

SUPREME COURT OF THE UNITED STATES
No. 142, Original

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

TRANSCRIPT OF PROCEEDINGS

The above-entitled matter came on for HEARING before SPECIAL MASTER RALPH I. LANCASTER, held in the U. S. Bankruptcy Court, at 537 Congress Street, Portland, Maine, on November 17, 2016, commencing at 8:50 a.m., before Claudette G. Mason, RMR, CRR, a Notary Public in and for the State of Maine.

APPEARANCES:

For the State of Florida: PHILIP J. PERRY, ESQ.
JAMIE L. WINE, ESQ.
ABID R. QURESHI, ESQ.
STACEY van BELLEGHEM, ESQ.
LAURA J. GLICKMAN, ESQ.

For the State of Georgia: CRAIG S. PRIMIS, ESQ.
ZACHARY A. AVALLONE, ESQ.
CHRISTOPHER J. MANER, ESQ.
CHRISTIAN REIGSTAD, ESQ.

Also Present: JOSHUA D. DUNLAP, ESQ.

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1 PROCEEDINGS
2 SPECIAL MASTER LANCASTER: Good morning.
3 MR. QURESHI: Good morning, your Honor.
4 SPECIAL MASTER LANCASTER: Good morning.

5 REDIRECT EXAMINATION

6 BY MR. QURESHI:

7 Q. Good morning, Dr. Kondolf.

8 A. **Good morning.**

9 Q. Sir, we spent some time yesterday responding to
10 questions regarding the operation of federal
11 reservoirs and Army Corps of Engineers dredging.
12 Today I would like to ask you some questions
13 about why these projects were undertaken. And
14 I'm going to provide you a document that you cite
15 in your testimony at paragraph 13, and then we'll
16 direct you to particular sections.

17 MR. QURESHI: Your Honor, with your
18 permission?

19 SPECIAL MASTER LANCASTER: Sure.

20 BY MR. QURESHI:

21 Q. Dr. Kondolf, I have handed you what's marked as
22 Joint Exhibit 1. Can you tell us what this
23 document is?

24 A. **Yes. This is a document that's a letter from the**
25 **Secretary of War to the U.S. Congress. It's**

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INDEX

Witness Direct Cross Redirect Recross

G. Mathias Kondolf, 2677, 2740 2714
Ph.D.

David L. Sunding, 2745 2746 2848 2898
Ph.D.

EXHIBITS

Number Page Referenced

JX-1 2717, 2677
JX-128 2720
JX-154 2866

FX-530 2690
FX-784 2762, 2799
FX-801 2764, 2838
FX-895 2884

GX-88 2708
GX-248 2700
GX-898 2820
GX-1276 2809
GX-1335 2722, 2740

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1 **basically a report of the chief of the Army Corps**
2 **of Engineers. And it's concerning potential**
3 **projects on the Apalachicola, Chattahoochee, and**
4 **Flint Rivers.**

5 Q. And, sir, why did you review this in connection
6 with your work in this matter?

7 A. **I reviewed a number of documents like this.**

8 **Pretty much every year the Army Corps of**
9 **Engineers would submit a report like this to**
10 **Congress to show what they have done to sort of**
11 **justify their appropriations, and in this case to**
12 **propose a very large regional-scale project.**
13 **This was the project that we referred to earlier**
14 **that involved construction of five federal dams**
15 **on the Chattahoochee and Apalachicola, and also**
16 **this very extensive dredging project that we**
17 **discussed yesterday.**

18 **And as is very clear in this document, this**
19 **was for a regional-scale economic development**
20 **plan, initiative. And they were going to have**
21 **a 9-foot deep navigation channel all the way to**
22 **Columbus, Georgia. And this is a huge scale.**
23 **It's the same depth as the navigation channel of**
24 **the Missouri River. So for the Chattahoochee and**
25 **Apalachicola this was very large-scale. And this**

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2679

1 **was done to serve the ports of Columbus and**
 2 **Bainbridge.**
 3 **And in the report here it notes that the**
 4 **Apalachicola itself is only a necessary outlet to**
 5 **the Gulf, that the whole project was done to**
 6 **benefit commerce to the upstream ports.**
 7 **Q.** Okay. Thank you, Dr. Kondolf.
 8 Now, I want to walk through some of the
 9 sections that you alluded to. In particular, on
 10 page 3, paragraph 3, I would ask you to review
 11 the first few sentences. You're welcome to read
 12 the entire paragraph if you like.
 13 And my question is going to be what is the
 14 significance of the reference to agricultural
 15 production and population in principal cities?
 16 **A.** **So here, it's describing the agriculture and the**
 17 **urban centers within the river basin. And these**
 18 **are pretty much -- these are all cities in**
 19 **Georgia -- one is in Alabama; the others are all**
 20 **in Georgia. And the agriculture that's referred**
 21 **to is predominantly in Georgia. So these would**
 22 **be served by the navigation project.**
 23 **Q.** Dr. Kondolf, in the same paragraph at the bottom
 24 of the page, there's a sentence that begins,
 25 commerce on the river system consists. And then

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2680

1 it goes on to the following page 4. Can you
 2 review that to yourself and explain how that
 3 discussion informs your understanding of the
 4 scale of the project that was undertaken.
 5 **A.** **So this -- this and the subsequent sentence**
 6 **describes commerce at the present time, so in --**
 7 **when this report was completed in the 1930's,**
 8 **which was mostly movement of sand and gravel,**
 9 **pulpwood to sawmills -- sorry, timber to sawmills**
 10 **and pulpwood to a paper mill. And so that -- the**
 11 **scale of that is much smaller than what's being**
 12 **proposed for this project in order to serve the**
 13 **regional interests.**
 14 **Q.** And this is prior to the onset of any dredging,
 15 sir?
 16 **A.** **There was some dredging. It was relatively**
 17 **minor.**
 18 **We looked yesterday at a plot of dredging**
 19 **over time. And -- and as you saw from that,**
 20 **beginning in 1956, the rate of dredging increased**
 21 **dramatically. So this was really a much**
 22 **larger-scale project that was done for the**
 23 **regional development.**
 24 **Prior to that, you had more local movement of**
 25 **goods, like as is shown here, pulpwood and timber**

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2681

1 **and some sand and gravel.**
 2 **Q.** Dr. Kondolf, on page 6 in paragraph 9 there is a
 3 discussion about the reservoirs, construction of
 4 reservoirs. Let's move from the dredging aspect
 5 to the reservoir aspect. And right before
 6 paragraph 10 there is a discussion about a dam in
 7 the Apalachicola. Can you review that to
 8 yourself and explain what that means.
 9 **A.** **So this passage essentially states that the**
 10 **purpose of construction of these dams is to**
 11 **maintain usable navigation depths in the**
 12 **Chattahoochee River to provide those depths up to**
 13 **Columbus, Georgia.**
 14 **Q.** How is it consistent with your opinion that the
 15 dredging and the construction of the dams was to
 16 benefit the upstream states?
 17 **A.** **Yes. These were really part of the same project,**
 18 **deepening the channel and building the dams. For**
 19 **the lower part of the river it was deepening the**
 20 **channel; above that, the dams were designed to**
 21 **provide the minimum depths. So they were all**
 22 **part of the same project, to make possible**
 23 **navigation up to Columbus and Bainbridge on the**
 24 **Chattahoochee with a 9-foot deep channel.**
 25 **Q.** Sir, earlier you explained that the Apalachicola

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2682

1 was only considered a necessary outlet. And if
 2 you turn to page 39, paragraph 140, can you
 3 explain how that discussion is consistent with
 4 your testimony.
 5 **A.** **This paragraph was one of the paragraphs on which**
 6 **I based my conclusions. And this paragraph very**
 7 **clearly says that the -- that the commerce for**
 8 **which the project is -- was proposed was -- it**
 9 **said that the Apalachicola River, the downstream**
 10 **part after the Chattahoochee and Flint come**
 11 **together, that that river is considered to be**
 12 **only a necessary outlet for these two streams,**
 13 **the upstream Chattahoochee and Flint; and its**
 14 **improvement to a greater depth than now**
 15 **authorized would be dependent on the improvement**
 16 **of one or both of them.**
 17 **So -- so only a necessary outlet for the**
 18 **upstream streams. So that it was not commerce on**
 19 **Apalachicola per se, but Apalachicola was simply**
 20 **the way for ships to get from the Gulf to these**
 21 **upstream ports.**
 22 **Q.** Dr. Kondolf, the last item I want to review on
 23 Joint Exhibit 1 appears on pages 45 and 47. In
 24 particular on page 45 in paragraph 158 of Joint
 25 Exhibit 1 there is a discussion about the

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2683

1 movement of gasoline and kerosene by barge
 2 constituting, quote, by far the largest item of
 3 commerce potential for the waterway, end quote.
 4 And then on page 47, there is a chart. Can
 5 you explain how that chart relates to the
 6 preceding paragraph that I just read from?
 7 **A. Yes. So much of this document is sort of**
 8 **projections of what economic benefit could be**
 9 **gained by doing this massive project of dams and**
 10 **dredging. And the document calls out**
 11 **specifically petroleum products as being an**
 12 **important item of commerce.**
 13 **And so on page 47 in this table there's a**
 14 **detail of the expectation of the -- of the**
 15 **petroleum that would be carried from the Gulf up**
 16 **into these counties as an alternative to the ways**
 17 **that the petroleum was being transported at the**
 18 **time.**
 19 **And as you go down on this table, it shows a**
 20 **number of counties in Alabama, about eight**
 21 **counties there. And then it describes the**
 22 **savings per ton in petroleum that would accrue**
 23 **from this project and others. By building the**
 24 **navigation project people in these counties would**
 25 **save so much in petroleum costs because of the**

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2684

1 **transport. So it quantifies that for Alabama.**
 2 **For Florida it says, no saving.**
 3 **And then it goes on, and then there are many**
 4 **counties in Georgia listed with the savings**
 5 **expected in terms of petroleum costs for them for**
 6 **those Georgia counties.**
 7 **So by far, the benefits are clearly for --**
 8 **primarily for Georgia, a little bit for Alabama.**
 9 **But in this case for the petroleum, there is no**
 10 **benefit shown for Florida at all.**
 11 **Q. Dr. Kondolf, did you -- do you typically rely on**
 12 **these types of historical documents in your field**
 13 **of study?**
 14 **A. Yes. As a fluvial geomorphologist, we are often,**
 15 **probably most of the time looking at impacts of**
 16 **human activities on rivers, trying to understand**
 17 **how those occurred, their nature; and then in my**
 18 **specific field, looking at how we can restore**
 19 **some of the function to rivers that's been**
 20 **affected by these human activities. So in order**
 21 **to understand those historical human impacts,**
 22 **it's essential to look at these kinds of**
 23 **historical documents.**
 24 **And going back to 1986, I think I published**
 25 **my first paper about using these kinds of methods**

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2685

1 **in -- in restoration kind of planning. I**
 2 **published another paper on that in 1995. In my**
 3 **book, which is about methods in the field of**
 4 **fluvial geomorphology, tools in fluvial**
 5 **geomorphology, we have a chapter specifically on**
 6 **historical analysis and how it's used in the**
 7 **field. We have another chapter on archaeological**
 8 **information as well.**
 9 **So it's a central part of the field of**
 10 **fluvial geomorphology to do this kind of**
 11 **historical analysis to inform your understanding**
 12 **of how the river has changed.**
 13 **Q. And based on that type of study, your review of**
 14 **Joint Exhibit 1, as well as other archival**
 15 **records, what is your conclusion about why these**
 16 **federal projects were built and why dredging by**
 17 **the Army Corps occurred?**
 18 **A. I think it's very clear that the reason for this**
 19 **project, especially this scale of project, was to**
 20 **benefit the upstream ports, especially Columbus.**
 21 **Q. Dr. Kondolf, I would now like to move to the**
 22 **period when dredging ceased. Can you remind us**
 23 **when dredging by the Army Corps ceased?**
 24 **A. The intensive dredging was starting in the '50's**
 25 **through 1999. That was the last year of really**

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2686

1 **large-scale dredging. They didn't do any**
 2 **dredging in 2000. And then in 2001 they started**
 3 **dredging; and they did some, but the barge ran**
 4 **aground and they quit. And there was no -- no**
 5 **dredging after that. So that was 15 years ago**
 6 **the last dredging occurred.**
 7 **Q. And why might the barge have run aground?**
 8 **A. I think it was a relatively low water year; but**
 9 **certainly the river -- the riverbed was coming**
 10 **back up.**
 11 **When they did the dredging, they were digging**
 12 **an artificially deep hole in the riverbed and in**
 13 **a sandy riverbed. And as most five-year-olds**
 14 **could tell you from their experience at the**
 15 **beach, if you dig a deep hole in the sand, the**
 16 **walls are going to collapse. So they were having**
 17 **to go back and try to re-excavate that navigation**
 18 **channel.**
 19 **Q. And when dredging was occurring prior to 2001,**
 20 **how often did it occur?**
 21 **A. It occurred most years. And yesterday we looked**
 22 **at some of the diagrams showing the distribution**
 23 **of dredging up and down the river and over time.**
 24 **But -- and the dredging was limited to certain**
 25 **parts of the river. It was upstream of river**

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2687

2689

1 mile 23.

2 And there were certain hot spots which

3 were -- which we looked at in the diagrams

4 yesterday, certain places that tended to shoal

5 more than others, so required more repeated

6 dredging.

7 Q. Why would they have to dredge every year?

8 A. Because the riverbed is recovering. You dig the

9 deep hole, and then sand fills it back in. And I

10 think when they proposed the project originally,

11 they had some idea that they could dig this deep

12 channel, and it would stay that way. But, you

13 know, these are sand banks; and they just

14 collapse. And so -- so that's why they were back

15 each -- you know, almost every year in most

16 places. It would depend on where you were, but

17 quite frequently they would have to go back and

18 dredge.

19 Q. Okay. Sir, what can you tell us about how the

20 river has recovered since dredging ceased in

21 2001?

22 A. Since the cessation of dredging in 2001, the

23 first thing is we know that the riverbed has come

24 back up, that it would be impossible for the

25 river to have kept that deep hole in sand. You

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1 sloughs were blocked during the dredging period.

2 And they -- they are now -- have become more

3 open. So the fishermen can access many of these

4 sloughs that had been blocked during the period

5 of active dredging with all the sand in

6 circulation.

7 Q. Dr. Kondolf, there was a suggestion yesterday

8 that since dredging has ceased and, as you have

9 described, the river is recovering, what do you

10 need? Why is the river not completely recovered?

11 A. Well, the river needs adequate flow. And, you

12 know, there have been a number of restoration

13 projects that have been done that are sort of

14 small-scale projects, which are good; but the

15 underlying problem is that the river needs

16 adequate flow.

17 If you were to use a medical analysis, if the

18 river is the patient, the patient has a systemic

19 disease; and that's the lack of flow. It also

20 has a broken arm. And you can do projects such

21 as a lot of the small-scale projects that have

22 been done to date to reconnect some of the

23 sloughs, which is like fixing the broken arm,

24 which you have to do; and that's important. But

25 that doesn't get at the underlying systemic

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2688

2690

1 know, we know that's going to collapse. And we

2 also know some parts of the river have been

3 shoaling. We lack really good survey data since

4 then, but it's quite clear that that's been

5 occurring.

6 And then we have the narrowing of the

7 channel. So we looked yesterday at how the

8 channel had widened. Since 2004, which are the

9 last data that were used by the U.S. Geological

10 Survey, we can see in the last 10 years that the

11 river has begun to narrow through establishment

12 of riparian vegetation, willows mostly, that are

13 now narrowing the channel.

14 We also know that the riverbanks have

15 stabilized. Back during the dredging year of --

16 when the dredge was operating, it was disturbing

17 sand; and so there was a lot of loose sand on the

18 banks. And since then, with the -- with the

19 stopping of the dredging, the banks have

20 stabilized; and they're now creating a firm

21 substrate. And that's beneficial for mussels

22 because that's important habitat for the mussels

23 to have a stable substrate.

24 And then the last thing that's really clear

25 in terms of recovery is the sloughs. Many of the

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1 disease, which is the lack of water.

2 So you have to have adequate flow to take

3 advantage of the habitats that have been

4 preserved, the restoration projects that have

5 been done. You need to have adequate water.

6 Q. Okay. Thank you, Dr. Kondolf. I would like to

7 stick with this topic and show you another

8 document, if I may.

9 MR. QURESHI: And, your Honor, this is

10 Florida Exhibit 530. It's not marked as 530

11 because I'm going to pass out a color copy.

12 The copy in the binders is a black and white

13 copy; but this is the same document, Florida

14 Exhibit FX-530.

15 BY MR. QURESHI:

16 Q. Dr. Kondolf, this is a February 2013 letter from

17 the United States Fish and Wildlife Service to

18 the ACFS Stakeholders. And you may not have seen

19 this before, but I want to direct your attention

20 to the first page and the bottom paragraph that

21 begins for example, and through the word

22 environmental flow components.

23 Also, I want you to have an opportunity to

24 review the graph on the last page and paying

25 attention to the red line on the graph on the

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2691

1 last page.

2 **A. Okay. I haven't seen this letter before, so I'll**

3 **try to --**

4 **Q.** Sure.

5 **A. -- take a look at the entire context.**

6 MR. PRIMIS: Your Honor, while the

7 witness is reading the document, I'm going to

8 object to introducing a technical document

9 that the witness has not seen before or

10 opined on before. And I just happen to know

11 from being involved in the case for a long

12 time that there were several detailed

13 technical analyses referenced here in the

14 first paragraph which he has no knowledge of.

15 MR. QURESHI: Your Honor, I'm simply

16 going to ask him how the references to the

17 environmental flow components are consistent

18 with his direct testimony.

19 SPECIAL MASTER LANCASTER: Proceed.

20 MR. QURESHI: Thank you, your Honor.

21 **A. Okay. Again, I'm not conversant in all the --**

22 **all the background of this.**

23 **Q.** Certainly, Dr. Kondolf. My question simply is

24 there is a reference on the first page to minimum

25 and maximum flow duration, magnitude, frequency,

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2692

1 and the rate of change that were observed at USGS

2 gages during the pre-dam period. And there is a

3 reference to these being essential environmental

4 flow components.

5 Now, in your direct testimony on -- and

6 that's in tab 2 of the binder they gave you

7 yesterday, in paragraph 49 you write, maintaining

8 an adequate flow regime is needed to keep the

9 river healthy while it continues the natural

10 process of self-healing.

11 So I would like to understand how this is

12 consistent with the reference in the U.S. Fish

13 and Wildlife Service's letter.

14 **A. Well, it appears that here they're referring to**

15 **using pre-dam flow data as a reference for --**

16 **against which to judge flows that you would have**

17 **today or might be simulated for today.**

18 **Q.** Okay. Dr. Kondolf, how does that relate to your

19 opinion that the river needs more flows to become

20 healthy?

21 **A. Well, so if I'm reading this correctly -- and,**

22 **again, I might need to read through it more**

23 **carefully; but it looks like roughly half the**

24 **time that the recommended flows were -- were**

25 **achieved. And so that would indicate that the**

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2693

1 **river is not getting sufficient flow now. That's**

2 **what this appears to be.**

3 **Q.** Okay. Why does it need that to regain its

4 health?

5 **A. Well, for example, the -- the river has complex**

6 **habitats on the banks and in the sloughs. And so**

7 **if the -- if the flows are artificially reduced,**

8 **a lot of those habitats will not be inundated.**

9 **So -- I was looking at this figure in the last**

10 **page. Sorry.**

11 **But the principle is that you can have**

12 **excellent complex habitats along the banks of the**

13 **river or in sloughs; but if the flows have been**

14 **artificially reduced, the river won't be**

15 **inundating those, and they won't be part of the**

16 **river ecosystem.**

17 **Q.** And can you describe what steps the State of

18 Florida has done to promote recovery of the river

19 to help it regain its health?

20 **A. I think the most -- most important thing is that**

21 **the State of Florida has set aside thousands and**

22 **thousands of acres in the floodplain. And it's**

23 **one of the least disturbed floodplains in North**

24 **America by far. And the State has -- by buying**

25 **or getting easements, it's ensured that most of**

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2694

1 **the floodplain will remain undeveloped. And so**

2 **that's by far the most important thing because**

3 **then, as long as you have a good flow regime, the**

4 **river has the capacity to recover.**

5 **And that's really the thing. Rivers have a**

6 **tremendous self-healing potential. And that**

7 **potential is very high on the Apalachicola**

8 **because of the wide floodplain that exists. And**

9 **so as long as there is a healthy flow regime,**

10 **then we can expect continued recovery of the**

11 **river.**

12 **In addition to setting aside the floodplain,**

13 **the State of Florida stopped the dredging that**

14 **was going on and initiated a number of**

15 **restoration projects. First they required the**

16 **Army Corps of Engineers to do the restoration**

17 **projects, but the Corps would tend to be very**

18 **heavy-handed and blunt, using very large river**

19 **equipment to do it. And then the State of**

20 **Florida was -- began doing these projects**

21 **themselves.**

22 **And they have hired my team, my colleagues at**

23 **the University of Florida and me, to undertake an**

24 **analysis of -- of restoration projects for river**

25 **mile 40 to 63 and to look at the relationship**

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2695

2697

1 **between channel change and mussel habitat there**
 2 **and how that can inform future restoration.**
 3 **Q.** Dr. Kondolf, there was a suggestion yesterday
 4 that it's only river mile zero through 23 that
 5 has not suffered from the impacts of dredging.
 6 Are there other areas of the river that you have
 7 observed that are showing signs of improvement;
 8 and, if so, why?
 9 **A. Yes. There's a lot of improvement throughout the**
 10 **river. I mentioned that the -- you know, that**
 11 **channels were largely recovering from dredging**
 12 **because -- which is what we would expect. The**
 13 **bank stabilization, the fact that many of the**
 14 **sloughs are now accessible. Fishermen can get in**
 15 **there. The water can get in there, which wasn't**
 16 **the case during the dredging.**
 17 **And we also see that the overwidening of the**
 18 **channel is reversing, that the channel was**
 19 **starting to narrow.**
 20 **That's the preliminary results of our**
 21 **analysis of aerial photographs since 2004.**
 22 **Q.** And, Dr. Kondolf, how are you able to
 23 differentiate the impacts of dredging on the
 24 river versus the impacts of low flows?
 25 **A. Well, first, the lower 23 miles of the river do**

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1 **having that much -- that difference in flow.**
 2 **Q.** Dr. Kondolf, I'm going to move to a slightly
 3 different topic; and this relates to the 2009
 4 American Rivers document that was highlighted
 5 during your cross-examination. That's behind tab
 6 4 of your binder.
 7 Before we dive into the substance of it, can
 8 you explain why you prepared the document?
 9 **A. I was asked by American Rivers, which is a**
 10 **national nonprofit environmental organization.**
 11 **Their -- their goal is to preserve and restore**
 12 **ivers in America. They asked me to assess the**
 13 **prospects for restoration of the Apalachicola**
 14 **River.**
 15 **American Rivers has identified the**
 16 **Apalachicola as a river of concern. And, in**
 17 **fact, this year, American Rivers identified the**
 18 **Apalachicola as the most endangered river in the**
 19 **United States. Each year American Rivers puts**
 20 **out a list of the most endangered rivers, and**
 21 **this year they identified the Apalachicola as the**
 22 **most endangered. And they cited the lack of flow**
 23 **as the primary threat to the river.**
 24 **So it's in that context that they asked me to**
 25 **prepare this report.**

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2696

2698

1 **not show any effects of the dredging. So we know**
 2 **that reduced flows there are entirely**
 3 **attributable to the reduced flows from upstream.**
 4 **The lower water levels in that part of the river**
 5 **are because of upstream reductions.**
 6 **And that's a very important part of the river**
 7 **because that has the vast majority of the swamp**
 8 **forest, which is the Ogeechee tupelo which**
 9 **provides the tupelo honey. And it's ecologically**
 10 **very important for fish and whatnot. That's**
 11 **described in Dr. Allan's report.**
 12 **As we go upstream on the river, with**
 13 **Dr. Hornberger's modeling and Dr. Allan's**
 14 **biological information, Dr. Allan's report is**
 15 **able to distinguish and identify the effect of**
 16 **that reduction in flow from the -- excuse me, the**
 17 **reduction in the stage of the river, the height**
 18 **of the river, from the reduced flows from**
 19 **upstream. So he's able to quantify that.**
 20 **And that's potentially quite important**
 21 **because, for example, if you talk about a**
 22 **difference between 5,000 and 7,000 cubic feet per**
 23 **second, that's about 37 sloughs that are**
 24 **connected in that interval. So that's a lot of**
 25 **habitat that -- that would be restored by just**

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1 **Q.** Okay. And since preparing this report in 2009,
 2 what additional work have you done in connection
 3 with Apalachicola River?
 4 **A. I'm currently working with colleagues at the**
 5 **University of Florida on a project for the**
 6 **Florida Fish and Wildlife Commission to evaluate**
 7 **channel change and mussel habitat from river**
 8 **mile 40 to 63.**
 9 **And after I completed the -- this report for**
 10 **American Rivers in 2009, I returned to the river**
 11 **a few times in subsequent years as well -- I**
 12 **don't remember exactly how many -- because my --**
 13 **my mother grew up in Tallahassee and around**
 14 **there. And so we would bring her back to the**
 15 **beach. She -- she found the beaches in**
 16 **California too cold. So we were bringing her**
 17 **back each summer. And so I was in the area**
 18 **anyway; I was very close, so I would go and visit**
 19 **the river with the riverkeeper. And so through**
 20 **that I had a chance to see more sites and sort of**
 21 **get a better understanding even since I did this**
 22 **report.**
 23 **Q.** And can you explain how this worked for the State
 24 of Florida as well as these personal visits to
 25 the area, how have they informed some of the

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2699

1 observations you made in 2009?

2 **A. In 2009 in this report, I was -- in a way I was**

3 **pitching, you know, some restoration projects.**

4 **And -- and so I think since then I appreciate**

5 **perhaps more the value of some of the projects**

6 **that had been done. And in this report I point**

7 **out that they were not -- they were not restoring**

8 **the process. So in a way they were not fixing**

9 **the patient's systemic problems, but just, you**

10 **know, fixing the broken arms. And I had, I**

11 **guess, maybe more of a critical attitude in this**

12 **report.**

13 **But since that time, for example, I have been**

14 **to some of these small projects that were done,**

15 **which include removing sediment from the mouth of**

16 **some of these tributaries. And the purpose was**

17 **to get the cold water from the tributary into the**

18 **river for the striped bass and other fish.**

19 **And it is really remarkable. If you approach**

20 **those in a boat, the water is just alive with**

21 **fish. They're all hanging out in that cold water**

22 **that's coming in from the tributary.**

23 **So anyway, I appreciate much more some of the**

24 **projects that had been done. Even though they're**

25 **not fixing the river's, you know, systemic**

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2700

1 **problems, the systemic disease, at least they are**

2 **providing a lot of benefit.**

3 **And I also -- in the report I emphasize one**

4 **of the first principles is do no harm; and so I**

5 **emphasized that. But I also make a strong case,**

6 **well, we should be looking at, for example,**

7 **reconnecting Battle Bend, which I acknowledge in**

8 **the report is a big project. But the emphasis in**

9 **the report is, well, let's really look into this.**

10 **And as I have observed further recovery in the**

11 **river and appreciate the potential impacts of the**

12 **Battle Bend reconnection that I'm proposing,**

13 **which would be a really big project and require**

14 **Congressional deauthorization and all this stuff,**

15 **I realize that I wouldn't promote that project so**

16 **strongly today. That would be a difference.**

17 **Q.** Okay. Thank you, Dr. Kondolf.

18 I want to focus in on one of the items you

19 mentioned, that "do no harm" principle. And

20 that's actually highlighted on page 11 of GX-248.

21 Why don't you take a moment to review that to

22 yourself and explain to us what exactly that

23 means.

24 **A. So in this paragraph I draw an analogy to -- to**

25 **the physician's craft in medicine. And I -- I**

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2701

1 **try to point out that -- you know, I have already**

2 **noted that the river can do a lot of**

3 **self-healing. And so by analogy with a human**

4 **patient, we should emphasize natural recovery,**

5 **that the -- by exercise or diet or simply the**

6 **ability of the body to heal, that we let the**

7 **river heal itself. And when we consider large,**

8 **intrusive projects, that we should be confident**

9 **that the benefits are going to outweigh the**

10 **impacts.**

11 **And those large, intrusive projects, those**

12 **could be likened to open heart surgery. And,**

13 **certainly, if it's really needed, it's great.**

14 **But you don't want to go into that lightly**

15 **because there -- it's a -- there's a lot of**

16 **trauma on the system from open heart surgery. So**

17 **you don't -- you don't necessarily do that**

18 **lightly.**

19 **And I think in relation to your earlier**

20 **comment, something like the Battle Bend**

21 **reconnection might be considered open heart**

22 **surgery. So you would -- you wouldn't do that**

23 **unless you felt that the river was not recovering**

24 **sufficiently on its own.**

25 **Q.** And, Dr. Kondolf, you mentioned the self-healing

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2702

1 aspects of the river. Are you suggesting that we

2 just leave it alone, and it will be fine in some

3 time?

4 **A. No. The self-healing -- you know, again, with**

5 **the physician's analogy, self-healing requires**

6 **good diet, exercise, fresh air. So the river --**

7 **and the main thing the river needs is flow. It**

8 **has the space. It has the floodplain. These**

9 **have been preserved. What's missing now is the**

10 **adequate flow regime. And with that, the river**

11 **can heal itself. I mean, it's doing it already.**

12 **Q.** If we could please turn to page 41 of GX-248,

13 sir. There's a discussion of a proposal to

14 remove sediment plugs from particular sloughs.

15 Please take a moment to review that and then let

16 us know if that project was undertaken.

17 **A. Okay. So this is generally about removing**

18 **sediment plugs from the inlets of sloughs or the**

19 **mouths of tributary streams. And some of these**

20 **projects have been undertaken. The State of**

21 **Florida required the Army Corps to do some of**

22 **these projects back during the days of dredging.**

23 **And then the State of Florida undertook some**

24 **of these projects themselves since, which Battle**

25 **Bend was the largest one. They opened up the**

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2703

1 downstream part of Battle Bend. There were three
 2 others, Blue Springs Run, Sweetwater Creek, and
 3 Kelly Branch -- there was a dam removed on that,
 4 which was a little different. But there have
 5 been a number of projects to -- to remove the
 6 sediment.

7 And here, I proposed Swift Slough as one
 8 example. And at the time I wrote this report in
 9 2009, I was not aware of an analysis done by the
 10 U.S. Fish and Wildlife Service which is reported
 11 in their 2006 biological opinion in which they
 12 actually went in the field and assessed the
 13 potential to clear the sand from Swift Slough.
 14 And they determined that it would actually have
 15 more of an impact -- negative impact than a
 16 benefit. So -- so I wasn't aware of that.

17 But for each of these -- and I think I make
 18 it clear in the report, for each of these
 19 potential slough projects, you would need to --
 20 you would need to do an assessment and to
 21 determine whether there's more benefit to be --
 22 to be gained versus impact from the project.

23 Q. Okay. Dr. Kondolf, you mentioned the 2006 BiOp;
 24 so I would like to provide you a copy. And maybe
 25 you can highlight for us the particular provision

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2704

1 you're referring to.

2 I refer you to page 120. And perhaps you can
 3 explain how this discussion refers to your
 4 assessment.

5 A. **It's a large document.**

6 Okay. Page 20 --

7 Q. I'm sorry, doctor. I said page 120.

8 A. **120.**

9 Q. It's the paragraph beginning the adverse.

10 A. **Okay. That's why I recognize that.**

11 Okay. So this paragraph begins in which the
 12 Fish and Wildlife Service is saying that the
 13 adverse effects of low flow to the -- these
 14 mussels could be minimized by increasing the
 15 minimum flows or conducting habitat management.

16 And by habitat management they go on to say
 17 that they have looked at Swift Slough in 2006 to
 18 see whether they should excavate sand to -- to
 19 connect Swift Slough at a lower flow. And they
 20 said, after careful examination of the channel
 21 morphology, they determined that it would -- it
 22 would do more damage than benefit because
 23 essentially it would drain these pools that the
 24 mussels were living in.

25 Q. Okay.

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2705

1 A. **So that would be a case. But in the context of**
 2 **my recommendations in my report, you know -- you**
 3 **know, I think we should be evaluating all these**
 4 **possible projects; but in each case we want to --**
 5 **we don't want to do more harm than good. And in**
 6 **this case the Fish and Wildlife Service did a**
 7 **field inspection and determined that removing the**
 8 **sand in that location would probably do more harm**
 9 **to the resource than benefit.**

10 Q. Okay. Dr. Kondolf, in your opinion, since 2009
 11 has the State of Florida undertaken steps to
 12 restore the Apalachicola River?

13 A. **Yes. Certainly, the -- again, there have been**
 14 **these projects, Blue Springs Run, Sweetwater**
 15 **Creek, Kelly Branch, those are examples of**
 16 **projects that have been undertaken. And I think**
 17 **more land has been acquired and set aside. And,**
 18 **you know, they hired my group based in the**
 19 **University of Florida to provide them with**
 20 **scientifically-based recommendations for**
 21 **restoration for river mile 40 to 63; and we're**
 22 **hoping that that will be expanded in the future.**

23 Q. Okay. Dr. Kondolf, if I may now refer you to
 24 tab 3 of the binder that you were provided
 25 yesterday. It was a PowerPoint presentation.

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2706

1 And counsel represented to you that was prepared
 2 by Mr. Ted Hoehn.

3 You asked counsel for Georgia the date on
 4 which this presentation was prepared. He never
 5 told you. Why did you ask for the date?

6 A. **Well, a lot of these things, the photographs that**
 7 **apparently show dredging going on and the text**
 8 **that describes many of the impacts, those would**
 9 **appear to be things that were current in the**
 10 **1990's perhaps or 1980's; but you wouldn't see**
 11 **that today. There's been a lot of recovery in**
 12 **the river since then. So -- so that's why I was**
 13 **asking about the date because it seems like a**
 14 **dated document.**

15 Q. And Mr. Hoehn actually testified that the date
 16 of the document was 2005, but some of the
 17 photographs may have appeared from earlier eras.
 18 He also explained that many of the issues
 19 highlighted in the presentation have since been
 20 remedied and are no longer in existence. How is
 21 that consistent with your observations?

22 A. **I haven't looked at the entire document, but that**
 23 **would make sense. 2005 was when the permit was**
 24 **denied. And so I'm sure a lot of these slides --**
 25 **they had to have been taken before 2000.**

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2707

1 **And so -- so, yes, given the recovery in the**
 2 **river, I would imagine that some of the issues**
 3 **highlighted here had resolved themselves or had**
 4 **been addressed.**
 5 **Q.** Okay. You didn't review all of the slides with
 6 counsel for Georgia; but if you flip to the
 7 latter half of the presentation -- and the pages,
 8 unfortunately, are not numbered; but they're
 9 entitled Additional Effects of Low Flows. I
 10 would like for you to explain how what's depicted
 11 on those slides is consistent with your personal
 12 observations.
 13 **A.** **Okay. So these -- this describes -- because of**
 14 **the lower flows you are inundating less of the --**
 15 **of the roots of trees. That's evident in this**
 16 **photograph; it looks like cypress trees and their**
 17 **roots. It also shows a slough that is apparently**
 18 **drying up. And there is a disconnected pool,**
 19 **which would have concentrations of fish.**
 20 **And as these -- as the sloughs disconnect**
 21 **from the river and you can no longer have flowing**
 22 **water through them, the pools become isolated,**
 23 **stagnant, and usually the dissolved oxygen levels**
 24 **drop. And so that's a big stress on the**
 25 **organisms, and it can be lethal.**
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2708

1 **So -- and then there's also a slide entitled**
 2 **Submerged Aquatic Vegetation Decline. So that**
 3 **would refer to the -- I presume to some of the --**
 4 **the vegetation that's naturally submerged in the**
 5 **water and has a lot of ecological importance for**
 6 **different species. But as that is exposed as the**
 7 **river levels decline, then, of course, you lose**
 8 **that habitat.**
 9 **Q.** And is it your assessment that the river is
 10 continuing to suffer from these types of issues?
 11 **A.** **Yes. Yes. Especially in the dry years. It's --**
 12 **it's a -- the lack of flow is still a significant**
 13 **problem, yes.**
 14 **Q.** Dr. Kondolf, if we may now go to tab 6 of the
 15 cross-examination binder, a copy of a study
 16 prepared by Ms. Helen Light at GX-88. Have you
 17 reviewed this report before?
 18 **A.** **Yes, I have.**
 19 **Q.** And, sir, what's your assessment of the work in
 20 this report?
 21 **A.** **I think it's an excellent report of -- the**
 22 **authors are all very good scientists; and they**
 23 **did a very good job. It's -- you know, of**
 24 **course, it's a report with a certain limited**
 25 **scope. It's 10 years ago now. And it relies**
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2709

1 **largely on data from 20 years ago or more. So**
 2 **obviously, you know, there are a lot of things**
 3 **that have changed since this report was done; and**
 4 **some of the conclusions I wouldn't necessarily**
 5 **agree with in any event. But I think it's a very**
 6 **good piece of work.**
 7 **Q.** Okay. And can you highlight any particular
 8 conclusion that you would disagree with?
 9 **A.** **I could go through and look at these, but --**
 10 **Q.** For example, at the bottom of page 1, there's a
 11 discussion about water level decline. What's
 12 your assessment of that particular opinion?
 13 **A.** **Okay. And this one was highlighted in the**
 14 **deposition and so on.**
 15 **Yes. So this -- this statement says, water**
 16 **level decline caused by channel change is**
 17 **probably the most serious impact. The next**
 18 **sentence on the top of page 2 says, this decline**
 19 **has been exacerbated by long-term reductions in**
 20 **spring and summer flows.**
 21 **I think I would not agree with the conclusion**
 22 **that water level decline caused by channel**
 23 **changes is the most significant anthropogenic**
 24 **impact.**
 25 **One thing I think is useful to keep in mind**
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2710

1 **is this report only addressed the nontidal part**
 2 **of the river, so river mile 20 upstream, when in**
 3 **fact from river mile 23 downstream you have no**
 4 **effect from the channel change.**
 5 **And also, the purpose of this report was**
 6 **simply to look at the physical changes from the**
 7 **dredging. It was not -- the purpose of the**
 8 **report was not to assess the effects of lowered**
 9 **flows from upstream. There is -- later in the**
 10 **document there is some discussion of those lower**
 11 **flows; and so that it's -- the importance is**
 12 **recognized. But that was not the focus of this**
 13 **report.**
 14 **Q.** And even if we go beyond river mile 23 and go
 15 further north, the water level decline associated
 16 with dredging, what's your assessment of that
 17 today?
 18 **A.** **Well, again, there's been a lot of recovery of**
 19 **the bed, which has to happen. There is no way**
 20 **you could dredge a deep channel and not have it**
 21 **fill in with sediment in a context like this.**
 22 **And we know from the analysis of**
 23 **Dr. Hornberger and Dr. Allan in which they**
 24 **essentially remove the effect of the consumption**
 25 **by upstream states, then you can see that there**
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2711

2713

1 is a significant impact from the lowered flows.

2 In terms of the impact of the -- of the

3 remaining effect of the dredging, you know,

4 there's certainly -- that is certainly still out

5 there; but we're -- again, we're seeing the

6 channels recovering from that.

7 Q. Dr. Kondolf, I now would like to move to a

8 discussion on sloughs. You had some questions

9 yesterday about the connectivity level of

10 sloughs, and there was a focus on the Swift

11 Slough. How many sloughs are in the Apalachicola

12 River?

13 A. There are over 300 sloughs connected to the

14 Apalachicola River.

15 Q. And knowing what you know about river dynamics,

16 what is your expectation regarding the change --

17 in regard to changes to the connecting flow level

18 to these various sloughs?

19 A. Well, first, these 300 sloughs are connected at

20 all different flows. There's a USGS report from

21 1998 that inventoried all the sloughs and

22 their -- the flows at which they were connected

23 at that time. And that report showed from about

24 4,000 cfs up to 19,000 cfs that, you know,

25 different sloughs will connect or disconnect at

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1 A. I have worked a lot on rivers in California, of

2 course. The San Joaquin River is one that I was

3 involved in. And there's a court case on that --

4 a pretty well-known court case. In the San

5 Joaquin, the construction of Friant Dam actually

6 dried the river out in two places downstream. So

7 there used to be between two and 300,000 salmon

8 that swam upstream the San Joaquin each year, and

9 that run was exterminated by the dam.

10 But, fortunately, the policy is now to

11 restore the salmon run. And the question is what

12 flow regime exactly do you need for that? And

13 that was what I worked on before -- in the

14 settlement for that case.

15 And this year for the first time we have

16 continuous flow in the San Joaquin from the dam

17 down to the delta.

18 So I have worked on the San Joaquin. I have

19 worked on the Sacramento, the Trinity River, the

20 Klamath River, worked on the Mississippi.

21 Internally I'm doing a lot of work on the Mekong

22 right now. I have worked on the Rhone River and

23 its tributaries in Europe, some -- a couple of

24 rivers in Portugal, Thailand -- Taiwan, sorry.

25 Well, Thailand also, and -- well, Korea.

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2712

2714

1 those different flows. So there's a wide range.

2 So essentially at almost any flow level if

3 you were to drop a thousand cfs, you would be

4 cutting off 10 or 20 sloughs. So throughout the

5 range of flows there are different sloughs that

6 connect or disconnect.

7 And over time, the level at which a slough

8 connects can change. And one of the factors has

9 already been talked about, deposition of sand as

10 a result of the dredging. But even without that,

11 there are always fluctuations. It's an alluvial

12 river. It's a dynamic system. So there would

13 always be fluctuations in the level of when some

14 of these sloughs would connect.

15 And we know that since the dredging stopped,

16 that many of these sloughs are flushing out of

17 sediment and that the -- they're accessible and

18 connected at a lower level than they were before.

19 Q. And what is required to flush out additional

20 sediment and connect additional flows in the

21 sloughs?

22 A. River flow is needed. That's what's needed.

23 Q. Okay. Dr. Kondolf, can you describe for the

24 Court some of the other river systems that you

25 have studied?

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1 Q. Okay. Thank you, Dr. Kondolf.

2 Just based on your extensive study of

3 rivers -- rivers around the world, can you give

4 us your assessment of the Apalachicola River?

5 A. In my view the Apalachicola is a real gem. It's

6 a beautiful system, highly productive, one of the

7 most biodiverse and ecologically productive

8 systems in the planet, certainly in North

9 America. And the fact that the floodplain has

10 been preserved, it has tremendous potential to

11 continue to be such an amazing place.

12 What it really needs is flow. It needs to

13 have adequate flow to preserve this for future

14 generations.

15 Q. Thank you, Dr. Kondolf.

16 SPECIAL MASTER LANCASTER: Recross?

17 MR. PRIMIS: Yes, your Honor.

18 RECCROSS-EXAMINATION

19 BY MR. PRIMIS:

20 Q. Dr. Kondolf, we highlighted yesterday in your

21 American Rivers report where you acknowledged

22 that low flow could have an impact on the river

23 as well as channel change. Right?

24 A. I believe so.

25 Q. And I showed you the portion of your report that

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2715

1 said that. Right?

2 **A. It's a bit of a blur; but I think so, yes.**

3 **Q.** Okay. And I'm only asking you because you have

4 done no quantitative analysis to assess the

5 relative impact on the river of channel change

6 caused by the Army Corps as opposed to low flow.

7 True?

8 **A. Certainly from river mile 23 downstream we can**

9 **attribute all the reduction in river stage to**

10 **reduced flows from upstream because there is no**

11 **channel change down there. As you go upstream**

12 **from that point, it was not part of my**

13 **responsibility to quantify the different effects.**

14 **But those that have been -- at least the effect**

15 **of the reduced flows from upstream have been**

16 **quantified by the Hornberger and Allan reports.**

17 **Q.** Dr. Kondolf, I'm just going to ask you to narrow

18 your answers and try to answer the question I'm

19 asking. So I'll just focus on river mile 23 and

20 up.

21 You personally, sir, have done no

22 quantitative analysis to assess the relative

23 impact between Army Corps dredging and channel

24 change on the one hand and low flows on the

25 other. Correct?

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2716

1 **A. So, again, the purpose of my report was not to do**

2 **a quantitative disaggregation of those two, no.**

3 **Q.** Are you capable of answering questions yes and

4 no?

5 **A. It depends on the question.**

6 **Q.** How about the last one? Can you answer that

7 question yes or no?

8 **A. Again --**

9 **Q.** I'll withdraw the question, Dr. Kondolf.

10 **A. I'm happy to expand on it, if you would like.**

11 **Q.** No. I'm going to ask you for the opposite,

12 please.

13 Dr. Kondolf, with regard to low flows that

14 you have talked about, you have done no

15 quantitative analysis to assess whether they are

16 caused by drought versus Corps operations versus

17 Georgia's use versus evaporation. Correct?

18 **A. It's correct that I have not -- it was not part**

19 **of my report scope to analyze what factors could**

20 **be causing the reduction in flow from upstream to**

21 **the Apalachicola River.**

22 **Q.** Is another way of saying that no?

23 **A. Yes. In answering your question, I did not**

24 **analyze those factors.**

25 **Q.** Okay. Sir, you were shown JX-1, which is the

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2717

1 letter from the Secretary of War. Can you pull

2 that out.

3 It was a loose document from Mr. Qureshi.

4 **A. Yes, I have it here.**

5 **Q.** Okay. And you said that this suggests that all

6 the dredging was done to benefit Georgia. Right?

7 That's your opinion?

8 **A. The dredging project and the construction of the**

9 **dams was done principally to benefit upstream**

10 **ports in Georgia and to some extent Alabama, but**

11 **Georgia primarily.**

12 **Q.** Okay. I just want to point out that the document

13 we're looking at, JX-1, it bears the header 76th

14 Congress First Session. Correct?

15 **A. Yes. That appears to be right.**

16 **Q.** And you understand that the dam was built as a

17 result of an Act of Congress. Right?

18 **A. Yes.**

19 **Q.** And Georgia doesn't control the Congress; I don't

20 think you're saying that. Right?

21 **A. No, I'm not saying that Georgia controls the**

22 **Congress.**

23 **Q.** And this letter is from the Secretary of War.

24 Correct?

25 **A. That's correct.**

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2718

1 **Q.** And that person is appointed by the President of

2 the United States. Right?

3 **A. Yes. That's correct.**

4 **Q.** The Governor of Georgia doesn't appoint the

5 Secretary of War. Right?

6 **A. That's correct.**

7 **Q.** And in the last part of the cover page, he notes

8 that he's giving this report as requested by

9 resolution of the Committee on Rivers and Harbors

10 of the House of Representatives. Correct?

11 **A. That's correct.**

12 **Q.** And that's the United States House of

13 Representatives. True?

14 **A. That's correct.**

15 **Q.** Now, you mentioned on your redirect that you have

16 done work in 2015 on the Apalachicola River.

17 Correct?

18 **A. That's right.**

19 **Q.** And in paragraph 8 of your written direct, that's

20 where you have a very short description and note

21 that that's what -- that you have been doing some

22 work there. Right?

23 **A. That's correct. In paragraph 8 I briefly**

24 **describe that work.**

25 **Q.** And when we talked about Ted Hoehn's presentation

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2719

2721

1 from 2005, you said that's dated. Right?

2 It's out of date. That's your view?

3 **A. Well, some of the photographs are certainly from**

4 **the dredging era, which would be, you know, 20**

5 **years ago. So --**

6 **Q.** So the photographs are dated?

7 **A. Well, and the -- the presentation is from 2000 --**

8 **what was it, 2005 or something?**

9 **Q.** Yes, sir. And Helen Light's report from 2006

10 that talked about channel change being the single

11 biggest effect on the river, that's from 2006.

12 And you said that's outdated. Right?

13 **A. Well, I --**

14 **Q.** It's a little old?

15 **A. Well, I mean, it is 10 years old; and it relies**

16 **on the -- the data it relies on is 20 years old.**

17 **Q.** And your 2009 American Rivers report that talks

18 about the severe degradation caused by the Army

19 Corps of the Apalachicola River, you said that's

20 somewhat outdated, too, because we're doing this

21 work now in 2015. Right?

22 **A. Well, I -- again, I think for the time these**

23 **reports were done, that they were -- it was fine.**

24 **But things -- we do get new information. As we**

25 **continue to work, we get further information.**

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1 You did a report, right, in 2015?

2 **A. Yes. My team did a report -- progress report in**

3 **2015.**

4 **Q.** It's not cited anywhere in your written direct

5 testimony; is it, sir?

6 **A. Maybe not. No.**

7 **Q.** It's not. And you didn't mention it with

8 Mr. Qureshi. Correct?

9 **A. I don't think so, no.**

10 **Q.** And when Mr. Hoehn was here, you're aware he

11 didn't mention that there was a 2015 report on

12 the Apalachicola River and mussels that you were

13 a part of; did he?

14 **A. I don't know. I wasn't here.**

15 **Q.** Now, you -- you -- so you acknowledge you did do

16 a report that you delivered to the Florida Fish

17 and Wildlife Commission in 2015. Correct?

18 **A. Yes. I think it was November of 2015.**

19 **Q.** And Ted Hoehn works for the Florida Fish and

20 Wildlife Commission. Right?

21 **A. Yes.**

22 **Q.** In fact, Mr. Hoehn, is the person responsible for

23 mussels along the river. Correct?

24 **A. I don't know what his responsibilities are.**

25 **Q.** Well, you know Mr. Hoehn got your report. Right?

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2720

2722

1 **Q.** And you want the Court to rely on the fact that

2 you have done more work and have new information.

3 Right? That's why you're here?

4 Things have changed since 2009. We should

5 look at new information. Right?

6 **A. Well, if it's relevant, certainly, yes.**

7 **Q.** Okay. Now, in paragraph 8 -- take a close look.

8 You don't mention any further documentation of

9 any work you have done for the Florida Fish and

10 Wildlife Commission in that paragraph; do you,

11 sir?

12 **A. I'm not sure what JX-128 is, but it looks like**

13 **historical gage data.**

14 **Q.** Well, it's your -- it's your testimony; and you

15 attached Exhibit 128 as attachment A.

16 **A. Yes.**

17 **Q.** So you can look at it. It's gage data. Right?

18 **A. Yes. Yes.**

19 **Q.** So you have never disclosed to this Court that

20 you actually have done and documented additional

21 work after your 2009 American Rivers report in

22 the Apalachicola River. Right?

23 **A. No. I think that -- I think that says it right**

24 **here.**

25 **Q.** Did you cite to that report?

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1 **A. I assume so. I -- I don't know.**

2 **Q.** He's the person at Fish and Wildlife who would

3 get it and review it. Correct?

4 **A. I'm not sure who would get it and review it at**

5 **Fish and Wildlife.**

6 **Q.** And you didn't review his testimony at all to

7 prepare for this?

8 **A. No. I think -- I think I was shown a couple**

9 **places where he mentioned me; but, no, I didn't**

10 **review his testimony.**

11 **Q.** And none of those mentioned your November 2015

12 report. Correct?

13 **A. I don't recall.**

14 **Q.** You don't. Well, the transcript will reflect

15 that he didn't mention it.

16 MR. PRIMIS: Your Honor, may I approach?

17 BY MR. PRIMIS:

18 **Q.** This is GX-1335.

19 And Dr. Kondolf, this is the report that you

20 provided to Florida Fish and Wildlife in November

21 of 2015 concerning your work on river mile 40

22 through 63. Correct?

23 **A. That's right.**

24 **Q.** And now that you have seen it, can you confirm,

25 again, you never cited this in your written

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2723

1 direct testimony. Right?

2 **A. I don't remember -- well, apparently I didn't.**

3 **I --**

4 **Q.** Now, let's walk through this report, the one that

5 you gave to Florida Fish and Wildlife and which

6 was not mentioned by their representative. On

7 page 2 you say at the bottom there is a history

8 of human impacts. Correct?

9 **A. So this report had multiple authors. I -- most**

10 **of it was not written by me; but -- but it was**

11 **written by other members of the team.**

12 **Q.** Okay. Dr. Kondolf, I should have asked this.

13 Let's just look at the first page. Your name is

14 the third one down. Correct?

15 **A. That's right.**

16 **Q.** That's you, Mat Kondolf?

17 **A. Yes.**

18 **Q.** So you were a part of this project?

19 **A. That's correct.**

20 **Q.** And you know the context of this document?

21 **A. Yes. So this was a progress report for the --**

22 **for this larger study which still had a year to**

23 **go.**

24 **Q.** Okay, sir.

25 **A. So --**

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2725

1 **A. Yes.**

2 **Q.** And I'm not going to go through it again because

3 it's very similar to what was in your American

4 Riverkeepers report, but take a moment and just

5 confirm that the history you describe here is

6 accurate?

7 **A. I didn't actually write this. And it does --**

8 **it's not complete. I think my American Rivers**

9 **report, that was my work; and that's probably a**

10 **better reflection of my summary of the history.**

11 **But this was done by members of the team.**

12 **Q.** The team that you were a part of?

13 **A. Yes.**

14 **Q.** Okay. Can you go to page 8.

15 **A. Okay.**

16 **Q.** Do you see the section called Channel Dredging

17 and Sediment Disposal?

18 **A. Yes.**

19 **Q.** In the middle there is a sentence that starts

20 dredge deposits. Can you take a look on that --

21 take a look at that.

22 Right in the middle of the Channel Dredging

23 and Sediment Disposal paragraph on page 8.

24 **A. Right. Beginning dredge deposits?**

25 **Q.** Right.

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2724

1 **Q.** On page 2 you outline --

2 MR. QURESHI: Your Honor, may I request

3 that you allow the witness to finish his

4 answer before you begin your next question?

5 BY MR. PRIMIS:

6 **Q.** Are you done, Dr. Kondolf?

7 **A. So as I said, this was a progress report. There**

8 **was another year to go in the project. And so**

9 **this was done so that we could get paid for our**

10 **deliverables 1 through 4.**

11 **Q.** And that's actually a good point. So thank you

12 to Mr. Qureshi for letting you finish.

13 You're currently getting paid by the State of

14 Florida to do this work. Right?

15 **A. That's correct.**

16 **Q.** And that's -- separate and apart from your expert

17 testimony, you are a paid consultant for the

18 State of Florida. True?

19 **A. Yes. This is a research project through the**

20 **University of Florida. And I'm one of the**

21 **investigators for this project.**

22 **Q.** For which you were compensated. Correct?

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

24 **Q.** Now, you have a whole section on history of human

25 impacts, correct -- your team in this report?

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2726

1 MR. PRIMIS: I'm also helping the Court out

2 here, too.

3 SPECIAL MASTER LANCASTER: What page is

4 that?

5 MR. PRIMIS: Page 8.

6 SPECIAL MASTER LANCASTER: Thank you.

7 MR. PRIMIS: In the section called

8 Channel Dredging, about halfway down.

9 SPECIAL MASTER LANCASTER: All right.

10 BY MR. PRIMIS:

11 **Q.** Dr. Kondolf, have you had a chance to read that?

12 **A. The sentence or the entire rest of the paragraph?**

13 **Q.** Well, I'm focused on that sentence to the end of

14 the paragraph.

15 **A. Okay. Okay.**

16 **Q.** Now, this report that you and your team submitted

17 to Florida Fish and Wildlife is telling the State

18 that there are dredge deposits. And when there

19 are high flows, the sand on those dredge deposits

20 can be deposited back into the river. Correct?

21 **A. Yes.**

22 **Q.** And one effect of that, I think you said, is that

23 that can raise the bed of the river, right, when

24 that sand goes back in?

25 **A. That's true. Yes.**

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2727

2729

- 1 **Q.** But another effect documented right here by your
- 2 team and reported a year ago to Florida Fish and
- 3 Wildlife is that they can plug slough channels.
- 4 Right?
- 5 **A. That's correct. There is -- sand is moving --**
- 6 **during floods there will be sand moving in and**
- 7 **out of the channel, in and out of sloughs. The**
- 8 **overall effect, since the cessation of dredging,**
- 9 **is there is less sand in circulation; and so the**
- 10 **sloughs are tending to flush out. But, yes, you**
- 11 **can certainly get sand going back into sloughs as**
- 12 **well.**
- 13 **Q.** Dr. Kondolf, I would just like a clean question
- 14 and answer. Your team reported to Florida Fish
- 15 and Wildlife a year ago in 2015 that sand and
- 16 dredge spoils are still going back into the river
- 17 and can clog sloughs. Correct?
- 18 **A. Yes. That's correct.**
- 19 **Q.** Now, the last sentence of that paragraph, your --
- 20 you and your team reported to the State of
- 21 Florida that these remaining dredge spoils are a
- 22 persistent source of sand to the river channel.
- 23 Isn't that what you and your team told the State?
- 24 **A. That's correct.**
- 25 **Q.** And can you go to the next change -- next

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- 1 **A. Yes.**
- 2 **Q.** And we have a standing rule in the case that
- 3 lawyers are not to read lengthy passages; but I
- 4 think, with some relief from the Court, this one
- 5 is pretty important, and I want to make sure this
- 6 one is in the record. So I hope I have developed
- 7 some goodwill by not reading.
- 8 But your team tells the State of Florida that
- 9 degradation of the riverbed and channel widening
- 10 of the river has decreased connectivity to the
- 11 floodplain and slough channels. Correct?
- 12 **A. Yes. That's what it says.**
- 13 **Q.** And you reported that one year ago -- almost one
- 14 year ago today. True?
- 15 **A. Right.**
- 16 **Q.** And you say that that causes floodplain
- 17 desiccation and loss of riparian tree species
- 18 characteristic of swamps. Correct?
- 19 **A. That's correct.**
- 20 **Q.** And that affects the tupelo trees that you
- 21 mentioned on your redirect. Correct?
- 22 **A. That's correct. That's -- the tupelos are**
- 23 **mentioned, yes.**
- 24 **Q.** And it has caused many previous perennial sloughs
- 25 to go dry. True.

