

SUPREME COURT OF THE UNITED STATES
No. 142, Original

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

VOLUME VIII

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 10, 2016, commencing at 8:56 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.
PAUL N. SINGARELLA, ESQ.
DEVIN M. O'CONNOR, ESQ.
BENJAMIN E. STEARNS, 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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1 PROCEEDINGS
2 SPECIAL MASTER LANCASTER: Good morning,
3 counsel.
4 MS. ALLON: Good morning.
5 MR. SINGARELLA: Good morning, your
6 Honor.
7 May I approach, your Honor?
8 SPECIAL MASTER LANCASTER: Please.
9 MR. SINGARELLA: Good morning, your
10 Honor. Paul Singarella for the State of
11 Florida.
12 This morning, your Honor, we will be
13 hearing from Dr. George Hornberger. Would
14 you like Dr. Hornberger to take the witness
15 chair?
16 SPECIAL MASTER LANCASTER: Please.
17 MR. SINGARELLA: Dr. Hornberger.
18 THE CLERK: Please raise your right
19 hand.
20 Do you solemnly swear that the testimony
21 you shall give in the cause now in hearing
22 shall be the truth, the whole truth, and
23 nothing but the truth, so help you God?
24 THE WITNESS: I do.
25 THE CLERK: Please be seated.
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1 Pull yourself right up to the microphone
2 and please state your name and spell your
3 last name.
4 THE WITNESS: My name is George
5 Hornberger, H O R N B E R G E R.
6 MR. SINGARELLA: Your Honor, may I
7 approach the witness and present him with his
8 testimony?
9 SPECIAL MASTER LANCASTER: Please.
10 MR. SINGARELLA: Thank you, sir.
11 DIRECT EXAMINATION
12 BY MR. SINGARELLA:
13 Q. Dr. Hornberger, you have in front of you your
14 written testimony for this matter. Do you adopt
15 that written testimony as your own?
16 A. Yes, I adopt it.
17 Q. Thank you, Doctor.
18 MS. ALLON: Good morning, your Honor.
19 SPECIAL MASTER LANCASTER: Good morning.
20 MS. ALLON: I haven't had the
21 opportunity to be up at the podium before, so
22 I wanted to introduce myself. I'm Devora
23 Allon from Kirkland & Ellis, the New York
24 office. And I also wanted to introduce some
25 of the new faces at our counsel table.
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1929

1 Obviously, you know Mr. Primis. We have
 2 Ms. Lewis and Mr. Pruitt at the counsel table
 3 today.
 4 MS. LEWIS: Good morning.
 5 SPECIAL MASTER LANCASTER: Good morning.
 6 MS. ALLON: I have some witness binders
 7 that I would like to hand up with the Court's
 8 permission.
 9 SPECIAL MASTER LANCASTER: Yes, ma'am.
 10 CROSS-EXAMINATION
 11 BY MS. ALLON:
 12 Q. Good morning, Dr. Hornberger.
 13 A. **Good morning, Ms. Allon.**
 14 Q. Dr. Hornberger, for this case you were asked to
 15 assess the impact of both increases and decreases
 16 in Georgia's consumptive use on state line flows
 17 into Florida. Is that correct?
 18 A. **Yes.**
 19 Q. And for that analysis you used reservoir
 20 modeling; is that correct?
 21 A. **As part of the analysis, yes.**
 22 Q. In your two different models that you developed,
 23 you had the data-driven ResSim model, and you had
 24 the Lake Seminole model; is that correct?
 25 A. **Yes.**

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1930

1 Q. All right. Let's start with your data-driven
 2 ResSim model. Your data-driven ResSim model is
 3 based on the ResSim model that was developed and
 4 used by the United States Army Corps; is that
 5 correct?
 6 A. **Yes.**
 7 Q. You made some modifications to the Army Corps
 8 model; is that right?
 9 A. **Not the model itself, but to the reservoir**
 10 **inflows.**
 11 Q. Right. Your model uses a different flow input
 12 than the Army Corps model does?
 13 A. **Yes.**
 14 Q. But, otherwise, your data-driven ResSim is pretty
 15 similar to the Army Corps' ResSim model; isn't
 16 that right?
 17 A. **Yes.**
 18 Q. Your data-driven ResSim model uses the same
 19 reservoir operating rules as the Army Corps
 20 model. Right?
 21 A. **Yes.**
 22 Q. Now, you used your data-driven ResSim model to
 23 look at the impact of decreases in Georgia's
 24 consumptive use on the amount of flow that would
 25 cross the state line into Florida; is that

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1931

1 correct?
 2 A. **We did the calculations.**
 3 Q. You used the model to simulate the impact of
 4 different consumption caps. Right?
 5 A. **We did the calculations.**
 6 Q. So you looked at what would happen in terms of
 7 flows into Florida, what the volume of the
 8 increase of those flows would be under different
 9 consumption cap scenarios; is that right?
 10 A. **We did those calculations, but they were not part**
 11 **of my opinion set.**
 12 MS. ALLON: Let's pull up demonstrative
 13 No. 1.
 14 BY MS. ALLON:
 15 Q. Dr. Hornberger, if you look at the screen, this
 16 is a manifestation, so to speak, of a model run
 17 that you did in your data-driven ResSim model.
 18 Is that right?
 19 A. **Yes. It certainly looks like it.**
 20 Q. Okay. And if you read at the bottom, the run is
 21 called half add IBT add-back. Do you see that?
 22 A. **Yes, I do.**
 23 Q. And the description says, 50 percent, and then a
 24 parenthetical, add irr plus Ag pond, close
 25 parenthetical, plus 100 percent IBT. Do you see

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1932

1 that?
 2 A. **Yes.**
 3 Q. The consumption cap scenario that you were
 4 modeling in this run includes an elimination of
 5 50 percent of agricultural irrigation in the
 6 Flint River Basin; is that correct?
 7 A. **It's 50 percent of what we estimated as a**
 8 **conservative lower bound on agricultural**
 9 **withdrawals.**
 10 Q. And this consumption cap also includes a 50
 11 percent elimination of small farm ponds in the
 12 Flint River Basin; is that correct?
 13 A. **Yes.**
 14 Q. And this consumption cap scenario that you
 15 modeled also includes a 100 percent elimination
 16 of all interbasin transfers out of the ACF Basin;
 17 is that correct?
 18 A. **Yes.**
 19 Q. And you looked at what the benefit to Florida
 20 would be in terms of additional flows at the
 21 state line if these cutbacks were imposed. Is
 22 that right?
 23 A. **Yes.**
 24 Q. Your model simulated how much additional water
 25 would go to Florida if this specific cap was

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1933

1 imposed under a variety of hydrologic conditions;
 2 is that right?
 3 **A. Yes.**
 4 **Q.** And those hydrologic conditions that you
 5 considered are based on historical hydrologic
 6 conditions; is that right?
 7 **A. Yes.**
 8 **Q.** So, for example, how much additional flow would
 9 be produced from this consumption cap under
 10 hydrologic conditions similar to the summer of
 11 2007. Correct?
 12 **A. Amongst others, yes.**
 13 **Q.** Now, you're aware of the result also of this
 14 modeling analysis; aren't you?
 15 **A. Yes.**
 16 **Q.** All right. Let's take a look at what you found.
 17 MS. ALLON: And I want to pull up
 18 demonstrative No. 2, please.
 19 BY MS. ALLON:
 20 **Q.** Dr. Hornberger, you found that when you modeled
 21 the scenario we just looked at, which included a
 22 50 percent reduction in Georgia's agricultural
 23 use, that scenario would produce zero cfs of
 24 additional flow at the state line for 63 days in
 25 the year 2000. Isn't that right?

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1934

1 **A. This is for data-driven ResSim and calculations**
 2 **of minimum releases under the RIOP.**
 3 **Q.** Dr. Hornberger, under your data-driven ResSim
 4 model run, under the consumption cap scenario
 5 that we just walked through, your model predicted
 6 there would be 63 total days of zero cfs
 7 additional flow at the state line under
 8 hydrological conditions similar to 2000. Is that
 9 correct?
 10 **A. Yes. The data-driven ResSim model produced that**
 11 **result.**
 12 **Q.** And your data-driven ResSim model also predicted
 13 that under this consumption cap scenario where
 14 Georgia's consumptive use was cut by 50 percent,
 15 there would be 81 total days of zero additional
 16 flow at the state line in a year with hydrologic
 17 conditions similar to 2007. Is that right?
 18 **A. Yes.**
 19 **Q.** And your model also predicted that using the same
 20 consumption cap scenario would produce zero
 21 additional flow at the state line for 93 total
 22 days in a year with hydrologic conditions similar
 23 to 2011; is that correct?
 24 **A. Yes.**
 25 **Q.** And finally, your data-driven ResSim model showed

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1935

1 that cutting Georgia's Ag use in half would
 2 produce zero cfs of additional flow at the state
 3 line into Florida for 153 days in a year with
 4 similar hydrologic conditions to 2012; is that
 5 correct?
 6 **A. It calculated that result, yes.**
 7 **Q.** For every single one of these days that we just
 8 walked through, your modeling from data-driven
 9 ResSim showed no impact at the state line from
 10 eliminating half of all of Georgia's irrigation
 11 in the Flint River Basin at that time; is that
 12 correct?
 13 **A. Half of the minimum estimate -- lower bound**
 14 **estimate. And it calculated it. It didn't show**
 15 **it.**
 16 **Q.** The results from your data-driven ResSim model
 17 where you looked at scenarios where Georgia's
 18 consumptive use was decreased showed that there
 19 were several months in several different years
 20 where there was no impact at the state line as a
 21 result of any of the reductions in the scenarios
 22 that you modeled; is that correct?
 23 **A. It calculated those results, yes.**
 24 **Q.** Now, you conducted this modeling before you
 25 submitted your expert report; is that correct?

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1936

1 **A. Yes.**
 2 **Q.** And you were aware of these results before you
 3 submitted your expert report; is that correct?
 4 **A. Yes. I produced them with the expert report.**
 5 **Q.** But your report itself doesn't discuss these
 6 results; does it?
 7 **A. It does not. My opinions were not based on the**
 8 **results of the data-driven ResSim model for**
 9 **reduction scenarios.**
 10 **Q.** Now, we just talked about this analysis where you
 11 looked at the impact of decreases in Georgia's
 12 consumptive use. You also used your data-driven
 13 ResSim model to analyze the impact of increases
 14 in Georgia's consumptive use; is that right?
 15 **A. Yes.**
 16 **Q.** And those results were included in your expert
 17 report?
 18 **A. Yes.**
 19 **Q.** You were trying to figure out what would happen
 20 to state line flows if Georgia's consumptive use
 21 increased. Right?
 22 **A. Yes.**
 23 **Q.** And in order to do that, you used your
 24 data-driven ResSim model to simulate the impact
 25 of decreased inflows into the reservoir system;

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1937

1 is that right?

2 **A. Yes.**

3 **Q.** And for this analysis of increased consumptive

4 use, you modeled a scenario that involved

5 projections for future water use for Georgia in

6 the year 2050; is that correct?

7 **A. Yes.**

8 **Q.** All right. Let's take a look at your results

9 from that modeling, and I want to turn to your

10 expert report. It's in the binder in front of

11 you. It's FX-785. And I want to turn

12 specifically to page 53, table 11.

13 Now, Dr. Hornberger, table 11 in FX-785 shows

14 the results of your data-driven ResSim modeling

15 of the impact of Georgia's projected future water

16 use on state line flows; isn't that right?

17 **A. Yes.**

18 **Q.** And specifically scenario 1, where it says,

19 Future Increases in Water Consumption in Georgia.

20 Right?

21 **A. Yes.**

22 **Q.** So let's just look at 2000 as an example. Your

23 modeling using data-driven ResSim shows that if

24 Georgia's water use rose to the levels that

25 Florida is projecting, state line flows would be

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1938

1 decreased by 231 cfs in a year with hydrologic

2 conditions similar to 2000. Is that right?

3 **A. Yes.**

4 **Q.** And you go through that analysis for nine

5 different years in table 11; isn't that right?

6 **A. Yes.**

7 **Q.** But what you don't report in table 11 or anywhere

8 else in your report is the magnitude of the

9 increase in Georgia's consumptive use that caused

10 the state line flow decline you identified; is

11 that right?

12 **A. Well, we had to produce that.**

13 **Q.** You produced that after Georgia asked you for

14 that at your deposition; isn't that right?

15 **A. I don't recall. I thought that we had produced**

16 **that with the report.**

17 **Q.** In table 11, you say how much state line flows go

18 down. Right?

19 **A. In the scenario 1, yes.**

20 **Q.** But table 11 doesn't say anything about what the

21 associated increase was in consumptive use that

22 caused that decline?

23 **A. It does not.**

24 **Q.** And table 11 doesn't say anything about what the

25 associated decrease was in water entering the

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1939

1 reservoirs. Right?

2 **A. Table 11 doesn't show -- could you repeat that?**

3 **Q.** Table 11 doesn't say anything about the decrease

4 in water entering the reservoirs that generated

5 the decrease in state line flows that you

6 identified in table 11?

7 **A. Yes.**

8 **Q.** Now, we did get the information you were

9 referring to and walked through it. And it's at

10 GX-1100, which is in the binders you have in

11 front of you; and I'll put it up on the screen as

12 well.

13 Now, GX-1100 shows your values from table 11

14 for future use scenario where Georgia's

15 consumptive use was increased to the levels that

16 Florida projects for 2050. Right?

17 **A. Yes.**

18 **Q.** And the column that says table 11, scenario 1,

19 Reduction in Outflow, that's reproduced from what

20 we just looked at in table 11 in your report.

21 Right?

22 **A. Yes. It looks that way.**

23 **Q.** Now, what GX-1100 also includes is the total

24 reduction in inflow to the reservoirs over the

25 same time period. Those are the columns that say

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1940

1 June, July, August, September, and then the

2 average. Right?

3 **A. Yes.**

4 **Q.** And we used your inflow data for the columns, and

5 we accurately reproduced it in GX-1100, didn't

6 we?

7 **A. It looks that way, yes.**

8 **Q.** Now, we can see two different things in GX-1100.

9 We can see the magnitude of the decrease in flows

10 caused by Georgia's projected increased water

11 consumption for this scenario, and we can also

12 see how much of that decrease actually

13 materialized into a decrease in state line flows.

14 Right?

15 **A. Yes.**

16 **Q.** In the column on the far right where it says

17 Reduction in Outflow Over Reduction in Inflow, we

18 also included the percent impact of the decreased

19 inflow to the reservoir under this scenario on

20 the decreased outflow into Florida. Do you see

21 that?

22 **A. Yes.**

23 **Q.** Let's use 2002 as an example. Under your future

24 use scenario that you're modeling, Georgia's

25 projected increases in consumptive use lead to

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1941

1 average decreased inflow into the reservoirs of
 2 1500 cfs for June through September. Is that
 3 right?
 4 **A. Yes.**
 5 **Q.** So Florida predicts that in this 2050 future-use
 6 scenario, Georgia's consumptive use will cause
 7 1500 less cfs to enter the reservoir system on
 8 average in June through September. Is that
 9 right?
 10 **A. Yes.**
 11 **Q.** And your modeling, using the data-driven ResSim
 12 model that you included in your report, shows
 13 that if 1500 less cfs enters the reservoir system
 14 in a year with hydrologic conditions similar to
 15 2002, the corresponding decrease in state line
 16 flows will be 120 cfs; is that right?
 17 **A. That's what the data-driven ResSim model**
 18 **calculates, yes.**
 19 **Q.** Your modeling shows that in a year with
 20 hydrologic conditions similar to 2002, only
 21 8 percent of the decreased flow entering the
 22 reservoir system as a result of Georgia's
 23 increased consumptive use will materialize as a
 24 decrease at the state line. Isn't that correct?
 25 **A. That is what is calculated, yes.**

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1942

1 **Q.** Let's look at the line at the bottom of GX-1100
 2 that says average. Do you see that?
 3 **A. Yes.**
 4 **Q.** The average reduction in inflows as a result of
 5 Georgia's projected increased consumptive use in
 6 this scenario from June through September of the
 7 nine years that you model is 1389 cfs; is that
 8 correct?
 9 **A. Yes.**
 10 **Q.** And your model shows that the average reduction
 11 in state line flows into Florida for this same
 12 period of time is 433 cfs. Is that right?
 13 **A. That is what the model calculates, yes.**
 14 **Q.** After you ran your data-driven ResSim model, you
 15 developed a second model. Right?
 16 **A. No. It wasn't after I ran the data-driven**
 17 **ResSim.**
 18 **Q.** Your testimony is that you did not create the
 19 Lake Seminole model after you created the
 20 data-driven ResSim model?
 21 **A. My best recollection is that we developed these**
 22 **in parallel.**
 23 MS. ALLON: Your Honor, I would like to
 24 hand a copy of Dr. Hornberger's deposition
 25 transcript, if that's all right.

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1943

1 BY MS. ALLON:
 2 **Q.** Dr. Hornberger, you recall giving a deposition in
 3 this case. Is that right?
 4 **A. Oh, yes.**
 5 **Q.** For three days we sat together; is that correct?
 6 **A. That's correct.**
 7 **Q.** Okay. And there was a court reporter there?
 8 **A. Yes.**
 9 **Q.** And you were under oath?
 10 **A. Yes.**
 11 **Q.** And you told the truth. Right?
 12 **A. I did.**
 13 **Q.** Okay. And I want to turn to page 735 in your
 14 deposition transcript, line 23. And I'm going to
 15 ask Mr. Smith to play clip 159.
 16 (Whereupon the video was played.)
 17 BY MS. ALLON:
 18 **Q.** Dr. Hornberger, were you asked those questions;
 19 and did you give those answers?
 20 **A. Yes.**
 21 **Q.** Now, your new Lake Seminole model was created
 22 specifically for the purpose of this litigation;
 23 isn't that correct?
 24 **A. That is correct.**
 25 **Q.** You have never used the Lake Seminole model in

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1944

1 the past with respect to any other matter; isn't
 2 that right?
 3 **A. That is correct.**
 4 **Q.** In fact, no one has ever used your Lake Seminole
 5 model outside of this case; isn't that right?
 6 **A. Yes.**
 7 **Q.** Florida has never used this model before?
 8 **A. Do I understand from the inflection that that's a**
 9 **question?**
 10 **Q.** It is a question.
 11 **A. No. Florida has not used it.**
 12 **Q.** The Army Corps has never used your Lake Seminole
 13 model before; has it?
 14 **A. No.**
 15 **Q.** Okay. Now, there are five reservoirs in the ACF
 16 Basin. Right?
 17 **A. Yes.**
 18 **Q.** The Army Corps ResSim model simulates all five
 19 reservoirs in the system. Right?
 20 **A. There is calculations for all five, yes.**
 21 **Q.** Your data-driven ResSim model also simulates all
 22 five reservoirs in the system. Right?
 23 **A. Yes.**
 24 **Q.** Your Lake Seminole model does not simulate all
 25 five reservoirs in the system. Right?

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1945

1 **A. It doesn't do calculations on all five.**

2 **Q.** Your Lake Seminole model only simulates a single

3 reservoir, Lake Seminole. Right?

4 **A. Right. We used the data, the actual data for the**

5 **other reservoirs as an input.**

6 **Q.** Lake Seminole is operated as run-of-river.

7 Right?

8 **A. Basically.**

9 **Q.** Which means pretty much that water just passes

10 through rather than being held in storage; isn't

11 that right?

12 **A. To a large extent.**

13 **Q.** Three of the other ACF reservoirs, Lake Lanier,

14 West Point, and Walter F. George, collectively

15 hold 100 percent of the system's storage

16 capacity. Right?

17 **A. Close.**

18 MS. ALLON: Your Honor, I'm going to be

19 referring to JX-124 a few times in my

20 cross-examination. It's the Army Corps DEIS,

21 and it's an extraordinarily lengthy document.

22 The Court has a copy of the full exhibit.

23 It's four binders. So I thought I would just

24 excerpt some of it in the witness binder.

25 But if the Court or if the witness would like

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1946

1 the full copy, we can provide it.

2 So I'm going to start at tab 1 behind

3 JX-124.

4 BY MS. ALLON:

5 **Q.** Dr. Hornberger, you recognize this as the DEIS.

6 Is that correct?

7 **A. Yes, I do.**

8 **Q.** And you're familiar with this document. Right?

9 **A. Reasonably.**

10 **Q.** It's the Draft Environmental Impact Statement

11 issued by the Army Corps in October 2015 as part

12 of their update and revision to the Water Control

13 Manual for the ACF Basin; is that right?

14 **A. Yes.**

15 **Q.** Let's turn to tab 4, which is page 2-63. And you

16 can see the heading at the top of the page, the

17 Corps is describing the ACF Water Control

18 Objectives and Guidelines. Do you see that?

19 **A. Yes.**

20 **Q.** And if you look three paragraphs down, the Corps

21 says, the reservoirs in the ACF Basin are managed

22 and operated in accordance with authorized

23 project purposes and as an integrated system of

24 water resource projects in which each reservoir

25 has a role to play.

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1947

1 That's what the Corps says. Right?

2 **A. Yes.**

3 **Q.** Your Lake Seminole model doesn't have the ability

4 to adjust conditions at any other reservoir

5 besides for Lake Seminole. Isn't that right?

6 **A. The conditions are adjusted according to the**

7 **recorded record. So according to the data, the**

8 **data themselves adjust the Lake Seminole model.**

9 **Q.** Dr. Hornberger, I would like you to turn to page

10 63 in your deposition transcript.

11 MS. ALLON: And I would like to ask

12 Mr. Smith to play clip 28.

13 (Whereupon the video was played.)

14 BY MS. ALLON:

15 **Q.** Dr. Hornberger, you were asked that question; and

16 you gave that answer. Right?

17 **A. Yes.**

18 **Q.** Your Lake Seminole model does not and cannot do

19 any type of calculation involving the other four

20 reservoirs in the ACF system; is that right?

21 **A. Yes.**

22 **Q.** Now, let's go to tab 6 behind JX-124. It's

23 appendix E to volume 1 of the DEIS. Now,

24 appendix E is the ResSim modeling report that the

25 Corps prepared in connection with the DEIS; is

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1948

1 that correct?

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

3 **Q.** And are you familiar with this document?

4 **A. Yes. I have looked at it, yes.**

5 **Q.** Let's go to tab 7 behind JX-124, which is page 19

6 of appendix E. And do you see section F where it

7 says System Operations?

8 **A. Yes.**

9 **Q.** And under section F, System Operations, the Corps

10 has said that the four large reservoirs in the

11 ACF are viewed as a system in which each

12 reservoir has its role to play. Do you see that?

13 **A. Yes.**

14 **Q.** The Corps also says that, many interests and

15 conditions must be continually considered and

16 balanced when making water control decisions. Do

17 you see that?

18 **A. Yes.**

19 **Q.** Okay. Now, in the next paragraph, the Corps

20 talks specifically about releases into Florida.

21 And the Corps says that releases are assigned to

22 Jim Woodruff but are supported by the upstream

23 reservoirs through tandem balancing operations.

24 Do you see that?

25 **A. Yes.**

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1949

1 **Q.** Now, you understand that in this litigation,
 2 Georgia's experts have opined that increased
 3 flows on the Flint that are generated by
 4 decreases in consumptive use -- in Georgia's
 5 consumptive use would be offset by decreases from
 6 the reservoirs and would, therefore, typically
 7 not be passed through to Florida as additional
 8 state line flows. Do you understand that?
 9 **A. I'm aware of that.**
 10 **Q.** Because your Lake Seminole model doesn't simulate
 11 the other four reservoirs or their interaction
 12 with Woodruff Dam, it is mathematically
 13 impossible for your Lake Seminole model to
 14 respond to increased flows on the Flint by
 15 releasing less from the upstream reservoirs;
 16 isn't that right?
 17 **A. The -- mathematically -- we're actually, of**
 18 **course, using the data that indicate how the**
 19 **Corps actually operates. And so the Corps on a**
 20 **day-to-day operation is not using ResSim.**
 21 **They're using the measurements of the reservoirs.**
 22 **And so in that sense, of course, we have taken it**
 23 **into account. But in the sense that you**
 24 **indicated previously, we do not do calculations**
 25 **on the other reservoirs.**

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1950

1 **Q.** And I'm just asking a very discrete question,
 2 Dr. Hornberger, which is does your Lake Seminole
 3 model have the ability mathematically to evaluate
 4 the possibility of additional inflow on the Flint
 5 affecting storage at upstream reservoirs?
 6 **A. No. We did not do calculations on upstream**
 7 **reservoirs.**
 8 **Q.** Now, you testified that you had to create your
 9 Lake Seminole model because of limitations that
 10 you observed both in ResSim and your data-driven
 11 ResSim; is that correct?
 12 **A. Yes.**
 13 **Q.** Your opinion is that the Lake Seminole model is
 14 better than ResSim and your data-driven ResSim at
 15 faithfully reflecting Army Corps operations. Is
 16 that right?
 17 **A. Yes.**
 18 **Q.** Now, one way to assess the strengths or accuracy
 19 of a model is by doing a goodness of fit
 20 analysis; is that right?
 21 **A. Yes.**
 22 **Q.** A goodness of fit analysis looks at how well a
 23 model fits the observed data. Right?
 24 **A. Yes.**
 25 **Q.** You did a goodness of fit analysis for your Lake

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1951

1 Seminole model. Right?
 2 **A. Yes.**
 3 **Q.** And you also did a goodness of fit analysis for
 4 your data-driven ResSim model. Right?
 5 **A. Yes.**
 6 **Q.** And you relied on your goodness of fit analysis
 7 as evidence that your Lake Seminole model is
 8 superior to your data-driven ResSim model.
 9 Right?
 10 **A. That's one piece of it, yes.**
 11 MS. ALLON: Let's put up demonstrative
 12 No. 3, please.
 13 BY MS. ALLON:
 14 **Q.** For the goodness of fit analysis that you
 15 performed, you used two numerical indices; is
 16 that right?
 17 **A. Yes.**
 18 **Q.** Okay. NSE and PBIAS.
 19 **A. Yes.**
 20 **Q.** NSE is the Nash-Sutcliffe efficiency, and it's an
 21 index used to assess the predictive power of
 22 hydrological models. Isn't that right?
 23 **A. It's used to assess how well a model agrees with**
 24 **data.**
 25 **Q.** It lets you know how close to perfectly your

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1952

1 model agrees with observed data. Right?
 2 **A. Yes.**
 3 **Q.** Okay. A perfect score in the NSE index is a 1.
 4 Right?
 5 **A. Yes.**
 6 **Q.** So you want your NSE to be as close to 1 as
 7 possible?
 8 **A. Right. When we're looking at models, yes.**
 9 **Q.** And percent bias, or PBIAS, is an index that
 10 tells you whether your model has a bias, meaning
 11 is it under-predicting or over-predicting the
 12 data. Right?
 13 **A. Yes.**
 14 **Q.** A PBIAS that is close to zero means little bias.
 15 Right?
 16 **A. Yes.**
 17 **Q.** So you want your PBIAS to be as close to zero as
 18 possible. Right?
 19 **A. Yes.**
 20 **Q.** Now, let's go back to your expert report at
 21 FX-785. And this FX-785, this is the first
 22 report that you submitted in connection with this
 23 case. Right?
 24 **A. Yes.**
 25 **Q.** Now, let's go to the bottom of page 47 and the

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1953

1 top of page 48 in FX-785.

2 **A. Yes.**

3 **Q.** And do you see where you write, as shown in table

4 10 -- it's about three lines up from the bottom

5 of the page. You say, as shown in table 10, the

6 NSE for the Lake Seminole model is much closer to

7 1, meaning that it is a closer match to observed

8 flows. Similarly, the PBIAS statistic is closer

9 to zero for the Lake Seminole model, again

10 indicating that this model tracks the observed

11 flows more closely than the data-driven ResSim

12 model.

13 Do you see that?

14 **A. Yes.**

15 **Q.** So you cited your goodness of fit results as a

16 basis for saying your Lake Seminole model does a

17 better job of predicting actual releases from

18 Woodruff Dam than your data-driven ResSim model?

19 **A. Yes. It's one of the metrics that we looked at.**

20 **Q.** And you said in your report that your Lake

21 Seminole model has an NSE that's much closer

22 to 1. Right?

23 **A. Yes.**

24 **Q.** And a PBIAS closer to zero?

25 **A. Yes.**

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1954

1 **Q.** And one of the reasons you used the Lake Seminole

2 model instead of the data-driven ResSim model

3 when you modeled consumption caps is because you

4 believed the Lake Seminole model better predicts

5 the data. Right?

6 **A. We used the one metric; but we were focused, of**

7 **course, on low-flow years. And we also looked at**

8 **the graphical output from the models because we**

9 **wanted to make sure that the Lake ResSim model --**

10 **the Lake Seminole model was not, you know, doing**

11 **something that was not reflective of reality.**

12 **Q.** Okay. I was asking a different question. My

13 question was one of the reasons you used the Lake

14 Seminole model instead of the data-driven ResSim

15 model is because of your belief that the Lake

16 Seminole model better predicts the data than the

17 data-driven ResSim model.

18 **A. We -- I can't say yes as you phrased it. It**

19 **wasn't the reason that we used the Lake Seminole**

20 **model. We did look at those metrics to assess**

21 **the fits of the two models. But it wasn't that,**

22 **you know, that was the basis of the decision to**

23 **use it. There were many other reasons that we**

24 **wanted to use the Lake Seminole model.**

25 **Q.** Dr. Hornberger, could you turn in your deposition

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1955

1 transcript to page 447.

2 MS. ALLON: And, Mr. Smith, could you

3 please place clip 104.

4 (Whereupon the video was played.)

5 BY MS. ALLON:

6 **Q.** Dr. Hornberger, were you asked those questions,

7 and did you give those answers?

8 **A. Yes.**

9 **Q.** Now, let's go back to your report at FX-785, and

10 we were on page 48. And I want to take a look at

11 your original goodness of fit results that you

12 reported in your February 29 report. So I'm on

13 page 48, table 10 at FX-785. Do you see that?

