman's video designations tomorrow.
SPECIAL MASTER LANCASTER: Thank you for that.
Anything else?
MS. WINE: No, your Honor.
SPECIAL MASTER LANCASTER: All right. We'll be in recess until tomorrow morning.
MR. PRIMIS: Thank you, your Honor.
MS. ALLON: Thank you, your Honor.
(Time Noted: 3:57 p.m.)
(Proceeding adjourned to Wednesday, November 29, 2016, at 9:00 a.m.)
(End of day)
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CERTIFICATE

I, Claudette G. Mason, a Notary Public in and for the State of Maine, hereby certify that the foregoing pages are a correct transcript of my stenographic notes of the Proceedings.

I further certify that I am a disinterested person in the event or outcome of the above-named cause of action.

IN WITNESS WHEREOF, I subscribe my hand this 13th day of December, 2016.

/s/ Claudette G. Mason
Claudette G. Mason, RMR, CRR
Court Reporter

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