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2728

2730

- 1 page, 9. There is a section called Observed
- 2 Channel Changes Caused By Human Activities.
- 3 Correct?
- 4 **A. That's correct.**
- 5 **Q.** And, again, a lot of the content here is similar
- 6 to material we covered yesterday; so I won't do
- 7 it again. But I do just want to establish for
- 8 the record that you and your team outlined for
- 9 the State of Florida a year ago in an updated
- 10 report that there are many coinciding
- 11 anthropogenic activities. Correct?
- 12 **A. Yes.**
- 13 **Q.** And then you go ahead and list them, like channel
- 14 widening and deepening and other factors.
- 15 Correct? Is that part of your report?
- 16 **A. So you're saying that we refer to many coinciding**
- 17 **anthropogenic activities within a relatively**
- 18 **short history --**
- 19 **Q.** Correct.
- 20 **A. -- making it difficult to attribute any given**
- 21 **channel change to a single human activity. Yes.**
- 22 **Q.** Now, can you go to the next page, Dr. Kondolf,
- 23 page 10 at the bottom. There is a section called
- 24 Lower Water Levels and Less Frequent Floodplain
- 25 Inundation. Do you see that?

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- 1 **A. Yes. There is a reference there to the report by**
- 2 **Helen Light, et al., of 2006 and Darst and Light.**
- 3 **So it's in effect summarizing information from**
- 4 **those USGS reports.**
- 5 **Q.** And reporting it to the State of Florida Fish and
- 6 Wildlife in 2015. Correct?
- 7 **A. I write that -- I think it's clear it's**
- 8 **referencing this -- these reports -- the**
- 9 **information in those reports.**
- 10 **Q.** And let's just focus on the next sentence because
- 11 you were talking all about mussel habitats on
- 12 redirect. You told the State of Florida a year
- 13 ago that these impacts of the Army Corps
- 14 operations has impacted mussel habitat in the
- 15 slough channels through loss of perennially
- 16 flowing water, deposition of sediment carried in
- 17 from areas of the mainstream -- mainstem
- 18 disturbed by dredging or outright desiccation.
- 19 Is that what you told the State of Florida
- 20 last year?
- 21 **A. Yes. And, again, the citations in that paragraph**
- 22 **are to the USGS reports. And all this is**
- 23 **summarized in those USGS reports.**
- 24 **Q.** And you're not saying, sir, that there isn't
- 25 still dredge spoils, and they're not still going

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2731

1 into the river. Right?

2 **A. No. There are still some out there, yes; and**

3 **some of them are still being eroded, yes.**

4 **Q.** And they can still impact the sloughs. Right?

5 **A. Yes. I would just emphasize, too, that the scale**

6 **of the sediment coming in from those is very**

7 **small compared to the scale of the impacts during**

8 **the act of dredging. I think you made that point**

9 **very well yesterday talking about the scale of**

10 **the dredging. The scale of the sediment that**

11 **comes in from these deposits that remain, these**

12 **spoil deposits that remain, is quite a bit**

13 **smaller.**

14 **Q.** Dr. Kondolf, on the next page, page 11, there is

15 a section called Preliminary Findings of Recent

16 Changes.

17 **A. Yes.**

18 **Q.** And can I direct your attention to the middle of

19 that paragraph starting these changes.

20 **A. Yes.**

21 **Q.** Can you read to the end, and then I'll ask you

22 some questions.

23 **A. Yes.**

24 **Q.** Now, you testified here that the river is in a

25 period of recovery; but a year ago your team told

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2732

1 the State of Florida that the river may be in a

2 period of recovery. Correct?

3 **A. That's correct.**

4 **Q.** And, Dr. Kondolf, one thing that this paragraph

5 points out is that very high flows, like 140,000

6 cfs, almost flood conditions, have a good effect

7 because they wash sand into the river. Correct?

8 **A. I'm not sure I follow you.**

9 **Q.** That's okay, Dr. Kondolf. Let's move to page --

10 two pages later. Do you have a chart called

11 figure 2? Do you see that?

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

13 **Q.** And each of those stars is a dredge spoil site as

14 documented by the Army Corps in 2001. Correct?

15 **A. Yes.**

16 **Q.** Can you go two pages later, and there we have

17 another aerial shot of the river. And this

18 shows, again, where the dredge spoils occur along

19 the stretch that you're looking at from river

20 mile 39 to 64. Correct?

21 **A. Well, two pages later it seems to be figure 4,**

22 **which is something else. Can you specify which**

23 **figure you're talking about?**

24 **Q.** Yes. Figure 4 -- oh, I'm sorry. That's

25 tree-line width. This is showing the changes at

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2733

1 tree-line width on figure 4. Correct?

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

3 **Q.** Now, let's go to figure 7. It's a couple pages

4 later. It has three horizontal maps of aerial

5 photos of the river.

6 Mr. Smith put them up vertically, but in your

7 report they're horizontal. Do you see that?

8 **A. Yes.**

9 **Q.** And the top one is dated 2012. Right?

10 **A. The one on the right, yes.**

11 **Q.** And those -- the sand that's shown, those are

12 dredge spoils in 2012. Correct?

13 **A. Well, they're -- they're point bars. And in some**

14 **cases the point bars were augmented by sand**

15 **deposited from dredge spoils. But I would have**

16 **to look at the individual ones here.**

17 **So, for example, the second one down is -- is**

18 **probably a natural -- well, let's see. It could**

19 **be a natural point bar that developed as part of**

20 **the -- these hook and bays. Certainly, the**

21 **fourth one down and the fifth one down, those**

22 **definitely look like they are fresh deposits of**

23 **sand. So they would not have been dredge spoils**

24 **but, rather, recently-deposited -- well, the term**

25 **is -- that's used is part of the hook, this**

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2734

1 **feature that grows out into the channel and is**

2 **effectively narrowing the width of the channel.**

3 **Q.** Dr. Kondolf, can you turn to page 22 of your

4 report, please. And I direct your attention to

5 the bottom of the last paragraph, perhaps four or

6 five lines from the bottom.

7 **A. So page 22, this is the paragraph beginning the**

8 **daily water surface elevation data?**

9 **Q.** Yes. The part beginning we chose not to use a

10 further downstream station at Sumatra. Do you

11 see that?

12 **A. Yes.**

13 **Q.** And what your team is saying here is that there

14 are tidal effects on the river levels south of

15 Sumatra at mile 20, and so they did not attempt

16 to capture river level information for those.

17 Correct?

18 **A. And I -- I didn't write this; but that appears to**

19 **be what it says, yes.**

20 **And, again, I tried to make this distinction**

21 **yesterday -- I think it's worthwhile -- is down**

22 **near the Sumatra Gage, that lower part of the**

23 **river, you have the river floodplain at this**

24 **level. You have the channel down here. So the**

25 **tides can go up and down in the channel, but they**

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2735

1 **don't affect the surface of the floodplain. So**
 2 **the floodplain surface is affected by higher**
 3 **flows in the river.**
 4 **So we have to -- it's important to**
 5 **distinguish the river channel itself may be**
 6 **tidal, whereas, the floodplain surface is only**
 7 **affected by riverine flows.**
 8 **Q.** Dr. Kondolf, can you turn to page 31 of your 2015
 9 report to Florida Fish and Wildlife. You have a
 10 section called Dredge Spoil in the Floodplain.
 11 Correct?
 12 **A. That's correct.**
 13 **Q.** At the bottom of that page there's a picture of
 14 Sand Mountain taken in 2015?
 15 **A. That's correct.**
 16 **Q.** It's still there?
 17 **A. Yes. As I said yesterday, Sand Mountain is still**
 18 **there.**
 19 **Q.** And in this section you report to Florida Fish
 20 and Wildlife in that first sentence that spoil
 21 mounds from past dredging is likely a continual
 22 source of sediment. Correct?
 23 **A. That's right.**
 24 **Q.** Can you go two pages back now to page 33, and
 25 there's a section called Slough and Cutoff

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2736

1 Inspections and Associated Photography. Do you
 2 see that?
 3 **A. Yes.**
 4 **Q.** Now, here is another slough that we haven't
 5 talked about called Mary Slough. Right?
 6 **A. Let's see.**
 7 **Q.** The last line above the caption identifies it as
 8 Mary Slough near river mile 58.5. Correct?
 9 **A. Yes. Figure B-5 on figures 22 to 24. Let's see.**
 10 **Okay. I'm not sure that the photograph**
 11 **below -- I don't think that is Mary Slough.**
 12 **But -- that's a cutoff that's in -- natural**
 13 **cutoff that's in progress.**
 14 **Q.** Okay. Well, let's go to the next page.
 15 **A. Okay.**
 16 **Q.** You're disputing, by the way, that this is Mary
 17 Slough?
 18 **A. I don't think this is Mary Slough.**
 19 **Q.** Okay.
 20 **A. No. This is -- so near -- near the Florida**
 21 **River -- I mean, if you like, we could pull out a**
 22 **photo; and I could show you where this is. Near**
 23 **the Florida River there's a very pronounced**
 24 **meander bend in the river. And at flood flow**
 25 **water flows across this meander bend. And so as**

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2737

1 **it does that, it erodes out -- it's eroding out a**
 2 **channel.**
 3 **This is a natural part of river dynamics is**
 4 **that you can get what are called meander cutoffs.**
 5 **So you have a meander bend; and it can cut off in**
 6 **two ways, either a neck cutoff or it's just bank**
 7 **erosion that eventually cuts through. Or you can**
 8 **have what's called a chute cutoff -- C H U T E,**
 9 **not spelled as you would expect. And this -- and**
 10 **this is where during the flood flows the river**
 11 **begins carving out a shortcut channel.**
 12 **And that's what's happening here. I would**
 13 **expect, you know, in 5 or 10 years' time that the**
 14 **river might be flowing through this channel**
 15 **instead of the existing river. And that's just a**
 16 **natural part of river dynamics.**
 17 **Q.** Dr. Kondolf, can you now turn to page 44 of your
 18 November 2015 report. And just to put it in
 19 context, if you look at page 43 first, you will
 20 see that we're in a section called Mussels.
 21 **A. Yes.**
 22 **Q.** And then go to page 44. And I want to direct
 23 your attention to the bottom of page 44, and in
 24 particular the sentence about five lines from the
 25 bottom that starts this survey.

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2738

1 **A. Okay.**
 2 **Q.** Before we go into this, the Latin name A
 3 neislerii, do you see that?
 4 **A. Yes.**
 5 **Q.** That is the fat threeridge mussel. Correct?
 6 **A. I believe so. I'm not an expert on mussels, but**
 7 **I think I recall seeing that that is the Latin**
 8 **name.**
 9 **Q.** You just testified on redirect about the work
 10 Dr. Allan was doing on mussels. Correct?
 11 **A. Yes.**
 12 **Q.** So you're familiar enough --
 13 **A. Yes.**
 14 **Q.** -- to give testimony to the Supreme Court about
 15 it?
 16 **A. Yes.**
 17 **Q.** Okay. In this report of November 2015, you
 18 report to the Florida Fish and Wildlife
 19 Commission that the fat threeridge is likely one
 20 of the most abundant mussels in the middle
 21 reaches of the Apalachicola River. Right?
 22 **A. Again, perhaps we should --**
 23 **Q.** My question, sir, was did you report what I just
 24 said before the Florida Fish and Wildlife
 25 Commission?

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2739

1 MR. QURESHI: Again, the witness needs
 2 to answer your question before you begin the
 3 next question, please.
 4 MR. PRIMIS: Your Honor, I won't debate
 5 with counsel. Can I just ask you to have the
 6 witness give an answer to my narrow question?
 7 SPECIAL MASTER LANCASTER: Just so you
 8 should understand, if you can answer the
 9 question yes or no, do so. Your counsel can
 10 come up and ask for clarification.
 11 **A. Okay. I think it would be the least misleading**
 12 **if I pointed out this is a report that was done**
 13 **by multiple authors, and I did not write this**
 14 **section on mussels. Our mussel expert on the**
 15 **team, Michael Gangloff, wrote the section on**
 16 **mussels. So this was not my work here.**
 17 **Q.** Dr. Kondolf, you and your team submitted a report
 18 a year ago to Florida Fish and Wildlife saying
 19 that the fat threeridge was likely one of the
 20 most abundant mussels in the middle reaches.
 21 Correct?
 22 **A. That is in our report, yes. Again, it's not a**
 23 **section that I wrote or even reviewed; but**
 24 **that -- that's the opinion of -- of my colleague**
 25 **obviously.**

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2740

1 **Q.** And you said your colleague is Michael Gangloff,
 2 who is a mussel expert who included this in your
 3 joint report to Florida Fish and Wildlife.
 4 Correct?
 5 **A. That's correct.**
 6 MR. PRIMIS: No further questions, your
 7 Honor.
 8 SPECIAL MASTER LANCASTER: Redirect?
 9 REDIRECT EXAMINATION
 10 BY MR. QURESHI:
 11 **Q.** Very briefly, Dr. Kondolf. What was the purpose
 12 of this work that's memorialized in GX-1335?
 13 **A. This was a progress report, so we had actually**
 14 **just started our study in the summer. And we had**
 15 **a deadline to produce these, you know,**
 16 **deliverables, they're called, reports or datasets**
 17 **that we -- we were to provide in order to get**
 18 **paid for our initial section of work. And so**
 19 **that's what this reflected.**
 20 **So this was not a final report in any way.**
 21 **It was simply the deliverables report,**
 22 **essentially a progress report.**
 23 **Q.** And what's your understanding as to why the State
 24 of Florida was undertaking this work?
 25 **A. Again, the purpose of our study was to develop a**

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2741

1 **strong scientific basis for evaluating**
 2 **restoration projects that would benefit mussels**
 3 **in this reach from river mile 40 to 63. And this**
 4 **reach has a lot of what are called hooks and**
 5 **bays. And it's a way that the river channel has**
 6 **been changing apparently to renarrow the**
 7 **riverbed. That seems to be the result of these**
 8 **channel changes.**
 9 **Q.** We went through the report, and counsel for
 10 Georgia took particular sentences out of
 11 particular sections. Can you tell us as a whole
 12 what's the relationship between this report and
 13 the conclusions you reached in your direct
 14 testimony?
 15 **A. The conclusions in my direct testimony stand. I**
 16 **don't -- there's -- this report is -- well,**
 17 **there's some aspects here that -- for example,**
 18 **the -- we talked -- in here we report on the --**
 19 **our analysis of 2013 aerial imagery showing**
 20 **that there has been narrowing of the river and**
 21 **colonization by vegetation. And that -- that**
 22 **informed my expert opinion that -- some of the**
 23 **experience that I gained from doing this work for**
 24 **Florida Fish and Wildlife Commission.**
 25 **Q.** And the narrowing of the river and the

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2742

1 colonization represents what?
 2 **A. That's a part of the recovery of the river from**
 3 **the past impacts.**
 4 **Q.** And was required for the river to fully recover?
 5 **A. To fully recover the river needs flow. It needs**
 6 **adequate flow.**
 7 **Q.** Okay. Thank you, doctor.
 8 MR. PRIMIS: No further questions, your
 9 Honor.
 10 SPECIAL MASTER LANCASTER: Doctor,
 11 you're going to have to help me here. I'm
 12 not sure that I'm familiar with the topics.
 13 But GX-1335 bears your name in part as --
 14 THE WITNESS: Yes.
 15 SPECIAL MASTER LANCASTER: -- as an
 16 author.
 17 THE WITNESS: Yes.
 18 SPECIAL MASTER LANCASTER: And your
 19 testimony is that you did not write certain
 20 parts of this; is that correct?
 21 THE WITNESS: That's right.
 22 SPECIAL MASTER LANCASTER: Did you read
 23 it all?
 24 THE WITNESS: I don't -- I don't think I
 25 read the mussel part. But I read other -- I

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2743

1 think I read all the other parts.
 2 SPECIAL MASTER LANCASTER: Did you
 3 approve of this report in total?
 4 THE WITNESS: Yes. I would say there
 5 was -- it was kind of a last-minute thing to
 6 pull it together, I think, amongst all of us
 7 on the team. But, yes.
 8 SPECIAL MASTER LANCASTER: Are you
 9 familiar with the tri-state Compact?
 10 THE WITNESS: Unfortunately, I'm not.
 11 SPECIAL MASTER LANCASTER: Are you
 12 familiar with the ACF Stakeholders
 13 Sustainable Water Management Plan?
 14 THE WITNESS: I have heard of it, but
 15 I'm not familiar with it.
 16 SPECIAL MASTER LANCASTER: You told me
 17 and the rest of the crew about your extensive
 18 experience with rivers worldwide. Do you
 19 know anything about the Penobscot?
 20 THE WITNESS: Not much, I -- I confess.
 21 SPECIAL MASTER LANCASTER: You know it's
 22 in Maine?
 23 THE WITNESS: I know it's in Maine.
 24 SPECIAL MASTER LANCASTER: I have been
 25 improving my vocabulary since this thing

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2744

1 started. I now understand what riverine is.
 2 What is fluvial?
 3 THE WITNESS: Fluvial is the same. It's
 4 just the Latin-based word. Fluvius from
 5 Latin for river. So fluvial just refers to
 6 something pertaining to rivers.
 7 SPECIAL MASTER LANCASTER: Further
 8 direct?
 9 Further cross?
 10 MR. PRIMIS: No, your Honor.
 11 MR. QURESHI: Nothing further, your
 12 Honor.
 13 SPECIAL MASTER LANCASTER: Thank you
 14 very much.
 15 THE WITNESS: Okay. Thank you.
 16 SPECIAL MASTER LANCASTER: Why don't we
 17 recess.
 18 (Time Noted: 10:26 a.m.)
 19 (Recess Called)
 20 (Time Noted: 10:40 a.m.)
 21 MR. PERRY: Good mourning, your Honor.
 22 SPECIAL MASTER LANCASTER: Good morning.
 23 MR. PERRY: Florida would like to call
 24 David Sunding, who is Florida's agricultural
 25 and natural resources economist. He is also

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2745

1 an expert on specific practical measures that
 2 have been applied to limit agricultural and
 3 municipal water use across the country for
 4 the benefit of the environment.
 5 THE CLERK: Please raise your right
 6 hand.
 7 Do you solemnly swear that the testimony
 8 you shall give in the cause now in hearing
 9 shall be the truth, the whole truth, and
 10 nothing but the truth, so help you God?
 11 THE WITNESS: I do.
 12 THE CLERK: Please be seated.
 13 Pull yourself right up to the microphone
 14 and please state your name and spell your
 15 last name.
 16 THE WITNESS: Let me get some water.
 17 My name is David Sunding. My last name
 18 is spelled S U N D I N G.
 19 MR. PERRY: Your Honor, may we approach
 20 to provide the witness with the --
 21 SPECIAL MASTER LANCASTER: Thank you.
 22 DIRECT EXAMINATION
 23 BY MR. PERRY:
 24 Q. Dr. Sunding, do you adopt that prefiled direct
 25 testimony as your testimony in this case?

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2746

1 **A. I do.**
 2 **Q.** Thank you.
 3 MR. PRIMIS: Your Honor, we have --
 4 again, I'm going to hand out some documents
 5 for the cross-examination.
 6 SPECIAL MASTER LANCASTER: Sure.
 7 CROSS-EXAMINATION
 8 BY MR. PRIMIS:
 9 **Q.** Good morning, Dr. Sunding.
 10 **A. Good morning.**
 11 MR. PRIMIS: Your Honor, just to explain
 12 what we have done here, there are a number of
 13 lengthy expert reports that bear on
 14 Dr. Sunding's testimony; but there's really
 15 two or three pages that we're going to come
 16 back to again and again. So I have just
 17 excerpted them, stapled them, and put them in
 18 the sleeve.
 19 BY MR. PRIMIS:
 20 **Q.** And, Dr. Sunding, are you able to recognize these
 21 as tables from your reports which we have just
 22 copied and pasted into a single demonstrative?
 23 **A. Yes. That appears to be the case.**
 24 **Q.** Okay. Dr. Sunding, you were first retained by
 25 Florida for this case around 2006 or 2007.

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2747

1 Correct?

2 **A. Yes.**

3 **Q.** And you have been working on becoming familiar

4 with the issues in this case for almost a decade.

5 True?

6 **A. Sure. With varying levels of intensity during**

7 **different time periods.**

8 **Q.** Doctor --

9 **A. My early involvement was not too much.**

10 **Q.** Dr. Sunding, can you just bring the microphone

11 closer?

12 **A. Sure. I'll scoot the chair up.**

13 **There you go.**

14 **Q.** Are you good?

15 **A. Is that better?**

16 **Q.** Yes.

17 One deficit that you have is you haven't been

18 here every day, so the lawyers know all the

19 tricks of the trade at this point. And the

20 microphone is a big one.

21 **A. All right.**

22 **Q.** As is speaking slowly.

23 **A. All right.**

24 **Q.** So, Dr. Sunding, you're an economist by trade.

25 Correct?

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2748

1 **A. I am.**

2 **Q.** And your opinions in this case focus on what you

3 believe Georgia could do in terms of cost

4 effective conservation measures for water.

5 Correct?

6 **A. That's a large part of what I'm testifying about.**

7 **Q.** Okay. I'm just trying to set the stage. We'll

8 get to your opinions.

9 Before I do go to your opinions, I just want

10 to make clear some of the things that you're not

11 offering opinions about in this case, okay, to

12 define your role.

13 Now, after being involved in this case for

14 almost a decade, you didn't -- you haven't

15 disclosed any opinions in your expert reports

16 about the economic impact of harm to Florida due

17 to Georgia's water use. Correct?

18 **A. I don't think that's right.**

19 **Q.** Let me get your deposition transcript.

20 MR. PRIMIS: May I approach, your Honor?

21 BY MR. PRIMIS:

22 **Q.** Dr. Sunding, you were deposed in this case.

23 Correct?

24 **A. I was.**

25 **Q.** And you were under oath and told the truth.

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2749

1 Correct?

2 **A. Absolutely.**

3 **Q.** Okay. Could you turn to page 24, line 20.

4 MR. PRIMIS: And I would ask Mr. Smith

5 to play clips 322 and 323.

6 (Whereupon the video was played.)

7 BY MR. PRIMIS:

8 **Q.** Dr. Sunding, were you asked those questions; and

9 did you give those answers?

10 **A. Yes. And I still believe they're accurate.**

11 **Q.** Now, you did not analyze any biologic or

12 hydrologic impacts of Georgia's consumptive use

13 in Florida. Correct?

14 **A. No. That was in the domain of other experts.**

15 **Q.** You would agree that you could have analyzed the

16 value of Florida's commercial oyster or fishing

17 industries under certain Georgia consumptive use

18 assumptions; is that correct?

19 **A. Are you talking about an increment or a total**

20 **value of, say, commercial landings?**

21 **Q.** Dr. Sunding, you haven't analyzed Florida's

22 oyster or commercial fishing industries in this

23 case. Correct?

24 **A. No. I think that was included in Dr. Phaneuf's**

25 **expert report. I don't remember reporting on a**

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2750

1 **value of the commercial fishery.**

2 **Q.** For oysters or fish. Correct?

3 **A. No.**

4 **Q.** And you mentioned Dr. Phaneuf. Correct?

5 **A. Yes.**

6 MR. PRIMIS: That's P H A N E U F.

7 BY MR. PRIMIS:

8 **Q.** Dr. Sunding, you understand he's not coming to

9 trial and providing testimony?

10 **A. That's my understanding.**

11 **Q.** Now, you haven't disclosed any opinions about

12 harm to the commercial oyster industry in

13 Florida. Right?

14 **A. No. I did not analyze, say, what would be a**

15 **change in revenue or economic activity in the**

16 **commercial fishery as a result of changes in**

17 **Georgia's consumption.**

18 **Q.** You didn't analyze the monetary or economic

19 impact of alleged harm to mussels in Florida;

20 correct?

21 **A. That's right. I don't believe that's possible to**

22 **do reliably.**

23 **Q.** You didn't analyze the economic or monetary

24 impact relating to alleged harm to trees or

25 plants in the ACF Basin. Correct?

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2751

2753

1 **A. Yes. Again, just so we're tracking the way --**
 2 **when you say impact, what I'm hearing is change.**
 3 **So I analyzed the fact that there was injury, but**
 4 **I didn't analyze a change.**
 5 **Q.** Can you turn to page 15, line 1, of your
 6 deposition, Dr. Sunding.
 7 MR. PRIMIS: And, Mr. Smith, could you
 8 play clips 6, 7, and 8 which go from 15, line
 9 1 to line 11.
 10 (Whereupon the video was played.)
 11 BY MR. PRIMIS:
 12 **Q.** Were you asked those questions --
 13 MR. PERRY: Your Honor?
 14 BY MR. PRIMIS:
 15 **Q.** -- and did you give that answer?
 16 MR. PERRY: I'm sorry. Your Honor,
 17 might I note that the transcript actually
 18 reads just a bit differently than the clip
 19 that was played because the clip omits the
 20 objections.
 21 BY MR. PRIMIS:
 22 **Q.** Were you asked those questions, and did you give
 23 that answer?
 24 **A. Yes. And I think it's consistent with what I**
 25 **just said.**

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1 **A. Yes. And I stand by that. You were asking me**
 2 **about what I quantified. I added one -- I added**
 3 **one -- you know, one qualification to the answer,**
 4 **which is that I also reported on what others**
 5 **testified about the amount of resources that**
 6 **Florida has dedicated to preserving land in the**
 7 **Apalachicola.**
 8 **Q.** I would just like a clean answer to this
 9 question. Were you asked the question posed at
 10 16, 21; and did you give the answer at line 17, 1
 11 of your deposition under oath?
 12 **A. Yes. Absolutely.**
 13 **Q.** I want to ask you some questions now about
 14 causation, sir. Okay?
 15 **A. All right.**
 16 **Q.** You would agree that as a general matter, it is
 17 important to eliminate other variables that could
 18 have contributed to the harm alleged. Correct?
 19 **A. Could you help me out with the context? Is that**
 20 **just a general statement or with respect to some**
 21 **specific situation?**
 22 **Q.** Dr. Sunding, can you answer that question?
 23 **A. I can't without more detail.**
 24 **Q.** Okay.
 25 **A. I want to make sure I know what you're talking**

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2752

2754

1 **Q.** Now, Dr. Sunding, you conducted a survey in this
 2 case which asked residents of Florida, Georgia,
 3 and Alabama questions about the resources in the
 4 ACF Basin. Correct?
 5 **A. I did. That's right.**
 6 **Q.** Okay. We're going to come back to this later,
 7 but I just want to ask you; apart from the
 8 survey, you would agree that you have not
 9 attempted to quantify in any economic or monetary
 10 sense the impact on Florida of Georgia's
 11 consumptive water use. True?
 12 **A. That's largely true. I would add one exception**
 13 **to that. In my direct testimony I also noted the**
 14 **amount of resources that the State of Florida has**
 15 **spent conserving land in the Apalachicola region.**
 16 **Q.** Dr. Sunding, can you turn to page 16, line 21,
 17 of your transcript, and going through page 17,
 18 line 1. And does it say there, apart from the
 19 survey, have you attempted to quantify in any
 20 economic or monetary sense the impact on Florida
 21 of Georgia's consumptive water use?
 22 And after an objection to form, you said,
 23 nothing comes to mind, no.
 24 Were you asked that question, and did you
 25 give that answer?

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1 **about.**
 2 **Q.** Can you turn to your deposition transcript where
 3 it appeared you knew what I was talking about.
 4 Page 19, line 3.
 5 MR. PRIMIS: And, Mr. Smith, could you
 6 play clip 228.
 7 (Whereupon the video was played.)
 8 BY MR. PRIMIS:
 9 **Q.** Were you asked that question, and did you give
 10 that answer?
 11 **A. Yes. In the context of a much longer discussion**
 12 **about biological issues.**
 13 **Q.** Dr. Sunding, you have not personally undertaken
 14 to do an analysis of what other -- of eliminating
 15 what other variables could have contributed to
 16 the harm alleged in this case. True?
 17 **A. I think that's right.**
 18 **Q.** Now, I understand that you have had discussion
 19 with other Florida experts about causation; but
 20 to be clear, you personally are not offering any
 21 expert opinion on whether Georgia's water use has
 22 caused the harm to Florida that's alleged.
 23 Correct?
 24 **A. I think that's right. I'm an economist, not a**
 25 **biologist or ecologist.**

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2755

1 **Q.** Now, can you turn to paragraph 35 of your written
 2 direct testimony. And we have included it in
 3 your binder. There is a tab called Sunding
 4 Direct; but I think you each have a loose copy of
 5 it, too. And specifically I want to ask you
 6 about paragraph 35. Have you had a chance to
 7 look at that?
 8 **A. Yes. I read the paragraph.**
 9 **Q.** Okay. And, Dr. Sunding, your view is that the
 10 Apalachicola is a large ecosystem. Correct?
 11 **A. Sure. Yes.**
 12 **Q.** And it's your sworn testimony that changes in
 13 streamflows will impact this ecosystem in ways
 14 that are complex and multifaceted. Right?
 15 **A. Yes. That's reflecting my understanding as an**
 16 **economist of what the biologists have testified**
 17 **to.**
 18 **Q.** And your testimony is that the changes in
 19 streamflows will impact this ecosystem in complex
 20 and multifaceted ways. Right?
 21 **A. That's my understanding, yes.**
 22 **Q.** And, in fact, it's your view that it's difficult
 23 for people to comprehend the ways in which those
 24 streamflows could impact the ecosystem. Correct?
 25 **A. Yes.**

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2756

1 **Q.** Now, Dr. Sunding, as an economist, you routinely
 2 look at costs and benefits of proposed actions.
 3 Correct?
 4 **A. That is true, yes.**
 5 **Q.** And you would agree that comparing the costs and
 6 benefits of an environmental policy is a standard
 7 means of evaluating whether it is socially
 8 desirable. Correct?
 9 **A. I do agree with that as a general matter,**
 10 **although I gave a lot more context and some other**
 11 **opinions in my testimony.**
 12 **Q.** Now, can you turn to paragraph 39 of your direct.
 13 **A. I -- just give me a second to read it.**
 14 **Q.** Sure.
 15 **A. All right. I see it.**
 16 **Q.** In paragraph 39 you say that the actions that you
 17 proposed would enable Georgia to cap its annual
 18 consumptive use of water at current levels at
 19 minimal incremental cost and would provide
 20 substantial environmental benefits to Florida in
 21 both drought and nondrought years.
 22 And that's your sworn testimony. Right?
 23 **A. Yes.**
 24 **Q.** Now, after you had been working on this case on
 25 and off for 10 years, none of the other experts

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2757

1 in this case have provided expert opinions that
 2 quantify the benefits to Florida from your
 3 proposed conservation measures. Are you aware of
 4 that?
 5 **A. I guess I'm confused by your question because my**
 6 **understanding was that -- at least Dr. Allan had**
 7 **looked at a thousand cfs.**
 8 **Q.** Well, let me reframe my question. After working
 9 on this case for 10 years, none of your expert
 10 reports provide expert opinions that quantify the
 11 benefits to Florida from your proposed
 12 conservation measures. Correct?
 13 **A. That's right. They quantify an incremental**
 14 **change in economic welfare.**
 15 **Q.** Okay. Now, you mentioned Dr. Allan. And I do
 16 now want to talk about a couple of Florida's
 17 biology and ecology experts. Okay?
 18 You understand that a series of Florida's
 19 environmental experts and biological experts
 20 modeled the impacts of a remedy scenario.
 21 Correct?
 22 **A. I do understand that.**
 23 **Q.** And you understand that the remedy scenario that
 24 they modeled involved a proposed 50 percent
 25 reduction in agricultural water usage, a 50

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2758

1 percent reduction in evaporation from small
 2 impoundments, and the elimination of all
 3 interbasin transfers in the ACF Basin. Are you
 4 aware of that?
 5 **A. That all sounds familiar.**
 6 **Q.** And that's not a specific thing that you
 7 recommended. That came from Dr. Flewelling.
 8 Right?
 9 **A. I'm not sure who it came from.**
 10 **Q.** Hornberger or Flewelling, someone else; right?
 11 **A. Yes.**
 12 **Q.** We have a tab in your binder called Florida
 13 Experts -- FLA Experts. It's all the way at the
 14 back.
 15 Just let me know when you're there,
 16 Dr. Sunding.
 17 The first page says Greenblatt. Correct?
 18 **A. Oh, it is way at the back.**
 19 **Q.** Way in the back.
 20 **A. Got it.**
 21 **Q.** I'm just going to give the Court a moment to get
 22 there.
 23 MR. PRIMIS: Are you there?
 24 BY MR. PRIMIS:
 25 **Q.** So we have here a demonstrative from Marcia

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2759

1 Greenblatt's direct testimony. And do you know
 2 who Dr. Greenblatt is?
 3 **A. No, I don't.**
 4 **Q.** Your not aware that she's Florida's expert on
 5 salinity patterns in Apalachicola Bay?
 6 **A. No.**
 7 **Q.** Dr. Sunding, I just want to ask you as a
 8 follow-up to your testimony that Georgia's
 9 reduction in use will provide substantial
 10 environmental benefits, did you take into account
 11 Dr. Greenblatt's testimony that the remedy
 12 scenario she ran would result in somewhere less
 13 than 1 part per thousand reduction in salinity in
 14 Apalachicola Bay?
 15 **A. No. I never have seen this before. I don't know**
 16 **who she is.**
 17 **Q.** So you're not aware that the white parts depicted
 18 in Dr. Greenblatt's exhibit indicate less than
 19 1 part per thousand with the cuts that --
 20 MR. PERRY: Objection, mischaracterization.
 21 **A. No, I'm not familiar with this document at all.**
 22 **Q.** Okay. Let's go to the second tab -- I'm sorry,
 23 the second slide behind Florida Experts. And we
 24 have excerpted a chart here from Dr. Allan's
 25 expert report regarding the tupelo trees. Have
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2760

1 you seen this one before?
 2 **A. I may have seen this one before. I also spoke**
 3 **with Dr. Allan about how he was quantifying**
 4 **impacts. But this particular table does not look**
 5 **familiar.**
 6 **Q.** All right. Now, with regard to the substantial
 7 environmental benefits to Florida, you're aware
 8 that when Dr. Allan ran the remedy scenario with
 9 the 50 percent reduction in agricultural
 10 irrigation, that he showed that for the tupelo
 11 trees on his 10 percent metric, you got 29 fewer
 12 days of harm over 16 years. Were you aware of
 13 that?
 14 **A. Again, you're picking a table out of his report.**
 15 **I'm not familiar enough with this to give an**
 16 **opinion about it.**
 17 **Q.** Are the 29 days benefit to the tupelo trees over
 18 16 years a substantial environmental benefit?
 19 **A. Well, when I made that statement, I wasn't**
 20 **referring just to the tupelo trees. There are,**
 21 **as you know, a number of species that Dr. Allan**
 22 **examined.**
 23 **Q.** Okay.
 24 **A. So it would have -- the tupelos would have been**
 25 **part of it, but not the entirety by any means.**
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2761

1 **Q.** When -- how about Dr. Wilson White; are you
 2 familiar with him?
 3 **A. No.**
 4 **Q.** Let's turn to the next demonstrative.
 5 Now, you don't recognize Dr. White as an
 6 oyster on -- I'm sorry, an expert on oysters?
 7 **A. No.**
 8 **Q.** And you're not aware that he ran the remedy
 9 scenario through his model to see what kind of
 10 change there would be in oyster biomass?
 11 **A. No. He was not one of the experts that I**
 12 **interacted with.**
 13 **Q.** So I take it then you're not familiar with the
 14 chart we have included here from page 50 of his
 15 direct testimony which shows a maximum change in
 16 oyster biomass, running the 50 percent reduction
 17 scenario, of a little over 1 percent?
 18 **A. No. I have never seen this table before or this**
 19 **figure before.**
 20 **Q.** And so you have no opinion whether Dr. White's
 21 1 percent change, would that type of reduction in
 22 Georgia be a substantial environmental benefit.
 23 Correct?
 24 MR. PERRY: Objection, mischaracterization.
 25 **A. No.**
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2762

1 **Q.** Now, can you turn to FX-784. It's your first
 2 expert report, and Florida gave it an exhibit
 3 number for identification. So it's the first
 4 tab.
 5 **A. All right. I see it.**
 6 **Q.** Now, after having been involved in this case on
 7 and off for a decade, this was the initial report
 8 that you submitted in this matter. Correct?
 9 **A. Yes, it was.**
 10 **Q.** Page 1 of the report has your statement of
 11 opinions -- it's actually page 3.
 12 **A. Yes, it does.**
 13 **Q.** And then if you go to page 9, there's a table.
 14 Correct?
 15 **A. Yes, there is. I think it's the same one you**
 16 **excerpted in the handout you gave me earlier.**
 17 **Q.** Correct, sir.
 18 And you include in your statement of opinions
 19 this table which shows four different scenarios
 20 for conservation in Georgia of a thousand cfs at
 21 peak summer streamflow. Correct?
 22 **A. That's right.**
 23 **Q.** Now, your report back on page 86 also has a much
 24 smaller table that you said could get you up to
 25 1500. Correct?
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2763

1 **A. Yes. I looked at both a thousand and 1500 cfs**
 2 **reductions.**
 3 **Q.** And when you summarized four different scenarios
 4 in the statement of opinions up front, you
 5 included these four scenarios for a thousand.
 6 Right?
 7 **A. That's right.**
 8 **Q.** Now, did you review the testimony of
 9 Dr. Hornberger in this trial?
 10 **A. I did.**
 11 **Q.** So you saw the transcript of his testimony here
 12 in Maine?
 13 **A. Over the live testimony here in court, no --**
 14 **Q.** Yes.
 15 **A. -- I don't think I saw that.**
 16 **Q.** Okay. You should get it. There are draft
 17 transcripts which are actually outstanding
 18 quality, and you can review them.
 19 So Dr. Sunding, when Dr. Hornberger was here,
 20 he testified that in all of his modeling, the
 21 only thing he modeled from you was a 1,000 cfs
 22 scenario. Are you aware of that?
 23 **A. That -- that is consistent with my memory. So it**
 24 **wouldn't surprise me that he would say that.**
 25 **Q.** Now, you did a second report in this case.
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2764

1 Right?
 2 **A. You mean the defensive report?**
 3 **Q.** Yes.
 4 **A. Yes.**
 5 **Q.** So about three months after this initial report
 6 with the four 1,000 cfs scenarios, you submitted
 7 a second report, which we have at FX-801. And
 8 this one is dated May 20, 2016. Correct?
 9 **A. That's right.**
 10 **Q.** Now, having laid out the four 1,000 cfs scenarios
 11 in February, if you look at page 2 of FX-801, we
 12 now see a scenario that gets us up to 2,000 cfs.
 13 Correct?
 14 **A. It's actually page 3, isn't it, paragraph 8?**
 15 **Q.** I have paragraph 6 on page 2.
 16 **A. No. I don't think that's right.**
 17 **Q.** Can I approach and just make sure we're looking
 18 at the same thing?
 19 **A. My gosh. I have the wrong thing. Let me --**
 20 **Q.** I knew there would come a point where I would
 21 have to say I was wrong to Dr. Sunding, but it's
 22 not this time.
 23 **A. Not this time, no.**
 24 **Q.** I'm banking it.
 25 **A. All right. Paragraph 2, yes; you're right.**
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2765

1 **Q.** So here in paragraph 2 in May of 2016 you
 2 outlined a scenario to get to 2,000 cfs in peak
 3 summer streamflow. Correct?
 4 **A. That's right.**
 5 **Q.** Now, the 2,000 cfs scenario -- and now, it might
 6 just be easier to flip -- use these -- the charts
 7 in the sleeve.
 8 **A. All right.**
 9 **Q.** I'm now focusing on the May report, which is the
 10 second page of this little handout.
 11 When you did the 2,000 cfs scenario, your
 12 report assumed hydrology conditions in 2011.
 13 Right?
 14 **A. That's right.**
 15 **Q.** And just so the Court understands, that
 16 essentially means the rainfall and the runoff and
 17 the usage of 2011. Correct?
 18 **A. That is right.**
 19 **Q.** And you evaluated 2011 hydrology, and then you
 20 said we can get 2,000 if we use those
 21 assumptions. Right?
 22 **A. Yes. So there's a given level of demand of 2011**
 23 **hydrology, meaning that amount of precipitation;**
 24 **and then I considered reductions from the amount**
 25 **of consumptive use that occurred in 2011.**
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2766

1 **Q.** Okay. Now, Dr. Sunding, I want to focus on the
 2 municipal and industrial portion of this 2000
 3 scenario. Okay?
 4 **A. All right.**
 5 **Q.** And you understand that sometimes you say M & I.
 6 Right?
 7 **A. I do.**
 8 MR. PRIMIS: And that's an M, ampersand, I.
 9 BY MR. PRIMIS:
 10 **Q.** So focusing on the M & I aspects here, we have
 11 municipal outdoor water use for 385. Right?
 12 **A. That's right.**
 13 **Q.** And we have municipal leak abatement for 95?
 14 **A. That's right.**
 15 **Q.** And 66 cfs from eliminating net basin exports.
 16 Right?
 17 **A. You're right.**
 18 **Q.** And if you tally those up, would you agree that
 19 you get about 546?
 20 **A. Yes.**
 21 **Q.** Okay. I don't have a calculator. We had
 22 calculator issues yesterday, but the math here is
 23 a lot easier.
 24 Now, you know Dr. Flewelling. Right?
 25 **A. I do.**
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2767

1 Q. And you know that Dr. Flewelling estimated
 2 Georgia's total M & I consumption over a period
 3 of about 20 years. Correct?
 4 A. Yes. I know that he did that.
 5 Q. Okay.
 6 MR. PRIMIS: Mr. Smith, can you put
 7 up --
 8 BY MR. PRIMIS:
 9 Q. Actually, we have a demonstrative of this. If
 10 you go to the tab called Georgia
 11 Demonstratives -- I'm sorry, Sunding
 12 Demonstratives. We gave you your own tab.
 13 The first one is a depiction of figure ES.2
 14 from Dr. Flewelling's expert report at page 3.
 15 And if you look at 2011, Dr. Flewelling
 16 estimated Georgia's M & I consumption at just a
 17 shade over 500 cfs. Right?
 18 A. I think that -- this is, yes, information that
 19 was in Dr. Flewelling's report from the
 20 consumptive use database.
 21 Q. Right. I just want to get at the figure. He's
 22 at about 500 cfs. Right?
 23 A. It is.
 24 Q. Now, we drew a line across here that represented
 25 your 545 cfs number for M & I in 2011. And you

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2768

1 will see, sir, that it is higher than the total
 2 amount of consumption estimated by
 3 Dr. Flewelling. Isn't that right?
 4 A. No. That's not right.
 5 Q. For --
 6 A. You're comparing things that should not be
 7 compared.
 8 Q. Okay. Well, then you can clarify that when
 9 Mr. Perry is up. But right now, I want to ask
 10 you does the red line showing your 545 cfs number
 11 exceed the number calculated by Dr. Flewelling
 12 using the methodology here in his table, which
 13 was about 500 cfs?
 14 A. Well, it's difficult for me to answer because I'm
 15 not proposing a 545 cfs reduction in every year,
 16 which is what a line implies.
 17 There are a number of other errors in this
 18 comparison, but I do agree with you that the --
 19 the M & I reduction that we just added up is 545;
 20 and that is greater than the amount of
 21 consumptive use that's shown on this table from
 22 this figure. But I do hope we come back to this
 23 because I don't think that's an accurate way to
 24 compare things.
 25 Q. Okay. And I just want to be very specific. Your

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2769

1 545 cfs reduction assumed 2011 conditions.
 2 Right?
 3 A. Yes.
 4 Q. And I'm just asking about 2011 from
 5 Dr. Flewelling. Your reduction under 2011
 6 conditions exceeds what Dr. Flewelling calculated
 7 as Georgia's consumptive use in 2011. Right?
 8 A. It exceeds his calculation of this part of
 9 Georgia's consumptive use.
 10 Q. Right. The M & I part?
 11 A. No. Even beyond that. There is M & I
 12 consumptive use that's not shown in this figure.
 13 Q. Now, I take it, Dr. Sunding, you're not
 14 suggesting that metro Atlanta should cut its
 15 water use by 100 percent. Right?
 16 A. No. I have never suggested that.
 17 And let's be careful when we go back and
 18 forth between water use and consumptive use,
 19 because they are different, as you know.
 20 Q. Dr. Sunding, did you ever go back to
 21 Dr. Flewelling and say, hey, I'm looking at
 22 streamflow contributions in peak summer months of
 23 546 out of M & I reductions. Does Georgia even
 24 use that much on M & I?
 25 Did you have that conversation with him?

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2770

1 A. Sure. We have had conversations all throughout
 2 the process of developing my analysis.
 3 Q. Can you turn to page 126, line 16, of your
 4 deposition, sir.
 5 MR. PRIMIS: And, Mr. Smith, I would ask
 6 you to play the clip from 126, line 16 to
 7 line 21.
 8 (Whereupon the video was played.)
 9 BY MR. PRIMIS:
 10 Q. Dr. Sunding, were you asked that question; and
 11 did you give that answer?
 12 A. I did.
 13 Q. Okay. Now, I would like to look at the estimated
 14 M & I savings that you included in your direct
 15 testimony in this case. Okay?
 16 A. So you're talking the direct testimony is the
 17 last report that I did?
 18 Q. The --
 19 A. The most recent one?
 20 Q. The most recent one we think of as your written
 21 direct testimony.
 22 A. All right. Got it.
 23 Q. It's not an expert report.
 24 And that one appears in paragraph 90 of your
 25 written direct. And, again, I'm still going to

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2771

1 be focusing on M & I. Do you see that?

2 **A. Yes.**

3 **Q.** Now, if we add up those same three items from

4 your written direct testimony, that being leak

5 abatement, reduced municipal outdoor use, and

6 eliminate net basin exports, the combined effect

7 of those has shrunk. Right?

8 **A. Yes, because of examining different policies.**

9 **Q.** Right. You changed the policies you examined;

10 and you went from 546 cfs reduction for M & I,

11 and you reduced it to 315. Correct?

12 **A. That's right.**

13 **Q.** And just let's be fair, Dr. Sunding. You didn't

14 just change the policies; right? You corrected

15 some errors that reduced the number?

16 **A. That's right. That's true as well. There**

17 **were -- there were at least two issues that I can**

18 **think of now that I corrected; and then I also**

19 **changed the policy. I considered different**

20 **implementation of the outdoor water use**

21 **restrictions.**

22 **Q.** And you changed that policy that you looked at

23 after the time of your deposition. Correct?

24 **A. Sure. But my testimony was always about**

25 **evaluating economic impacts across a whole range**

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2772

1 **of policies.**

2 **Q.** Dr. Sunding, when you went from 546 cfs for M & I

3 and reduced it to 315 through error corrections

4 and policy changes, you reduced the amount by 42

5 percent of what you were recommending Georgia do

6 to conserve for M & I. Correct?

7 **A. Well, there are a couple of issues. I'm not**

8 **recommending anything. I'm examining the cost of**

9 **different conservation scenarios.**

10 **But, yes, it did go down by -- I'll accept**

11 **your number -- 42 percent.**

12 **Q.** And I do want to pause on something you just

13 said. It is true, sir, that you're not

14 recommending any particular policy to the Supreme

15 Court; you're just evaluating different potential

16 options and their costs. Correct?

17 **A. Yes. And I can offer testimony and have about**

18 **which policies might be the most economical for**

19 **Georgia to implement. But it's the State of**

20 **Florida that's bringing the complaint.**

21 **Q.** Now, we don't need to put the chart back up;

22 but you will recall for 2011 conditions

23 Dr. Flewelling had about 500 cfs of consumptive

24 use by metro Atlanta. Right?

25 **A. Understanding that that's not total consumptive**

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2773

1 **use, yes; that's the number that was on his**

2 **figure.**

3 **Q.** And so 315 is still about 60 percent of what

4 Dr. Flewelling had in this figure. Correct?

5 **A. Of consumptive use, yes.**

6 **Q.** Okay. So now, I want to switch from M & I over

7 to agricultural usage. And we can stick with

8 your 2,000 cfs scenario. And this, again, is

9 page 3 of the handout or paragraph 90 in your

10 written direct.

11 I find it easier to use the handout.

12 **A. Okay.**

13 **Q.** But I'll defer to everyone's preference.

14 **A. Okay. So I would like to turn to the right page**

15 **in my direct. So it's page 3 of the handout**

16 **or -- what's the right page in my direct?**

17 **Q.** It's paragraph 90.

18 MR. PERRY: Page 44.

19 MR. PRIMIS: Or page 44.

20 MR. PERRY: The handout, I believe, is

21 from your report -- the first report.

22 MR. PRIMIS: This -- your Honor,

23 this was a source of some confusion at

24 Dr. Sunding's deposition because there are

25 different sets of numbers. Just -- I want to

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2774

1 be clear what I have handed out.

2 BY MR. PRIMIS:

3 **Q.** This three-page demonstrative tucked in the

4 sleeve, Dr. Sunding, the first table is from your

5 February expert report. And it's the four 1,000

6 cfs scenarios. The second page is the 2,000 cfs

7 reduction chart from your second expert report.

8 And the third page is the 2,000 cfs chart from

9 your written direct.

10 **A. Yes.**

11 MR. PRIMIS: And, your Honor, they are

12 all a little different; so it matters which

13 page we're on.

14 BY MR. PRIMIS:

15 **Q.** And I will just say that for the third page of

16 this demonstrative, the 2,000 cfs from your

17 written direct, it indeed appears on page 44 of

18 your written direct testimony. Correct?

19 **A. Yes. Okay.**

20 **Now, I'm with you.**

21 **Q.** Okay. Now, in the 2,000 column you have six

22 different scenarios that sum up to a certain

23 amount of savings in agricultural water usage.

24 Right?

25 **A. I would just describe it a little differently. I**

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2775

1 **have six different conservation measures that**
 2 **produce different amounts of consumptive use**
 3 **savings --**
 4 **Q.** Right.
 5 **A.** -- **in agriculture.**
 6 **Q.** That's fair. The first three on the chart are
 7 M & I, and then everything under eliminate net
 8 basin exports is agricultural?
 9 **A.** **That's correct.**
 10 **Q.** And there are six agricultural conservation
 11 scenarios. Right?
 12 **A.** **Yes.**
 13 **Q.** Now, when you add up in the 2,000 column all the
 14 agricultural ones, you get 1,685 cfs savings in
 15 peak summer streamflow under your direct
 16 testimony. Correct?
 17 **A.** **Yes. And just so I'm clear, are you referring to**
 18 **the column that's labeled .6 Connectivity?**
 19 **Q.** Yes.
 20 **A.** **All right, yes. I will take your word for the**
 21 **math.**
 22 **Q.** That's the only column you have got that adds up
 23 to 2,000. Correct?
 24 **A.** **That's right.**
 25 **Q.** So that's -- it sums up to 1,685 cfs in peak
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2777

1 **further away. So I would have to think through**
 2 **that aspect of it.**
 3 **Q.** With the qualification you just gave, you would
 4 actually need to have more Georgia water use than
 5 double 1,685, correct, because you don't get one
 6 to one out of the groundwater. Right?
 7 **A.** **I think that's right, yes.**
 8 **Q.** All right. So if the charge here were, Georgia,
 9 you got to cut by 50 percent -- or you would have
 10 to actually cut more -- Georgia would have to use
 11 more than 3500 cfs for agriculture. Right?
 12 **A.** **Under the assumptions you just laid out, yes.**
 13 **Q.** Now, can you turn in your binder to the tab
 14 called Complaint -- Florida Complaint, and turn
 15 to page 21. Do you see the Prayer For Relief on
 16 page 21 of the Complaint?
 17 **A.** **I do.**
 18 **Q.** In the second paragraph Florida told the Supreme
 19 Court that it would like it to enter an Order
 20 capping Georgia's overall depleted water uses at
 21 the level then existing on January 3, 1992. Do
 22 you see that?
 23 **A.** **Yes.**
 24 **Q.** And you were working with Florida at the time
 25 this complaint got filed. Right?
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2776

1 summer streamflow savings. And, Dr. Sunding, you
 2 know that Georgia's agricultural water use is
 3 actually lower than 1,685 cfs; is that right?
 4 **A.** **I don't know that, no. I think that's wrong.**
 5 **Q.** Okay. And let's say even under your scenario, if
 6 you wanted to reduce agricultural water use by 50
 7 percent in Georgia, that would imply that Georgia
 8 would have to use at least 3,370 cfs in peak
 9 summer streamflow. Correct?
 10 **A.** **If -- so if I wanted to reduce streamflow**
 11 **depletions by -- give me the question again.**
 12 **Q.** Sure.
 13 **A.** **Let me make sure I'm getting you.**
 14 **Q.** If you have a recommendation -- if you have a set
 15 of -- not recommendations, sorry. If you have a
 16 set of scenarios that total up to 1,685 cfs
 17 benefit at peak summer streamflow, you would --
 18 Georgia would have to use at least twice that if
 19 you were targeting a 50 percent reduction.
 20 Right?
 21 It's just simple math.
 22 **A.** **Well, yes. But the thing I'm thinking about, not**
 23 **all agricultural water use has the same impact on**
 24 **streamflow, as you know. Pumping right next to**
 25 **the stream has more connectivity than pumping**
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2778

1 **A.** **Yes. I didn't have a role in writing this, of**
 2 **course; but I had been doing work for Florida for**
 3 **a while before this was written.**
 4 **Q.** You were aware that Florida was seeking a return
 5 to January 1992 depleted water use levels in
 6 Georgia?
 7 **A.** **I'm not sure if I did or not.**
 8 **Q.** You have become aware of it during this case
 9 though. Right?
 10 **A.** **I have heard 1992 come up. My feeling is that's**
 11 **a -- that's largely a legal issue. I haven't --**
 12 **I haven't given that an excessive amount of**
 13 **thought.**
 14 **Q.** You haven't calculated anything to figure out
 15 what 1992 conditions were?
 16 **A.** **No. I have some testimony on that point in my**
 17 **first report, about the cost of reducing**
 18 **consumptive use relative to different baselines.**
 19 **And I did calculate the cost of achieving a given**
 20 **level of streamflow starting at 1992 levels.**
 21 **Q.** You anticipated where I was going. So,
 22 Dr. Sunding, you would agree with me that when
 23 you proposed the 1,000 cfs reduction, you
 24 understand that that would have actually taken
 25 Georgia to a level of water use lower than 1992
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2779

1 levels. Correct?

2 **A. I'm not sure of that.**

3 **Q.** Well, you recall in your expert report you

4 estimated how much it would be to get to 1992.

5 Correct?

6 **A. I -- that's not quite what I remember.**

7 **Q.** Okay.

8 **A. I'm trying to turn to the page where I did that.**

9 **Q.** Sure. Turn to page 7 of your first report, which

10 is the first tab, FX-784.

11 **A. All right. I'm at page 7.**

12 **Q.** And on page 7 you analyze the cost of your 1,000

13 cfs scenario, assuming that Georgia's irrigated

14 acreage have remained at 1992 levels. Correct?

15 **A. Well, I think it's actually -- just so we're**

16 **tracking, I think it's actually sort of the**

17 **inverse of what you said. I was starting from a**

18 **1992 level of consumption and then going down to**

19 **the same level of streamflow you would get to by**

20 **reducing by a thousand from 2011.**

21 **Q.** Right. And this is getting a little confusing,

22 so I'm going to try and clarify it. You looked

23 at how much it would cost to get from 2011 down

24 to 1992. Correct?

25 **A. I didn't cost that.**

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2780

1 **Q.** But you then concluded that it would actually

2 cost more to get to your 1,000 cfs level. Right?

3 There is an incremental cost to go from 1992

4 levels to your 1,000 cfs level. Correct?

5 **A. Which is less than the cost, yes. But I want to**

6 **make sure we're understanding each other. What I**

7 **wrote about in my first report was the cost of**

8 **reading -- or reaching a given streamflow target**

9 **starting at 1992 levels or 2011 levels.**

10 **Q.** Okay. Fine. So if we have the thousand cfs

11 level, it would cost this much to get to 1992;

12 and then it costs more to get up to 2011. Right?

13 **A. Yes, but working the other way around. You start**

14 **with the status quo level of consumption and then**

15 **work down to a given streamflow level.**

16 **Q.** Yes.

17 MR. PRIMIS: I'm sorry, your Honor.

18 We're getting a little bogged down.

19 BY MR. PRIMIS:

20 **Q.** But the basic point I'm trying to establish,

21 Dr. Sunding, is that when you went from -- you

22 compared 1,000 cfs versus 2011 and 1,000 cfs

23 versus 1992. Right?

24 **A. Yes.**

25 **Q.** And you make the point if Georgia had just stayed

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2781

1 at 1992 levels, it would cost them less to get to

2 1,000 cfs streamflow benefit now. Right?

3 **A. Yes.**

4 **Q.** And implicit in that, isn't it, sir, that you

5 would have to have a greater reduction at the

6 1,000 cfs level than to be at the 1992 level?