14 **A. Yes.**

15 **Q.** Now, table 10 shows your original results for

16 your goodness of fit analysis. Right?

17 **A. Yes.**

18 **Q.** Now, this analysis is based off the entire period

19 of records. Is that right?

20 **A. That's correct.**

21 **Q.** All 37 years of flow data from 1976 to 2012.

22 Isn't that right?

23 **A. That is correct.**

24 **Q.** And table 10 is what you were referring to just a

25 paragraph above when you said that the Lake

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1956

1 Seminole model has an NSE much closer to 1 than

2 the ResSim model and a PBIAS closer to zero.

3 Right?

4 **A. Yes.**

5 **Q.** That's what table 10 shows?

6 **A. Yes.**

7 **Q.** Now, after you submitted your report, you

8 realized that the row labels in table 10 were

9 inadvertently switched. Right?

10 **A. Correct.**

11 **Q.** That's the language your counsel used in

12 describing what had happened.

13 **A. That's correct.**

14 MS. ALLON: Let's pull up demonstrative

15 No. 4, please.

16 BY MS. ALLON:

17 **Q.** This is what your original table 10 should have

18 looked like. Right?

19 **A. Yes.**

20 **Q.** This shows that your data-driven ResSim model

21 actually had a better goodness of fit than your

22 Lake Seminole model. Right?

23 **A. Yes.**

24 **Q.** Your data-driven ResSim model had an NSE closer

25 to 1. Right?

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1957

1 **A. Yes.**
 2 **Q.** And your data-driven ResSim model had a PBIAS
 3 closer to 0. Right?
 4 **A. Yes.**
 5 **Q.** Now, when you acknowledged that you had made a
 6 mistake with respect to inadvertently switching
 7 the rows in your table 10, you actually submitted
 8 a revised table 10. Right?
 9 **A. Yes.**
 10 **Q.** But you didn't just switch the rows back the
 11 right way. Right?
 12 **A. I -- I don't think I understand the question.**
 13 **Q.** Let's pull up your revised table 10. It's in
 14 JX-158. And it is attachment 1 to that JX. So
 15 it's the second to last page.
 16 **A. Right.**
 17 **Q.** Do you see your updated --
 18 **A. Yes.**
 19 **Q.** -- table 10?
 20 **A. Yes.**
 21 **Q.** In your updated table 10, your goodness of fit
 22 scores are based only on the June to September
 23 period for five specific years. Right?
 24 **A. Yes. That's what we did.**
 25 **Q.** Okay. They're not based on all 37 years of flow
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1958

1 data like the ones we just looked at. Right?
 2 **A. Correct.**
 3 **Q.** Just June through September of five specific
 4 years.
 5 **A. Yes.**
 6 **Q.** So your updated table 10 only looks at a subset
 7 of the flow record. Right?
 8 **A. Yes.**
 9 **Q.** And we did the math at your deposition. We can
 10 certainly walk through it again. But this subset
 11 that you looked through is only 5 percent of the
 12 original 37-year flow record that you had
 13 originally considered?
 14 **A. Yes.**
 15 **I take that to be a question from the**
 16 **inflection.**
 17 **Q.** For the other 95 percent of the record from 1976
 18 to 2012 that you didn't include in the analysis
 19 in updated table 10, the data-driven ResSim model
 20 showed superior goodness of fit than the Lake
 21 Seminole model. Right?
 22 **A. I don't -- I don't know. I don't have those**
 23 **numbers in front of me.**
 24 **Q.** Dr. Hornberger, why don't we take a look at your
 25 deposition, and perhaps that will refresh your
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1959

1 recollection, at page 495.
 2 MS. ALLON: And I'm going to ask
 3 Mr. Smith to play clips 122, 121, 123, and
 4 124, please.
 5 (Whereupon the video was played.)
 6 BY MS. ALLON:
 7 **Q.** Dr. Hornberger, were you asked those questions,
 8 and did you give those answers?
 9 **A. Yes.**
 10 **Q.** In your expert report you consistently used a set
 11 of nine dry years since 2000 as the hydrologic
 12 record for modeling purposes; isn't that right?
 13 **A. Yes.**
 14 **Q.** And for those nine years since 2000 that you have
 15 consistently used as the relevant flow record for
 16 your analysis, the data-driven ResSim model
 17 showed a better goodness of fit than the Lake
 18 Seminole model; isn't that right?
 19 **A. Yes.**
 20 **Q.** It had a -- ResSim had an NSE closer to 1.
 21 Right?
 22 **A. Yes.**
 23 **Q.** And ResSim had a PBIAS closer to zero. Right?
 24 **A. Yes.**
 25 **Q.** Let's consider another dataset. For the June to
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1960

1 September period only of the nine dry years since
 2 2000 that you used for your modeling, the
 3 data-driven ResSim model showed superior goodness
 4 of fit than the Lake Seminole model. Right?
 5 **A. Yes.**
 6 **Q.** ResSim had an NSE closer to 1. Right?
 7 **A. Yes.**
 8 **Q.** And ResSim had a PBIAS closer to zero. Right?
 9 **A. Yes.**
 10 **Q.** And finally, if you look at all 37 years of flow
 11 data, which is the analysis that you originally
 12 did, the ResSim model showed superior performance
 13 to the Lake Seminole model; isn't that right?
 14 **A. Yes.**
 15 **Q.** Now, you did a model run of the Lake Seminole
 16 model where you looked at increases to Georgia's
 17 consumptive use. Right?
 18 **A. Yes. The model certainly wasn't designed for**
 19 **that, but we did do the run.**
 20 **Q.** And like the analysis that we just walked through
 21 in your data-driven ResSim model, you used your
 22 Lake Seminole model to evaluate the impact of
 23 projected 2050 consumptive use levels on state
 24 line flows. Right?
 25 **A. No. We didn't use it for that. We did the**
 THE REPORTING GROUP
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1961

1 **calculation.**

2 **Q.** You didn't report the results of that analysis in

3 any of your reports. Right?

4 **A. No, I didn't.**

5 **Q.** Under the 2050 scenario run, using your Lake

6 Seminole model, your Lake Seminole model allows

7 Lake Seminole -- the actual reservoir now, not

8 the model -- it allows Lake Seminole to go dry.

9 Right?

10 **A. In the model, yes. The -- certainly it**

11 **doesn't -- it has nothing -- no control over the**

12 **actual Lake Seminole; so the actual Lake Seminole**

13 **can't go dry.**

14 **Q.** That's what your model shows. Right?

15 **A. The model calculation under those conditions,**

16 **because the model was not designed to handle**

17 **that, it actually does that, yes.**

18 **Q.** Your Lake Seminole model predicted that at some

19 point Lake Seminole would reach a state of zero

20 storage. Correct?

21 **A. It didn't predict it. The model was -- I didn't**

22 **report the model run because the model was never**

23 **designed to do that. But if you do the**

24 **calculation, that is what it shows.**

25 **Q.** And again, Dr. Hornberger, I understand that your

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1962

1 testimony is that you didn't think the Lake

2 Seminole model was appropriate. But I'm just

3 asking you about the results of the model run.

4 Okay?

5 And in this scenario that you modeled where

6 your model predicted that Lake Seminole would

7 reach a state of zero storage, that means that

8 Lake Seminole would be completely empty. That's

9 what zero storage means. Right?

10 **A. Yes.**

11 **Q.** And at the same time your model showed Lake

12 Seminole as completely empty, it also calculated

13 an outflow from Woodruff Dam; isn't that right?

14 **A. Yes, I believe that's right.**

15 **Q.** Okay. So there's no water in the reservoir, but

16 your model is saying that Woodruff Dam is

17 releasing water into Florida. Right?

18 **A. The model calculation shows that, yes.**

19 **Q.** Your Lake Seminole model showed that at the same

20 time the reservoir is literally running dry,

21 Woodruff Dam is discharging hundreds of thousands

22 of cfs from Lake Seminole into Florida. Is that

23 right?

24 **A. Yes.**

25 **Q.** You agree that would absolutely not happen in

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1963

1 real life. Right?

2 **A. Absolutely.**

3 **Q.** In real life, if Lake Seminole was running dry,

4 the Corps would not be releasing hundreds of

5 thousands of cfs of flow into Florida. Right?

6 **A. Yes.**

7 **Q.** Your Lake Seminole model is not appropriate for

8 evaluating increases in Georgia's consumptive

9 use. Is that right?

10 **A. That is correct.**

11 **Q.** Your Lake Seminole model produces results that

12 are not faithful to the actual reservoir

13 operations of the Army Corps; isn't that right?

14 **A. Under conditions of decreases -- or increased use**

15 **of water in Georgia, yes. It is -- it's not**

16 **designed to do that, so it doesn't.**

17 **Q.** Now, I understand that your testimony is that the

18 Lake Seminole model is not designed to analyze

19 increases in Georgia's consumptive use. But you

20 do believe the model is appropriate to use to

21 analyze decreases in Georgia's consumptive use;

22 is that right?

23 **A. Yes.**

24 **Q.** And that's how you used the model in the

25 testimony that you presented to this Court.

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1964

1 Right?

2 **A. Yes.**

3 **Q.** Your opinion is that the Lake Seminole model

4 faithfully reproduces what Woodruff Dam releases

5 would be if Georgia's consumptive use was

6 decreased. Correct?

7 **A. Yes.**

8 **Q.** The Lake Seminole model is your best estimate of

9 how you think the Army Corps would actually

10 operate under the reservoir operating rules.

11 Right?

12 **A. Yes.**

13 **Q.** Now, the Corps operating rules for Woodruff Dam

14 are called the RIOP. Right?

15 **A. Yes.**

16 **Q.** That stands for Revised Interim Operating Plan.

17 Right?

18 **A. Yes.**

19 **Q.** Under the RIOP, the Corps sets a minimum release

20 from Woodruff Dam of 5000 cfs; isn't that right?

21 **A. Yes.**

22 **Q.** And under specific extraordinary drought

23 operations, that minimum release can be reduced

24 to 4500 cfs. Right?

25 **A. Yes.**

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1965

1 **Q.** Releases from Jim Woodruff Dam into Florida can
 2 never go below 4500 cfs. Right?
 3 **A. Under the RIOP, that's correct.**
 4 **Q.** Now, I understand that Florida is offering an
 5 opinion through one of its other experts that the
 6 Corps has discretion to make releases in excess
 7 of the 5000 minimum. But you are not offering
 8 the opinion that the Corps has discretion to make
 9 releases below the RIOP minimum; are you?
 10 **A. I'm not offering that opinion.**
 11 **Q.** You're not aware of any Florida expert who is
 12 offering the opinion that the Corps has
 13 discretion to make releases below the 5000
 14 minimum. Right?
 15 **A. That is correct.**
 16 **Q.** Okay. Let's take a look at the consumption cap
 17 scenarios you modeled with the Lake Seminole
 18 model. And let's turn to demonstrative No. 5.
 19 These are screen shots that we took from the
 20 spreadsheet that you produced to us that
 21 accompanied your model. And you used your Lake
 22 Seminole model to analyze each of these five
 23 consumption caps and what their impact would be
 24 on state line flows. Is that right?
 25 **A. Yes.**

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1966

1 **Q.** Now, one of the consumption cap scenarios that
 2 you modeled was a cut to 1992 consumptive use
 3 levels. Is that right?
 4 **A. Yes.**
 5 **Q.** And for this scenario, your Lake Seminole model
 6 generated outflows from Woodruff Dam of less than
 7 5,000 cfs; isn't that right?
 8 **A. Yes.**
 9 **Q.** In other words, your Lake Seminole model
 10 predicted that if Georgia's consumptive use was
 11 capped to 1992 levels, there would be days where
 12 Jim Woodruff releases were less than 5,000 cfs.
 13 Right?
 14 **A. Yes.**
 15 **Q.** Your Lake Seminole model computed 28 days of flow
 16 below 5,000 cfs. Right?
 17 **A. I believe that's the number.**
 18 **Q.** The lowest value predicted by your Lake Seminole
 19 model for the 1992 consumption cap scenario was
 20 4,313 cfs released from Woodruff Dam; is that
 21 right?
 22 **A. I believe that's right.**
 23 **Q.** Now, another consumption cap scenario that you
 24 modeled is what you call in your spreadsheet the
 25 E con scenario. Do you see that?

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1967

1 **A. Yes.**
 2 **Q.** And that's a scenario from Dr. Sunding, Florida's
 3 economist. Right?
 4 **A. Yes.**
 5 **Q.** It's a scenario where Dr. Sunding proposes that
 6 Georgia could cut 1,000 cfs of water use in peak
 7 summer months. Is that correct?
 8 **A. Yes. I believe that's right.**
 9 **Q.** For this scenario, your Lake Seminole model also
 10 simulated outflows from Woodruff Dam of less than
 11 5,000 cfs. Right?
 12 **A. Yes.**
 13 **Q.** Your Lake Seminole model predicted that if the
 14 Corps imposed Dr. Sunding's original proposed cap
 15 and Georgia cut its consumptive use by 1,000 cfs
 16 in peak summer months, there would be days when
 17 Jim Woodruff releases were less than 5,000 cfs.
 18 Right?
 19 **A. Yes.**
 20 **Q.** Another consumption cap you modeled involved
 21 eliminating 40 percent of Georgia's irrigation in
 22 two sub-basins, Spring Creek and Ichawaynochaway
 23 Creek. Correct?
 24 MR. SINGARELLA: I object. Counsel is
 25 mischaracterizing her own document here.

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1968

1 SPECIAL MASTER LANCASTER: Sorry. Would
 2 you repeat the question?
 3 BY MS. ALLON:
 4 **Q.** Dr. Hornberger, another consumption cap you
 5 modeled involved the elimination of 40 percent of
 6 Ag irrigation in two sub-basins, Spring Creek and
 7 Ichawaynochaway. And I'm looking specifically at
 8 your tab from your spread sheet that says, Feb 27
 9 Ag 40 for Ich.
 10 **A. Was there a question there?**
 11 **Q.** Did you model a consumption cap that involved the
 12 elimination of 40 percent of agricultural
 13 irrigation in the two specific sub-basins of
 14 Spring Creek and Ichawaynochaway?
 15 **A. We modeled 40 percent reduction in irrigation.**
 16 **We did not ever say anything about elimination of**
 17 **Ag. So part of the answer is yes.**
 18 **Q.** You modeled the scenario that involved the
 19 reduction of 40 percent of agricultural
 20 irrigation in Spring Creek and Ichawaynochaway
 21 Creek. Is that right?
 22 **A. Yes.**
 23 **Q.** And your Lake Seminole model showed that in that
 24 scenario, there would be outflows from Woodruff
 25 Dam of less than 5,000 cfs; isn't that right?

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<p style="text-align: right;">1969</p> <p>1 A. Yes.</p> <p>2 Q. Specifically your Lake Seminole model computed 49</p> <p>3 days of outflow from Woodruff Dam below 5,000 cfs</p> <p>4 in that scenario; isn't that right?</p> <p>5 A. Yes.</p> <p>6 Q. And the lowest value your model predicted was</p> <p>7 4,256 cfs; isn't that right?</p> <p>8 A. I believe that's right.</p> <p>9 Q. Now, another consumption cap scenario that you</p> <p>10 looked at involved a 50 percent reduction in</p> <p>11 agricultural irrigation in the Flint River, a 50</p> <p>12 percent reduction of small impoundments, and a</p> <p>13 100 percent elimination of interbasin transfers</p> <p>14 out of the ACF Basin. Isn't that right?</p> <p>15 A. Yes. Again, reduction of 50 percent Ag, but that</p> <p>16 is correct.</p> <p>17 Q. For this scenario, your Lake Seminole model also</p> <p>18 simulated outflows from Woodruff Dam of less than</p> <p>19 5,000 cfs. Isn't that correct?</p> <p>20 A. Yes.</p> <p>21 Q. And finally, the fifth consumption cap that you</p> <p>22 looked at is a 50 percent reduction in</p> <p>23 agricultural irrigation in the Flint River Basin</p> <p>24 and a 50 percent reduction of small impoundments.</p> <p>25 Is that right?</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>	<p style="text-align: right;">1971</p> <p>1 pull up demonstrative No. 6.</p> <p>2 You talk about low flows days. And you look</p> <p>3 specifically at three difference gages, the</p> <p>4 Chattahoochee Gage, the Bainbridge Gage, and Iron</p> <p>5 City Gage. Is that right?</p> <p>6 A. Yes.</p> <p>7 Q. And you do analysis of recent droughts versus</p> <p>8 historic droughts, and you say that streamflow</p> <p>9 during recent droughts is actually lower than</p> <p>10 streamflow during historic droughts; is that</p> <p>11 right?</p> <p>12 A. Yes.</p> <p>13 Q. And you have an analysis where you talk about</p> <p>14 declines in basin yield since 1970; is that</p> <p>15 right?</p> <p>16 A. Yes.</p> <p>17 Q. And you also say that groundwater levels are</p> <p>18 declining. Right?</p> <p>19 A. Yes.</p> <p>20 Q. Okay. Let's talk about each of these four points</p> <p>21 starting first with the low flow days you</p> <p>22 identify at the Chattahoochee Gage. Now, when</p> <p>23 you talk about low flow days at the Chattahoochee</p> <p>24 Gage, you used 6,000 cfs as a threshold for low</p> <p>25 flows for that analysis. Right?</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>
<p style="text-align: right;">1970</p> <p>1 A. Yes.</p> <p>2 Q. And for this scenario, your Lake Seminole model</p> <p>3 also simulated outflows from Woodruff Dam of less</p> <p>4 than 5,000 cfs?</p> <p>5 A. Yes.</p> <p>6 Q. Dr. Hornberger, I would like to move to a</p> <p>7 different topic and talk about your analysis of</p> <p>8 what you call hydrologic changes in the ACF</p> <p>9 Basin. Now, you point to some hydrologic changes</p> <p>10 that you say are evidence of Georgia's</p> <p>11 consumptive use; is that right?</p> <p>12 A. Yes.</p> <p>13 Q. And it's your opinion that the data you collected</p> <p>14 on these hydrologic changes shows obvious impacts</p> <p>15 to the Apalachicola River in Florida from</p> <p>16 Georgia's consumptive use; is that right?</p> <p>17 A. Data that I used. I didn't collect the data</p> <p>18 myself.</p> <p>19 Q. The data that you used on these hydrologic</p> <p>20 changes, it's your opinion that data shows</p> <p>21 obvious impacts to the Apalachicola River in</p> <p>22 Florida from Georgia's consumptive use. Right?</p> <p>23 A. Yes.</p> <p>24 Q. Now, I want to just put up a list of the</p> <p>25 hydrologic changes that you observed. So we can</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>	<p style="text-align: right;">1972</p> <p>1 A. Yes.</p> <p>2 Q. And your opinion is that since 1970, flows below</p> <p>3 6,000 cfs occur more frequently and for longer in</p> <p>4 the ACF Basin; is that right?</p> <p>5 A. Yes.</p> <p>6 Q. And you say that 1970 is when Georgia's water use</p> <p>7 escalated significantly. Right?</p> <p>8 A. I believe that's a good point to identify as to</p> <p>9 where the increases began.</p> <p>10 Q. And you conclude that, therefore, Georgia's water</p> <p>11 use is causing the reduced flows that you observe</p> <p>12 at the Chattahoochee Gage. Is that right?</p> <p>13 A. In large part, yes.</p> <p>14 Q. Let's talk about the flow metrics that you point</p> <p>15 to. If we turn in your report -- I'm sorry, in</p> <p>16 your direct testimony, which is in the witness</p> <p>17 binder, and I believe you have a loose copy of it</p> <p>18 as well. But it's the first tab in the witness</p> <p>19 binder. And I want to turn to page 23 and look</p> <p>20 at figure 3.</p> <p>21 Figure 3 shows your analysis of the total</p> <p>22 number of consecutive days of flow below 6,000</p> <p>23 cfs at the Chattahoochee Gage. Right?</p> <p>24 A. Yes.</p> <p>25 Q. Okay. And figure 3 is based on USGS gage data</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>

1973

1 for the Chattahoochee Gage; is that right?

2 **A. Yes.**

3 **Q.** And you compare pre-1970 to post-1970. Right?

4 **A. Well, all the years, for the record, are on that**

5 **figure.**

6 **Q.** In the corresponding text of your direct where

7 you discuss figure 3, the point of your analysis

8 is that you compare pre-1970 to post-1970.

9 Right?

10 **A. Yes.**

11 **Q.** And you say that since 1970, there have been

12 more stretches of consecutive low flow days than

13 pre-1970?

14 **A. Yes.**

15 **Q.** Now, looking at figure 3, the vast majority of

16 consecutive days below 6,000 cfs that you

17 observe -- that you identify occur in 2007 and

18 2012. Right?

19 **A. The -- the largest bars are in 2007 and 2012,**

20 **yes.**

21 **Q.** 2007 and 2012 were both severe droughts in the

22 ACF Basin. Right?

23 **A. Yes.**

24 **Q.** In figure --

25 **A. They were severe hydrological droughts, yes.**

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1974

1 **That is, they were low flows. They weren't**

2 **necessarily severe meteorological droughts. The**

3 **precipitation wasn't exceptionally low.**

4 **Q.** Your testimony is that the precipitation in 2007

5 and 2012 was not exceptionally low?

6 **A. No. I would say not compared with 1954, 1955.**

7 **Definitely not.**

8 **Q.** In figure 3 you don't identify any low flow days

9 after 1970 until about 1998. Is that right?

10 **A. No flows -- no days with consecutive values below**

11 **6,000. Correct.**

12 **Q.** So you talk about this analysis in terms of pre

13 and post-1970's, but there's actually no

14 discernible impact in your analysis until almost

15 2000. Isn't that right?

16 **A. By this metric, yes.**

17 **Q.** Your opinion is that Georgia's consumptive use

18 has caused a fundamental change to the basin over

19 the past 45 years; but that use had no impact

20 with respect to consecutive low flow days, which

21 is the metric we're looking at in figure 3 for

22 the first 30 of those years. Right?

23 **A. By this metric, that is correct.**

24 **Q.** New, let's look at the pre-1970 period,

25 specifically the period 1950 to 1970. You don't

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1975

1 show any years in that period with more than 10

2 consecutive days below 6,000 cfs. Is that right?

3 **A. Yes.**

4 MS. ALLON: Let's pull up cross

5 demonstrative No. 8, please.

6 **Q.** Dr. Hornberger, you recognize this as a clip in

7 the USGS website. Right?

8 **A. Yes.**

9 MS. ALLON: And, your Honor, the

10 demonstratives are all in the witness binder;

11 and they're numbered if the Court would

12 prefer to look at them in hard copy.

13 SPECIAL MASTER LANCASTER: Thank you.

14 MS. ALLON: There's a tab that says

15 Demonstratives, and they're all behind that

16 tab. And same for the witness if that would

17 be easier.

18 SPECIAL MASTER LANCASTER: Thank you.

19 That saves me from asking you to produce

20 copies of them.

21 BY MS. ALLON:

22 **Q.** And I'm on tab -- demonstrative No. 8 right

23 now.

24 MR. SINGARELLA: Your Honor, we're

25 seeing materials for the first time here this

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1976

1 morning, including these materials.

2 SPECIAL MASTER LANCASTER: So am I.

3 MR. SINGARELLA: I guess we're in it

4 together, your Honor.

5 SPECIAL MASTER LANCASTER: We are.

6 BY MS. ALLON:

7 **Q.** Dr. Hornberger, this USGS website that we just

8 took a clip out of, this is the same place that

9 you got your underlying data for figure 3.

10 Right?

11 **A. Yes.**

12 **Q.** And what we did was we actually showed you on

13 slide 8 the search that we ran to get the mean

14 daily discharge for 1954 for the Chattahoochee

15 Gage. Do you see that?

16 **A. Is it on this?**

17 **Q.** Yes. You can see the begin data is 1954,

18 January 1?

19 **A. I see it.**

20 **Q.** Okay. Now, turning to slide 9, the next slide --

21 SPECIAL MASTER LANCASTER: Counsel, it

22 would be helpful if you used the joint

23 exhibit numbers on these because I don't see

24 them numbered as 8 or 9.

25 MS. ALLON: Your Honor, they should have

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1977

1 a number at the bottom right-hand corner.

2 SPECIAL MASTER LANCASTER: I'm sorry.

3 MS. ALLON: The problem is the JX number

4 is not going to be very helpful because it's

5 not consecutive.

6 SPECIAL MASTER LANCASTER: You're right.

7 Thank you.

8 BY MS. ALLON:

9 Q. Looking at demonstrative No. 9, Dr. Hornberger,

10 you recognize this as the mean daily discharge at

11 the Chattahoochee Gage as reported by the USGS

12 for 1954. Right?

13 A. Yes.

14 Q. Okay. Now, we highlighted all of the days based

15 on your definition of low flows, meaning less

16 than 6,000 cfs. And would you agree that the

17 gage data shows a total of 67 consecutive days

18 below 6,000 cfs for 1954?

19 A. Yes.

20 Q. Those 67 consecutive days are not reflected on

21 your figure 3 in your direct testimony; are they?

22 A. **I believe that the direct testimony referred to**

23 **the period June to September.**

24 Q. Let's turn back to figure 3, page 23 of your

25 direct testimony.

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1978

1 And do you see that the caption of figure 3

2 says number of consecutive days below 6,000 cfs

3 at Chattahoochee Gage. Do you see that?

4 A. **Yes, I do.**

5 Q. Is it your testimony now that in actuality you

6 have only counted and considered in figure 3

7 consecutive low flow days between June and

8 September?

9 A. **May I look back at my February report, figure 8?**

10 Q. Sure.

11 A. **No, I don't -- I don't qualify it.**

12 Q. So turning back to slide 9, you agree there are

13 67 days in 1954 that meet your definition of low

14 flow days that you did not include in your

15 figure 3 in your direct testimony; is that right?

16 A. **It appears that way, yes.**

17 Q. Let's turn to demonstrative No. 10.

18 A. **Oh. If I can check one more time, I basically**

19 **tend to work in water years. I think that the**

20 **same criticism you have would apply, but I**

21 **believe that I may have been using water years.**

22 Q. Yes. I believe the same criticism would apply,

23 but I'm happy for you to check the water year

24 instead of the calendar year.

25 A. **Yes. So I mean, the water year would include**

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1979

1 **only the September values for 1954.**

2 Q. Even if we were including only the September

3 values --

4 A. **Yes.**

5 Q. -- for 1954, we would still have --

6 A. **Yes. We would have a larger number in 1955.**

7 Q. Yes. And either of those would not have been

8 reported in your figure 3?

9 A. **Correct.**

10 Q. So whether we're working in calendar year or

11 water year, there are days that meet your

12 definition of low flows -- consecutive days --

13 that are not reported in your figure 3?

14 A. **Apparently.**

15 Q. Now, looking at demonstrative No. 10, you will

16 see that we did the same search from the USGS

17 website for 1925. Do you see that?

18 A. **Yes. Yes.**

19 Q. And if you turn to slide 11, you can see the

20 results of that search. You recognize slide 11

21 as the mean daily discharge at the Chattahoochee

22 Gage for 1925. Right?

23 A. **Yes, I do.**

24 Q. Okay. And we have highlighted all of the days

25 based on your definition of low flows. And you

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1980

1 can see there are at least 43 consecutive days

2 below 6,000 cfs in 1925. Right?

3 A. **Yes.**

4 Q. And those aren't reflected anywhere in your

5 figure 3 in your direct testimony?

6 A. **Correct.**

7 Q. I want to talk about the second set of gage data

8 that you discussed, which is the Bainbridge Gage

9 data. Now, the Bainbridge Gage is on the Flint

10 River above the state line. Right?

11 A. **Yes.**

12 Q. And you talk about low flows at the Bainbridge

13 Gage. Right?

14 A. **Yes.**

15 Q. You identify six years since 2000 where

16 Bainbridge gage flows fell below 2,500 cfs.

17 Right?

18 A. **Yes.**

19 Q. 2002, 2006, 2007, 2008, 2011, and 2012. Right?

20 A. **Yes.**

21 Q. Those are all dry years. Right?

22 A. **Yes.**

23 Q. And these low flows at Bainbridge are another

24 hydrologic shift that you attribute to Georgia's

25 consumptive use. Is that right?

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1981

1 **A. Yes.**
 2 **Q.** And you say specifically that these hydrologic
 3 shifts show impacts to the Apalachicola River in
 4 Florida. Right?
 5 **A. Because the Flint River feeds into the**
 6 **Apalachicola River, yes, that's a reasonable**
 7 **conclusion.**
 8 **Q.** Now, the Bainbridge gage isn't in Florida.
 9 Right?
 10 **A. Correct.**
 11 **Q.** It's in Georgia on the Flint River above the
 12 state line?
 13 **A. Correct.**
 14 **Q.** But your testimony is that low flows at the
 15 Bainbridge gage in Georgia show obvious impacts
 16 to the Apalachicola River in Florida as a result
 17 of Georgia's consumptive use. Right?
 18 **A. I think that's a reasonable inference, yes.**
 19 **Q.** You didn't do any analysis of how low flows on
 20 the Flint River at Bainbridge compare with flows
 21 entering the Apalachicola River in Florida. Did
 22 you?
 23 **A. So compare the flows at Bainbridge with the flows**
 24 **in the Apalachicola itself?**
 25 **Q.** Yes.