7 **A. Yes. And I'm going to answer it this way. I**

8 **think I get your question, but I really want to**

9 **make sure we're on the same page with this.**

10 **What I wrote about in my first report was we**

11 **have three levels of streamflow. There's the**

12 **2011, 1992, and then where you get to if you**

13 **subtract a thousand cfs off of the 2011 actual.**

14 **And so I examined the cost of going from 2011**

15 **actual to 1,000 minus that, and then from 1992**

16 **actual down to the same level of streamflow. But**

17 **if Georgia had capped its consumption at 1992**

18 **levels, my testimony is that it would cost less**

19 **to reach that same streamflow target than if it**

20 **allowed consumption to grow to what it actually**

21 **did.**

22 **Q.** And because there is a cost to go from 1992

23 levels down to a 1,000 cfs level, you would agree

24 that you need to cut more than 1992 levels to get

25 to a thousand. Correct?

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2782

1 **A. Yes. That -- that cost is positive. So it**

2 **implies that you would have to go down below 1992**

3 **levels.**

4 **Q.** Correct. And if you take the cfs savings from

5 the thousand and then add another thousand on top

6 to 2,000, we're a lot lower than what Georgia was

7 using in 1992. Correct?

8 **A. Sure. That's how the math would work.**

9 MR. PRIMIS: Your Honor, I just need one

10 moment. I am going to do a little math in a

11 minute.

12 I want to be mindful of the clock. And

13 we can break whenever; but I -- I can

14 probably do this in 15 to 20 minutes. Not

15 finish, but get through this part.

16 SPECIAL MASTER LANCASTER: Proceed.

17 MR. PRIMIS: Thank you.

18 And my colleague Mr. Sturek -- Ken

19 Sturek -- is going to help me set up that

20 easel.

21 BY MR. PRIMIS:

22 **Q.** So, Dr. Sunding, on your estimated costs tied to

23 the streamflow benefits, I want to look now at

24 your first report, which is the first page of

25 that three-page handout.

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2783

1 **A. All right.**

2 **Q.** So you -- you have some costs in this chart. And

3 I just want to be clear. When you say cost per

4 year, that's -- that's averaged out over a

5 three-year period. Correct?

6 **A. Well, it's a -- it's an average cost that's borne**

7 **every year to achieve certain conservation**

8 **savings in dry years. So I have tried to adjust**

9 **for the fact that many of these conservation**

10 **measures aren't needed every year.**

11 **Q.** And you assume in your analysis that dry years

12 occur --

13 MR. PRIMIS: Ken, bring it over here,

14 please.

15 BY MR. PRIMIS:

16 **Q.** You assume that --

17 MR. PRIMIS: Turn it around.

18 BY MR. PRIMIS:

19 **Q.** You assume that dry years occur once every three

20 years. Right?

21 **A. Yes. That was an assumption that I was given by**

22 **the hydrology team for Florida.**

23 **Q.** And so if you wanted to determine the cost of any

24 of these measures here in your first expert

25 report, in the dry year itself you actually need

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2784

1 to multiply the estimate by 3. Correct?

2 **A. Yes. For at least some of it.**

3 **Q.** So it's the same principle in your direct

4 testimony. True -- too, correct?

5 If you want to estimate the cost of achieving

6 some of these streamflow benefits in the dry

7 year, you have to multiply the cost estimate

8 by 3. Correct?

9 **A. Yes. Again, understanding that some of these**

10 **measures in table 4 are permanent measures that**

11 **would be undertaken every year; and some are**

12 **measures that are just undertaken in dry years.**

13 **Q.** And you would agree that sometimes droughts

14 happen in back-to-back years. Right?

15 **A. Absolutely.**

16 **Q.** And if there are two consecutive years of

17 drought, you have to take that one-year cost and

18 then incur it two years in a row. Correct?

19 **A. Yes.**

20 **Q.** So I want to compare the dry year math from your

21 first report to your direct testimony. Okay?

22 **A. All right.**

23 **Q.** Now, on page -- it's page 9 of your first report;

24 but it's right here in this handy flier we gave

25 out.

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2785

1 For the first scenario, you estimate a cost

2 per year for deficit irrigation of \$64 million.

3 Right?

4 **A. All right.**

5 **Q.** Do you see that?

6 **A. Yes.**

7 **Q.** And that would get you a summer streamflow

8 benefit of a thousand cfs. Right?

9 **A. Yes.**

10 **Q.** And if you multiply that by 3 to get the single

11 dry year cost, it's actually \$190 million.

12 Right?

13 **A. Yes.**

14 **Q.** So then if we go to the third page of your -- of

15 the handout, we have the table from your direct

16 testimony. Right?

17 **A. Yes.**

18 **Q.** And you have a total cost for the 2,000 scenario

19 of \$35.2 million. Right?

20 **A. Yes.**

21 **Q.** And if you multiply that by 3 you get 105

22 million. True?

23 **A. 35 times 3 is 100 million roughly, a little more.**

24 **But I'm feeling uncomfortable with where I think**

25 **you're heading.**

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2786

1 **Q.** That's part of the plan, Dr. Sunding.

2 So in February of 2016, for scenario 1,

3 deficit irrigation, you said you could get a

4 thousand cfs. Right?

5 **A. Yes.**

6 **Q.** And the cost that we just figured out with the

7 multiplication was --

8 **A. \$64 million.**

9 **Q.** Times 3. And the dry year is 190 million.

10 Correct?

11 **A. Yes.**

12 **Q.** And then in October of 2016, you said we could

13 get 2,000 cfs for a total of 105 million.

14 Correct?

15 MR. PERRY: Your Honor, I think

16 Mr. Primis is referring to the prefiled

17 direct. Is that correct?

18 MR. PRIMIS: I'm sorry if I misspoke.

19 BY MR. PRIMIS:

20 **Q.** In your prefiled written direct in October of

21 2016, the single dry year cost to get 2,000 cfs

22 is about \$105 million. Correct?

23 **A. But, again, the reason -- part of the reason I'm**

24 **uncomfortable with this is I think you probably**

25 **know that some of the measures I'm talking about**

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2787

1 **here are not dry year only measures. So it's not**
 2 **proper to compound the cost the way you're trying**
 3 **to do.**
 4 **Q.** Dr. Sunding, would it cost less than \$105 million
 5 to achieve 2,000 cfs in a single year?
 6 **A. If you looked at just a drought year, yes.**
 7 **Because some of these other measures are done**
 8 **every year. And it's not proper to attribute all**
 9 **the costs to just the dry years.**
 10 **Q.** But you do agree that as you initially analyzed
 11 it, it would have cost \$190 million in a single
 12 year to get 1,000 cfs. Right?
 13 **A. Yes.**
 14 **Q.** Now, let's talk about why some of your costs went
 15 down, Dr. Sunding.
 16 **A. Sure.**
 17 **Q.** If we focus on the first report, in the chart you
 18 have some estimates for reductions in municipal
 19 outdoor use.
 20 **A. Yes. That's right.**
 21 **Q.** And you were -- we're focusing now -- this is the
 22 first page of that handout, page 9 of your first
 23 expert report. You costed out 20 percent and 30
 24 percent reductions in outdoor water use. Right?
 25 **A. I think that's right. Yes.**

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2788

1 **Q.** And you said that would cost Georgia 22 million
 2 for a 20 percent reduction and 40 million for a
 3 30 percent reduction. Right?
 4 **A. It would cost Georgia water consumers that much**
 5 **in consumer surplus loss.**
 6 **Q.** And these are the types of scenarios where you
 7 would have to multiply it by three to get the
 8 single year cost, right, because these are
 9 drought year measures?
 10 **A. Yes.**
 11 **Q.** And so if we do the same type of math we did in a
 12 drought year, you would estimate that the cost
 13 would be \$66 million for a 20 percent reduction
 14 in municipal outdoor water use, and 120 million
 15 to get it up to 30 percent reduction. Correct?
 16 **A. Yes.**
 17 **Q.** Now --
 18 **A. I think it's actually 150 million, isn't it -- or**
 19 **no?**
 20 **No. 40 times 3. I got it.**
 21 **Q.** Now, if we go back to your direct testimony,
 22 which is page 3, you now estimate that -- a 50
 23 percent reduction in outdoor water use. Correct?
 24 **A. Yes.**
 25 **Q.** And you say that can generate 207 cfs. Correct?

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2789

1 **A. Yes.**
 2 **Q.** And the cost you assign to that in your written
 3 direct testimony is now zero.
 4 **A. Because the column is labeled fiscal cost. So**
 5 **it's a different kind of cost than what I was**
 6 **looking at in the first report.**
 7 **Q.** Apples and oranges?
 8 **A. To some extent, yes.**
 9 **Q.** Okay. But for the type of cost you were looking
 10 at in February, that cost was \$120 million for
 11 150 cfs in a dry year. Right?
 12 **A. Yes.**
 13 **Q.** And, now, with your different costs, your fiscal
 14 costs, it's zero for 207 cfs. Right?
 15 **A. Yes.**
 16 **Q.** Now, you do actually have a cost metric in your
 17 direct testimony for this outdoor water use. You
 18 know that; right?
 19 **A. Yes.**
 20 **You're referring to the consumer surplus**
 21 **metric?**
 22 **Q.** No. Not there yet.
 23 **A. All right.**
 24 **Q.** You estimate that for a 50 percent cut-back in
 25 outdoor water use there would actually be a \$78

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2790

1 per connection service cost -- per service
 2 connection cost. Correct?
 3 In paragraph 76.
 4 **A. Let me take a look.**
 5 **Q.** About four lines up from the bottom.
 6 And I stand corrected. You are referencing a
 7 welfare loss there, so that is what you are
 8 talking about. But you estimate \$78 per service
 9 connection. Correct?
 10 **A. And, I'm sorry. What page?**
 11 **Q.** I'm sorry. It's paragraph 76, page 37 of your
 12 trial testimony.
 13 **A. All right. We keep switching back and forth**
 14 **between reports.**
 15 **Q.** If there's a way I could have had you write fewer
 16 reports, Dr. Sunding, I would have taken that
 17 deal.
 18 Okay. Are you there yet?
 19 **A. Yes.**
 20 **Q.** Is --
 21 **A. You're right; this is the welfare cost we have**
 22 **been talking about.**
 23 **Q.** So you estimate a welfare loss of about \$78 per
 24 service connection. Right?
 25 **A. Yes.**

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2791

1 Q. And you know that given the number of service
 2 connections, that that would cost hundreds of
 3 millions of dollars a year in welfare loss in
 4 metro Atlanta. Correct?
 5 A. **I haven't done the math; but it would be -- it**
 6 **would come to over a hundred million, definitely.**
 7 Q. Somewhere between 100 and 200 million?
 8 A. **I think so, yes.**
 9 Q. Now, in paragraph 79 of your expert report you
 10 explain -- I'm sorry, of your direct testimony --
 11 now, it's my fault.
 12 In paragraph 79 of your direct testimony you
 13 explain why you don't include any costs for a
 14 50 percent reduction in municipal and outdoor
 15 water use. Correct?
 16 A. **Yes.**
 17 Q. And the first reason is that it's not associated
 18 with any fiscal cost. Right?
 19 A. **That's right. It's not something the legislature**
 20 **would have to appropriate money for to compensate**
 21 **people.**
 22 Q. Now, on that point, Dr. Sunding, that's the same
 23 cost you assigned a number to in February.
 24 Right?
 25 A. **Yes. And I reported it again in my direct**

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2792

1 **report -- in my direct testimony.**
 2 Q. We haven't changed the types of costs. Right?
 3 You had welfare costs of 120 million in a dry
 4 year in February. And you changed the name to
 5 fiscal costs and reported zero. But the welfare
 6 cost of 120 million still exists. Right?
 7 A. **Sure. Yes. And that's why -- that's why I**
 8 **reported it.**
 9 Q. And as an economist, you know that a welfare cost
 10 is a real cost. Right?
 11 A. **It is a real cost. And as I point out in my**
 12 **testimony, it's a -- it's qualitatively different**
 13 **than a fiscal cost. I think any economist**
 14 **realizes that.**
 15 Q. You thought it was real enough to make
 16 significant estimates for it in February. True?
 17 A. **And I reported those estimates again in my direct**
 18 **testimony. Yes.**
 19 Q. But in the handy chart that we look at to see
 20 what the cost to Georgia is, you changed the
 21 label; and you report zero. True?
 22 A. **Because I was focusing on it -- yes. Because I**
 23 **was focusing on a different aspect of cost.**
 24 Q. Now, Dr. Sunding, you also say that these
 25 hundreds to \$200 million in welfare costs, they

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2793

1 will be offset because the people of Atlanta will
 2 feel good about it. Right?
 3 A. **I'm not sure I would put it exactly like that;**
 4 **but, yes, I think there are welfare gains that**
 5 **would be experienced by Atlanta residents from**
 6 **having more water in the stream.**
 7 Q. The way you would say it as an economist is that
 8 the preferences of urban consumers to minimize
 9 downstream impacts to Florida would offset these
 10 hundred to \$200 million of welfare costs.
 11 Correct?
 12 A. **Sure. Those would -- would both be examples of**
 13 **welfare costs.**
 14 Q. And that concept comes from this survey you
 15 conducted, right, where you asked people what
 16 they would be willing to pay for and what they
 17 might do. Correct?
 18 A. **Yes. Sure.**
 19 Q. Now, the survey never actually asked respondents
 20 what they would do if confronted with a 50
 21 percent reduction in outdoor water usage to help
 22 Florida out. Right?
 23 You never asked that specific scenario?
 24 A. **I disagree. It asked them what they would do if**
 25 **they were confronted with particular outdoor**

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2794

1 **watering restrictions that we know would generate**
 2 **that amount of water.**
 3 Q. Is it your testimony that you said to these
 4 people, we're going to cut your water consumption
 5 for outdoor use by 50 percent?
 6 A. **Oh, no. Definitely not. It's -- we have the**
 7 **survey instrument that was included in my report.**
 8 **And the questions talk about certain kinds of**
 9 **outdoor water use restrictions. And then we**
 10 **asked people what was their willingness to**
 11 **support those if the water would make its way**
 12 **down to Florida.**
 13 **We have other information about how much**
 14 **water that would save, and that's where I built**
 15 **the crosswalk.**
 16 Q. Okay. Now, Dr. Sunding, you didn't quantify the
 17 value, if any, to Georgia residents of minimizing
 18 the downstream impacts to Florida. Correct?
 19 A. **You mean monetary value?**
 20 Q. Correct.
 21 A. **Right.**
 22 Q. You say that the -- Georgia would -- it would be
 23 offset -- the cost would be offset by this
 24 positive feeling, but you never actually -- you
 25 didn't do any quantitative analysis to determine

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2795

1 that. Correct?

2 **A. No. It's in my experience easier for survey**

3 **respondents to answer questions about specific**

4 **behaviors or things that are easy to comprehend.**

5 MR. PRIMIS: Your Honor, this might be a

6 good time for a break, if it's not too early.

7 SPECIAL MASTER LANCASTER: Fine.

8 MR. PRIMIS: Thank you.

9 (Time Noted: 11:46 a.m.)

10 (Recess Called)

11 (Time Noted: 12:46 p.m.)

12 MR. PRIMIS: I'm sorry, your Honor. I

13 didn't see that you had slipped in.

14 SPECIAL MASTER LANCASTER: I sneaked in.

15 MR. PRIMIS: Well, you're always welcome.

16 We have two housekeeping matters to put

17 on the record. The first is that I simply

18 marked for identification this chart as

19 Sunding demonstrative 1 in case we need to

20 track it down later.

21 And, second, Mr. Dunlap advised us about

22 the Court's approach to written direct

23 testimony and what will actually be admitted.

24 And our understanding, both parties, is that

25 unless there is an opportunity to

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2796

1 cross-examine or an agreement, that direct

2 written testimony will not be admitted into

3 the record.

4 We do have an agreement on one pair of

5 witnesses. They kind of testify against one

6 another. It's Dr. Scyphers, S C Y P H E R S.

7 He's a survey expert. And Dr. Cantor is

8 Georgia's response to Dr. Scyphers. And the

9 parties have agreed that that testimony can

10 come in without the need for cross-examination.

11 SPECIAL MASTER LANCASTER: Mr. Perry?

12 MR. PERRY: That's right, your Honor.

13 SPECIAL MASTER LANCASTER: Thank you.

14 MR. PRIMIS: Okay. May I proceed?

15 SPECIAL MASTER LANCASTER: Please.

16 MR. PRIMIS: Thank you.

17 BY MR. PRIMIS:

18 **Q.** Dr. Sunding, before the break we were talking

19 about various scenarios that gross up to either

20 1,000 or 2,000 cfs of streamflow. Do you

21 remember that?

22 **A. Sure. I remember it.**

23 **Q.** You're not suggesting that the Court pick any

24 particular number, whether it's 1,000 or 2,000 or

25 something in between. Correct?

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2797

1 **A. Well, again, I'm -- it's the State of Florida**

2 **that's suggesting. What I analyzed is the cost**

3 **of conservation -- conservation scenarios. But**

4 **I -- as I understand it, what Florida is asking**

5 **for is a cap on consumption that would translate**

6 **into a certain amount of reduction in depletions,**

7 **whether it's 1,000, 2,000, or something in**

8 **between.**

9 **Q.** And just to make the record clear on my question,

10 it's not your role to say to the Court the

11 streamflow impact number should be X or Y; you're

12 just evaluating a series of options and

13 calculating it out. Correct?

14 **A. That's right. That's fair.**

15 **Q.** Dr. Sunding, I want to focus your attention on

16 what we call indirect costs.

17 **A. All right. Sure.**

18 **Q.** Can you turn to paragraph 91 of your direct

19 testimony.

20 This is your trial testimony I'm talking

21 about.

22 **A. Oh. Paragraph 91?**

23 **Q.** Yes, sir.

24 **A. Sure.**

25 **Q.** And in particular, the third line down starting

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2798

1 with echoing claims.

2 **A. Yes?**

3 **Q.** And do you see here that you're stating that it

4 would be improper in this case to consider

5 employment impacts from reductions in

6 agricultural output that result from water

7 conservation efforts. Correct?

8 **A. No. I'm not saying that. I quantified indirect**

9 **impacts myself in this case.**

10 **Q.** You have; right. But you're not offering that as

11 part of your testimony here. Correct?

12 **A. No. Those numbers weren't included in my direct**

13 **testimony. They were in my expert report.**

14 **Q.** Okay. Just -- again, since there's a lot of

15 paper around, I just want to be clear. In your

16 expert report you calculated the indirect costs

17 in terms of things like job losses and the like;

18 but you don't include that as part of your

19 written direct testimony for the trial. Correct?

20 **A. That's correct. And to be clear, I did that for**

21 **the agricultural sector.**

22 **Q.** Correct. Thank you for that clarification.

23 So let's go to your first report where you

24 calculated those impacts. It's paragraph 81.

25 And it's FX-784, which I think is the first tab

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2799

1 in the binder.

2 **A. All right. I'm there.**

3 MR. PRIMIS: It's page 54, just so

4 everyone can follow along, of FX-784, that

5 first tab.

6 BY MR. PRIMIS:

7 **Q.** Okay. Now, this section, Dr. Sunding, is called

8 Indirect and Induced Impacts. Correct?

9 **A. It is.**

10 **Q.** And in paragraph 81, you observed that in

11 addition to the direct economic cost of not

12 growing various crops, that the irrigation

13 cut-backs will also impact industries that

14 support agricultural activity. Correct?

15 **A. Yes.**

16 **Q.** Then if we go to page 55 of your report, you

17 actually provide some calculations that estimate

18 those impacts. Right?

19 **A. Yes. In table 9, for example, those are**

20 **displayed.**

21 **Q.** Right. That's what I was talking about.

22 And for purposes of this exercise, you

23 estimated the indirect economic and employment

24 impacts of a 50 percent reduction in agricultural

25 water use. Correct?

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2800

1 **A. Let me just refresh my memory about how I did**

2 **this.**

3 **Q.** Paragraph 83 might refresh your recollection.

4 **A. Right. That's what I'm reading.**

5 **All right. Yes, I think you characterized**

6 **that correctly.**

7 **Q.** So what you're doing here is you're looking at

8 the indirect effects in terms of other industries

9 that could be impacted or other jobs that might

10 be lost that aren't directly related to pulling

11 corn or cotton out of the ground. Right?

12 **A. That's right.**

13 **Q.** And table 9 reflects the numbers that you

14 generated by doing that analysis. Right?

15 **A. Yes.**

16 **Q.** You say also in paragraph 83 right after that,

17 you estimate an additional \$8 million in indirect

18 economic impact and \$15 million in induced

19 impact. Correct?

20 **A. I see that, yes, in paragraph 83.**

21 **Q.** And like we did earlier with the single-year

22 costs, these are annualized over a three-year

23 period. Correct?

24 **A. That's right.**

25 **Q.** So you actually tripled them to find out what the

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2801

1 one-time impact would be in that drought year.

2 Right?

3 **A. Yes.**

4 **Q.** If we do that here, we end up with 24 million in

5 indirect economic impact and 45 in induced

6 economic impact in that dry year. Correct?

7 **A. Yes.**

8 **Q.** If you sum those up, you get \$69 million in a dry

9 year of indirect economic impact under your

10 analysis. Correct?

11 **A. Yes.**

12 **Q.** You also tallied up some job losses that would go

13 along with the agricultural reduction. Correct?

14 **A. Yes.**

15 **Q.** You estimate that with a 50 percent reduction in

16 agricultural irrigation, there would be a loss of

17 488 full-time jobs in the farming sector.

18 Correct?

19 **A. So -- right. Those are job losses on farm.**

20 **Q.** Right. Okay. And those would be 488 full-time

21 jobs. And that's depicted in table 9. Right?

22 **A. Yes.**

23 **Q.** You also identify 64 jobs in indirectly-affected

24 sectors and 93 jobs in induced economic impacts.

25 Right?

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2802

1 **A. Yes.**

2 **Q.** If we tally those up, we get approximately 650

3 jobs?

4 **A. That sounds right.**

5 **Q.** Now, again, these are annualized numbers?

6 **A. I knew you were going to ask me that. That I**

7 **can't remember if these are annualized or when**

8 **the impacts actually occur.**

9 **Q.** Well, if they are annualized, you would, again,

10 multiply by 3. And we calculated about fifteen

11 to 1600 jobs -- actually, no; I'm wrong. We

12 calculate 1935 jobs lost in the dry year with the

13 three-time multiplier?

14 **A. That's right. If that's how I calculated these**

15 **impacts, that would be correct.**

16 **Q.** So if we lose 1935 jobs in that dry year from the

17 50 percent cut in Georgia, I just want to compare

18 that to a number in Florida. Are you aware that

19 Florida's official records show that there are

20 only about 1700 licensed oyster harvesters in

21 Apalachicola Bay?

22 **A. No. But that -- that sounds about right based on**

23 **what I know about the industry.**

24 **Q.** And so the job loss you projected from a 50

25 percent reduction in Georgia would actually

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2803

1 exceed the number of all oyster fishermen
 2 licensed in Apalachicola Bay. Correct?
 3 **A. Well, not -- not exactly. The table that we're**
 4 **referring to, you will note, is labeled impacts.**
 5 **So these are people who might lose a job in**
 6 **agriculture or some other sector. But they could**
 7 **find another job. So it's not to say that they**
 8 **would be unemployed for the duration of the water**
 9 **cut-back. They would just have some dislocation.**
 10 **Q.** So we would have almost 2,000 dislocated people
 11 in Georgia?
 12 **A. Yes. The -- the agricultural labor force is one**
 13 **of the mostly highly elastic parts of the labor**
 14 **sector. So these people -- you know, I know this**
 15 **from California, Texas, other places. They can**
 16 **move around from sector to sector quite easily.**
 17 **Q.** I might have missed it. Do you have an
 18 elasticity analysis here in your expert report
 19 about Georgia farmers?
 20 **A. No. These are farm workers, not farmers.**
 21 **Q.** Dr. Sunding, do you have an elasticity analysis
 22 in your expert report or written direct testimony
 23 about these dislocated Georgia farm workers who
 24 would lose their job in a dry year with
 25 irrigation reductions?

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2804

1 **A. If you look at paragraph 84 --**
 2 **Q.** Yes?
 3 **A. -- the first sentence reads, it should be noted,**
 4 **however, that IMPLAN's employment impact**
 5 **estimates are likely overstated.**
 6 **And one of the reasons is that just because**
 7 **someone loses a job in one sector doesn't mean**
 8 **that they sit on their hands until the water**
 9 **comes back. They adapt.**
 10 **Q.** My question was did you calculate that and put it
 11 in your report?
 12 **A. Not a numerical value, no.**
 13 **Q.** Now, Dr. Sunding, in your first expert report,
 14 which we're in right now, if you go to --
 15 actually, let's stick -- I want to look at the
 16 table; so we can use the handout. It's the first
 17 page of the handout, or in your book it's your
 18 first report.
 19 And you have the four scenarios for 1,000
 20 cfs. Correct?
 21 **A. Yes.**
 22 **Q.** That's on page 9 of your first report, or it's
 23 the first page of this three-page handout.
 24 **A. I like the handout.**
 25 **Q.** The handout is easier, because I'm going to move

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2805

1 now -- I hope it's the last time; but I am going
 2 to move across reports.
 3 **A. Okay.**
 4 **Q.** So what I want to draw your attention to --
 5 actually, of course, our handout doesn't have
 6 this; but the -- we can just cut to the chase.
 7 In your initial expert report you calculated what
 8 you called dry year peak streamflow depletions.
 9 Correct?
 10 **A. Yes.**
 11 **Q.** And you focused on what you modeled to be a dry
 12 year, which was a combination of 2011 and 2012
 13 hydrology conditions. Correct?
 14 **A. That's right.**
 15 **Q.** Now, in your second expert report you changed
 16 that. Right?
 17 **A. Yes. I evaluated the conservation measures under**
 18 **a different assumption about hydrology.**
 19 **Q.** Right. You took 2012 out of the picture, and you
 20 focused just on the year 2011. Right?
 21 **A. Yes.**
 22 **Q.** And you used 2011 hydrology in this second
 23 report. Right?
 24 **A. Yes.**
 25 **Q.** Now, you called it in your second report a

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2806

1 drought year scenario, not a dry year scenario.
 2 Right?
 3 **A. I believe you're right.**
 4 **Q.** And the reason you did that is because the
 5 drought was more severe in 2011 than in 2012.
 6 Right?
 7 **A. I mean, certainly it's the case that 2011 was**
 8 **drier than 2012. Yes, I think that's why I**
 9 **changed the terminology.**
 10 **Q.** And when you actually changed, going from a
 11 hybrid of 2011 and 2012 and just to 2011, that
 12 had the effect of generating more streamflow
 13 savings from the same actions. Right?
 14 **A. Yes. Because demands are higher in a very dry**
 15 **year like 2011. That's correct.**
 16 **Q.** Now, when I asked you why you changed that
 17 benchmark to go from 2011 and 2012 hybrid to just
 18 2011, you couldn't answer that question without
 19 revealing conversations with counsel. Correct?
 20 **A. That's right.**
 21 **Q.** And you declined to answer the question. Right?
 22 **A. That's right.**
 23 **Q.** Now, with regard to the 2011 conditions -- well,
 24 actually, no. Let me move on. Let's go down to
 25 your direct testimony, sir. The written

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2807

1 testimony for this Court.

2 **A. All right.**

3 **Q.** And in particular, I want to go to paragraph 71.

4 **A. Almost there.**

5 **Q.** Actually, let me start you on paragraph 75, which

6 is page 36.

7 **A. Okay. Just give me a second to read it.**

8 **All right.**

9 **Q.** All I really want to determine here, Dr. Sunding,

10 is that for your drought year calculations in

11 your final written testimony for this Court you

12 assumed those 2011 drought conditions. Correct?

13 **A. Yes, that's right.**

14 **Q.** You didn't use the 2011-2012 hybrid. Right?

15 **A. That's correct. It's a different assumption.**

16 **Q.** So, now, let's go to paragraph 71. And here you

17 say that you're evaluating scenarios where

18 Georgia could reduce consumptive use in both

19 drought and nondrought years. Correct?

20 **A. Yes.**

21 **Q.** And the scenarios you have in tables 4 through 6

22 of your direct testimony, and that we have got

23 excerpted here in the handout, they include

24 estimates of nondrought year water savings

25 associated with the conservation measures.

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2808

1 Right?

2 **A. Yes. Because some of the conservation measures**

3 **are in place in both dry and nondry years or**

4 **drought and nondrought years.**

5 **Q.** And you also say in your testimony that these

6 conservation measures would, quote, provide

7 substantial environmental benefits to Florida in

8 both drought and nondrought years. That's your

9 view. Right, sir?

10 **A. Yes.**

11 **Q.** Now, the first time you presented estimates of

12 nondrought year water savings in the way you have

13 done here in your direct testimony was in the

14 direct testimony. Right?

15 **A. That's right.**

16 **Q.** You didn't have a column called nondrought year

17 in report 1. True?

18 **A. That's correct.**

19 **Q.** And you didn't have a column called nondrought

20 year in report 2. Correct?

21 **A. That's also correct.**

22 **Q.** And so the first time I saw this was when we got

23 your direct testimony. Correct?

24 **A. Yes. I'm sure that's right.**

25 **Q.** Now, I want to test this proposition about

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2809

1 substantial environmental benefits in nondrought

2 years, that being having cuts to Georgia in

3 nondrought years. And can you turn in your book

4 to GX-1276.

5 **A. All right.**

6 **Q.** The first page of GX-1276 just says Exhibit 3,

7 but that's because it was an exhibit to a court

8 filing in an earlier case.

9 If you turn to the next page, you will see

10 that this is a declaration of Douglas Barr. Do

11 you see that?

12 **A. I do.**

13 **Q.** And do you know who Doug Barr is?

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

15 **Q.** Are you aware that he was the executive director

16 of the Northwest Florida Management District?

17 **A. I am now. I see in his qualification statement**

18 **in paragraph 2 that it says that.**

19 **Q.** Okay. And do you see on the top of this that it

20 was filed in federal court twice, in January of

21 2009 and in December of 2009.

22 **A. Yes. That's the way it appears.**

23 **Q.** Can you turn to paragraph 31 of Mr. Barr's

24 affidavit. It's on page 13. And I would ask you

25 to read to yourself the sentence following the

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2810

1 internet link, about halfway down.

2 **A. That begins thus?**

3 **Q.** It begins thus.

4 **A. All right.**

5 **Q.** And I take it, Dr. Sunding, that you're in no

6 position to dispute Mr. Barr's assertion that

7 flows in average annual years are more than

8 sufficient to connect floodplain channels and

9 inundate aquatic habitat to sustain the

10 significant biological processes in the river and

11 bay?

12 **A. No. I see that is his opinion, and that's**

13 **outside my area of expertise.**

14 **Q.** You can't -- you can't disagree or agree with

15 that. Right?

16 **A. No.**

17 **Q.** Do you also see that Mr. Barr says that upstream

18 consumption in average annual years of flows is

19 not significant enough to interfere with those

20 processes?

21 **A. I do see he says that.**

22 **Q.** And, again, the same answer; you can't really

23 agree or disagree with that. Right?

24 **A. There are other experts who would be better**

25 **positioned to comment on that.**

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2811

1 Q. Well, let's talk about that. In this case, your
 2 discussions with other experts, in virtually all
 3 of those discussions that you have had with other
 4 Florida experts they focused on dry years.
 5 Correct?
 6 A. **Yeah. The discussions that I had, especially
 7 with the biologists and the hydrologists, were
 8 largely almost exclusively focused on dry years.**
 9 Q. In fact, you have not heard any issues from those
 10 other experts raised about average or wet-year
 11 problems. True?
 12 A. **I can't -- I can't think of any. But that was
 13 not all I had in mind when I wrote this sentence
 14 in my direct report that we're discussing now.**
 15 Q. Dr. Sunding, can you turn to page 280, line 23,
 16 of your deposition, please. And I'm going to
 17 play a clip from 280, 23 to 281, line 9.
 18 A. **What page are we on in the deposition?**
 19 Q. Page 280.
 20 A. **280.**
 21 Q. And let's hold -- let's wait. 280, line 23 --
 22 A. **All right.**
 23 Q. -- to 281, line 9.
 24 MR. PRIMIS: And, Mr. Smith, can you
 25 play that, clips 233 and 234.

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2812

1 (Whereupon the video was played.)
 2 BY MR. PRIMIS:
 3 Q. Dr. Sunding, were you asked those questions; and
 4 did you give those answers?
 5 A. **Yes. Understanding that this discussion is about
 6 biological impacts.**
 7 Q. Dr. Sunding, I now want to shift gears and talk
 8 about what you have described as a least-cost
 9 means of conservation-based scenarios. Okay?
 10 A. **Okay.**
 11 Q. And I don't know if anyone else knows what I'm
 12 talking about, but you do. Right?
 13 A. **I think so. But I would like you to be specific
 14 as you go along.**
 15 Q. Sure. Absolutely.
 16 So now, we're looking at your table from your
 17 direct testimony. So it's the third page of the
 18 handout.
 19 A. **All right. Yes.**
 20 Q. And you have got a -- well, let's wait for the
 21 Court to get there.
 22 MR. PRIMIS: This is page 44 of the
 23 direct testimony, table 4.
 24 BY MR. PRIMIS:
 25 Q. Dr. Sunding, I want to focus in particular on the

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2813

1 row called Deficit Irrigation to Reach 2,000 cfs.
 2 Do you see that?
 3 A. **I do.**
 4 Q. Now, when you talk about deficit irrigation,
 5 that's your least-cost means of conservation.
 6 Correct?
 7 A. **Again, we're going to have to be careful about
 8 terminology. Deficit irrigation is not the
 9 least-cost alternative across all the
 10 conservation possibilities. But I do use a
 11 least-cost concept in defining the cost of
 12 deficit irrigation. I just want to make sure
 13 we're talking about the same thing.**
 14 Q. Dr. Sunding, I was just reading from the --
 15 trying to save some time. I was reading from
 16 page 51 of your first expert report, paragraph
 17 73, next to last sentence.
 18 A. **Right, yes. This is what I was just talking
 19 about.**
 20 Q. Right. I thought that's what I read verbatim,
 21 but you agree with that statement?
 22 A. **I do.**
 23 Q. Okay. So this deficit irrigation concept
 24 provides the least-cost combination of deficit
 25 irrigation that will achieve any given reduction

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2814

1 in consumptive use. Right?
 2 A. **Yes. Understanding that this approach means how
 3 I am modeling the way water would be moved around
 4 across crops and soil types under a deficit
 5 irrigation regime.**
 6 Q. I was going to get to that.
 7 So you rank in terms of order opportunities
 8 for irrigation cut-backs that go from the least
 9 to the most expensive. And then you try and
 10 target the ones you have determined to be least
 11 expensive. Right?
 12 A. **Yes.**
 13 Q. That's how it works?
 14 A. **Yes.**
 15 Q. There's a lot of factors that go into that.
 16 Right?
 17 A. **Sure. I considered the type of water year that
 18 determines productivity. In part I considered
 19 the crop; and I considered the soil quality, the
 20 type of soil that different farmers are operating
 21 on.**
 22 Q. You also looked at the level to which their
 23 groundwater connected to the river. Correct?
 24 A. **That's correct.**
 25 Q. So you're looking at crop type, soil type, user

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2815

1 type, connectivity of the aquifer, and you're

2 taking that all into account and saying under a

3 certain year, this type of crop is the least

4 expensive to eliminate. So let's start there.

5 Right?

6 **A. Yes. It's not exactly how I would say it, but**

7 **the idea is correct.**

8 **Q.** Now, when we talked about how you could implement

9 such a thing where you have all these different

10 moving parts, I was confused. I said, how are

11 farmers going to know if it's my turn to reduce?

12 And one way you said that the State could do

13 this is to adopt a cap and trade system. Right?

14 **A. Yes.**

15 **Q.** This would mean that either the Court or Georgia

16 or someone else picks a cap, and then you assume

17 that the efficient market will sort out who is

18 going to water what crop. Right?

19 **A. Yes. That there would be a cap established on**

20 **the total amount of water used. And then farmers**

21 **would move water around to maximize profits**

22 **subject to that resource constraint.**

23 **Q.** And once you have that resource constraint,

24 farmers would efficiently act to reduce water use

25 depending on the crop and soil type and

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2816

1 connectivity and all those other factors. Right?

2 **A. Absolutely.**

3 **Q.** Now, you're familiar with the difference between

4 riparian states and prior appropriation states at

5 a general level. Correct, sir?

6 **A. I am, yes.**

7 **Q.** You're aware that in prior appropriation states,

8 water rights are segregated from ownership of the

9 land?

10 **A. In prior appropriation states, yes.**

11 **Q.** And whereas in riparian states, water rights are

12 tied to the property adjacent to the water.

13 Correct?

14 **A. Yes.**

15 **Q.** You know Georgia is a regulated riparian state.

16 Right?

17 **A. Yes.**

18 **Q.** And you also know that in a riparian state, the

19 owner of the land doesn't have a stand-alone

20 right to transfer the ownership of that water.

21 Correct?

22 **A. Yes.**

23 **Q.** And you're not aware of a single riparian state

24 that has a marketplace for trading water among

25 irrigators. Correct?

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2817

1 **A. Not -- not a riparian state, but my mechanism**

2 **doesn't necessarily involve trading across users.**

3 **Q.** It would be a departure from a riparian regime to

4 have farmers owning their water rights and

5 trading them amongst themselves. Correct?

6 **A. Yes. It would be easier for farmers to transfer**

7 **within their own operations, which is part of**

8 **what I have in mind. I mean, remember, farmers**

9 **own multiple pivots in many cases; and they can**

10 **move water around within their own operations to**

11 **achieve the same kind of outcome I'm talking**

12 **about.**

13 **Q.** My question related to a cap and trade system

14 where farmers trade amongst themselves. That

15 would be a departure from a regulated riparian

16 situation. Correct?

17 **A. Yes. If Georgia wants to minimize costs, it will**

18 **likely have to make some institutional**

19 **improvements.**

20 **Q.** The legal regime for property in Georgia would

21 have to be changed. Correct?

22 **A. I can't comment on the legal regime. But there**

23 **would -- there would likely have to be some**

24 **change in institutions.**

25 **Q.** Let's stick with deficit irrigation, Dr. Sunding.

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2818

1 And can I refer you to paragraph 49 of your

2 direct testimony.

3 **A. Sure.**

4 **Q.** Can you read the second sentence of paragraph 49.

5 **A. The second sentence of paragraph 49?**

6 **Q.** Yes.

7 **A. My gosh. I'm on the wrong report.**

8 **Q.** We're -- just to be clear, we're talking about

9 the Sunding direct written testimony, paragraph

10 49, second sentence.

11 **A. All right. So it begins I found?**

12 **Q.** Yes.

13 **A. I found through my analysis --**

14 **Q.** Don't read it out loud.

15 **A. Oh, I'm sorry. I thought you wanted me to.**

16 **Yes.**

17 **Q.** So you're saying here that you have done an

18 analysis, and you have determined that Georgia

19 farmers apply much more water than they need to

20 irrigate their crops. Right?

21 **A. Some do is what the sentence says.**

22 **Q.** And those some that do are effectively wasting

23 water in your view. Correct?

24 **A. Yes. They're applying water above a biological**

25 **maximum.**

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2819

2821

1 Q. Now, you haven't gone out personally around
 2 Georgia and seen any wasteful watering practices.
 3 Have you?
 4 A. **No. Although I have seen pictures.**
 5 Q. You have seen pictures?
 6 A. **From this case, yes.**
 7 Q. Maybe I'll show you a picture. Before I do that,
 8 you haven't spoken to anybody who has seen or
 9 reported wasteful watering practices in Georgia.
 10 Correct?
 11 A. **That's -- that's not quite true. I have spoken**
 12 **to experts on the Florida side who report having**
 13 **seen wasteful irrigation practices.**
 14 Q. Okay. Can you turn to page 322 of your
 15 deposition, Dr. Sunding. And you were asked at
 16 your deposition, sir, have you spoken to anybody
 17 who has seen or reported such a thing, referring
 18 to wasteful watering practices. And your answer
 19 was not a specific instance I can recall.
 20 Did you -- were you asked that question; and
 21 did you give that answer?
 22 A. **Wait. Where are you? You're on page --**
 23 Q. 322.
 24 A. **What line?**
 25 Q. Line 25. And my question is were you asked that
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1 **picture and the figures that were in my report**
 2 **that started this whole discussion.**
 3 Q. Well, should this irrigation unit be watering the
 4 road?
 5 A. **No.**
 6 Q. Okay. Now, Dr. Sunding, you know that GX-898 is
 7 a picture that was taken in Florida of a Florida
 8 irrigation system; or did you not know that?
 9 A. **Well, when I saw the GX on the bottom, I assumed.**
 10 Q. Okay. And you understand that a Georgia
 11 investigator drove around Florida to see if there
 12 were any instances like this, and he found this
 13 one. Are you aware of that?
 14 A. **Yes.**
 15 Q. You weren't just shown pictures of Georgia doing
 16 this kind of thing; you saw pictures of farmers
 17 in Florida irrigating roads. Correct?
 18 A. **I have.**
 19 Q. Now, to figure out whether there's overwatering
 20 in Georgia, you ran a crop simulation model.
 21 Correct?
 22 Or you had Dr. Hoogenboom, who is another
 23 expert in this case, run a crop simulation model?
 24 A. **That was one part of the analysis. There was**
 25 **more to it than that.**
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2820

2822

1 question, and did you give that answer?
 2 A. **Well, right. But just above that is what I had**
 3 **in my mind when I answered the question about**
 4 **talking to Drs. Hoogenboom and Bottcher.**
 5 Q. Dr. Sunding, you mentioned some pictures.
 6 Correct?
 7 A. **Yes.**
 8 Q. I want to show you a picture. We have marked
 9 this as GX-898.
 10 MR. PRIMIS: Can I approach?
 11 SPECIAL MASTER LANCASTER: Yes.
 12 MR. PRIMIS: I handwrote the exhibit
 13 number on your copy so you would have it.
 14 BY MR. PRIMIS:
 15 Q. Dr. Sunding, does this look like the picture that
 16 you recall seeing of a wasteful watering
 17 practice?
 18 A. **Sure. I have seen a number of pictures that look**
 19 **like this.**
 20 Q. And the reason you would say this is wasteful is
 21 because you have a center-pivot irrigation unit
 22 spraying water onto a road, and you can quite
 23 clearly see the road being irrigated. Correct?
 24 A. **I see the road being irrigated. It's a little**
 25 **difficult to draw a connection between this**
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1 Q. Well --
 2 A. **But that was something that Dr. Hoogenboom did.**
 3 Q. And then you overlaid your calculation of
 4 irrigation depths from the Georgia agricultural
 5 metering database to determine whether farmers
 6 were watering above what you determined to be an
 7 optimal amount. Right?
 8 A. **What Dr. Hoogenboom determined to be an optimal**
 9 **amount, yes.**
 10 Q. And if a farmer irrigates over what you thought
 11 or Dr. Hoogenboom thought was an optimal amount,
 12 you say they're wasting water. Correct?
 13 A. **Yes.**
 14 Q. You would agree with me, sir, that, on average,
 15 irrigation depths applied by Georgia farmers are
 16 actually below the optimal amount as calculated
 17 by you and Dr. Hoogenboom?
 18 A. **Yes. I -- I think that. I think I believe**
 19 **Dr. Hoogenboom thinks that, and I believe that**
 20 **even Dr. Irmak thinks that, that on average**
 21 **Georgia farmers are below this maximum irrigation**
 22 **depth.**
 23 Q. It's below the optimal irrigation depth. Right?
 24 A. **It's not optimal. It's -- what I'm looking at is**
 25 **really a biological maximum. So it's the amount**
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2823

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1 **of water beyond which there's no additional**
 2 **beneficial plant growth.**
 3 **Q.** Dr. Sunding, just to make this crystal clear,
 4 your analysis and Dr. Hoogenboom's analysis show
 5 that Georgia farmers in the aggregate are
 6 underwatering compared to that maximum amount
 7 that you identified. Correct?
 8 **A. Yes. That question I like better.**
 9 **Q.** In addition to your preference to the question,
 10 do you agree with the assertion?
 11 **A. I do. It's just that you used the word optimal**
 12 **before, and you modified the question in a way**
 13 **that I will agree with.**
 14 **Q.** Dr. Sunding, can you turn to page 25 of your
 15 written direct testimony.
 16 We have a figure 4 there. You actually have
 17 a figure 3 and a figure 4. Correct?
 18 **A. I'm sorry. We're on which page now?**
 19 **Q.** Page 25.
 20 **A. Yes.**
 21 **Q.** If we look at the bottom one, figure 4, the way
 22 your analysis worked was that red vertical line
 23 shows what you considered to be the maximum
 24 productive depth for the type of crop and soil
 25 and growth year depicted. Right?

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1 **A. That -- it could be true.**
 2 **Q.** And right now, we're talking about percentage of
 3 acreage, just to be clear. The percentage of
 4 acreage that is underwatered is higher than 80
 5 percent. Correct?
 6 **A. That I don't know.**
 7 **Q.** Do you have any basis to disagree that it's 80
 8 percent or even higher in other years?
 9 **A. You know, I would have thought it somewhere in**
 10 **the 60 to 80 percent range; but I -- again, I may**
 11 **have done that calculation at some point; but I**
 12 **don't have it in my mind now.**
 13 **Q.** Okay. We have had our experts do it, so we'll
 14 bring it up later in the trial.
 15 Dr. Sunding, I want to talk now about your
 16 assertion that agricultural irrigation is, quote,
 17 clearly discretionary. Do you recall giving that
 18 testimony?
 19 **A. I do.**
 20 **Q.** You don't believe that farmers in ACF Georgia
 21 should exercise their discretion to stop
 22 irrigating altogether. Right?
 23 **A. I'm not sure I understand the question.**
 24 **Q.** Well, you're not of the view that all the farmers
 25 should exercise their discretion and should go

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2824

2826

1 **A. Yes. Again, that's the number that I got from**
 2 **Dr. Hoogenboom.**
 3 **Q.** So here, if you're growing peanuts on fine soil
 4 in 2011, this would show that the vast majority
 5 of farmers are to the left of the maximum
 6 productive depth and, therefore, underwatering.
 7 Right?
 8 **A. Yes, it does.**
 9 **Q.** And there's a few instances to the right of
 10 people you say would be overwatering?
 11 **A. That's correct.**
 12 **Q.** And then on the other one, you have more people
 13 in that particular instance who you considered to
 14 be overwatering; is that right?
 15 **A. Yes. It's just another example.**
 16 **Q.** Now, have you calculated the percentage of
 17 farmers using your analysis that are
 18 underwatering in Georgia?
 19 **A. I don't -- we might have calculated that sometime**
 20 **along the way; but I don't have it in my head now**
 21 **if I did.**
 22 **Q.** Are you familiar enough with your own analysis to
 23 agree that it's more than 80 percent of Georgia
 24 farmers who would be underwatering under your
 25 analysis?

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1 entirely to dry-land farming in southwest
 2 Georgia; are you?
 3 **A. No. I don't think I have said that.**
 4 **Q.** You would agree that without irrigation, farming
 5 is totally dependent on precipitation. Correct?
 6 **A. It is dependent on precipitation, but there are a**
 7 **lot of other inputs that go into agriculture**
 8 **besides just water.**
 9 **Q.** Well, we're here talking about water. So as it
 10 relates to water, you would agree that natural
 11 precipitation exclusively if you're not going to
 12 do irrigation. Right?
 13 **A. Yes. I just think your question before was**
 14 **overstated.**
 15 **Q.** Precipitation varies from year to year. Right?
 16 **A. Of course, it does.**
 17 **Q.** Varies from season to season?
 18 **A. Yes, it does.**
 19 **Q.** And it can also vary regionally even within the
 20 ACF Basin within the same season. Correct?
 21 **A. It can, yes.**
 22 **Q.** You would agree that irrigation helps farms
 23 improve their yields. Correct?
 24 **A. In certain years. Not in every year.**
 25 **Q.** You would also agree that irrigation helps

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2827

1 stabilize production. Right?

2 **A. Yes. I would agree with that.**

3 **Q.** And without irrigation, you can have a bouncing

4 around of yield according to how precipitation

5 varies from one year to another. Correct?

6 **A. Yes. Yield can go up and down to a greater**

7 **degree with no irrigation.**

8 **Q.** And irrigation also raises average yields across

9 all years it's used. Correct?

10 **A. Yes.**

11 **Q.** It eliminates downside risk in years where yields

12 would otherwise be low. Correct?

13 **A. Well, now you're talking about a financial risk.**

14 **And to answer that, you would have to know**

15 **something about whether or not growers have**

16 **access to crop insurance.**

17 **Q.** Dr. Sunding, can you turn to page 254 of your

18 deposition, please, lines 16 through 24. Are you

19 there, sir?

20 **A. You're on page 254, line 16 through 24?**

21 **Q.** Correct.

22 **A. All right.**

23 **Q.** The question was, of what benefit is stabilized

24 production for farmers?

25 The answer was, well, it's two benefits. If

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2828

1 irrigation is used predominantly in the drier

2 years, it has two effects. It raises average

3 yields across all years, and it eliminates or

4 reduces some downside risk. So in years that the

5 yields would otherwise be low, it reduces risk.

6 Were you asked that question, and did you

7 give that answer?

8 **A. Yes. And there we're talking about production**

9 **risk as opposed to financial risk. They're**

10 **different.**

11 **Q.** Dr. Sunding, farmers who practice dry-land

12 farming face an increased risk of a lower yield

13 during a dry year. Correct?

14 **A. I think that's right. Yes.**

15 **Q.** Farmers who practice dry-land farming face an

16 increased risk of crop failure in dry years

17 compared to farmers who irrigate. Correct?

18 **A. That may also be true, yes.**

19 **Q.** And you would agree that agricultural lenders pay

20 attention to the yields that come off of a farm

21 when making a decision whether to loan money out,

22 among other factors. Right?

23 **A. Among other factors, sure. That fits with my**

24 **experience.**

25 **Q.** That's because agricultural lenders are

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2829

1 interested in the stability of yield from a

2 farmer's crops. Right?

3 **A. Yes. Again, among other things, sure. They want**

4 **to get repaid if they're loaning money.**

5 **Q.** And you would agree that it is possible that the

6 presence of irrigation influences a farmer's

7 ability to secure a loan to finance his farm.

8 True?

9 **A. I think it's possible.**

10 **Q.** I want to make a big transition now, and we're

11 going to talk about pecans.

12 **A. All right.**

13 **Q.** All right. You have an opinion about pecans.

14 Right?

15 **A. Yes.**

16 **Q.** Let's go to paragraph 54 of your direct

17 testimony. Can you read that and just let us

18 know if that's where you offer your pecan

19 opinion?

20 **A. Paragraph 54 or page 54?**

21 **Q.** Paragraph, on page 27.

22 By the time you figure this routine out,

23 we're going to be done, Dr. Sunding.

24 **A. Right.**

25 **Okay. I see it.**

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2830

1 **Q.** Okay. And here you say that if farmers reduce

2 pecan irrigation by 38 percent at certain times

3 of year, you can generate streamflow benefits

4 exceeding 100 cfs in a dry year. Correct?

5 **A. Yes.**

6 **Q.** You base this conclusion entirely on a paper

7 written by Lenny Wells from the University of

8 Georgia. Correct?

9 **A. It's not entirely on the paper. As we discussed**

10 **in my deposition, it's more than that.**

11 **Q.** Dr. Wells gave a PowerPoint presentation to

12 farmers, too, that you looked at. Right?

13 **A. Yeah. More than one presentation, but I have a**

14 **copy of the PowerPoint that he uses.**

15 **Q.** And the PowerPoint is based on his single study.

16 Correct?

17 **A. I don't know about that. I presume he has other**

18 **experiences beyond those that were reflected in**

19 **the paper.**

20 **Q.** That's what you presume?

21 **A. Yes.**

22 **Q.** Now, the paper came out in April of 2015.

23 Correct?

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

25 **Q.** The Wells paper, it's five pages long?

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2831

2833

- 1 **A. The paper in Horticultural Science, yes.**
- 2 **Q.** Yes. And it describes a single study conducted
- 3 from 2012 to 2014. Right?
- 4 **A. Yes. The paper does.**
- 5 **Q.** And this pecan paper for Dr. Wells was conducted
- 6 on a single pecan farm in Berrien County. Right?
- 7 **A. I believe that's right.**
- 8 **Q.** Berrien County is not in the ACF Basin. Right?
- 9 **A. It is not.**
- 10 **Q.** You have never met Dr. Wells. Correct?
- 11 **A. No.**
- 12 **Q.** You had never heard of Dr. Wells before you read
- 13 his 2015 article. Right?
- 14 **A. No.**
- 15 **Q.** And you never discussed this paper with Dr. Wells
- 16 after you read the article. Right?
- 17 **A. No.**
- 18 **Q.** You did not do anything to confirm the analysis
- 19 in Dr. Wells's article. Right?
- 20 **A. No. He's outside my field.**
- 21 **Q.** In fact, you couldn't check it because you didn't
- 22 have the underlying data that he used in the
- 23 study. Right?
- 24 **A. That's right.**
- 25 **Q.** And I think it's your view if it's good enough

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- 1 October.
- 2 **A. Right.**
- 3 **Q.** It's in your right hand.
- 4 **A. Yes. I'm turning to paragraph 13.**
- 5 **Q.** Yes.
- 6 **A. Got it.**
- 7 **Q.** Paragraph 13 addresses the issue of return flows.
- 8 Correct?
- 9 **A. Yes.**
- 10 **Q.** And you say that water withdrawn by an M & I user
- 11 but then returned to the ACF has little impact on
- 12 streamflows. Right?
- 13 **A. That's right. This is the distinction we were**
- 14 **talking about earlier between water use and**
- 15 **consumptive use.**
- 16 **Q.** Right. And it's very important to distinguish
- 17 between the withdrawal of water and the actual
- 18 consumptive use of water. Right?
- 19 **A. I think so, yes. Certainly in this case.**
- 20 **Q.** And the consumptive use is the net result of the
- 21 withdrawal minus the return. Correct?
- 22 **A. Yes.**
- 23 **Q.** Now, you assume that municipal use in Georgia is
- 24 largely nonconsumptive. Right?
- 25 **A. Sure. Yes.**

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2832

2834

- 1 for Dr. Wells, it's good enough for you. Right,
- 2 Dr. Sunding?
- 3 **A. He's the lead pecan researcher at the University**
- 4 **of Georgia, as far as I know. If he feels**
- 5 **confident enough to be out on the road telling**
- 6 **Georgia farmers to curtail early season**
- 7 **irrigation, that's something I put some stock in.**
- 8 **Q.** And if he writes one paper about Berrien County
- 9 pecan farms on a single experiment, that's good
- 10 enough for you to tell the Supreme Court Georgia
- 11 can generate 100 cfs with that measure. Correct?
- 12 **A. It's more than just the paper. He has a whole**
- 13 **career, as far as I can tell from looking at his**
- 14 **vitae, working on essentially nothing but pecans**
- 15 **and other nut crops. So he has a lot of**
- 16 **experience in this area.**
- 17 **Q.** Okay. Dr. Sunding, I want to skip back over to
- 18 M & I.
- 19 **A. All right.**
- 20 **Q.** Municipal and industrial. All right?
- 21 I'm sorry. Your reports cover a lot of
- 22 ground. We need to cover a lot of issues.
- 23 **A. They do. That's all right.**
- 24 **Q.** Now, in paragraph 13 of your written direct --
- 25 that's the loose one that was just filed in

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- 1 **Q.** That's consistent with the data that you have
- 2 seen and that you use in your analysis. Right?
- 3 **A. Yes, that's right.**
- 4 **Q.** Let's go to your first expert report. It's the
- 5 first tab, page 23.
- 6 **A. All right.**
- 7 **Q.** And I want to focus in particular on table 3.
- 8 **A. Right.**
- 9 **Q.** So in your first report you included this table
- 10 that shows per capita water use in the Atlanta
- 11 service area in gallons per day. Right?
- 12 **A. I see that, yes.**
- 13 **Q.** And per capita water use is the amount of water
- 14 used per person in the Atlanta metro area.
- 15 Right?
- 16 **A. Yes.**
- 17 **Q.** You would --
- 18 **A. There are different measures of per capita use.**
- 19 **But this is just withdrawals divided by people.**
- 20 **Q.** Now, if we focus on the top line, this is the
- 21 total withdrawals. Right?
- 22 **A. Yes.**
- 23 **Q.** And so this is that distinction you drew. This
- 24 is the amount that actually gets taken out, but
- 25 it's the gross number. It doesn't talk about

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2835

1 returns. Right?

2 **A. Right.**

3 **Q.** And you would agree that from 2000 to 2009 total

4 withdrawals have declined from 123 million

5 gallons per day to 92 million gallons per day for

6 this service area. Correct?

7 **A. Comparing just those two numbers, yes.**

8 **Q.** You would also agree that the per capital -- per

9 capita water use in metro Atlanta has steadily

10 declined over the last 16 years; wouldn't you,

11 sir?

12 **A. It is declining. The word steadily may be a**

13 **little bit of an overstatement. But it has**

14 **declined over this period.**

15 **Q.** Dr. Sunding, can you pull out your deposition,

16 page 358, line 23. Are you there?

17 **A. Yes.**

18 **Q.** The question was, Dr. Sunding, you will agree

19 that the per capita water use in the metro

20 Atlanta area has steadily declined over the last

21 16 years. Correct?

22 Answer. Yes.

23 Were you asked that question, and did you

24 give that answer?

25 **A. Yes. And then if you go down a little bit**

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2836

1 **further, there is some more detail on this point.**

2 **Q.** Dr. Sunding, table 3 in your first expert report

3 only goes through 2009. Correct?

4 **A. Yes.**

5 **Q.** And you were unaware at your deposition that per

6 capita usage in Atlanta continued to decline

7 after 2009. Correct?

8 **A. In my deposition I think that's the case.**

9 **Q.** You're aware that Georgia's expert, Dr. Mayer,

10 analyzed per capita water use in the metro

11 district of Atlanta?

12 **A. I saw that, yes.**

13 **Q.** And you know that he found that per capita water

14 use continued to decline through 2013. Correct?

15 **A. Yes.**

16 **Q.** And you're aware that Mr. Mayer has calculated

17 that per capita water use has gone beneath 100

18 gallons per capita per day. Correct?

19 **A. Yes.**

20 **Q.** Now, sticking with M & I, I want to talk about

21 your estimates of the amount of outdoor water

22 that is used in Georgia for M & I purposes.

23 Okay?

24 **A. All right.**

25 **Q.** Just give me one moment.

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2837

1 Let's go to -- sticking in your first report,

2 to page 72, please, sir.

3 **A. All right.**

4 **Q.** And you have a table there, table 11. Correct?

5 **A. I see it, yes.**

6 **Q.** This is where you estimated Georgia's total

7 outdoor water use in the ACF Basin for the year

8 2011. Correct?

9 **A. I just want to read the text that's describing**

10 **table 11.**

11 **Okay. Yes.**

12 **Q.** Okay. And, sir, would you agree -- and this is

13 municipal and industrial outdoor water use.

14 Right?

15 **A. Well, it's -- we need to be a little careful**

16 **about this. There are municipal withdrawal**

17 **permits, and then there are industrial withdrawal**

18 **permits. Some large manufacturers, like the pulp**

19 **and paper facilities and whatnot, they will have**

20 **their own withdrawal permits. Those were not**

21 **part of the analysis. But there were also some**

22 **businesses that buy water from urban water**

23 **utilities.**

24 **So I just want to be clear about what we're**

25 **talking about when we use the term municipal and**

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2838

1 **industrial, especially in this context where**

2 **there are both kinds of permits.**

3 **Q.** Okay. Well, just how would you define -- there

4 is a number there, 114,550 acre-feet.

5 **A. Yes.**

6 **Q.** How would you define what is included in that?

7 **A. That's -- I would call it municipal and**

8 **industrial, but just understand there's a whole**

9 **other category of industrial users that are**

10 **outside this analysis.**

11 **Q.** Okay. That's fine.

12 Now, you made a similar estimate for the same

13 type of thing in your second report. Correct?

14 **A. Yes.**

15 **Q.** And it was a different number. Correct?

16 Let's go to your second report, FX-801 at

17 page 4.

18 **A. Yes.**

19 **Q.** So you have a table there called table 2, outdoor

20 use in the ACF Basin.

21 **A. Yes.**

22 **Q.** Now, the number you estimate is 162,792

23 acre-feet. Correct?

24 **A. For 2011, yes.**

25 **Q.** So the number in the first report was 114,000,

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2839

1 and the second report it's now 162,000 and
 2 change. Right?
 3 **A. Yes. And this -- this has to be just a reporting**
 4 **issue because nothing changed in the analysis**
 5 **between those two dates.**
 6 **Q.** The number changed?
 7 **A. Right. But the analysis didn't change. This has**
 8 **to be reflecting either a different set of**
 9 **permits or something like that, but the analysis**
 10 **didn't change between these two reports.**
 11 **Q.** Let's go to your direct testimony and see if
 12 there's another estimate for the same thing. And
 13 can you refer to paragraph 74.
 14 **A. Yes.**
 15 **Q.** Okay. At the bottom of paragraph 74 in your
 16 direct testimony, there is a sentence that
 17 begins, aggregate outdoor water use in the ACF in
 18 Georgia. Do you see that?
 19 **A. I do.**
 20 **Q.** And there you say that it resulted in over
 21 130,000 acre-feet of consumption in 2011.
 22 Correct?
 23 **A. Yes.**
 24 **Q.** So we have had 114,000 in February, 163,000 for
 25 some reason in May, and now for trial we have

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2840

1 130,000 acre-feet in outdoor water use as you
 2 calculated it. Correct, sir?
 3 **A. Well, again, there are really only two numbers.**
 4 **The -- whatever discrepancy is between the first**
 5 **and second reports has to do with just the way**
 6 **the numbers are put together for the tables. I**
 7 **only had two versions of -- two versions of an**
 8 **estimate of outdoor water use. The one in my**
 9 **direct testimony corrects for an error that you**
 10 **presented to me during my deposition.**
 11 **Q.** Sir, is it fair to say you had one figure for
 12 outdoor water use in February; and you have a
 13 different one here in November. And there's one
 14 in the middle that you can't explain?
 15 **A. No. The one in the middle, the 162, that -- that**
 16 **number I know was what the original modeling was.**
 17 **I would have to take time and look at the table**
 18 **in the first report to see exactly what I was**
 19 **reporting that for.**
 20 **Q.** And you do agree that you corrected an error and
 21 now have a different number from your first
 22 report to your trial testimony. Correct?
 23 **A. Yes.**
 24 **No, I agree with the issue that was pointed**
 25 **out during my deposition; and I stand by the**

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2841

1 **130,000.**
 2 **Q.** Dr. Sunding, can you go to the table that you
 3 used for the trial testimony where you have
 4 various options for 2,000 cfs.
 5 **A. Sure.**
 6 **Q.** And tell me when you're there.
 7 **A. All right. I'm there.**
 8 **Q.** Okay. You touched on this earlier; but if we
 9 look at the table under drought year, you
 10 actually have two columns with a high and a low
 11 range. Correct?
 12 **A. Are you referring to the connectivity?**
 13 **Q.** You have -- right. You have two estimates for
 14 the drought year, one called .43 connectivity and
 15 the other called .6 connectivity. Correct?
 16 **A. That's correct.**
 17 **Q.** You explained this, I believe, in paragraph 48 of
 18 your direct testimony?
 19 **A. Yes.**
 20 **Q.** Can you look at that.
 21 **A. All right, yes.**
 22 **Q.** And you said in paragraph 48 that decreases in
 23 consumptive use in the agricultural sector don't
 24 translate directly to reductions in peak monthly
 25 streamflows. Right?

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2842

1 **A. What I meant by that, it's not a one-for-one**
 2 **relationship.**
 3 **Q.** Right. I want to pause on this. This came up
 4 briefly during Dr. Hornberger's testimony, who
 5 had adopted this from Dr. Langseth, who I believe
 6 you mentioned in your testimony. But the
 7 principle is that if you take a gallon of water
 8 out of the ground, it does not reduce the
 9 streamflow one-to-one per gallon. Right?
 10 **A. Yes. That's what I just said.**
 11 **Q.** Whereas, if you're irrigating directly out of a
 12 stream, each gallon you take out is gone from the
 13 stream; and it does have a one-to-one reduction?
 14 **A. That's correct.**
 15 **Q.** And when you have this .43 and this .6
 16 connectivity, what you're modeling are two
 17 scenarios. One where pumping reduces streamflow
 18 by 43 percent; right?
 19 So if you pull out a gallon, it reduces
 20 streamflow by .43 gallons, versus another
 21 scenario where it's a more significant reduction
 22 in streamflow of .6 for every gallon pumped.
 23 Right?
 24 **A. On average, understanding that connectivity**
 25 **actually varies over space, you know, by**

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2843

1 **location. But the .43 and .6 are average**
 2 **estimates across the landscape.**
 3 **Q.** Right. And you actually just made a very
 4 important point that I want to pause on. A pump
 5 in one location in the ACF Basin may have a very
 6 different impact on streamflow from a groundwater
 7 pump in a different part of the basin. Right?
 8 **A. I believe that's correct. Yes.**
 9 **Q.** And so what you have done is you say on average,
 10 it's either .43 on the low end or .6 impact on
 11 the high end. Right?
 12 **A. Those are the two -- the two sets of assumptions**
 13 **I was given by the hydrogeologist, yes.**
 14 **Q.** The .6, the 60 percent impact figure that you
 15 used for connectivity, you didn't use that in
 16 either of your expert reports. Correct?
 17 **A. That's right. Although I did have language**
 18 **around the .43 connectivity suggesting that that**
 19 **might be on the low side.**
 20 **Q.** Right. You -- when you did your initial work and
 21 came up with your thousand cfs estimates, you
 22 used a .43 connectivity factor. Right?
 23 **A. For the numerical analysis, yes.**
 24 **Q.** And you got that from Dr. Langseth?
 25 **A. I did.**

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2844

1 **Q.** And when you did your second report and had 2,000
 2 cfs, you used a .43 connectivity factor. Right?
 3 **A. I did.**
 4 **Q.** The first time you offered any numbers for
 5 streamflow based on a .6 connectivity factor was
 6 in your direct testimony that we're looking at
 7 now which we received on October 14, 2016.
 8 Correct?
 9 **A. That's the first time I modeled that numerically,**
 10 **yes.**
 11 **Q.** Back to your table where you have those two
 12 columns, you agree that you get more streamflow
 13 benefit in your analysis when you use a .6
 14 connectivity factor. Right?
 15 **A. Sure, which I think reflects -- to me that makes**
 16 **sense. That result seems intuitive.**
 17 **Q.** And in the aggregate, it increases your total
 18 number from 1800 to 2,000 under the drought year
 19 scenarios. Correct?
 20 **A. Yes. It makes a modest difference in**
 21 **streamflows.**
 22 **Q.** You say in that paragraph -- you say in paragraph
 23 42 -- I'm sorry. You say in paragraph 90 of your
 24 direct that the new connectivity value, the .6 --
 25 I'll just let you get there. It's paragraph 90.

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2845

1 **A. Yes. I'm there.**
 2 **Q.** Just give me a moment, Dr. Sunding.
 3 **A. Right.**
 4 **Q.** I misdirected you.
 5 Now, I'm wrong. I get confused between the
 6 pages and the paragraphs sometimes.
 7 But let's go to paragraph 48 on page 23.
 8 **A. Yes?**
 9 **Q.** Okay. You say at the bottom -- in particular I'm
 10 focused on the bottom of page 23 where you say
 11 that you have a .43 average connectivity, about
 12 four lines up from the bottom?
 13 **A. I see that. Sure.**
 14 **Q.** And you say that that's highly conservative.
 15 Right?
 16 **A. Yes. That's the information I was given.**
 17 **Q.** That's what the hydrologists told you, highly
 18 conservative at .43?
 19 **A. They have told me that for as long as they worked**
 20 **on the project, yes.**
 21 **Q.** Okay. And so you then say you adjusted the
 22 connectivity values averaging .6 across the
 23 Georgia ACF. Right?
 24 **A. Yes.**
 25 **Q.** And you got that from Drs. Langseth and

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2846

1 Hornbergerer to be a more middle-of-the-road
 2 estimate. Right?
 3 **A. That was the way they described it, yes.**
 4 **Q.** You weren't here when Dr. Hornberger testified;
 5 were you?
 6 **A. I was not, no.**
 7 **Q.** Are you aware that Dr. Hornberger was asked about
 8 Dr. Langseth's selection of connectivity values?
 9 **A. No.**
 10 **Q.** Are you aware that in his expert report,
 11 Dr. Langseth specifically reviewed and rejected
 12 the 1996 Torak and McDowell model that
 13 Dr. Hornberger now uses to get the .6
 14 connectivity value?
 15 **A. No. I -- I don't know that level of detail.**
 16 **Q.** You don't know that Dr. Langseth rejected that
 17 model?
 18 **A. No.**
 19 **Q.** Are you aware that Dr. Hornberger admitted that
 20 Dr. Langseth had reviewed and rejected the Torak
 21 and McDowell model just last week?
 22 MR. PERRY: Objection, mischaracterization.
 23 BY MR. PRIMIS:
 24 **Q.** We can put the trial transcript up if you prefer,
 25 but are you aware of that?

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2847

2849

1 **A. For?**
 2 **Q.** Are you aware that Dr. Hornberger said that he
 3 had never run the 1996 Torak and McDowell model
 4 that he now relies on for the .6 connectivity
 5 value that you have used now for the first time?
 6 **A. Again, that's all part of their work.**
 7 **Q.** And just to be clear, when we're talking about
 8 the .6 model -- .6 factor, that comes from the
 9 modeling that was done in 1996 that Dr. Langseth
 10 reviewed. You know that; right?
 11 **A. But that's outside what I know. No. That's in**
 12 **their -- in their area.**
 13 **Q.** Dr. Sunding, I want to ask you now about the role
 14 of the Army Corps. You didn't consult with
 15 anyone from the Army Corps of Engineers in doing
 16 your analysis in this case. Right?
 17 **A. No.**
 18 **Q.** The reservoir and dam operations of the Army
 19 Corps are not part of your analysis. Correct?
 20 **A. That's correct.**
 21 **Q.** You haven't analyzed how the Corps would handle
 22 the additional streamflows that you say can be
 23 saved through its dam operations in a drought.
 24 Right?
 25 **A. No. That's -- that's not an economic question.**

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1 **A. Good afternoon.**
 2 **Q.** I would like to start at a little bit of a higher
 3 level of generality than what Mr. Primis was. I
 4 don't want to obviously repeat everything in your
 5 prefiled direct, but could you help us
 6 understand, just as an initial matter, what an
 7 agricultural economist and an expert in natural
 8 resources economics does.
 9 **A. Sure. I can describe that. What we do in my**
 10 **profession is look at the economic impacts and**
 11 **economic costs of different measures to conserve**
 12 **natural resources. And water would be a prime**
 13 **example. Land would be another example. But we**
 14 **understand how a natural resource is used in the**
 15 **economy. And part of the field is to study what**
 16 **are the economic impacts of public policies to**
 17 **conserve natural resources.**
 18 **Q.** Now, this isn't the only case where you have
 19 looked at issues of natural resources and water;
 20 is it?
 21 **A. No. Definitely not.**
 22 **Q.** Could you describe for the Court a few other
 23 examples where agricultural irrigation has been
 24 limited because of the impacts on the environment
 25 or ecosystems.

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2848

2850

1 **That's a hydrological one.**
 2 **Q.** And that's not something that you have considered,
 3 whether the water you say would be saved would be
 4 passed through by the Army Corps. Correct?
 5 **A. It was certainly something I discussed with**
 6 **Florida's experts, and they assured me that the**
 7 **water would make its way to Florida. But beyond**
 8 **that, it's outside my area to do any modeling on**
 9 **this issue.**
 10 **Q.** So just from your own expertise, you don't know.
 11 You just rely on other people. Correct?
 12 **A. That's right, yes.**
 13 **Q.** And, Dr. Sunding, you haven't evaluated the cost
 14 that would be associated with the Army Corps
 15 supplementing streamflow through reservoir
 16 operations to achieve the values that you have
 17 calculated. Correct?
 18 **A. That's right.**
 19 MR. PRIMIS: No further questions.
 20 MR. PERRY: Good afternoon, your Honor.
 21 SPECIAL MASTER LANCASTER: Good
 22 afternoon, Mr. Perry.
 23 REDIRECT EXAMINATION
 24 BY MR. PERRY:
 25 **Q.** Good afternoon, Dr. Sunding.

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1 **A. Sure. I could give examples of situations**
 2 **involving litigation and also other situations**
 3 **where agricultural water uses had to be limited**
 4 **to protect the environment. This is actually a**
 5 **very common issue across the United States where**
 6 **farming areas have overshot a level that's**
 7 **sustainable in terms of environmental conditions.**
 8 **Some very good examples I could give would be**
 9 **the Klamath Basin in Oregon and just into the**
 10 **northern part of California, the Republican River**
 11 **in Nebraska, the Pecos River in Texas and New**
 12 **Mexico, others as well. But this is actually a**
 13 **very common phenomenon across the country.**
 14 **Q.** Now, with respect to those examples, did you draw
 15 on those examples in performing the work you did
 16 here?
 17 **A. I did. What I tried to do in my testimony is two**
 18 **things. I tried to show what would be the cost**
 19 **to Georgia of different conservation measures,**
 20 **but then also demonstrate that there have been**
 21 **programs adopted in other parts of the country**
 22 **that Georgia could model itself after that would**
 23 **actually make these measures feasible, sort of**
 24 **practical.**
 25 **Q.** Sir, can you give us a couple examples of the

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2851

1 types of measures we're discussing in this case
 2 being applied in other circumstances.
 3 **A. Sure. I started with the Klamath before, so I'll**
 4 **start with the Klamath now. In the Klamath**
 5 **Basin, there were issues related to in-stream**
 6 **flows -- you know, flows in the river -- and**
 7 **salmon in particular. And farmers had to cut**
 8 **back their water usage in particular dry years.**
 9 **And the way the government did that was they**
 10 **instituted an auction. So they actually paid**
 11 **farmers to reduce their irrigation during certain**
 12 **dry periods to keep the water in the river for**
 13 **salmon.**
 14 **Q.** Would that auction have been somewhat similar to
 15 the tools used in the Flint River Drought
 16 Protection Act when it was actually being
 17 employed?
 18 **A. At a high level of generality, yes. There were a**
 19 **number of institutional details in the Klamath**
 20 **program that made it more successful, if I could,**
 21 **than the program in the Flint; but it's**
 22 **conceptually similar.**
 23 **Q.** Now, you have been involved in situations where
 24 farmers have been, on a permanent basis, asked to
 25 stop irrigating; isn't that right?

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2852

1 **A. Yes. That's also quite common.**
 2 **Q.** Can you describe some of those circumstances
 3 elsewhere in the country.
 4 **A. Sure.**
 5 **Well, in -- in California right now, we're in**
 6 **the process of a very large-scale unwinding of**
 7 **several hundred thousand acres of irrigated**
 8 **agriculture due to environmental flow**
 9 **considerations.**
 10 **Another example that I -- sort of more**
 11 **bite-sized that I had quite a bit of personal**
 12 **involvement in is the -- a situation in Nevada in**
 13 **the Newlands Irrigation District, which is**
 14 **actually the first project undertaken by the**
 15 **Bureau of Reclamation in its history. That was**
 16 **another case where, for environmental reasons,**
 17 **there were just too many acres under production.**
 18 **And so the government, working with the Nature**
 19 **Conservancy and the water district itself,**
 20 **started a program where agricultural irrigation**
 21 **rights were retired on a permanent basis both to**
 22 **expand the size of a wildlife refuge, but more**
 23 **importantly to get more water back in-stream.**
 24 **Q.** When you say water back in-stream, was it the
 25 purpose of that project to aid aquatic species or

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2853

1 was there a different purpose?
 2 **A. That particular project was both aquatic species**
 3 **and then birds. There's a -- in the area outside**
 4 **of Fallon, Nevada, there is a very large national**
 5 **wildlife refuge that they need water to support**
 6 **birds overwintering there in their migratory**
 7 **paths.**
 8 SPECIAL MASTER LANCASTER: Excuse me,
 9 doctor. Could you speak into the microphone.
 10 THE WITNESS: Sure. Sorry.
 11 SPECIAL MASTER LANCASTER: You don't
 12 have to look at me, but she has to get every
 13 word you say.
 14 THE WITNESS: All right.
 15 BY MR. PERRY:
 16 **Q.** Now, sir, Mr. Primis mentioned maybe once or
 17 twice the word riparian. Are you familiar with
 18 the Imperial Valley and what, if anything, was
 19 done there?
 20 **A. I am.**
 21 **Q.** Could you describe that for the Court, please.
 22 **A. Sure. The Imperial Valley -- let's start with**
 23 **the Imperial Irrigation District is a very large**
 24 **federal reclamation project in the Mojave Desert**
 25 **of California and gets water supply from the**

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2854

1 **Colorado River. The case of Imperial I think is**
 2 **notable here because the farmers in the Imperial**
 3 **Valley had very senior water rights. They**
 4 **settled that part of California at a very early**
 5 **stage. And historically, farmers in the Imperial**
 6 **Irrigation District had no quantified upper limit**
 7 **on the amount of water they could use, much like**
 8 **Georgia groundwater users in the agricultural**
 9 **sector. And as part of what's known as the**
 10 **Quantification Settlement Agreement on the**
 11 **Colorado River, which I helped negotiate, the**
 12 **farmers in Imperial accepted a cap on their**
 13 **irrigation per acre, much like we're suggesting**
 14 **should happen here. And then they're free to**
 15 **move that water around in whatever way maximizes**
 16 **their productivity.**
 17 **Q.** And when you say move water around, is that
 18 between their various fields and among their crop
 19 rotations; is that fair?
 20 **A. Yes.**
 21 **Q.** Now, you also mentioned, I think a moment ago,
 22 the Republican River in Nebraska. Could you just
 23 give us just a bit of detail about that, please.
 24 **A. Sure. Actually, the only other time I have been**
 25 **to Portland, Maine, was to testify in the**

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2855

2857

1 **Republican River case. I testified on behalf of**
 2 **the State of Nebraska.**
 3 **The Republican River has similar**
 4 **environmental flow issues. And something that's**
 5 **notable about that case is that the Nebraska --**
 6 **the State of Nebraska has overall responsibility**
 7 **for making sure that a consumption cap is**
 8 **enforced. But what the State has done is set up**
 9 **three what are called Natural Resources Districts**
 10 **across the Republican River. And each of those**
 11 **districts represents a particular area. They**
 12 **each come up with a water management plan that**
 13 **makes sense to them, to farmers, and other users**
 14 **in those particular areas. And I describe this**
 15 **in my testimony.**
 16 **And so what will happen when the State**
 17 **determines what's the allowable amount of**
 18 **consumption under the Compact, they flow that**
 19 **down to the Natural Resource Districts. They**
 20 **actually have to implement the consumption cap,**
 21 **and the State oversees it.**
 22 **And if there's compliance, great; everybody**
 23 **goes along. If there's noncompliance, then the**
 24 **State has to intervene and request additional**
 25 **measures. But there's both, you know,**

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1 to save water here.
 2 **A. Sure. Could I actually start with the Ag sector?**
 3 **Q. Yes.**
 4 **A. Sure. So the work that I did on the agricultural**
 5 **sector was extremely data intensive, and I tried**
 6 **to implement it very carefully. The State of**
 7 **Georgia has an agricultural metering database.**
 8 **So they have meters installed on a little more**
 9 **than half the agriculture wells in the Flint**
 10 **Basin. And so we took information by well on how**
 11 **much those farmers were using by year and matched**
 12 **that up with satellite information collected by**
 13 **the USDA.**
 14 **The USDA flies satellites over agricultural**
 15 **areas in the country every 16 days. Each area is**
 16 **covered every 16 days. And they take that**
 17 **satellite imagery and use it to figure out field**
 18 **by field what farmers are growing. It's an**
 19 **incredible amount of information.**
 20 **So we took Georgia's information on**
 21 **agricultural water use and matched that up**
 22 **center-pivot by center-pivot with what we knew**
 23 **from the satellites about what was being grown on**
 24 **each field. We controlled for soil quality.**
 25 **It's -- also information was collected by the**

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2856

2858

1 **back-checking to make sure that the caps are**
 2 **enforced. But, then again, there is an element**
 3 **of local control that makes it more palatable to**
 4 **the growers.**
 5 **Q.** Now, we have talked a little bit in this case
 6 about M & I uses, municipal and industrial. And
 7 could you give the Court a sense of your
 8 real-world, practical experience on that, too.
 9 **A. Sure. Well, I'll give you just some recent**
 10 **experience. I know Atlanta has gone through some**
 11 **revisions to its long-term water demand forecast**
 12 **and water supply planning. I actually did the**
 13 **same thing for the Los Angeles and San Diego area**
 14 **combined for an entity called the Metropolitan**
 15 **Water District, kind of a similarly-generic name**
 16 **to what you have in Atlanta. So I did that for**
 17 **LA and San Diego.**
 18 **I also did it for San Francisco and the**
 19 **Silicon Valley, developed their long-term demand**
 20 **forecast and evaluated the effects of different**
 21 **conservation programs on their usage.**
 22 **Q.** All right, sir. So let's turn to the specific
 23 elements of this case. And I would like you just
 24 to start briefly by describing how you took that
 25 experience and used it to focus on specific ways

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1 **USDA, and got a picture. Again, a disaggregated**
 2 **picture. So not just looking at basin-wide**
 3 **averages, but a disaggregated picture of what was**
 4 **happening with respect to agricultural water use.**
 5 **So it really, I think, is a -- as an academic, I**
 6 **would say that is a big accomplishment.**
 7 **Q.** And in -- you used the word a few times
 8 depletions. And I believe you are referring to
 9 rivers or tributaries when you say that. Could
 10 you explain that term.
 11 **A. Sure. Depletion is a reduction in the amount of**
 12 **water that's in a stream. So you might have one**
 13 **level of water before some action is taken and**
 14 **then another level afterwards.**
 15 **Q.** So, sir, when Mr. Primis was up here, he was
 16 asking you about a three-page or maybe it was a
 17 four-page assembly of tables. I would like to
 18 actually look at your full prefiled direct in
 19 pages 44 and 45. So we can go, first, to the
 20 specific agricultural measures that you're
 21 talking about.
 22 **But importantly, there is not just one table**
 23 **on that page 45 -- or 44 and 45; is there?**
 24 **A. That's right.**
 25 **Q.** And the first of three tables is for 2000. But

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2859

1 could you describe the other two tables, please?

2 **A. Sure. So I have three tables looking at the**

3 **fiscal costs of possible combinations of**

4 **conservation measures that would achieve. The**

5 **first table, table 4, looks at 2000. The next**

6 **table on the bottom half of the page looks at**

7 **1500 cfs, so less aggressive measures. And then**

8 **the third table on the next page looks at the**

9 **thousand cfs.**

10 **Q.** Now, these aren't the exclusive measures that

11 Georgia could apply to achieve these aims; are

12 they?

13 **A. No, definitely not. And one theme I tried to**

14 **advance through my different reports is that**

15 **Georgia has a lot of options for reducing**

16 **depletions. You know, ultimately they will have**

17 **to choose which ones make sense for them. But my**

18 **testimony is that they have a lot of options that**

19 **are practical that can achieve these reductions**

20 **in depletions.**

21 **Q.** And those other options are discussed throughout

22 your prefiled direct; is that right?

23 **A. Yes.**

24 **Q.** Okay. So let's turn to this question. Why did

25 you choose the specific options you have here on

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2860

1 table 4 on page 44 of your prefiled direct?

2 **A. What I was trying to illustrate with the way I**

3 **chose the measures is I have some that impact**

4 **urban areas and others that impact agriculture.**

5 **I have some measures that are permanent, some**

6 **that are temporary and invoked only in dry years.**

7 **And then I have some measures that through my**

8 **analysis I have come to believe are quite low**

9 **cost, and others that might be palatable for**

10 **other reasons, but might be a little more**

11 **expensive.**

12 **Q.** Well, sir, if we might, I would like to start, as

13 you suggested, with just the agricultural

14 measures. Then we'll get back to the measures

15 for municipal and industrial. But I believe the

16 first agricultural measure on your table 4 is

17 titled Eliminate Unpermitted Acreage. Do you see

18 that, sir?

19 **A. Yes, I do.**

20 **Q.** Could you describe that for us?

21 **A. Sure. Through the course of our work on this**

22 **case, in particular once we received the complete**

23 **wetted acreage database in July of this year,**

24 **what we were able to do is compare what the**

25 **wetted acreage database says is happening permit**

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2861

1 **by permit with respect to the amount of irrigated**

2 **area and compare that to the actual permit terms.**

3 **The permit for groundwater withdrawal will**

4 **specify an amount of land that can be irrigated**

5 **with each permit.**

6 **This is a very simple analysis. We have just**

7 **compared one dataset entry to another.**

8 **Q.** And what did you find?

9 **A. What we found is that there are a large number of**

10 **groundwater withdrawal permits where users are**

11 **irrigating more acres than they're allowed under**

12 **their permit conditions, up to something like**

13 **90,000 acres.**

14 **Q.** And that is principally in the Lower Flint Basin?

15 **A. Yes.**

16 **Q.** Now, the next item on there reads eliminate

17 excessive irrigation on -- of rotation crops.

18 What rotation crops does that relate to?

19 **A. So my analysis concerns cotton, soybeans, and**

20 **corn. Those are the three that I looked at for**

21 **this excessive irrigation analysis.**

22 **Q.** Okay. Throughout this case so far we have heard

23 a phrase that --

24 **A. Sorry. Did I say soybeans?**

25 **Q.** You did.

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2862

1 **A. I meant peanuts. Sorry.**

2 **Q.** So, sir, I'm sorry for interrupting you.

3 Throughout this case we heard this phrase

4 from Georgia's counsel, and I think it said

5 something like wipe out half of Georgia

6 agriculture.

7 **A. Yes.**

8 **Q.** Is that what you're doing here on this table?

9 **A. Absolutely not.**

10 **Q.** Can you explain why not?

11 **A. Sure. This is why we went to all the time and**

12 **trouble to do such a careful analysis of matching**

13 **up what farmers were growing with what soil type**

14 **they're operating on and how much water they're**

15 **using. So, again, we're doing this analysis**

16 **pivot by pivot.**

17 **Q.** I'm sorry. Can you describe what a center-pivot

18 is.

19 **A. Sure. A center-pivot system, you know, is the**

20 **circular area that's irrigated with a**

21 **center-pivot.**

22 **In designing any conservation program,**

23 **whether it's for residential electricity or**

24 **agricultural water, the first place you look is**

25 **to users who are wasting the resource, who are**

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2863

1 **using way more than some norm. And so by doing**
 2 **such a disaggregated pivot-by-pivot analysis of**
 3 **water use, we were able to identify the fraction**
 4 **of growers who are using more than they would**
 5 **need possibly to grow their crop.**
 6 **Q.** Now, when you say more than they would need, how
 7 is that generally measured?
 8 Is it inches, or how does one do that?
 9 **A. Yes. It's measured in terms of inches per acre**
 10 **over the course of a growing season.**
 11 **Q.** And do you know if Florida in its part of the ACF
 12 Basin has an absolute limitation on the number of
 13 inches that can be applied per acre?
 14 **A. It does.**
 15 **Q.** But Georgia does not?
 16 **A. That's my understanding.**
 17 **Q.** Okay. Pardon me, sir. And in drought years is
 18 it your observation that more or fewer inches per
 19 acre are applied?
 20 **A. Oh, a lot more. Water -- water demand goes up in**
 21 **a very dry year to replace the precipitation that**
 22 **is not coming.**
 23 **Q.** So why would a farmer apply too many inches per
 24 acre?
 25 **A. You know, in my original report I have this under**

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2864

1 **a section on management decisions or farmer**
 2 **behavior.**
 3 **Why do people leave the light on when they**
 4 **walk out of the room? Why do they leave the**
 5 **faucet on when they're brushing their teeth?**
 6 **This is not an uncommon finding when it comes**
 7 **to utilities and consumer behavior.**
 8 **Remember, the water that farmers are using,**
 9 **the groundwater that they're using, is very, very**
 10 **inexpensive. They pay nothing for it beyond the**
 11 **energy cost of lifting it out of the ground. So**
 12 **they're just paying, you know, a few dollars per**
 13 **acre. And given that, they don't have much**
 14 **incentive to be careful.**
 15 **Q.** Some are; isn't that right?
 16 **A. Some are. You know, people are not robots. Some**
 17 **people are careful. Some people are less**
 18 **careful.**
 19 **And what we're identifying in this**
 20 **conservation measure is some fraction of**
 21 **people -- it's not a majority; but it's some**
 22 **fraction who are not as careful as they should**
 23 **be.**
 24 **Q.** Now, from your work on agriculture and other
 25 contexts, you know that there are ways to save

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2865

1 water that farmers employ when they're adequately
 2 motivated to do that. Isn't that right?
 3 **A. Yes. I see it in my work all the time.**
 4 **Economics is fundamentally about incentives,**
 5 **so this is a question I have studied in the area**
 6 **of agricultural water use.**
 7 MR. PERRY: Your Honor, may I approach
 8 to hand an exhibit to the witness?
 9 SPECIAL MASTER LANCASTER: Certainly.
 10 **A. Thank you.**
 11 **Q.** Now, sir, I have handed you Joint Exhibit 154,
 12 which we have discussed at some length in this
 13 proceeding already. But what I would really like
 14 to do is ask you just to focus on the second page
 15 as we discuss page 44 of your report. And in
 16 particular, the bullet points that are preceded
 17 by the sentence, EPD's initial analysis has
 18 suggested several options for further evaluation.
 19 Do you see that, sir?
 20 **A. Yes.**
 21 **Q.** Now, I want you to keep that in mind while we
 22 talk about what's on your table 4 on page 44.
 23 Okay?
 24 **A. Sure.**
 25 **Q.** So the next item on table 4 is -- on your table 4

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2866

1 on page 44 of your prefiled direct is irrigation
 2 permit buy-back. Do you see that?
 3 **A. Yes.**
 4 **Q.** Now, if you look at JX-154, which I have -- and
 5 then you look across to see where it says
 6 temporary removal of land from irrigation, do you
 7 see that?
 8 **A. I do.**
 9 **Q.** All right. Now, temporary and permanent removal
 10 are both possible in concept. Right?
 11 **A. Absolutely.**
 12 **Q.** And do you see one bullet up on JX-154 where it
 13 says acquiring easements for permanent removal of
 14 irrigation?
 15 **A. I do.**
 16 **Q.** Is that the same concept that you're evaluating
 17 in table 4 just under the subheading Additional
 18 Agricultural Measures?
 19 **A. Yes. Easements are a very common mechanism in my**
 20 **experience for achieving reductions in**
 21 **irrigation.**
 22 **Remember that what I'm talking about, either**
 23 **a permanent or a temporary buy-back of irrigation**
 24 **rights, that doesn't foreclose the possibility of**
 25 **farming. It's not like these acres shut down.**

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2867

1 **They just convert from one type of agriculture;**
 2 **namely, irrigated agriculture, to dry-land or**
 3 **rain-fed agriculture. And so the way one could**
 4 **do that is by acquiring an easement or a**
 5 **restriction on the land that would prevent**
 6 **farmers from irrigating in exchange for some**
 7 **payment of money.**
 8 **Q.** Are you aware of any federal programs that either
 9 temporarily or permanently pay farmers not to
 10 irrigate?
 11 **A. Absolutely.**
 12 **Q.** Can you describe those, please.
 13 **A. Sure. Well, the -- again, back to the Klamath**
 14 **Basin. That was a good example of a successful**
 15 **auction program where the farmers were paid to**
 16 **reduce their irrigation or curtail irrigation on**
 17 **certain acres in exchange for a money payment.**
 18 **Q.** And any other federal programs you can think of
 19 that put aside acreage for conservation and the
 20 like?
 21 **A. Of course. At a larger scale, the federal**
 22 **Conservation Reserve Program, which works through**
 23 **a market mechanism, that results in the**
 24 **retirement of millions of acres across the**
 25 **country every year. And other programs that are**

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2868

1 **similar would include EQIP and the Wetlands**
 2 **Reserve Program. So this is in my experience a**
 3 **very common type of a public policy.**
 4 **Q.** Now, the next item on your chart -- and I don't
 5 want to ask you to spend too much time on this;
 6 but it reads deficit irrigation. Do you see
 7 that?
 8 **A. I'm sorry. Where are we?**
 9 **Q.** I am back in your prefiled direct.
 10 **A. All right.**
 11 **Q.** That's why I was trying to refer you to your
 12 chart.
 13 But it says deficit irrigation. It's just
 14 under the irrigation buy-back on page 24 of your
 15 table 4. Are you with me?
 16 **A. Yes.**
 17 **Q.** Very quickly, could you describe how that differs
 18 from eliminating excessive irrigation?
 19 **A. Sure. Eliminating excessive irrigation would**
 20 **prohibit farmers from irrigating above a**
 21 **biological maximum. The deficit irrigation is**
 22 **about reducing water application below the**
 23 **biological maximum. So what happens is farmers**
 24 **might apply a little bit less water and get a**
 25 **little bit less yield; but they're still applying**

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2869

1 **some irrigation water.**
 2 **Q.** And then next you have got farm ponds. Do you
 3 see that, sir?
 4 **A. Yes.**
 5 **Q.** Describe what that means.
 6 **A. Farmers have farm ponds, small impoundments that**
 7 **they use for a number of purposes. The ones I'm**
 8 **looking at here are related to production of the**
 9 **rotation crops primarily.**
 10 **Q.** And so a restriction to reduce evaporation would
 11 have some effect?
 12 **A. Yes.**
 13 **Q.** And that -- is it your view that that would save
 14 water and thus reduce depletions in the river?
 15 **A. Yes, certainly. Farm ponds evaporate in the hot**
 16 **summer sun, and water is lost to the system --**
 17 **large amounts of water.**
 18 **Q.** Now, lastly, you have got switch high-value crops
 19 to deeper aquifers. And I would ask you, while
 20 keeping that in mind, to look at the exhibit I
 21 gave you, JX-154.
 22 **A. Yes.**
 23 **Q.** And do you see where in this, the same group of
 24 bullets, it says transferring water users to
 25 deeper aquifers?

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2870

1 **A. I do, yes.**
 2 **Q.** And it's got surface water in Floridan Aquifer
 3 users?
 4 **A. Yes. This is what -- what was discussed at this**
 5 **meeting was the concept of transferring surface**
 6 **water users and then users on the Floridan**
 7 **Aquifer down to deeper aquifers below the**
 8 **Floridan.**
 9 **Q.** And when you say this meeting, you're referring
 10 to JX-154, which is titled Georgia Environmental
 11 Protection Division Stakeholder Meeting Summary.
 12 Right?
 13 **A. Yes. JX-154.**
 14 **Q.** Okay. Now, can you -- and, I'm sorry, back to
 15 your prefiled direct again, page 44, switch
 16 higher -- switch high-value crops to deeper
 17 aquifers. Just very briefly can you describe
 18 what that means.
 19 **A. Sure. What I'm envisioning here in this measure**
 20 **is switching a fraction of farmers that are**
 21 **producing high-value crops like pecans or farmers**
 22 **who run greenhouses or grow turf grass, switching**
 23 **75 percent of them -- so not all, but 75 percent**
 24 **from surface water sources in the Floridan down**
 25 **to deeper aquifers.**

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2871

1 **So it's the very same measure that was shown**
 2 **in JX-154.**
 3 **Q.** Now, sir, I would like to move up to the top part
 4 of the chart. And here, we'll be talking about
 5 municipal and industrial use, including but not
 6 limited to metro Atlanta.
 7 So you have got municipal leak abatement as
 8 your first item there. Just a very short
 9 description of what that is and why it's
 10 important, please.
 11 **A. Sure. The term municipal leaks, I think -- I'm**
 12 **using it the same way Georgia's experts are using**
 13 **it -- this is water that leaks out of the**
 14 **distribution system in urban areas. So between**
 15 **the water treatment plant and the meter on the**
 16 **customer's home or business water leaks out of**
 17 **breaks in the pipe and gaps and whatnot. And**
 18 **that water is lost to the system.**
 19 **Q.** Okay. The next one is the lawn watering or
 20 municipal outdoor use, and it is reduced by 50
 21 percent. Do you see that?
 22 **A. Yes.**
 23 **Q.** Before -- before I ask you about that, I would
 24 like to come back to a couple questions that
 25 Mr. Primis asked you about some of your columns
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2872

1 here on your chart. So the very last column,
 2 the farthest to the right reads Incremental
 3 financial -- or fiscal cost, pardon me. What
 4 does that mean?
 5 **A. Well, we'll break it down adjective by adjective.**
 6 **Incremental refers to costs that would be related**
 7 **to any Order that the Court might issue here. So**
 8 **what I'm trying to reflect there is that Atlanta**
 9 **and other cities in the ACF Basin have already**
 10 **undertaken leak abatement programs. And what I'm**
 11 **considering is programs beyond what they're**
 12 **already doing.**
 13 **Q.** All right. And Mr. Primis also asked you to
 14 compare this one of three charts on pages 44 and
 15 45 with some charts that were in your original
 16 report, right, where it said 1,000 cfs. Is that
 17 right?
 18 **A. Yes.**
 19 **Q.** How does this concept of incremental financial
 20 cost compare or differ from what you did in your
 21 initial 1,000 cfs chart that Mr. Primis was
 22 focused on?
 23 **A. Sure. The main difference is an issue that**
 24 **Mr. Primis and I talked about just a little bit.**
 25 **There is a distinction between fiscal cost, you**
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2873

1 **know, what's the actual dollar outlay that's**
 2 **required to achieve conservation savings, and**
 3 **welfare losses that might result from consumer**
 4 **impacts, aesthetics, quality of life. Those are**
 5 **not measures where dollars change hands, but they**
 6 **are impacts that economists consider routinely.**
 7 **Q.** And you did consider and evaluate that here in
 8 this report. Right?
 9 **A. I mentioned those numbers here in the report as**
 10 **in my first report.**
 11 **Q.** Now --
 12 **A. The welfare loss numbers.**
 13 **Q.** Right. Right. Specifically on municipal outdoor
 14 use, which I called lawn watering a bit ago, when
 15 you say welfare costs, you evaluated that in part
 16 by determining whether, through a survey,
 17 residents of metro areas in Georgia would
 18 undertake additional costs for lawn watering if
 19 it meant a particular outcome in terms of water
 20 flow. Do I have that right?
 21 **A. Yes. That -- I did a couple of things. I did**
 22 **the survey that you were mentioning and engaged**
 23 **whether or not urban residents of Georgia were**
 24 **willing to undertake conservation measures to**
 25 **benefit the Florida environment. But I also**
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2874

1 **looked at what urban consumers are actually**
 2 **paying for water. I mean, they're buying water**
 3 **from their local utility to water their lawns and**
 4 **shrubs and wash their cars, use for other**
 5 **purposes. And so I used that information on the**
 6 **actual transactions that are occurring to figure**
 7 **out what's the loss from preventing those**
 8 **transactions from occurring, from imposing an**
 9 **outdoor watering ban.**
 10 **Q.** Now, just pausing a minute to talk about your
 11 first expert report just for another minute.
 12 When you put examples in that report for a
 13 thousand cfs, was that part of a series of data
 14 points that you made available to the State of
 15 Georgia on how each of these measures worked?
 16 **A. Absolutely. I turned over all my models for both**
 17 **urban and agricultural conservation costs. And I**
 18 **thought I made plain from the beginning that**
 19 **these models can be used to measure a whole range**
 20 **of outcomes. In the reports, each one I'm**
 21 **examining just particular combinations or points**
 22 **on a curve; but the underlying point is that my**
 23 **models evaluate a range of outcomes. And Georgia**
 24 **has had all that for some time.**
 25 **Q.** So when Mr. Primis infers from his comparison of
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2875

1 your charts that your number or your methodology
 2 has somehow dramatically changed, is that fair?
 3 **A. No.**
 4 MR. PERRY: Now, your Honor, it's just
 5 about 2:30, which is our typical time for a
 6 break.
 7 SPECIAL MASTER LANCASTER: It's fine by me.
 8 MR. PERRY: Okay. We'll have a short
 9 break.
 10 (Time Noted: 2:30 p.m.)
 11 (Recess Called)
 12 (Time Noted: 2:40 p.m.)
 13 SPECIAL MASTER LANCASTER: Ready?
 14 MR. PERRY: Thank you, your Honor.
 15 BY MR. PERRY:
 16 **Q.** Dr. Sunding, do all farmers in Georgia irrigate?
 17 **A. No, sir. No. Certainly not.**
 18 **Q.** About what percentage do?
 19 **A. Well --**
 20 SPECIAL MASTER LANCASTER: Mr. Perry, do
 21 you want to just raise that microphone a
 22 little.
 23 Thank you.
 24 MR. PERRY: Is that better?
 25 SPECIAL MASTER LANCASTER: Much.

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2876

1 **A. Do you want to ask the question again?**
 2 **Q.** I will. What percentage of Georgia farmers in
 3 the Flint and Chattahoochee Basin irrigate?
 4 **A. It's about half.**
 5 **Q.** And have you looked to see the number of farmers
 6 with small farms or large farms that irrigate?
 7 **A. I have. The agricultural census that the USDA**
 8 **performs every five years has statistics on the**
 9 **fraction of farmers that irrigate over different**
 10 **size categories.**
 11 **Q.** All right. And do larger farms tend to irrigate
 12 more or irrigate less, or is there any
 13 statistically significant difference?
 14 **A. There -- larger farms, you know, over several**
 15 **hundreds or several thousand acres, tend to**
 16 **irrigate somewhat more; and some smaller farms**
 17 **tend to irrigate more. So there is somewhat of a**
 18 **pattern in the data. But there are farmers**
 19 **across every size category, significant numbers,**
 20 **that chose not to irrigate in the ACF Basin.**
 21 **Q.** Why would it be economic not to irrigate?
 22 **A. Well, to -- to understand -- you know, we have**
 23 **heard a lot in the questions from Mr. Primis**
 24 **about the benefits of irrigation. There are**
 25 **costs of irrigation as well. And when farmers**

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2877

1 **make a decision about whether or not to irrigate,**
 2 **they're making an economic choice. To irrigate,**
 3 **farmers have to, in the first instance, purchase**
 4 **equipment, very expensive equipment like a**
 5 **center-pivot system, to apply irrigation water.**
 6 **So there's a cost -- an upfront capital cost of**
 7 **irrigating that farmers would have to compare to**
 8 **the benefits of irrigating.**
 9 **Another category of cost is the cost of the**
 10 **water, lifting it up out of the ground, if**
 11 **farmers are irrigating with groundwater.**
 12 **Q.** Would that be a pump?
 13 **A. A pump, exactly. So they have to pay an energy**
 14 **cost, and the cost of the well and the pump to**
 15 **get that out of the ground.**
 16 **Q.** Now, you mentioned, when Mr. Primis was up here,
 17 crop insurance. Is that -- is the premium for
 18 crop insurance federally subsidized?
 19 **A. It is. Crop insurance is not what we call**
 20 **actuarial fair, meaning that the payouts don't**
 21 **have an expected value equal to the premiums.**
 22 **Q.** Do farmers have the option to insure against some
 23 loss in yields and perhaps a loss of a crop in an
 24 extreme circumstance through crop insurance?
 25 **A. They do. There are federal programs that insure**

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2878

1 **against crop loss, including drought loss.**
 2 **Q.** And including yield and not to the entire crop?
 3 **A. Yes.**
 4 **Q.** So, sir, I would like to focus back now where we
 5 were before the break. That's on page 44 of your
 6 prefiled direct, table 4. And now, I would like
 7 to ask you to do something a little different.
 8 I understand you have some markers up there,
 9 and I can see the tablet. I want to make sure
 10 the Court can see the tablet.
 11 But if you don't mind, sir, I would like to
 12 have you rise and identify graphically what your
 13 2,000 cfs actually means. And we can do it item
 14 by item on your chart; but if you could draw that
 15 out, I would appreciate it.
 16 **A. All right.**
 17 SPECIAL MASTER LANCASTER: Doctor,
 18 please keep your voice up.
 19 THE WITNESS: I will.
 20 SPECIAL MASTER LANCASTER: Thank you.
 21 THE WITNESS: I'm used to teaching, so I
 22 can talk loud.
 23 Can I move this a little bit --
 24 MR. PERRY: With the Court's permission.
 25 THE WITNESS: -- so you can see it?

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2879

2881

1 **A. Is that all right?**
 2 **Q.** It's fine with me.
 3 MR. PERRY: I want to make sure that the
 4 Court --
 5 MR. PRIMIS: Do you have a marker?
 6 THE WITNESS: I do.
 7 Can you see what I'm --
 8 MR. PRIMIS: I'll make it over there if
 9 I need to.
 10 THE WITNESS: Okay. Sure.
 11 BY MR. PERRY:
 12 **Q.** Please proceed, sir.
 13 **A. All right. So what Mr. Perry asked me to**
 14 **illustrate was how do these conservation measures**
 15 **add up to a 2,000 cfs reduction in depletions.**
 16 **And so I will draw it like this.**
 17 **So on this axis, what I would like to show is**
 18 **months of the year. So we'll do this over a**
 19 **calendar year and start in -- start in January.**
 20 **And then we go through June and then on to**
 21 **December. So this is, you know, as we go**
 22 **throughout the calendar year.**
 23 **And then what I would like to show on this**
 24 **axis is a reduction in consumptive use that**
 25 **results from implementing different measures.**
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1 **irrigation, the outdoor water use, is higher in**
 2 **the summertime, so higher in, like, the June-July**
 3 **time frame.**
 4 **So if you stopped water use, the reduction in**
 5 **depletions you would get would look something**
 6 **like that (witness drawing).**
 7 **Q.** And, again, that's a municipal type of measure.
 8 Right?
 9 **A. Yes.**
 10 **So then let's move to the agricultural side**
 11 **and measures that reduce agricultural**
 12 **consumption, permanent or temporary buy-back,**
 13 **measures like deficit irrigation.**
 14 **Crop water use also peaks out in the**
 15 **summertime. And so what that would look like is**
 16 **something like this (witness drawing).**
 17 **And I drew it a little bit larger because**
 18 **there's more agricultural water use than urban.**
 19 **So when I talk about a measure that improves**
 20 **streamflows by 2,000 cfs, I'm evaluating that at**
 21 **the peak month, which is June.**
 22 **Q.** Now, why would there be more use in June than,
 23 say, January?
 24 **A. Because both -- what has a temporal pattern is**
 25 **the outdoor water use and then the crop**
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2880

2882

1 **Okay. So just to get oriented what I'm**
 2 **showing here, so with a measure like leak**
 3 **abatement, which is one of the measures I'm**
 4 **talking about --**
 5 **Q.** Is that a municipal measure, leak abatement?
 6 **A. It is. This is fixing the leaky pipes in the**
 7 **distribution system.**
 8 **The leaks in the pipes happen as a result of**
 9 **pressurization. The water in the urban system is**
 10 **under pressure to move it around. And so the**
 11 **leaks happen all-year-round because the system is**
 12 **under pressure all-year-round. So a program of**
 13 **leak abatement would result in a reduction in**
 14 **consumption that was about the same from one**
 15 **month to another, again, because the water is**
 16 **under pressure.**
 17 **So this would be, say, leak abatement. So**
 18 **I'll just call that leaks.**
 19 **And then a second measure would be reducing**
 20 **urban outdoor use, say, through an outdoor**
 21 **watering ban, like what Atlanta put in place in**
 22 **2008.**
 23 **So if that were to happen, there's not much**
 24 **irrigation in January. Nobody waters their lawn**
 25 **in January, at least they shouldn't be. But that**
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1 **irrigation because crops grow in the summertime,**
 2 **and they need more water. The plants use more**
 3 **water in the summer.**
 4 **Q.** Now, one related question, if I might, sir. Does
 5 this differ from year to year how your curves
 6 look?
 7 **A. Yes.**
 8 **Q.** And why is that?
 9 **A. Well, what would happen, say, if we looked at a**
 10 **year that was drier than the one I'm drawing up**
 11 **here, in a drier year, absent any kind of policy,**
 12 **both residential consumers and farmers have**
 13 **higher demand for water. So these curves would**
 14 **be higher.**
 15 **Q.** Could you help us by totaling out and showing
 16 graphically what the combination of those
 17 measures would be?
 18 **A. Sure. So what I would do is add these up month**
 19 **by month. So I'm going to add them up this way,**
 20 **you know, vertically. And what I would get would**
 21 **be something that would look like that. So this**
 22 **would be the total.**
 23 **Q.** And can you identify, just keeping in mind your
 24 chart that says 2,000 cfs -- it's table -- I
 25 should say your table, it's table 4, where that
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2883

1 2,000 cfs would fall.

2 **A. It's right there. I'm labeling that as**

3 **agricultural and outdoor water use.**

4 **Q.** Okay. I'm sorry. What I was trying to ask was

5 could you put a point on that drawing that shows

6 where 2,000 cfs would be.

7 **A. Sure. The sum total of the reduction in**

8 **consumption from these three measures in this**

9 **example has a peak value of 2,000.**

10 **So when I talk about 2,000 in those tables**

11 **that Mr. Perry is showing up there, this is what**

12 **I mean. So 2,000 reduction in peak usage. But**

13 **there are also reductions that happen in other**

14 **times of the year.**

15 **Q.** Now, we haven't talked about net basin exports;

16 but you could easily -- we didn't put it on the

17 chart yet, but you could easily factor that in,

18 too. Right?

19 **A. Yes. Sure. That would be another line like this**

20 **red one down here.**

21 **Q.** Okay, sir. Now, in various places in your

22 prefiled direct testimony you talk about peak

23 use. Is 2,000 the peak use there?

24 **A. Well, 2,000 is the peak reduction. The actual**

25 **usage could be much higher than that.**

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2884

1 **Q.** That's a fair point. And you have used the term

2 depletions; you defined it for me before. Is

3 that 2,000 a depletions number?

4 **A. Yes.**

5 **Q.** And that means that that much river water

6 wouldn't be used and, therefore, you would have

7 that much more?

8 **A. That's correct.**

9 **Q.** Okay. Now, I would like to focus just for a

10 moment on how this type of cap on depletions or

11 consumption might be administered.

12 **A. Can I sit?**

13 **Q.** Sure. Sit back down.

14 MR. PERRY: And if I could approach, your

15 Honor, I would like to hand out --

16 SPECIAL MASTER LANCASTER: Please.

17 BY MR. PERRY:

18 **Q.** Now, sir, what I have just handed you is our

19 effort to capture your beautiful drawing on an

20 exhibit. And it's Florida Exhibit 895.

21 But what I would like to talk about now,

22 given your experience with all the other

23 agricultural reduction measures you have talked

24 about in other places, how this type of depletion

25 or consumption cap could actually be managed. So

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2885

1 could you give us your thoughts on that, please.

2 **A. Sure. Like I illustrate in these tables, I think**

3 **a way that Georgia could -- could implement a**

4 **consumption cap, again, Georgia has already**

5 **considered itself as we have been through a few**

6 **minutes ago in the last document you showed me.**

7 **What I have in mind here is a combination of**

8 **permanent easements, permanent buy-backs,**

9 **additional buy-backs of irrigation rights that**

10 **could be put in place in dry conditions, and then**

11 **limitations on amounts of water that farmers**

12 **could use beyond that, if they chose, you know,**

13 **not to take the buy-out and go ahead and continue**

14 **irrigating.**

15 **Q.** So --

16 **A. So what -- you know, what I have in mind there**

17 **would be to implement the deficit irrigation**

18 **scheme. What Georgia could do is what the states**

19 **do all over the country and tell farmers, well,**

20 **look, you can't use 20 inches or 30 inches or 14**

21 **inches in this year given drought conditions.**

22 **You only have 8 inches or 6 inches. Now, you use**

23 **that the way you want, but you only have this**

24 **much water per acre. And it's less than what**

25 **you're used to and less than what you need to**

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2886

1 **grow at the biological maximum.**

2 **Q.** So, sir, let me ask my question just a bit

3 differently than that, if I might. You talked

4 about Newlands and Klamath and Imperial Valley

5 and Republican River; and I would like to get a

6 picture, given all of your experience, as to how

7 an independent administrator of a depletion or a

8 consumption cap might actually, as a practical

9 and verifiable manner, go out and ensure that

10 Georgia, using whatever measures they chose,

11 including among your options, actually complies.

12 So could you help us work through that issue?

13 **A. Sure. The big issue there, I think I would see**

14 **immediately, is how do you know that whatever**

15 **measures you put in place on the ground are, in**

16 **fact, reducing consumption by the amount that the**

17 **Court requires. So there is an element of**

18 **verification, and that involves a suite of**

19 **measures that in my experience are pretty**

20 **commonly done. You would want to look at how**

21 **much water farmers are actually using, so back to**

22 **the metering issue. You would want to be**

23 **monitoring that. You would want to take a look**

24 **at what is happening with respect to -- you know,**

25 **look around the landscape and see what areas are**

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2887

1 **being irrigated and which ones are not. But then**
 2 **beyond that, I would go and look at or I would**
 3 **think that the State would want to go and look at**
 4 **stream gages and actually check and see what's**
 5 **happening in the river and are you getting the**
 6 **responses that you think you should get that --**
 7 **given whatever consumption cap is in place that**
 8 **year.**

9 **So the combination of looking at what farmers**
 10 **and urban users are actually doing and then does**
 11 **that translate into environmental changes in the**
 12 **way that one would think.**

13 **Q.** Okay. Sir, there's a concept that hasn't come up
 14 much yet in this trial; but I would like your
 15 help with it, adaptive management. What do those
 16 two words mean?

17 **A. Sure. So adaptive management is a very common**
 18 **concept in environmental management situations.**
 19 **And what it involves is setting some goals, some**
 20 **environmental performance goals, and enacting**
 21 **measures to achieve those goals. And then you**
 22 **check and see, did things perform the way you**
 23 **thought? If not, then maybe we need some course**
 24 **corrections. Maybe we need other measures,**
 25 **tougher, looser, whatever. But it's adaptive.**

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2888

1 **You don't just set a set of policies in place**
 2 **for all time and never revisit them. It's**
 3 **adaptive. You check and see how the environment**
 4 **is responding and go back and adapt as needed.**

5 **Q.** So you mentioned in particular earlier Imperial
 6 Valley where farmers could move their water
 7 around. And there was a -- I think you said a
 8 water district. Thinking about your concept of
 9 adaptive management, in that context or other
 10 context, what does that actually mean in terms of
 11 verifying that the results are being achieved?

12 **A. Right. So in -- in that case, they actually have**
 13 **an extensive verification program where they will**
 14 **look at satellite imagery. They look at water**
 15 **metering in the way I was discussing to make sure**
 16 **that compliance is being achieved.**

17 **Q.** Now, sir, I would like to come back to some of the
 18 charts that Mr. Primis examined with you. And
 19 the first of those is under a tab in the binder
 20 he handed out called Sunding Demonstratives.
 21 It's titled Sunding M & I Remedy Versus Total
 22 M & I Consumption. Can you try to find that and
 23 let me know when you have.