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1982

1 **A. Sort of like a direct comparison?**
 2 **Q.** Yes.
 3 **A. No, I don't recall doing an explicit analysis.**
 4 **Q.** All right. Well, let's take a look at that data.
 5 One of the years that you looked at in your
 6 Bainbridge analysis is 2012. Right?
 7 **A. Yes.**
 8 **Q.** And you say that in 2012 flows at Bainbridge were
 9 below 2,500 cfs for eight months straight from
 10 May to December. Right?
 11 **A. Yes.**
 12 **Q.** Let's take a look at --
 13 **A. Now, of course, I may have been talking about**
 14 **monthly average flows there.**
 15 **Q.** Well, we can turn to your direct, if that would
 16 be helpful.
 17 **A. Okay.**
 18 **Q.** It's page 19, paragraph 47.
 19 **A. Yes. It says monthly average flow right at the**
 20 **top. Yes.**
 21 **Q.** Now, turning to slide 30, which is on the screen,
 22 and it's also in the back under the demonstrative
 23 slides, what we did is we plotted your Bainbridge
 24 gage data with the same data for 2012. That's
 25 the orange line. And we also plotted the state

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1983

1 line flows into Florida for the same period.
 2 That's the blue line. So the analysis that you
 3 said you didn't do directly, that's what we have
 4 shown here.
 5 Now, as you note in your testimony, flows at
 6 Bainbridge, you can see the orange line, are
 7 below 2,500 cfs for most of May through November.
 8 Right?
 9 **A. Yes.**
 10 **Q.** But at the same time as flows at Bainbridge are
 11 below 2,500 cfs, Florida is receiving more than
 12 2,500 cfs at the state line. Right?
 13 **A. Yes. I'm -- I must add I'm not sure what the**
 14 **blue line is. It says, observed Woodruff**
 15 **outflow. So I don't know if that's what the Army**
 16 **Corps reports or whether it's at the compliance**
 17 **point, which is the Chattahoochee Gage. So I**
 18 **don't know that.**
 19 **Q.** Okay.
 20 **A. But it's certainly higher.**
 21 **Q.** And you can see that in June, for example -- and
 22 this is in the yellow circle on the left --
 23 Bainbridge flows drop below 2,000 cfs. Right?
 24 **A. Yes.**
 25 **Q.** There is no corresponding decrease in state line

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1984

1 flows; is there?
 2 **A. There is no decrease in the blue line.**
 3 **Q.** And then you see there's a spike in Bainbridge
 4 flows in mid-June. Right?
 5 **A. Yes.**
 6 **Q.** There's no corresponding increase in state line
 7 flows in mid-June; is there?
 8 **A. Not on the blue line.**
 9 **Q.** Let's go over to the other yellow circle. And
 10 actually, you see in October there's a little
 11 spike at the beginning of October; and you do see
 12 a small spike in state line flows, too. Right?
 13 **A. In the blue line, yes.**
 14 **Q.** But then Bainbridge flows drop below 2,000 cfs
 15 again toward the middle of October. Right?
 16 **A. Yes.**
 17 **Q.** There is no corresponding decrease in state line
 18 flows; is there?
 19 **A. No.**
 20 **Q.** And then in early November there's a spike in
 21 Bainbridge flows. Right?
 22 **A. Yes.**
 23 **Q.** There is no corresponding increase in state line
 24 flows; is there?
 25 **A. Well, the graph ends; so I don't know.**

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1985

1 Q. In early November right where there is a spike --

2 A. **Oh, November. I'm sorry. I thought -- I went to**

3 **the end of the graph. November, not December.**

4 **Yes, I see that.**

5 Q. Okay. So let me just ask my question again so we

6 have it clear for the record.

7 In early November where there is a spike in

8 Bainbridge flows, there is no corresponding

9 increase in state line flows; is that correct?

10 A. **Correct.**

11 MS. ALLON: Your Honor, I'm about to

12 start a new section. I would be happy to

13 take a break now if it's convenient for the

14 Court, or I would be happy to wait until

15 after the next section.

16 SPECIAL MASTER LANCASTER: Can you give

17 me an estimate of how much longer you will be

18 with Dr. Hornberger?

19 MS. ALLON: For the entire

20 cross-examination? I would estimate about

21 another hour-and-a-half to two hours.

22 SPECIAL MASTER LANCASTER: We'll take a

23 break.

24 MS. ALLON: Thank you.

25 (Time Noted: 10:17 a.m.)

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1986

1 (Recess Called)

2 (Time Noted: 10:30 a.m.)

3 SPECIAL MASTER LANCASTER: You may

4 proceed.

5 MS. ALLON: Thank you, your Honor.

6 BY MS. ALLON:

7 Q. Dr. Hornberger, before the break we were talking

8 about your opinions about hydrologic shift in

9 the ACF Basin; and we were talking about the

10 three sets of gage data that you looked at. And

11 I want to turn to the third set, which is the

12 Iron City Gage for Spring Creek. Now, let's turn

13 to page 12 of your direct testimony. And I want

14 to look specifically at figure 2.

15 Now, this is a map from your direct

16 testimony. Right?

17 A. **Yes.**

18 Q. And it shows, you can see, the Iron City Gage for

19 Spring Creek. Correct?

20 A. **Yes.**

21 Q. Spring Creek is a tributary off the Flint River.

22 Right?

23 A. **Yes.**

24 Q. And with respect to Spring Creek, you talk about

25 the impact of Georgia's groundwater pumping on

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1987

1 low flows. Right?

2 A. **Yes.**

3 Q. Now, you didn't actually run a groundwater model

4 to study the impact of groundwater pumping in

5 Spring Creek. Right?

6 A. **I did not.**

7 Q. You also talk about the interaction between

8 surface water and groundwater in Spring Creek.

9 Right?

10 A. **Yes.**

11 Q. You didn't do any calculations of groundwater and

12 surface water interaction in Spring Creek. Did

13 you?

14 A. **No.**

15 Q. You didn't compare any data on groundwater

16 pumping in Spring Creek to streamflow data in

17 Spring Creek to see if you could establish a

18 correlation between groundwater pumping and low

19 flows. Right?

20 A. **Right.**

21 Q. You didn't do any analysis to determine whether

22 the low flows at Spring Creek were a local

23 phenomenon that did not have any impact

24 downstream. Right?

25 A. **That sounds to me like an absurdity because water**

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1988

1 **flows downhill. And so if it's not flowing at**

2 **Iron City, I don't see how it could be**

3 **inconsequential downstream. That doesn't make**

4 **any hydrological sense.**

5 Q. Your testimony is that the low flows observed at

6 the Iron City Gage in Spring Creek have an

7 obvious impact to the Apalachicola River in

8 Florida. Right?

9 A. **As -- as an input -- one of the inputs to the**

10 **Apalachicola River, it certainly is an indicator**

11 **of impact, yes.**

12 Q. Spring Creek doesn't flow directly into Florida;

13 does it?

14 A. **It does not.**

15 Q. Okay. It flows into the Flint River. Then it

16 flows into Lake Seminole and the Army Corps

17 reservoir. Right?

18 A. **It may actually flow directly into the Army Corps**

19 **reservoir. I would have to look that up.**

20 Q. The Corps -- the Army Corps controls releases

21 into Florida from Lake Seminole for its operation

22 of Woodruff Dam. Right?

23 A. **Right. The Army releases water from Jim Woodruff**

24 **Dam. That's what flows down into the**

25 **Apalachicola, yes.**

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1989

1 **Q.** You're not offering the opinion that a decline in
 2 flows at one gage on a tributary of the Flint
 3 River translates to an equal or corresponding
 4 decline in state line flows; are you?
 5 **A. No. It's an indicator.**
 6 **Q.** And you didn't do anything to quantify the impact
 7 of Spring Creek flows on total state line flows
 8 into Florida; did you?
 9 **A. In terms of a direct comparison as we were**
 10 **talking about earlier, no.**
 11 **Q.** And as a result, you don't know how much or how
 12 little flows from Spring Creek influence flows at
 13 the state line. Right?
 14 **A. No. That was -- as I said, it's an indicator.**
 15 **It's not my contention that there's a direct**
 16 **connection.**
 17 **Q.** You're familiar with the terms gaining reach and
 18 losing reach. Right?
 19 **A. Yes.**
 20 **Q.** A gaining reach refers to a stream that overall
 21 has more flow downstream than it does upstream.
 22 Right?
 23 **A. Yes.**
 24 **Q.** It means as it flows down, it's gaining water?
 25 **A. Yes.**

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1990

1 **Q.** And a losing reach refers to a stream that has
 2 overall less flow downstream than it does
 3 upstream. Right?
 4 **A. Yes.**
 5 **Q.** It means as it flows, it's losing water --
 6 **A. Yes.**
 7 **Q.** -- right?
 8 You didn't do any analysis as to whether
 9 Spring Creek was a gaining or losing reach
 10 overall; did you?
 11 **A. An analysis -- I mean, I looked at reports; but**
 12 **I, myself, did not do any calculations or**
 13 **analysis.**
 14 **Q.** And your analysis of Spring Creek in your direct
 15 testimony is limited to one gage at the Iron City
 16 Gage. Right?
 17 **A. Yes.**
 18 **Q.** You didn't do anything to determine whether the
 19 flows you observed at that single gage at Iron
 20 City actually occurred at other gages in Spring
 21 Creek. Right?
 22 **A. I did not.**
 23 **Q.** Okay. Let's go back to your map on figure 2,
 24 page 12 of your direct testimony. And, again, if
 25 we look at the Iron City Gage on Spring Creek,

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1991

1 you don't show on this map any other gages in
 2 Spring Creek. Do you?
 3 **A. I do not.**
 4 **Q.** Okay. But there are other gages in Spring Creek.
 5 Right?
 6 **A. I believe there is at least one upstream gage.**
 7 **Q.** Let's look at slide 14. I'll put it on the
 8 screen, and it's also going to be the slide
 9 numbered 14 beyond the demonstrative tab in your
 10 binder.
 11 And what we did in slide 14 is we actually
 12 just took your map from your direct, but we added
 13 the Reynoldsville Gage which you can see is
 14 immediately downstream of the Iron City Gage at
 15 Spring Creek. Right?
 16 **A. It is downstream of it, yes.**
 17 **Q.** You don't know whether the -- the Reynoldsville
 18 Gage has ever experienced zero flow. Right?
 19 **A. Oh, I would doubt that. The Reynoldsville Gage**
 20 **is affected by what we refer to as a backwater**
 21 **effect from Lake Seminole itself.**
 22 **Q.** So as a part of your analysis of what you call
 23 low flows in Spring Creek, you didn't consider
 24 flows at the Reynoldsville Gage; did you?
 25 **A. I did not.**

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1992

1 **Q.** And are you aware that the Reynoldsville Gage has
 2 never measured zero flow conditions?
 3 **A. That would not surprise me.**
 4 **Q.** Even in the drought years of 2007, 2011, and 2012
 5 that you point to with respect to your analysis
 6 of the Iron City Gage?
 7 **A. The inflection, right?**
 8 **That's correct.**
 9 **Q.** And that means because Reynoldsville Gage has
 10 never reported zero flows during all of the low
 11 flow conditions that you point to at the Iron
 12 City Gage, Spring Creek was still a gaining
 13 reach. Right?
 14 **A. As I said, the Reynoldsville Gage I believe is**
 15 **affected by Lake Seminole. So I would have to**
 16 **really do a very careful analysis to answer that**
 17 **question.**
 18 **Q.** Well, Dr. Hornberger, before you said that a
 19 gaining reach was pretty simple. If there was
 20 more flow downstream than upstream, it was a
 21 gaining reach. Right?
 22 **A. They would be for gages on a free-flowing river,**
 23 **not a gage that is partially affected by a**
 24 **backwater from a reservoir.**
 25 **Q.** So your testimony is you cannot use the

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1993

1 definition of gaining reaches and losing reaches
 2 that you just testified to with respect to the
 3 two gages on Spring Creek?
 4 **A. I could not do it with respect to a gage that is**
 5 **affected by -- materially affected by reservoir.**
 6 **And I believe that the Reynoldsville Gage is so**
 7 **affected.**
 8 **Q.** You don't have any discussion in your direct
 9 testimony about the Reynoldsville Gage or any
 10 analysis about how it might be affected by a
 11 reservoir; do you?
 12 **A. No.**
 13 **Q.** Now, the second basis for your opinion about
 14 hydrological shifts in the ACF Basin is this
 15 analysis you did of recent versus historic
 16 droughts. Right?
 17 **A. In what sense? Can you be more specific?**
 18 **Q.** One hydrologic shift that you attribute to
 19 Georgia's consumptive use is your observation
 20 that recent droughts have caused greater
 21 streamflow decline than historic droughts.
 22 Correct?
 23 **A. Correct.**
 24 **Q.** And you say -- you attribute the difference in
 25 streamflows between the earlier drought and the

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1994

1 more recent drought to Georgia's consumptive use.
 2 Right?
 3 **A. Yes. Yes.**
 4 **Q.** Now, let's look at page 20 of your direct
 5 testimony and specifically at table 1. In
 6 table 1 you're comparing two sets of back-to-back
 7 drought years. Right?
 8 **A. Yes.**
 9 **Q.** 1954 and 1955 on the one hand and 2011 and 2012
 10 on the other hand?
 11 **A. Yes.**
 12 **Q.** And you say, not in table 11 but in the text
 13 right around it, that the 1954 to 1955 drought is
 14 before the growth in Georgia's consumptive use;
 15 and the 2011 to 2012 drought is after there have
 16 already been moderate consumptive use levels.
 17 Right?
 18 **A. Yes.**
 19 **Q.** And you observed a difference of approximately
 20 3,500 to 4,000 cfs between streamflow in the
 21 earlier drought and the later drought?
 22 **A. Yes.**
 23 **Q.** And because you say that you rule out climate as
 24 a possible cause, your opinion is that the only
 25 remaining interpretation for that 3,500 to 4,000

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1995

1 cfs difference in streamflow between the two sets
 2 of droughts is Georgia's consumptive use. Right?
 3 **A. Yes.**
 4 **Q.** But it's also true that the 1954 to 1955 drought
 5 is before there were any reservoirs in the ACF
 6 Basin, and the 2011 to 2012 drought is after the
 7 reservoirs were built. Isn't that right?
 8 **A. Yes.**
 9 **Q.** You don't dispute that the federal reservoirs in
 10 the ACF Basin have some influence on how much
 11 water flows through to Florida at the state line;
 12 do you?
 13 **A. No.**
 14 **Q.** But you attribute the entire difference in
 15 streamflow between the 1954 to 1955 drought and
 16 the 2011 to 2012 drought to Georgia's consumptive
 17 use. Right?
 18 **A. Yes. We have looked at the impact of the**
 19 **reservoirs in terms of the evaporation from the**
 20 **reservoirs, and it is a small amount.**
 21 **Q.** There is no discussion in your direct testimony
 22 of any analysis ruling out the reservoirs as a
 23 possible interpretation for any of the difference
 24 in streamflow between the two droughts; is there?
 25 **A. You're right.**

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1996

1 **Q.** Let's talk about what you call basin yield, and
 2 that's another shift that you identify. Basin
 3 yield is essentially the amount of precipitation
 4 that ultimately becomes streamflow. Right?
 5 **A. It's the -- yes, the fraction of rainfall over a**
 6 **basin that flows out as streamflow, yes.**
 7 **Q.** And you say that basin yield has declined in the
 8 ACF Basin. Right?
 9 **A. Yes.**
 10 **Q.** And you say the cause of that decline is
 11 Georgia's consumptive use?
 12 **A. Yes.**
 13 **Q.** And for this opinion you only looked at basin
 14 yield changes at a single gage. Right?
 15 **A. Yes.**
 16 **Q.** And that was the Chattahoochee Gage just below
 17 the state line. Right?
 18 **A. Yes.**
 19 **Q.** You didn't do any analysis of how basin yield
 20 might have changed in rivers outside the ACF
 21 Basin; did you?
 22 **A. I did not.**
 23 **Q.** Let's look at the analysis you did do. It's on
 24 page 27 of your direct testimony at table 4.
 25 In table 4 on page 27 in the middle column

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1997

1 that says basin yield, you report your basin
 2 yield numbers. Is that right?
 3 **A. Yes.**
 4 **Q.** I want to turn to demonstrative No. 23. Now,
 5 Dr. Hornberger, in your original report that you
 6 submitted on February 29, 2016, your basin yield
 7 values were .349, .330, .296, and .261. Is that
 8 right?
 9 **A. That's what the table says, yes.**
 10 **Q.** And you later revised your basin yield numbers in
 11 a July 19, 2016, supplemental memorandum. And
 12 there you reported that your basin yield numbers
 13 were .343, .328, .301, and .282. Is that right?
 14 **A. Yes.**
 15 **Q.** And now in your direct testimony that you
 16 submitted to the Court a few weeks ago, your
 17 basin yield numbers are .329, .316, .289, and
 18 .270. Isn't that right?
 19 **A. Yes.**
 20 **Q.** For today, I'm just going to work off of the most
 21 recent set of numbers from your direct testimony,
 22 so the table 4 that's reproduced at the bottom of
 23 this slide. And you show average annual basis
 24 yield numbers for four periods, 1924 to 1970,
 25 1971 to 2013, 1992 to 2013, and 2003 to 2013. Is

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1998

1 that right?
 2 **A. Yes.**
 3 **Q.** All three of the sets of data where you report
 4 post-1970 include and reflect data from recent
 5 droughts; isn't that right?
 6 **A. Yes.**
 7 **Q.** There's no subset in your analysis reported here
 8 that would show a period of basin yield that did
 9 not include a major drought. Right?
 10 **A. That's right. I think there are droughts**
 11 **included in all of those periods.**
 12 **Q.** Now, you recall at your deposition we had gone
 13 back to the underlying data so that we could see
 14 actually what it showed for some of the subsets
 15 that you didn't report. Do you recall that?
 16 **A. Vaguely.**
 17 **Q.** And you agreed at your deposition that the basin
 18 yield data that you relied on for your analysis
 19 actually showed an increase in basin yield over
 20 the period of 1971 to 1998. Do you recall that?
 21 **A. That is the calculation you showed me, yes.**
 22 **Q.** So while your data showed an overall decline for
 23 1971 to 2013, it actually showed an increase for
 24 the first 30 years of that period. Right?
 25 **A. Yes. One really needs to be careful what periods**

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1999

1 **one picks. And so if you pick a period such as**
 2 **1970 to 1999, you're not capturing a**
 3 **representative set of both wet and dry years.**
 4 **And so the periods that I picked, if one looks at**
 5 **the precipitation record, all have a balance**
 6 **between wet and dry years. And so it's not**
 7 **really a good calculation to just pick out a**
 8 **section where the basin yield is high because you**
 9 **don't have a representative set of wet and dry**
 10 **years.**
 11 **Q.** All of the data sets that you chose to pick out
 12 and report to this Court all show a decline in
 13 the basin yield; is that right?
 14 **A. Yes.**
 15 **Q.** Now, let's look at table 5 in your direct. It's
 16 on page 28. And page 28 of your direct on table
 17 5 also discusses basin yield. Right?
 18 **A. Yes.**
 19 **Q.** Table 5 is basin yield presented by year in order
 20 of lowest basin yield. Right?
 21 **A. Yes.**
 22 **MS. ALLON: Your Honor, I'm sorry. I'm back**
 23 **in Dr. Hornberger's direct testimony.**
 24 **SPECIAL MASTER LANCASTER: Thank you.**
 25 **MS. ALLON: On page 20.**

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2000

1 BY MS. ALLON:
 2 **Q.** Now, in table 5 you include a selection of years
 3 with lowest basin yield at the top. Right?
 4 **A. Yes.**
 5 **Q.** And the basin yields that you present in table 5
 6 range from 13.9 percent to 39.9 percent. Right?
 7 **A. Yes.**
 8 **Q.** And, again, in the text discussing this table,
 9 you contrast pre-and-post 1970 basin yields.
 10 Right?
 11 **A. Yes.**
 12 **Q.** And you agree that the low basin yield values
 13 before 1970 are not associated with Georgia's
 14 consumptive use. Right?
 15 **A. Yes.**
 16 **Q.** Now, let's turn to demonstrative No. 24. And in
 17 demonstrative 24 what we have done is on the
 18 left, we have reproduced the table 5 from your
 19 direct that we were just looking at. And on the
 20 right, we have reproduced the data from the
 21 backup sheet that was produced to Georgia along
 22 with your direct testimony supporting table 5.
 23 Now, according to your backup data, in 1932
 24 there was a basin yield of 25.7 percent. Is that
 25 right?

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<p style="text-align: center;">2001</p> <p>1 A. 1932. I can't find 19 -- in my direct testimony?</p> <p>2 Q. In the backup data.</p> <p>3 A. Oh, the backup data.</p> <p>4 1932, yes, okay. So what is 1932?</p> <p>5 Q. There was a basin yield of 25.7 percent. That's</p> <p>6 what you reported in your backup data?</p> <p>7 A. I see that.</p> <p>8 Q. That's not listed under your table 5 in your</p> <p>9 direct; is it?</p> <p>10 A. No, it is not.</p> <p>11 Q. According to your backup data in 1941, there was</p> <p>12 a basin yield of 22.6 percent; isn't that right?</p> <p>13 A. Yes.</p> <p>14 Q. That's not listed in your table 5 in your direct;</p> <p>15 is it?</p> <p>16 A. I believe it is, about halfway down.</p> <p>17 Q. You're right.</p> <p>18 Let's look at 1963. According to your backup</p> <p>19 data, there was a basin yield of 26.9 percent in</p> <p>20 1963. Is that right?</p> <p>21 A. Yes.</p> <p>22 Q. Okay. That's not reported on your table 5, is</p> <p>23 it?</p> <p>24 A. It is not.</p> <p>25 Q. And according to your backup data, there was a</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>	<p style="text-align: center;">2003</p> <p>1 in the Flint River Basin identified by Gordon, et</p> <p>2 al., 2012. Is that right?</p> <p>3 A. Yes.</p> <p>4 Q. Okay. The red and yellow lines show losing and</p> <p>5 dry stream reaches. Right?</p> <p>6 A. Yes.</p> <p>7 Q. And you believe that this phenomenon is caused by</p> <p>8 groundwater pumping in Georgia altering the</p> <p>9 natural hydrology. Right?</p> <p>10 A. Yes.</p> <p>11 Q. Now, you say that figure 5 was prepared by</p> <p>12 adapting figure 13 in the Gordon article. Right?</p> <p>13 A. Yes.</p> <p>14 Q. Let's take a look at the Gordon article. It's</p> <p>15 JX-54. And if you turn to page 22, you will see</p> <p>16 the figure 13 that you referred to.</p> <p>17 A. Could you tell me the page again?</p> <p>18 Q. Page 22.</p> <p>19 Dr. Hornberger, figure 13 on page 22 is the</p> <p>20 figure that your figure 5 that we just looked at</p> <p>21 is adapted from. Right?</p> <p>22 A. Give me a minute, please.</p> <p>23 Q. Sure.</p> <p>24 A. Yes, I believe so.</p> <p>25 Q. Now, I want to actually compare your figure 5 and</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>
<p style="text-align: center;">2002</p> <p>1 basin yield in 1969 of 24.3 percent. Isn't that</p> <p>2 right?</p> <p>3 A. Yes.</p> <p>4 Q. That's not listed in your table 5 either; is it?</p> <p>5 A. It is not.</p> <p>6 Q. Now let's talk about the final hydrologic shift</p> <p>7 that you talk about, which is groundwater level</p> <p>8 declines. Your opinion is that groundwater</p> <p>9 pumping has altered the natural hydrology of the</p> <p>10 Lower Flint River Basin; is that right?</p> <p>11 A. Yes.</p> <p>12 Q. And if we turn to your direct testimony on page</p> <p>13 29 at paragraph 68, you say that groundwater</p> <p>14 declines are causing streams that historically</p> <p>15 gained water from groundwater, called gaining</p> <p>16 streams, to actually lose stream load to the</p> <p>17 groundwater and thus are becoming losing streams.</p> <p>18 Do you see that?</p> <p>19 A. Yes.</p> <p>20 Q. Now, your related figure 4 on page 31 shows a map</p> <p>21 from an article that was written by Gordon in</p> <p>22 2012. Is that right?</p> <p>23 A. Yes.</p> <p>24 Q. Okay. If we look at figure 5 on page 31, the</p> <p>25 caption of figure 5 says, losing stream reaches</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>	<p style="text-align: center;">2004</p> <p>1 Gordon figure 13. So on slide 25, I have</p> <p>2 prepared a demonstrative where I just put the</p> <p>3 figures up side by side.</p> <p>4 MS. ALLON: I'm -- I'm sorry, it's slide</p> <p>5 26. But if you're looking in the hard copy,</p> <p>6 it may say 25 in the bottom right-hand</p> <p>7 corner.</p> <p>8 BY MS. ALLON:</p> <p>9 Q. All right. Now, the figure on the left is your</p> <p>10 figure 5 from your testimony. Right?</p> <p>11 A. Yes.</p> <p>12 Q. Okay. And the figure on the right is the Gordon</p> <p>13 article that you cite to. Right?</p> <p>14 A. Yes.</p> <p>15 Q. Now, you see in the basin next to the Flint, east</p> <p>16 of the Flint, there is a river called the</p> <p>17 Ochlockonee River?</p> <p>18 A. Yes.</p> <p>19 Q. And in that basin, in the Gordon article there</p> <p>20 are some losing and dry reaches. Right?</p> <p>21 A. Yes.</p> <p>22 Q. Okay. You didn't include those losing and dry</p> <p>23 reaches in your figure 5; did you?</p> <p>24 A. No. We were concentrating on the Flint River</p> <p>25 Basin.</p> <p style="text-align: center;">THE REPORTING GROUP Mason & Lockhart</p>

2005

1 **Q.** Now, it's not labeled on the Gordon map, but the
 2 river to the west of the Apalachicola River is
 3 the Chipola River. Right?

4 **A. Yes.**

5 **Q.** And you can see on Gordon figure 13 that there's
 6 a section along the Chipola River that was also
 7 identified by the Gordon authors as a losing
 8 reach. Right?

9 **A. Yes.**

10 **Q.** That's not reflected in your figure 5 either; is
 11 it?

12 **A. No. We were focused on the Flint River**
 13 **basically.**

14 **Q.** Now, the Apalachicola portion is actually a
 15 little bit hard to see in figure 13. So the
 16 article -- the Gordon article, the authors
 17 extended it to the next page. So if you turn to
 18 the next slide, again I just compared your figure
 19 5 with the Gordon figure that blows up, so to
 20 speak, the portion of the Apalachicola River.
 21 And figure 13 from Gordon shows that portions of
 22 the Apalachicola River are losing reaches, too.
 23 Right?

24 **A. Yes.**

25 **Q.** Okay. And those aren't reflected in your
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2006

1 figure 5 either. Right?

2 **A. That's correct.**

3 **Q.** Let's talk about your rainfall runoff model. You
 4 wanted to quantify the streamflow depletions that
 5 you believe have been caused by Georgia's
 6 consumptive use. Is that right?

7 **A. Yes.**

8 **Q.** Now, what a rainfall runoff model does is it
 9 tells you how much streamflow there will be based
 10 on rainfall, temperature, and other climatic
 11 factors. Right?

12 **A. Yes.**

13 **Q.** So you use a rainfall runoff model to forecast
 14 what streamflows would have been with minimal
 15 human impact. Right?

16 **A. Yes.**

17 **Q.** And then you compared what your rainfall runoff
 18 model forecast flows would have been with what
 19 flows actually were. Right?

20 **A. Yes.**

21 **Q.** And you say that the difference between those two
 22 numbers, your modeled value of what flows would
 23 have been and your observed value of what flows
 24 actually were, is attributable to Georgia's
 25 consumptive use. Right?

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2007

1 **A. In large part, yes.**

2 **Q.** Now, for your rainfall runoff model you used the
 3 USGS P R M S, or PRMS, model that had already
 4 been developed by USGS for analysis of the ACF
 5 Basin. Right?

6 **A. Yes.**

7 **Q.** When USGS developed its PRMS model, it also
 8 calibrated the model to observed flows in the ACF
 9 Basin. Right?

10 **A. Yes.**

11 **Q.** Calibration is important because it helps ensure
 12 that models provide reliable estimates. Right?

13 **A. Yes.**

14 **Q.** Now, you redid the USGS's calibration. Right?

15 **A. Yes.**

16 **Q.** So I'm going to refer to your recalibrated PRMS
 17 model as your PRMS model so that we can
 18 distinguish it from the USGS PRMS model. Okay?

19 **A. Okay.**

20 **Q.** Your PRMS model was developed specifically for
 21 this litigation. Right?

22 **A. Yes.**

23 **Q.** You have never calculated the PRMS model before
 24 this litigation. Right?

25 **A. Not the specific PRMS model, no.**

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2008

1 **Q.** Well, in fact, as an expert consultant in the
 2 past, you have never taken a model that's already
 3 been calibrated, decided you weren't satisfied
 4 with the calibration, and then recalibrated it
 5 yourself. Right?

6 **A. Since I have never been involved in litigation**
 7 **before, that is absolutely true.**

8 **Q.** But even in your work as an expert consultant
 9 outside the context of litigation, you have never
 10 taken a model that's already been calibrated,
 11 decided you weren't satisfied with the
 12 calibration, and recalibrated it yourself. Have
 13 you?

14 **A. That's a very broad question. I would have to**
 15 **think about that. I believe that I have worked**
 16 **with students who have calibrated models and then**
 17 **gone back and redone a calibration. So I think**
 18 **that in a general sense, I have to not agree with**
 19 **you on that.**

20 **Q.** Well, when you did your recalibration, what you
 21 did was you compared the PRMS modeled results
 22 with observed data so that you could see how well
 23 the two sets matched. Right?

24 **A. Yes.**

25 **Q.** And the goal is to get as close a match as
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 Mason & Lockhart

2009

1 possible between modeled results and observed
 2 data during your calibration period?
 3 **A. Yes.**
 4 **Q.** Okay. Now, let's take a look at the result of
 5 your PRMS recalibration. You didn't include them
 6 in your direct, so we'll have to go back to your
 7 expert report. They're at FX-785, page 68.
 8 Now, figure A.4 on page 68 shows the results
 9 of your calibration for your PRMS model. Right?
 10 **A. Figure A.5 you're pointing to?**
 11 **Q.** A.4.
 12 **A. A.4, yes.**
 13 **Q.** Now, the red line shows modeled flows from your
 14 PRMS model. Right?
 15 **A. Yes.**
 16 **Q.** The blue line shows observed flows from the
 17 Chattahoochee Gage.
 18 **A. Yes.**
 19 **Q.** And what the figure 4 -- A.4 does is it shows a
 20 comparison between modeled and observed for the
 21 period 1935 to 1940. Right?
 22 **A. Yes.**
 23 **Q.** Okay. The X axis is the water year. Right?
 24 **A. Yes.**
 25 **Q.** And that just means that instead of the calendar

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2010

1 year, the water year goes from October 1 to
 2 September 30. Right?
 3 **A. Yes.**
 4 **Q.** It's a hydrologist's version of a fiscal year.
 5 **A. Good analogy.**
 6 **Q.** Now, the Y axis is the flow or discharge in cfs.
 7 Right?
 8 **A. Yes.**
 9 **Q.** Now, the Y axis scale looks like it goes from
 10 zero to 2. But you see there is a notation at
 11 the top over there that says times 10 to the 5th
 12 power. That means that the scale actually goes
 13 from zero to 200,000 cfs. Right?
 14 **A. Yes.**
 15 **Q.** Now, the time period that you reflect in figure
 16 A.4, the calibration period, is the time period
 17 during which your modelled results should most
 18 closely match the observed data. Right?
 19 **A. Yes.**
 20 **Q.** However, for your calibration period, there are
 21 times where the modeled flows are substantially
 22 different from the observed flows. There can be
 23 differences between your modeled results and your
 24 observed flows of several thousands of cfs.
 25 Right?

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2011

1 **A. There are differences. I would not characterize**
 2 **them as substantial. I, as a hydrologist, would**
 3 **look at this figure and think that it is quite a**
 4 **good fit.**
 5 **Q.** All right. Well, let's look at a couple of
 6 examples. If you look in early 1936, do you see
 7 a sharp spike there?
 8 **A. Yes.**
 9 **Q.** Okay. That reflects a difference of at least
 10 20,000 cfs between modeled and observed. Right?
 11 **A. My eye is probably not that finely calibrated,**
 12 **but certainly there is a difference.**
 13 **Q.** Let's look at early 1938. Do you see a sharp
 14 spike there?
 15 **A. Yes.**
 16 **Q.** And that also shows a difference between modeled
 17 and observed of at least 20,000 cfs. Right?
 18 **A. Probably, yes.**
 19 **Q.** Now, the difference between modeled and observed
 20 in the calibration period is not a result of
 21 Georgia's consumptive use. Right?
 22 **A. Right.**
 23 **Q.** And the difference that exists in the calibration
 24 period similarly exists in the post-1955 period.
 25 Right?

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2012

1 **A. Yes.**
 2 **Q.** Meaning there will always be some difference
 3 between your modeled and observed results that is
 4 not due to Georgia's consumptive use. Right?
 5 **A. There will always be some differences in modeled**
 6 **results on a day-to-day basis, without a doubt.**
 7 **Q.** That are not due to Georgia's consumptive use.
 8 Right?
 9 **A. Well, Georgia's consumptive use is not even**
 10 **included in the model. So all the model tells**
 11 **us -- the model tells us these differences. And**
 12 **you're right; we infer that over a long period**
 13 **the average of those differences give a clear**
 14 **indication of hydrologic change. That was the**
 15 **purpose of the modeling.**
 16 **Q.** Dr. Hornberger, is it fair to say that in your
 17 post-1955 period, there will always be some
 18 difference between your modeled results and
 19 observed results that is not due to Georgia's
 20 consumptive use?
 21 **A. Yes. In such a model, one can't attribute -- go**
 22 **to any given day and attribute what the**
 23 **difference between model and -- modeled and**
 24 **observed data. You can't -- you can't**
 25 **desegregate at that level.**

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2013

1 **Q.** Why don't you take a look at your deposition
 2 transcript on page 326.
 3 MS. ALLON: And I would like to ask
 4 Mr. Smith to play clip 93.
 5 (Whereupon the video was played.)
 6 BY MS. ALLON:
 7 **Q.** Were you asked that question, and did you give
 8 that answer?
 9 **A. Yes.**
 10 MS. ALLON: I'm about to start two
 11 sections of my cross-examination that relate
 12 to testimony that Dr. Hornberger has adopted
 13 from other Florida experts. Now, these
 14 opinions are the subject of a letter that was
 15 sent to your Honor several weeks ago; and I
 16 understand that your Honor has reserved
 17 judgment on those issues. But I just wanted
 18 to flag that my cross-examination may be a
 19 little bit unconventional because I have to
 20 cross Dr. Hornberger on work done by other
 21 experts. But I'm happy to proceed with that
 22 pending the Court's ruling.
 23 SPECIAL MASTER LANCASTER: Please.
 24 BY MS. ALLON:
 25 **Q.** Now, Dr. Hornberger, in your testimony you offer
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2014

1 opinions quantifying Georgia's consumptive use.
 2 Right?
 3 **A. Yes.**
 4 **Q.** And you're relying on another Florida expert,
 5 Dr. Flewelling -- you're relying on his work as
 6 the basis for those opinions. Right?
 7 **A. Yes.**
 8 **Q.** You didn't repeat any of Dr. Flewelling's
 9 calculations for the conclusions he reached to
 10 independently see if you could verify them; did
 11 you?
 12 **A. I reviewed all of the work and -- but I -- you're**
 13 **right; I did not do independent calculations. I**
 14 **certainly reviewed it and checked it and accepted**
 15 **it.**
 16 **Q.** You didn't repeat any of his calculations to see
 17 independently if you got the same number. Right?
 18 **A. Not in bulk, that's correct.**
 19 **Q.** You didn't make any effort to go back to the
 20 underlying data and manipulate it in any way; did
 21 you?
 22 **A. I did not manipulate underlying data.**
 23 **Q.** You now offer the opinion that Dr. Flewelling's
 24 estimates of Georgia's consumptive use are
 25 conservative. Right?
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2015

1 **A. Yes.**
 2 **Q.** But you told me at your deposition that
 3 if I wanted the detailed answer to how
 4 Dr. Flewelling's estimates are conservative,
 5 I needed to ask Dr. Flewelling myself. Right?
 6 **A. Yes.**
 7 **Q.** You told me Dr. Flewelling is a much better
 8 source to ask questions about consumptive use.
 9 Right?
 10 **A. Yes. He did the calculations.**
 11 **Q.** Now, in addition to adopting Dr. Flewelling's
 12 consumptive use opinions, you also use his
 13 estimates as inputs in your modeling. Right?
 14 **A. Yes.**
 15 **Q.** If Dr. Flewelling's consumptive use calculations
 16 were too high, that would impact your conclusions
 17 about streamflow at the state line. Right?
 18 **A. No.**
 19 **Q.** Your testimony is that if Dr. Flewelling's
 20 consumptive use was too high, it would not impact
 21 your calculations of streamflow depletions at the
 22 Chattahoochee Gage?
 23 **A. Streamflow depletions that are calculated**
 24 **using the PRMS model did not depend upon**
 25 **Dr. Flewelling's estimates of consumptive use.**
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2016

1 **Q.** I'm not asking about the PRMS model. I'm asking
 2 about the modeling you did that we talked about
 3 at the beginning of this cross-examination where
 4 you looked at increases and decreases to
 5 Georgia's consumptive use, and you assessed what
 6 impact those increases or decreases would have on
 7 state line flows. Is it your testimony that if
 8 Dr. Flewelling's consumptive use calculations
 9 were too high, that would have no impact on those
 10 conclusions?
 11 **A. No. Obviously when -- where we used it for those**
 12 **scenarios, the -- the results would scale.**
 13 **Q.** Now, one part of consumptive use estimates is
 14 irrigation depths. Right?
 15 **A. Yes.**
 16 **Q.** Dr. Sunding actually updated his irrigation
 17 depths after expert reports were submitted.
 18 Right?
 19 **A. I believe that is correct.**
 20 **Q.** And then Dr. Flewelling evaluated Dr. Sunding's
 21 adjustment and found that the new irrigation
 22 depths reduced Dr. Flewelling's consumptive use
 23 estimates -- agricultural consumptive use
 24 estimates by 6 to 7 percent. Isn't that right?
 25 **A. Yes.**
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 Mason & Lockhart

2017

1 Q. And your testimony is that this impact is
 2 insignificant. Right?
 3 A. **It doesn't make any material difference to my
 4 conclusions. That's right.**
 5 Q. Now, I want to turn to slide 28, please.
 6 And slide 28 is taken directly from
 7 Dr. Flewelling's spreadsheet underlying his
 8 consumptive use estimates. Dr. Flewelling
 9 calculated peak summer consumptive use in some
 10 years to be over 3,000 cfs. Right?
 11 A. **Yes.**
 12 Q. For example, in May of 2007 -- and that's what we
 13 highlighted in yellow -- Dr. Flewelling estimated
 14 agricultural consumptive use to be 3,867 cfs.
 15 Right?
 16 A. **Yes.**
 17 Q. Now, you can take my word for it or I can give
 18 you a calculator; but 6 to 7 percent of 3,867 cfs
 19 is about 232 to 270 cfs. Does that sound right?
 20 A. **Sounds about right.**
 21 Q. That difference, 232 to 270 cfs, that's what you
 22 were referring to when you testified that the
 23 difference was insignificant. Is that correct?
 24 A. **It is immaterial with respect to my opinions.**
 25 Q. That wasn't my question. My question was when
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2018

1 you referred to a difference, you were referring
 2 to that 6 to 7 percent difference, that 232 to
 3 270 cfs difference, for your testimony that the
 4 difference was insignificant?
 5 A. **Significance is very difficult to assess
 6 depending upon what your comparison is.
 7 Obviously one could say 200 cfs is significant to
 8 someone if they're not getting 200 cfs. But in
 9 terms of evaluating impacts, it didn't have a
 10 material impact on my analysis. So in that
 11 sense, it was insignificant to me.**
 12 Q. Dr. Hornberger, I'm going to ask you to try to
 13 answer my question; and my question was a very
 14 narrow question. It was just when you said the
 15 difference was insignificant, is the difference
 16 you're referring to the one we just walked
 17 through of 6 to 7 percent equating to 232 to 270
 18 cfs?
 19 A. **For May of 2007, yes, that's the calculation.**
 20 Q. Let's talk about small impoundments. Now, a
 21 small impoundment is basically a man-made body of
 22 water that farmers construct to store water.
 23 Right?
 24 A. **Yes.**
 25 Q. And you assume in your testimony that evaporation
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 Mason & Lockhart

2019

1 from small impoundments results in streamflow
 2 depletions. Right?
 3 A. **Yes.**
 4 Q. And, therefore, you include that in your
 5 calculation of consumptive use estimates?
 6 A. **Yes.**
 7 Q. And this is based on work originally done by
 8 Dr. Flewelling. Right?
 9 A. **Yes.**
 10 Q. You didn't do any independent analysis to
 11 evaluate evaporative water loss from small farm
 12 impoundments; did you?
 13 A. **By repeating Dr. Flewelling's calculations --**
 14 Q. Yes.
 15 A. **-- is that what you mean?**
 16 **No. I reviewed them and did what we call**
 17 **spot checks. But, no, I did not get into the**
 18 **underlying data base and do massive amounts of**
 19 **computation.**
 20 Q. Now, Dr. Flewelling estimated incremental
 21 evaporation from small impoundments based on the
 22 surface area of the small impoundment. Right?
 23 A. **Yes.**
 24 Q. And the way he estimated the surface area is he
 25 looked at aerial imagery data for certain years.
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 Mason & Lockhart

2020

1 Right?
 2 A. **Yes.**
 3 Q. He then used a regression to estimate the surface
 4 area for other years. Right?
 5 A. **Yes.**
 6 Q. Now, Dr. Flewelling gets to incremental
 7 evaporation by multiplying the surface area of
 8 the small impoundment by the ET deficit. Right?
 9 A. **Yes.**
 10 Q. So the greater the estimated cumulative surface
 11 area of the small impoundments, the greater the
 12 evaporative loss from them. Right?
 13 A. **Yes.**
 14 Q. Now, storage in small impoundments is increased
 15 by rainfall; is that right?
 16 A. **Yes.**
 17 Q. All else being equal, a small impoundment will
 18 have a greater surface area after a period of a
 19 lot of rain than a period with no rain. Right?
 20 A. **Yes.**
 21 Q. Dr. Flewelling estimated the surface area of
 22 small impoundments using aerial imagery from
 23 1993, 2010, and 2014. Right?
 24 A. **I believe that's right.**
 25 Q. 1993 and 2010 were both preceded by relatively
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 Mason & Lockhart

2021

1 wet years. Correct?

2 **A. I believe that's right.**

3 **Q.** Okay. So for at least two of the three years

4 that Dr. Flewelling directly estimated small

5 impoundment surface area, he did so after

6 relatively wet years. Right?

7 **A. Yes.**

8 **Q.** Dr. Flewelling could have used years after

9 drought years instead of years after wet years.

10 Right?

11 **A. I'm not sure what of the aerial photography was**

12 **available. If -- assuming that the aerial**

13 **photography was available for other years, then**

14 **that could have been done. But I don't know that**

15 **those data are available.**

16 **Q.** Since we don't have Dr. Flewelling with us in

17 the courtroom, why don't we take a look at

18 Dr. Flewelling's testimony on this topic. You

19 have a binder that's called volume 2 in front of

20 you, and that has in it Dr. Flewelling's

21 deposition testimony. And if you turn to page

22 248 of that testimony, I'm going to ask you to

23 look at line 20.

24 **A. What page again?**

25 **Q.** 248.

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Mason & Lockhart

2023

1 take out, the streamflow is depleted by 1 cfs.

2 Right?

3 **A. For irrigation, yes.**

4 **Q.** Okay. But when you talk about groundwater

5 pumping, you don't have the same one-to-one

6 impact on streamflow. Right?

7 **A. That is correct.**

8 **Q.** For every 1 cfs of water you pump from

9 groundwater, you're not going to see a reduction

10 in surface water flows of that same 1 cfs.

11 Right?

12 **A. Not in many cases, that's correct.**

13 **Q.** Now, you used the term impact factor in your

14 direct testimony. Right?

15 **A. Yes.**

16 **Q.** And an impact factor is a way to take groundwater

17 pumping data and convert it to streamflow

18 depletions. Right?

19 **A. Yes.**

20 **Q.** And you also sometimes refer to it as a

21 groundwater conversion factor. Right?

22 **A. Yes.**

23 **Q.** And in this case in your testimony, you offer

24 some opinions about the appropriate groundwater

25 impact factors. Right?

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2022

1 **A. Yes, I see that.**

2 **Q.** And do you see at line 20 Dr. Flewelling was

3 asked, you could have compared years after

4 drought years instead of years after wet years.

5 Right?

6 And his answer was, that's correct.

7 Do you see that?

8 **A. I do.**

9 **Q.** You don't have any basis to disagree with

10 Dr. Flewelling's testimony on this point; do

11 you?

12 **A. I do not.**

13 **Q.** Now, I want to talk about your groundwater

14 opinions. And I understand that some of these

15 opinions were adopted from another Florida

16 expert, Dr. Langseth. Is that correct?

17 **A. That's correct.**

18 **Q.** Now, much of Georgia's agricultural irrigation is

19 done through groundwater pumping. Is that right?

20 **A. Yes.**

21 **Q.** Now, when you irrigate from surface water,

22 there's a one-to-one impact on streamflow.

23 Right?

24 **A. Yes.**

25 **Q.** Meaning for every cfs of surface water that you

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1 **A. Yes.**

2 **Q.** Now, even though you're offering opinions about

3 impact factors, you never independently ran a

4 groundwater model for this case; did you?

5 **A. I did not.**

6 **Q.** You never ran any codes to calculate

7 groundwater/surface water interaction; did you?

8 **A. I did not.**

9 **Q.** Now, Jones and Torak is a groundwater model of

10 the ACF Basin that was developed by USGS. Isn't

11 that right?

12 **A. Yes.**

13 **Q.** You have never used the Jones and Torak

14 groundwater model for any impact work. Have you?

15 **A. We rely on the reported results from the Jones**

16 **and Torak model. But if your question is did I**

17 **run a computer, then the answer is no. I did not**

18 **do computation.**

19 **Q.** Okay. Not just in this case. My question was in

20 any of your expert work, you have never before

21 run or used the Jones and Torak groundwater

22 model; have you?

23 **A. No.**

24 **Q.** Now Dr. Langseth, he doesn't know how to run the

25 Jones and Torak model either; does he?

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1 **A. That's not true.**
 2 MR. SINGARELLA: Objection.
 3 **A. That is not true. That is simply not true. I**
 4 **know how to run the Jones and Torak model. I**
 5 **have run groundwater models. I have written a**
 6 **book on groundwater modeling. And it's**
 7 **absolutely outrageous to suggest that either I or**
 8 **Dr. Langseth doesn't know how to run the Jones**
 9 **and Torak model.**
 10 **Q.** Why don't we take a look at Dr. Langseth's
 11 deposition testimony on this topic. On page 7 of
 12 his transcript at line 15 I asked Dr. Langseth,
 13 is it fair to say that you personally don't have
 14 the capacity to run it; but there are others on
 15 your team who do?
 16 And he answered, well, as I sit here right
 17 now, I don't know the specific command structure
 18 for running that model.
 19 Do you see that?
 20 **A. Yes.**
 21 **Q.** Now, for his groundwater analysis in connection
 22 with this case, Dr. Langseth never did run a
 23 groundwater model himself. Right?
 24 **A. I believe that's correct.**
 25 **Q.** Dr. Langseth did not run any simulations from any

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1 **A. Dr. Langseth was part of a hydrology team. And,**
 2 **again, we had many conversations. I reviewed the**
 3 **work. He reviewed the work of others. I**
 4 **certainly rely on Dr. Langseth's work and adopt**
 5 **it, if that's your question.**
 6 **Q.** Why don't we turn to your deposition transcript
 7 at page 238.
 8 MS. ALLON: And I'm going to ask Mr. Smith to
 9 play clip 72.
 10 (Whereupon the video was played.)
 11 BY MS. ALLON:
 12 **Q.** Were you asked those questions, and did you give
 13 those answers?
 14 **A. Yes.**
 15 **Q.** Now, you used the term short-term impact factor
 16 to mean the average percent of water that results
 17 in streamflow depletion over one year. Right?
 18 **A. Yes.**
 19 **Q.** And you say that you rely on 60 percent as a
 20 conservative estimate of the actual short-term
 21 impact factor. Right?
 22 **A. Yes.**
 23 **Q.** And in support of the 60 percent impact factor,
 24 you rely on Dr. Langseth's analysis. Right?
 25 **A. Yes.**

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1 model in support of his affirmative opinions in
 2 this case. Is that right?
 3 **A. He didn't run the numerical groundwater models;**
 4 **that's correct.**
 5 **Q.** Instead of actually running the models,
 6 Dr. Langseth extrapolated numbers from published
 7 results to come up with groundwater impact
 8 factors. Right?
 9 **A. Yes.**
 10 **Q.** And you used the groundwater impact factors
 11 calculated by Dr. Langseth?
 12 **A. Yes.**
 13 **Q.** You relied on Dr. Langseth for the impact
 14 factors?
 15 **A. There wasn't enough inflection in it.**
 16 **Yes.**
 17 **Q.** And the reason you didn't do anything to
 18 independently verify Dr. Langseth's work was
 19 because Dr. Langseth did it. Is that right?
 20 **A. Could you repeat that again? I didn't get that**
 21 **question.**
 22 **Q.** The reason you said you didn't need to do
 23 anything to independently verify Dr. Langseth's
 24 work was because, in your words, Dr. Langseth
 25 did it?

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1 **Q.** And you also rely on a report that was written by
 2 Sorab Panday, who is Georgia's groundwater expert
 3 in this case. Right?
 4 **A. Amongst others, yes.**
 5 **Q.** And that report was written in 1998. Right?
 6 **A. Yes.**
 7 **Q.** Now, let's start with Dr. Langseth's analysis.
 8 And I want to refer to his expert report so that
 9 we can see his discussion of impact factors
 10 first-hand. So Dr. Langseth's report is in
 11 volume 2 of the binders that you have in front of
 12 you, and I want to turn to page 36.
 13 Are you there, Dr. Hornberger?
 14 **A. Yes.**
 15 **Q.** Okay. Now, if you look at the paragraph that
 16 starts among the issues, do you see that?
 17 **A. Yes.**
 18 **Q.** Now, I'm not going to read verbatim from the
 19 report, but do you see that Dr. Langseth
 20 performed a quantitative evaluation of the
 21 relationship between pumping and streamflow
 22 depletions?
 23 **A. Yes.**
 24 **Q.** And the question Dr. Langseth says he wanted to
 25 answer on page 36 is if pumping rates are changed

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1 by a given amount in a given location, how much
 2 will streamflow change in the near term. Right?
 3 **A. Yes.**
 4 **Q.** And Dr. Langseth said that mathematical
 5 simulation models are the state-of-the-art tools
 6 used to answer this question. Right?
 7 **A. Yes.**
 8 **Q.** He said that there have been numerous groundwater
 9 models for aquifers that have been developed for
 10 the ACF Basin. Right?
 11 **A. Yes.**
 12 **Q.** And Dr. Langseth himself actually reviewed those
 13 models. Right?
 14 **A. Yes.**
 15 **Q.** And Dr. Langseth explained that the Jones and
 16 Torak model was developed for and adopted by
 17 Georgia to estimate streamflow depletions related
 18 to pumping during drought years. Right?
 19 **A. Yes.**
 20 **Q.** Based on Dr. Langseth's review of
 21 previously-developed models, Dr. Langseth
 22 selected the model developed by Jones and Torak.
 23 Is that correct?
 24 **A. Yes.**
 25 **Q.** Dr. Langseth said that the Jones and Torak model

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1 is the best currently-available model simulation
 2 to address the impact of pumping on streamflow.
 3 Is that right?
 4 **A. Yes.**
 5 **Q.** Now, Dr. Langseth relied on the Jones and Torak
 6 model to calculate an impact factor of 41
 7 percent. Is that right?
 8 **A. Yes.**
 9 **Q.** Dr. Langseth relied on the Jones and Torak model
 10 to determine that pumping of 100 cfs from
 11 groundwater reduces surface water streamflow that
 12 year by 41 cfs. Is that right?
 13 **A. 100 to 41, is that what you said?**
 14 **Q.** Yes.
 15 **A. Yes.**
 16 **Q.** Now, in your direct testimony, you say, I agree
 17 with Dr. Langseth that the short-term impact
 18 factor ranges from at least 41 percent to a more
 19 realistic, yet still conservative, 60 percent.
 20 Right?
 21 **A. Yes.**
 22 **Q.** And you used 60 percent as your impact factor.
 23 Right?
 24 **A. Yes.**
 25 **Q.** But in his expert report, Dr. Langseth never

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1 mentioned 60 percent as an impact factor. Did
 2 he?
 3 **A. I believe somewhere in his report I'm certain**
 4 **that he articulated why the .41 was very**
 5 **conservative.**
 6 **Q.** That wasn't my question. My question was in his
 7 expert report, Dr. Langseth never mentioned 60
 8 percent as an impact factor. Did he?
 9 **A. I'm not sure. But I -- you know, I would have to**
 10 **go back and -- he was certainly focused on the**
 11 **.41 from the Jones and Torak. I don't know if he**
 12 **mentioned specifically 60 percent or not.**
 13 **Q.** Are you aware that on June 16, 2016, on the first
 14 day of Dr. Langseth's four days of deposition in
 15 this matter, he explained that 40.6 percent is
 16 the annual impact factor for pumping in the ACF
 17 portion -- in Georgia's portion of the ACF Basin?
 18 **A. I don't know that for a fact, but I will take**
 19 **your word for it.**
 20 **Q.** You're aware that Dr. Langseth drafted a
 21 supplemental memo on June 28, 2016. Right?
 22 **A. Yes.**
 23 **Q.** Okay. The memo is actually addressed to you?
 24 Right?
 25 **A. Yes.**

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1 **Q.** And that memo didn't mention anything about a 60
 2 percent impact factor. Did it?
 3 **A. I would have to go back and reread it, but I**
 4 **don't recall if it specifically did or not.**
 5 **Q.** Are you aware that in July, the night before his
 6 next round of deposition, Dr. Langseth disclosed
 7 some additional notes and analysis?
 8 **A. I don't think I know that.**
 9 **Q.** And you have never seen those?
 10 **A. I -- I can't say for sure. I don't recall them.**
 11 **Q.** Would it surprise you to learn that those notes
 12 didn't mention anything about a 60 percent impact
 13 factor?
 14 **A. No.**
 15 **Q.** Now, we already talked about Dr. Langseth's
 16 testimony from his first day of deposition. On
 17 the second and third day, Dr. Langseth didn't
 18 mention anything about a 60 percent impact
 19 factor. But on the fourth day, Dr. Langseth did
 20 testify for the first time about an impact factor
 21 that was different than his original impact
 22 factor. Am I right?
 23 **A. I'll take your word for it.**
 24 **Q.** Are you aware that on his fourth day of
 25 deposition Dr. Langseth testified that he had

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1 changed his impact factor from 40.6 percent to
 2 40.8 percent?
 3 **A. I didn't recall that.**
 4 **Q.** Okay. And are you aware that I asked
 5 Dr. Langseth, are you changing the opinion in
 6 your first report as to the proper impact factor?
 7 And he said he was not. Are you aware of that?
 8 **A. I wasn't aware of it.**
 9 **Q.** Now, the second thing you rely on in support of
 10 your 60 percent impact factor is a 1999 -- '98
 11 hydrogeologic paper that reports modeling results
 12 by Dr. Panday, Georgia's groundwater expert.
 13 Right?
 14 **A. Yes. That's -- that's one of the references that**
 15 **we --**
 16 **Q.** Now, Dr. Panday ran the groundwater model that
 17 generated the results that you cite to 20 years
 18 ago. Right?
 19 **A. Yes.**
 20 **Q.** The modeling that Dr. Panday did in the report
 21 that you cite to was based on a 1996 Torak and
 22 McDowell model. Right?
 23 **A. Yes.**
 24 **Q.** The Torak and McDowell model was created by USGS.
 25 Right?

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1 **A. Yes.**
 2 **Q.** You have never run the Torak and McDowell model;
 3 have you?
 4 **A. No.**
 5 **Q.** And Dr. Langseth has never run the Torak and
 6 McDowell model; has he?
 7 **A. Not that I know of.**
 8 **Q.** So the only person that has actually run the
 9 Torak and McDowell model is Georgia's groundwater
 10 expert, Dr. Panday?
 11 **A. I assume that Torak and McDowell ran it.**
 12 **Q.** The only person who is directly and personally
 13 involved in this litigation who has run the Torak
 14 and McDowell model to your knowledge is
 15 Dr. Panday?
 16 **A. To my knowledge.**
 17 **Q.** Now, I'm sure you have reviewed the direct
 18 testimony submitted in this case by Dr. Panday.
 19 Have you?
 20 **A. I have looked at it.**
 21 **Q.** So you know that he said that your reliance on an
 22 older model is unreasonable because there's more
 23 up-to-date information available. Are you aware
 24 that he said that?
 25 **A. Yes.**

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1 **Q.** You don't disagree that more up-to-date
 2 information has become available in the past 20
 3 years; do you?
 4 **A. No.**
 5 **Q.** And you're aware that actually USGS has released
 6 a new model since 1996 -- since 1998. Right?
 7 **A. Yes.**
 8 **Q.** And that new model is called the Jones and Torak
 9 model. Right?
 10 **A. Yes.**
 11 **Q.** And you know that the updated Jones and Torak
 12 model is based on more accurate data. Right?
 13 **A. Certainly more up-to-date data.**
 14 **Q.** And USGS specifically described the Jones and
 15 Torak model as an improvement from the Torak and
 16 McDowell model. Right?
 17 **A. Yes.**
 18 **Q.** Now, we talked before about Dr. Langseth's expert
 19 report, and we said that Dr. Langseth had done a
 20 survey of other groundwater models. Right?
 21 **A. Yes.**
 22 **Q.** And he had concluded that the Jones and Torak
 23 model is the best currently-available model to
 24 evaluate the relationship between pumping and
 25 streamflow changes in the ACF Basin. Right?