24 **A. I have quite a pile built up over here.**
 25 **It must be in the back.**

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2889

1 **All right. Yes, I have it.**

2 **Q.** Now, when Mr. Primis was asking you about this, I
 3 think he referred to Dr. Flewelling a few times
 4 and Dr. Hornberger, too. But I think you wanted
 5 to explain in a little more depth when you were
 6 testifying about this what your response was to
 7 Mr. Primis's questions. So I would like to
 8 invite that explanation, if I might.

9 **A. Sure. Well, the implication of Mr. Primis's**
 10 **question is that I'm asking for more reduction in**
 11 **consumption than is actually taking place, at**
 12 **least in most years. And I don't think that's**
 13 **accurate.**

14 **Q.** Now, this chart doesn't include all of the
 15 relevant consumptive use; does it?

16 **A. No, it doesn't. This chart doesn't include, for**
 17 **example, urban systems that are serviced by**
 18 **groundwater sources. This is only surface water.**
 19 **And groundwater is about 15 percent of the total**
 20 **water supply in this area.**

21 **Q.** So in a hot and dry summer, what percent of urban
 22 consumption would be outdoor water use?

23 **A. It's -- you know, it varies by sector. I would**
 24 **say multi-family residential will have a smaller**
 25 **outdoor percentage than businesses or single-family**

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2890

1 **residences. But it's in the neighborhood of 20**
 2 **percent in this part of the country.**

3 **Q.** Okay. Now, if you could turn with me, please, to
 4 the tab that's called -- that's marked -- that's
 5 labeled Florida Complaint.

6 **A. All right.**

7 **Q.** And there I would like you to turn with me in
 8 this tab to page 21, which was also a focus of
 9 some of Mr. Primis's questions.

10 **A. Page 21?**

11 **Q.** Yes, please, sir.

12 **A. All right.**

13 **Q.** Now, sir, I believe Mr. Primis was referring
 14 to what's labeled Prayer For Relief there.
 15 And there's an indication there of a date,
 16 January 3, 1992. Was 1992 a very wet year;
 17 do you know?

18 **A. I don't believe so, but I don't know.**

19 **Q.** And -- it wasn't a drought year though; was it?

20 **A. No.**

21 **Q.** All right. Now, in a nondrought year you're
 22 going to see substantially less consumption of
 23 water than in a severe drought year. Right?

24 MR. PRIMIS: Objection, your Honor.
 25 Leading.

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2891

1 BY MR. PERRY:
 2 **Q.** What, if any, difference in the amount of water
 3 would you expect between a severe drought year
 4 and a nondrought year?
 5 **A.** **Well, as we discussed and what I believe is shown**
 6 **on the figure that we were just looking at, the**
 7 **amount of consumptive water use can vary**
 8 **considerably between average, wet, and dry years**
 9 **because the outdoor water use changes quite a bit**
 10 **between those scenarios.**
 11 **Q.** So let me focus just a minute on agriculture
 12 again. And when we're thinking about the amount
 13 of water used on a field, not just the acreage,
 14 it's the amount of water applied; is that fair?
 15 **A.** **That's right. Agricultural water demand is the**
 16 **product of the number of acres irrigated times**
 17 **the amount of water that's applied per acre.**
 18 **Q.** Could you explain what you would expect in terms
 19 of the amount of water applied per acre in a
 20 drought year as opposed to a normal or a wet
 21 year?
 22 **A.** **Sure. I actually have dry figures on this**
 23 **through my analysis. And this is what Georgia**
 24 **farmers are actually applying in different types**
 25 **of water years.**

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2892

1 **If you look at my direct testimony on page --**
 2 **on page 15, for example, if you look at table 1,**
 3 **I have derived figures here for average**
 4 **irrigation depths for different crops grown in**
 5 **the ACF Basin. And I have compared them between**
 6 **average or nondrought years and drought years.**
 7 **Q.** So let me just invite your attention to the
 8 totals at the bottom for average irrigation depth
 9 in a nondrought year. Do you see that?
 10 **A.** **Yes.**
 11 **Q.** And could you compare that for us with the
 12 average for a drought year.
 13 **A.** **Sure. The average depth across the range of**
 14 **crops grown in the basin in a drought year is 15**
 15 **inches per acre. So, you know, 1-foot-3-inches**
 16 **per acre. And in a nondrought year, the average**
 17 **water use is only 9.1 inches per acre.**
 18 **Q.** Okay. Would you regard that as a significant
 19 difference?
 20 **A.** **Oh, yes.**
 21 **Q.** Now, Mr. Primis also mentioned Dr. Phaneuf. You
 22 know Dr. Phaneuf; don't you?
 23 **A.** **I do.**
 24 **Q.** And I believe he was attempting to discuss the
 25 way that either you or Dr. Phaneuf had referred

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2893

1 to or valued the basin in Florida -- part of the
 2 ACF Basin in Florida. Do you remember those
 3 questions?
 4 **A.** **I do.**
 5 **Q.** All right. Could you focus with me for a moment
 6 on how an economist would look at a pristine
 7 natural area like the ACF -- or like Florida's
 8 part of the ACF Basin?
 9 **A.** **Sure. What we normally do to come up with an**
 10 **economic value for a natural area is to consider**
 11 **what we call ecosystem services, so a range of**
 12 **benefits to human beings that flow from those**
 13 **environmental resources.**
 14 **For example, a forest could be used for**
 15 **cutting timber; that would be a commercial use.**
 16 **It could be used for hiking or bird-watching;**
 17 **that would be a recreational use. And it might**
 18 **also have some value as habitat for endangered**
 19 **species or, you know, other types of amenities.**
 20 **Q.** And you teach at California, Berkeley. Right?
 21 **A.** **I do.**
 22 **Q.** Now, has there been a change in the way that the
 23 faculty there in your department instruct
 24 students as to how to look at ecosystem services
 25 over the years?

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2894

1 **A.** **There has been. I'm the chair of the Department**
 2 **of Agricultural and Resource Economics at**
 3 **Berkeley. We are, I don't mind saying, by any**
 4 **measure the No. 1 department in the field in the**
 5 **world. We produce more graduates who go on to**
 6 **distinguished academic careers in environmental**
 7 **and resource economics than any other program.**
 8 **Our faculty got together a few years ago and**
 9 **decided that we had enough misgivings about the**
 10 **valuation of what are sometimes called nonuse**
 11 **values -- so these values other than things like**
 12 **recreation and commercial activities -- that we**
 13 **were actually not going to include that in the**
 14 **graduate curriculum anymore. So we do not teach**
 15 **that because we don't think it's reliable enough,**
 16 **and there is not enough scientific consensus that**
 17 **those methods are worthwhile.**
 18 **Q.** But that doesn't mean, sir, that economists don't
 19 understand the value of a pristine natural area?
 20 **A.** **No. Definitely not. There are things that we**
 21 **can look to, like I have done here. For example,**
 22 **conservation investments that are made by a state**
 23 **or by nonprofit groups here like the Nature**
 24 **Conservancy or Trust for Public Land as being an**
 25 **indicator of value.**

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2895

2897

1 Q. And you weren't here when Secretary Steverson was
2 presented and Georgia decided not to cross him,
3 but are you aware of all of the investments that
4 the State of Florida has made to preserve the
5 pristine nature of the river and bay?

6 A. Yes. I think I even included some of those
7 statistics in my direct testimony. I think the
8 number is something like almost half a billion
9 dollars.

10 MR. PERRY: Your Honor, may I approach
11 to hand out one more item?

12 SPECIAL MASTER LANCASTER: Certainly.
13 BY MR. PERRY:

14 Q. And, sir, what I believe I have handed you is a
15 page from Mr. Primis's opening statement. And
16 part of the text on that page is gray. It -- the
17 question posed is apart from the survey, and then
18 it begins in black text. Could you tell us what
19 the survey is there and why graying out that text
20 struck you as inappropriate?

21 A. Sure. Graying out that text changes the meaning
22 of the question.

23 I conducted actually an extensive amount of
24 work to understand attitudes in Florida and
25 Georgia and Alabama toward the environmental

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1 Q. Now, I would like to invite your attention, if I
2 might, to page 24 of 34. And there -- have you
3 found that page yet, sir?

4 A. I have it, yes.

5 Q. Okay. There I asked Dr. Cowie, during the exam
6 earlier this week, about the last two sentences
7 there -- it's actually the last sentence. And in
8 particular the sentence begins with, quote, the
9 issue of what is practical will cost. Do you see
10 that, sir?

11 A. I do.

12 Q. And then it ends with at least 3.5 million for
13 each million gallons of water per day. Do you
14 see that?

15 A. I do.

16 Q. Now, your report goes through in some level of
17 detail, as we have discussed, a wide range of
18 options for Georgia; and you assigned costs to
19 them. Do any of your options approach that type
20 of cost level?

21 A. No. They're far less than 3.5 million per mgd --
22 per million gallons per day.

23 Q. All right. Thank you, sir.

24 MR. PERRY: Your Honor, just give me a
25 moment while I gather my things to sit down.

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2896

2898

1 resources in the basin. And by that I mean both
2 gauging the public's awareness of these resources
3 and then whether or not they spend time and money
4 to recreate at different sites in the basin.

5 And so, again, I think this -- this question
6 is disappointing because to me it reads other
7 than the part of your work where you attempted to
8 value the environment, did you value the
9 environment?

10 But that -- that was the point of doing the
11 survey.

12 MR. PERRY: Your Honor, I believe I have
13 one more exhibit I would like to hand up.
14 Just one.

15 BY MR. PERRY:

16 Q. Now, sir, this document is something that I'm
17 fairly -- this document was a document used with
18 Dr. Cowie just a couple days ago when she was
19 here. And have you seen it before?

20 A. I have, yes.

21 Q. Now, the first page of the document is labeled
22 UGA River Basin Science and Policy Center. Do
23 you understand UGA to be the University of
24 Georgia?

25 A. I do, yes.

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1 SPECIAL MASTER LANCASTER: Sure.
2 RE-CROSS-EXAMINATION

3 BY MR. PRIMIS:

4 Q. Hello, Dr. Sunding.

5 A. Hello.

6 Q. Mr. Perry gave you this slide from my opening.
7 Do you remember that?

8 A. I can't see the slide.

9 Q. It's the one with the picture of you.

10 A. Yes.

11 Q. And just to be clear and also to be fair, when I
12 asked you the same question today, Dr. Sunding, I
13 introduced the survey. And I said, apart from
14 the survey, have you attempted -- and then the
15 rest of the question. You recall that. Right?

16 A. I recall you spoke those words today, yes.

17 Q. And so your sworn testimony reflects this entire
18 question and the same answer. Correct?

19 A. Yes.

20 Q. Now, with regard to this survey, you did the
21 survey; and then you gave it to Dr. Phaneuf.
22 Right?

23 A. That's right, yes.

24 Q. And Dr. Phaneuf relied on it for his testimony.
25 Correct?

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2899

1 **A. Yes.**
 2 **Q.** And Dr. Phaneuf isn't coming to trial. Correct?
 3 **A. That's my understanding.**
 4 **Q.** Now, Dr. Sunding, we talked about the scenarios
 5 where you had four at a thousand back in
 6 February; and then you ended up with 2,000 in
 7 May and in your trial testimony. Do you recall
 8 that?
 9 **A. Yes. That's -- it's not quite the full picture.**
 10 **But I also had 1500 in my first report.**
 11 **Q.** Right. And I'm just trying to be efficient.
 12 I acknowledged you had 1500 in your first
 13 report when I crossed you before. Is that right?
 14 **A. Yes, you did.**
 15 **Q.** So, Dr. Sunding, when I asked you at your
 16 deposition why you went from 1,000 to 2,000 cfs,
 17 you refused to answer that question. Correct?
 18 **A. Yes. I couldn't divulge conversations with**
 19 **counsel.**
 20 **Q.** I said, why did you do it? You said, I can't
 21 answer that question without disclosing
 22 conversations with counsel; it's privileged.
 23 Correct?
 24 **A. That's right.**
 25 MR. PRIMIS: No further questions.
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2900

1 SPECIAL MASTER LANCASTER: Mr. Perry?
 2 MR. PERRY: Nothing further, your Honor.
 3 SPECIAL MASTER LANCASTER: Doctor, I
 4 don't believe you have been here when I
 5 explained I'm not trying to be rude, but I
 6 have to look into the microphone so that
 7 Claudette can take down what I'm trying to
 8 say.
 9 So --
 10 THE WITNESS: Okay.
 11 SPECIAL MASTER LANCASTER: So, first,
 12 welcome back.
 13 THE WITNESS: Thank you.
 14 SPECIAL MASTER LANCASTER: You had the
 15 privilege and the pleasure of appearing
 16 before my former partner, Bill Kayatta, who
 17 is, for his brilliance and other
 18 characteristics, now on the 1st Circuit. I'm
 19 about to prove that there is a reason that
 20 I'm not Bill Kayatta.
 21 In doing your work and making your
 22 recommendations, did you consider the
 23 possibility of disengaging the Upper and
 24 Lower Flint?
 25 THE WITNESS: Could you -- could you
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2901

1 explain what you mean by disengaging?
 2 SPECIAL MASTER LANCASTER: By that I
 3 mean cutting off the two stretches.
 4 THE WITNESS: I'm not sure that that
 5 would factor into my -- I'm trying to think
 6 how it would factor into my economic
 7 analysis. Most of the agricultural water use
 8 that I considered is in the Lower Flint.
 9 But, no, I don't think I considered that
 10 specifically, the Upper and Lower Flint.
 11 SPECIAL MASTER LANCASTER: I'm sorry.
 12 What was your answer?
 13 THE WITNESS: Oh, that most of the
 14 agricultural water use I looked at was in the
 15 lower part of the Flint River Basin. So if
 16 you meant disengaging the upper and lower
 17 parts of the Flint; or did you mean upper and
 18 lower parts of the basin -- the overall
 19 basin?
 20 SPECIAL MASTER LANCASTER: Not
 21 necessarily.
 22 You didn't consider the possibility of
 23 disengaging them in any way?
 24 THE WITNESS: Well, if -- I want to make
 25 sure I'm understanding your question. Most
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2902

1 of the urban water use occurs in the upper
 2 part of the ACF Basin. And most of the
 3 agricultural water use occurs to the south of
 4 that in the lower part of the basin. I
 5 considered measures that would reduce
 6 consumptive use in both; but I have some
 7 measures that only impact use on the Flint.
 8 So if that's what you mean by disengaging,
 9 then I did have some scenarios that were
 10 Flint only.
 11 SPECIAL MASTER LANCASTER: Are you
 12 familiar with the -- the Georgia agricultural
 13 metering program?
 14 THE WITNESS: Yes, your Honor. The
 15 metering data was the basis for my analysis
 16 of, say, the excessive irrigation and deficit
 17 irrigation.
 18 SPECIAL MASTER LANCASTER: Are you
 19 familiar with the 2006 Flint River Basin
 20 Plan?
 21 THE WITNESS: Yes, your Honor, I am.
 22 SPECIAL MASTER LANCASTER: Are you
 23 familiar with the ACF Stakeholders
 24 Sustainable Water Management Plan?
 25 THE WITNESS: I'm less familiar with
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2903

1 that, but I have seen it.

2 SPECIAL MASTER LANCASTER: And what's

3 your opinion on it?

4 THE WITNESS: My -- my read of the

5 Stakeholders Plan was that it was not

6 definitive. It had a number of ideas for

7 measuring drought, developing drought

8 indicators, potentially reducing consumptive

9 use. So it did address a range of measures;

10 but I'm not sure I have an opinion on it

11 beyond that. It did not seem like a complete

12 conservation strategy.

13 SPECIAL MASTER LANCASTER: Are you

14 familiar with the terms of the ACF -- of the

15 tri-state ACF Compact?

16 THE WITNESS: Only in a general sense.

17 SPECIAL MASTER LANCASTER: Are you

18 familiar with the Stripling Irrigation

19 Research Project?

20 THE WITNESS: Yes, your Honor, I am.

21 SPECIAL MASTER LANCASTER: Are you

22 familiar with the Flint River Partnership?

23 THE WITNESS: That, no, I'm not.

24 SPECIAL MASTER LANCASTER: Are you

25 familiar with the Flint Soil and Water

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2904

1 Conservation District?

2 THE WITNESS: Yes.

3 SPECIAL MASTER LANCASTER: And you took

4 those into consideration in making your --

5 writing your opinion and making your

6 recommendations?

7 THE WITNESS: I believe so, yes.

8 SPECIAL MASTER LANCASTER: Now, doctor,

9 you testified to a huge volume of resources

10 that are available from federal and other

11 national sources. Correct?

12 THE WITNESS: You mean money resources

13 or --

14 SPECIAL MASTER LANCASTER: I mean all

15 kinds of resources. You testified to

16 satellites and other things.

17 THE WITNESS: Oh, sure. Those are

18 programs that are undertaken by the USDA and

19 other federal agencies.

20 SPECIAL MASTER LANCASTER: And would it

21 be possible to apply those items to Florida

22 as well as to Georgia?

23 THE WITNESS: Absolutely. Those

24 satellites see everything.

25 SPECIAL MASTER LANCASTER: But you

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2905

1 weren't asked to do that?

2 THE WITNESS: No. No. The contribution

3 of the streamflow depletion resulting from

4 Florida agriculture in this part of the basin

5 is an order of magnitude less than what

6 occurs in Georgia. I think it's less than 50

7 cfs in total.

8 SPECIAL MASTER LANCASTER: Would your

9 proposed M & I remedy exceed the total M & I

10 consumption?

11 THE WITNESS: It absolutely would not.

12 In fact, the M & I measures that I proposed

13 have already been accomplished once before by

14 Atlanta when they imposed that outdoor

15 watering ban. The reduction in consumptive

16 use that actually occurred in 2008 is almost

17 exactly the number that I calculated in my

18 report.

19 SPECIAL MASTER LANCASTER: Further

20 cross?

21 MR. PRIMIS: No, your Honor.

22 SPECIAL MASTER LANCASTER: Mr. Perry?

23 MR. PERRY: No, your Honor.

24 SPECIAL MASTER LANCASTER: You're off

25 the hook.

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2906

1 THE WITNESS: Thank you.

2 SPECIAL MASTER LANCASTER: Why don't we

3 take our recess now.

4 MR. PERRY: Yes.

5 (Time Noted: 3:25 p.m.)

6 (Proceeding adjourned to Friday,

7 November 18, 2016, at 9:00 a.m.)

8 (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 10th day December, 2016.

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

My Commission Expires
June 9, 2019.

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\$	2786:13 10:26 [1] - 2744:18 10:40 [1] - 2744:20 10th [1] - 2907:11 11 [5] - 2700:20, 2731:14, 2751:9, 2837:4, 2837:10 114,000 [2] - 2838:25, 2839:24 114,550 [1] - 2838:4 11:46 [1] - 2795:9 120 [6] - 2704:2, 2704:7, 2704:8, 2788:14, 2792:3, 2792:6 123 [1] - 2835:4 126 [2] - 2770:3, 2770:6 128 [1] - 2720:15 12:46 [1] - 2795:11 13 [5] - 2677:15, 2809:24, 2832:24, 2833:4, 2833:7 130,000 [3] - 2839:21, 2840:1, 2841:1 14 [2] - 2844:7, 2885:20 140 [1] - 2682:2 140,000 [1] - 2732:5 142 [1] - 2675:1 15 [7] - 2686:5, 2751:5, 2751:8, 2782:14, 2889:19, 2892:2, 2892:14 150 [2] - 2788:18, 2789:11 1500 [5] - 2762:25, 2763:1, 2859:7, 2899:10, 2899:12 154 [1] - 2865:11 158 [1] - 2682:24 16 [12] - 2752:16, 2753:10, 2760:12, 2760:18, 2770:3, 2770:6, 2827:18, 2827:20, 2835:10, 2835:21, 2857:15, 2857:16 1600 [1] - 2802:11 162 [1] - 2840:15 162,000 [1] - 2839:1 162,792 [1] - 2838:22 163,000 [1] - 2839:24 17 [3] - 2675:13, 2752:17, 2753:10 1700 [1] - 2802:20 18 [1] - 2906:7 1800 [1] - 2844:18 19 [1] - 2754:4 19,000 [1] - 2711:2	190 [1] - 2786:9 1930's [1] - 2680:7 1935 [2] - 2802:12, 2802:16 1956 [1] - 2680:20 1980's [1] - 2706:10 1986 [1] - 2684:24 1990's [1] - 2706:10 1992 [25] - 2777:21, 2778:5, 2778:10, 2778:15, 2778:20, 2778:25, 2779:4, 2779:14, 2779:18, 2779:24, 2780:3, 2780:9, 2780:11, 2780:23, 2781:1, 2781:6, 2781:12, 2781:15, 2781:17, 2781:22, 2781:24, 2782:2, 2782:7, 2890:16 1995 [1] - 2685:2 1996 [3] - 2846:12, 2847:3, 2847:9 1998 [1] - 2711:21 1999 [1] - 2685:25 1st [1] - 2900:18	2749:3, 2764:8, 2767:3, 2782:14, 2787:23, 2788:2, 2788:13, 2885:20, 2890:1 200 [1] - 2791:7 2000 [7] - 2686:2, 2706:25, 2719:7, 2766:2, 2835:3, 2858:25, 2859:5 2001 [5] - 2686:2, 2686:19, 2687:21, 2687:22, 2732:14 2004 [2] - 2688:8, 2695:21 2005 [4] - 2706:16, 2706:23, 2719:1, 2719:8 2006 [8] - 2703:11, 2703:23, 2704:17, 2719:9, 2719:11, 2730:2, 2746:25, 2902:19 2007 [1] - 2746:25 2008 [2] - 2880:22, 2905:16 2009 [15] - 2697:3, 2698:1, 2698:10, 2699:1, 2699:2, 2703:9, 2705:10, 2719:17, 2720:4, 2720:21, 2809:21, 2835:3, 2836:3, 2836:7 2011 [36] - 2765:12, 2765:17, 2765:19, 2765:22, 2765:25, 2767:15, 2767:25, 2769:1, 2769:4, 2769:5, 2769:7, 2772:22, 2779:20, 2779:23, 2780:9, 2780:12, 2780:22, 2781:12, 2781:13, 2781:14, 2805:12, 2805:20, 2805:22, 2806:5, 2806:7, 2806:11, 2806:15, 2806:17, 2806:18, 2806:23, 2807:12, 2824:4, 2837:8, 2838:24, 2839:21 2011-2012 [1] - 2807:14 2012 [9] - 2733:9, 2733:12, 2805:12, 2805:19, 2806:5, 2806:8, 2806:11, 2806:17, 2831:3, 2690:16	2741:19, 2836:14 2014 [1] - 2831:3 2015 [17] - 2718:16, 2719:21, 2721:1, 2721:3, 2721:11, 2721:17, 2721:18, 2722:11, 2722:21, 2727:15, 2730:6, 2735:8, 2735:14, 2737:18, 2738:17, 2830:22, 2831:13 2016 [9] - 2675:13, 2764:8, 2765:1, 2786:2, 2786:12, 2786:21, 2844:7, 2906:7, 2907:11 2019 [1] - 2907:17 207 [2] - 2788:25, 2789:14 21 [7] - 2752:16, 2753:10, 2770:7, 2777:15, 2777:16, 2890:8, 2890:10 22 [4] - 2734:3, 2734:7, 2736:9, 2788:1 228 [1] - 2754:6 23 [14] - 2687:1, 2695:4, 2695:25, 2710:3, 2710:14, 2715:8, 2715:19, 2811:15, 2811:17, 2811:21, 2834:5, 2835:16, 2845:7, 2845:10 233 [1] - 2811:25 234 [1] - 2811:25 24 [7] - 2736:9, 2749:3, 2801:4, 2827:18, 2827:20, 2868:14, 2897:2 25 [3] - 2819:25, 2823:14, 2823:19 254 [2] - 2827:17, 2827:20 2677 [2] - 2676:3, 2676:9 2690 [1] - 2676:11 27 [1] - 2829:21 2700 [1] - 2676:14 2708 [1] - 2676:14 2714 [1] - 2676:3 2717 [1] - 2676:9 2720 [1] - 2676:9 2722 [1] - 2676:16 2740 [2] - 2676:3, 2676:16 2745 [1] - 2676:4 2746 [1] - 2676:4 2762 [1] - 2676:12
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/s [1] - 2907:15				
1				
1 [20] - 2677:22, 2682:23, 2682:25, 2685:14, 2709:10, 2724:10, 2751:5, 2751:9, 2752:18, 2753:10, 2759:13, 2759:19, 2761:17, 2761:21, 2762:10, 2786:2, 2795:19, 2808:17, 2892:2, 2894:4 1,000 [22] - 2763:21, 2764:6, 2764:10, 2774:5, 2778:23, 2779:12, 2780:2, 2780:4, 2780:22, 2781:2, 2781:6, 2781:15, 2781:23, 2787:12, 2796:20, 2796:24, 2797:7, 2804:19, 2872:16, 2872:21, 2899:16 1,685 [5] - 2775:14, 2775:25, 2776:3, 2776:16, 2777:5 1-foot-3-inches [1] - 2892:15 10 [10] - 2681:6, 2688:10, 2708:25, 2712:4, 2719:15, 2728:23, 2737:13, 2756:25, 2757:9, 2760:11 100 [6] - 2769:15, 2785:23, 2791:7, 2830:4, 2832:11, 2836:17 105 [2] - 2785:21,	2 2 [12] - 2692:6, 2709:18, 2723:7, 2724:1, 2732:11, 2764:11, 2764:15, 2764:25, 2765:1, 2808:20, 2809:18, 2838:19 2,000 [39] - 2764:12, 2765:2, 2765:5, 2765:11, 2765:20, 2773:8, 2774:6, 2774:8, 2774:16, 2774:21, 2775:13, 2775:23, 2782:6, 2785:18, 2786:13, 2786:21, 2787:5, 2796:20, 2796:24, 2797:7, 2803:10, 2813:1, 2841:4, 2844:1, 2844:18, 2878:13, 2879:15, 2881:20, 2882:24, 2883:1, 2883:6, 2883:9, 2883:10, 2883:12, 2883:23, 2883:24, 2884:3, 2899:6, 2899:16 20 [16] - 2704:6, 2709:1, 2710:2, 2710:4, 2710:4 2011-2012 [1] - 2690:16,			

<p>2764 [1] - 2676:12 2799 [1] - 2676:12 280 [5] - 2811:15, 2811:17, 2811:19, 2811:20, 2811:21 2809 [1] - 2676:15 281 [2] - 2811:17, 2811:23 2820 [1] - 2676:15 2838 [1] - 2676:12 2848 [1] - 2676:4 2866 [1] - 2676:10 2884 [1] - 2676:13 2898 [1] - 2676:4 29 [2] - 2760:11, 2760:17 2:30 [2] - 2875:5, 2875:10 2:40 [1] - 2875:12</p>	<p>38 [1] - 2830:2 385 [1] - 2766:11 39 [4] - 2682:2, 2732:20, 2756:12, 2756:16 3:25 [1] - 2906:5</p>	<p>5,000 [1] - 2696:22 50 [19] - 2757:24, 2757:25, 2760:9, 2761:14, 2761:16, 2776:6, 2776:19, 2777:9, 2788:22, 2789:24, 2791:14, 2793:20, 2794:5, 2799:24, 2801:15, 2802:17, 2802:24, 2871:20, 2905:6 50's [1] - 2685:24 500 [4] - 2767:17, 2767:22, 2768:13, 2772:23 51 [1] - 2813:16 530 [2] - 2690:10 537 [1] - 2675:12 54 [4] - 2799:3, 2829:16, 2829:20 545 [5] - 2767:25, 2768:10, 2768:15, 2768:19, 2769:1 546 [4] - 2766:19, 2769:23, 2771:10, 2772:2 55 [1] - 2799:16 58.5 [1] - 2736:8</p>	<p>73 [1] - 2813:17 74 [2] - 2839:13, 2839:15 75 [3] - 2807:5, 2870:23 76 [2] - 2790:3, 2790:11 76th [1] - 2717:13 79 [2] - 2791:9, 2791:12</p>	<p>2880:3, 2880:5, 2880:13, 2880:17 ABID [1] - 2675:18 ability [2] - 2701:6, 2829:7 able [6] - 2695:22, 2696:15, 2696:19, 2746:20, 2860:24, 2863:3 above-entitled [1] - 2675:10 above-named [1] - 2907:9 absent [1] - 2882:11 absolute [1] - 2863:12 absolutely [11] - 2749:2, 2753:12, 2784:15, 2812:15, 2816:2, 2862:9, 2866:11, 2867:11, 2874:16, 2904:23, 2905:11 abundant [2] - 2738:20, 2739:20 academic [2] - 2858:5, 2894:6 accept [1] - 2772:10 accepted [1] - 2854:12 access [2] - 2689:3, 2827:16 accessible [2] - 2695:14, 2712:17 accomplished [1] - 2905:13 accomplishment [1] - 2858:6 according [1] - 2827:4 account [2] - 2759:10, 2815:2 accrue [1] - 2683:22 accurate [4] - 2725:6, 2749:10, 2768:23, 2889:13 ACF [24] - 2743:12, 2750:25, 2752:4, 2758:3, 2825:20, 2826:20, 2831:8, 2833:11, 2837:7, 2838:20, 2839:17, 2843:5, 2845:23, 2863:11, 2872:9, 2876:20, 2892:5, 2893:2, 2893:7, 2893:8, 2902:2, 2902:23, 2903:14, 2903:15 ACFS [1] - 2690:18 achieve [10] - 2783:7, 2787:5, 2813:25, 2817:11, 2848:16,</p>	
3	4	6	8	8	
<p>3 [24] - 2679:10, 2705:24, 2754:4, 2762:11, 2764:14, 2767:14, 2773:9, 2773:15, 2777:21, 2784:1, 2784:8, 2785:10, 2785:21, 2785:23, 2786:9, 2788:20, 2788:22, 2802:10, 2809:6, 2823:17, 2834:7, 2836:2, 2890:16 3,370 [1] - 2776:8 3.5 [2] - 2897:12, 2897:21 30 [4] - 2787:23, 2788:3, 2788:15, 2885:20 300 [2] - 2711:13, 2711:19 300,000 [1] - 2713:7 31 [2] - 2735:8, 2809:23 315 [3] - 2771:11, 2772:3, 2773:3 322 [3] - 2749:5, 2819:14, 2819:23 323 [1] - 2749:5 33 [1] - 2735:24 34 [1] - 2897:2 35 [3] - 2755:1, 2755:6, 2785:23 35.2 [1] - 2785:19 3500 [1] - 2777:11 358 [1] - 2835:16 36 [1] - 2807:6 37 [2] - 2696:23, 2790:11</p>	<p>4 [23] - 2680:1, 2697:6, 2724:10, 2732:21, 2732:24, 2733:1, 2784:10, 2807:21, 2812:23, 2823:16, 2823:17, 2823:21, 2838:17, 2859:5, 2860:1, 2860:16, 2865:22, 2865:25, 2866:17, 2868:15, 2878:6, 2882:25 4,000 [1] - 2711:24 40 [7] - 2694:25, 2698:8, 2705:21, 2722:21, 2741:3, 2788:2, 2788:20 41 [1] - 2702:12 42 [3] - 2772:4, 2772:11, 2844:23 43 [12] - 2737:19, 2841:14, 2842:15, 2842:18, 2842:20, 2843:1, 2843:10, 2843:18, 2843:22, 2844:2, 2845:11, 2845:18 44 [16] - 2737:17, 2737:22, 2737:23, 2773:18, 2773:19, 2774:17, 2812:22, 2858:19, 2858:23, 2860:1, 2865:15, 2865:22, 2866:1, 2870:15, 2872:14, 2878:5 45 [7] - 2682:23, 2682:24, 2801:5, 2858:19, 2858:23, 2872:15 47 [3] - 2682:23, 2683:4, 2683:13 48 [3] - 2841:17, 2841:22, 2845:7 488 [2] - 2801:17, 2801:20 49 [5] - 2692:7, 2818:1, 2818:4, 2818:5, 2818:10</p>	<p>6 [21] - 2681:2, 2708:14, 2751:8, 2764:15, 2775:18, 2807:21, 2841:15, 2842:15, 2842:22, 2843:1, 2843:10, 2843:14, 2844:5, 2844:13, 2844:24, 2845:22, 2846:13, 2847:4, 2847:8, 2885:22 60 [3] - 2773:3, 2825:10, 2843:14 63 [5] - 2694:25, 2698:8, 2705:21, 2722:22, 2741:3 64 [2] - 2732:20, 2801:23 650 [1] - 2802:2 66 [1] - 2766:15</p>	<p>8 [10] - 2718:19, 2718:23, 2720:7, 2725:14, 2725:23, 2726:5, 2751:8, 2764:14, 2800:17, 2885:22 80 [4] - 2824:23, 2825:4, 2825:7, 2825:10 81 [2] - 2798:24, 2799:10 83 [3] - 2800:3, 2800:16, 2800:20 84 [1] - 2804:1 86 [1] - 2762:23 895 [1] - 2884:20 8:50 [1] - 2675:14</p>	<p>9</p> <p>9 [12] - 2681:2, 2728:1, 2762:13, 2784:23, 2787:22, 2799:19, 2800:13, 2801:21, 2804:22, 2811:17, 2811:23, 2907:17 9-foot [2] - 2678:21, 2681:24 9.1 [1] - 2892:17 90 [5] - 2770:24, 2773:9, 2773:17, 2844:23, 2844:25 90,000 [1] - 2861:13 91 [2] - 2797:18, 2797:22 92 [1] - 2835:5 93 [1] - 2801:24 95 [1] - 2766:13 9:00 [1] - 2906:7</p>	<p>A</p> <p>a.m [5] - 2675:14, 2744:18, 2744:20, 2795:9, 2906:7 abatement [8] - 2766:13, 2771:5, 2782:10,</p>
5	7	9	A	A	
<p>5 [1] - 2737:13</p>	<p>7 [5] - 2733:3, 2751:8, 2779:9, 2779:11, 2779:12 7,000 [1] - 2696:22 71 [2] - 2807:3, 2807:16</p>	<p>THE REPORTING GROUP : 7, 2872:10,</p>	<p>THE REPORTING GROUP : 7, 2872:10,</p>	<p>THE REPORTING GROUP : 7, 2872:10,</p>	

2859:4, 2859:11, 2859:19, 2873:2, 2887:21 achieved [3] - 2692:25, 2888:11, 2888:16 achieving [3] - 2778:19, 2784:5, 2866:20 acknowledge [2] - 2700:7, 2721:15 acknowledged [2] - 2714:21, 2899:12 acquired [1] - 2705:17 acquiring [2] - 2866:13, 2867:4 acre [16] - 2838:4, 2838:23, 2839:21, 2840:1, 2854:13, 2863:9, 2863:13, 2863:19, 2863:24, 2864:13, 2885:24, 2891:17, 2891:19, 2892:15, 2892:16, 2892:17 acre-feet [4] - 2838:4, 2838:23, 2839:21, 2840:1 Acreage [1] - 2860:17 acreage [7] - 2779:14, 2825:3, 2825:4, 2860:23, 2860:25, 2867:19, 2891:13 acres [10] - 2693:22, 2852:7, 2852:17, 2861:11, 2861:13, 2866:25, 2867:17, 2867:24, 2876:15, 2891:16 Act [2] - 2717:17, 2851:16 act [2] - 2731:8, 2815:24 action [2] - 2858:13, 2907:9 actions [3] - 2756:2, 2756:16, 2806:13 active [1] - 2689:5 activities [5] - 2684:16, 2684:20, 2728:11, 2728:17, 2894:12 Activities [1] - 2728:2 activity [3] - 2728:21, 2750:15, 2799:14 actual [8] - 2781:13, 2781:15, 2781:16, 2833:17, 2861:2, 2873:1, 2874:6, 2883:24	actuarial [1] - 2877:20 adapt [2] - 2804:9, 2888:4 adaptive [5] - 2887:15, 2887:17, 2887:25, 2888:3, 2888:9 add [7] - 2752:12, 2771:3, 2775:13, 2782:5, 2879:15, 2882:18, 2882:19 added [3] - 2753:2, 2768:19 addition [3] - 2694:12, 2799:11, 2823:9 Additional [2] - 2707:9, 2866:17 additional [10] - 2698:2, 2712:19, 2712:20, 2720:20, 2800:17, 2823:1, 2847:22, 2855:24, 2873:18, 2885:9 address [1] - 2903:9 addressed [2] - 2707:4, 2710:1 addresses [1] - 2833:7 adds [1] - 2775:22 adequate [8] - 2689:11, 2689:16, 2690:2, 2690:5, 2692:8, 2702:10, 2714:13, 2742:6 adequately [1] - 2865:1 adjacent [1] - 2816:12 adjective [2] - 2872:5 adjourned [1] - 2906:6 adjust [1] - 2783:8 adjusted [1] - 2845:21 administered [1] - 2884:11 administrator [1] - 2886:7 admitted [3] - 2795:23, 2796:2, 2846:19 adopt [2] - 2745:24, 2815:13 adopted [2] - 2842:5, 2850:21 advance [1] - 2859:14 advantage [1] - 2690:3 adverse [2] - 2704:9, 2704:13 advised [1] - 2795:21 aerial [4] - 2695:21, 2732:17, 2733:4 2741:19	aesthetics [1] - 2873:4 affect [1] - 2735:1 affected [4] - 2684:20, 2735:2, 2735:7, 2801:23 affects [1] - 2729:20 affidavit [1] - 2809:24 afternoon [4] - 2848:20, 2848:22, 2848:25, 2849:1 afterwards [1] - 2858:14 Ag [1] - 2857:2 agencies [1] - 2904:19 aggregate [3] - 2823:5, 2839:17, 2844:17 aggressive [1] - 2859:7 ago [17] - 2686:5, 2708:25, 2709:1, 2719:5, 2727:2, 2727:15, 2728:9, 2729:13, 2729:14, 2730:13, 2731:25, 2739:18, 2854:21, 2873:14, 2885:6, 2894:8, 2896:18 agree [34] - 2709:5, 2709:21, 2749:15, 2752:8, 2753:16, 2756:5, 2756:9, 2766:18, 2768:18, 2778:22, 2781:23, 2784:13, 2787:10, 2810:14, 2810:23, 2813:21, 2822:14, 2823:10, 2823:13, 2824:23, 2826:4, 2826:10, 2826:22, 2826:25, 2827:2, 2828:19, 2829:5, 2835:3, 2835:8, 2835:18, 2837:12, 2840:20, 2840:24, 2844:12 agreed [1] - 2796:9 Agreement [1] - 2854:10 agreement [2] - 2796:1, 2796:4 Agricultural [2] - 2866:18, 2894:2 agricultural [52] - 2679:14, 2744:24, 2745:2, 2757:25, 2760:9, 2773:7, 2774:23, 2775:8, 2775:10, 2775:14, 2776:23, 2798:6, 2798:21, 2799:14, 2799:24, 2801:13, 2801:16, 2803:12, 2822:4, 2825:16, 2828:19, 2828:25, 2841:23, 2849:7, 2849:23, 2850:3, 2852:20, 2854:8, 2857:4, 2857:7, 2857:14, 2857:21, 2858:4, 2858:20, 2860:13, 2860:16, 2862:24, 2865:6, 2874:17, 2876:7, 2881:10, 2881:11, 2881:18, 2883:3, 2884:23, 2891:15, 2901:7, 2901:14, 2902:3, 2902:12 agriculture [16] - 2679:16, 2679:20, 2775:5, 2777:11, 2803:6, 2826:7, 2852:8, 2857:9, 2860:4, 2862:6, 2864:24, 2867:1, 2867:2, 2867:3, 2891:11, 2905:4 aground [2] - 2686:4, 2686:7 ahead [2] - 2728:13, 2885:13 aid [1] - 2852:25 aims [1] - 2859:11 air [1] - 2702:6 al [1] - 2730:2 Alabama [7] - 2679:19, 2683:20, 2684:1, 2684:8, 2717:10, 2752:3, 2895:25 alive [1] - 2699:20 all-year-round [2] - 2880:11, 2880:12 Allan [8] - 2710:23, 2715:16, 2738:10, 2757:6, 2757:15, 2760:3, 2760:8, 2760:21 Allan's [4] - 2696:11, 2696:13, 2696:14, 2759:24 alleged [5] - 2750:19, 2750:24, 2753:18, 2754:16, 2754:22 allow [1] - 2724:3 allowable [1] - 2855:17	2861:11 alluded [1] - 2679:9 alluvial [1] - 2712:11 almost [11] - 2687:15, 2712:2, 2729:13, 2732:6, 2747:4, 2748:14, 2803:10, 2807:4, 2811:8, 2895:8, 2905:16 alone [2] - 2702:2, 2816:19 alternative [2] - 2683:16, 2813:9 altogether [1] - 2825:22 amazing [1] - 2714:11 amenities [1] - 2893:19 America [3] - 2693:24, 2697:12, 2714:9 American [11] - 2697:4, 2697:9, 2697:15, 2697:17, 2697:19, 2698:10, 2714:21, 2719:17, 2720:21, 2725:3, 2725:8 amount [35] - 2752:14, 2753:5, 2765:23, 2765:24, 2768:2, 2768:20, 2772:4, 2774:23, 2778:12, 2794:2, 2797:6, 2815:20, 2822:7, 2822:9, 2822:11, 2822:16, 2822:25, 2823:6, 2834:13, 2834:24, 2836:21, 2854:7, 2855:17, 2857:19, 2858:11, 2861:1, 2861:4, 2886:16, 2891:2, 2891:7, 2891:12, 2891:14, 2891:17, 2891:19, 2895:23 amounts [3] - 2775:2, 2869:17, 2885:11 ampersand [1] - 2766:8 analogy [3] - 2700:24, 2701:3, 2702:5 analyses [1] - 2691:13 analysis [50] - 2685:6, 2685:11, 2689:17, 2694:24, 2695:21, 2703:9, 2710:22, 2715:4, 2715:22, 2716:15, 2741:19, 2754:14, 2770:2, 2783:11, 2794:25,
---	--	---	---

<p>2800:14, 2801:10, 2803:18, 2803:21, 2818:13, 2818:18, 2821:24, 2823:4, 2823:22, 2824:17, 2824:22, 2824:25, 2831:18, 2834:2, 2837:21, 2838:10, 2839:4, 2839:7, 2839:9, 2843:23, 2844:13, 2847:16, 2847:19, 2860:8, 2861:6, 2861:19, 2861:21, 2862:12, 2862:15, 2863:2, 2865:17, 2891:23, 2901:7, 2902:15</p> <p>analyze [8] - 2716:19, 2716:24, 2749:11, 2750:14, 2750:18, 2750:23, 2751:4, 2779:12</p> <p>analyzed [7] - 2749:15, 2749:21, 2751:3, 2787:10, 2797:2, 2836:10, 2847:21</p> <p>Angeles [1] - 2856:13</p> <p>annual [3] - 2756:17, 2810:7, 2810:18</p> <p>annualized [4] - 2800:22, 2802:5, 2802:7, 2802:9</p> <p>answer [34] - 2715:18, 2716:6, 2724:4, 2727:14, 2739:2, 2739:6, 2739:8, 2751:15, 2751:23, 2752:25, 2753:3, 2753:8, 2753:10, 2753:22, 2754:10, 2768:14, 2770:11, 2781:7, 2795:3, 2806:18, 2806:21, 2810:22, 2819:18, 2819:21, 2820:1, 2827:14, 2827:25, 2828:7, 2835:22, 2835:24, 2898:18, 2899:17, 2899:21, 2901:12</p> <p>answered [1] - 2820:3</p> <p>answering [2] - 2716:3, 2716:23</p> <p>answers [3] - 2715:18, 2749:9, 2812:4</p> <p>anthropogenic [3] - 2709:23, 2728:11, 2728:17</p> <p>anticipated [1] -</p>	<p>2778:21</p> <p>anyway [2] - 2698:18, 2699:23</p> <p>Apalachicola [33] - 2678:3, 2678:15, 2678:25, 2679:4, 2681:7, 2681:25, 2682:9, 2682:19, 2694:7, 2697:13, 2697:16, 2697:18, 2697:21, 2698:3, 2705:12, 2711:11, 2711:14, 2714:4, 2714:5, 2716:21, 2718:16, 2719:19, 2720:22, 2721:12, 2738:21, 2752:15, 2753:7, 2755:10, 2759:5, 2759:14, 2802:21, 2803:2</p> <p>apart [5] - 2724:16, 2752:7, 2752:18, 2895:17, 2898:13</p> <p>appear [1] - 2706:9</p> <p>APPEARANCES [1] - 2675:16</p> <p>appeared [2] - 2706:17, 2754:3</p> <p>appearing [1] - 2900:15</p> <p>apples [1] - 2789:7</p> <p>application [1] - 2868:22</p> <p>applied [8] - 2745:2, 2822:15, 2851:2, 2863:13, 2863:19, 2891:14, 2891:17, 2891:19</p> <p>apply [6] - 2818:19, 2859:11, 2863:23, 2868:24, 2877:5, 2904:21</p> <p>applying [3] - 2818:24, 2868:25, 2891:24</p> <p>appoint [1] - 2718:4</p> <p>appointed [1] - 2718:1</p> <p>appreciate [4] - 2699:4, 2699:23, 2700:11, 2878:15</p> <p>approach [12] - 2699:19, 2722:16, 2745:19, 2748:20, 2764:17, 2795:22, 2814:2, 2820:10, 2865:7, 2884:14, 2895:10, 2897:19</p> <p>appropriate [1] - 2791:20</p> <p>appropriation [3] -</p>	<p>2816:4, 2816:7, 2816:10</p> <p>appropriations [1] - 2678:11</p> <p>approve [1] - 2743:3</p> <p>April [1] - 2830:22</p> <p>Aquatic [1] - 2708:2</p> <p>aquatic [3] - 2810:9, 2852:25, 2853:2</p> <p>Aquifer [2] - 2870:2, 2870:7</p> <p>aquifer [1] - 2815:1</p> <p>aquifers [5] - 2869:19, 2869:25, 2870:7, 2870:17, 2870:25</p> <p>archaeological [1] - 2685:7</p> <p>archival [1] - 2685:14</p> <p>area [21] - 2698:17, 2698:25, 2810:13, 2832:16, 2834:11, 2834:14, 2835:6, 2835:20, 2847:12, 2848:8, 2853:3, 2855:11, 2856:13, 2857:15, 2861:2, 2862:20, 2865:5, 2889:20, 2893:7, 2893:10, 2894:19</p> <p>areas [9] - 2695:6, 2730:17, 2850:6, 2855:14, 2857:15, 2860:4, 2871:14, 2873:17, 2886:25</p> <p>arm [2] - 2689:20, 2689:23</p> <p>arms [1] - 2699:10</p> <p>Army [17] - 2677:11, 2678:1, 2678:8, 2685:17, 2685:23, 2694:16, 2702:21, 2715:6, 2715:23, 2719:18, 2730:13, 2732:14, 2847:14, 2847:15, 2847:18, 2848:4, 2848:14</p> <p>article [3] - 2831:13, 2831:16, 2831:19</p> <p>artificially [3] - 2686:12, 2693:7, 2693:14</p> <p>aside [4] - 2693:21, 2694:12, 2705:17, 2867:19</p> <p>aspect [4] - 2681:4, 2681:5, 2777:2, 2792:23</p> <p>aspects [3] - 2702:1, 2741:17, 2766:10</p>	<p>2858:17</p> <p>assertion [3] - 2810:6, 2823:10, 2825:16</p> <p>assess [5] - 2697:12, 2710:8, 2715:4, 2715:22, 2716:15</p> <p>assessed [1] - 2703:12</p> <p>assessment [7] - 2703:20, 2704:4, 2708:9, 2708:19, 2709:12, 2710:16, 2714:4</p> <p>assign [1] - 2789:2</p> <p>assigned [2] - 2791:23, 2897:18</p> <p>associated [4] - 2710:15, 2791:17, 2807:25, 2848:14</p> <p>Associated [1] - 2736:1</p> <p>assume [6] - 2722:1, 2783:11, 2783:16, 2783:19, 2815:16, 2833:23</p> <p>assumed [4] - 2765:12, 2769:1, 2807:12, 2821:9</p> <p>assuming [1] - 2779:13</p> <p>assumption [3] - 2783:21, 2805:18, 2807:15</p> <p>assumptions [4] - 2749:18, 2765:21, 2777:12, 2843:12</p> <p>assured [1] - 2848:6</p> <p>Atlanta [17] - 2769:14, 2772:24, 2791:4, 2793:1, 2793:5, 2834:10, 2834:14, 2835:9, 2835:20, 2836:6, 2836:11, 2856:10, 2856:16, 2871:6, 2872:8, 2880:21, 2905:14</p> <p>attached [1] - 2720:15</p> <p>attachment [1] - 2720:15</p> <p>attempt [1] - 2734:15</p> <p>attempted [4] - 2752:9, 2752:19, 2896:7, 2898:14</p> <p>attempting [1] - 2892:24</p> <p>attention [10] - 2690:19, 2690:25, 2731:18, 2734:4, 2737:23, 2797:15, 2828:20,</p>	<p>2892:7, 2897:1</p> <p>attitude [1] - 2699:11</p> <p>attitudes [1] - 2895:24</p> <p>attributable [1] - 2696:3</p> <p>attribute [3] - 2715:9, 2728:20, 2787:8</p> <p>auction [3] - 2851:10, 2851:14, 2867:15</p> <p>augmented [1] - 2733:14</p> <p>author [1] - 2742:16</p> <p>authorized [1] - 2682:15</p> <p>authors [3] - 2708:22, 2723:9, 2739:13</p> <p>available [2] - 2874:14, 2904:10</p> <p>AVALLONE [1] - 2675:21</p> <p>average [19] - 2783:6, 2810:7, 2810:18, 2811:10, 2822:14, 2822:20, 2827:8, 2828:2, 2842:24, 2843:1, 2843:9, 2845:11, 2891:8, 2892:3, 2892:6, 2892:8, 2892:12, 2892:13, 2892:16</p> <p>averaged [1] - 2783:4</p> <p>averages [1] - 2858:3</p> <p>averaging [1] - 2845:22</p> <p>aware [27] - 2703:9, 2703:16, 2721:10, 2757:3, 2758:4, 2759:4, 2759:17, 2760:7, 2760:12, 2761:8, 2763:22, 2778:4, 2778:8, 2802:18, 2809:15, 2816:7, 2816:23, 2821:13, 2836:9, 2836:16, 2846:7, 2846:10, 2846:19, 2846:25, 2847:2, 2867:8, 2895:3</p> <p>awareness [1] - 2896:2</p> <p>axis [2] - 2879:17, 2879:24</p>
<p>THE REPORTING GROUP</p>				
<p>Mason & Lockhart</p>				

<p>background [1] - 2691:22 backs [4] - 2799:13, 2814:8, 2885:8, 2885:9 Bainbridge [2] - 2679:2, 2681:23 ban [3] - 2874:9, 2880:21, 2905:15 bank [2] - 2695:13, 2737:6 banking [1] - 2764:24 Bankruptcy [1] - 2675:12 banks [5] - 2687:13, 2688:18, 2688:19, 2693:6, 2693:12 bar [1] - 2733:19 barge [3] - 2683:1, 2686:3, 2686:7 Barr [3] - 2809:10, 2809:13, 2810:17 Barr's [2] - 2809:23, 2810:6 bars [2] - 2733:13, 2733:14 base [1] - 2830:6 based [10] - 2682:6, 2685:13, 2705:18, 2705:20, 2714:2, 2744:4, 2802:22, 2812:9, 2830:15, 2844:5 baselines [1] - 2778:18 basic [1] - 2780:20 Basin [24] - 2750:25, 2752:4, 2758:3, 2826:20, 2831:8, 2837:7, 2838:20, 2843:5, 2850:9, 2851:5, 2857:10, 2861:14, 2863:12, 2867:14, 2872:9, 2876:3, 2876:20, 2892:5, 2893:2, 2893:8, 2896:22, 2901:15, 2902:2, 2902:19 basin [15] - 2679:17, 2766:15, 2771:6, 2775:8, 2843:7, 2858:2, 2883:15, 2892:14, 2893:1, 2896:1, 2896:4, 2901:18, 2901:19, 2902:4, 2905:4 basin-wide [1] - 2858:2 basis [5] - 2741:1,</p>	<p>2825:7, 2851:24, 2852:21, 2902:15 bass [1] - 2699:18 Battle [5] - 2700:7, 2700:12, 2701:20, 2702:24, 2703:1 Bay [4] - 2759:5, 2759:14, 2802:21, 2803:2 bay [2] - 2810:11, 2895:5 bays [2] - 2733:20, 2741:5 beach [2] - 2686:15, 2698:15 beaches [1] - 2698:15 bear [1] - 2746:13 bears [2] - 2717:13, 2742:13 beautiful [2] - 2714:6, 2884:19 become [4] - 2689:2, 2692:19, 2707:22, 2778:8 becoming [1] - 2747:3 bed [2] - 2710:19, 2726:23 began [1] - 2694:20 begin [2] - 2724:4, 2739:2 beginning [6] - 2680:20, 2704:9, 2725:24, 2734:7, 2734:9, 2874:18 begins [10] - 2679:24, 2690:21, 2704:11, 2737:11, 2810:2, 2810:3, 2818:11, 2839:17, 2895:18, 2897:8 begun [1] - 2688:11 behalf [1] - 2855:1 behavior [2] - 2864:2, 2864:7 behaviors [1] - 2795:4 behind [2] - 2697:5, 2759:23 beings [1] - 2893:12 BELLEHEM [1] - 2675:18 below [7] - 2736:11, 2782:2, 2822:16, 2822:21, 2822:23, 2868:22, 2870:7 benchmark [1] - 2806:17 bend [3] - 2736:24, 2736:25, 2737:5 Bend [5] - 2700:7, 2700:12, 2701:2</p>	<p>2702:25, 2703:1 beneath [1] - 2836:17 beneficial [2] - 2688:21, 2823:2 benefit [23] - 2679:6, 2681:16, 2683:8, 2684:10, 2685:20, 2700:2, 2703:16, 2703:21, 2704:22, 2705:9, 2717:6, 2717:9, 2741:2, 2745:4, 2760:17, 2760:18, 2761:22, 2776:17, 2781:2, 2785:8, 2827:23, 2844:13, 2873:25 benefits [18] - 2684:7, 2701:9, 2756:2, 2756:6, 2756:20, 2757:2, 2757:11, 2759:10, 2760:7, 2782:23, 2784:6, 2808:7, 2809:1, 2827:25, 2830:3, 2876:24, 2877:8, 2893:12 Berkeley [2] - 2893:20, 2894:3 Berrien [3] - 2831:6, 2831:8, 2832:8 better [6] - 2698:21, 2725:10, 2747:15, 2810:24, 2823:8, 2875:24 between [25] - 2695:1, 2696:22, 2713:7, 2715:23, 2741:12, 2769:18, 2790:14, 2791:7, 2796:25, 2797:8, 2816:3, 2820:25, 2833:14, 2833:17, 2839:5, 2839:10, 2840:4, 2845:5, 2854:18, 2871:14, 2872:25, 2891:3, 2891:8, 2891:10, 2892:5 beyond [10] - 2710:14, 2769:11, 2823:1, 2830:18, 2848:7, 2864:10, 2872:11, 2885:12, 2887:2, 2903:11 big [7] - 2700:8, 2700:13, 2707:24, 2747:20, 2829:10, 2858:6, 2886:13 biggest [1] - 2719:11 Bill [2] - 2900:16,</p>	<p>billion [1] - 2895:8 binder [9] - 2692:6, 2697:6, 2705:24, 2708:15, 2755:3, 2758:12, 2777:13, 2799:1, 2888:19 binders [1] - 2690:12 biodiverse [1] - 2714:7 biologic [1] - 2749:11 biological [11] - 2696:14, 2703:11, 2754:12, 2757:19, 2810:10, 2812:6, 2818:24, 2822:25, 2868:21, 2868:23, 2886:1 biologist [1] - 2754:25 biologists [2] - 2755:16, 2811:7 biology [1] - 2757:17 biomass [2] - 2761:10, 2761:16 BiOp [1] - 2703:23 bird [1] - 2893:16 bird-watching [1] - 2893:16 birds [2] - 2853:3, 2853:6 bit [18] - 2684:8, 2715:2, 2731:12, 2751:18, 2835:13, 2835:25, 2849:2, 2852:11, 2854:23, 2856:5, 2868:24, 2868:25, 2872:24, 2873:14, 2878:23, 2881:17, 2886:2, 2891:9 bite [1] - 2852:11 bite-sized [1] - 2852:11 black [2] - 2690:12, 2895:18 blocked [2] - 2689:1, 2689:4 Blue [2] - 2703:2, 2705:14 blunt [1] - 2694:18 blur [1] - 2715:2 boat [1] - 2699:20 body [1] - 2701:6 bogged [1] - 2780:18 book [3] - 2685:3, 2804:17, 2809:3 borne [1] - 2783:6 Bottcher [1] - 2820:4 bottom [19] - 2679:23, 2690:20, 2709:10, 2728:23,</p>	<p>2734:5, 2734:6, 2735:13, 2737:23, 2737:25, 2790:5, 2821:9, 2823:21, 2839:15, 2845:9, 2845:10, 2845:12, 2859:6, 2892:8 bouncing [1] - 2827:3 Branch [2] - 2703:3, 2705:15 break [7] - 2782:13, 2795:6, 2796:18, 2872:5, 2875:6, 2875:9, 2878:5 breaks [1] - 2871:17 briefly [5] - 2718:23, 2740:11, 2842:4, 2856:24, 2870:17 brilliance [1] - 2900:17 bring [4] - 2698:14, 2747:10, 2783:13, 2825:14 bringing [2] - 2698:16, 2772:20 broken [3] - 2689:20, 2689:23, 2699:10 brushing [1] - 2864:5 building [2] - 2681:18, 2683:23 built [4] - 2685:16, 2717:16, 2794:14, 2888:24 bullet [2] - 2865:16, 2866:12 bullets [1] - 2869:24 Bureau [1] - 2852:15 business [1] - 2871:16 businesses [2] - 2837:22, 2889:25 buy [8] - 2837:22, 2866:2, 2866:23, 2868:14, 2881:12, 2885:8, 2885:9, 2885:13 buy-back [4] - 2866:2, 2866:23, 2868:14, 2881:12 buy-backs [2] - 2885:8, 2885:9 buy-out [1] - 2885:13 buying [2] - 2693:24, 2874:2 BY [43] - 2677:6, 2677:20, 2690:15, 2714:19, 2722:17, 2724:5, 2726:10, 2740:10, 2745:23, 2746:8, 2746:19,</p>
--	--	---	--	---