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1 **A. Yes.**
 2 **Q.** Okay. Now, I want to turn to Dr. Langseth's
 3 expert report. It's in volume 2 of your binders.
 4 And I want to turn to page 37. And I just want
 5 to read five lines of Dr. Langseth's discussion
 6 where he has reviewed other models. It's the
 7 second full paragraph under section 4.1.1. And
 8 Dr. Langseth says, I also screened out models
 9 that had been clearly superseded by newer models
 10 constructed either by the same model developers,
 11 or by others. This consideration screened out
 12 the following models developed by Torak and
 13 McDowell 1996, and Torak, et al., 1996, that were
 14 superseded by the model developed by Jones and
 15 Torak, 2006.
 16 And then Dr. Langseth goes on to say, I also
 17 screened out use of the model developed by
 18 Hydrogeologic, Inc., 1998, since it was based on
 19 the Torak and McDowell 2006, and Torak, et al.,
 20 1996 models.
 21 Do you see that?
 22 **A. Yes.**
 23 **Q.** The model Dr. Langseth refers to in his report as
 24 being superseded is the same model you cite in
 25 paragraph 100 of your testimony as supporting

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1 your use of the 60 percent impact factor. Is
 2 that right?
 3 **A. Yes.**
 4 **Q.** Dr. Langseth specifically considered the
 5 Hydrogeologic model and screened it out of
 6 consideration because it was superseded by the
 7 Jones and Torak model. Is that correct?
 8 **A. Yes.**
 9 **Q.** Dr. Hornberger, you offer some opinions on the
 10 feasibility of reducing Georgia's water use. Is
 11 that right?
 12 **A. Yes.**
 13 **Q.** But you're not offering an opinion that Georgia's
 14 water use needs to be reduced or constrained in
 15 any way; are you?
 16 **A. I'm -- I don't think I fully understand the**
 17 **question. Needs to be in what sense?**
 18 **Q.** Is it one of your opinions in this report that
 19 Georgia's consumptive use needs to be
 20 constrained?
 21 **A. My opinion, I guess, is a hydrologic opinion.**
 22 **And if flows to Florida are to be increased, then**
 23 **Georgia's consumptive use must be curtailed. But**
 24 **that's a hydrologic opinion.**
 25 **Q.** Right. But you're not offering a policy
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1 opinion --
 2 **A. I am not.**
 3 **Q.** -- as to whether Georgia needs to constrain its
 4 flows in the first place?
 5 **A. I am not.**
 6 **Q.** You are offering the opinion that if Georgia's
 7 consumptive use is cut, that would provide
 8 significant benefit to Florida. Right?
 9 **A. Yes.**
 10 **Q.** And what you mean is that the additional water
 11 Georgia conserves will make its way to the
 12 Apalachicola River as additional flow. Right?
 13 **A. Yes.**
 14 **Q.** There are other ways to provide additional flow
 15 entering the Apalachicola River that do not
 16 necessarily involve reducing Georgia's water use.
 17 Isn't that right?
 18 **A. Weather modification, cloud seeding, nothing**
 19 **practical.**
 20 **Q.** The Army Corps could decide to change its
 21 operations to allow for more releases from any of
 22 the upstream reservoirs and to allow for a higher
 23 minimum flow at the state line, and that could
 24 work in terms of getting more water to Florida.
 25 Right?
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1 **A. I mean, that's what storage reservoirs do; and**
 2 **that's how the Army Corps operates, to store in**
 3 **wet times and release in low times. One would**
 4 **have to do a very careful analysis as to what the**
 5 **hydrologic feasibility would be. I haven't done**
 6 **that.**
 7 **Q.** But you agree with me that the Corps could decide
 8 to change its operations to allow for more
 9 releases and a higher minimum flow at the state
 10 line, and that could work in terms of getting
 11 more water to Florida. Isn't that right?
 12 **A. The Army Corps can't manufacture water. So the**
 13 **reason I'm hesitating is that if the water isn't**
 14 **there in the reservoirs, the Army can't release**
 15 **it. And so one would have to do a very, very**
 16 **careful analysis to determine.**
 17 **In the long run, I don't think that it is**
 18 **feasible for the Army to augment flows. But it**
 19 **might be possible for restricted periods. I just**
 20 **don't know. I would have to do a very careful**
 21 **analysis.**
 22 **Q.** All right. Let's take a look at your deposition
 23 transcript at page 171.
 24 MS. ALLON: And I would like to ask
 25 Mr. Smith to play clip 66.
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1 (Whereupon the video was played.)
 2 BY MS. ALLON:
 3 **Q.** Dr. Hornberger, were you asked that question; and
 4 did you give that answer?
 5 **A. I did. It might work.**
 6 MS. ALLON: I have nothing else, your
 7 Honor.
 8 SPECIAL MASTER LANCASTER: Thank you.
 9 MR. SINGARELLA: Good morning, your
 10 Honor.
 11 SPECIAL MASTER LANCASTER: Good morning.
 12 MR. SINGARELLA: I think it's still
 13 morning.
 14 It's getting close to the noon hour.
 15 I'm happy to start, of course; but if you
 16 would like to break at this point --
 17 SPECIAL MASTER LANCASTER: Please go
 18 ahead.
 19 MR. SINGARELLA: -- we would be happy to
 20 take our break, too.
 21 SPECIAL MASTER LANCASTER: Go ahead.
 22 We'll break at noontime.
 23 MR. SINGARELLA: Thank you, your Honor.
 24 We'll see you after lunch.
 25 THE CLERK: He said go ahead.
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1 MR. SINGARELLA: Oh, go ahead. Thank
 2 you.
 3 Sorry. I misunderstood that.
 4 REDIRECT EXAMINATION
 5 BY MR. SINGARELLA:
 6 Q. Dr. Hornberger, how would you describe your
 7 scientific discipline?
 8 A. **I'm a hydrologist. Hydrology is water science.**
 9 **I study how the natural system works in terms of**
 10 **rainfall and runoff in river basins basically.**
 11 Q. And how would your discipline of hydrology help
 12 us understand the issues related to Georgia's
 13 water consumption?
 14 A. **So the -- of course, the -- one of the main**
 15 **things that we look at is recorded streamflow.**
 16 **Streamflow records really tell you -- the data**
 17 **tells you how much water is flowing from the**
 18 **upper reaches of a basin, high areas. Water**
 19 **flows downhill, collects itself into rivers, and**
 20 **flows out of the basin. So we definitely look at**
 21 **streamflow records as one major thing.**
 22 MR. SINGARELLA: And, your Honor, we're
 23 going to actually use some of the boards that
 24 we prepared that show some of the streamflow
 25 records. So at some point we will have to
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1 just take a pause to set up those boards as
 2 well.
 3 SPECIAL MASTER LANCASTER: Then why
 4 don't we take our noon break now.
 5 MR. SINGARELLA: Okay. Thank you, your
 6 Honor.
 7 (Time Noted: 11:46 a.m.)
 8 (Recess Called)
 9 (Time Noted: 12:50 p.m.)
 10 MR. SINGARELLA: Good afternoon, your
 11 Honor.
 12 SPECIAL MASTER LANCASTER: Good
 13 afternoon.
 14 MR. SINGARELLA: Thank you for giving us
 15 the opportunity to break a little bit earlier
 16 before lunch so that Dr. Hornberger could be
 17 surrounded by his boards and his data.
 18 BY MR. SINGARELLA:
 19 Q. Doctor, on cross many of the questions you heard
 20 from Ms. Allon were about computer modeling. To
 21 what extent was there a data analysis related to
 22 your computer modeling?
 23 A. **I think the -- a very large part of my work was**
 24 **to investigate the basic data that described the**
 25 **hydrology of the Apalachicola-Chattahoochee-Flint**
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1 **Basin. So it was a large component.**
 2 Q. And upon what basic data do hydrologists rely?
 3 A. **Well, amongst them, as I started to say right**
 4 **before lunch, was a discharge that is reported**
 5 **by -- chiefly by the U.S. Geological Survey for a**
 6 **whole suite of what we refer to as gaging**
 7 **stations, in other words, points on a river where**
 8 **these measurements are made.**
 9 Q. And what do you mean by the word discharge in
 10 this context?
 11 A. **So discharge is a measurement of the volume of**
 12 **water flowing in a river or stream past the gage,**
 13 **past the point on the river. So -- and it's**
 14 **typically expressed in this country as cubic feet**
 15 **per second. So it's that many cubic feet flowing**
 16 **past that point every second.**
 17 Q. And you mentioned the USGS. What is the USGS?
 18 A. **The United States Geological Survey is basically**
 19 **the -- in the Department of Interior of the**
 20 **United States. They are in charge of the stream**
 21 **gaging program and the network in the country.**
 22 Q. And you mentioned a gaging station. What is a
 23 gaging station?
 24 A. **So a gaging station -- we've been talking about,**
 25 **for example here, at the Chattahoochee Gage. The**
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1 **Chattahoochee Gage is on the Apalachicola River**
 2 **at the -- near the -- right at the state line**
 3 **where the river flows into Florida. So there's a**
 4 **gage there.**
 5 **Now, what is a gage? You may have been**
 6 **driving along, and particularly if you pass a**
 7 **bridge, you may see a vertical pipe with a little**
 8 **roof on it. And that is what -- it's called a**
 9 **stage recorder. And in pre-electronic days, what**
 10 **that consisted of was a float that went up and**
 11 **down as the river level went up and down. And it**
 12 **went around a spindle, and a pin recorded it.**
 13 **It's basically the same thing now except**
 14 **that, of course, we do it electronically.**
 15 **And there are other gages that I relied on.**
 16 **Bainbridge is up here. It's on the Flint Basin,**
 17 **and it's right before the Flint flows into Lake**
 18 **Seminole. And I think we talked this morning**
 19 **about the Iron City Gage, which is a gage on**
 20 **Spring Creek. So those gages, amongst others, I**
 21 **relied on.**
 22 SPECIAL MASTER LANCASTER: Excuse me,
 23 counsel.
 24 MR. SINGARELLA: Yes, sir?
 25 SPECIAL MASTER LANCASTER: Are you able
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1 to see where his light is flashing on?
 2 MS. ALLON: No, your Honor.
 3 SPECIAL MASTER LANCASTER: Would you
 4 like to come around and sit somewhere where
 5 you can?
 6 I'm just --
 7 MS. ALLON: I don't know if Florida
 8 perhaps has copies for us. Perhaps that
 9 would work, too.
 10 MR. SINGARELLA: We don't have copies --
 11 other copies of the boards. These records
 12 here are all from one of the joint documents.
 13 MS. ALLON: I'll just walk around.
 14 Thank you, your Honor.
 15 MR. PERRY: The Bainbridge Gage is
 16 Exhibit 259 in the book, I believe; and the
 17 Apalachicola Gage was from the opening
 18 statement. I believe you all took a
 19 photograph of it. It's also in the exhibits.
 20 MR. SINGARELLA: Can we proceed,
 21 Ms. Allon? Are you in a good position there?
 22 MS. ALLON: I'm good. Thank you.
 23 MR. SINGARELLA: Okay, great. Great.
 24 As Mr. Perry mentioned, these boards
 25 last appeared during his opening statement

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1 earlier in the proceeding.
 2 BY MR. SINGARELLA:
 3 Q. And Doctor, you mentioned some particular gages.
 4 Why is the Chattahoochee Gage of a particular
 5 importance in this case?
 6 A. **So the whole notion of a river basin is that it**
 7 **collects -- rivers collect all the flow above a**
 8 **certain point on the river. That's why we**
 9 **outline the basin that way. So that the rainfall**
 10 **that flows in and starts at the upper end of the**
 11 **basin -- there are even some mountains in the**
 12 **northern end of the basin -- flows down through**
 13 **the Flint River, the Chattahoochee River. And**
 14 **they join at Chattahoochee, Florida, to form the**
 15 **Apalachicola River, which flows into Florida.**
 16 Q. So the Chattahoochee Gage is actually in Florida;
 17 it's not up on the Chattahoochee River?
 18 A. **It's not on the Chattahoochee River.**
 19 Q. Thank you.
 20 A. **It's below Jim Woodruff Dam.**
 21 Q. How about the Bainbridge Gage?
 22 You mentioned the Bainbridge Gage. Is that
 23 of any particular importance in this case?
 24 A. **Yes. It's the most downstream gage in the Flint**
 25 **River. And what you see is the Flint River Basin**

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1 **outlined in green here. It's about 62 percent of**
 2 **the area that drains to the Apalachicola River.**
 3 **And it is the area of very intense agriculture --**
 4 **irrigated agriculture.**
 5 Q. Now, which one is the Chattahoochee board?
 6 A. **It's -- the map?**
 7 Q. I was wondering about the flow records.
 8 A. **Oh, the flow records. The flow records here**
 9 **are -- this is the Apalachicola River at**
 10 **Chattahoochee, Florida. That's the tall one,**
 11 **long record.**
 12 Q. So how does one obtain the records shown on --
 13 we'll call that the big board, the Chattahoochee
 14 board.
 15 A. **The big board.**
 16 **So measurements of river stage, the float**
 17 **that I mentioned, will only give you the**
 18 **elevation. And so what one has to do is go out**
 19 **periodically with a velocity meter and actually**
 20 **measure how much water is flowing. This gets**
 21 **related to the level of water in the river. We**
 22 **call this a rating curve. And then the stage**
 23 **record, the water level records, get converted**
 24 **into discharge, cubic feet per second. These are**
 25 **averaged typically to daily values and reported**

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1 **by the USGS monitoring times.**
 2 **Of course, we get them all from the internet.**
 3 **In years past, they used to produce books with**
 4 **these data.**
 5 Q. And with regard to the yellow highlighting on the
 6 big board, why is there yellow highlighting on
 7 the big board?
 8 A. **So all of these -- the yellow highlighting**
 9 **indicates months where the average flow was less**
 10 **than 6,000 cfs.**
 11 **And the importance, again, in looking at**
 12 **these records, we see that there are very few --**
 13 **there are a few anyway months in which average**
 14 **flow was less than 6,000. And, yet, when we get**
 15 **down here into 19 -- starting roughly in 1980 and**
 16 **certainly up to 1999 to the present, we see lots**
 17 **of these yellow highlighting indicating there**
 18 **were many, many more months where the average**
 19 **flow for the month was less than 6,000 cfs.**
 20 Q. And you first pointed to -- some of this is hard
 21 to see. I understand that, and I apologize for
 22 that. But you first pointed to a couple years --
 23 four months out of two years.
 24 A. **Yes.**
 25 Q. What -- what -- to what years and months do those

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1 particular average monthly flows correspond?

2 **A. So this is 1954 and 1955, and it's October and**

3 **November. And 1954 is the year with the**

4 **lowest-ever recorded rainfall in the record.**

5 **Q.** And how might these flow records help one to

6 understand the issue of consumption, Georgia's

7 consumption of these waters?

8 **A. So what happens in a basin like this, you have so**

9 **much rainfall coming in. And the rainfall then**

10 **gets apportioned; and some of it flows into the**

11 **ivers and flows out, in this case, to the**

12 **Apalachicola River. But some of it is**

13 **evaporated. So we talk about evaporation, or**

14 **transpiration, is just that plants take water**

15 **from the soil through their roots up through the**

16 **plant; and it gets evaporated from the leaves.**

17 **We refer to that as transpiration.**

18 **Another component is what I refer to as**

19 **consumptive use, which is the additional return**

20 **of water to the atmosphere due to human**

21 **appropriation of water. And so one has to**

22 **account for all of these things.**

23 **In the absence of any changes in consumptive**

24 **use by human appropriation and in the absence of**

25 **any changes in -- any systematic changes in**

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1 **rainfall, we don't anticipate that there would be**

2 **a change in flows, and particularly low flows in**

3 **critical summer months.**

4 **So we look at these data. And basically the**

5 **data themselves speak to the fact that there has**

6 **really been a consumptive use impact.**

7 **Q.** And, once again, with regard to the big board for

8 the Chattahoochee flow record, over what time

9 horizon do those records suggest that some kind

10 of hydrologic change has occurred?

11 **A. Well, certainly there's no doubt that starting in**

12 **1999 there are just very large differences that**

13 **we see just by looking at the number of colored**

14 **months on the board.**

15 **Q.** Now, let's turn our attention to the Bainbridge

16 board for a minute. How would one put together a

17 board like that?

18 We'll call that one the small board.

19 **A. Small board. So, again, we look at records from**

20 **the Bainbridge Gage, which is here on the Flint**

21 **River Basin. You will notice that this board is**

22 **not as big because the USGS stopped recording**

23 **flows in 1971 and didn't start again until 2001.**

24 **So there's roughly a 30-year gap.**

25 **Nevertheless, we can for the Bainbridge Gage**

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1 **look at records before 1971 and records after**

2 **2001. And, again, we see -- for example, in**

3 **2011-2012 we have five months, or seven months.**

4 **And we never had any occurrences except here in**

5 **1954, the lowest precipitation ever; and we did**

6 **have three occurrences there.**

7 **So, again, it's pretty much the same story**

8 **that we see a really large impact of consumptive**

9 **use.**

10 **Q.** And what is -- what is the meaning of the yellow

11 highlighting on the small board?

12 **A. Oh, thank you. So I had to pick a value for**

13 **flows on the Flint at Bainbridge. And I looked**

14 **at flows less than or equal to 2,500 cfs average**

15 **monthly values.**

16 **Q.** Why did you pick that particular value?

17 **A. So for two reasons. First of all, I recognized**

18 **from the data that there were very few months**

19 **where the flow dropped that low. And also,**

20 **there's a 1999 report looking at critical low**

21 **flows to be observed. And the suggested value**

22 **was 2,506, I believe.**

23 **Q.** So that's -- there is a threshold -- some type of

24 threshold of 2,506?

25 **A. Yes. This was basically to maintain a healthy**

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1 **ecosystem on the river.**

2 **Q.** Could we perhaps turn to the Iron City Gage? Is

3 that what it's called?

4 **A. Yes.**

5 **Q.** What is the Iron City Gage?

6 **A. The Iron City Gage is here on the -- Spring**

7 **Creek. And Spring Creek is -- drains -- as we**

8 **heard this morning, drains into Lake Seminole.**

9 **So it's one of the tributaries to Lake Seminole.**

10 **Q.** And Mr. Berrigan in his opening had a slide

11 showing the gage data from that particular gage.

12 MR. SINGARELLA: Your Honor, may I

13 approach the witness and give him a copy of

14 that?

15 SPECIAL MASTER LANCASTER: You don't

16 have to stand.

17 MS. ALLON: I can go sit back down?

18 Thank you, your Honor.

19 MR. SINGARELLA: I'll bring one over

20 here, too, sir.

21 Thank you.

22 And your Honor, I'm totally remiss for

23 not introducing Devin O'Connor earlier today.

24 So --

25 SPECIAL MASTER LANCASTER: Welcome.

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1 MR. SINGARELLA: She is a quite able
 2 assistant to me, and I really appreciate her
 3 being here today and sitting at the table
 4 with me.
 5 BY MR. SINGARELLA:
 6 Q. Doctor, are you familiar with the data shown in
 7 this figure?
 8 A. Yes. This is -- these are data from Spring Creek
 9 near Iron City.
 10 Q. And what do these streamflow records show?
 11 A. Again, through the yellow highlighting, we're
 12 showing low flows. I can't remember exactly the
 13 criterion we used; but all of them, except one of
 14 the numbers here, is below 100 cfs. And many are
 15 much less than that.
 16 Q. And why were you focused on the Spring Creek
 17 area?
 18 A. Well, the Spring Creek area, even though it's a
 19 small basin, we would anticipate that it would
 20 manifest change, any impacts first. And in
 21 Spring Creek there is very heavy groundwater
 22 pumping for irrigation. And so I thought it was
 23 really important to look at this to see if -- to
 24 see what the signals were telling us up in this
 25 basin.

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1 Q. This was one of the gages that Ms. Allon
 2 questioned you about. Right?
 3 A. Yes.
 4 Q. Yes. Did you have occasion to look at the
 5 frequency of low flow events --
 6 A. Oh, yes.
 7 Q. -- at Spring Creek?
 8 A. Yes, I did. And so when I looked at the
 9 analysis, I -- my analysis, I looked at low flow
 10 days. And prior to 1970, the lowest recorded
 11 flow was about 9 -- was 9 cfs, 9 cubic feet per
 12 second. And there were, as I recall, 100 --
 13 241 days where the flow was less than that
 14 after 1970. And if you took 1/50 of that
 15 value -- that's the value for 1/50 of that
 16 value, which would be 0.18 cfs, less than
 17 1 cfs.
 18 And at 9 cfs, according to the USGS data --
 19 field data, the stream would be about 20 feet
 20 wide. So you would get your boots wet if you
 21 wanted to walk across. But at 0.18 feet, any one
 22 of us could just step across. It's really
 23 reduced to a trickle.
 24 Q. And did you find other occasions where the flows
 25 at Spring Creek were below 0.18?

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1 A. Oh, yes. So there are numerous recordings, as I
 2 think Ms. Allon indicated this morning, of zero.
 3 So the flow -- recorded flow is zero. It stopped
 4 flowing.
 5 Q. And what might the flows at Spring Creek, the
 6 Iron City Gage, tell us about agricultural
 7 irrigation in that part of Georgia?
 8 A. It's -- it's very clear that the lowering of the
 9 groundwater due to pumping is seriously
 10 impacting -- seriously impacting that stream
 11 segment.
 12 Q. I would like to turn your attention, Doctor, to a
 13 figure we just received a week-and-a-half ago on
 14 October 26 from Georgia's expert, Dr. Bedient.
 15 I'm going to put that up on the screen.
 16 MR. SINGARELLA: May I approach, your
 17 Honor?
 18 SPECIAL MASTER LANCASTER: Excuse me,
 19 counsel.
 20 MR. SINGARELLA: Yes, sir?
 21 SPECIAL MASTER LANCASTER: May I have
 22 one?
 23 MR. SINGARELLA: Oh, my gosh, I thought
 24 the one that I gave -- I'm so sorry, your
 25 Honor.

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1 SPECIAL MASTER LANCASTER: Thank you.
 2 MR. SINGARELLA: I seem to be making one
 3 faux pas after another today, your Honor. I
 4 will carry on.
 5 BY MR. SINGARELLA:
 6 Q. So this -- this particular plot was produced to
 7 us on October 26 from Bedient demo 52-53.XLSX.
 8 What would that mean, Doctor, that it's -- it's
 9 an XLSX?
 10 A. The XLSX means it's an Excel spreadsheet. So
 11 it's a computer spreadsheet.
 12 Q. And have you had occasion to look at this chart
 13 before your testimony today?
 14 A. Yes. I did see this.
 15 Q. And what are your impressions of it?
 16 A. Oh, I think it, again, shows just what we've been
 17 talking about, the large increase of -- even in
 18 the '80's and certainly post-1998 in the
 19 occurrence, the number of days below these
 20 various thresholds.
 21 And so the top line is the blue line, 6,000.
 22 And one clearly sees that the number of days
 23 below 6,000 cfs has -- it has just increased
 24 dramatically.
 25 Q. And where did Dr. Bedient get his information for

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1 this plot?

2 **A. Well, I believe he used the data for the**

3 **Apalachicola River at Chattahoochee, the USGS**

4 **flow data.**

5 **Q.** And what are these flow records? Are these

6 averages or single days? What are they?

7 **A. So these -- so as I indicated earlier, the USGS**

8 **publishes on their website average daily**

9 **discharges for their gaging stations. So I think**

10 **these data are average daily discharges.**

11 **Q.** And to what extent is the pattern that

12 Dr. Bedient is showing here in his -- in your --

13 similar to patterns that you have yourself

14 identified?

15 **A. Yes. It's very similar, very similar.**

16 **Q.** In what respects?

17 **A. Oh, again, the -- sort of the number of days, the**

18 **number of low flow days no matter -- just about**

19 **no matter what statistic you look at. I have**

20 **looked at a number. And these have just various**

21 **thresholds from 5,000 to 6,000. And in just**

22 **about every category you see a dramatic increase**

23 **in recent years.**

24 **Q.** And all this information that you have looked at

25 so far, do you have an opinion as to its

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1 reliability?

2 **A. Yes. I think that the USGS gage data for these**

3 **gages that we have used are good. They're**

4 **reliable. USGS takes great pains to publish**

5 **reliable data and are very careful in their**

6 **approval process.**

7 **Q.** What other kinds of data do hydrologists rely on?

8 **A. All right. So, of course, as I was saying**

9 **before, the Apalachicola Basin, what we have to**

10 **keep track of if we're going to follow the water**

11 **is how much water is coming in. And so we have**

12 **to keep track of rainfall. We've already talked**

13 **about river discharge.**

14 **We also use climate data such as temperature,**

15 **sun -- hours of sunlight, and other climate data**

16 **to calculate what we refer to as**

17 **evapotranspiration. So evapotranspiration is**

18 **just combining evaporation along with**

19 **transpiration that I mentioned was really just**

20 **the evaporation of water through plants.**

21 **Q.** And how is evapotranspiration of relevance to

22 this case?

23 **A. So, of course, there's evapotranspiration that**

24 **will go on in any catchment. So it's a natural**

25 **process. We have a vegetative surface. We have**

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1 **puddles. We have other things. So this is just**

2 **the natural return of water to the atmosphere.**

3 **It's also important for my analysis to**

4 **look at evapotranspiration because it is one of**

5 **the major components of what we call the water**

6 **balance. The water balance is just keeping track**

7 **of how much water comes in and how much water**

8 **goes out along various routes. And**

9 **evapotranspiration is an important component.**

10 **And it's, therefore, also an important**

11 **component of consumptive use because we can**

12 **create a lot more evapotranspiration by putting**

13 **water on the land surface, for example, on lawns**

14 **or agricultural fields.**

15 **Q.** Did you rely on any particular climate data?

16 **A. Yes. So we used what is referred to as a gridded**

17 **climate dataset. It was published -- developed**

18 **by the University of Washington. Dennis**

19 **Lettenmaier, who will testify next week, is one**

20 **of the authors of this. It is posted on the**

21 **National Oceanic and Atmospheric Administration**

22 **website. So it's a well-recognized,**

23 **well-accepted dataset.**

24 **They basically took many, many rainfall**

25 **stations, meteorological stations, and basically**

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1 **used that data to scale it to a grid so that it's**

2 **most useful for looking at river basin studies.**

3 **Q.** Now, these data that you have been discussing,

4 are these data -- do they have any relevance to

5 the modeling that was a -- a major topic this

6 morning?

7 **A. Yes, absolutely. So the -- the rainfall data**

8 **provided input to our water budget modeling**

9 **because if a model is going to keep track of**

10 **where the water is, where -- the fall of the**

11 **water, we have to know how much goes in. And we**

12 **go through a series of calculations to determine**

13 **how much is stored in groundwater and how much**

14 **is -- flows out of the river and how much is lost**

15 **by evapotranspiration.**

16 **Q.** Could we turn to your prefiled direct, page 20,

17 please. We'll put it up on the screen. I think

18 everybody has that, table 1.

19 **A. Yes.**

20 **Q.** Let me invite your attention to some of these

21 specific drought years that you looked at.

22 Ms. Allon asked you some questions about this

23 this morning. Could you just briefly describe

24 what this table is?

25 **A. Yes. So 1954-1955 represents a multiple-year**

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1 drought, two years in a row of lower than normal
 2 precipitation. And 2011-2012 are two years --
 3 back-to-back years with lower than normal
 4 precipitation.
 5 So at the top, you can see I did a comparison
 6 of the June to September precipitation. So we
 7 see the June to September precipitation, and we
 8 see that 1954 is a low year. 1955, somewhat
 9 higher, 15.8 inches. And you see that the
 10 precipitation is somewhat higher in 2011-2012,
 11 even though these both represent back-to-back
 12 drought years.
 13 The temperatures in the summer season for all
 14 of these years are pretty similar. So we
 15 wouldn't anticipate changes in
 16 evapotranspiration. And, yet, when we look at
 17 the June to September streamflow, we see on the
 18 order of 3,500 or larger, 4,000 cfs less flow in
 19 2011-2012.
 20 Q. What does that mean to you, sir?
 21 A. Well, with no other explanation, no explanation
 22 due to rainfall coming in, that means that there
 23 must have been -- no change -- no change in
 24 temperature indicating a change in the
 25 evapotranspiration, this has to be due to an

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1 increase in consumptive use.
 2 Q. Doctor, what steps did you take to assure
 3 yourself that this was a fair comparison?
 4 A. Oh, yes. So, I mean, I looked at all --
 5 obviously looked at all the discharge records,
 6 looked at the precipitation records. And
 7 obviously every year is different. So it's not
 8 that they are perfectly overlapped. But in
 9 looking at all the data, these are quite
 10 reasonable years to make this comparison.
 11 Q. Now, I know there's been so many numbers flying
 12 around. Is this the product of -- is table 1 the
 13 product of a modeling exercise?
 14 A. No. These are data. These are just objective
 15 data taken from the Livneh dataset and the USGS
 16 discharge data.
 17 Q. What's the Livneh dataset?
 18 A. I'm sorry. The Livneh dataset is this gridded
 19 dataset that can be downloaded from the NOAA
 20 website. And it is basically the scaling of
 21 objective rainfall data to a grid to make it
 22 useful for watershed studies. And Livneh was the
 23 lead author of the -- of the data product.
 24 Q. I have heard you mention grid a few times. What
 25 is the relationship between gridded climate data

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1 and rain gages?
 2 A. So the rain -- so rain gages are a point
 3 measurement. So perhaps we have all seen rain
 4 gages. It's a cylinder. It's a bucket.
 5 The way that NOAA uses it, makes the
 6 measurement, it's 8 inches in circumference. It
 7 captures the rain and records the rain. So it's
 8 a point measurement.
 9 And the -- point measurements are great.
 10 That's what we can do. It's about the only thing
 11 we can do. But, again, we all know from
 12 experience that it can even be raining on one end
 13 of Portland and not the other. And so there are
 14 some limitations with point measurements.
 15 And so to overcome this, we like to use a
 16 whole series of rain gages and, basically for
 17 studies such as I have done, to interpolate to a
 18 gridded basis to account for -- we can never
 19 fully account for some of the variability in the
 20 rainfall field; but to the extent that we can,
 21 that's the best we can do.
 22 Q. Earlier today you, in response to one of
 23 Ms. Allon's questions, referred to two different
 24 kinds of droughts. One I think you said was
 25 meteorological; and the other was hydrological,

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1 if I have that right. Could you explain those
 2 two types of droughts and the distinction between
 3 them?
 4 A. Yes. So when we talk about a meteorological or
 5 climatological drought, that has to do with
 6 rainfall coming in. It's, if you will, what
 7 nature gives us. And if nature doesn't give us
 8 too much, that's a meteorological drought.
 9 From the table we were just looking at, we
 10 could see that the level of meteorological
 11 drought in 1954-1955 was slightly higher than
 12 2011-2012; but 2011-2012 also had low rainfall.
 13 On the other hand, a hydrological drought
 14 incorporates not only what nature gives us but
 15 what we take way, i.e., what human appropriation
 16 of water consumes. And that's reflected
 17 hydrologically.
 18 And so the hydrological drought is reflected
 19 in the June to September streamflow on this
 20 table. In other words -- and that's part of my
 21 comparison. There is no reason to think that
 22 there's a more extreme meteorological drought in
 23 2011-2012. In fact, quite the opposite. But
 24 nevertheless, there's a big hydrological
 25 difference. And so we could conclude that in

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1 **2011-2012 there definitely was a hydrological**
 2 **drought, but we attribute that to consumptive**
 3 **use.**
 4 **Q.** And what is the importance of this distinction to
 5 this case?
 6 **A.** **The way I look at it, the meteorological drought,**
 7 **what nature gives us, is really fairly what we**
 8 **should be thinking of as the available quantity**
 9 **of water and not the hydrological response, which**
 10 **already incorporates everything that's been taken**
 11 **out.**
 12 **Q.** Doctor, I think you're aware that Dr. Bedient, an
 13 expert for Georgia, argues that the lower flows
 14 the last 16 years are because of low rainfall.
 15 What is your response to that argument?
 16 **A.** **One -- all one has to do is look at the rainfall**
 17 **for modern years. And you see that that -- that**
 18 **just doesn't make sense.**
 19 **Dennis Lettenmaier -- Dr. Lettenmaier is**
 20 **another expert in this case; and he'll be**
 21 **testifying next week, I believe. And he is an**
 22 **expert on climate.**
 23 **I have looked at the data. I have calculated**
 24 **what is called a standardized precipitation**
 25 **index. It's a technical term, but it's basically**
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1 **a measure of the rainfall. And one can see that**
 2 **there really isn't any systematic change in**
 3 **rainfall. And Dr. Lettenmaier has done extensive**
 4 **analyses and come to the same conclusion.**
 5 **So I certainly do not believe that the**
 6 **differences between the 1954, the historical**
 7 **period, and the modern period can be explained by**
 8 **climate changes.**
 9 **Q.** Sir, what would you ascribe those changes to
 10 between those historic droughts and the modern
 11 droughts?
 12 **A.** **There isn't any conclusion that I think anyone**
 13 **who objectively looks at this can come to save**
 14 **that it is consumptive use in the ACF Basin.**
 15 **Q.** And for what purpose did you use -- I'm going to
 16 turn now to one of the models. For what purpose
 17 did you use the PRMS model that you -- that you
 18 had some questions on this morning?
 19 **A.** **So, again, the rainfall runoff models are tools**
 20 **that we use. And in this case, it's a tool that**
 21 **we use to detect change. And the way we do that**
 22 **is to follow the water.**
 23 **So the model computationally keeps track of**
 24 **how much water is coming in. It does**
 25 **calculations as to how much water is going out by**
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1 **evapotranspiration, by -- not by consumptive use**
 2 **because I only used it for natural conditions,**
 3 **evapotranspiration, how much is in the -- goes to**
 4 **the stream.**
 5 **And so what I did was to calibrate that**
 6 **model. And, in particular, my calibration had a**
 7 **focus on low flows because we are most concerned**
 8 **in this case not with overall flows, not with**
 9 **peak flows caused by hurricanes, let's say, but**
 10 **by -- we're concerned with the low flows. And so**
 11 **I calibrated with particular attention to the low**
 12 **flows.**
 13 **One can then use a calibrated model and**
 14 **extend that into the post -- post-calibration**
 15 **period, the post-impact period. And you get a**
 16 **calculation of what the flow would have been --**
 17 **it's a calculation -- an estimate of what the**
 18 **flow would have been had there not been increases**
 19 **in consumptive use.**
 20 **And so what we can do with that is then look**
 21 **at those differences, look at that change**
 22 **detection. Did the change occur? Yes. If it**
 23 **did, we can use those -- that modelled output to**
 24 **calculate what the magnitude of that change is.**
 25 **Q.** I heard you use the word tools or tool there a
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1 couple times. What does that term mean to a
 2 hydrologist?
 3 **A.** **So it's basically a methodology. It is a method**
 4 **of doing a calculation. Typically these are**
 5 **encoded in computer languages.**
 6 **Q.** Did -- to what extent did you apply different
 7 tools, different methodologies in your work
 8 for -- on this case?
 9 **A.** **So -- oh, of course, we -- as we just discussed,**
 10 **we looked at data very much, as much as we could**
 11 **in every way that we could think of to look at**
 12 **the data because we really believed that the data**
 13 **formed the bedrock. But -- we used the PRMS**
 14 **model; but we also looked at the calculation -- I**
 15 **looked at calculations that other people did.**
 16 **And so Dr. Lettenmaier also exercised a**
 17 **model. He has a model that's called the variable**
 18 **infiltration capacity model or VIC. And he finds**
 19 **very similar things.**
 20 **We looked -- I looked at -- there was a paper**
 21 **by Jaramillo and Destouni, J A R A M I L L O and**
 22 **D E S T O U N I. These are the names of the**
 23 **people. This was a paper -- a report published**
 24 **in Science magazine, one of the top scientific**
 25 **journals in the world. And quite independently,**
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1 they looked at basins around the world. And they

2 came to a very similar conclusion that I did with

3 my modeling and a very comparable level.

4 So we have a series of models. And the --

5 all of these models point to the same result.

6 And all of them agree with multiple ways we

7 looked at the data as well. So we -- we tried to

8 build this as a -- almost a weight of evidence.

9 We looked at every avenue to see if there were

10 differences. And amazingly, everything kept

11 pointing to the -- roughly the same impact.

12 Q. And you mentioned with regard to the PRMS -- can

13 I call it the PRMS --

14 A. Yes.

15 Q. -- P R M S?

16 With regard to the PRMS model, a technique

17 called change detection. What is that?

18 A. So in hydrology, as I say, what we do is if we

19 think there's been a change in the record, we --

20 this is a typical hydrology methodology. We

21 calibrate the model before we think there's been

22 any change and forecast going forward and compare

23 what actually happened -- that's the data -- with

24 what the model calculates. And one can then look

25 at these differences.

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1 And, of course, you know, differences between

2 model and data will bounce around. It's not --

3 models aren't perfect. But we can basically look

4 and see if there is a statistically significant

5 change. We refer to that as change detection.

6 Q. And you mentioned a phrase called water balance.

7 Does that have any relevance to your PRMS?

8 A. Yes. So the PRMS is a water balance model. A

9 water balance model -- we have very few things.

10 Hydrology may seem complex; but on my first day

11 of class for undergraduates I try to convince

12 them, look, a water balance is just like

13 accounting. You keep track of what comes in.

14 You keep track -- it's like a bank account. You

15 keep track of what's there, and you keep track of

16 what's coming out. That's called a water

17 balance.

18 And the PRMS model is just a methodology, a

19 calculation tool, that helps us keep track of the

20 water in this water balance because it's

21 basically an expression of conservation of mass.

22 Water doesn't appear or disappear without a

23 process.

24 Q. How long have these water balance models been

25 around?

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1 A. So in terms of the computer models, for about 50

2 years. I think Norm Crawford and Ray Linsley

3 first published the Stanford Watershed Model in,

4 if my memory serves me correctly, 1966. And that

5 was -- I think that was the very first digital

6 computer model for a basin for a water balance.

7 Q. I'm sorry. You mentioned a gentleman. Who was

8 that?

9 A. Oh, Crawford did his Ph.D. at Stanford; and

10 Professor Ray Linsley was a famous hydrologist at

11 Stanford at the time.

12 Q. And turning back to your particular model, how

13 could one use your PRMS model to make an estimate

14 of the impacts to the rivers from Georgia's

15 consumption?

16 A. So we -- basically we followed the procedure that

17 I just said, do change detection, find what the

18 level of change is, and say that really is a

19 consumptive use. We then have to, of course, do

20 some accounting because the ACF isn't 100 percent

21 in Georgia. And so one has to account for the

22 non-Georgia part. One has to account for added

23 evaporation from federal reservoirs.

24 And so, again, it's still a -- it's still in

25 the level of accounting to do this calculation or

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1 back-calculation as to what the consumptive use

2 must have been.

3 Q. I would like to turn your attention, Doctor, to

4 table 8 in your prefiled direct.

5 We'll pull that up on the screen. I know

6 you're familiar with that.

7 Why did you put this table together?

8 A. I used this table basically to illustrate for the

9 years that I show what the -- again, remember,

10 the streamflow depletion is the piece that isn't

11 flowing due to consumptive use. And so I wanted

12 to illustrate the magnitude of the streamflow

13 depletion due to consumptive use. And what you

14 see is there are many thousands of cfs.

15 Q. With reference to your table, could you fill that

16 in a little bit for perhaps the last cycle of

17 drought?

18 A. So, again, if we look at, as a sample, 2012, we

19 see 3,400 cfs depletion from June to September.

20 That's an average. And you see a maximum of

21 almost 4,000 -- 3,900 cfs, which is a

22 considerable amount of water, especially at low

23 flow.

24 Q. And where -- where on your map over here is that

25 water supposed to be?

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1 **A. Right here at Chattahoochee, the Chattahoochee**
 2 **Gage, Chattahoochee, Florida, where the basin**
 3 **drains into Florida.**
 4 **Q.** And in your opinion, why isn't it there in 2012?
 5 **A. In my opinion, again, there is no reason to think**
 6 **that the numbers like this for roughly 4,000 cfs**
 7 **should be there except for consumptive use of**
 8 **water in Georgia.**
 9 **Q.** And could you describe with reference to your
 10 findings here in table 8 -- describe what your
 11 findings are for 2011.
 12 **A. Oh, yes. So 2011 -- I'm sorry. So in 2011 it's**
 13 **a similar calculation, 4,200 cfs for the June to**
 14 **September, and a peak depletion of 5,300 cfs.**
 15 **Q.** And I think, Doctor, you understand that Florida
 16 is asking for a remedy from the Court on the
 17 order of 2,000 cfs. Right?
 18 **A. Yes.**
 19 **Q.** And how does -- that request from Florida, how
 20 does that relate to the overall depletions that
 21 you ascribed to the State of Georgia?
 22 **A. Well, in its -- from this table, it would be**
 23 **roughly half in drought years and certainly**
 24 **hydrologically feasible.**
 25 **Q.** And have you formed an opinion as to whether it's

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1 a reasonable request?
 2 **A. In my estimation it's very much a hydrologically**
 3 **reasonable request.**
 4 **Q.** Could we turn to table 7 of your prefiled direct.
 5 And here, I think maybe you described some of
 6 this, but I thought it might be useful to put
 7 this up just for a minute and have you speak to
 8 it.
 9 Why did you prepare table 7, Doctor?
 10 **A. Yes. So, again, you know, what I wanted to do**
 11 **was -- in science, of course, you're always**
 12 **concerned about whether your results are**
 13 **consistent with anything that is related -- done**
 14 **by others. And so in this table you can see that**
 15 **Dr. Lettenmaier gave me the first things there.**
 16 **I already said the VIC, variable infiltration**
 17 **capacity, model is one that he uses. And I also**
 18 **mentioned Jaramillo and Destouni, which is a**
 19 **completely independent estimate. And Jaramillo**
 20 **and Destouni had produced their result in terms**
 21 **of an average from 1953 to -- it's either 2012 or**
 22 **2011. I would have to check.**
 23 **So we wanted to convert everything to a**
 24 **common basis. So we did that. We did the**
 25 **average from 1953 to 2012. And it's very**

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1 **reassuring to me the similarity of all these**
 2 **numbers. That gives me high confidence that the**
 3 **results that I got from PRMS is very close to**
 4 **what we refer to as an ensemble average.**
 5 **We -- in hydrology we find that if we have**
 6 **multiple models, the average of the ensemble of**
 7 **models is often a very, very good -- it's a very**
 8 **good forecast.**
 9 **Q.** Doctor, you mentioned a common basis that went
 10 into creating table 7. Could you just explain
 11 the differences in the numbers between table 7
 12 and table 8?
 13 **A. Yes. So the -- good point. So in table 7 this**
 14 **is an average over what is a 60-year period**
 15 **roughly. So that 60-year average will include**
 16 **years in the 1970's and even the 1980's when**
 17 **the depletions would have been much smaller than**
 18 **they are in recent years. And so the numbers**
 19 **in table 7 reflect that. That is a long-term**
 20 **average.**
 21 **And if we were to transpose those to the**
 22 **figures in table -- or the figures roughly in**
 23 **table 8, they would all be comparable.**
 24 **Q.** I would like to go back to your February 29
 25 expert report, figure A.7, and have that pulled

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1 up. That was in Ms. Allon's binder this morning.
 2 And figure A.7 -- appendix 7 -- let me just
 3 ask you a prefatory question, which is this is
 4 about the calibration of the PRMS. Why did you
 5 recalibrate the PRMS model?
 6 **A. So -- yes. So Ms. Allon referred to the USGS**
 7 **PRMS model. Often, and especially if you really**
 8 **are interested in the highest flows, that's what**
 9 **you focus on matching in a calibration procedure.**
 10 **Because we were very interested in low flows,**
 11 **we wanted to have a balance between high flow**
 12 **calibration and low flow calibration. And we**
 13 **really focused strongly on getting the low flows**
 14 **to be representative as well as we could because**
 15 **we knew that that's really what this matter is**
 16 **all about.**
 17 **Q.** And did you accomplish that to your satisfaction?
 18 **A. Yes, yes. We worked at it and -- there is the**
 19 **exhibit, the figure that's up now. And what you**
 20 **see here is a statistic that is often used to**
 21 **indicate low flows, and it's called the 7-day low**
 22 **flow. So we look through the summer period, and**
 23 **we look for the week where the flow on average**
 24 **was the lowest. And that -- we refer to that as**
 25 **the 7-day low flow. And that's a statistic that**

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1 **is used -- a metric that is used in a lot of**
 2 **regulations even.**
 3 **And so we -- we looked at that as an**
 4 **indicator of how we were doing with low flows.**
 5 **And what you're seeing is the differences between**
 6 **the model and the observed -- that's on the**
 7 **vertical axis -- versus the year. And I have**
 8 **highlighted in red the -- where the -- where we**
 9 **had low flow conditions, where you observed 7-day**
 10 **low flow was less than 7,000 cfs. And what you**
 11 **see is that the -- the model differences -- the**
 12 **differences between model and observed is**
 13 **actually quite small for those particular years.**
 14 **In other words, we were doing a good job in the**
 15 **low flow years.**
 16 **Q.** And for some of the larger differences on the
 17 blue bars, what is driving the differences in
 18 those years?
 19 **A.** **Well, I know for a fact from looking at some of**
 20 **the information, if you recall -- this is, of**
 21 **course, in Florida; and Florida is subject to**
 22 **hurricanes. And some of these occurred at times**
 23 **when the flow in the Apalachicola -- the recorded**
 24 **flow was very large, indeed.**
 25 **And, again, we weren't really trying to only**
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1 **Q.** So you mentioned 7-day low flows as a metric.
 2 **A.** **Yes.**
 3 **Q.** What do you mean by that?
 4 **A.** **By a metric all I mean is that it's often used**
 5 **as -- even in regulation, as an indicator of**
 6 **value that you don't want to fall below, as an**
 7 **example.**
 8 **Q.** And you mentioned that those metrics show up in a
 9 lot of regulations. What kind of regulations?
 10 **A.** **Oh, they show up, for example, in some EPA**
 11 **regulations looking at water quality concerns.**
 12 **And so when there's permitting done for**
 13 **discharges, it often relates -- it refers to the**
 14 **7-day low flows.**
 15 **Q.** Are you familiar with the Flint River Plan?
 16 **A.** **Moderately so. I didn't commit it to memory.**
 17 **Q.** That's JX-21. It's a --
 18 MR. SINGARELLA: If you can hand that
 19 out.
 20 Thanks.
 21 May I approach, your Honor?
 22 THE WITNESS: I think you can see, your
 23 Honor, why I didn't commit it to memory.
 24 BY MR. SINGARELLA:
 25 **Q.** Can we turn to -- and you recognize this as the
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1 **focus on the high flows. We weren't building a**
 2 **hurricane model. We were building primarily a**
 3 **low flow model.**
 4 **Q.** And why weren't you building a hurricane model?
 5 **A.** **Perhaps we should have been to avoid hurricane**
 6 **damage, but that didn't seem to be the focus of**
 7 **this case. The focus of this case -- we don't**
 8 **want more water during times when the flow is**
 9 **extremely high. Obviously, nobody wants a flood.**
 10 **But Florida really needs more water during low**
 11 **flow times, and we were particularly interested**
 12 **in change in those times.**
 13 **Q.** And does the State of Georgia rely on rainfall
 14 run-off modeling in its regulatory document?
 15 **A.** **Yes, yes, yes. Everyone does. This is the way**
 16 **hydrologists do work.**
 17 **Q.** Are you familiar with the Flint River Plan?
 18 **A.** **Yes, yes. They -- they report in that plan**
 19 **rainfall runoff model.**
 20 **Q.** And how does your calibration stack up against
 21 the calibration for the rainfall runoff model
 22 incorporated into Georgia's official plan?
 23 **A.** **At the risk of patting myself on the back, I**
 24 **looked at the results and think that we have done**
 25 **a much better calibration.**
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1 Flint River Plan --
 2 **A.** **Yes.**
 3 **Q.** -- that you studied in this case?
 4 **A.** **Yes.**
 5 **Q.** Can we turn to page 22, please. Are you familiar
 6 with the State of Georgia's technical findings in
 7 the Flint River Plan?
 8 **A.** **Yes, I am.**
 9 **Q.** If I can turn your attention to the third
 10 technical finding there.
 11 **A.** **Yes.**
 12 **Q.** Just take a quick look to refamiliarize with
 13 that.
 14 **A.** **Yes, absolutely.**
 15 **Q.** In the -- in the second sentence, there's a
 16 reference to low flow criteria established by the
 17 federal agency?
 18 **A.** **Yes, the U.S. Fish and Wildlife Service.**
 19 **Q.** Are you familiar with those low flow criteria?
 20 **A.** **Yes. Actually, I -- the -- yes, I am. I am**
 21 **familiar with those criteria.**
 22 **Q.** And what are they, Doctor?
 23 **A.** **So these are, again, people who got together,**
 24 **U.S. Fish and Wildlife Service; I believe, if I'm**
 25 **not mistaken, there was input from the EPA and**
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1 **the state agencies as well, but definitely the**
 2 **Fish and Wildlife Service. And they basically**
 3 **looked at what flows -- what flows were needed to**
 4 **be protective of the ecosystem services.**
 5 Q. And which ecosystem services were the subject of
 6 those criteria?
 7 A. **So they were looking at aquatic habitat. They**
 8 **focused on things like, as I recall, mussels,**
 9 **other species.**
 10 Q. And what is your understanding with regard to the
 11 use of the word established here in the Flint
 12 River Plan with reference to those low flow
 13 criteria?
 14 A. **I think that the U.S. Fish and Wildlife Service**
 15 **put these criteria forward. They established**
 16 **them.**
 17 Q. And later on down in that finding, there is an
 18 interesting word, magnified, in that last
 19 sentence. Do you see that?
 20 A. **Yes.**
 21 Q. The effect is magnified. What is your
 22 understanding as to this finding here in the
 23 State of Georgia and their point about the
 24 magnification?
 25 A. **So, you know, natural systems, as we say, the**
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1 **climate -- rainfall is -- we have low rainfall**
 2 **years; and we have high rainfall years. So we**
 3 **will always have hydrological drought even**
 4 **corresponding to meteorological drought. But**
 5 **what is happening there is referring to the fact**
 6 **that it gets magnified. The impacts get**
 7 **magnified of hydrological drought due to human**
 8 **appropriation of water, i.e. -- and consumptive**
 9 **use, basically what I call consumptive use.**
 10 **Water is taken out and, therefore, it's not**
 11 **available to flow in the stream.**
 12 Q. And are your findings consistent, inconsistent
 13 with the State of Georgia's finding here in
 14 No. 3?
 15 A. **Totally consistent.**
 16 Q. Let's perhaps turn our attention to the low flow
 17 criteria being referred to here.
 18 MR. SINGARELLA: May I approach, your
 19 Honor?
 20 BY MR. SINGARELLA:
 21 Q. This document is FX-599 marked as a trial
 22 exhibit. It was featured in Mr. Perry's opening.
 23 What are these -- do you know, sir, whether
 24 these are the guidelines referred to in the Flint
 25 River Plan?
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1 A. **Yes, I believe they are.**
 2 Q. The ones having been established by the federal
 3 agencies?
 4 A. **Yes. And I also see them as correct that they**
 5 **were coordinated with U.S. Geological Service,**
 6 **the Biological Resources Division, EPA, and the**
 7 **agencies of Alabama, Florida, Georgia as well as**
 8 **the Nature Conservancy.**
 9 Q. And what is the significance of that to you?
 10 A. **Well, I think that people agreed that these**
 11 **were -- these established criteria were very**
 12 **reasonable measures, metrics to use for**
 13 **evaluating where we needed to be.**
 14 Q. And could I invite your attention to that first
 15 sentence. I don't want to belabor it, but there
 16 is a reference to the final version. Do you see
 17 that, sir?
 18 A. **Yes, yes. In the first sentence they're**
 19 **providing the enclosed final version.**
 20 Q. I don't know if it needs interpretation, but what
 21 is your interpretation of that first sentence?
 22 A. **Typically, I think of a final version as being**
 23 **one that is not going -- that they don't envision**
 24 **revisiting. It's the final version. It's what**
 25 **they believe, what they put out there.**
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1 Q. I'm sorry to belabor it, but there has been
 2 apparently some debate over that in this case.
 3 A. **Ah.**
 4 Q. Let me invite your attention to the last sentence
 5 of the second paragraph here on the screen. Do
 6 you see how the authors refer to these guidelines
 7 as having some relevance to flow regime features?
 8 A. **Yes, yes.**
 9 Q. What does that mean to a hydrologist?
 10 A. **So flow regime features really means having**
 11 **appropriate flows, particularly at critical**
 12 **times. They refer to structure and function of**
 13 **the riverine ecosystem. And so there are -- I'm**
 14 **not a biologist. There are critters that need a**
 15 **certain amount of flow at certain times of the**
 16 **year to flourish, and that's what they're**
 17 **referring to.**
 18 Q. And then further on down in that same sentence,
 19 there's a reference to maintaining the structure
 20 and function of the riverine ecosystems. Do you
 21 see that?
 22 A. **Yes.**
 23 Q. And what -- what does that mean to you, sir?
 24 A. **Well, you know, structure and function of**
 25 **riverine ecosystems -- ecosystems, as we know,**
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1 **are complex. They're built up of food webs of**
 2 **different species. They can be damaged. We can**
 3 **have die-offs of species. There can be bad**
 4 **things that can happen to riverine ecosystems**
 5 **when, you know, proper flow is not maintained.**
 6 **Q.** And to what riverine ecosystems do these
 7 guidelines apply?
 8 **A. So this is -- this is for the ACT and ACF Basin**
 9 **Interstate Water Allocation Formula. That's what**
 10 **the title is. So it's certainly for the ACF.**
 11 **Q.** All three rivers?
 12 **A. All three rivers, I think.**
 13 **Q.** Top to bottom?
 14 **A. Top to bottom.**
 15 **Q.** Okay. And in this sentence here that you have
 16 been describing to us, it seems that there is
 17 some connection between two disciplines. Are you
 18 familiar with that connection in your discipline?
 19 **A. Oh, yes, very much so.**
 20 **Q.** And what is that?
 21 **A. Well, the connection -- I mean, in many cases**
 22 **it's even a two-way connection. But certainly**
 23 **there is a one-way connection, and that is that**
 24 **hydrology has a significant impact on aquatic**
 25 **ecosystems. You can pick any aquatic ecosystem**

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1 **you want, and hydrology has a large impact. And**
 2 **so there is just this connection, a natural**
 3 **connection.**
 4 **I -- people talk about wetlands protection.**
 5 **There's a whole range of things that**
 6 **hydrologically are, you know, connections to**
 7 **ecosystems. So this is --**
 8 **Q.** And is that -- do you understand that connection
 9 to have relevance to the riverine ecosystem of
 10 the Apalachicola River?
 11 **A. Yes. I believe that -- I know I have spoken with**
 12 **Dr. Allan, who I think has represented**
 13 **opinions -- expert opinions -- he's an**
 14 **ecologist -- that there is a connection and an**
 15 **important connection to the ecosystem.**
 16 **Q.** Can we turn to another slide from Mr. Perry's
 17 opening.
 18 **MR. SINGARELLA:** We'll hand this out.
 19 **BY MR. SINGARELLA:**
 20 **Q.** Are you familiar with the information on
 21 Mr. Perry's slide?
 22 **A. Yes. I have looked at this.**
 23 **Q.** And could you please describe it, sir.
 24 **A. Yes. So this is, again, these guidelines**
 25 **for natural flow regime; and this is for the**

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1 **Apalachicola River at Chattahoochee. The slide**
 2 **that I'm looking at is 1929 to 1953. And**
 3 **these -- the period of record used for the**
 4 **calculation is 1929 to 1953. And what is boxed**
 5 **in in red is what the criteria say for one-day**
 6 **minimum at -- that shouldn't be exceeded. Okay?**
 7 **In other words, it's a minimum one-day that**
 8 **should not be exceeded in all the years.**
 9 **Q.** At what frequency can it be exceeded?
 10 **A. According to the -- these guidelines, never.**
 11 **It's not supposed to be exceeded. This is --**
 12 **this is a very hard criterion.**
 13 **Q.** And based on your understanding of the
 14 guidelines, what happens when these criteria are
 15 exceeded, these floors?
 16 **A. In terms of regulation, I couldn't tell you. I**
 17 **don't know how these are -- or if they're**
 18 **enforced. But from what I know about, for**
 19 **example, what Dr. Allan has reported, there**
 20 **aren't good things that come from exceeding**
 21 **these.**
 22 **Q.** What do you mean by that?
 23 **A. Well, there are -- there are critical habitats.**
 24 **And some of them -- for example, they have these**
 25 **beautiful cypress forests; and they need to be**

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1 **inundated. I traveled down there and had the**
 2 **opportunity to look at some of this, and they're**
 3 **absolutely gorgeous. But if they don't receive**
 4 **high flows at certain times, they get -- they get**
 5 **taken over by other species. And so there --**
 6 **there can be ecological change, ecological harm.**
 7 **But I know that Dr. Allan has talked about**
 8 **mussels -- endangered species being endangered as**
 9 **well.**
 10 **Q.** Can we turn to the next slide of Mr. Perry's
 11 opening.
 12 **MR. SINGARELLA:** We're going to hand this
 13 out.
 14 **A. It's the back side, Paul -- Mr. Singarella.**
 15 **Q.** Oh, it's on the back side of what we already
 16 handed out.
 17 **I'll be. That's great.**
 18 **Doctor, what does this slide from Mr. Perry's**
 19 **opening tell us?**
 20 **A. So what Mr. Perry had assembled in his opening**
 21 **was to look at the discharge records from the**
 22 **U.S. Geological Survey. And he recorded the**
 23 **single-day lowest flow which, you will recall,**
 24 **was the table on the other side told you the**
 25 **critical values that were not to be exceeded**

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1 ever.

2 **By exceeded it's sort of weird because we're**

3 **talking about falling below. We're not supposed**

4 **to fall below certain flow levels, so exceeded in**

5 **that sense.**

6 **And the yellow shading just shows the months**

7 **in which there was at least one violation. At**

8 **least one day was below the -- the specified flow**

9 **in the guidelines.**

10 Q. And did you have an opportunity to look at

11 compliance with these criteria in the historical

12 record?

13 A. **Yes, I did. And they were, again, another**

14 **indicator. They were much, much less. Not that**

15 **they never occurred, but they were much less.**

16 Q. So what is your -- qualitatively your comparison

17 between what we're seeing in the modern period to

18 compliance with these criteria in the decades

19 gone by?

20 A. **So clearly we're violating the compliance**

21 **measures much more frequently, much more**

22 **frequently. And, again, it's all consistent with**

23 **having streamflow depletions of several thousands**

24 **of cfs in these summer periods.**

25 Q. Can we turn to the LFO Plan. That's the Lower

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1 Flint-Ochlockonee Plan. Was that another source

2 of low flow criteria that you relied upon,

3 Doctor?

4 A. **Yes. Yes, I did look at that.**

5 MR. SINGARELLA: We'll hand that out.

6 May we approach the bench?

7 BY MR. SINGARELLA:

8 Q. I invite your attention to table 3-1 in this

9 document. Perhaps it's table 3-1.

10 A. **Table 3-1.**

11 Q. Do you know when this plan was adopted, Doctor?

12 A. **I did look at that. The date on this is**

13 **September 2011. I'm not quite sure when it was**

14 **adopted.**

15 Q. Adopted in the State of Georgia?

16 A. **Yes.**

17 Q. Did it establish targets against which shortfalls

18 and gaps could be determined?

19 A. **Yes, absolutely. That was one of the purposes of**

20 **the -- the plan.**

21 Q. And I invite your attention to table 3-1 of the

22 LFO Plan. I'll call it the LFO Plan, if that's

23 all right with you.

24 A. **Yes.**

25 SPECIAL MASTER LANCASTER: Excuse me,

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1 counsel. Where is that?

2 MR. SINGARELLA: Oh, I'm sorry, your

3 Honor. So we are on page --

4 THE WITNESS: 3-6.

5 MR. SINGARELLA: -- 3-6. Each chapter

6 is -- starts with its own one, just to make

7 sure I get confused.

8 SPECIAL MASTER LANCASTER: Thank you.

9 MR. SINGARELLA: You're welcome, your

10 Honor.

11 BY MR. SINGARELLA:

12 Q. So we're on table 3-1 here in the LFO Plan. And

13 could you describe to me what this shows?

14 MS. ALLON: Your Honor, I'm sorry. I

15 just wanted to make an objection. Not only

16 is this discussion not in Dr. Hornberger's

17 expert report, it's also not in his direct

18 testimony. So this analysis is being

19 presented for the first time right now as

20 well as its source.

21 MR. SINGARELLA: This is an important

22 document that Dr. Hornberger considered in

23 his first report on this case. And what we

24 heard this morning is that everything is

25 fine. There's been no hydrologic change.

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1 And one of the ways that Dr. Hornberger is

2 explaining that everything is not fine is

3 with reference to the objective criteria that

4 he has studied in this case.

5 SPECIAL MASTER LANCASTER: You may

6 proceed.