<p>2748:21, 2749:7, 2750:7, 2751:11, 2751:14, 2751:21, 2754:8, 2758:24, 2766:9, 2767:8, 2770:9, 2774:2, 2774:14, 2780:19, 2782:21, 2783:15, 2783:18, 2786:19, 2796:17, 2799:6, 2812:2, 2812:24, 2820:14, 2846:23, 2853:15, 2875:15, 2879:11, 2884:17, 2891:1, 2895:13, 2896:15, 2898:3</p>	<p>2836:6, 2836:10, 2836:13, 2836:17, 2836:18 capital [2] - 2835:8, 2877:6 capped [1] - 2781:17 capping [1] - 2777:20 caps [1] - 2856:1 caption [1] - 2736:7 capture [2] - 2734:16, 2884:19 career [1] - 2832:13 careers [1] - 2894:6 careful [9] - 2704:20, 2769:17, 2813:7, 2837:15, 2862:12, 2864:14, 2864:17, 2864:18, 2864:22</p>	<p>caused [7] - 2709:16, 2709:22, 2715:6, 2716:16, 2719:18, 2729:24, 2754:22 causes [1] - 2729:16 causing [1] - 2716:20 ceased [4] - 2685:22, 2685:23, 2687:20, 2689:8 census [1] - 2876:7 Center [1] - 2896:22 center [7] - 2820:21, 2857:22, 2862:17, 2862:19, 2862:21, 2877:5 center-pivot [7] - 2820:21, 2857:22, 2862:17, 2862:19, 2862:21, 2877:5 centers [1] - 2679:17 central [1] - 2685:9 certain [15] - 2686:24, 2687:2, 2687:4, 2708:24, 2742:19, 2749:17, 2774:22, 2783:7, 2794:8, 2797:6, 2815:3, 2826:24, 2830:2, 2851:11, 2867:17 certainly [19] - 2686:9, 2691:23, 2701:13, 2705:13, 2711:4, 2714:8, 2715:8, 2719:3, 2720:6, 2727:11, 2733:20, 2806:7, 2833:19, 2848:5, 2865:9, 2869:15, 2875:17, 2895:12</p>	<p>2775:25, 2776:3, 2776:8, 2776:16, 2777:11, 2778:23, 2779:13, 2780:2, 2780:4, 2780:10, 2780:22, 2781:2, 2781:6, 2781:13, 2781:23, 2782:4, 2785:8, 2786:4, 2786:13, 2786:21, 2787:5, 2787:12, 2788:25, 2789:11, 2789:14, 2796:20, 2804:20, 2813:1, 2830:4, 2832:11, 2841:4, 2843:21, 2844:2, 2859:7, 2859:9, 2872:16, 2872:21, 2874:13, 2878:13, 2879:15, 2881:20, 2882:24, 2883:1, 2883:6, 2899:16, 2905:7 chair [2] - 2747:12, 2894:1 chance [3] - 2698:20, 2726:11, 2755:6 change [28] - 2692:1, 2695:1, 2698:7, 2709:16, 2710:4, 2711:16, 2712:8, 2714:23, 2715:5, 2715:11, 2715:24, 2719:10, 2727:25, 2728:21, 2750:15, 2751:2, 2751:4, 2757:14, 2761:10, 2761:15, 2761:21, 2771:14, 2817:24, 2839:2, 2839:7, 2839:10, 2873:5, 2893:22 changed [17] - 2685:12, 2709:3, 2720:4, 2771:9, 2771:19, 2771:22, 2792:2, 2792:4, 2792:20, 2805:15, 2806:9, 2806:10, 2806:16, 2817:21, 2839:4, 2839:6, 2875:2 Changes [2] - 2728:2, 2731:16 changes [13] - 2709:23, 2710:6, 2711:17, 2731:19, 2732:25, 2741:8, 2750:16, 2755:12, 2777:18, 2772:4,</p>	<p>2887:11, 2891:9, 2895:21 changing [1] - 2741:6 channel [39] - 2678:21, 2678:23, 2681:18, 2681:20, 2681:24, 2686:18, 2687:12, 2688:7, 2688:8, 2688:13, 2695:1, 2695:18, 2698:7, 2704:20, 2709:16, 2709:22, 2710:4, 2710:20, 2714:23, 2715:5, 2715:11, 2715:23, 2719:10, 2727:7, 2727:22, 2728:13, 2728:21, 2729:9, 2734:1, 2734:2, 2734:24, 2734:25, 2735:5, 2737:2, 2737:11, 2737:14, 2741:5, 2741:8 Channel [4] - 2725:16, 2725:22, 2726:8, 2728:2 channels [6] - 2695:11, 2711:6, 2727:3, 2729:11, 2730:15, 2810:8 chapter [2] - 2685:5, 2685:7 characteristic [1] - 2729:18 characteristics [1] - 2900:18 characterized [1] - 2800:5 charge [1] - 2777:8 chart [23] - 2683:4, 2683:5, 2732:10, 2759:24, 2761:14, 2772:21, 2774:7, 2774:8, 2775:6, 2783:2, 2787:17, 2792:19, 2795:18, 2868:4, 2868:12, 2871:4, 2872:1, 2872:21, 2878:14, 2882:24, 2883:17, 2889:14, 2889:16 charts [5] - 2765:6, 2872:14, 2872:15, 2875:1, 2888:18 chase [1] - 2805:6 Chattahoochee [8] - 2678:3, 2678:15, 2678:24, 2681:12, 2681:24, 2682:10, 2682:13, 2876:3</p>
C				
<p>calculate [3] - 2778:19, 2802:12, 2804:10 calculated [15] - 2768:11, 2769:6, 2778:14, 2798:16, 2798:24, 2802:10, 2802:14, 2805:7, 2822:16, 2824:16, 2824:19, 2836:16, 2840:2, 2848:17, 2905:17 calculating [1] - 2797:13 calculation [3] - 2769:8, 2822:3, 2825:11 calculations [2] - 2799:17, 2807:10 calculator [2] - 2766:21, 2766:22 calendar [2] - 2879:19, 2879:22 California [8] - 2698:16, 2713:1, 2803:15, 2850:10, 2852:5, 2853:25, 2854:4, 2893:20 Cantor [1] - 2796:7 cap [14] - 2756:17, 2797:5, 2815:13, 2815:16, 2815:19, 2817:13, 2854:12, 2855:7, 2855:20, 2884:10, 2884:25, 2885:4, 2886:8, 2887:7 capable [1] - 2716:3 capacity [1] - 2694:4 capita [10] - 2834:10, 2834:13, 2834:18, 2835:9, 2835:19,</p>	<p>carefully [2] - 2692:23, 2857:6 carried [2] - 2683:15, 2730:16 cars [1] - 2874:4 carving [1] - 2737:11 case [53] - 2678:11, 2684:9, 2691:11, 2695:16, 2700:5, 2705:1, 2705:4, 2705:6, 2713:3, 2713:4, 2713:14, 2729:2, 2745:25, 2746:23, 2746:25, 2747:4, 2748:2, 2748:11, 2748:13, 2748:22, 2749:23, 2752:2, 2754:16, 2756:24, 2757:1, 2757:9, 2762:6, 2763:25, 2770:15, 2778:8, 2795:19, 2798:4, 2798:9, 2806:7, 2809:8, 2811:1, 2819:6, 2821:23, 2833:19, 2836:8, 2847:16, 2849:18, 2851:1, 2852:16, 2854:1, 2855:1, 2855:5, 2856:5, 2856:23, 2860:22, 2861:22, 2862:3, 2888:12 cases [2] - 2733:14, 2817:9 categories [1] - 2876:10 category [3] - 2838:9, 2876:19, 2877:9 causation [2] - 2753:14, 2754:19 Caused [1] - 2728</p>	<p>THE REPORTING GROUP</p>		
65 of 94 sheets	Mason & Lockhart	The Reporting Group		The Reporting Group (207) 797-6040

<p>check [4] - 2831:21, 2887:4, 2887:22, 2888:3</p> <p>checking [1] - 2856:1</p> <p>chief [1] - 2678:1</p> <p>choice [1] - 2877:2</p> <p>choose [2] - 2859:17, 2859:25</p> <p>chose [5] - 2734:9, 2860:3, 2876:20, 2885:12, 2886:10</p> <p>CHRISTIAN [1] - 2675:22</p> <p>CHRISTOPHER [1] - 2675:21</p> <p>chute [1] - 2737:8</p> <p>Circuit [1] - 2900:18</p> <p>circular [1] - 2862:20</p> <p>circulation [2] - 2689:6, 2727:9</p> <p>circumstance [1] - 2877:24</p> <p>circumstances [2] - 2851:2, 2852:2</p> <p>citations [1] - 2730:21</p> <p>cite [2] - 2677:14, 2720:25</p> <p>cited [3] - 2697:22, 2721:4, 2722:25</p> <p>cities [3] - 2679:15, 2679:18, 2872:9</p> <p>claims [1] - 2798:1</p> <p>clarification [2] - 2739:10, 2798:22</p> <p>clarify [2] - 2768:8, 2779:22</p> <p>Claudette [5] - 2675:14, 2900:7, 2907:2, 2907:15, 2907:15</p> <p>clean [2] - 2727:13, 2753:8</p> <p>clear [21] - 2678:18, 2685:18, 2688:4, 2688:24, 2703:13, 2703:18, 2730:7, 2748:10, 2754:20, 2774:1, 2775:17, 2783:3, 2797:9, 2798:15, 2798:20, 2818:8, 2823:3, 2825:3, 2837:24, 2847:7, 2898:11</p> <p>clearly [4] - 2682:7, 2684:7, 2820:23, 2825:17</p> <p>CLERK [2] - 2745:5, 2745:12</p> <p>clip [5] - 2751:18, 2751:19, 2754:6,</p>	<p>2770:6, 2811:17</p> <p>clips [3] - 2749:5, 2751:8, 2811:25</p> <p>clock [1] - 2782:12</p> <p>clog [1] - 2727:17</p> <p>close [2] - 2698:18, 2720:7</p> <p>closer [1] - 2747:11</p> <p>coinciding [2] - 2728:10, 2728:16</p> <p>cold [3] - 2698:16, 2699:17, 2699:21</p> <p>collapse [3] - 2686:16, 2687:14, 2688:1</p> <p>colleague [3] - 2739:24, 2740:1, 2782:18</p> <p>colleagues [2] - 2694:22, 2698:4</p> <p>collected [2] - 2857:12, 2857:25</p> <p>colonization [2] - 2741:21, 2742:1</p> <p>color [1] - 2690:11</p> <p>Colorado [2] - 2854:1, 2854:11</p> <p>Columbus [5] - 2678:22, 2679:1, 2681:13, 2681:23, 2685:20</p> <p>column [8] - 2774:21, 2775:13, 2775:18, 2775:22, 2789:4, 2808:16, 2808:19, 2872:1</p> <p>columns [3] - 2841:10, 2844:12, 2871:25</p> <p>combination [5] - 2805:12, 2813:24, 2882:16, 2885:7, 2887:9</p> <p>combinations [2] - 2859:3, 2874:21</p> <p>combined [2] - 2771:6, 2856:14</p> <p>coming [6] - 2686:9, 2699:22, 2731:6, 2750:8, 2863:22, 2899:2</p> <p>commencing [1] - 2675:13</p> <p>comment [3] - 2701:20, 2810:25, 2817:22</p> <p>commerce [7] - 2679:6, 2679:25, 2680:6, 2682:7, 2682:18, 2683:3, 2683:12</p>	<p>commercial [8] - 2749:16, 2749:20, 2749:22, 2750:1, 2750:12, 2750:16, 2893:15, 2894:12</p> <p>Commission [8] - 2698:6, 2720:10, 2721:17, 2721:20, 2738:19, 2738:25, 2741:24, 2907:17</p> <p>Committee [1] - 2718:9</p> <p>common [6] - 2850:5, 2850:13, 2852:1, 2866:19, 2868:3, 2887:17</p> <p>commonly [1] - 2886:20</p> <p>Compact [3] - 2743:9, 2855:18, 2903:15</p> <p>compare [9] - 2768:24, 2784:20, 2802:17, 2860:24, 2861:2, 2872:14, 2872:20, 2877:7, 2892:11</p> <p>compared [7] - 2731:7, 2768:7, 2780:22, 2823:6, 2828:17, 2861:7, 2892:5</p> <p>comparing [3] - 2756:5, 2768:6, 2835:7</p> <p>comparison [2] - 2768:18, 2874:25</p> <p>compensate [1] - 2791:20</p> <p>compensated [1] - 2724:22</p> <p>complaint [2] - 2772:20, 2777:25</p> <p>Complaint [4] - 2777:14, 2777:16, 2890:5</p> <p>complete [3] - 2725:8, 2860:22, 2903:11</p> <p>completed [2] - 2680:7, 2698:9</p> <p>completely [1] - 2689:10</p> <p>complex [4] - 2693:5, 2693:12, 2755:14, 2755:19</p> <p>compliance [2] - 2855:22, 2888:16</p> <p>complies [1] - 2886:11</p> <p>components [3] -</p>	<p>2692:4</p> <p>compound [1] - 2787:2</p> <p>comprehend [2] - 2755:23, 2795:4</p> <p>concentrations [1] - 2707:19</p> <p>concept [10] - 2793:14, 2813:11, 2813:23, 2866:10, 2866:16, 2870:5, 2872:19, 2887:13, 2887:18, 2888:8</p> <p>conceptually [1] - 2851:22</p> <p>concern [1] - 2697:16</p> <p>concerning [2] - 2678:2, 2722:21</p> <p>concerns [1] - 2861:19</p> <p>concluded [1] - 2780:1</p> <p>conclusion [4] - 2685:15, 2709:8, 2709:21, 2830:6</p> <p>conclusions [4] - 2682:6, 2709:4, 2741:13, 2741:15</p> <p>conditions [13] - 2732:6, 2765:12, 2769:1, 2769:6, 2772:22, 2778:15, 2805:13, 2806:23, 2807:12, 2850:7, 2861:12, 2885:10, 2885:21</p> <p>conducted [5] - 2752:1, 2793:15, 2831:2, 2831:5, 2895:23</p> <p>conducting [1] - 2704:15</p> <p>confess [1] - 2743:20</p> <p>confident [2] - 2701:8, 2832:5</p> <p>confirm [3] - 2722:24, 2725:5, 2831:18</p> <p>confronted [2] - 2793:20, 2793:25</p> <p>confused [3] - 2757:5, 2815:10, 2845:5</p> <p>confusing [1] - 2779:21</p> <p>confusion [1] - 2773:23</p> <p>Congress [7] - 2675:12, 2677:25, 2678:10, 2717:14, 2717:17, 2717:19,</p>	<p>Congressional [1] - 2700:14</p> <p>connect [6] - 2704:19, 2711:25, 2712:6, 2712:14, 2712:20, 2810:8</p> <p>connected [6] - 2696:24, 2711:13, 2711:19, 2711:22, 2712:18, 2814:23</p> <p>connecting [1] - 2711:17</p> <p>connection [7] - 2678:5, 2698:2, 2790:1, 2790:2, 2790:9, 2790:24, 2820:25</p> <p>connections [1] - 2791:2</p> <p>Connectivity [1] - 2775:18</p> <p>connectivity [22] - 2711:9, 2729:10, 2776:25, 2815:1, 2816:1, 2841:12, 2841:14, 2841:15, 2842:16, 2842:24, 2843:15, 2843:18, 2843:22, 2844:2, 2844:5, 2844:14, 2844:24, 2845:11, 2845:22, 2846:8, 2846:14, 2847:4</p> <p>connects [1] - 2712:8</p> <p>consecutive [1] - 2784:16</p> <p>consensus [1] - 2894:16</p> <p>Conservancy [2] - 2852:19, 2894:24</p> <p>Conservation [2] - 2867:22, 2904:1</p> <p>conservation [31] - 2748:4, 2757:3, 2757:12, 2762:20, 2772:9, 2775:1, 2775:10, 2783:7, 2783:9, 2797:3, 2798:7, 2805:17, 2807:25, 2808:2, 2808:6, 2812:9, 2813:5, 2813:10, 2850:19, 2856:21, 2859:4, 2862:22, 2864:20, 2867:19, 2873:2, 2873:24, 2874:17, 2879:14, 2894:22, 2903:12</p> <p>conservation-based [1] - 2812:9</p>
--	--	---	--	---

<p>conservative [2] - 2845:14, 2845:18 conserve [3] - 2772:6, 2849:11, 2849:17 conserving [1] - 2752:15 consider [7] - 2701:7, 2798:4, 2873:6, 2873:7, 2893:10, 2900:22, 2901:22 considerably [1] - 2891:8 consideration [1] - 2904:4 considerations [1] - 2852:9 considered [15] - 2682:1, 2682:11, 2701:21, 2765:24, 2771:19, 2814:17, 2814:18, 2814:19, 2823:23, 2824:13, 2848:2, 2885:5, 2901:8, 2901:9, 2902:5 considering [1] - 2872:11 consistent [9] - 2681:14, 2682:3, 2691:17, 2692:12, 2706:21, 2707:11, 2751:24, 2763:23, 2834:1 consists [1] - 2679:25 constituting [1] - 2683:2 constraint [2] - 2815:22, 2815:23 construction [6] - 2678:14, 2681:3, 2681:10, 2681:15, 2713:5, 2717:8 consult [1] - 2847:14 consultant [1] - 2724:17 consumer [4] - 2788:5, 2789:20, 2864:7, 2873:3 consumers [4] - 2788:4, 2793:8, 2874:1, 2882:12 consumption [29] - 2710:24, 2750:17, 2767:2, 2767:16, 2768:2, 2779:18, 2780:14, 2781:17, 2781:20, 2794:4, 2797:5, 2810:18, 2839:21, 2855:7, 2855:18, 2855:20,</p>	<p>2880:14, 2881:12, 2883:8, 2884:11, 2884:25, 2885:4, 2886:8, 2886:16, 2887:7, 2889:11, 2889:22, 2890:22, 2905:10 Consumption [1] - 2888:22 consumptive [29] - 2749:12, 2749:17, 2752:11, 2752:21, 2756:18, 2765:25, 2767:20, 2768:21, 2769:7, 2769:9, 2769:12, 2769:18, 2772:23, 2772:25, 2773:5, 2775:2, 2778:18, 2807:18, 2814:1, 2833:15, 2833:18, 2833:20, 2841:23, 2879:24, 2889:15, 2891:7, 2902:6, 2903:8, 2905:15 content [1] - 2728:5 context [12] - 2691:5, 2697:24, 2705:1, 2710:21, 2723:20, 2737:19, 2753:19, 2754:11, 2756:10, 2838:1, 2888:9, 2888:10 contexts [1] - 2864:25 continual [1] - 2735:21 continue [3] - 2714:11, 2719:25, 2885:13 continued [3] - 2694:10, 2836:6, 2836:14 continues [1] - 2692:9 continuing [1] - 2708:10 continuous [1] - 2713:16 contributed [2] - 2753:18, 2754:15 contribution [1] - 2905:2 contributions [1] - 2769:22 control [2] - 2717:19, 2856:3 controlled [1] - 2857:24 controls [1] - 2717:21 conversant [1] - 2691:21</p>	<p>conversation [1] - 2769:25 conversations [4] - 2770:1, 2806:19, 2899:18, 2899:22 convert [1] - 2867:1 copied [1] - 2746:22 copy [8] - 2690:11, 2690:12, 2690:13, 2703:24, 2708:15, 2755:4, 2820:13, 2830:14 corn [2] - 2800:11, 2861:20 Corps [20] - 2677:11, 2678:1, 2678:8, 2685:17, 2685:23, 2694:16, 2694:17, 2702:21, 2715:6, 2715:23, 2716:16, 2719:19, 2730:13, 2732:14, 2847:14, 2847:15, 2847:19, 2847:21, 2848:4, 2848:14 correct [241] - 2715:25, 2716:17, 2716:18, 2717:14, 2717:24, 2717:25, 2718:3, 2718:6, 2718:10, 2718:11, 2718:14, 2718:17, 2718:23, 2721:8, 2721:17, 2721:23, 2722:3, 2722:12, 2722:22, 2723:8, 2723:14, 2723:19, 2724:15, 2724:22, 2724:23, 2724:25, 2726:20, 2727:5, 2727:17, 2727:18, 2727:24, 2728:3, 2728:4, 2728:11, 2728:15, 2728:19, 2729:11, 2729:18, 2729:19, 2729:21, 2729:22, 2730:6, 2732:2, 2732:3, 2732:7, 2732:14, 2732:20, 2733:1, 2733:2, 2733:12, 2734:17, 2735:11, 2735:12, 2735:15, 2735:22, 2736:8, 2738:5, 2738:10, 2739:21, 2740:4, 2740:5, 2742:20, 2747:1, 2747:25, 2748:5, 2748:17,</p>	<p>2749:13, 2749:18, 2749:23, 2750:2, 2750:4, 2750:20, 2750:25, 2752:4, 2753:18, 2754:23, 2755:10, 2755:24, 2756:3, 2756:8, 2757:12, 2757:21, 2758:17, 2761:23, 2762:8, 2762:14, 2762:17, 2762:21, 2762:25, 2764:8, 2764:13, 2765:3, 2765:17, 2767:3, 2771:11, 2771:23, 2772:6, 2772:16, 2773:4, 2774:18, 2775:9, 2775:16, 2775:23, 2776:9, 2777:5, 2779:1, 2779:5, 2779:14, 2779:24, 2780:4, 2781:25, 2782:4, 2782:7, 2783:5, 2784:1, 2784:4, 2784:8, 2784:18, 2786:10, 2786:14, 2786:17, 2786:22, 2788:15, 2788:23, 2788:25, 2790:2, 2790:9, 2791:4, 2791:15, 2793:11, 2793:17, 2794:18, 2794:20, 2795:1, 2796:25, 2797:13, 2798:7, 2798:11, 2798:19, 2798:20, 2798:22, 2799:8, 2799:14, 2799:25, 2800:19, 2800:23, 2801:6, 2801:10, 2801:13, 2801:18, 2802:15, 2803:2, 2804:20, 2805:9, 2805:13, 2806:15, 2806:19, 2807:12, 2807:15, 2807:19, 2808:18, 2808:20, 2808:21, 2808:23, 2811:5, 2813:6, 2814:23, 2814:24, 2815:7, 2816:5, 2816:13, 2816:21, 2816:25, 2817:5, 2817:16, 2817:21, 2818:23, 2819:10, 2820:6, 2820:23, 2821:17, 2821:21, 2822:12, 2823:7, 2823:17, 2824:11,</p>	<p>2826:20, 2826:23, 2827:5, 2827:9, 2827:12, 2827:21, 2828:13, 2828:17, 2830:4, 2830:8, 2830:16, 2830:23, 2831:10, 2832:11, 2833:8, 2833:21, 2835:6, 2835:21, 2836:3, 2836:7, 2836:14, 2836:18, 2837:4, 2837:8, 2838:13, 2838:15, 2838:23, 2839:22, 2840:2, 2840:22, 2841:11, 2841:15, 2841:16, 2842:14, 2843:8, 2843:16, 2844:8, 2844:19, 2847:19, 2847:20, 2848:4, 2848:11, 2848:17, 2848:8, 2898:18, 2898:25, 2899:2, 2899:17, 2899:23, 2904:11, 2907:4 corrected [4] - 2771:14, 2771:18, 2790:6, 2840:20 corrections [2] - 2772:3, 2887:24 correctly [2] - 2692:21, 2800:6 corrects [1] - 2840:9 cost [79] - 2748:3, 2756:19, 2772:8, 2778:17, 2778:19, 2779:12, 2779:23, 2779:25, 2780:2, 2780:3, 2780:5, 2780:7, 2780:11, 2781:1, 2781:14, 2781:18, 2781:22, 2782:1, 2783:3, 2783:6, 2783:23, 2784:5, 2784:7, 2784:17, 2785:1, 2785:11, 2785:18, 2786:6, 2786:21, 2787:2, 2787:4, 2787:11, 2788:1, 2788:4, 2788:8, 2788:12, 2789:2, 2789:4, 2789:5, 2789:9, 2789:10, 2789:16, 2790:1, 2790:2, 2790:21, 2791:2, 2791:18, 2791:23, 2792:6, 2792:9, 2792:10,</p>
---	--	---	---	--

2792:11, 2792:13,
2792:20, 2792:23,
2794:23, 2797:2,
2799:11, 2812:8,
2813:5, 2813:9,
2813:11, 2813:24,
2848:13, 2850:18,
2860:9, 2864:11,
2872:3, 2872:20,
2872:25, 2877:6,
2877:9, 2877:14,
2897:9, 2897:20
costed [1] - 2787:23
costs [31] - 2683:25,
2684:5, 2756:2,
2756:5, 2772:16,
2780:12, 2782:22,
2783:2, 2787:9,
2787:14, 2789:13,
2789:14, 2791:13,
2792:2, 2792:3,
2792:5, 2792:25,
2793:10, 2793:13,
2797:16, 2798:16,
2800:22, 2817:17,
2849:11, 2859:3,
2872:6, 2873:15,
2873:18, 2874:17,
2876:25, 2897:18
cotton [2] - 2800:11,
2861:19
counsel [10] - 2706:1,
2706:3, 2707:6,
2739:5, 2739:9,
2741:9, 2806:19,
2862:4, 2899:19,
2899:22
counties [6] -
2683:16, 2683:20,
2683:21, 2683:24,
2684:4, 2684:6
country [8] - 2745:3,
2850:13, 2850:21,
2852:3, 2857:15,
2867:25, 2885:19,
2890:2
County [3] - 2831:6,
2831:8, 2832:8
couple [9] - 2713:23,
2722:8, 2733:3,
2757:16, 2772:7,
2850:25, 2871:24,
2873:21, 2896:18
course [10] - 2708:7,
2708:24, 2713:2,
2778:2, 2805:5,
2826:16, 2860:21,
2863:10, 2867:21,
2887:23
COURT [1] - 2675:1

court [5] - 2713:3,
2713:4, 2763:13,
2809:7, 2809:20
Court [26] - 2675:12,
2712:24, 2720:1,
2720:19, 2726:1,
2729:4, 2738:14,
2758:21, 2765:15,
2772:15, 2777:19,
2796:23, 2797:10,
2807:1, 2807:11,
2812:21, 2815:15,
2832:10, 2849:22,
2853:21, 2856:7,
2872:7, 2878:10,
2879:4, 2886:17,
2907:16
Court's [2] - 2795:22,
2878:24
cover [3] - 2718:7,
2832:21, 2832:22
covered [2] - 2728:6,
2857:16
Cowie [2] - 2896:18,
2897:5
craft [1] - 2700:25
CRAIG [1] - 2675:20
creating [1] - 2688:20
Creek [2] - 2703:2,
2705:15
crew [1] - 2743:17
critical [1] - 2699:11
crop [21] - 2814:19,
2814:25, 2815:3,
2815:18, 2815:25,
2821:20, 2821:23,
2823:24, 2827:16,
2828:16, 2854:18,
2863:5, 2877:17,
2877:18, 2877:19,
2877:23, 2877:24,
2878:1, 2878:2,
2881:14, 2881:25
crops [14] - 2799:12,
2814:4, 2818:20,
2829:2, 2832:15,
2861:17, 2861:18,
2869:9, 2869:18,
2870:16, 2870:21,
2882:1, 2892:4,
2892:14
cross [8] - 2697:5,
2708:15, 2744:9,
2746:5, 2796:1,
2796:10, 2895:2,
2905:20
CROSS [1] - 2746:7
Cross [1] - 2676:2
CROSS-
EXAMINATION |

2746:7
cross-examination [4]
- 2697:5, 2708:15,
2746:5, 2796:10
cross-examine [1] -
2796:1
crossed [1] - 2899:13
crosswalk [1] -
2794:15
CRR [2] - 2675:14,
2907:15
crystal [1] - 2823:3
cubic [1] - 2696:22
current [2] - 2706:9,
2756:18
curriculum [1] -
2894:14
curtail [2] - 2832:6,
2867:16
curve [1] - 2874:22
curves [2] - 2882:5,
2882:13
customer's [1] -
2871:16
cut [13] - 2737:5,
2769:14, 2777:9,
2777:10, 2781:24,
2789:24, 2794:4,
2799:13, 2802:17,
2803:9, 2805:6,
2814:8, 2851:7
cut-back [2] -
2789:24, 2803:9
cut-backs [2] -
2799:13, 2814:8
cutoff [4] - 2736:12,
2736:13, 2737:6,
2737:8
Cutoff [1] - 2735:25
cutoffs [1] - 2737:4
cuts [3] - 2737:7,
2759:19, 2809:2
cutting [3] - 2712:4,
2893:15, 2901:3
cypress [1] - 2707:16

D

daily [1] - 2734:8
Dam [1] - 2713:5
dam [9] - 2681:6,
2692:2, 2692:15,
2703:3, 2713:9,
2713:16, 2717:16,
2847:18, 2847:23
damage [1] - 2704:22
dams [7] - 2678:14,
2681:10, 2681:15,
2681:18, 2681:20,

Darst [1] - 2730:2
data [14] - 2688:3,
2688:9, 2692:15,
2709:1, 2719:16,
2720:13, 2720:17,
2734:8, 2831:22,
2834:1, 2857:5,
2874:13, 2876:18,
2902:15
database [5] -
2767:20, 2822:5,
2857:7, 2860:23,
2860:25
dataset [1] - 2861:7
datasets [1] - 2740:16
date [7] - 2689:22,
2706:3, 2706:5,
2706:13, 2706:15,
2719:2, 2890:15
dated [5] - 2706:14,
2719:1, 2719:6,
2733:9, 2764:8
dates [1] - 2839:5
David [3] - 2676:4,
2744:24, 2745:17
days [6] - 2702:22,
2760:12, 2760:17,
2857:15, 2857:16,
2896:18
deadline [1] - 2740:15
deal [1] - 2790:17
deauthorization [1] -
2700:14
debate [1] - 2739:4
decade [3] - 2747:4,
2748:14, 2762:7
December [3] -
2809:21, 2879:21,
2907:11
decided [2] - 2894:9,
2895:2
decision [2] -
2828:21, 2877:1
decisions [1] - 2864:1
declaration [1] -
2809:10
Decline [1] - 2708:2
decline [8] - 2708:7,
2709:11, 2709:16,
2709:18, 2709:22,
2710:15, 2836:6,
2836:14
declined [5] -
2806:21, 2835:4,
2835:10, 2835:14,
2835:20
declining [1] -
2835:12
decreased [1] -

decreases [1] -
2841:22
dedicated [1] - 2753:6
deep [8] - 2678:21,
2681:24, 2686:12,
2686:15, 2687:9,
2687:11, 2687:25,
2710:20
deepening [3] -
2681:18, 2681:19,
2728:14
deeper [5] - 2869:19,
2869:25, 2870:7,
2870:16, 2870:25
Defendants [1] -
2675:7
defensive [1] - 2764:2
defer [1] - 2773:13
deficit [16] - 2747:17,
2785:2, 2786:3,
2813:4, 2813:8,
2813:12, 2813:23,
2813:24, 2814:4,
2817:25, 2868:6,
2868:13, 2868:21,
2881:13, 2885:17,
2902:16
Deficit [1] - 2813:1
define [3] - 2748:12,
2838:3, 2838:6
defined [1] - 2884:2
defining [1] - 2813:11
definitely [6] -
2733:22, 2791:6,
2794:6, 2849:21,
2859:13, 2894:20
definitive [1] - 2903:6
degradation [2] -
2719:18, 2729:9
degree [1] - 2827:7
deliverables [3] -
2724:10, 2740:16,
2740:21
delivered [1] -
2721:16
delta [1] - 2713:17
demand [6] - 2765:22,
2856:11, 2856:19,
2863:20, 2882:13,
2891:15
demands [1] -
2806:14
demonstrate [1] -
2850:20
demonstrative [7] -
2746:22, 2758:25,
2761:4, 2767:9,
2774:3, 2774:16,
2795:19
Demonstratives [3] -

<p>2767:11, 2767:12, 2888:20 denied [1] - 2706:24 department [2] - 2893:23, 2894:4 Department [1] - 2894:1 departure [2] - 2817:3, 2817:15 dependent [3] - 2682:15, 2826:5, 2826:6 depicted [4] - 2707:10, 2759:17, 2801:21, 2823:25 depiction [1] - 2767:13 depleted [2] - 2777:20, 2778:5 depletion [4] - 2858:11, 2884:24, 2886:7, 2905:3 depletions [12] - 2776:11, 2797:6, 2805:8, 2858:8, 2859:16, 2859:20, 2869:14, 2879:15, 2881:5, 2884:2, 2884:3, 2884:10 deposed [1] - 2748:22 deposited [3] - 2726:20, 2733:15, 2733:24 deposition [22] - 2709:14, 2712:9, 2730:16, 2748:19, 2751:6, 2753:11, 2754:2, 2770:4, 2771:23, 2773:24, 2811:16, 2811:18, 2819:15, 2819:16, 2827:18, 2830:10, 2835:15, 2836:5, 2836:8, 2840:10, 2840:25, 2899:16 deposits [7] - 2725:20, 2725:24, 2726:18, 2726:19, 2731:11, 2731:12, 2733:22 depth [9] - 2678:23, 2682:14, 2822:22, 2822:23, 2823:24, 2824:6, 2889:5, 2892:8, 2892:13 depths [6] - 2681:11, 2681:12, 2681:21, 2822:4, 2822:15, 2892:4 derived [1] - 2892:3</p>	<p>describe [17] - 2693:17, 2712:23, 2718:24, 2725:5, 2774:25, 2849:9, 2849:22, 2852:2, 2853:21, 2855:14, 2859:1, 2860:20, 2862:17, 2867:12, 2868:17, 2869:5, 2870:17 described [4] - 2689:9, 2696:11, 2812:8, 2846:3 describes [5] - 2680:6, 2683:21, 2706:8, 2707:13, 2831:2 describing [3] - 2679:16, 2837:9, 2856:24 description [2] - 2718:20, 2871:9 Desert [1] - 2853:24 desiccation [2] - 2729:17, 2730:18 designed [1] - 2681:20 designing [1] - 2862:22 desirable [1] - 2756:8 detail [6] - 2683:14, 2753:23, 2836:1, 2846:15, 2854:23, 2897:17 detailed [1] - 2691:12 details [1] - 2851:19 determine [5] - 2703:21, 2783:23, 2794:25, 2807:9, 2822:5 determined [7] - 2703:14, 2704:21, 2705:7, 2814:10, 2818:18, 2822:6, 2822:8 determines [2] - 2814:18, 2855:17 determining [1] - 2873:16 develop [1] - 2740:25 developed [3] - 2729:6, 2733:19, 2856:19 developing [2] - 2770:2, 2903:7 development [2] - 2678:19, 2680:23 diagrams [2] - 2686:22, 2687:3 Diego [2] - 2856:1</p>	<p>2856:17 diet [2] - 2701:5, 2702:6 differ [2] - 2872:20, 2882:5 difference [9] - 2696:22, 2697:1, 2700:16, 2816:3, 2844:20, 2872:23, 2876:13, 2891:2, 2892:19 different [49] - 2697:3, 2703:4, 2708:6, 2711:20, 2711:25, 2712:1, 2712:5, 2715:13, 2747:7, 2762:19, 2763:3, 2769:19, 2771:8, 2771:19, 2772:9, 2772:15, 2773:25, 2774:12, 2774:22, 2775:1, 2775:2, 2778:18, 2789:5, 2789:13, 2792:12, 2792:23, 2805:18, 2807:15, 2814:20, 2815:9, 2828:10, 2834:18, 2838:15, 2839:8, 2840:13, 2840:21, 2843:6, 2843:7, 2849:11, 2850:19, 2853:1, 2856:20, 2859:14, 2876:9, 2878:7, 2879:25, 2891:24, 2892:4, 2896:4 differentiate [1] - 2695:23 differently [3] - 2751:18, 2774:25, 2886:3 differs [1] - 2868:17 difficult [4] - 2728:20, 2755:22, 2768:14, 2820:25 dig [3] - 2686:15, 2687:8, 2687:11 digging [1] - 2686:11 DIRECT [1] - 2745:22 Direct [2] - 2676:2, 2755:4 direct [81] - 2677:16, 2690:19, 2691:18, 2692:5, 2718:19, 2721:4, 2723:1, 2731:18, 2734:4, 2737:22, 2741:13, 2741:15, 2744:8, 2745:24, 2752:13,</p>	<p>2759:1, 2761:15, 2770:14, 2770:16, 2770:21, 2770:25, 2771:4, 2773:10, 2773:15, 2773:16, 2774:9, 2774:17, 2774:18, 2775:15, 2784:3, 2784:21, 2785:15, 2786:17, 2786:20, 2788:21, 2789:3, 2789:17, 2791:10, 2791:12, 2791:25, 2792:1, 2792:17, 2795:22, 2796:1, 2797:18, 2798:12, 2798:19, 2799:11, 2803:22, 2806:25, 2807:22, 2808:13, 2808:14, 2808:23, 2811:14, 2812:17, 2812:23, 2818:2, 2818:9, 2823:15, 2829:16, 2832:24, 2839:11, 2839:16, 2840:9, 2841:18, 2844:6, 2844:24, 2849:5, 2858:18, 2859:22, 2860:1, 2866:1, 2868:9, 2870:15, 2878:6, 2883:22, 2892:1, 2895:7 directly [3] - 2800:10, 2841:24, 2842:11 director [1] - 2809:15 disaggregated [3] - 2858:1, 2858:3, 2863:2 disaggregation [1] - 2716:2 disagree [5] - 2709:8, 2793:24, 2810:14, 2810:23, 2825:7 disappointing [1] - 2896:6 disclosed [3] - 2720:19, 2748:15, 2750:11 disclosing [1] - 2899:21 disconnect [3] - 2707:20, 2711:25, 2712:6 disconnected [1] - 2707:18 discrepancy [1] - 2840:4 discretion [2] - 2825:21, 2825:25</p>	<p>2825:17 discuss [2] - 2865:15, 2892:24 discussed [9] - 2678:17, 2830:9, 2831:15, 2848:5, 2859:21, 2865:12, 2870:4, 2891:5, 2897:17 discussing [3] - 2811:14, 2851:1, 2888:15 discussion [14] - 2680:3, 2681:3, 2681:6, 2682:3, 2682:25, 2702:13, 2704:3, 2709:11, 2710:10, 2711:8, 2754:11, 2754:18, 2812:5, 2821:2 discussions [3] - 2811:2, 2811:3, 2811:6 disease [3] - 2689:19, 2690:1, 2700:1 disengaging [5] - 2900:23, 2901:1, 2901:16, 2901:23, 2902:8 disinterested [1] - 2907:8 dislocated [2] - 2803:10, 2803:23 dislocation [1] - 2803:9 displayed [1] - 2799:20 Disposal [2] - 2725:17, 2725:23 dispute [1] - 2810:6 disputing [1] - 2736:16 dissolved [1] - 2707:23 distinction [4] - 2734:20, 2833:13, 2834:23, 2872:25 distinguish [3] - 2696:15, 2735:5, 2833:16 distinguished [1] - 2894:6 distribution [3] - 2686:22, 2871:14, 2880:7 District [6] - 2809:16, 2852:13, 2853:23, 2854:6, 2856:15, 2904:1 district [3] - 2836:11,</p>
---	---	---	---	---

<p>2852:19, 2888:8 Districts [2] - 2855:9, 2855:19 districts [1] - 2855:11 disturbed [2] - 2693:23, 2730:18 disturbing [1] - 2688:16 dive [1] - 2697:7 divided [1] - 2834:19 Division [1] - 2870:11 divulge [1] - 2899:18 doctor [8] - 2704:7, 2742:7, 2742:10, 2747:8, 2853:9, 2878:17, 2900:3, 2904:8 document [26] - 2677:14, 2677:23, 2677:24, 2678:18, 2683:7, 2683:10, 2690:8, 2690:13, 2691:7, 2691:8, 2697:4, 2697:8, 2704:5, 2706:14, 2706:16, 2706:22, 2710:10, 2717:3, 2717:12, 2723:20, 2759:21, 2885:6, 2896:16, 2896:17, 2896:21 documentation [1] - 2720:8 documented [3] - 2720:20, 2727:1, 2732:14 documents [4] - 2678:7, 2684:12, 2684:23, 2746:4 dollar [1] - 2873:1 dollars [4] - 2791:3, 2864:12, 2873:5, 2895:9 domain [1] - 2749:14 done [41] - 2678:10, 2679:1, 2679:5, 2680:22, 2689:13, 2689:22, 2690:5, 2693:18, 2698:2, 2699:6, 2699:14, 2699:24, 2703:9, 2709:3, 2715:4, 2715:21, 2716:14, 2717:6, 2717:9, 2718:16, 2719:23, 2720:2, 2720:9, 2720:20, 2724:6, 2724:9, 2725:11, 2739:12, 2746:12, 2787:7, 2791:5,</p>	<p>2808:13, 2818:17, 2825:11, 2829:23, 2843:9, 2847:9, 2853:19, 2855:8, 2886:20, 2894:21 double [1] - 2777:5 Doug [1] - 2809:13 Douglas [1] - 2809:10 down [37] - 2683:19, 2686:23, 2713:17, 2715:11, 2723:14, 2726:8, 2733:17, 2733:21, 2734:21, 2734:24, 2734:25, 2772:10, 2779:18, 2779:23, 2780:15, 2780:18, 2781:16, 2781:23, 2782:2, 2787:15, 2794:12, 2795:20, 2797:25, 2806:24, 2810:1, 2827:6, 2835:25, 2855:19, 2866:25, 2870:7, 2870:24, 2872:5, 2883:20, 2884:13, 2897:25, 2900:7 downside [2] - 2827:11, 2828:4 downstream [8] - 2682:9, 2703:1, 2710:3, 2713:6, 2715:8, 2734:10, 2793:9, 2794:18 Dr [202] - 2677:7, 2677:21, 2679:7, 2679:23, 2681:2, 2682:22, 2684:11, 2685:21, 2689:7, 2690:6, 2690:16, 2691:23, 2692:18, 2695:3, 2695:22, 2696:11, 2696:13, 2696:14, 2697:2, 2700:17, 2701:25, 2703:23, 2705:10, 2705:23, 2708:14, 2710:23, 2711:7, 2712:23, 2714:1, 2714:15, 2714:20, 2715:17, 2716:9, 2716:13, 2722:19, 2723:12, 2724:6, 2726:11, 2727:13, 2728:22, 2731:14, 2732:4, 2732:9, 2734:3, 2735:8, 2737:17, 2738:10, 2739:17, 2740:11, 2745:24, 2746:9</p>	<p>2746:14, 2746:20, 2746:24, 2747:10, 2747:24, 2748:22, 2749:8, 2749:21, 2749:24, 2750:4, 2750:8, 2751:6, 2752:1, 2752:16, 2753:22, 2754:13, 2755:9, 2756:1, 2757:6, 2757:15, 2758:7, 2758:16, 2759:2, 2759:7, 2759:11, 2759:18, 2759:24, 2760:3, 2760:8, 2760:21, 2761:1, 2761:5, 2761:20, 2763:9, 2763:19, 2764:21, 2766:1, 2766:24, 2767:1, 2767:14, 2767:15, 2767:19, 2768:3, 2768:11, 2769:5, 2769:6, 2769:13, 2769:20, 2769:21, 2770:10, 2771:13, 2772:2, 2772:23, 2773:4, 2773:24, 2774:4, 2776:1, 2778:22, 2780:21, 2782:22, 2786:1, 2787:4, 2787:15, 2790:16, 2791:22, 2792:24, 2794:16, 2796:6, 2796:7, 2796:8, 2796:18, 2797:15, 2799:7, 2803:21, 2804:13, 2807:9, 2810:5, 2811:15, 2812:3, 2812:7, 2812:25, 2813:14, 2817:25, 2819:15, 2820:5, 2820:15, 2821:6, 2821:22, 2822:2, 2822:8, 2822:11, 2822:17, 2822:19, 2822:20, 2823:3, 2823:4, 2823:14, 2824:2, 2825:15, 2827:17, 2828:11, 2829:23, 2830:11, 2831:5, 2831:10, 2831:12, 2831:15, 2831:19, 2832:1, 2832:2, 2832:17, 2835:15, 2835:18, 2836:2, 2836:9, 2841:2, 2842:4, 2842:5,</p>	<p>2846:8, 2846:11, 2846:13, 2846:16, 2846:19, 2846:20, 2847:2, 2847:9, 2847:13, 2848:13, 2848:25, 2875:16, 2889:3, 2889:4, 2892:21, 2892:22, 2892:25, 2896:18, 2897:5, 2898:4, 2898:12, 2898:21, 2898:24, 2899:2, 2899:4, 2899:15 draft [1] - 2763:16 drain [1] - 2704:23 dramatically [2] - 2680:21, 2875:2 draw [6] - 2700:24, 2805:4, 2820:25, 2850:14, 2878:14, 2879:16 drawing [3] - 2882:10, 2883:5, 2884:19 drawing [2] - 2881:6, 2881:16 dredge [16] - 2687:7, 2687:18, 2688:16, 2710:20, 2725:20, 2725:24, 2726:18, 2726:19, 2727:16, 2727:21, 2730:25, 2732:13, 2732:18, 2733:12, 2733:15, 2733:23 Dredge [1] - 2735:10 Dredging [3] - 2725:16, 2725:22, 2726:8 dredging [52] - 2677:11, 2678:16, 2680:14, 2680:16, 2680:18, 2680:20, 2681:4, 2681:15, 2683:10, 2685:16, 2685:22, 2685:23, 2685:24, 2686:1, 2686:2, 2686:3, 2686:5, 2686:6, 2686:11, 2686:19, 2686:23, 2686:24, 2687:6, 2687:20, 2687:22, 2688:15, 2688:19, 2689:1, 2689:5, 2689:8, 2694:13, 2695:5, 2695:11, 2695:16, 2695:23, 2696:1, 2702:22, 2706:7, 2710:7, 2710:16, 2712:10, 2712:16,</p>	<p>2712:15, 2715:23, 2717:6, 2717:8, 2719:4, 2727:8, 2730:18, 2731:8, 2731:10, 2735:21 draw [3] - 2767:24, 2834:23, 2881:17 dried [1] - 2713:6 drier [4] - 2806:8, 2828:1, 2882:10, 2882:11 drop [2] - 2707:24, 2712:3 Drought [1] - 2851:15 drought [30] - 2716:16, 2756:21, 2784:17, 2787:6, 2788:9, 2788:12, 2801:1, 2806:1, 2806:5, 2807:10, 2807:12, 2807:19, 2808:4, 2808:8, 2841:9, 2841:14, 2844:18, 2847:23, 2863:17, 2878:1, 2885:21, 2890:19, 2890:23, 2891:3, 2891:20, 2892:6, 2892:12, 2892:14, 2903:7 droughts [1] - 2784:13 drove [1] - 2821:11 Drs [2] - 2820:4, 2845:25 dry [43] - 2708:11, 2729:25, 2783:8, 2783:11, 2783:19, 2783:25, 2784:6, 2784:12, 2784:20, 2785:11, 2786:9, 2786:21, 2787:1, 2787:9, 2789:11, 2792:3, 2801:6, 2801:8, 2802:12, 2802:16, 2803:24, 2805:8, 2805:11, 2806:1, 2806:14, 2808:3, 2811:4, 2811:8, 2826:1, 2828:11, 2828:13, 2828:15, 2828:16, 2830:4, 2851:8, 2851:12, 2860:6, 2863:21, 2867:2, 2885:10, 2889:21, 2891:8, 2891:22 dry-land [4] - 2826:1, 2828:11, 2828:15, 2867:2</p>
--	---	--	--	--

<p>drying [1] - 2707:18 due [2] - 2748:16, 2852:8 Dunlap [1] - 2795:21 DUNLAP [1] - 2675:23 duration [2] - 2691:25, 2803:8 during [18] - 2688:15, 2689:1, 2689:4, 2692:2, 2695:16, 2697:5, 2702:22, 2727:6, 2731:7, 2737:10, 2747:6, 2778:8, 2828:13, 2840:10, 2840:25, 2842:4, 2851:11, 2897:5 dynamic [1] - 2712:12 dynamics [3] - 2711:15, 2737:3, 2737:16</p>	<p>2901:6 economical [1] - 2772:18 Economics [1] - 2894:2 economics [3] - 2849:8, 2865:4, 2894:7 economist [10] - 2744:25, 2747:24, 2754:24, 2755:16, 2756:1, 2792:9, 2792:13, 2793:7, 2849:7, 2893:6 economists [2] - 2873:6, 2894:18 economy [1] - 2849:15 ecosystem [7] - 2693:16, 2755:10, 2755:13, 2755:19, 2755:24, 2893:11, 2893:24 ecosystems [1] - 2849:25 effect [14] - 2696:15, 2710:4, 2710:24, 2711:3, 2715:14, 2719:11, 2726:22, 2727:1, 2727:8, 2730:3, 2732:6, 2771:6, 2806:12, 2869:11 effective [1] - 2748:4 effectively [2] - 2734:2, 2818:22 Effects [1] - 2707:9 effects [8] - 2696:1, 2704:13, 2710:8, 2715:13, 2734:14, 2800:8, 2828:2, 2856:20 efficient [2] - 2815:17, 2899:11 efficiently [1] - 2815:24 effort [1] - 2884:19 efforts [1] - 2798:7 eight [1] - 2683:20 either [9] - 2737:6, 2796:19, 2815:15, 2839:8, 2843:10, 2843:16, 2866:22, 2867:8, 2892:25 elastic [1] - 2803:13 elasticity [2] - 2803:18, 2803:21 electricity [1] - 2862:23 element [2] - 2856</p>	<p>2886:17 elements [1] - 2856:23 elevation [1] - 2734:8 Eliminate [1] - 2860:17 eliminate [5] - 2753:17, 2771:6, 2775:7, 2815:4, 2861:16 eliminates [2] - 2827:11, 2828:3 eliminating [4] - 2754:14, 2766:15, 2868:18, 2868:19 elimination [1] - 2758:2 elsewhere [1] - 2852:3 emphasis [1] - 2700:8 emphasize [3] - 2700:3, 2701:4, 2731:5 emphasized [1] - 2700:5 employ [1] - 2865:1 employed [1] - 2851:17 employment [3] - 2798:5, 2799:23, 2804:4 enable [1] - 2756:17 enacting [1] - 2887:20 end [6] - 2683:3, 2726:13, 2731:21, 2801:4, 2843:10, 2843:11 End [1] - 2906:8 endangered [4] - 2697:18, 2697:20, 2697:22, 2893:18 ended [1] - 2899:6 ends [1] - 2897:12 energy [2] - 2864:11, 2877:13 enforced [2] - 2855:8, 2856:2 engaged [1] - 2873:22 Engineers [5] - 2677:11, 2678:2, 2678:9, 2694:16, 2847:15 ensure [1] - 2886:9 ensured [1] - 2693:25 enter [1] - 2777:19 entire [6] - 2679:12, 2691:5, 2706:22, 2726:12, 2878:2, 2898:17 entirely [4] - 2696:2, 2826:1, 2830:6</p>	<p>entirety [1] - 2760:25 entitled [3] - 2675:10, 2707:9, 2708:1 entity [1] - 2856:14 entry [1] - 2861:7 environment [7] - 2745:4, 2849:24, 2850:4, 2873:25, 2888:3, 2896:8, 2896:9 environmental [23] - 2690:22, 2691:17, 2692:3, 2697:10, 2756:6, 2756:20, 2757:19, 2759:10, 2760:7, 2760:18, 2761:22, 2808:7, 2809:1, 2850:7, 2852:8, 2852:16, 2855:4, 2887:11, 2887:18, 2887:20, 2893:13, 2894:6, 2895:25 Environmental [1] - 2870:10 envisioning [1] - 2870:19 EPD's [1] - 2865:17 EQIP [1] - 2868:1 equal [1] - 2877:21 equipment [3] - 2694:19, 2877:4 era [1] - 2719:4 eras [1] - 2706:17 eroded [1] - 2731:3 erodes [1] - 2737:1 eroding [1] - 2737:1 erosion [1] - 2737:7 error [3] - 2772:3, 2840:9, 2840:20 errors [2] - 2768:17, 2771:15 ES.2 [1] - 2767:13 especially [5] - 2685:19, 2685:20, 2708:11, 2811:6, 2838:1 ESQ [10] - 2675:17, 2675:17, 2675:18, 2675:18, 2675:19, 2675:20, 2675:21, 2675:21, 2675:22, 2675:23 essential [2] - 2684:22, 2692:3 essentially [7] - 2681:9, 2704:23, 2710:24, 2712:2, 2740:22, 2765:16,</p>	<p>establish [2] - 2728:7, 2780:20 established [1] - 2815:19 establishment [1] - 2688:11 estimate [17] - 2784:1, 2784:5, 2784:7, 2785:1, 2788:12, 2788:22, 2789:24, 2790:8, 2790:23, 2799:17, 2800:17, 2801:15, 2838:12, 2838:22, 2839:12, 2840:8, 2846:2 estimated [8] - 2767:1, 2767:16, 2768:2, 2770:13, 2779:4, 2782:22, 2799:23, 2837:6 estimates [10] - 2787:18, 2792:16, 2792:17, 2804:5, 2807:24, 2808:11, 2836:21, 2841:13, 2843:2, 2843:21 et [1] - 2730:2 Europe [1] - 2713:23 evaluate [3] - 2698:6, 2873:7, 2874:23 evaluated [5] - 2765:19, 2805:17, 2848:13, 2856:20, 2873:15 evaluating [9] - 2705:3, 2741:1, 2756:7, 2771:25, 2772:15, 2797:12, 2807:17, 2866:16, 2881:20 evaluation [1] - 2865:18 evaporate [1] - 2869:15 evaporation [3] - 2716:17, 2758:1, 2869:10 event [2] - 2709:5, 2907:8 eventually [1] - 2737:7 evident [1] - 2707:15 exacerbated [1] - 2709:19 exactly [9] - 2698:12, 2700:22, 2713:12, 2793:3, 2803:3, 2815:6, 2840:18, 2877:13, 2905:17 exam [1] - 2897:5 EXAMINATION [7] -</p>
<p>E</p>				
<p>early [4] - 2747:9, 2795:6, 2832:6, 2854:4 easel [1] - 2782:20 easement [1] - 2867:4 easements [4] - 2693:25, 2866:13, 2866:19, 2885:8 easier [6] - 2765:6, 2766:23, 2773:11, 2795:2, 2804:25, 2817:6 easily [3] - 2803:16, 2883:16, 2883:17 easy [1] - 2795:4 echoing [1] - 2798:1 ecological [1] - 2708:5 ecologically [2] - 2696:9, 2714:7 ecologist [1] - 2754:25 ecology [1] - 2757:17 economic [25] - 2678:19, 2683:8, 2748:16, 2750:15, 2750:18, 2750:23, 2752:9, 2752:20, 2757:14, 2771:25, 2799:11, 2799:23, 2800:18, 2801:5, 2801:6, 2801:9, 2801:24, 2847:25, 2849:10, 2849:11, 2849:16, 2876:21, 2877:2, 2893:10,</p>	<p>THE REPORTING GROUP</p>			
<p>Mason & Lockhart</p>				