7 MR. SINGARELLA: Thank you, your Honor.

8 BY MR. SINGARELLA:

9 Q. Doctor?

10 A. **So, I mean, just looking at the table, the**

11 **reason that it's referred to as gaps is they're**

12 **looking basically at an average shortfall of**

13 **water. And then to me what I -- one of the**

14 **things I focused on was the column on the far**

15 **right-hand side, flow regime target. And so this**

16 **is -- this is corresponding to the maximum**

17 **shortfall.**

18 **And what we see is that the target, if you**

19 **will, for the Bainbridge Gage is 2,506. And you**

20 **will recall that the small board that we referred**

21 **to earlier, I had used 2,500. And so the small**

22 **board actually shows the -- the number of**

23 **times -- the frequency with which that target is**

24 **not met.**

25 Q. So turning back to your board, could you describe

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1 with reference to your board the relevance of the
 2 yellow highlighting with regard to this State of
 3 Georgia criterion?
 4 **A. So, again, basically it is showing the frequency**
 5 **with which this criterion is violated. And as I**
 6 **said, yes, there was a very severe drought in**
 7 **1954-'55; and we do see the criterion having been**
 8 **violated there. But, again, what we see from all**
 9 **these yellow-colored blocks is just a tremendous**
 10 **increase in the number of times that -- the**
 11 **number of months in which that criterion is**
 12 **violated, at least one time since 1998 when they**
 13 **started the Bainbridge Gage back up.**
 14 **Q.** The -- let's turn back to another topic from this
 15 morning, which is -- which is the different
 16 models -- the two different models, the data
 17 ResSim model and the Lake Seminole model. And
 18 Ms. Allon suggested, Doctor, that you actually
 19 decided to refer to an inferior model. Doctor,
 20 why would you have done that?
 21 **A. I didn't.**
 22 **Q.** What did you do?
 23 **A. I relied on the Lake Seminole model. The ResSim**
 24 **model is a planning tool. It requires historical**
 25 **data to actually exercise it. And in operation,**

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1 **when the Corps is actually operating, they have**
 2 **information on the day. And so what I wanted to**
 3 **do was to discern as best I could how the Corps**
 4 **exercised discretion that it is granted in the**
 5 **operating rules.**
 6 **So if -- when I think about it, let's say on**
 7 **July 1, 1984, what information the Corps had was**
 8 **the reservoir levels in all the upstream**
 9 **reservoirs, their expected flows into the**
 10 **reservoirs. And then they had the RIOP to**
 11 **calculate what they could release, the minimum**
 12 **flows they had to release.**
 13 **And so the Lake Seminole model is just a one**
 14 **box input-output model taking account of the data**
 15 **that the Corps actually would have had when they**
 16 **made their decision to operate.**
 17 **And we then used what I refer to as a**
 18 **one-step-ahead prediction model and said, well,**
 19 **okay, let's see if the RIOP rules, given all the**
 20 **data they had, actually produced the flows that**
 21 **they really did produce. And that then allowed**
 22 **me to assess, in effect, the extra flow that the**
 23 **Corps released over and above the minimum that**
 24 **the RIOP had.**
 25 **Dr. Shanahan has done an extensive analysis**

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1 **of the ResSim versus how the Corps operates its**
 2 **reservoir system. And the ResSim model simply**
 3 **calculates wildly incorrect values for the**
 4 **volumes of water in the upstream reservoir. So**
 5 **even with the ResSim model, if you are getting**
 6 **close to the right outflow measured, it's for the**
 7 **wrong reason. And so the Lake Seminole model**
 8 **really is to me the true reflection of how the**
 9 **Corps operates.**
 10 **Q.** I would like to invite your attention to a
 11 pleading in this case.
 12 MR. SINGARELLA: May I approach, your
 13 Honor?
 14 BY MR. SINGARELLA:
 15 **Q.** Now, earlier today Ms. Allon seemed to be arguing
 16 that the Army Corps was the cause of the low
 17 flows in the summertime of 2011 and 2012.
 18 I would invite you, Doctor, to turn to page
 19 11 of the State of Georgia's pretrial brief in
 20 this matter. Are you with me, sir?
 21 **A. Yes.**
 22 **Q.** And do you see the second paragraph that begins
 23 with the words, through its operation?
 24 **A. Yes.**
 25 **Q.** Could you just read that sentence to yourself,

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1 sir.
 2 **A. Yes.**
 3 **Q.** And, sir, what is your opinion on this topic?
 4 Is it -- is it the Corps that hurt Georgia
 5 during the summers of 2011 and 2012 or the State
 6 of Georgia itself?
 7 **A. I don't believe that the Corps operates to**
 8 **provide minimum values of flow. They certainly**
 9 **have restrictions as to what they do. But the**
 10 **low flows -- the streamflow depletions are**
 11 **just -- to me, I have absolutely no doubt that**
 12 **this is largely due to consumptive use of water**
 13 **by -- in Georgia.**
 14 **Q.** And Ms. Allon strongly suggested that there has
 15 not been fundamental change of the hydrology of
 16 the Georgia portion of the ACF Basin. What is
 17 your response to that?
 18 **A. I think that it's -- it's just clear, as I said,**
 19 **to anyone that looks at the objective data that**
 20 **there has been fundamental hydrologic change.**
 21 **There just isn't anything around that.**
 22 **Q.** Thank you, Doctor.
 23 MR. SINGARELLA: Thank you, your Honor.
 24 SPECIAL MASTER LANCASTER: Recross?
 25 MS. ALLON: Very brief, your Honor.

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1 REXCROSS EXAMINATION

2 BY MS. ALLON:

3 **Q.** Dr. Hornberger, on redirect just now you

4 testified that you understand Florida is asking

5 for a remedy from this Court of about 2,000 cfs.

6 Is that right?

7 **A. That's what I understand.**

8 **Q.** And you understand that Dr. Sunding, Florida's

9 economist, has proposed in his direct testimony

10 conservation scenarios that he claims could

11 generate somewhere between 1,500 to over 2,000

12 cfs. Right?

13 **A. Yes.**

14 **Q.** And you discussed that in your direct testimony;

15 is that right?

16 **A. Yes.**

17 **Q.** Okay. Let's turn briefly to that discussion.

18 It's at page 56, paragraph 123 of your direct

19 testimony.

20 **A. I'm sorry. Could you repeat the page?**

21 **Q.** Page 120 -- page 56, paragraph 123.

22 **A. Okay. I have it.**

23 **Q.** And if you look at about two sentences from the

24 bottom of that paragraph, your testimony is that

25 you believe the scenarios of 1,500 to over 2,000

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1 cfs of measures Dr. Sunding proposed in his

2 testimony falls somewhere between the two model

3 runs I just discussed. Do you see that?

4 **A. Yes.**

5 **Q.** And the reason you say you believe is because you

6 never actually modeled the scenarios Dr. Sunding

7 discusses in his direct testimony. Isn't that

8 right?

9 **A. That is correct.**

10 **Q.** And let's go back briefly to demonstrative No. 5

11 that we looked at this morning and that is in the

12 binders, slide No. 5. And we discussed this

13 morning that slide 5 represented five consumption

14 cap scenarios that you modeled. Right?

15 **A. Yes.**

16 **Q.** And if we look at slide 5, we can see that you

17 did model a conservation scenario from

18 Dr. Sunding of 1,000 cfs. Right?

19 **A. Yes.**

20 **Q.** But you never modeled his 1,500 or his 2,000 cfs

21 scenarios. Right?

22 **A. Right.**

23 **Q.** You modeled five different consumption cap

24 scenarios, but you didn't model any of the

25 scenarios Florida actually proposes to this Court

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1 as a remedy. Isn't that right?

2 **A. Wait. I modeled a range of scenarios that were**

3 **hydrologically demonstrable. They were**

4 **illustrative. But you are right. I did not**

5 **model explicitly Dr. Sunding's 1,500 and 2,000**

6 **scenario.**

7 MS. ALLON: Thank you, your Honor.

8 Nothing else.

9 MR. SINGARELLA: Nothing further, your

10 Honor.

11 SPECIAL MASTER LANCASTER: Doctor, will

12 you bear with me? I'm a laymen in terms of

13 ecology. For example, I never heard of

14 riverine until today. What is a riverine

15 ecosystem?

16 THE WITNESS: Riverine is just a word

17 that refers, as you might anticipate, to

18 rivers and streams. So they're ecosystems

19 associated with -- with surface water,

20 flowing surface water.

21 SPECIAL MASTER LANCASTER: Thank you.

22 Would you turn to -- let me find it, if

23 I can. Bear with me for a minute, if you

24 will.

25 I'm looking at your prefled direct

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1 testimony.

2 Sorry. I should have been better

3 prepared. But somewhere in there there's an

4 exhibit that shows your conclusions about the

5 low flow. Do you remember that one?

6 THE WITNESS: It was probably near the

7 table.

8 SPECIAL MASTER LANCASTER: Yes, one of

9 the tables.

10 THE WITNESS: Yes. It could have been

11 either table 1, which is on page 20, or

12 table 8 that is on page 46.

13 But it -- I thought you said the

14 prefled direct. I'm sorry, your Honor.

15 That's my February 29 report that you're

16 looking at.

17 Did you mean the February 29 report or

18 the prefled direct?

19 SPECIAL MASTER LANCASTER: If I knew, I

20 would be there.

21 It's the one in which you show the low

22 flow for May through -- whatever it is, May

23 through September.

24 THE WITNESS: June through September,

25 your Honor. There is a table in the prefled

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1 direct that's table 8.
 2 SPECIAL MASTER LANCASTER: And what page
 3 is that on?
 4 THE WITNESS: That would have been
 5 page 46. But it's in the prefiled direct,
 6 not in the February 29 report. You're
 7 looking at the February 29 report right now.
 8 I think it's at the beginning of that
 9 binder.
 10 There it is.
 11 SPECIAL MASTER LANCASTER: Okay. It's
 12 right here.
 13 Again, this will show you how little I
 14 know. I have lived in Maine all my life, and
 15 I have never seen a drought until this year.
 16 And we were -- we have a large field outside
 17 our house. It turned brown. And then
 18 suddenly in October we got deluged; and we
 19 got more rain in October than we had all year
 20 long, and everything is green again.
 21 So my question to you is are your
 22 measurements based upon seasonality?
 23 THE WITNESS: By their very nature,
 24 looking at months, of course, we do see that
 25 in our records. Typically, it's later in the

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1 autumn but -- that the flows start to go up
 2 in the Apalachicola.
 3 SPECIAL MASTER LANCASTER: Well, look at
 4 2011 and 2012 --
 5 THE WITNESS: Right.
 6 SPECIAL MASTER LANCASTER: -- for
 7 example. If you measure solely from May
 8 down, aren't you going to get a different
 9 result than if you measure all year?
 10 THE WITNESS: Yes. So we measure all
 11 year. But this table simply summarizes what
 12 the measurements say for May through -- or
 13 June through September because that's the --
 14 we think the critical timing, the critical
 15 time for the river ecosystem.
 16 SPECIAL MASTER LANCASTER: Well,
 17 diagnosing causal factors of changes at the
 18 ecosystem level is difficult; isn't it?
 19 THE WITNESS: Yes.
 20 SPECIAL MASTER LANCASTER: Very?
 21 THE WITNESS: Yes.
 22 SPECIAL MASTER LANCASTER: And so does
 23 it make a difference in a given year if
 24 there's a drought, and you're measuring
 25 during a period when there is a drought?

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1 THE WITNESS: Yes, your Honor. And, of
 2 course, the other table that we referred to,
 3 that's one of the reasons why I looked at the
 4 1954-1955 drought, really a very significant
 5 drought, the drought of record, versus
 6 2011-2012. So we're doing a fair comparison
 7 between droughts that occurred in the past
 8 and the droughts that occur now. And we're
 9 seeing the strong lowering, the much lower
 10 discharges in the river.
 11 SPECIAL MASTER LANCASTER: Do you see my
 12 concern? You concluded that Georgia's
 13 consumptive use is affecting the flow; but
 14 you're only measuring from May to September
 15 or whatever the year -- the month is.
 16 THE WITNESS: Again, your Honor, of
 17 course, the measurements go year-round and
 18 they're continuous.
 19 SPECIAL MASTER LANCASTER: But your
 20 opinion was based on data?
 21 THE WITNESS: Correct. Correct. And
 22 the data go all year. It's just that I
 23 excised from the data the results for the
 24 critical period for the ecosystem June
 25 through September.

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1 SPECIAL MASTER LANCASTER: And why did
 2 you determine that that was the critical
 3 period?
 4 THE WITNESS: So the seasonality you
 5 mentioned, even in Maine, of course, you tend
 6 to get at least a little drier, not brown,
 7 but still green. But the rivers -- the river
 8 flow is lower in the summer because the sun
 9 is out, and you're getting
 10 evapotranspiration. So the flow is lower in
 11 the summer than it is in the winter. And so
 12 that seasonality in the temperate zone all up
 13 and down the East Coast is prevalent. And,
 14 yet, in the summer, the summertime is when
 15 all of the critters in the river grow. And
 16 so what they're sensitive to -- the most
 17 sensitive to is the flow in the river in this
 18 period that I chose to look at.
 19 SPECIAL MASTER LANCASTER: But you
 20 concluded that it was Georgia's --
 21 THE WITNESS: Consumptive use, yes, sir.
 22 SPECIAL MASTER LANCASTER: Precipitation
 23 level, aspiration level, all of those things
 24 affect it?
 25 THE WITNESS: All of those things affect

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1 it. And that's why we had to do this water
 2 balance that I talked about. So we take into
 3 account the natural values of precipitation,
 4 of evapotranspiration. And what's left over
 5 is what we can't explain by those natural
 6 processes. And so it's the -- the only thing
 7 left to explain that difference is increased
 8 consumptive use because humans are taking
 9 water out of the system.
 10 SPECIAL MASTER LANCASTER: Counsel?
 11 MS. ALLON: Nothing further, your Honor.
 12 MR. SINGARELLA: Nothing else, your
 13 Honor.
 14 SPECIAL MASTER LANCASTER: Thank you.
 15 THE WITNESS: Thank you, sir.
 16 SPECIAL MASTER LANCASTER: Thank you,
 17 especially for telling me what a riverine
 18 estuary is.
 19 MR. PRIMIS: Your Honor, is this a good
 20 time for the afternoon break?
 21 SPECIAL MASTER LANCASTER: Certainly.
 22 (Time Noted: 2:26 p.m.)
 23 (Recess Called)
 24 (Time Noted: 2:37 p.m.)
 25 MR. LEOPOLD: Good afternoon, your Honor.
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1 SPECIAL MASTER LANCASTER: Good
 2 afternoon.
 3 Counsel, for the record, before we
 4 start, the reference that I was trying to
 5 find and couldn't is on page 20 of
 6 Dr. Hornberger's direct testimony. It's
 7 table 1. And he had described it as bedrock
 8 data. That's just for the record.
 9 MR. LEOPOLD: Thank you very much, your
 10 Honor.
 11 Your Honor, Florida would like to call
 12 Mr. Brett Cyphers to the stand.
 13 THE CLERK: Please raise your right
 14 hand.
 15 Do you solemnly swear that the testimony
 16 you shall give in the cause now in hearing
 17 shall be the truth, the whole truth, and
 18 nothing but the truth, so help you God?
 19 THE WITNESS: I do.
 20 THE CLERK: Please be seated.
 21 Pull yourself right up to the microphone
 22 and please state your name and spell your
 23 last name.
 24 THE WITNESS: Sure. My name is Brett
 25 Jason Cyphers. It's spelled B R E T T,
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1 J A S O N, C Y P H E R S.
 2 MR. LEOPOLD: May I approach, your
 3 Honor?
 4 SPECIAL MASTER LANCASTER: Please.
 5 DIRECT EXAMINATION
 6 BY MR. LEOPOLD:
 7 Q. Mr. Cyphers, I handed you your prefiled direct
 8 testimony submitted in this case. Do you adopt
 9 this as your sworn testimony here today?
 10 A. Yes, sir.
 11 MR. LEOPOLD: Thank you. I tender the
 12 witness.
 13 MR. ALLEN: Good afternoon, your Honor.
 14 SPECIAL MASTER LANCASTER: Good
 15 afternoon.
 16 CROSS-EXAMINATION
 17 BY MR. ALLEN:
 18 Q. Good afternoon, Mr. Cyphers.
 19 A. Good afternoon.
 20 Q. My name is Winn Allen. I'm one of the State of
 21 Georgia's lawyers in this case. I have a few
 22 questions to ask you this afternoon about your
 23 written direct testimony, if that's okay.
 24 Mr. Cyphers, you worked at the Northwest
 25 Florida Management District in September of 2012.
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1 Correct?
 2 A. Yes, sir.
 3 Q. That was a few months after you started there, I
 4 believe. Correct?
 5 A. That's correct. I believe I started in June.
 6 Q. Okay. I would like to show you a document from
 7 that time frame.
 8 MR. ALLEN: Your Honor, may I approach?
 9 SPECIAL MASTER LANCASTER: Please.
 10 BY MR. ALLEN:
 11 Q. Here you go, sir.
 12 SPECIAL MASTER LANCASTER: Thank you.
 13 BY MR. ALLEN: For the record, I have
 14 just handed the witness a copy of GX-455.
 15 BY MR. ALLEN:
 16 Q. Mr. Cyphers, do you see in the To: line your name
 17 is listed?
 18 A. I do.
 19 Q. And do you see also Jon Steverson?
 20 A. Yes, sir.
 21 Q. And at this time, Mr. Steverson was the executive
 22 director of the Northwest Florida Water
 23 Management District. Correct?
 24 A. That's correct.
 25 Q. In the From: line there is a -- the first name is
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1 Graham Lewis. Do you see?

2 **A. I do.**

3 **Q.** And Graham Lewis was a hydrologist at the

4 District at this time. Correct?

5 **A. Yes, sir.**

6 **Q.** In the Subject: line of this memo, GX-455, says,

7 water volumes needed to augment Apalachicola

8 River flows for oyster protection.

9 Do you see that, sir?

10 **A. I do.**

11 **Q.** And as we mentioned, the memo is dated September

12 of 2012. Do you see that?

13 **A. I do.**

14 **Q.** And you're aware, sir, that this lawsuit was

15 filed in October of 2013?

16 **A. Yes, sir. I believe so.**

17 **Q.** Okay. So the memo is about -- from about a year

18 before the lawsuit was filed. Fair?

19 **A. So it seems.**

20 **Q.** Now, sir, this memorandum, if you have had a

21 chance to review it, evaluates three scenarios.

22 Fair?

23 **A. I believe so from memory here.**

24 **Q.** Okay. And each of those scenarios examines ways

25 to supplement flows into the Apalachicola River

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1 during the dry season. Correct?

2 **A. That's what it seems, yes, sir.**

3 **Q.** And the memo also evaluates what impact each

4 scenario might have on salinities at Cat Point

5 and Dry Bar. Correct?

6 **A. I see that scenario 2 -- I see the Cat Point, and**

7 **Dry Bar scenario 3 as well.**

8 **Q.** So it's fair to say that the memo evaluates what

9 impact each scenario might have on salinity

10 levels at Cat Point and Dry Bar. Correct?

11 **A. It seems like that's what they wrote in the memo.**

12 **I'm not an expert on these issues though.**

13 **Q.** That seems what the memo is saying. Right?

14 **A. That is what the memo is saying. It seems so.**

15 **Q.** And, sir, I want to just briefly summarize the

16 three scenarios without reading the whole memo.

17 The best way to do it might just be to look at

18 the summary on the bottom of page 2. There's a

19 couple bullets that say scenario 1, scenario 2,

20 scenario 3. Do you see that?

21 **A. I do.**

22 **Q.** Okay. And do you see that scenario 1 examines a

23 20,000 cfs pulse for 30 days during the dry

24 season?

25 **A. I do.**

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1 **Q.** And scenario 2 examines two pulses, 10,000 cfs

2 for 15 days each during the dry season. Correct,

3 sir?

4 **A. That's what it says in the summary; yes, sir.**

5 **Q.** And scenario 3 appears to be a range of pulses

6 ranging from 7,000 cfs in June, 5,700 in July and

7 August, and some other cfs's in some later

8 months. Do you see that, sir?

9 **A. I do see that.**

10 **Q.** Okay. I want to show you a demonstrative we

11 created, and all it is is it's figure 7 from

12 Dr. Hornberger's direct examination. That's all

13 it is. It's nothing new. We have pulled out

14 figure 7 into a demonstrative.

15 MR. ALLEN: Your Honor, may I approach?

16 SPECIAL MASTER LANCASTER: You may.

17 BY MR. ALLEN:

18 **Q.** Have you ever seen this chart before, sir?

19 **A. I'm not sure. I don't believe so.**

20 **Q.** Okay. This is figure 7 from Dr. Hornberger's

21 report. And it reports total monthly consumptive

22 water use in the Georgia ACF Basin from 1923 to

23 2013, and this is as calculated by

24 Dr. Flewelling. Dr. Hornberger just reports it.

25 Now, I'll submit to you these are consumptive

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1 use numbers compiled by Florida's experts.

2 Georgia does not agree with them, but I'm putting

3 them up just to ask you some questions about

4 them. Okay, sir?

5 **A. Okay.**

6 **Q.** Do you see, sir, that in the two highest years --

7 and I'll walk over and point them out in a

8 second -- that there are peaks at around 5,000

9 cfs?

10 **A. I see that on the chart; yes, sir.**

11 **Q.** Right up here, sir?

12 **A. Yes.**

13 **Q.** Okay. And do you also see, sir, that the next --

14 the next lowest down, there are some that -- for

15 total amount of consumptive water use in the

16 Georgia portion of the ACF Basin, they're around

17 4,500 cfs? Do you see that, sir, right here?

18 **A. I do.**

19 **Q.** Okay. And looking back, sir, at GX-455 in the

20 scenarios we discussed, are you aware of any

21 Florida expert in this case that's asking for

22 supplemental flows of 20,000 cfs in the dry

23 months?

24 **A. I wouldn't know.**

25 **Q.** And you're not aware of any expert that's asking

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1 for 10,000 cfs supplemental flows during the dry
 2 months?
 3 **A. Not that I -- not that I'm aware of.**
 4 **Q.** Not that you're aware of.
 5 You're also not aware of any Florida expert
 6 that's asking for 7,000 cfs during June.
 7 Correct?
 8 **A. I'm not sure what they're asking for.**
 9 **Q.** Sir, looking at the same place at the bottom of
 10 page 2 of GX-455, scenario 1 and scenario 2
 11 include some volume calculations. Do you see
 12 that, where it reports some acre-feet?
 13 **A. I do.**
 14 **Q.** And scenario 1 is 1,190,000 roughly acre-feet.
 15 Do you see that?
 16 **A. I see that number; yes, sir.**
 17 **Q.** And scenario 3 is 1,789,884 acre-feet. Do you
 18 see that?
 19 **A. I see that.**
 20 **Q.** Sir, are you aware that those numbers are greater
 21 than the entire conservation volume of Lake
 22 Lanier?
 23 **A. No. No.**
 24 **Q.** And do you see, sir, that at the end of
 25 scenario 3 it says -- in a little bracketed

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1 section it says, this is likely not a reasonable
 2 alternative given volume requirements and should
 3 not be evaluated further. In reality none of
 4 these scenarios are viable given estimated
 5 storage requirements.
 6 Do you see that, sir?
 7 **A. I do.**
 8 **Q.** And you recall, sir, having some discussions, I
 9 believe, with Mr. Lewis about how augmenting
 10 flows in this way would require Florida to build
 11 a reservoir I think -- I think he said the size
 12 of Calhoun County. Is that right, sir?
 13 **A. That was my understanding based on my**
 14 **conversation, yes.**
 15 **Q.** Or Florida would have to construct somewhere
 16 between 8,000 to 10,000 ASR wells?
 17 **A. That was my understanding, yes.**
 18 **Q.** Okay. Thank you, sir.
 19 I want to shift to a different topic now.
 20 Sir, in your prefiled testimony, you say that
 21 most of the irrigated acreage in the Florida
 22 portion of the ACF Basin is in Jackson County.
 23 Right, sir?
 24 **A. Agricultural, yes.**
 25 **Q.** Okay. And on page 10 of your written direct, you

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1 cite FX-862a. And I would like to show you that
 2 document and ask you some questions about it, if
 3 I might.
 4 MR. ALLEN: Your Honor, may I approach?
 5 SPECIAL MASTER LANCASTER: Sure.
 6 BY MR. ALLEN:
 7 **Q.** All right. Sir, if you would turn with me,
 8 please, to page 54.
 9 MR. ALLEN: And, again, for the record,
 10 we're looking at FX-862a, and I'm on page 54.
 11 BY MR. ALLEN:
 12 **Q.** Just let me know when you're there, sir.
 13 **A. I'm on 54 now.**
 14 **Q.** Okay. It's a table A-4 that says Historical and
 15 Projected Irrigated Acreage by County. Do you
 16 see that?
 17 **A. I do.**
 18 **Q.** And, sir, you're aware that this report was
 19 prepared by the Balmoral Group under contract
 20 with FDACS. Correct?
 21 **A. Yes, sir.**
 22 **Q.** And, sir, on page 54 of FX-862a, do you see a
 23 line that says Jackson County -- or just says
 24 Jackson?
 25 **A. I do.**

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1 **Q.** And you will see, sir, that in 2002 the document
 2 reports 13,374 irrigated acreages in -- irrigated
 3 acres in Jackson County. Do you see that?
 4 **A. I do.**
 5 **Q.** And then if you look over at 2015, do you see it
 6 reports 32,378? Do you see that, sir?
 7 **A. I do.**
 8 **Q.** So we can agree, sir, that at least according to
 9 this document, irrigated acreage in Jackson
 10 County more than doubled between 2002 and 2015?
 11 **A. I'm not sure about that calculation. I know that**
 12 **it doubled between -- I believe it was 1987 and**
 13 **2015, I believe.**
 14 **Q.** Okay. But if we just looked at the numbers from
 15 2002 and 2015, do you agree with me that if you
 16 multiply 13,374 by 2, you get a number that's
 17 less than 32,378?
 18 **A. Indeed.**
 19 **Q.** And, sir, if you look at the same county, Jackson
 20 County, year 2012, do you see that?
 21 **A. I do.**
 22 **Q.** And you see 2012 for Jackson County lists 21,508
 23 irrigated acres. Do you see that?
 24 **A. I do.**
 25 **Q.** And, again, in 2015 now, there's 32,378. Do you

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1 see that?

2 **A. I do.**

3 **Q.** That's an increase of 10,000 acres between those

4 two numbers. Right, sir?

5 **A. Between these two numbers, yes.**

6 **Q.** Between those two numbers, that's a 50 percent

7 increase between 2012 and 2015, at least as

8 reported by this document?

9 **A. That's correct on this document.**

10 **Q.** Sir, in your written direct at -- at

11 paragraph 55, you testified that there are

12 about 460 irrigation systems in the Florida

13 portion of the ACF. Correct?

14 **A. Still getting to 55. Just a moment, please.**

15 **Q.** Take your time.

16 **A. Okay. I'm here.**

17 **Q.** And you testified that there are about 460

18 irrigation systems in the Florida portion of the

19 ACF. Correct?

20 **A. Yes.**

21 **Q.** And I believe it's also true that the majority of

22 Florida's water withdrawals in the ACF come from

23 groundwater wells in the Floridan Aquifer.

24 Correct?

25 **A. Yes, that's correct.**

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1 **Q.** And it's also true, sir, that the District has

2 not done a comprehensive groundwater model of the

3 basin to determine the impact those groundwater

4 withdrawals have on streamflow into the

5 Apalachicola River?

6 **A. We don't have a comprehensive groundwater model,**

7 **but we have two different kinds of models that we**

8 **use for agricultural uses in the basin. One of**

9 **them is a draw-down model that we use for**

10 **individual users to determine impacts on other**

11 **users, things likes streamflows, springs, things**

12 **like that. We also have AFSIRS. It's a**

13 **regulatory model that we use. We input data, and**

14 **it tells us what impacts or what we use in terms**

15 **of agricultural purposes. And those two things**

16 **together can tell us what impacts.**

17 **Q.** And AFSIRS, as I understand it, is used in part

18 to determine numerical limits on permits?

19 **A. Correct.**

20 **Q.** But it's, nevertheless, true that the District

21 has not done a comprehensive groundwater model of

22 the basin. Correct?

23 **A. That's correct.**

24 **Q.** And to your knowledge, the District also has not

25 done analysis to quantify the impact that

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1 irrigation in Florida has on river flows in the

2 ACF Basin. Correct?

3 **A. No. But my -- based -- when you look at the**

4 **entire permitted quantities though in the basin,**

5 **my understanding is from my staff that the actual**

6 **quantity wouldn't show up in the gages used to**

7 **measure the river. So it would be pretty small.**

8 **Q.** I appreciate that, sir; but it's, nonetheless,

9 true that the District has not done an analysis

10 to quantify the impact that irrigation in Florida

11 has on the river flows in the ACF Basin. Fair?

12 **A. Okay.**

13 **Q.** Do you agree with that?

14 **A. Not necessarily. I mean, the -- I said the**

15 **analysis comes from the draw-down model. You**

16 **have the actual users, say, of agriculture in the**

17 **basin at 26 million gallons of water a day.**

18 **That's about 45 cubic feet per second. That's if**

19 **you take 100 percent of that from the river. So**

20 **in my mind, that seems like an analysis of -- at**

21 **least to determine that there's not a meaningful**

22 **impact on the river.**

23 **Q.** Okay. I appreciate that, sir.

24 You recall giving a deposition in this case.

25 Right?

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1 **A. Of course.**

2 MR. ALLEN: Your Honor, may I approach?

3 BY MR. ALLEN:

4 **Q.** All right, sir. If you would turn with me to

5 page 75.

6 MR. ALLEN: And for the record, I have

7 handed the witness a copy of his deposition.

8 BY MR. ALLEN:

9 **Q.** Are you with me?

10 I'm looking at page 75, sir.

11 **A. Yes, sir.**

12 **Q.** All right. I'm going to read from line 3.

13 Question. And, you know, does the -- has the

14 State of Florida done any analysis to evaluate

15 whether irrigation in Florida has affected the

16 flows in those rivers?

17 Answer. I don't believe that that analysis

18 has done to -- has been done to determine to be

19 able to quantify any of those impacts.

20 Sir, were you asked that question; and did

21 you give that answer during your deposition?

22 **A. I did. I was just trying to provide a little**

23 **more context for you.**

24 **Q.** All right, sir. Shifting to another topic, as we

25 sit here today, if an individual or farmer asking

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1 for an irrigation permit otherwise meets the

2 permitting requirements in the District, the

3 District will issue that farmer a permit.

4 Correct?

5 **A. If they meet all of the requirements to be issued**

6 **a permit, of course.**

7 **Q.** Right. And there is not, as we sit here today, a

8 moratorium on new agricultural permits in the

9 Florida portion of the ACF Basin. Correct?

10 **A. I think that's partially true. We don't use the**

11 **word moratorium, but we do reservations. So you**

12 **can't withdraw water directly from the**

13 **Apalachicola River or the Chipola River.**

14 **Also, as a condition of each permit, if it**

15 **was determined that the use is having an impact**

16 **on, say, another legal existing user or some**

17 **natural feature like a wetland or stream, then we**

18 **are able to decrease their pumping if we discover**

19 **that it's having an impact.**

20 **Q.** I'm sorry. I didn't mean to interrupt you.

21 I appreciate that all, sir; but there is no

22 absolute prohibition, separate and apart from the

23 reservations -- we'll talk about that in a

24 second. There is no absolute prohibition on

25 granting a permit for a new groundwater

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1 impose. Correct?

2 **A. We do impose some.**

3 **Q.** And some of those restrictions are voluntary.

4 Correct?

5 **A. Yes.**

6 **Q.** And the District has the authority to impose

7 restrictions that are mandatory as well.

8 Correct?

9 **A. That's correct.**

10 **Q.** And I understand the District imposed voluntary

11 reductions in 2000. Do you recall that?

12 **A. Yes.**

13 **Q.** Okay. And in 2007, correct?

14 **A. That's correct.**

15 **Q.** But the Northwest Florida Water Management

16 District has not implemented any mandatory water

17 use restrictions since 2000. Right?

18 **A. In the ACF Basin?**

19 **Q.** In the ACF Basin, sir.

20 **A. That's right.**

21 **Q.** So there were no mandatory water use restrictions

22 in the ACF Basin in 2007 or 2008. Right?

23 **A. That's correct.**

24 **Q.** And there were no mandatory water use

25 restrictions in the ACF Basin of Florida in 2011

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1 agricultural permit in the water portion of the

2 ACF Basin. Correct?

3 **A. That's right.**

4 **Q.** All right, sir. Are you familiar with the Water

5 Shortage Planning Rule?

6 **A. Generally speaking, sure.**

7 **Q.** And the Water Shortage Planning Rule, as I

8 understand it, allows the District to impose

9 certain water use restrictions during times of

10 drought. Correct?

11 **A. Can I maybe see a -- if we're going to do -- I**

12 **want to make sure --**

13 **Q.** I'm not reading any documents, sir. I'm just

14 asking you from your knowledge.

15 The Water Shortage Planning Rule allows the

16 District to impose water use restrictions during

17 times of drought. Right?

18 **A. Right. We can do that for each individual permit**

19 **as well. Sure.**

20 **Q.** Got it. Sure. But then I'm talking about

21 district-wide. There can be -- there can be

22 water shortage rules issued for the whole

23 district?

24 **A. Certainly.**

25 **Q.** And there are restrictions that the District can

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1 or 2012. Correct?

2 **A. That's correct.**

3 **Q.** All right, sir. Are you familiar with a concept

4 called minimal flows and levels?

5 **A. I am.**

6 **Q.** And that's a term used in Florida's statute.

7 Correct?

8 **A. That's correct.**

9 **Q.** And it's called MFL. Right?

10 **A. Yes, sir.**

11 **Q.** And as I understand it, MFL's are the limit at

12 which further withdrawals will be significantly

13 harmful to the water resources or ecology of the

14 area. Correct?

15 **A. That's correct.**

16 **Q.** And Florida law actually requires water

17 management districts to develop MFL's for

18 specific surface and groundwater bodies within

19 their jurisdiction. Correct?

20 **A. That's correct.**

21 **Q.** And Florida law also requires water management

22 districts to develop priority lists and schedules

23 for the establishment of the MFL's. Correct?

24 **A. That's correct.**

25 **Q.** As I understand it, the priorities list is

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1 supposed to be based on the importance of the

2 waters to the state or the region. Correct?

3 **A. As determined by the governing board, yes.**

4 **Q.** As determined by the District and the Board.

5 Correct?

6 **A. Sure.**

7 **Q.** Now, Florida -- the State of Florida began

8 requiring MFL's in 1997. Correct?

9 **A. Correct.**

10 **Q.** And since 1997 it is true, sir, that the

11 Northwest Florida Water Management District has

12 had zero MFL's. Correct?

13 **A. That is correct.**

14 **Q.** You mentioned earlier the reservation on the

15 Apalachicola and Chipola Rivers. Correct?

16 **A. Yes, sir.**

17 **Q.** And you also mentioned that in your written

18 direct. So I want to ask you a couple questions

19 about the reservation just so the record is very

20 clear about what that is.

21 Before -- the reservation was imposed in

22 2006. Correct?

23 **A. Sorry. I'm finding my way to the --**

24 **Q.** Okay. Take your time, sir.

25 **A. Thank you.**

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1 **Q.** Just let me know when you're ready.

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

3 **Q.** And the reservation was imposed in 2006.

4 Correct, sir?

5 **A. Yes, sir.**

6 **Q.** All right. And I just want the record before the

7 Supreme Court to be clear about this.

8 Before 2006 there was no reservation in place

9 for the Apalachicola or Chipola Rivers. Correct?

10 **A. That's my understanding.**

11 **Q.** And before 2006 there was no MFL in place for

12 either of those rivers. Correct?

13 **A. That is correct.**

14 **Q.** And the reservation applies only to surface water

15 withdrawals. Correct?

16 **A. That's correct.**

17 **Q.** It does not apply to groundwater withdrawals.

18 Correct?

19 **A. Right.**

20 **Q.** And the reservation only applies to withdrawals

21 from the mainstem of the Apalachicola or Chipola

22 Rivers. Correct?

23 **A. That's correct.**

24 **Q.** One moment, sir.

25 MR. ALLEN: Your Honor, may I approach?

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1 BY MR. ALLEN:

2 **Q.** I'm handing you two exhibits that I would like

3 identified for the record.

4 MR. ALLEN: All right. For the record,

5 I have handed the witness copies of GX-526

6 and GX-529.

7 BY MR. ALLEN:

8 **Q.** Sir, GX-526, at the top it says Memo. This is a

9 memorandum that you wrote. Correct?

10 **A. Yes, sir.**

11 **Q.** And then GX-529, I believe these are the

12 attachments to the memo that you wrote. Is that

13 fair?

14 **A. It seems like that's the case.**

15 **Q.** Okay. And you wrote this, sir, as a policy

16 statement for the Water Management District.

17 Correct?

18 **A. I think that's fair.**

19 **Q.** And you distributed the memo to certain

20 interested parties. Correct?

21 **A. A few -- a few in particular that we wanted to**

22 **reach out directly to; but, yes, sir.**

23 **Q.** And it included members of the press. Correct?

24 **A. That's correct.**

25 **Q.** And the memo discusses the development and

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1 implementation of MFL's at the Northwest Florida

2 Water Management District. Correct?

3 **A. Yes, sir.**

4 **Q.** And in your view, sir, at some point in time

5 there was a pattern of delays in issuing MFL's in

6 the district. Correct?

7 **A. It appeared to me from looking from the outside.**

8 **Yes, sir.**

9 **Q.** And in your view, sir, during some period of time

10 there was a lack of funding budgeted by the

11 District for the MFL's. Correct?

12 **A. It would -- for them to do MFL's, there would**

13 **need to be funding. We didn't see the funding in**

14 **place where that would come from.**

15 **Q.** And, sir, if you look down with me at the

16 paragraph that begins, the pattern of delays, do

17 you see that?

18 **A. On the front part of the memo?**

19 **Q.** Yes. It's the first page. It's the second

20 paragraph from the bottom. Do you see that?

21 **A. Second from the bottom? Yes.**

22 **Q.** And the paragraph reads, the pattern of delays

23 continued until Governor Scott took office and

24 selected Herschel Vinyard as the Secretary of the

25 DEP.

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1 And then it says -- there is a sentence there
 2 about the letter was sent to the District asking
 3 directly about the lack of MFL's in the district.
 4 The District's response was that the law only
 5 required the creation and submittal of a priority
 6 list, not the actual creation of any MFL's.
 7 Do you see that, sir?
 8 **A. I do.**
 9 **Q.** And then the next sentence says, it then became
 10 blatantly obvious that the Northwest Florida
 11 Water Management District had no intention of
 12 following the law and implementing the MFL's.
 13 Do you see that, sir?
 14 **A. I do see that.**
 15 **Q.** And at the time you made it in February 2012,
 16 that was an accurate statement. Correct, sir?
 17 **A. That was my perception of it, yes, sir.**
 18 **Q.** Okay. Thank you, Mr. Cyphers. I have no further
 19 questions for you at this time.
 20 REDIRECT EXAMINATION
 21 BY MR. LEOPOLD:
 22 **Q.** Good afternoon, Mr. Cyphers.
 23 **A. Good afternoon.**
 24 **Q.** You were asked about Florida's agricultural water
 25 use permit. Do you recall that?
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1 **A. I do recall that.**
 2 **Q.** Can you describe for the Court generally how
 3 water use permitting is done within the Northwest
 4 Florida Water Management District?
 5 **A. Sure. It's a little different than public supply**
 6 **is done in northwest Florida in general. First,**
 7 **you would have a farmer that would come into the**
 8 **district, contact us seeking information about a**
 9 **permit, looking for a permit application. We**
 10 **would either try to do a preapplication on their**
 11 **property or at the district. That's to give an**
 12 **idea of what they're looking for, how much water**
 13 **they're looking to use, the conditions nearby.**
 14 **It gives us a decent idea to do a rough analysis**
 15 **on whether or not it's an appropriate use of**
 16 **water in that place and the kind of work they**
 17 **will have to do to show us that the use is**
 18 **appropriate in that area.**
 19 **At that point sometimes an applicant will**
 20 **decide not to pursue the permit. In some cases**
 21 **they move forward. Sometimes that requires their**
 22 **own modeling. Aquifer performance tests are**
 23 **sometimes required. Those can be quite**
 24 **expensive, so that's kind of the limiting factor**
 25 **for some applicants.**
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1 **At that point we get a little more -- I hate**
 2 **to use the term nitty-gritty with the data.**
 3 **We'll ask for specific acreage data. We'll input**
 4 **soil type information, climatic information,**
 5 **harvesting, planting seasons, whether or not**
 6 **frost-freeze protection is appropriate for that**
 7 **crop.**
 8 **And then we'll plug those data into what's**
 9 **called that AFSIRS model I mentioned a little**
 10 **while ago. I apologize for not being clear on**
 11 **the acronym there. So I will just say AFSIRS,**
 12 **what I say is the smart guys.**
 13 **Q.** And, Mr. Cyphers, do you recall what the AFSIRS
 14 acronym stands for?
 15 I think it's on page 14 of your testimony.
 16 **A. Thank you. I'm sorry. You'd think being in**
 17 **government, I would be better with acronyms.**
 18 **Q.** Paragraph 37.
 19 **A. Sure. It's the Agricultural Field Scale**
 20 **Irrigation Requirement Simulation model. That's**
 21 **a mouthful.**
 22 **Q.** And if the District decides to grant an
 23 agricultural water use permit, what -- what are
 24 the requirements of those permits?
 25 **A. So in this instance, getting to kind of the end**
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1 **of that AFSIRS process -- I guess that kind of**
 2 **logs in there what maybe you're getting at -- it**
 3 **produces a water quantity that's reasonable to**
 4 **meet maximum yield for a grower in 8 out of 10**
 5 **years. And then two dry years, it would not be**
 6 **enough to meet the maximum yield for that crop in**
 7 **that soil for that time.**
 8 **Q.** So why doesn't the District give farmers 100
 9 percent in dry years?
 10 **A. Essentially we're trying to preserve the**
 11 **resource. And we understand that as things get a**
 12 **little drier, we want to make sure that we're**
 13 **racheting back on the use of the resource to make**
 14 **sure that we're not unintentionally impacting**
 15 **other legal existing users or natural systems.**
 16 **Q.** Do you know what the standard is, sir, to grant
 17 one of these permits?
 18 **A. Yes. It's in -- statutes refer to the**
 19 **three-pronged test. It's -- it means a use has**
 20 **to be reasonable, beneficial, in the public**
 21 **interest, and it can't impact another legal**
 22 **existing user.**
 23 **Q.** And can you give your understanding, if you can,
 24 for the Court what's included in the reasonable
 25 beneficial standard?
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1 **A. Sure. And, sir, I'm going to try to find my way**
 2 **to --**
 3 **Q.** If you want to reference page 30 of your written
 4 direct.
 5 **A. Okay. It isn't on page 30. Do you mean**
 6 **paragraph 30?**
 7 **Q.** Excuse me, paragraph 30 and 31.
 8 **A. All right. So I want to make sure I've got it.**
 9 **And there are a lot that are actually in -- and I**
 10 **think we have the applicant's handbook here; and**
 11 **it lists all the various things we have to do.**
 12 **One is to make sure that the actual purpose for**
 13 **which the water is to be used is considered**
 14 **appropriate under the circumstance. And in the**
 15 **case of agriculture, that would mean an**
 16 **appropriate amount of water for an appropriate**
 17 **crop for the soil type and climatic conditions of**
 18 **the district.**
 19 **Q.** Does it have anything -- does the standard have
 20 anything to do with environmental values?
 21 **A. Certainly. And that also stretches into not**
 22 **impacting legal existing users. A legal existing**
 23 **user is not just considered a person, but it's**
 24 **also considered natural features as well.**
 25 **So if your withdrawal perspective or**
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1 **post-permitting has an impact on, say, another**
 2 **well nearby or a wetland or stream or something**
 3 **like that, we would have to constrict your**
 4 **ability to use your permit that you wanted for**
 5 **that area.**
 6 **That's how we -- that's how we permit,**
 7 **hopefully to avoid that in the first place. But**
 8 **we make conditions on the permit that in case**
 9 **there's an impact in any way, that we're able to**
 10 **ratchet back that use.**
 11 **Q.** And counsel for Georgia asked you about Florida's
 12 water use in the basin. Do you recall that?
 13 **A. Can you repeat the question?**
 14 **Q.** Counsel asked you about Florida's total water use
 15 in the basin?
 16 **A. Yes.**
 17 **Q.** And he asked you about how you know, if you do,
 18 whether it's impacting the Apalachicola River?
 19 **A. Yes. I remember.**
 20 **Q.** Do you know, sir, whether Florida's water use has
 21 any impact on the Apalachicola?
 22 **A. I'll reiterate it, as I did for Mr. Allen, is the**
 23 **amount is so small and it's so spread out over**
 24 **the course of -- of the area of the basin that**
 25 **when you look at the total amount of water -- you**
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1 **know, just speaking with my staff, folks that are**
 2 **hydrologists, scientists, are saying that the**
 3 **use, even if you took 100 percent of it, you**
 4 **know, wouldn't show up in the gage records for**
 5 **the river.**
 6 **Q.** And referring back to the AFSIRS model, which you
 7 have discussed, for granting agricultural
 8 permits, do you recall when Florida first started
 9 using that model to grant permits?
 10 **A. I believe it was 1991.**
 11 **Q.** And do you recall whether it was used in any
 12 other context?
 13 **A. I know that we developed it -- when I say we, the**
 14 **University of Florida, I believe, was the actual**
 15 **place of its -- of its genesis. But we started**
 16 **using it in 1991. I believe it was the basis in**
 17 **the comprehensive study between Georgia, Alabama,**
 18 **and Florida in the '90's to use potentially in**
 19 **common.**
 20 **Q.** And I would like to reference Joint Exhibit 6,
 21 which is the ACF comprehensive study.
 22 MR. LEOPOLD: May I approach, your
 23 Honor?
 24 BY MR. LEOPOLD:
 25 **Q.** Now, Mr. Cyphers, is this the study that you were
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1 referring to just now?
 2 **A. Yes, sir.**
 3 **Q.** And this was cited in your testimony, sir?
 4 **A. Yes, sir. I believe it was.**
 5 **Q.** And if you would, look at page 117 of the
 6 document, please.
 7 **A. 117?**
 8 **Q.** That's right.
 9 **A. Is it one of these red tags that you have here?**
 10 **Okay.**
 11 **Q.** And do you recall, sir, the purpose for which
 12 AFSIRS was referenced in this document?
 13 **A. It seems like it's trying -- it's pointing to**
 14 **appropriate irrigation levels produced by it for**
 15 **the Lower Apalachicola area, southern Georgia,**
 16 **northern Florida, southern Alabama.**
 17 **Q.** Would you explain for the Court, please, what the
 18 comprehensive study is to your knowledge?
 19 **A. Generally speaking, my understanding is this is a**
 20 **compilation of work between the three states in**
 21 **looking at various agricultural argument issues.**
 22 **Q.** Thank you, Mr. Cyphers.
 23 Does the District monitor water use within
 24 the Florida portion of the ACF Basin?
 25 **A. It monitors use throughout the entire district**
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1 **but, yes, the basin as well.**
 2 **Q.** And how does it do that?
 3 **A.** **Well, I have an entire -- I guess, first, it's**
 4 **required in their individual permits -- the**
 5 **conditions of permits. We also have an entire**
 6 **bureau at the District whose job it is to audit**
 7 **pumpage reports, inspect wells going in,**
 8 **operations throughout the basin.**
 9 **The area where agriculture takes place is**
 10 **actually relatively small. So it's easy for us**
 11 **to physically cover those areas. But we all have**
 12 **office staff that audit those reports that look**
 13 **for anomalies and potential overuse.**
 14 **Q.** And if your staff finds an anomaly in the audit,
 15 what happens then?
 16 **A.** **Usually the first -- the first thing they would**
 17 **do is contact -- whether it was a public supply**
 18 **utility or an agricultural user, they would**
 19 **contact them to find out if there was some sort**
 20 **of measuring mistake, arithmetic error, something**
 21 **like that. Maybe something is broken. Maybe**
 22 **there's been a large accident. That's usually**
 23 **the first step.**
 24 **If it's found that it's not anomalous, it's**
 25 **an actual over-pumping of water, then we work**
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1 **with the permittee to reduce that use or get that**
 2 **use within their permitted allowable cap.**
 3 **Sometimes it's -- it's very easy to do so.**
 4 **We have really good growers. We have good**
 5 **utilities. But sometimes we have to take**
 6 **compliance, regulatory action where we send**
 7 **notices of violation. Sometimes we have to fine**
 8 **farmers and utilities.**
 9 **Q.** And has the District fined any individual water
 10 users in the ACF Basin?
 11 **A.** **Certainly. It's not often; but I think in terms**
 12 **of fines, it's only -- maybe a few dozen times,**
 13 **24, 25 times.**
 14 **Q.** Okay. Now, moving on, sir, beyond the permitting
 15 process, is there anything else that the Water
 16 Management District does for water use
 17 conservation and agriculture?
 18 **A.** **Of course. We start with the Mobile Irrigation**
 19 **Lab program, which we do with the Department of**
 20 **Agriculture and Consumer Services. Its job is to**
 21 **work with growers.**
 22 **Specifically in this basin -- they have them**
 23 **throughout the state, but ours is -- works in the**
 24 **basin almost exclusively in Jackson County.**
 25 **Their job is to work with the growers, help them**
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1 **analyze their farms, and then suggest potential**
 2 **improvements to those farms. We manage to save**
 3 **about a quarter of all Ag use from the work that**
 4 **those Mobile Irrigation Labs have done.**
 5 **And in conjunction with that, we make that a**
 6 **requirement for those that also want to take**
 7 **advantage of agricultural best-management**
 8 **practice, cost-share projects with us. That's**
 9 **where we pay part of the dollars to, say, do a**
 10 **center-pivot irrigation system retrofit. We**
 11 **would remove, let's say, end-guns, do drop-nozzle**
 12 **irrigation, those sorts of things.**
 13 **We also are doing an investigation of the**
 14 **Claiborne Aquifer in the basin to see if we can**
 15 **go to someplace other than the Floridan Aquifer**
 16 **for agricultural use.**
 17 **We're also moving from the study phase of the**
 18 **sod-based crop rotation. And that's where you**
 19 **plant two seasons of grass; and then behind it**
 20 **you would plant, say, peanuts or cotton or**
 21 **something like that. And that, we're just now**
 22 **moving to contract with four growers in the basin**
 23 **to get them to do that. They will save 50**
 24 **percent, sometimes 60 percent in water use as**
 25 **well as nutrient use with those types of**
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1 **projects.**
 2 **Q.** And, Mr. Cyphers, you mentioned center-pivots.
 3 How many center-pivot irrigation systems are in
 4 Florida's portion of the ACF Basin?
 5 **A.** **I believe the number is 440.**
 6 **Q.** And do you know how many of those have gone
 7 through the program you have discussed?
 8 **A.** **The number that's gone through the Mobile**
 9 **Irrigation Lab program twice -- that's where they**
 10 **go out. The scientists evaluate their operation,**
 11 **provide a report, offer suggestions, and go back**
 12 **out to follow up with them once they take some --**
 13 **some of the suggestions. That's about 60 percent**
 14 **of the -- of those systems in the basin.**
 15 **Q.** And, Mr. Cyphers, do you have any knowledge of
 16 how many center-pivot systems exist in Georgia?
 17 **A.** **I know our staff counted all of our systems in**
 18 **Florida, Georgia, and Alabama once. I think it's**
 19 **over 9,000.**
 20 **Q.** And if you would, I would like to refer you back
 21 to paragraph 55 of your testimony.
 22 **MR. LEOPOLD:** Mr. Walton, if we could pull up
 23 that page on the screen, please, paragraph 55.
 24 **Actually, and scroll down to the next page,**
 25 **if you would, Mr. Walton.**
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1 BY MR. LEOPOLD:
 2 **Q.** And, Mr. Cyphers, how is it that you know or have
 3 an idea of how many center-pivot irrigation
 4 systems may be in Georgia?
 5 **A.** Well, the figure here that was produced for now
 6 Secretary Steverson, but then he was the
 7 executive director of the District, when he was
 8 giving U.S. Senate committee testimony, my staff
 9 at that time and also since, because they update
 10 these things, took aerial satellite imagery and
 11 hand-identified every single center-pivot
 12 irrigation.
 13 In Florida we were able to identify those by
 14 mapping them with FSAID, F S A I D, work as well
 15 as our own staff who know where the wells are and
 16 permits are for the basin.
 17 **Q.** And can you -- is that -- can you describe what
 18 this figure is that we're looking at in your
 19 testimony?
 20 **A.** Sure. You can see the confluence of the
 21 Chattahoochee and Flint Rivers forming the border
 22 between Alabama, Florida, and Georgia. The lower
 23 part of the -- of the state line, you see the red
 24 dots above and below. Essentially, the red dots
 25 represent a center-pivot irrigation unit.

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1 **Q.** Thank you, Mr. Cyphers.
 2 And can you -- can you describe for the
 3 Court, if you can, a little bit about the ACF
 4 Basin, given your familiarity with it.
 5 **A.** In -- in Florida -- I'm obviously a Florida guy;
 6 so I know -- I know my territory. These are
 7 small rural communities. Jackson County is the
 8 one you see right on the border of Alabama as
 9 well as the Georgia border. That's where you can
 10 see almost all the agriculture takes place in the
 11 basin.
 12 As you move down in the basin, mostly you
 13 have small rural communities. They're not farm
 14 communities; they're mostly, you know, foresters
 15 and rural folks like that. And where you end up
 16 is down in that Apalachicola and Carrabelle area
 17 at the bay.
 18 **Q.** And how much water use is there in Florida's
 19 portion?
 20 **A.** I -- I think the total use permit -- actual use
 21 is somewhere around 42 million gallons of water a
 22 day. I think they're permitted to 69 million
 23 gallons of water a day, but we haven't reached
 24 those numbers.
 25 **Q.** And can you describe, if you would, as you did in

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1 your testimony the geography of the basin?
 2 **A.** Sure. I mean, you move from more of a -- more
 3 relief, higher areas, as you -- as you start in
 4 the top part of the basin. As you move down, as
 5 others have more aptly described, Lee Edmiston
 6 being one of them, the areas get lower and the
 7 habitat becomes a little bit more lower, more
 8 marine, more estuarine.
 9 **Q.** And what about the landings of the basin?
 10 **A.** Well, again, you can see there's the agriculture
 11 area in that part of Jackson County. I would
 12 also note that of the entire basin, about a third
 13 of it -- 609,000 acres I believe is my
 14 testimony -- is in conservation ownership.
 15 That's between state, federal, and private groups
 16 like the Nature Conservancy that own that
 17 property. So that's unavailable for use, whether
 18 it be urban, although I hesitate to chuckle when
 19 I say urban in Apalachicola Basin, or
 20 agriculture.
 21 **Q.** Okay. And, Mr. Cyphers, do you recall a question
 22 that counsel asked you about MFL's and
 23 reservations?
 24 **A.** I do.
 25 **Q.** Can you explain your understanding of the

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1 difference between an MFL and a reservation?
 2 **A.** Sure. In this case -- I guess that's probably
 3 part of the misconception in terms of MFL's
 4 versus reservations in the basin. In the basin
 5 they created the reservation because that was the
 6 only real avenue for protection of the water
 7 resource available to the District. The MFL
 8 process -- and I have been pretty clear about the
 9 District's policy since I've been there, that
 10 it's important to, if lawful, to do.
 11 But in this case, we wouldn't be able to do
 12 that -- I would never even try to do an MFL on
 13 the Apalachicola River because an MFL is a
 14 regulatory and planning construct. So the whole
 15 point is to determine what the level at which you
 16 withdraw more causes significant harm. But I
 17 can't do that on the Apalachicola River because
 18 all of the impact, all of the consumption and
 19 harm is taking place in Georgia and impacting
 20 Florida. And I can only do it where I have some
 21 sort of regulatory authority; and obviously, I
 22 have no regulatory authority in Georgia.
 23 **Q.** So then why did the District enter reservations
 24 on the river?
 25 **A.** That was -- that was the best we could do under

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1 **the circumstance in terms of preserving that**
 2 **water.**
 3 **Now, it's not the only thing. Obviously, you**
 4 **saw the conservation programs that we have**
 5 **invested in for the last decade, you know, in**
 6 **terms of the best-management practice,**
 7 **cost-share, and the studies and investigation and**
 8 **the Mobile Irrigation Labs. But in terms of**
 9 **producing any actual water in the river, we**
 10 **can't -- that's the best we can do.**
 11 Q. Okay. Thank you, Mr. Cyphers.
 12 MR. LEOPOLD: No further questions.
 13 Your Honor, I failed to introduce my
 14 colleague Ben Stearns. He's been helping me
 15 with this exam.
 16 SPECIAL MASTER LANCASTER: Welcome.
 17 MR. ALLEN: No further questions, your
 18 Honor.
 19 SPECIAL MASTER LANCASTER: Mr. Cyphers,
 20 the counsel for Georgia handed you two
 21 documents, GX-526 and GX-529. And did I
 22 understand your testimony to be that 526 is
 23 the memo from you and that 529 is the
 24 attachment to the memo?
 25 THE WITNESS: Yes, sir.
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1 SPECIAL MASTER LANCASTER: Well, help me
 2 here because the memo is dated February 3,
 3 2012; and the attachment is dated February 3,
 4 2013.
 5 THE WITNESS: That's a -- that's a bit
 6 of a mystery for me. It may have been a lag
 7 in terms of me sending it to the folks listed
 8 here and when I maybe got permission from the
 9 executive director to deliver the memo
 10 itself.
 11 SPECIAL MASTER LANCASTER: But the
 12 memo -- 526 is the memo?
 13 THE WITNESS: Yes, sir.
 14 SPECIAL MASTER LANCASTER: And 529 is
 15 the attachment?
 16 THE WITNESS: Yes, sir. And it may --
 17 it may have been a function of it didn't go
 18 through in some sort of technical aspect when
 19 we tried to e-mail it to these parties. I'm
 20 not -- I'm just not sure about that part.
 21 SPECIAL MASTER LANCASTER: It doesn't
 22 matter. Okay.
 23 MR. ALLEN: One thing to clarify on
 24 that?
 25 SPECIAL MASTER LANCASTER: Please.
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1 MR. ALLEN: GX-529 has a number of
 2 attachments. The last page, Page 529, your
 3 Honor, the memo is reproduced. So that might
 4 help a little bit in terms of -- it's also at
 5 the end of GX-529.
 6 SPECIAL MASTER LANCASTER: Thank you.
 7 MR. ALLEN: You're welcome.
 8 SPECIAL MASTER LANCASTER: Anything
 9 further?
 10 MR. LEOPOLD: Nothing from Florida, your
 11 Honor.
 12 SPECIAL MASTER LANCASTER: You may be
 13 excused.
 14 THE WITNESS: Thank you, sir.
 15 MR. PERRY: Good afternoon, your Honor.
 16 SPECIAL MASTER LANCASTER: Mr. Perry?
 17 MR. PERRY: Our expectation today was
 18 that Dr. Hornberger might take all day, and
 19 happily it didn't take all day. And we had
 20 Mr. Cyphers ready in case of that eventuality.
 21 He's now testified. We have witnesses -- I
 22 think one is Georgia's witnesses -- for
 23 Monday morning. But for the next hour, we
 24 haven't prepared a witness because we didn't
 25 anticipate the day would finish.
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1 SPECIAL MASTER LANCASTER: So are you
 2 suggesting that we should recess, Mr. Perry?
 3 MR. PERRY: In a long-winded way, I am,
 4 your Honor.
 5 SPECIAL MASTER LANCASTER: That's a
 6 wonderful suggestion. Thank you.
 7 Let me remind counsel, I'm sure you're
 8 aware, that tomorrow is a holiday and this
 9 office is closed, and that Tuesday of next
 10 week the Bankruptcy Court will be sitting; so
 11 that we will have a four-day week next week
 12 as well.
 13 I suggest, as I have before, that you
 14 use Alec's list of restaurants. The weather
 15 forecast for the weekend is great weather, so
 16 take your umbrellas. I suggest that you
 17 relax, enjoy, and be ready to roll on Monday.
 18 Thank you very much.
 19 MR. PRIMIS: Thank you, your Honor.
 20 SPECIAL MASTER LANCASTER: Thank you.
 21 Have a good weekend.
 22 (Time Noted: 3:35 p.m.)
 23 (Proceeding adjourned to Monday,
 24 November 14, 2016, at 9:00 a.m.)
 25 (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 6th day of December, 2016.

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

My Commission Expires
June 9, 2019.

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