<p>2677:5, 2714:18, 2740:9, 2745:22, 2746:7, 2848:23, 2898:2 examination [5] - 2697:5, 2704:20, 2708:15, 2746:5, 2796:10 examine [1] - 2796:1 examined [4] - 2760:22, 2771:9, 2781:14, 2888:18 examining [3] - 2771:8, 2772:8, 2874:21 example [20] - 2690:21, 2693:5, 2696:21, 2699:13, 2700:6, 2703:8, 2709:10, 2733:17, 2741:17, 2799:19, 2824:15, 2849:13, 2852:10, 2867:14, 2883:9, 2889:17, 2892:2, 2893:14, 2894:21 examples [9] - 2705:15, 2793:12, 2849:23, 2850:1, 2850:8, 2850:14, 2850:15, 2850:25, 2874:12 excavate [2] - 2686:17, 2704:18 exceed [3] - 2768:11, 2803:1, 2905:9 exceeding [1] - 2830:4 exceeds [2] - 2769:6, 2769:8 excellent [2] - 2693:12, 2708:21 exception [1] - 2752:12 excerpted [4] - 2746:17, 2759:24, 2762:16, 2807:23 excessive [6] - 2778:12, 2861:17, 2861:21, 2868:18, 2868:19, 2902:16 exchange [2] - 2867:6, 2867:17 exclusive [1] - 2859:10 exclusively [2] - 2811:8, 2826:11 excuse [1] - 2696:16 Excuse [1] - 2853:8 executive [1] -</p>	<p>2809:15 exercise [5] - 2701:5, 2702:6, 2799:22, 2825:21, 2825:25 Exhibit [10] - 2677:22, 2682:23, 2682:25, 2685:14, 2690:10, 2690:14, 2720:15, 2809:6, 2865:11, 2884:20 exhibit [8] - 2759:18, 2762:2, 2809:7, 2820:12, 2865:8, 2869:20, 2884:20, 2896:13 EXHIBITS [1] - 2676:7 existence [1] - 2706:20 existing [2] - 2737:15, 2777:21 exists [2] - 2694:8, 2792:6 expand [2] - 2716:10, 2852:22 expanded [1] - 2705:22 expect [6] - 2694:10, 2695:12, 2737:9, 2737:13, 2891:3, 2891:18 expectation [2] - 2683:14, 2711:16 expected [2] - 2684:5, 2877:21 expensive [5] - 2814:9, 2814:11, 2815:4, 2860:11, 2877:4 experience [14] - 2686:14, 2741:23, 2743:18, 2795:2, 2828:24, 2832:16, 2856:8, 2856:10, 2856:25, 2866:20, 2868:2, 2884:22, 2886:6, 2886:19 experienced [1] - 2793:5 experiences [1] - 2830:18 experiment [1] - 2832:9 expert [42] - 2724:16, 2738:6, 2739:14, 2740:2, 2741:22, 2745:1, 2746:13, 2748:15, 2749:25, 2754:21, 2757:1, 2757:9, 2757:10, 2759:4, 2759:25</p>	<p>2761:6, 2762:2, 2767:14, 2770:23, 2774:5, 2774:7, 2779:3, 2783:24, 2787:23, 2791:9, 2796:7, 2798:13, 2798:16, 2803:18, 2803:22, 2804:13, 2805:7, 2805:15, 2813:16, 2821:23, 2834:4, 2836:2, 2836:9, 2843:16, 2846:10, 2849:7, 2874:11 expertise [2] - 2810:13, 2848:10 Experts [3] - 2758:13, 2759:23 experts [15] - 2749:14, 2754:19, 2756:25, 2757:17, 2757:19, 2761:11, 2810:24, 2811:2, 2811:4, 2811:10, 2819:12, 2825:13, 2848:6, 2871:12 Expires [1] - 2907:17 explain [18] - 2680:2, 2681:8, 2682:3, 2683:5, 2697:8, 2698:23, 2700:22, 2704:3, 2707:10, 2746:11, 2791:10, 2791:13, 2840:14, 2858:10, 2862:10, 2889:5, 2891:18, 2901:1 explained [4] - 2681:25, 2706:18, 2841:17, 2900:5 explanation [1] - 2889:8 exports [4] - 2766:15, 2771:6, 2775:8, 2883:15 exposed [1] - 2708:6 extensive [5] - 2678:16, 2714:2, 2743:17, 2888:13, 2895:23 extent [2] - 2717:10, 2789:8 exterminated [1] - 2713:9 extreme [1] - 2877:24 extremely [1] - 2857:5</p>	<p>facilities [1] - 2837:19 fact [13] - 2695:13, 2697:17, 2710:3, 2714:9, 2720:1, 2721:22, 2751:3, 2755:22, 2783:9, 2811:9, 2831:21, 2886:16, 2905:12 factor [8] - 2843:22, 2844:2, 2844:5, 2844:14, 2847:8, 2883:17, 2901:5, 2901:6 factors [8] - 2712:8, 2716:19, 2716:24, 2728:14, 2814:15, 2816:1, 2828:22, 2828:23 faculty [2] - 2893:23, 2894:8 failure [1] - 2828:16 fair [10] - 2771:13, 2775:6, 2797:14, 2840:11, 2854:19, 2875:2, 2877:20, 2884:1, 2891:14, 2898:11 fairly [1] - 2896:17 fall [1] - 2883:1 Fallon [1] - 2853:4 familiar [23] - 2738:12, 2742:12, 2743:9, 2743:12, 2743:15, 2747:3, 2758:5, 2759:21, 2760:5, 2760:15, 2761:2, 2761:13, 2816:3, 2824:22, 2853:17, 2902:12, 2902:19, 2902:23, 2902:25, 2903:14, 2903:18, 2903:22, 2903:25 family [2] - 2889:24, 2889:25 far [8] - 2683:2, 2684:7, 2693:24, 2694:2, 2832:4, 2832:13, 2861:22, 2897:21 farm [9] - 2801:19, 2803:20, 2803:23, 2828:20, 2829:7, 2831:6, 2869:2, 2869:6, 2869:15 farmer [3] - 2822:10, 2863:23, 2864:1 farmer's [2] - 2829:2, 2829:6 farmers [65] -</p>	<p>2814:20, 2815:11, 2815:20, 2815:24, 2817:4, 2817:6, 2817:8, 2817:14, 2818:19, 2821:16, 2822:5, 2822:15, 2822:21, 2823:5, 2824:5, 2824:17, 2824:24, 2825:20, 2825:24, 2827:24, 2828:11, 2828:15, 2828:17, 2830:1, 2830:12, 2832:6, 2851:7, 2851:11, 2851:24, 2854:2, 2854:5, 2854:12, 2855:13, 2857:11, 2857:18, 2862:13, 2864:8, 2865:1, 2867:6, 2867:9, 2867:15, 2868:20, 2868:23, 2869:6, 2870:20, 2870:21, 2875:16, 2876:2, 2876:5, 2876:9, 2876:18, 2876:25, 2877:3, 2877:7, 2877:11, 2877:22, 2882:12, 2885:11, 2885:19, 2886:21, 2887:9, 2888:6, 2891:24 farming [7] - 2801:17, 2826:1, 2826:4, 2828:12, 2828:15, 2850:6, 2866:25 farms [7] - 2826:22, 2832:9, 2876:6, 2876:11, 2876:14, 2876:16 farthest [1] - 2872:2 fat [3] - 2738:5, 2738:19, 2739:19 faucet [1] - 2864:5 fault [1] - 2791:11 feasible [1] - 2850:23 feature [1] - 2734:1 February [11] - 2690:16, 2764:11, 2774:5, 2786:2, 2789:10, 2791:23, 2792:4, 2792:16, 2839:24, 2840:12, 2899:6 fed [1] - 2867:3 federal [11] - 2677:10, 2678:14, 2685:16, 2809:20, 2853:24, 2867:8, 2867:18, 2867:21, 2877:25,</p>
---	--	---	--	---

F

2904:10, 2904:19
federally [1] - 2877:18
feet [5] - 2696:22, 2838:4, 2838:23, 2839:21, 2840:1
felt [1] - 2701:23
few [9] - 2679:11, 2698:11, 2824:9, 2849:22, 2858:7, 2864:12, 2885:5, 2889:3, 2894:8
fewer [3] - 2760:11, 2790:15, 2863:18
field [14] - 2684:12, 2684:18, 2685:3, 2685:7, 2685:9, 2703:12, 2705:7, 2831:20, 2849:15, 2857:17, 2857:18, 2857:24, 2891:13, 2894:4
fields [1] - 2854:18
fifteen [1] - 2802:10
fifth [1] - 2733:21
figure [27] - 2693:9, 2732:11, 2732:21, 2732:23, 2732:24, 2733:1, 2733:3, 2736:9, 2761:19, 2767:13, 2767:21, 2768:22, 2769:12, 2773:2, 2773:4, 2778:14, 2821:19, 2823:16, 2823:17, 2823:21, 2829:22, 2840:11, 2843:14, 2857:17, 2874:6, 2891:6
figured [1] - 2786:6
figures [4] - 2736:9, 2821:1, 2891:22, 2892:3
filed [3] - 2777:25, 2809:20, 2832:25
filing [1] - 2809:8
fill [1] - 2710:21
fills [1] - 2687:9
final [2] - 2740:20, 2807:11
finance [1] - 2829:7
financial [4] - 2827:13, 2828:9, 2872:3, 2872:19
Findings [1] - 2731:15
fine [8] - 2702:2, 2719:23, 2780:10, 2795:7, 2824:3, 2838:11, 2875:7, 2879:2
finish [3] - 2724:3,

2724:12, 2782:15
firm [1] - 2688:20
First [1] - 2717:14
first [79] - 2679:11, 2684:25, 2687:23, 2690:20, 2691:14, 2691:24, 2694:15, 2695:25, 2700:4, 2711:19, 2713:15, 2723:13, 2735:20, 2737:19, 2746:24, 2758:17, 2762:1, 2762:3, 2767:13, 2773:21, 2774:4, 2775:6, 2778:17, 2779:9, 2779:10, 2780:7, 2781:10, 2782:24, 2783:24, 2784:21, 2784:23, 2785:1, 2787:17, 2787:22, 2789:6, 2791:17, 2795:17, 2798:23, 2798:25, 2799:5, 2804:3, 2804:13, 2804:16, 2804:18, 2804:22, 2804:23, 2808:11, 2808:22, 2809:6, 2813:16, 2834:4, 2834:5, 2834:9, 2836:2, 2837:1, 2838:25, 2840:4, 2840:18, 2840:21, 2844:4, 2844:9, 2847:5, 2852:14, 2858:19, 2858:25, 2859:5, 2860:16, 2862:24, 2871:8, 2873:10, 2874:11, 2877:3, 2888:19, 2896:21, 2899:10, 2899:12, 2900:11
fiscal [8] - 2789:4, 2789:13, 2791:18, 2792:5, 2792:13, 2859:3, 2872:3, 2872:25
Fish [24] - 2690:17, 2692:12, 2698:6, 2703:10, 2704:12, 2705:6, 2720:9, 2721:16, 2721:19, 2722:2, 2722:5, 2722:20, 2723:5, 2726:17, 2727:2, 2727:14, 2730:5, 2735:9, 2735:19, 2738:18, 2738:24, 2739:18, 2740:3, 2741:24

fish [5] - 2696:10, 2699:18, 2699:21, 2707:19, 2750:2
fishermen [3] - 2689:3, 2695:14, 2803:1
fishery [2] - 2750:1, 2750:16
fishing [2] - 2749:16, 2749:22
fits [1] - 2828:23
five [6] - 2678:14, 2686:13, 2734:6, 2737:24, 2830:25, 2876:8
five-year-olds [1] - 2686:13
fixing [5] - 2689:23, 2699:8, 2699:10, 2699:25, 2880:6
FLA [1] - 2758:13
Flewelling [13] - 2758:7, 2758:10, 2766:24, 2767:1, 2767:15, 2768:3, 2768:11, 2769:5, 2769:6, 2769:21, 2772:23, 2773:4, 2889:3
Flewelling's [2] - 2767:14, 2767:19
flier [1] - 2784:24
flies [1] - 2857:14
Flint [18] - 2678:4, 2682:10, 2682:13, 2851:15, 2851:21, 2857:9, 2861:14, 2876:3, 2900:24, 2901:8, 2901:10, 2901:15, 2901:17, 2902:7, 2902:10, 2902:19, 2903:22, 2903:25
flip [2] - 2707:6, 2765:6
flood [3] - 2732:6, 2736:24, 2737:10
floodplain [13] - 2693:22, 2694:1, 2694:8, 2694:12, 2702:8, 2714:9, 2729:11, 2729:16, 2734:23, 2735:1, 2735:2, 2735:6, 2810:8
Floodplain [2] - 2728:24, 2735:10
floodplains [1] - 2693:23

FLORIDA [1] - 2675:3
Florida [98] - 2675:17, 2684:2, 2684:10, 2690:10, 2690:13, 2693:18, 2693:21, 2694:13, 2694:20, 2694:23, 2698:5, 2698:6, 2698:24, 2702:21, 2702:23, 2705:11, 2705:19, 2720:9, 2721:16, 2721:19, 2722:20, 2723:5, 2724:14, 2724:18, 2724:20, 2726:17, 2727:2, 2727:14, 2727:21, 2728:9, 2729:8, 2730:5, 2730:12, 2730:19, 2732:1, 2735:9, 2735:19, 2736:20, 2736:23, 2738:18, 2738:24, 2739:18, 2740:3, 2740:24, 2741:24, 2744:23, 2746:25, 2748:16, 2749:13, 2750:13, 2750:19, 2752:2, 2752:10, 2752:14, 2752:20, 2753:6, 2754:19, 2754:22, 2756:20, 2757:2, 2757:11, 2758:12, 2759:23, 2760:7, 2762:2, 2772:20, 2777:14, 2777:18, 2777:24, 2778:2, 2778:4, 2783:22, 2793:9, 2793:22, 2794:12, 2794:18, 2797:1, 2797:4, 2802:18, 2808:7, 2809:16, 2811:4, 2819:12, 2821:7, 2821:11, 2821:17, 2848:7, 2863:11, 2873:25, 2884:20, 2890:5, 2893:1, 2893:2, 2895:4, 2895:24, 2904:21, 2905:4
Florida's [9] - 2744:24, 2749:16, 2749:21, 2757:16, 2757:18, 2759:4, 2802:19, 2848:6, 2893:7
Floridan [4] - 2870:2, 2870:6, 2870:8, 2870:24
Florida's [9] - 2689:11,

2689:16, 2689:19, 2690:2, 2690:22, 2691:17, 2691:25, 2692:4, 2692:8, 2692:15, 2693:1, 2694:3, 2694:9, 2696:16, 2697:1, 2697:22, 2702:7, 2702:10, 2704:13, 2704:19, 2708:12, 2711:17, 2712:2, 2712:22, 2713:12, 2713:16, 2714:12, 2714:13, 2714:22, 2715:6, 2716:20, 2736:24, 2742:5, 2742:6, 2852:8, 2855:4, 2855:18, 2873:20, 2893:12
flowing [3] - 2707:21, 2730:16, 2737:14
flows [35] - 2692:16, 2692:19, 2692:24, 2693:7, 2693:13, 2695:24, 2696:2, 2696:3, 2696:18, 2704:15, 2707:14, 2709:20, 2710:9, 2710:11, 2711:1, 2711:20, 2711:22, 2712:1, 2712:5, 2712:20, 2715:10, 2715:15, 2715:24, 2716:13, 2726:19, 2732:5, 2735:3, 2735:7, 2736:25, 2737:10, 2810:7, 2810:18, 2833:7, 2851:6
Flows [1] - 2707:9
fluctuations [2] - 2712:11, 2712:13
flush [2] - 2712:19, 2727:10
flushing [1] - 2712:16
fluvial [7] - 2684:14, 2685:4, 2685:10, 2744:2, 2744:3, 2744:5
fluvius [1] - 2744:4
focus [19] - 2700:18, 2710:12, 2711:10, 2715:19, 2730:10, 2748:2, 2766:1, 2787:17, 2797:15, 2812:25, 2834:7, 2834:20, 2856:25, 2865:14, 2878:4, 2884:9, 2890:8, 2891:11, 2893:5

THE REPORTING GROUP

Mason & Lockhart

<p>focused [7] - 2726:13, 2805:11, 2805:20, 2811:4, 2811:8, 2845:10, 2872:22</p> <p>focusing [6] - 2765:9, 2766:10, 2771:1, 2787:21, 2792:22, 2792:23</p> <p>follow [3] - 2732:8, 2759:8, 2799:4</p> <p>follow-up [1] - 2759:8</p> <p>following [2] - 2680:1, 2809:25</p> <p>force [1] - 2803:12</p> <p>forecast [2] - 2856:11, 2856:20</p> <p>foreclose [1] - 2866:24</p> <p>foregoing [1] - 2907:4</p> <p>forest [2] - 2696:8, 2893:14</p> <p>form [1] - 2752:22</p> <p>former [1] - 2900:16</p> <p>forth [2] - 2769:18, 2790:13</p> <p>fortunately [1] - 2713:10</p> <p>four [12] - 2734:5, 2762:19, 2763:3, 2763:5, 2764:6, 2764:10, 2774:5, 2790:5, 2804:19, 2845:12, 2858:17, 2899:5</p> <p>four-page [1] - 2858:17</p> <p>fourth [1] - 2733:21</p> <p>fraction [5] - 2863:3, 2864:20, 2864:22, 2870:20, 2876:9</p> <p>frame [1] - 2881:3</p> <p>Francisco [1] - 2856:18</p> <p>free [1] - 2854:14</p> <p>frequency [1] - 2691:25</p> <p>Frequent [1] - 2728:24</p> <p>frequently [1] - 2687:17</p> <p>fresh [2] - 2702:6, 2733:22</p> <p>Friant [1] - 2713:5</p> <p>Friday [1] - 2906:6</p> <p>front [1] - 2763:4</p> <p>full [4] - 2801:17, 2801:20, 2858:18, 2899:9</p> <p>full-time [2] - 2801:17, 2801:20</p> <p>fully [2] - 2742:4,</p>	<p>2742:5</p> <p>function [1] - 2684:19</p> <p>fundamentally [1] - 2865:4</p> <p>future [3] - 2695:2, 2705:22, 2714:13</p> <p>FX-530 [2] - 2676:11, 2690:14</p> <p>FX-784 [5] - 2676:12, 2762:1, 2779:10, 2798:25, 2799:4</p> <p>FX-801 [3] - 2764:7, 2764:11, 2838:16</p> <p>fx-801 [1] - 2676:12</p> <p>FX-895 [1] - 2676:13</p> <hr/> <p style="text-align: center;">G</p> <hr/> <p>Gage [1] - 2734:22</p> <p>gage [2] - 2720:13, 2720:17</p> <p>gages [2] - 2692:2, 2887:4</p> <p>gained [3] - 2683:9, 2703:22, 2741:23</p> <p>gains [1] - 2793:4</p> <p>gallon [5] - 2842:7, 2842:9, 2842:12, 2842:19, 2842:22</p> <p>gallons [7] - 2834:11, 2835:5, 2836:18, 2842:20, 2897:13, 2897:22</p> <p>Gangloff [2] - 2739:15, 2740:1</p> <p>gaps [1] - 2871:17</p> <p>gasoline [1] - 2683:1</p> <p>gather [1] - 2897:25</p> <p>gauging [1] - 2896:2</p> <p>gears [1] - 2812:7</p> <p>gem [1] - 2714:5</p> <p>general [5] - 2753:16, 2753:20, 2756:9, 2816:5, 2903:16</p> <p>generality [2] - 2849:3, 2851:18</p> <p>generally [2] - 2702:17, 2863:7</p> <p>generate [4] - 2788:25, 2794:1, 2830:3, 2832:11</p> <p>generated [1] - 2800:14</p> <p>generating [1] - 2806:12</p> <p>generations [1] - 2714:14</p> <p>generic [1] - 2856:15</p> <p>Geological [1] - 2688:9</p>	<p>geomorphologist [1] - 2684:14</p> <p>geomorphology [3] - 2685:4, 2685:5, 2685:10</p> <p>GEORGIA [1] - 2675:6</p> <p>Georgia [104] - 2675:20, 2678:22, 2679:19, 2679:20, 2679:21, 2681:13, 2684:4, 2684:6, 2684:8, 2706:3, 2707:6, 2717:6, 2717:10, 2717:11, 2717:19, 2717:21, 2718:4, 2741:10, 2748:3, 2749:17, 2752:2, 2756:17, 2761:22, 2762:20, 2767:10, 2769:23, 2772:5, 2772:19, 2776:7, 2776:18, 2777:4, 2777:8, 2777:10, 2778:6, 2778:25, 2780:25, 2781:17, 2782:6, 2788:1, 2788:4, 2792:20, 2794:17, 2794:22, 2802:17, 2802:25, 2803:11, 2803:19, 2803:23, 2807:18, 2809:2, 2815:15, 2816:15, 2817:17, 2817:20, 2818:18, 2819:2, 2819:9, 2821:10, 2821:15, 2821:20, 2822:4, 2822:15, 2822:21, 2823:5, 2824:18, 2824:23, 2825:20, 2826:2, 2830:8, 2832:4, 2832:6, 2832:10, 2833:23, 2836:22, 2839:18, 2845:23, 2850:19, 2850:22, 2854:8, 2857:7, 2859:11, 2859:15, 2862:5, 2863:15, 2870:10, 2873:17, 2873:23, 2874:15, 2874:23, 2875:16, 2876:2, 2885:3, 2885:4, 2885:18, 2886:10, 2891:23, 2895:2, 2895:25, 2896:24, 2897:18, 2902:12, 2904:22, 2905:6</p>	<p>2716:17, 2748:17, 2749:12, 2750:17, 2752:10, 2752:21, 2754:21, 2759:8, 2767:2, 2767:16, 2769:7, 2769:9, 2776:2, 2777:20, 2779:13, 2796:8, 2836:9, 2837:6, 2857:20, 2862:4, 2871:12</p> <p>given [17] - 2707:1, 2728:20, 2765:22, 2778:12, 2778:19, 2780:8, 2780:15, 2783:21, 2791:1, 2813:25, 2843:13, 2845:16, 2864:13, 2884:22, 2885:21, 2886:6, 2887:7</p> <p>GLICKMAN [1] - 2675:19</p> <p>goal [1] - 2697:11</p> <p>goals [3] - 2887:19, 2887:20, 2887:21</p> <p>God [1] - 2745:10</p> <p>goods [1] - 2680:25</p> <p>goodwill [1] - 2729:7</p> <p>gosh [2] - 2764:19, 2818:7</p> <p>government [2] - 2851:9, 2852:18</p> <p>Governor [1] - 2718:4</p> <p>graduate [1] - 2894:14</p> <p>graduates [1] - 2894:5</p> <p>graph [2] - 2690:24, 2690:25</p> <p>graphically [2] - 2878:12, 2882:16</p> <p>grass [1] - 2870:22</p> <p>gravel [2] - 2680:8, 2681:1</p> <p>gray [1] - 2895:16</p> <p>graying [2] - 2895:19, 2895:21</p> <p>great [2] - 2701:13, 2855:22</p> <p>greater [4] - 2682:14, 2768:20, 2781:5, 2827:6</p> <p>Greenblatt [2] - 2758:17, 2759:2</p> <p>Greenblatt's [3] - 2759:1, 2759:11, 2759:18</p> <p>greenhouses [1] - 2870:22</p> <p>grew [1] - 2698:13</p> <p>gross [2] - 2796:19,</p>	<p>ground [7] - 2800:11, 2832:22, 2842:8, 2864:11, 2877:10, 2877:15, 2886:15</p> <p>groundwater [10] - 2777:6, 2814:23, 2843:6, 2854:8, 2861:3, 2861:10, 2864:9, 2877:11, 2889:18, 2889:19</p> <p>group [2] - 2705:18, 2869:23</p> <p>groups [1] - 2894:23</p> <p>grow [5] - 2781:20, 2863:5, 2870:22, 2882:1, 2886:1</p> <p>growers [3] - 2827:15, 2856:4, 2863:4</p> <p>growing [5] - 2799:12, 2824:3, 2857:18, 2862:13, 2863:10</p> <p>grown [3] - 2857:23, 2892:4, 2892:14</p> <p>grows [1] - 2734:1</p> <p>growth [2] - 2823:2, 2823:25</p> <p>guess [2] - 2699:11, 2757:5</p> <p>Gulf [3] - 2679:5, 2682:20, 2683:15</p> <p>GX [1] - 2821:9</p> <p>GX-1276 [3] - 2676:15, 2809:4, 2809:6</p> <p>GX-1335 [4] - 2676:16, 2722:18, 2740:12, 2742:13</p> <p>GX-248 [3] - 2676:14, 2700:20, 2702:12</p> <p>GX-88 [2] - 2676:14, 2708:16</p> <p>GX-898 [3] - 2676:15, 2820:9, 2821:6</p> <hr/> <p style="text-align: center;">H</p> <hr/> <p>habitat [10] - 2688:22, 2695:1, 2696:25, 2698:7, 2704:15, 2704:16, 2708:8, 2730:14, 2810:9, 2893:18</p> <p>habitats [5] - 2690:3, 2693:6, 2693:8, 2693:12, 2730:11</p> <p>half [7] - 2692:23, 2707:7, 2857:9, 2859:6, 2862:5, 2876:4, 2895:8</p> <p>halfway [2] - 2726:8, 2810:1</p>
--	--	--	--	--

<p>hand [9] - 2715:24, 2745:6, 2746:4, 2833:3, 2865:8, 2884:15, 2895:11, 2896:13, 2907:10</p> <p>handed [7] - 2677:21, 2694:18, 2774:1, 2865:11, 2884:18, 2888:20, 2895:14</p> <p>handle [1] - 2847:21</p> <p>handout [17] - 2762:16, 2765:10, 2773:9, 2773:11, 2773:15, 2773:20, 2782:25, 2785:15, 2787:22, 2804:16, 2804:17, 2804:23, 2804:24, 2804:25, 2805:5, 2807:23, 2812:18</p> <p>hands [2] - 2804:8, 2873:5</p> <p>handwrote [1] - 2820:12</p> <p>handy [2] - 2784:24, 2792:19</p> <p>hanging [1] - 2699:21</p> <p>happy [1] - 2716:10</p> <p>Harbors [1] - 2718:9</p> <p>harm [12] - 2700:4, 2700:19, 2705:5, 2705:8, 2748:16, 2750:12, 2750:19, 2750:24, 2753:18, 2754:16, 2754:22, 2760:12</p> <p>harvesters [1] - 2802:20</p> <p>head [1] - 2824:20</p> <p>header [1] - 2717:13</p> <p>heading [1] - 2785:25</p> <p>heal [3] - 2701:6, 2701:7, 2702:11</p> <p>healing [6] - 2692:10, 2694:6, 2701:3, 2701:25, 2702:4, 2702:5</p> <p>health [2] - 2693:4, 2693:19</p> <p>healthy [3] - 2692:9, 2692:20, 2694:9</p> <p>heard [7] - 2743:14, 2778:10, 2811:9, 2831:12, 2861:22, 2862:3, 2876:23</p> <p>HEARING [1] - 2675:10</p> <p>hearing [2] - 2745:8, 2751:2</p> <p>heart [3] - 2701:12,</p>	<p>2701:16, 2701:21</p> <p>heavy [1] - 2694:18</p> <p>heavy-handed [1] - 2694:18</p> <p>height [1] - 2696:17</p> <p>held [1] - 2675:11</p> <p>Helen [3] - 2708:16, 2719:9, 2730:2</p> <p>hello [2] - 2898:4, 2898:5</p> <p>help [10] - 2693:19, 2742:11, 2745:10, 2753:19, 2782:19, 2793:21, 2849:5, 2882:15, 2886:12, 2887:15</p> <p>helped [1] - 2854:11</p> <p>helping [1] - 2726:1</p> <p>helps [2] - 2826:22, 2826:25</p> <p>hereby [1] - 2907:3</p> <p>high [9] - 2694:7, 2726:19, 2732:5, 2841:10, 2843:11, 2851:18, 2869:18, 2870:16, 2870:21</p> <p>high-value [3] - 2869:18, 2870:16, 2870:21</p> <p>higher [12] - 2735:2, 2768:1, 2806:14, 2825:4, 2825:8, 2849:2, 2870:16, 2881:1, 2881:2, 2882:13, 2882:14, 2883:25</p> <p>highlight [2] - 2703:25, 2709:7</p> <p>highlighted [6] - 2697:4, 2700:20, 2706:19, 2707:3, 2709:13, 2714:20</p> <p>highly [4] - 2714:6, 2803:13, 2845:14, 2845:17</p> <p>hiking [1] - 2893:16</p> <p>hired [2] - 2694:22, 2705:18</p> <p>historical [6] - 2684:12, 2684:21, 2684:23, 2685:6, 2685:11, 2720:13</p> <p>historically [1] - 2854:5</p> <p>history [6] - 2723:7, 2724:24, 2725:5, 2725:10, 2728:18, 2852:15</p> <p>Hoehn [6] - 2706:2, 2706:15, 2721:1</p>	<p>2721:19, 2721:22, 2721:25</p> <p>Hoehn's [1] - 2718:25</p> <p>hold [1] - 2811:21</p> <p>hole [4] - 2686:12, 2686:15, 2687:9, 2687:25</p> <p>home [1] - 2871:16</p> <p>honey [1] - 2696:9</p> <p>Honor [44] - 2677:3, 2677:17, 2690:9, 2691:6, 2691:15, 2691:20, 2714:17, 2722:16, 2724:2, 2739:4, 2740:7, 2742:9, 2744:10, 2744:12, 2744:21, 2745:19, 2746:3, 2746:11, 2748:20, 2751:13, 2751:16, 2773:22, 2774:11, 2780:17, 2782:9, 2786:15, 2795:5, 2795:12, 2796:12, 2848:20, 2865:7, 2875:4, 2875:14, 2884:15, 2890:24, 2895:10, 2896:12, 2897:24, 2900:2, 2902:14, 2902:21, 2903:20, 2905:21, 2905:23</p> <p>Hoogenboom [8] - 2820:4, 2821:22, 2822:2, 2822:8, 2822:11, 2822:17, 2822:19, 2824:2</p> <p>Hoogenboom's [1] - 2823:4</p> <p>hook [3] - 2733:20, 2733:25, 2905:25</p> <p>hooks [1] - 2741:4</p> <p>hope [3] - 2729:6, 2768:22, 2805:1</p> <p>hoping [1] - 2705:22</p> <p>horizontal [2] - 2733:4, 2733:7</p> <p>Hornberger [11] - 2710:23, 2715:16, 2758:10, 2763:9, 2763:19, 2846:4, 2846:7, 2846:13, 2846:19, 2847:2, 2889:4</p> <p>Hornberger's [2] - 2696:13, 2842:4</p> <p>Hornbergerer [1] - 2846:1</p> <p>Horticultural [1] -</p>	<p>hot [3] - 2687:2, 2869:15, 2889:21</p> <p>House [2] - 2718:10, 2718:12</p> <p>housekeeping [1] - 2795:16</p> <p>huge [2] - 2678:22, 2904:9</p> <p>human [8] - 2684:16, 2684:20, 2684:21, 2701:3, 2723:8, 2724:24, 2728:21, 2893:12</p> <p>Human [1] - 2728:2</p> <p>hundred [3] - 2791:6, 2793:10, 2852:7</p> <p>hundreds [3] - 2791:2, 2792:25, 2876:15</p> <p>hybrid [3] - 2806:11, 2806:17, 2807:14</p> <p>hydrogeologist [1] - 2843:13</p> <p>hydrologic [1] - 2749:12</p> <p>hydrological [1] - 2848:1</p> <p>hydrologists [2] - 2811:7, 2845:17</p> <p>hydrology [7] - 2765:12, 2765:19, 2765:23, 2783:22, 2805:13, 2805:18, 2805:22</p> <p style="text-align: center;">I</p> <p>idea [2] - 2687:11, 2815:7</p> <p>ideas [1] - 2903:6</p> <p>identification [2] - 2762:3, 2795:18</p> <p>identified [4] - 2697:15, 2697:17, 2697:21, 2823:7</p> <p>identifies [1] - 2736:7</p> <p>identify [5] - 2696:15, 2801:23, 2863:3, 2878:12, 2882:23</p> <p>identifying [1] - 2864:19</p> <p>illustrate [3] - 2860:2, 2879:14, 2885:2</p> <p>imagery [3] - 2741:19, 2857:17, 2888:14</p> <p>imagine [1] - 2707:2</p> <p>immediately [1] - 2886:14</p> <p>impact [37] - 2703:15, 2703:22, 2709:17,</p>	<p>2711:2, 2714:22, 2715:5, 2715:23, 2731:4, 2748:16, 2750:19, 2750:24, 2751:2, 2752:10, 2752:20, 2755:13, 2755:19, 2755:24, 2776:23, 2797:11, 2799:13, 2800:18, 2800:19, 2801:1, 2801:5, 2801:6, 2801:9, 2804:4, 2833:11, 2843:6, 2843:10, 2843:14, 2860:3, 2860:4, 2902:7</p> <p>impacted [2] - 2730:14, 2800:9</p> <p>Impacts [1] - 2799:8</p> <p>impacts [34] - 2684:15, 2684:21, 2695:5, 2695:23, 2695:24, 2700:11, 2701:10, 2706:8, 2723:8, 2724:25, 2730:13, 2731:7, 2742:3, 2749:12, 2757:20, 2760:4, 2771:25, 2793:9, 2794:18, 2798:5, 2798:9, 2798:24, 2799:18, 2799:24, 2801:24, 2802:8, 2802:15, 2803:4, 2812:6, 2849:10, 2849:16, 2849:24, 2873:4, 2873:6</p> <p>Imperial [9] - 2853:18, 2853:22, 2853:23, 2854:1, 2854:2, 2854:5, 2854:12, 2886:4, 2888:5</p> <p>IMPLAN's [1] - 2804:4</p> <p>implement [6] - 2772:19, 2815:8, 2855:20, 2857:6, 2885:3, 2885:17</p> <p>implementation [1] - 2771:20</p> <p>implementing [1] - 2879:25</p> <p>implication [1] - 2889:9</p> <p>implicit [1] - 2781:4</p> <p>implies [2] - 2768:16, 2782:2</p> <p>imply [1] - 2776:7</p> <p>importance [2] - 2708:5, 2710:11</p> <p>important [14] -</p>
---	--	---	--	---

<p>2683:12, 2688:22, 2689:24, 2693:20, 2694:2, 2696:6, 2696:10, 2696:20, 2729:5, 2735:4, 2753:17, 2833:16, 2843:4, 2871:10</p> <p>importantly [2] - 2852:23, 2858:22</p> <p>imposed [1] - 2905:14</p> <p>imposing [1] - 2874:8</p> <p>impossible [1] - 2687:24</p> <p>impoundments [2] - 2758:2, 2869:6</p> <p>improper [1] - 2798:4</p> <p>improve [1] - 2826:23</p> <p>improvement [4] - 2682:14, 2682:15, 2695:7, 2695:9</p> <p>improvements [1] - 2817:19</p> <p>improves [1] - 2881:19</p> <p>improving [1] - 2743:25</p> <p>IN [1] - 2907:10</p> <p>in-stream [3] - 2851:5, 2852:23, 2852:24</p> <p>inappropriate [1] - 2895:20</p> <p>incentive [1] - 2864:14</p> <p>incentives [1] - 2865:4</p> <p>inches [12] - 2863:8, 2863:9, 2863:13, 2863:18, 2863:23, 2885:20, 2885:21, 2885:22, 2892:15, 2892:17</p> <p>include [9] - 2699:15, 2762:18, 2791:13, 2798:18, 2807:23, 2868:1, 2889:14, 2889:16, 2894:13</p> <p>included [11] - 2740:2, 2749:24, 2755:2, 2761:14, 2763:5, 2770:14, 2794:7, 2798:12, 2834:9, 2838:6, 2895:6</p> <p>including [4] - 2871:5, 2878:1, 2878:2, 2886:11</p> <p>increased [3] - 2680:20, 2828:12, 2828:16</p> <p>increases [1] - 2844:17</p> <p>increasing [1] - 2704:14</p>	<p>incredible [1] - 2857:19</p> <p>increment [1] - 2749:19</p> <p>incremental [5] - 2756:19, 2757:13, 2780:3, 2872:6, 2872:19</p> <p>Incremental [1] - 2872:2</p> <p>incur [1] - 2784:18</p> <p>indeed [1] - 2774:17</p> <p>independent [1] - 2886:7</p> <p>INDEX [1] - 2676:1</p> <p>indicate [2] - 2692:25, 2759:18</p> <p>indication [1] - 2890:15</p> <p>indicator [1] - 2894:25</p> <p>indicators [1] - 2903:8</p> <p>indirect [8] - 2797:16, 2798:8, 2798:16, 2799:23, 2800:8, 2800:17, 2801:5, 2801:9</p> <p>Indirect [1] - 2799:8</p> <p>indirectly [1] - 2801:23</p> <p>indirectly-affected [1] - 2801:23</p> <p>individual [1] - 2733:16</p> <p>Induced [1] - 2799:8</p> <p>induced [3] - 2800:18, 2801:5, 2801:24</p> <p>industrial [10] - 2766:2, 2832:20, 2837:13, 2837:17, 2838:1, 2838:8, 2838:9, 2856:6, 2860:15, 2871:5</p> <p>industries [4] - 2749:17, 2749:22, 2799:13, 2800:8</p> <p>industry [2] - 2750:12, 2802:23</p> <p>inexpensive [1] - 2864:10</p> <p>infers [1] - 2874:25</p> <p>influences [1] - 2829:6</p> <p>inform [2] - 2685:11, 2695:2</p> <p>information [18] - 2685:8, 2696:14, 2719:24, 2719:25, 2720:2, 2720:5, 2730:3, 2730:9, 2734:16, 2767:1</p>	<p>2794:13, 2845:16, 2857:10, 2857:12, 2857:19, 2857:20, 2857:25, 2874:5</p> <p>informed [2] - 2698:25, 2741:22</p> <p>informs [1] - 2680:3</p> <p>initial [8] - 2740:18, 2762:7, 2764:5, 2805:7, 2843:20, 2849:6, 2865:17, 2872:21</p> <p>initiated [1] - 2694:14</p> <p>initiative [1] - 2678:20</p> <p>injury [1] - 2751:3</p> <p>inlets [1] - 2702:18</p> <p>inputs [1] - 2826:7</p> <p>inspection [1] - 2705:7</p> <p>Inspections [1] - 2736:1</p> <p>installed [1] - 2857:8</p> <p>instance [3] - 2819:19, 2824:13, 2877:3</p> <p>instances [2] - 2821:12, 2824:9</p> <p>instead [1] - 2737:15</p> <p>instituted [1] - 2851:10</p> <p>institutional [2] - 2817:18, 2851:19</p> <p>institutions [1] - 2817:24</p> <p>instruct [1] - 2893:23</p> <p>instrument [1] - 2794:7</p> <p>insurance [5] - 2827:16, 2877:17, 2877:18, 2877:19, 2877:24</p> <p>insure [2] - 2877:22, 2877:25</p> <p>intensity [1] - 2747:6</p> <p>intensive [2] - 2685:24, 2857:5</p> <p>interacted [1] - 2761:12</p> <p>interbasin [1] - 2758:3</p> <p>interested [1] - 2829:1</p> <p>interests [1] - 2680:13</p> <p>interfere [1] - 2810:19</p> <p>internally [1] - 2713:21</p> <p>internet [1] - 2810:1</p> <p>interrupting [1] - 2862:2</p> <p>interval [1] - 2696:24</p> <p>intervene [1] - 2794:13, 2845:16, 2857:10, 2857:12, 2857:19, 2857:20, 2857:25, 2874:5</p>	<p>introduced [1] - 2898:13</p> <p>introducing [1] - 2691:8</p> <p>intrusive [2] - 2701:8, 2701:11</p> <p>intuitive [1] - 2844:16</p> <p>inundate [1] - 2810:9</p> <p>inundated [1] - 2693:8</p> <p>inundating [2] - 2693:15, 2707:14</p> <p>Inundation [1] - 2728:25</p> <p>inventoried [1] - 2711:21</p> <p>inverse [1] - 2779:17</p> <p>investigator [1] - 2821:11</p> <p>investigators [1] - 2724:21</p> <p>investments [2] - 2894:22, 2895:3</p> <p>invite [3] - 2889:8, 2892:7, 2897:1</p> <p>invoked [1] - 2860:6</p> <p>involve [1] - 2817:2</p> <p>involved [7] - 2678:14, 2691:11, 2713:3, 2748:13, 2757:24, 2762:6, 2851:23</p> <p>involvement [2] - 2747:9, 2852:12</p> <p>involves [2] - 2886:18, 2887:19</p> <p>involving [1] - 2850:2</p> <p>Irmak [1] - 2822:20</p> <p>irrigate [15] - 2818:20, 2828:17, 2867:10, 2875:16, 2876:3, 2876:6, 2876:9, 2876:11, 2876:12, 2876:16, 2876:17, 2876:20, 2876:21, 2877:1, 2877:2</p> <p>irrigated [10] - 2779:13, 2820:23, 2820:24, 2852:7, 2861:1, 2861:4, 2862:20, 2867:2, 2887:1, 2891:16</p> <p>irrigates [1] - 2822:10</p> <p>irrigating [11] - 2821:17, 2825:22, 2842:11, 2851:25, 2861:11, 2867:6, 2868:20, 2877:7, 2877:8, 2877:11, 2885:14</p> <p>irrigation [67] - 2786:3, 2799:12, 2801:16, 2803:25, 2813:4, 2813:8, 2813:12, 2813:23, 2813:25, 2814:5, 2814:8, 2817:25, 2819:13, 2820:21, 2821:3, 2821:8, 2822:4, 2822:15, 2822:21, 2822:23, 2825:16, 2826:4, 2826:12, 2826:22, 2826:25, 2827:3, 2827:7, 2827:8, 2828:1, 2829:6, 2830:2, 2832:7, 2849:23, 2851:11, 2852:20, 2854:13, 2861:17, 2861:21, 2866:1, 2866:6, 2866:14, 2866:21, 2866:23, 2867:16, 2868:6, 2868:13, 2868:14, 2868:18, 2868:19, 2868:21, 2869:1, 2876:24, 2876:25, 2877:5, 2880:24, 2881:1, 2881:13, 2882:1, 2885:9, 2885:17, 2892:4, 2892:8, 2902:16, 2902:17</p>	<p>Irrigation [5] - 2813:1, 2852:13, 2853:23, 2854:6, 2903:18</p> <p>irrigators [1] - 2816:25</p> <p>isolated [1] - 2707:22</p> <p>issue [12] - 2778:11, 2833:7, 2839:4, 2840:24, 2848:9, 2850:5, 2872:7, 2872:23, 2886:12, 2886:13, 2886:22, 2897:9</p> <p>issues [13] - 2706:18, 2707:2, 2708:10, 2747:4, 2754:12, 2766:22, 2771:17, 2772:7, 2811:9, 2832:22, 2849:19, 2851:5, 2855:4</p> <p>item [10] - 2682:22, 2683:2, 2683:12, 2861:16, 2865:25, 2868:4, 2871:8, 2878:13, 2878:14, 2895:11</p> <p>items [3] - 2700:18, 2771:3, 2904:21</p>
---	---	--	--	---

<p>itself [8] - 2679:4, 2701:7, 2702:11, 2735:5, 2783:25, 2850:22, 2852:19, 2885:5</p>	<p>Ken [2] - 2782:18, 2783:13 kept [1] - 2687:25 kerosene [1] - 2683:1 kind [10] - 2685:1, 2685:10, 2743:5, 2761:9, 2789:5, 2796:5, 2817:11, 2821:16, 2856:15, 2882:11 kinds [5] - 2684:22, 2684:25, 2794:8, 2838:2, 2904:15 Klamath [8] - 2713:20, 2850:9, 2851:3, 2851:4, 2851:19, 2867:13, 2886:4 knowing [1] - 2711:15 knowledge [1] - 2691:14 known [2] - 2713:4, 2854:9 knows [1] - 2812:11 Kondolf [46] - 2676:3, 2677:7, 2677:21, 2679:7, 2679:23, 2681:2, 2682:22, 2684:11, 2685:21, 2689:7, 2690:6, 2690:16, 2691:23, 2692:18, 2695:3, 2695:22, 2697:2, 2700:17, 2701:25, 2703:23, 2705:10, 2705:23, 2708:14, 2711:7, 2712:23, 2714:1, 2714:15, 2714:20, 2715:17, 2716:9, 2716:13, 2722:19, 2723:12, 2723:16, 2724:6, 2726:11, 2727:13, 2728:22, 2731:14, 2732:4, 2732:9, 2734:3, 2735:8, 2737:17, 2739:17, 2740:11 Korea [1] - 2713:25</p>	<p>lack [5] - 2688:3, 2689:19, 2690:1, 2697:22, 2708:12 laid [2] - 2764:10, 2777:12 LANCASTER [72] - 2675:11, 2677:2, 2677:4, 2677:19, 2691:19, 2714:16, 2726:3, 2726:6, 2726:9, 2739:7, 2740:8, 2742:10, 2742:15, 2742:18, 2742:22, 2743:2, 2743:8, 2743:11, 2743:16, 2743:21, 2743:24, 2744:7, 2744:13, 2744:16, 2744:22, 2745:21, 2746:6, 2782:16, 2795:7, 2795:14, 2796:11, 2796:13, 2796:15, 2820:11, 2848:21, 2853:8, 2853:11, 2865:9, 2875:7, 2875:13, 2875:20, 2875:25, 2878:17, 2878:20, 2884:16, 2895:12, 2898:1, 2900:1, 2900:3, 2900:11, 2900:14, 2901:2, 2901:11, 2901:20, 2902:11, 2902:18, 2902:22, 2903:2, 2903:13, 2903:17, 2903:21, 2903:24, 2904:3, 2904:8, 2904:14, 2904:20, 2904:25, 2905:8, 2905:19, 2905:22, 2905:24, 2906:2 Land [1] - 2894:24 land [13] - 2705:17, 2752:15, 2753:6, 2816:9, 2816:19, 2826:1, 2828:11, 2828:15, 2849:13, 2861:4, 2866:6, 2867:2, 2867:5 landings [1] - 2749:20 landscape [2] - 2843:2, 2886:25 Langseth [7] - 2842:5, 2843:24, 2845:25, 2846:11, 2846:16, 2846:20, 2847:9 Langseth's [1] - 2846:8</p>	<p>2843:17 large [16] - 2678:12, 2678:25, 2686:1, 2694:18, 2701:7, 2701:11, 2704:5, 2748:6, 2755:10, 2837:18, 2852:6, 2853:4, 2853:23, 2861:9, 2869:17, 2876:6 large-scale [3] - 2678:25, 2686:1, 2852:6 largely [6] - 2695:11, 2709:1, 2752:12, 2778:11, 2811:8, 2833:24 larger [6] - 2680:22, 2723:22, 2867:21, 2876:11, 2876:14, 2881:17 larger-scale [1] - 2680:22 largest [2] - 2683:2, 2702:25 last [28] - 2682:22, 2685:25, 2686:6, 2688:9, 2688:10, 2688:24, 2690:24, 2691:1, 2693:9, 2716:6, 2718:7, 2727:19, 2730:20, 2734:5, 2736:7, 2743:5, 2745:15, 2745:17, 2770:17, 2805:1, 2813:17, 2835:10, 2835:20, 2846:21, 2872:1, 2885:6, 2897:6, 2897:7 last-minute [1] - 2743:5 lastly [1] - 2869:18 Latin [4] - 2738:2, 2738:7, 2744:4, 2744:5 Latin-based [1] - 2744:4 latter [1] - 2707:7 LAURA [1] - 2675:19 lawn [4] - 2871:19, 2873:14, 2873:18, 2880:24 lawns [1] - 2874:3 lawyers [2] - 2729:3, 2747:18 lead [1] - 2832:3 leading [1] - 2890:25 leak [8] - 2766:13, 2871:7,</p>	<p>2872:10, 2880:2, 2880:5, 2880:13, 2880:17 leaks [6] - 2871:11, 2871:13, 2871:16, 2880:8, 2880:11, 2880:18 leaky [1] - 2880:6 least [20] - 2693:23, 2700:1, 2715:14, 2739:11, 2757:6, 2771:17, 2776:8, 2776:18, 2784:2, 2812:8, 2813:5, 2813:9, 2813:11, 2813:24, 2814:8, 2814:10, 2815:3, 2880:25, 2889:12, 2897:12 least-cost [5] - 2812:8, 2813:5, 2813:9, 2813:11, 2813:24 leave [3] - 2702:2, 2864:3, 2864:4 left [1] - 2824:5 legal [3] - 2778:11, 2817:20, 2817:22 legislature [1] - 2791:19 lenders [2] - 2828:19, 2828:25 length [1] - 2865:12 lengthy [2] - 2729:3, 2746:13 Lenny [1] - 2830:7 Less [1] - 2728:24 less [20] - 2707:14, 2727:9, 2759:12, 2759:18, 2780:5, 2781:1, 2781:18, 2787:4, 2859:7, 2864:17, 2868:24, 2868:25, 2876:12, 2885:24, 2885:25, 2890:22, 2897:21, 2902:25, 2905:5, 2905:6 lethal [1] - 2707:25 letter [6] - 2677:24, 2690:16, 2691:2, 2692:13, 2717:1, 2717:23 letting [1] - 2724:12 level [37] - 2709:11, 2709:16, 2709:22, 2710:15, 2711:9, 2711:17, 2712:2, 2712:7, 2712:13, 2712:18, 2734:16,</p>
J				
<p>JAMIE [1] - 2675:17 January [8] - 2777:21, 2778:5, 2809:20, 2879:19, 2880:24, 2880:25, 2881:23, 2890:16 Joaquin [5] - 2713:2, 2713:5, 2713:8, 2713:16, 2713:18 job [9] - 2708:23, 2798:17, 2801:12, 2801:19, 2802:24, 2803:5, 2803:7, 2803:24, 2804:7 jobs [9] - 2800:9, 2801:17, 2801:21, 2801:23, 2801:24, 2802:3, 2802:11, 2802:12, 2802:16 joint [1] - 2740:3 Joint [5] - 2677:22, 2682:23, 2682:24, 2685:14, 2685:11 JOSHUA [1] - 2675:23 judge [1] - 2692:16 July [2] - 2860:23, 2881:2 June [5] - 2879:20, 2881:2, 2881:21, 2881:22, 2907:17 June-July [1] - 2881:2 justify [1] - 2678:11 JX-1 [3] - 2676:9, 2716:25, 2717:13 JX-128 [2] - 2676:9, 2720:12 JX-154 [7] - 2676:10, 2866:4, 2866:12, 2869:21, 2870:10, 2870:13, 2871:2</p>				
K	L			
<p>Kayatta [2] - 2900:16, 2900:20 keep [6] - 2692:8, 2709:25, 2790:13, 2851:12, 2865:21, 2878:18 keeping [2] - 2869:20, 2882:23 Kelly [2] - 2703:3, 2705:15</p>	<p>LA [1] - 2856:17 label [1] - 2792:21 labeled [6] - 2775:18, 2789:4, 2803:4, 2890:5, 2890:14, 2896:21 labeling [1] - 2883:2 labor [2] - 2803:12, 2803:13</p>			

<p>2734:24, 2765:22, 2777:21, 2778:20, 2778:25, 2779:18, 2779:19, 2780:2, 2780:4, 2780:11, 2780:14, 2780:15, 2781:6, 2781:16, 2781:23, 2814:22, 2816:5, 2846:15, 2849:3, 2850:6, 2851:18, 2858:13, 2858:14, 2897:16, 2897:20</p> <p>levels [19] - 2696:4, 2707:23, 2708:7, 2734:14, 2747:6, 2756:18, 2778:5, 2778:20, 2779:1, 2779:14, 2780:4, 2780:9, 2781:1, 2781:11, 2781:18, 2781:23, 2781:24, 2782:3</p> <p>Levels [1] - 2728:24</p> <p>licensed [2] - 2802:20, 2803:2</p> <p>life [1] - 2873:4</p> <p>lifting [2] - 2864:11, 2877:10</p> <p>Light [3] - 2708:16, 2730:2</p> <p>light [1] - 2864:3</p> <p>Light's [1] - 2719:9</p> <p>lightly [2] - 2701:14, 2701:18</p> <p>likely [6] - 2735:21, 2738:19, 2739:19, 2804:5, 2817:18, 2817:23</p> <p>likened [1] - 2701:12</p> <p>limit [2] - 2745:2, 2854:6</p> <p>limitation [1] - 2863:12</p> <p>limitations [1] - 2885:11</p> <p>limited [5] - 2686:24, 2708:24, 2849:24, 2850:3, 2871:6</p> <p>line [30] - 2690:25, 2732:25, 2733:1, 2736:7, 2749:3, 2751:5, 2751:8, 2751:9, 2752:16, 2752:18, 2753:10, 2754:4, 2767:24, 2768:10, 2768:16, 2770:3, 2770:6, 2770:7, 2797:25, 2811:15, 2811:17,</p>	<p>2811:21, 2811:23, 2819:24, 2819:25, 2823:22, 2827:20, 2834:20, 2835:16, 2883:19</p> <p>lines [5] - 2734:6, 2737:24, 2790:5, 2827:18, 2845:12</p> <p>link [1] - 2810:1</p> <p>list [2] - 2697:20, 2728:13</p> <p>listed [1] - 2684:4</p> <p>litigation [1] - 2850:2</p> <p>live [1] - 2763:13</p> <p>living [1] - 2704:24</p> <p>loan [2] - 2828:21, 2829:7</p> <p>loaning [1] - 2829:4</p> <p>local [3] - 2680:24, 2856:3, 2874:3</p> <p>location [3] - 2705:8, 2843:1, 2843:5</p> <p>long-term [3] - 2709:19, 2856:11, 2856:19</p> <p>look [57] - 2684:22, 2691:5, 2694:25, 2700:9, 2709:9, 2710:6, 2720:5, 2720:7, 2720:17, 2723:13, 2725:20, 2725:21, 2733:16, 2733:22, 2737:19, 2755:7, 2756:2, 2760:4, 2764:11, 2767:15, 2770:13, 2782:23, 2790:4, 2792:19, 2804:1, 2804:15, 2820:15, 2820:18, 2823:21, 2840:17, 2841:9, 2841:20, 2849:10, 2853:12, 2858:18, 2862:24, 2866:4, 2866:5, 2869:20, 2881:5, 2881:15, 2882:6, 2882:21, 2885:20, 2886:20, 2886:23, 2886:25, 2887:2, 2887:3, 2888:14, 2892:1, 2892:2, 2893:6, 2893:24, 2894:21, 2900:6</p> <p>looked [19] - 2680:18, 2686:21, 2687:3, 2688:7, 2704:17, 2706:22, 2757:7, 2763:1, 2771:22, 2779:22, 2787:6</p>	<p>2814:22, 2830:12, 2849:19, 2861:20, 2874:1, 2876:5, 2882:9, 2901:14</p> <p>looking [21] - 2684:15, 2684:18, 2693:9, 2700:6, 2717:13, 2732:19, 2764:17, 2769:21, 2789:6, 2789:9, 2800:7, 2812:16, 2814:25, 2822:24, 2832:13, 2844:6, 2858:2, 2859:2, 2869:8, 2887:9, 2891:6</p> <p>looks [6] - 2692:23, 2707:16, 2720:12, 2859:5, 2859:6, 2859:8</p> <p>loose [4] - 2688:17, 2717:3, 2755:4, 2832:25</p> <p>looser [1] - 2887:25</p> <p>Los [1] - 2856:13</p> <p>lose [4] - 2708:7, 2802:16, 2803:5, 2803:24</p> <p>loses [1] - 2804:7</p> <p>loss [14] - 2729:17, 2730:15, 2788:5, 2790:7, 2790:23, 2791:3, 2801:16, 2802:24, 2873:12, 2874:7, 2877:23, 2878:1</p> <p>losses [4] - 2798:17, 2801:12, 2801:19, 2873:3</p> <p>lost [4] - 2800:10, 2802:12, 2869:16, 2871:18</p> <p>loud [2] - 2818:14, 2878:22</p> <p>low [13] - 2686:8, 2695:24, 2704:13, 2714:22, 2715:6, 2715:24, 2716:13, 2827:12, 2828:5, 2841:10, 2843:10, 2843:19, 2860:8</p> <p>Low [1] - 2707:9</p> <p>lower [16] - 2681:19, 2695:25, 2696:4, 2704:19, 2707:14, 2710:10, 2712:18, 2734:22, 2776:3, 2778:25, 2782:6, 2828:12, 2901:15, 2901:16, 2901:18,</p>	<p>Lower [5] - 2728:24, 2861:14, 2900:24, 2901:8, 2901:10</p> <p>lowered [2] - 2710:8, 2711:1</p> <hr/> <p style="text-align: center;">M</p> <hr/> <p>magnitude [2] - 2691:25, 2905:5</p> <p>main [2] - 2702:7, 2872:23</p> <p>Maine [7] - 2675:13, 2675:15, 2743:22, 2743:23, 2763:12, 2854:25, 2907:3</p> <p>mainstem [1] - 2730:17</p> <p>mainstream [1] - 2730:17</p> <p>maintain [1] - 2681:11</p> <p>maintaining [1] - 2692:7</p> <p>majority [3] - 2696:7, 2824:4, 2864:21</p> <p>managed [1] - 2884:25</p> <p>Management [3] - 2743:13, 2809:16, 2902:24</p> <p>management [8] - 2704:15, 2704:16, 2855:12, 2864:1, 2887:15, 2887:17, 2887:18, 2888:9</p> <p>MANER [1] - 2675:21</p> <p>manner [1] - 2886:9</p> <p>manufacturers [1] - 2837:18</p> <p>maps [1] - 2733:4</p> <p>Marcia [1] - 2758:25</p> <p>marked [5] - 2677:21, 2690:10, 2795:18, 2820:8, 2890:4</p> <p>marker [1] - 2879:5</p> <p>markers [1] - 2878:8</p> <p>market [2] - 2815:17, 2867:23</p> <p>marketplace [1] - 2816:24</p> <p>Mary [5] - 2736:5, 2736:8, 2736:11, 2736:16, 2736:18</p> <p>Mason [4] - 2675:14, 2907:2, 2907:15, 2907:15</p> <p>massive [1] - 2683:9</p> <p>MASTER [72] - 2675:11, 2677:2, 2677:19,</p>	<p>2691:19, 2714:16, 2726:3, 2726:6, 2726:9, 2739:7, 2740:8, 2742:10, 2742:15, 2742:18, 2742:22, 2743:2, 2743:8, 2743:11, 2743:16, 2743:21, 2743:24, 2744:7, 2744:13, 2744:16, 2744:22, 2745:21, 2746:6, 2782:16, 2795:7, 2795:14, 2796:11, 2796:13, 2796:15, 2820:11, 2848:21, 2853:8, 2853:11, 2865:9, 2875:7, 2875:13, 2875:20, 2875:25, 2878:17, 2878:20, 2884:16, 2895:12, 2898:1, 2900:1, 2900:3, 2900:11, 2900:14, 2901:2, 2901:11, 2901:20, 2902:11, 2902:18, 2902:22, 2903:2, 2903:13, 2903:17, 2903:21, 2903:24, 2904:3, 2904:8, 2904:14, 2904:20, 2904:25, 2905:8, 2905:19, 2905:22, 2905:24, 2906:2</p> <p>Mat [1] - 2723:16</p> <p>matched [2] - 2857:11, 2857:21</p> <p>matching [1] - 2862:12</p> <p>material [1] - 2728:6</p> <p>math [8] - 2766:22, 2775:21, 2776:21, 2782:8, 2782:10, 2784:20, 2788:11, 2791:5</p> <p>mathias [1] - 2676:3</p> <p>matter [6] - 2675:10, 2678:6, 2753:16, 2756:9, 2762:8, 2849:6</p> <p>matters [2] - 2774:12, 2795:16</p> <p>maximize [1] - 2815:21</p> <p>maximizes [1] - 2854:15</p> <p>maximum [11] - 2691:25, 2761:15, 2818:25, 2822:21, 2822:25, 2823:6,</p>
--	--	---	--	--

2823:23, 2824:5,
2868:21, 2868:23,
2886:1
Mayer [2] - 2836:9,
2836:16
McDowell [3] -
2846:12, 2846:21,
2847:3
mean [22] - 2702:11,
2719:15, 2736:21,
2764:2, 2794:19,
2804:7, 2806:7,
2815:15, 2817:8,
2872:4, 2874:2,
2883:12, 2887:16,
2888:10, 2894:18,
2896:1, 2901:1,
2901:3, 2901:17,
2902:8, 2904:12,
2904:14
meander [4] -
2736:24, 2736:25,
2737:4, 2737:5
meaning [3] -
2765:23, 2877:20,
2895:21
means [12] - 2681:8,
2700:23, 2756:7,
2760:25, 2765:16,
2812:9, 2813:5,
2814:2, 2869:5,
2870:18, 2878:13,
2884:5
meant [4] - 2842:1,
2862:1, 2873:19,
2901:16
measure [12] -
2832:11, 2860:16,
2864:20, 2870:19,
2871:1, 2874:19,
2880:2, 2880:5,
2880:19, 2881:7,
2881:19, 2894:4
measured [2] -
2863:7, 2863:9
measures [53] -
2745:1, 2748:4,
2757:3, 2757:12,
2775:1, 2783:10,
2783:24, 2784:10,
2784:12, 2786:25,
2787:1, 2787:7,
2788:9, 2805:17,
2807:25, 2808:2,
2808:6, 2834:18,
2849:11, 2850:19,
2850:23, 2851:1,
2855:25, 2858:20,
2859:4, 2859:7,
2859:10, 2860:3,

2860:5, 2860:7,
2860:14, 2873:5,
2873:24, 2874:15,
2879:14, 2879:25,
2880:3, 2881:11,
2881:13, 2882:17,
2883:8, 2884:23,
2886:10, 2886:15,
2886:19, 2887:21,
2887:24, 2902:5,
2902:7, 2903:9,
2905:12
Measures [1] -
2866:18
measuring [1] -
2903:7
mechanism [3] -
2817:1, 2866:19,
2867:23
medical [1] - 2689:17
medicine [1] -
2700:25
meeting [2] - 2870:5,
2870:9
Meeting [1] - 2870:11
Mekong [1] - 2713:21
members [2] -
2723:11, 2725:11
memorialized [1] -
2740:12
memory [2] - 2763:23,
2800:1
mention [4] - 2720:8,
2721:7, 2721:11,
2722:15
mentioned [20] -
2695:10, 2700:19,
2701:25, 2703:23,
2718:15, 2722:9,
2722:11, 2723:6,
2729:21, 2729:23,
2750:4, 2757:15,
2820:5, 2842:6,
2853:16, 2854:21,
2873:9, 2877:16,
2888:5, 2892:21
mentioning [1] -
2873:22
met [1] - 2831:10
meter [1] - 2871:15
metering [6] - 2822:5,
2857:7, 2886:22,
2888:15, 2902:13,
2902:15
meters [1] - 2857:8
methodology [2] -
2768:12, 2875:1
methods [3] -
2684:25, 2685:3,
2894:17

metric [3] - 2760:11,
2789:16, 2789:21
metro [9] - 2769:14,
2772:24, 2791:4,
2834:14, 2835:9,
2835:19, 2836:10,
2871:6, 2873:17
Metropolitan [1] -
2856:14
Mexico [1] - 2850:12
mgd [1] - 2897:21
Michael [2] - 2739:15,
2740:1
microphone [6] -
2745:13, 2747:10,
2747:20, 2853:9,
2875:21, 2900:6
middle [8] - 2725:19,
2725:22, 2731:18,
2738:20, 2739:20,
2840:14, 2840:15,
2846:1
middle-of-the-road
[1] - 2846:1
might [30] - 2686:7,
2692:17, 2692:22,
2701:21, 2737:14,
2751:17, 2765:5,
2772:18, 2793:17,
2795:5, 2800:3,
2800:9, 2803:5,
2803:17, 2824:19,
2843:19, 2858:12,
2860:9, 2860:10,
2860:12, 2868:24,
2872:7, 2873:3,
2882:4, 2884:11,
2886:3, 2886:8,
2889:8, 2893:17,
2897:2
migratory [1] - 2853:6
mile [15] - 2687:1,
2694:25, 2695:4,
2698:8, 2705:21,
2710:2, 2710:3,
2710:14, 2715:8,
2715:19, 2722:21,
2732:20, 2734:15,
2736:8, 2741:3
miles [1] - 2695:25
mill [1] - 2680:10
million [33] - 2785:2,
2785:11, 2785:19,
2785:22, 2785:23,
2786:8, 2786:9,
2786:13, 2786:22,
2787:4, 2787:11,
2788:1, 2788:2,
2788:13, 2788:14,

2791:6, 2791:7,
2792:3, 2792:6,
2792:25, 2793:10,
2800:17, 2800:18,
2801:4, 2801:8,
2835:4, 2835:5,
2897:12, 2897:13,
2897:21, 2897:22
millions [2] - 2791:3,
2867:24
mind [13] - 2709:25,
2752:23, 2811:13,
2817:8, 2820:3,
2825:12, 2865:21,
2869:20, 2878:11,
2882:23, 2885:7,
2885:16, 2894:3
mindful [1] - 2782:12
minimal [1] - 2756:19
minimize [2] - 2793:8,
2817:17
minimized [1] -
2704:14
minimizing [1] -
2794:17
minimum [3] -
2681:21, 2691:24,
2704:15
minor [1] - 2680:17
minus [2] - 2781:15,
2833:21
minute [5] - 2743:5,
2782:11, 2874:10,
2874:11, 2891:11
minutes [2] - 2782:14,
2885:6
mischaracterization
[3] - 2759:20,
2761:24, 2846:22
misdirected [1] -
2845:4
misgivings [1] -
2894:9
misleading [1] -
2739:11
missed [1] - 2803:17
missing [1] - 2702:9
Mississippi [1] -
2713:20
Missouri [1] - 2678:24
misspoke [1] -
2786:18
model [9] - 2761:9,
2821:20, 2821:23,
2846:12, 2846:17,
2846:21, 2847:3,
2847:8, 2850:22
modeled [5] -
2757:20, 2757:24,
2805:11,

2844:9
modeling [7] -
2696:13, 2763:20,
2814:3, 2840:16,
2842:16, 2847:9,
2848:8
models [3] - 2874:16,
2874:19, 2874:23
modest [1] - 2844:20
modified [1] - 2823:12
Mojave [1] - 2853:24
moment [11] -
2700:21, 2702:15,
2725:4, 2758:21,
2782:10, 2836:25,
2845:2, 2854:21,
2884:10, 2893:5,
2897:25
monetary [5] -
2750:18, 2750:23,
2752:9, 2752:20,
2794:19
money [7] - 2791:20,
2828:21, 2829:4,
2867:7, 2867:17,
2896:3, 2904:12
monitoring [1] -
2886:23
month [4] - 2880:15,
2881:21, 2882:18,
2882:19
monthly [1] - 2841:24
months [3] - 2764:5,
2769:22, 2879:18
morning [8] - 2677:2,
2677:3, 2677:4,
2677:7, 2677:8,
2744:22, 2746:9,
2746:10
morphology [1] -
2704:21
most [26] - 2684:15,
2686:13, 2686:21,
2687:15, 2693:20,
2693:25, 2694:2,
2697:18, 2697:20,
2697:22, 2709:17,
2709:23, 2714:7,
2723:9, 2738:20,
2739:20, 2770:19,
2770:20, 2772:18,
2814:9, 2889:12,
2901:7, 2901:13,
2901:25, 2902:2
mostly [3] - 2680:8,
2688:12, 2803:13
mother [1] - 2698:13
motivated [1] - 2865:2
mounds [1] - 2735:21
Mountain [2] -

<p>2735:14, 2735:17 mourning [1] - 2744:21 mouth [1] - 2699:15 mouths [1] - 2702:19 move [18] - 2681:4, 2685:21, 2697:2, 2711:7, 2732:9, 2803:16, 2804:25, 2805:2, 2806:24, 2815:21, 2817:10, 2854:15, 2854:17, 2871:3, 2878:23, 2880:10, 2881:10, 2888:6 moved [1] - 2814:3 movement [3] - 2680:8, 2680:24, 2683:1 moving [3] - 2727:5, 2727:6, 2815:10 MR [126] - 2677:3, 2677:6, 2677:17, 2677:20, 2690:9, 2690:15, 2691:6, 2691:15, 2691:20, 2714:17, 2714:19, 2722:16, 2722:17, 2724:2, 2724:5, 2726:1, 2726:5, 2726:7, 2726:10, 2739:1, 2739:4, 2740:6, 2740:10, 2742:8, 2744:10, 2744:11, 2744:21, 2744:23, 2745:19, 2745:23, 2746:3, 2746:8, 2746:11, 2746:19, 2748:20, 2748:21, 2749:4, 2749:7, 2750:6, 2750:7, 2751:7, 2751:11, 2751:13, 2751:14, 2751:16, 2751:21, 2754:5, 2754:8, 2758:23, 2758:24, 2759:20, 2761:24, 2766:8, 2766:9, 2767:6, 2767:8, 2770:5, 2770:9, 2773:18, 2773:19, 2773:20, 2773:22, 2774:2, 2774:11, 2774:14, 2780:17, 2780:19, 2782:9, 2782:17, 2782:21, 2783:13, 2783:15, 2783:17, 2783:18, 2786:15, 2786:18, 2786:19,</p>	<p>2795:5, 2795:8, 2795:12, 2795:15, 2796:12, 2796:14, 2796:16, 2796:17, 2799:3, 2799:6, 2811:24, 2812:2, 2812:22, 2812:24, 2820:10, 2820:12, 2820:14, 2846:22, 2846:23, 2848:19, 2848:20, 2848:24, 2853:15, 2865:7, 2875:4, 2875:8, 2875:14, 2875:15, 2875:24, 2878:24, 2879:3, 2879:5, 2879:8, 2879:11, 2884:14, 2884:17, 2890:24, 2891:1, 2895:10, 2895:13, 2896:12, 2896:15, 2897:24, 2898:3, 2899:25, 2900:2, 2905:21, 2905:23, 2906:4 multi [1] - 2889:24 multi-family [1] - 2889:24 multifaceted [2] - 2755:14, 2755:20 multiple [3] - 2723:9, 2739:13, 2817:9 multiplication [1] - 2786:7 multiplier [1] - 2802:13 multiply [6] - 2784:1, 2784:7, 2785:10, 2785:21, 2788:7, 2802:10 municipal [23] - 2745:3, 2766:2, 2766:11, 2766:13, 2771:5, 2787:18, 2788:14, 2791:14, 2832:20, 2833:23, 2837:13, 2837:16, 2837:25, 2838:7, 2856:6, 2860:15, 2871:5, 2871:7, 2871:11, 2871:20, 2873:13, 2880:5, 2881:7 mussel [8] - 2695:1, 2698:7, 2730:11, 2730:14, 2738:5, 2739:14, 2740:2, 2742:25 mussels [14] - 2688:21, 2688:2</p>	<p>2704:14, 2704:24, 2721:12, 2721:23, 2738:6, 2738:10, 2738:20, 2739:14, 2739:16, 2739:20, 2741:2, 2750:19 Mussels [1] - 2737:20 must [1] - 2888:25</p> <hr/> <p style="text-align: center;">N</p> <hr/> <p>name [10] - 2723:13, 2738:2, 2738:8, 2742:13, 2745:14, 2745:15, 2745:17, 2792:4, 2856:15 named [1] - 2907:9 namely [1] - 2867:2 narrow [4] - 2688:11, 2695:19, 2715:17, 2739:6 narrowing [5] - 2688:6, 2688:13, 2734:2, 2741:20, 2741:25 national [3] - 2697:10, 2853:4, 2904:11 natural [17] - 2692:9, 2701:4, 2733:18, 2733:19, 2736:12, 2737:3, 2737:16, 2744:25, 2826:10, 2849:7, 2849:12, 2849:14, 2849:17, 2849:19, 2893:7, 2893:10, 2894:19 Natural [2] - 2855:9, 2855:19 naturally [1] - 2708:4 Nature [2] - 2852:18, 2894:23 nature [2] - 2684:17, 2895:5 navigation [7] - 2678:21, 2678:23, 2679:22, 2681:11, 2681:23, 2683:24, 2686:17 near [5] - 2734:22, 2736:8, 2736:20, 2736:22 Nebraska [5] - 2850:11, 2854:22, 2855:2, 2855:5, 2855:6 necessarily [4] - 2701:17, 2709:4, 2817:2, 2901:21 necessary [4] - 2670:4, 2670:4</p>	<p>2682:12, 2682:17 neck [1] - 2737:6 need [25] - 2689:10, 2690:5, 2692:22, 2693:3, 2703:19, 2703:20, 2713:12, 2772:21, 2777:4, 2781:24, 2782:9, 2783:25, 2795:19, 2796:10, 2818:19, 2832:22, 2837:15, 2853:5, 2863:5, 2863:6, 2879:9, 2882:2, 2885:25, 2887:23, 2887:24 needed [6] - 2692:8, 2701:13, 2712:22, 2783:10, 2888:4 needs [9] - 2689:11, 2689:15, 2692:19, 2702:7, 2714:12, 2739:1, 2742:5 negative [1] - 2703:15 negotiate [1] - 2854:11 neighborhood [1] - 2890:1 neislerii [1] - 2738:3 net [5] - 2766:15, 2771:6, 2775:7, 2833:20, 2883:15 Nevada [2] - 2852:12, 2853:4 never [14] - 2706:4, 2720:19, 2722:25, 2759:15, 2761:18, 2769:16, 2793:19, 2793:23, 2794:24, 2831:10, 2831:12, 2831:15, 2847:3, 2888:2 new [4] - 2719:24, 2720:2, 2720:5, 2844:24 New [1] - 2850:11 Newlands [2] - 2852:13, 2886:4 next [20] - 2709:17, 2724:4, 2727:25, 2728:22, 2730:10, 2731:14, 2736:14, 2739:3, 2761:4, 2776:24, 2809:9, 2813:17, 2859:5, 2859:8, 2861:16, 2865:25, 2868:4, 2869:2, 2871:19 nobody [1] - 2880:24 noncompliance [1] -</p>	<p>nonconsumptive [1] - 2833:24 nondrought [15] - 2756:21, 2807:19, 2807:24, 2808:4, 2808:8, 2808:12, 2808:16, 2808:19, 2809:1, 2809:3, 2890:21, 2891:4, 2892:6, 2892:9, 2892:16 nondry [1] - 2808:3 none [3] - 2722:11, 2756:25, 2757:9 nonprofit [2] - 2697:10, 2894:23 nontidal [1] - 2710:1 nonuse [1] - 2894:10 norm [1] - 2863:1 normal [1] - 2891:20 normally [1] - 2893:9 North [2] - 2693:23, 2714:8 north [1] - 2710:15 northern [1] - 2850:10 Northwest [1] - 2809:16 notable [2] - 2854:2, 2855:5 Notary [2] - 2675:15, 2907:2 note [3] - 2718:20, 2751:17, 2803:4 noted [3] - 2701:2, 2752:13, 2804:3 Noted [7] - 2744:18, 2744:20, 2795:9, 2795:11, 2875:10, 2875:12, 2906:5 notes [3] - 2679:3, 2718:7, 2907:5 nothing [7] - 2744:11, 2745:10, 2752:23, 2832:14, 2839:4, 2864:10, 2900:2 November [8] - 2675:13, 2721:18, 2722:11, 2722:20, 2737:18, 2738:17, 2840:13, 2906:7 number [44] - 2678:7, 2683:20, 2689:12, 2694:14, 2703:5, 2746:12, 2760:21, 2762:3, 2767:25, 2768:10, 2768:11, 2768:17, 2771:15, 2772:11, 2773:1, 2791:1, 2791:23, 2796:24, 2797:11,</p>
--	--	---	---	---

<p>2802:18, 2803:1, 2820:13, 2820:18, 2824:1, 2834:25, 2838:4, 2838:15, 2838:22, 2838:25, 2839:6, 2840:16, 2840:21, 2844:18, 2851:19, 2861:9, 2863:12, 2869:7, 2875:1, 2876:5, 2884:3, 2891:16, 2895:8, 2903:6, 2905:17</p> <p>Number [1] - 2676:8</p> <p>numbered [1] - 2707:8</p> <p>numbers [11] - 2773:25, 2798:12, 2800:13, 2802:5, 2835:7, 2840:3, 2840:6, 2844:4, 2873:9, 2873:12, 2876:19</p> <p>numerical [2] - 2804:12, 2843:23</p> <p>numerically [1] - 2844:9</p> <p>nut [1] - 2832:15</p>	<p>2874:6, 2874:8</p> <p>occurs [3] - 2902:1, 2902:3, 2905:6</p> <p>October [4] - 2786:12, 2786:20, 2833:1, 2844:7</p> <p>OF [4] - 2675:1, 2675:3, 2675:6, 2675:9</p> <p>offer [2] - 2772:17, 2829:18</p> <p>offered [1] - 2844:4</p> <p>offering [3] - 2748:11, 2754:20, 2798:10</p> <p>official [1] - 2802:19</p> <p>offset [4] - 2793:1, 2793:9, 2794:23</p> <p>often [2] - 2684:14, 2686:20</p> <p>Ogeechee [1] - 2696:8</p> <p>old [3] - 2719:14, 2719:15, 2719:16</p> <p>olds [1] - 2686:13</p> <p>omits [1] - 2751:19</p> <p>once [5] - 2783:19, 2815:23, 2853:16, 2860:22, 2905:13</p> <p>one [102] - 2679:19, 2682:5, 2682:16, 2693:23, 2700:3, 2700:18, 2702:25, 2703:7, 2709:13, 2709:25, 2712:8, 2713:2, 2714:6, 2715:24, 2716:6, 2723:4, 2723:14, 2724:20, 2726:22, 2729:4, 2729:6, 2729:13, 2732:4, 2733:9, 2733:10, 2733:17, 2733:21, 2738:19, 2739:19, 2747:17, 2747:20, 2752:12, 2753:2, 2753:3, 2760:1, 2760:2, 2761:11, 2762:15, 2764:8, 2767:13, 2770:19, 2770:20, 2770:24, 2777:5, 2777:6, 2782:9, 2784:17, 2796:4, 2796:5, 2801:1, 2803:12, 2804:6, 2804:7, 2815:12, 2821:13, 2821:24, 2823:21, 2824:12, 2827:5, 2830:13, 2832:8, 2832:25, 2836:25, 2840:8, 2840:11</p>	<p>2840:13, 2840:15, 2841:14, 2842:1, 2842:9, 2842:13, 2842:17, 2843:5, 2848:1, 2858:12, 2858:22, 2859:13, 2861:7, 2863:8, 2866:12, 2867:1, 2867:3, 2871:19, 2872:14, 2874:20, 2880:3, 2880:14, 2882:4, 2882:10, 2883:20, 2887:12, 2895:11, 2896:13, 2896:14, 2898:9</p> <p>one-for-one [1] - 2842:1</p> <p>one-time [1] - 2801:1</p> <p>one-to-one [2] - 2842:9, 2842:13</p> <p>one-year [1] - 2784:17</p> <p>ones [6] - 2733:16, 2775:14, 2814:10, 2859:17, 2869:7, 2887:1</p> <p>onset [1] - 2680:14</p> <p>open [4] - 2689:3, 2701:12, 2701:16, 2701:21</p> <p>opened [1] - 2702:25</p> <p>opening [2] - 2895:15, 2898:6</p> <p>operating [3] - 2688:16, 2814:20, 2862:14</p> <p>operation [1] - 2677:10</p> <p>operations [7] - 2716:16, 2730:14, 2817:7, 2817:10, 2847:18, 2847:23, 2848:16</p> <p>opined [1] - 2691:10</p> <p>opinion [17] - 2681:14, 2692:19, 2703:11, 2705:10, 2709:12, 2717:7, 2739:24, 2741:22, 2754:21, 2760:16, 2761:20, 2810:12, 2829:13, 2829:19, 2903:3, 2903:10, 2904:5</p> <p>opinions [12] - 2748:2, 2748:8, 2748:9, 2748:11, 2748:15, 2750:11, 2756:11, 2757:1, 2757:10, 2762:11,</p>	<p>opportunities [1] - 2814:7</p> <p>opportunity [2] - 2690:23, 2795:25</p> <p>opposed [3] - 2715:6, 2828:9, 2891:20</p> <p>opposite [1] - 2716:11</p> <p>optimal [7] - 2822:7, 2822:8, 2822:11, 2822:16, 2822:23, 2822:24, 2823:11</p> <p>option [1] - 2877:22</p> <p>options [11] - 2772:16, 2797:12, 2841:4, 2859:15, 2859:18, 2859:21, 2859:25, 2865:18, 2886:11, 2897:18, 2897:19</p> <p>oranges [1] - 2789:7</p> <p>Order [2] - 2777:19, 2872:7</p> <p>order [5] - 2680:12, 2684:20, 2740:17, 2814:7, 2905:5</p> <p>Oregon [1] - 2850:9</p> <p>organisms [1] - 2707:25</p> <p>organization [1] - 2697:10</p> <p>oriented [1] - 2880:1</p> <p>Original [1] - 2675:1</p> <p>original [3] - 2840:16, 2863:25, 2872:15</p> <p>originally [1] - 2687:10</p> <p>otherwise [2] - 2827:12, 2828:5</p> <p>outcome [3] - 2817:11, 2873:19, 2907:8</p> <p>outcomes [2] - 2874:20, 2874:23</p> <p>outdated [2] - 2719:12, 2719:20</p> <p>outdoor [34] - 2766:11, 2771:5, 2771:20, 2787:19, 2787:24, 2788:14, 2788:23, 2789:17, 2789:25, 2791:14, 2793:21, 2793:25, 2794:5, 2794:9, 2836:21, 2837:7, 2837:13, 2838:19, 2839:17, 2840:1, 2840:8, 2840:12, 2871:20, 2873:13, 2874:9, 2880:20, 2881:1, 2881:25, 2889:22,</p>	<p>2889:25, 2891:9, 2905:14</p> <p>outlay [1] - 2873:1</p> <p>outlet [4] - 2679:4, 2682:1, 2682:12, 2682:17</p> <p>outline [1] - 2724:1</p> <p>outlined [2] - 2728:8, 2765:2</p> <p>output [1] - 2798:6</p> <p>outright [1] - 2730:18</p> <p>outside [6] - 2810:13, 2831:20, 2838:10, 2847:11, 2848:8, 2853:3</p> <p>outstanding [1] - 2763:17</p> <p>outweigh [1] - 2701:9</p> <p>overall [4] - 2727:8, 2777:20, 2855:6, 2901:18</p> <p>overlaid [1] - 2822:3</p> <p>oversees [1] - 2855:21</p> <p>overshot [1] - 2850:6</p> <p>overstated [2] - 2804:5, 2826:14</p> <p>overstatement [1] - 2835:13</p> <p>overwatering [3] - 2821:19, 2824:10, 2824:14</p> <p>overwidening [1] - 2695:17</p> <p>overwintering [1] - 2853:6</p> <p>own [8] - 2701:24, 2767:12, 2817:7, 2817:9, 2817:10, 2824:22, 2837:20, 2848:10</p> <p>owner [1] - 2816:19</p> <p>ownership [2] - 2816:8, 2816:20</p> <p>owning [1] - 2817:4</p> <p>oxygen [1] - 2707:23</p> <p>oyster [8] - 2749:16, 2749:22, 2750:12, 2761:6, 2761:10, 2761:16, 2802:20, 2803:1</p> <p>oysters [2] - 2750:2, 2761:6</p>
		O		
<p>oath [2] - 2748:25, 2753:11</p> <p>object [1] - 2691:8</p> <p>objection [5] - 2752:22, 2759:20, 2761:24, 2846:22, 2890:24</p> <p>objections [1] - 2751:20</p> <p>observation [1] - 2863:18</p> <p>observations [3] - 2699:1, 2706:21, 2707:12</p> <p>Observed [1] - 2728:1</p> <p>observed [4] - 2692:1, 2695:7, 2700:10, 2799:10</p> <p>obviously [3] - 2709:2, 2739:25, 2849:4</p> <p>occur [5] - 2686:20, 2732:18, 2783:12, 2783:19, 2802:8</p> <p>occurred [6] - 2684:17, 2685:17, 2686:6, 2686:21, 2765:25, 2905:16</p> <p>occurring [4] - 2686:19, 2688:5,</p>	<p>2874:6, 2874:8</p> <p>occurs [3] - 2902:1, 2902:3, 2905:6</p> <p>October [4] - 2786:12, 2786:20, 2833:1, 2844:7</p> <p>OF [4] - 2675:1, 2675:3, 2675:6, 2675:9</p> <p>offer [2] - 2772:17, 2829:18</p> <p>offered [1] - 2844:4</p> <p>offering [3] - 2748:11, 2754:20, 2798:10</p> <p>official [1] - 2802:19</p> <p>offset [4] - 2793:1, 2793:9, 2794:23</p> <p>often [2] - 2684:14, 2686:20</p> <p>Ogeechee [1] - 2696:8</p> <p>old [3] - 2719:14, 2719:15, 2719:16</p> <p>olds [1] - 2686:13</p> <p>omits [1] - 2751:19</p> <p>once [5] - 2783:19, 2815:23, 2853:16, 2860:22, 2905:13</p> <p>one [102] - 2679:19, 2682:5, 2682:16, 2693:23, 2700:3, 2700:18, 2702:25, 2703:7, 2709:13, 2709:25, 2712:8, 2713:2, 2714:6, 2715:24, 2716:6, 2723:4, 2723:14, 2724:20, 2726:22, 2729:4, 2729:6, 2729:13, 2732:4, 2733:9, 2733:10, 2733:17, 2733:21, 2738:19, 2739:19, 2747:17, 2747:20, 2752:12, 2753:2, 2753:3, 2760:1, 2760:2, 2761:11, 2762:15, 2764:8, 2767:13, 2770:19, 2770:20, 2770:24, 2777:5, 2777:6, 2782:9, 2784:17, 2796:4, 2796:5, 2801:1, 2803:12, 2804:6, 2804:7, 2815:12, 2821:13, 2821:24, 2823:21, 2824:12, 2827:5, 2830:13, 2832:8, 2832:25, 2836:25, 2840:8, 2840:11</p>	<p>2840:13, 2840:15, 2841:14, 2842:1, 2842:9, 2842:13, 2842:17, 2843:5, 2848:1, 2858:12, 2858:22, 2859:13, 2861:7, 2863:8, 2866:12, 2867:1, 2867:3, 2871:19, 2872:14, 2874:20, 2880:3, 2880:14, 2882:4, 2882:10, 2883:20, 2887:12, 2895:11, 2896:13, 2896:14, 2898:9</p> <p>one-for-one [1] - 2842:1</p> <p>one-time [1] - 2801:1</p> <p>one-to-one [2] - 2842:9, 2842:13</p> <p>one-year [1] - 2784:17</p> <p>ones [6] - 2733:16, 2775:14, 2814:10, 2859:17, 2869:7, 2887:1</p> <p>onset [1] - 2680:14</p> <p>open [4] - 2689:3, 2701:12, 2701:16, 2701:21</p> <p>opened [1] - 2702:25</p> <p>opening [2] - 2895:15, 2898:6</p> <p>operating [3] - 2688:16, 2814:20, 2862:14</p> <p>operation [1] - 2677:10</p> <p>operations [7] - 2716:16, 2730:14, 2817:7, 2817:10, 2847:18, 2847:23, 2848:16</p> <p>opined [1] - 2691:10</p> <p>opinion [17] - 2681:14, 2692:19, 2703:11, 2705:10, 2709:12, 2717:7, 2739:24, 2741:22, 2754:21, 2760:16, 2761:20, 2810:12, 2829:13, 2829:19, 2903:3, 2903:10, 2904:5</p> <p>opinions [12] - 2748:2, 2748:8, 2748:9, 2748:11, 2748:15, 2750:11, 2756:11, 2757:1, 2757:10, 2762:11,</p>	<p>opportunities [1] - 2814:7</p> <p>opportunity [2] - 2690:23, 2795:25</p> <p>opposed [3] - 2715:6, 2828:9, 2891:20</p> <p>opposite [1] - 2716:11</p> <p>optimal [7] - 2822:7, 2822:8, 2822:11, 2822:16, 2822:23, 2822:24, 2823:11</p> <p>option [1] - 2877:22</p> <p>options [11] - 2772:16, 2797:12, 2841:4, 2859:15, 2859:18, 2859:21, 2859:25, 2865:18, 2886:11, 2897:18, 2897:19</p> <p>oranges [1] - 2789:7</p> <p>Order [2] - 2777:19, 2872:7</p> <p>order [5] - 2680:12, 2684:20, 2740:17, 2814:7, 2905:5</p> <p>Oregon [1] - 2850:9</p> <p>organisms [1] - 2707:25</p> <p>organization [1] - 2697:10</p> <p>oriented [1] - 2880:1</p> <p>Original [1] - 2675:1</p> <p>original [3] - 2840:16, 2863:25, 2872:15</p> <p>originally [1] - 2687:10</p> <p>otherwise [2] - 2827:12, 2828:5</p> <p>outcome [3] - 2817:11, 2873:19, 2907:8</p> <p>outcomes [2] - 2874:20, 2874:23</p> <p>outdated [2] - 2719:12, 2719:20</p> <p>outdoor [34] - 2766:11, 2771:5, 2771:20, 2787:19, 2787:24, 2788:14, 2788:23, 2789:17, 2789:25, 2791:14, 2793:21, 2793:25, 2794:5, 2794:9, 2836:21, 2837:7, 2837:13, 2838:19, 2839:17, 2840:1, 2840:8, 2840:12, 2871:20, 2873:13, 2874:9, 2880:20, 2881:1, 2881:25, 2889:22,</p>	<p>2889:25, 2891:9, 2905:14</p> <p>outlay [1] - 2873:1</p> <p>outlet [4] - 2679:4, 2682:1, 2682:12, 2682:17</p> <p>outline [1] - 2724:1</p> <p>outlined [2] - 2728:8, 2765:2</p> <p>output [1] - 2798:6</p> <p>outright [1] - 2730:18</p> <p>outside [6] - 2810:13, 2831:20, 2838:10, 2847:11, 2848:8, 2853:3</p> <p>outstanding [1] - 2763:17</p> <p>outweigh [1] - 2701:9</p> <p>overall [4] - 2727:8, 2777:20, 2855:6, 2901:18</p> <p>overlaid [1] - 2822:3</p> <p>oversees [1] - 2855:21</p> <p>overshot [1] - 2850:6</p> <p>overstated [2] - 2804:5, 2826:14</p> <p>overstatement [1] - 2835:13</p> <p>overwatering [3] - 2821:19, 2824:10, 2824:14</p> <p>overwidening [1] - 2695:17</p> <p>overwintering [1] - 2853:6</p> <p>own [8] - 2701:24, 2767:12, 2817:7, 2817:9, 2817:10, 2824:22, 2837:20, 2848:10</p> <p>owner [1] - 2816:19</p> <p>ownership [2] - 2816:8, 2816:20</p> <p>owning [1] - 2817:4</p> <p>oxygen [1] - 2707:23</p> <p>oyster [8] - 2749:16, 2749:22, 2750:12, 2761:6, 2761:10, 2761:16, 2802:20, 2803:1</p> <p>oysters [2] - 2750:2, 2761:6</p>
		P		
		THE REPORTING GROUP		

2681:2, 2682:2,
2682:24, 2683:4,
2683:13, 2690:20,
2690:24, 2691:1,
2691:24, 2693:10,
2700:20, 2702:12,
2704:2, 2704:6,
2704:7, 2709:10,
2709:18, 2718:7,
2723:7, 2723:13,
2724:1, 2725:14,
2725:23, 2726:3,
2726:5, 2728:1,
2728:22, 2728:23,
2731:14, 2732:9,
2734:3, 2734:7,
2735:8, 2735:13,
2735:24, 2736:14,
2737:17, 2737:19,
2737:22, 2737:23,
2749:3, 2751:5,
2752:16, 2752:17,
2754:4, 2758:17,
2761:14, 2762:10,
2762:11, 2762:13,
2762:23, 2764:11,
2764:14, 2764:15,
2765:10, 2767:14,
2770:3, 2773:9,
2773:14, 2773:15,
2773:16, 2773:18,
2773:19, 2774:3,
2774:6, 2774:8,
2774:13, 2774:15,
2774:17, 2777:15,
2777:16, 2779:8,
2779:9, 2779:11,
2779:12, 2781:9,
2782:24, 2782:25,
2784:23, 2785:14,
2787:22, 2788:22,
2790:10, 2790:11,
2799:3, 2799:16,
2804:17, 2804:22,
2804:23, 2807:6,
2809:6, 2809:9,
2809:24, 2811:15,
2811:18, 2811:19,
2812:17, 2812:22,
2813:16, 2819:14,
2819:22, 2823:14,
2823:18, 2823:19,
2827:17, 2827:20,
2829:20, 2829:21,
2834:5, 2835:16,
2837:2, 2838:17,
2845:7, 2845:10,
2858:16, 2858:17,
2858:23, 2859:6,
2859:8, 2860:1,
2865:14, 2865:15,

2865:22, 2866:1,
2868:14, 2870:15,
2878:5, 2890:8,
2890:10, 2892:1,
2892:2, 2895:15,
2895:16, 2896:21,
2897:2, 2897:3
Page [1] - 2676:8
pages [13] - 2682:23,
2707:7, 2732:10,
2732:16, 2732:21,
2733:3, 2735:24,
2746:15, 2830:25,
2845:6, 2858:19,
2872:14, 2907:4
paid [6] - 2724:9,
2724:13, 2724:17,
2740:18, 2851:10,
2867:15
pair [1] - 2796:4
palatable [2] - 2856:3,
2860:9
paper [16] - 2680:10,
2684:25, 2685:2,
2798:15, 2830:6,
2830:9, 2830:19,
2830:22, 2830:25,
2831:1, 2831:4,
2831:5, 2831:15,
2832:8, 2832:12,
2837:19
paragraph [80] -
2677:15, 2679:10,
2679:12, 2679:23,
2681:2, 2681:6,
2682:2, 2682:5,
2682:6, 2682:24,
2683:6, 2690:20,
2691:14, 2692:7,
2700:24, 2704:9,
2704:11, 2718:19,
2718:23, 2720:7,
2720:10, 2725:23,
2726:12, 2726:14,
2727:19, 2730:21,
2731:19, 2732:4,
2734:5, 2734:7,
2755:1, 2755:6,
2755:8, 2756:12,
2756:16, 2764:14,
2764:15, 2764:25,
2765:1, 2770:24,
2773:9, 2773:17,
2777:18, 2790:3,
2790:11, 2791:9,
2791:12, 2797:18,
2797:22, 2798:24,
2799:10, 2800:3,
2800:16, 2800:20,
2804:1, 2807:3,

2807:5, 2807:16,
2809:18, 2809:23,
2813:16, 2818:1,
2818:4, 2818:5,
2818:9, 2829:16,
2829:20, 2829:21,
2832:24, 2833:4,
2833:7, 2839:13,
2839:15, 2841:17,
2841:22, 2844:22,
2844:23, 2844:25,
2845:7
paragraphs [2] -
2682:5, 2845:6
pardon [2] - 2863:17,
2872:3
part [61] - 2681:17,
2681:19, 2681:22,
2682:10, 2685:9,
2693:15, 2696:4,
2696:6, 2703:1,
2710:1, 2715:12,
2716:18, 2718:7,
2721:13, 2723:18,
2725:12, 2728:15,
2733:19, 2733:25,
2734:9, 2734:22,
2737:3, 2737:16,
2742:2, 2742:13,
2742:25, 2748:6,
2759:13, 2759:19,
2760:25, 2769:8,
2769:10, 2782:15,
2786:1, 2786:23,
2798:11, 2798:18,
2814:18, 2817:7,
2821:24, 2837:21,
2843:7, 2847:6,
2847:19, 2849:15,
2850:10, 2854:4,
2854:9, 2863:11,
2871:3, 2873:15,
2874:13, 2890:2,
2893:1, 2893:8,
2895:16, 2896:7,
2901:15, 2902:2,
2902:4, 2905:4
particular [31] -
2677:16, 2679:9,
2682:24, 2702:14,
2703:25, 2709:7,
2709:12, 2737:24,
2741:10, 2741:11,
2760:4, 2772:14,
2793:25, 2796:24,
2797:25, 2807:3,
2812:25, 2824:13,
2834:7, 2845:9,
2851:7, 2851:8,
2852:2, 2855:14

2865:16, 2873:19,
2874:21, 2888:5,
2897:8
parties [2] - 2795:24,
2796:9
partner [1] - 2900:16
Partnership [1] -
2903:22
parts [10] - 2686:25,
2688:2, 2742:20,
2743:1, 2759:17,
2803:13, 2815:10,
2850:21, 2901:17,
2901:18
pass [1] - 2690:11
passage [1] - 2681:9
passages [1] - 2729:3
passed [1] - 2848:4
past [2] - 2735:21,
2742:3
pasted [1] - 2746:22
paths [1] - 2853:7
patient [3] - 2689:18,
2701:4
patient's [1] - 2699:9
pattern [2] - 2876:18,
2881:24
patterns [1] - 2759:5
pause [3] - 2772:12,
2842:3, 2843:4
pausing [1] - 2874:10
pay [5] - 2793:16,
2828:19, 2864:10,
2867:9, 2877:13
paying [3] - 2690:24,
2864:12, 2874:2
payment [2] - 2867:7,
2867:17
payouts [1] - 2877:20
peak [15] - 2762:21,
2765:2, 2769:22,
2775:15, 2775:25,
2776:8, 2776:17,
2805:8, 2841:24,
2881:21, 2883:9,
2883:12, 2883:22,
2883:23, 2883:24
peaks [1] - 2881:14
peanuts [2] - 2824:3,
2862:1
pecan [6] - 2829:18,
2830:2, 2831:5,
2831:6, 2832:3,
2832:9
pecans [4] - 2829:11,
2829:13, 2832:14,
2870:21
Pecos [1] - 2850:11
Penobscot [1] -

people [19] - 2683:24,
2755:23, 2791:21,
2793:1, 2793:15,
2794:4, 2794:10,
2803:5, 2803:10,
2803:14, 2824:10,
2824:12, 2834:19,
2848:11, 2864:3,
2864:16, 2864:17,
2864:21
per [44] - 2682:19,
2683:22, 2696:22,
2759:13, 2759:19,
2783:3, 2785:2,
2790:1, 2790:8,
2790:23, 2834:10,
2834:11, 2834:13,
2834:14, 2834:18,
2835:5, 2835:8,
2835:19, 2836:5,
2836:10, 2836:13,
2836:17, 2836:18,
2842:9, 2854:13,
2863:9, 2863:13,
2863:18, 2863:23,
2864:12, 2885:24,
2891:17, 2891:19,
2892:15, 2892:16,
2892:17, 2897:13,
2897:21, 2897:22
percent [42] - 2757:24,
2758:1, 2760:9,
2760:11, 2761:16,
2761:17, 2761:21,
2769:15, 2772:5,
2772:11, 2773:3,
2776:7, 2776:19,
2777:9, 2787:23,
2787:24, 2788:2,
2788:3, 2788:13,
2788:15, 2788:23,
2789:24, 2791:14,
2793:21, 2794:5,
2799:24, 2801:15,
2802:17, 2802:25,
2824:23, 2825:5,
2825:8, 2825:10,
2830:2, 2842:18,
2843:14, 2870:23,
2871:21, 2889:19,
2889:21, 2890:2
percentage [6] -
2824:16, 2825:2,
2825:3, 2875:18,
2876:2, 2889:25
perennial [1] -
2729:24
perennially [1] -
2730:15
perform [1] - 2887:22

<p>performance [1] - 2887:20</p> <p>performing [1] - 2850:15</p> <p>performs [1] - 2876:8</p> <p>perhaps [6] - 2699:5, 2704:2, 2706:10, 2734:5, 2738:22, 2877:23</p> <p>period [10] - 2685:22, 2689:1, 2689:4, 2692:2, 2731:25, 2732:2, 2767:2, 2783:5, 2800:23, 2835:14</p> <p>periods [2] - 2747:7, 2851:12</p> <p>permanent [10] - 2784:10, 2851:24, 2852:21, 2860:5, 2866:9, 2866:13, 2866:23, 2881:12, 2885:8</p> <p>permanently [1] - 2867:9</p> <p>permission [2] - 2677:18, 2878:24</p> <p>permit [8] - 2706:23, 2860:25, 2861:1, 2861:2, 2861:3, 2861:5, 2861:12, 2866:2</p> <p>permits [6] - 2837:17, 2837:18, 2837:20, 2838:2, 2839:9, 2861:10</p> <p>Perry [9] - 2768:9, 2796:11, 2848:22, 2875:20, 2879:13, 2883:11, 2898:6, 2900:1, 2905:22</p> <p>PERRY [37] - 2675:17, 2744:21, 2744:23, 2745:19, 2745:23, 2751:13, 2751:16, 2759:20, 2761:24, 2773:18, 2773:20, 2786:15, 2796:12, 2846:22, 2848:20, 2848:24, 2853:15, 2865:7, 2875:4, 2875:8, 2875:14, 2875:15, 2875:24, 2878:24, 2879:3, 2879:11, 2884:14, 2884:17, 2891:1, 2895:10, 2895:13, 2896:12, 2896:15, 2897:24, 2900:2, 2905:23, 2906:4</p>	<p>persistent [1] - 2727:22</p> <p>person [5] - 2718:1, 2721:22, 2722:2, 2834:14, 2907:8</p> <p>personal [3] - 2698:24, 2707:11, 2852:11</p> <p>personally [4] - 2715:21, 2754:13, 2754:20, 2819:1</p> <p>pertaining [1] - 2744:6</p> <p>petroleum [7] - 2683:11, 2683:15, 2683:17, 2683:22, 2683:25, 2684:5, 2684:9</p> <p>Ph.D [2] - 2676:3, 2676:5</p> <p>Phaneuf [7] - 2750:4, 2892:21, 2892:22, 2892:25, 2898:21, 2898:24, 2899:2</p> <p>Phaneuf's [1] - 2749:24</p> <p>phenomenon [1] - 2850:13</p> <p>PHILIP [1] - 2675:17</p> <p>photo [1] - 2736:22</p> <p>photograph [2] - 2707:16, 2736:10</p> <p>photographs [5] - 2695:21, 2706:6, 2706:17, 2719:3, 2719:6</p> <p>Photography [1] - 2736:1</p> <p>photos [1] - 2733:5</p> <p>phrase [2] - 2861:23, 2862:3</p> <p>physical [1] - 2710:6</p> <p>physician's [2] - 2700:25, 2702:5</p> <p>pick [1] - 2796:23</p> <p>picking [1] - 2760:14</p> <p>picks [1] - 2815:16</p> <p>picture [13] - 2735:13, 2805:19, 2819:7, 2820:8, 2820:15, 2821:1, 2821:7, 2858:1, 2858:2, 2858:3, 2886:6, 2898:9, 2899:9</p> <p>pictures [6] - 2819:4, 2819:5, 2820:5, 2820:18, 2821:15, 2821:16</p> <p>piece [1] - 2709:6</p> <p>pile [1] - 2888:24</p> <p>pipe [1] - 2871:17</p>	<p>pipes [2] - 2880:6, 2880:8</p> <p>pitching [1] - 2699:3</p> <p>pivot [11] - 2820:21, 2857:22, 2862:16, 2862:17, 2862:19, 2862:21, 2863:2, 2877:5</p> <p>pivot-by-pivot [1] - 2863:2</p> <p>pivots [1] - 2817:9</p> <p>place [9] - 2714:11, 2808:3, 2862:24, 2880:21, 2885:10, 2886:15, 2887:7, 2888:1, 2889:11</p> <p>places [7] - 2687:4, 2687:16, 2713:6, 2722:9, 2803:15, 2883:21, 2884:24</p> <p>plain [1] - 2874:18</p> <p>Plaintiff [1] - 2675:4</p> <p>plan [3] - 2678:20, 2786:1, 2855:12</p> <p>Plan [4] - 2743:13, 2902:20, 2902:24, 2903:5</p> <p>planet [1] - 2714:8</p> <p>planning [2] - 2685:1, 2856:12</p> <p>plant [2] - 2823:2, 2871:15</p> <p>plants [2] - 2750:25, 2882:2</p> <p>play [6] - 2749:5, 2751:8, 2754:6, 2770:6, 2811:17, 2811:25</p> <p>played [6] - 2749:6, 2751:10, 2751:19, 2754:7, 2770:8, 2812:1</p> <p>pleasure [1] - 2900:15</p> <p>plot [1] - 2680:18</p> <p>plug [1] - 2727:3</p> <p>plugs [2] - 2702:14, 2702:18</p> <p>point [23] - 2699:6, 2701:1, 2715:12, 2717:12, 2724:11, 2731:8, 2733:13, 2733:14, 2733:19, 2747:19, 2764:20, 2778:16, 2780:20, 2780:25, 2791:22, 2792:11, 2825:11, 2836:1, 2843:4, 2874:22, 2883:5, 2884:1, 2896:10</p>	<p>2840:24</p> <p>points [4] - 2732:5, 2865:16, 2874:14, 2874:21</p> <p>policies [7] - 2771:8, 2771:9, 2771:14, 2772:1, 2772:18, 2849:16, 2888:1</p> <p>policy [8] - 2713:10, 2756:6, 2771:19, 2771:22, 2772:4, 2772:14, 2868:3, 2882:11</p> <p>Policy [1] - 2896:22</p> <p>ponds [3] - 2869:2, 2869:6, 2869:15</p> <p>pool [1] - 2707:18</p> <p>pools [2] - 2704:23, 2707:22</p> <p>population [1] - 2679:15</p> <p>portion [2] - 2714:25, 2766:2</p> <p>Portland [2] - 2675:13, 2854:25</p> <p>ports [5] - 2679:1, 2679:6, 2682:21, 2685:20, 2717:10</p> <p>Portugal [1] - 2713:24</p> <p>posed [2] - 2753:9, 2895:17</p> <p>position [1] - 2810:6</p> <p>positioned [1] - 2810:25</p> <p>positive [2] - 2782:1, 2794:24</p> <p>possibilities [1] - 2813:10</p> <p>possibility [3] - 2866:24, 2900:23, 2901:22</p> <p>possible [8] - 2681:22, 2705:4, 2750:21, 2829:5, 2829:9, 2859:3, 2866:10, 2904:21</p> <p>possibly [1] - 2863:5</p> <p>potential [9] - 2678:2, 2683:3, 2694:6, 2694:7, 2700:11, 2703:13, 2703:19, 2714:10, 2772:15</p> <p>potentially [2] - 2696:20, 2903:8</p> <p>PowerPoint [4] - 2705:25, 2830:11, 2830:14, 2830:15</p> <p>practical [6] - 2745:1, 2850:24, 2856:8, 2886:8,</p>	<p>2897:9</p> <p>practice [3] - 2820:17, 2828:11, 2828:15</p> <p>practices [4] - 2819:2, 2819:9, 2819:13, 2819:18</p> <p>Prayer [2] - 2777:15, 2890:14</p> <p>pre [2] - 2692:2, 2692:15</p> <p>pre-dam [2] - 2692:2, 2692:15</p> <p>preceded [1] - 2865:16</p> <p>preceding [1] - 2683:6</p> <p>precipitation [7] - 2765:23, 2826:5, 2826:6, 2826:11, 2826:15, 2827:4, 2863:21</p> <p>predominantly [2] - 2679:21, 2828:1</p> <p>prefer [1] - 2846:24</p> <p>preference [2] - 2773:13, 2823:9</p> <p>preferences [1] - 2793:8</p> <p>prefiled [12] - 2745:24, 2786:16, 2786:20, 2849:5, 2858:18, 2859:22, 2860:1, 2866:1, 2868:9, 2870:15, 2878:6, 2883:22</p> <p>preliminary [1] - 2695:20</p> <p>Preliminary [1] - 2731:15</p> <p>premium [1] - 2877:17</p> <p>premiums [1] - 2877:21</p> <p>prepare [2] - 2697:25, 2722:7</p> <p>prepared [4] - 2697:8, 2706:1, 2706:4, 2708:16</p> <p>preparing [1] - 2698:1</p> <p>presence [1] - 2829:6</p> <p>Present [1] - 2675:23</p> <p>present [1] - 2680:6</p> <p>presentation [8] - 2705:25, 2706:4, 2706:19, 2707:7, 2718:25, 2719:7, 2830:11, 2830:13</p> <p>presented [3] - 2808:11, 2840:10, 2895:2</p> <p>preserve [3] - 2697:11, 2714:13,</p>
---	---	--	---	--

<p>2895:4 preserved [3] - 2690:4, 2702:9, 2714:10 preserving [1] - 2753:6 President [1] - 2718:1 pressure [3] - 2880:10, 2880:12, 2880:16 pressurization [1] - 2880:9 presume [3] - 2708:3, 2830:17, 2830:20 pretty [5] - 2678:8, 2679:18, 2713:4, 2729:5, 2886:19 prevent [1] - 2867:5 preventing [1] - 2874:7 previous [1] - 2729:24 primarily [3] - 2684:8, 2717:11, 2869:9 primary [1] - 2697:23 prime [1] - 2849:12 PRIMIS [79] - 2675:20, 2691:6, 2714:17, 2714:19, 2722:16, 2722:17, 2724:5, 2726:1, 2726:5, 2726:7, 2726:10, 2739:4, 2740:6, 2742:8, 2744:10, 2746:3, 2746:8, 2746:11, 2746:19, 2748:20, 2748:21, 2749:4, 2749:7, 2750:6, 2750:7, 2751:7, 2751:11, 2751:14, 2751:21, 2754:5, 2754:8, 2758:23, 2758:24, 2766:8, 2766:9, 2767:6, 2767:8, 2770:5, 2770:9, 2773:19, 2773:22, 2774:2, 2774:11, 2774:14, 2780:17, 2780:19, 2782:9, 2782:17, 2782:21, 2783:13, 2783:15, 2783:17, 2783:18, 2786:18, 2786:19, 2795:5, 2795:8, 2795:12, 2795:15, 2796:14, 2796:16, 2796:17, 2799:3, 2799:6, 2811:24, 2812:2, 2812:22, 2812:24, 2820:10,</p>	<p>2820:12, 2820:14, 2846:23, 2848:19, 2879:5, 2879:8, 2890:24, 2898:3, 2899:25, 2905:21 Primis [15] - 2786:16, 2849:3, 2853:16, 2858:15, 2871:25, 2872:13, 2872:21, 2872:24, 2874:25, 2876:23, 2877:16, 2888:18, 2889:2, 2890:13, 2892:21 Primis's [4] - 2889:7, 2889:9, 2890:9, 2895:15 principal [1] - 2679:15 principally [2] - 2717:9, 2861:14 principle [4] - 2693:11, 2700:19, 2784:3, 2842:7 principles [1] - 2700:4 pristine [3] - 2893:6, 2894:19, 2895:5 privilege [1] - 2900:15 privileged [1] - 2899:22 problem [2] - 2689:15, 2708:13 problems [3] - 2699:9, 2700:1, 2811:11 proceed [4] - 2691:19, 2782:16, 2796:14, 2879:12 proceeding [1] - 2865:13 Proceeding [1] - 2906:6 PROCEEDINGS [2] - 2675:9, 2677:1 Proceedings [1] - 2907:6 process [4] - 2692:10, 2699:8, 2770:2, 2852:6 processes [2] - 2810:10, 2810:20 produce [3] - 2740:15, 2775:2, 2894:5 producing [1] - 2870:21 product [1] - 2891:16 production [6] - 2679:15, 2827:1, 2827:24, 2828:8, 2852:17, 2869:8 productive [4] - 2714:6, 2714:7, 2823:24, 2824:6</p>	<p>productivity [2] - 2814:18, 2854:16 products [1] - 2683:11 profession [1] - 2849:10 profits [1] - 2815:21 Program [2] - 2867:22, 2868:2 program [9] - 2851:20, 2851:21, 2852:20, 2862:22, 2867:15, 2880:12, 2888:13, 2894:7, 2902:13 programs [9] - 2850:21, 2856:21, 2867:8, 2867:18, 2867:25, 2872:10, 2872:11, 2877:25, 2904:18 progress [6] - 2721:2, 2723:21, 2724:7, 2736:13, 2740:13, 2740:22 prohibit [1] - 2868:20 project [33] - 2678:12, 2678:13, 2678:16, 2679:5, 2679:22, 2680:4, 2680:12, 2680:22, 2681:17, 2681:22, 2682:8, 2683:9, 2683:23, 2683:24, 2685:19, 2687:10, 2698:5, 2700:8, 2700:13, 2700:15, 2702:16, 2703:22, 2717:8, 2723:18, 2724:8, 2724:19, 2724:21, 2845:20, 2852:14, 2852:25, 2853:2, 2853:24 Project [1] - 2903:19 projected [1] - 2802:24 projections [1] - 2683:8 projects [27] - 2677:13, 2678:3, 2685:16, 2689:13, 2689:14, 2689:20, 2689:21, 2690:4, 2694:15, 2694:17, 2694:20, 2694:24, 2699:3, 2699:5, 2699:14, 2699:24, 2701:8, 2701:11, 2702:20, 2702:22, 2702:24, 2703:5, 2703:19, 2705:4,</p>	<p>2741:2 promote [2] - 2693:18, 2700:15 pronounced [1] - 2736:23 proper [2] - 2787:2, 2787:8 property [2] - 2816:12, 2817:20 proposal [1] - 2702:13 propose [1] - 2678:12 proposed [12] - 2680:12, 2682:8, 2687:10, 2703:7, 2756:2, 2756:17, 2757:3, 2757:11, 2757:24, 2778:23, 2905:9, 2905:12 proposing [2] - 2700:12, 2768:15 proposition [1] - 2808:25 prospects [1] - 2697:13 protect [1] - 2850:4 Protection [2] - 2851:16, 2870:11 prove [1] - 2900:19 provide [12] - 2677:14, 2681:12, 2681:21, 2703:24, 2705:19, 2740:17, 2745:20, 2756:19, 2757:10, 2759:9, 2799:17, 2808:6 provided [3] - 2705:24, 2722:20, 2757:1 provides [2] - 2696:9, 2813:24 providing [2] - 2700:2, 2750:9 provision [1] - 2703:25 Public [3] - 2675:15, 2894:24, 2907:2 public [2] - 2849:16, 2868:3 public's [1] - 2896:2 published [2] - 2684:24, 2685:2 pull [5] - 2717:1, 2736:21, 2743:6, 2835:15, 2842:19 Pull [1] - 2745:13 pulling [1] - 2800:10 pulp [1] - 2837:18 pulpwood [3] - 2680:9, 2680:10,</p>	<p>pump [5] - 2843:4, 2843:7, 2877:12, 2877:13, 2877:14 pumped [1] - 2842:22 pumping [3] - 2776:24, 2776:25, 2842:17 purchase [1] - 2877:3 purpose [9] - 2681:10, 2699:16, 2710:5, 2710:7, 2716:1, 2740:11, 2740:25, 2852:25, 2853:1 purposes [4] - 2799:22, 2836:22, 2869:7, 2874:5 put [18] - 2733:6, 2737:18, 2746:17, 2767:6, 2772:21, 2793:3, 2795:16, 2804:10, 2832:7, 2840:6, 2846:24, 2867:19, 2874:12, 2880:21, 2883:5, 2883:16, 2885:10, 2886:15 puts [1] - 2697:19</p>
<p>Q</p>				
<p>qualification [3] - 2753:3, 2777:3, 2809:17 qualitatively [1] - 2792:12 quality [4] - 2763:18, 2814:19, 2857:24, 2873:4 Quantification [1] - 2854:10 quantified [4] - 2715:16, 2753:2, 2798:8, 2854:6 quantifies [1] - 2684:1 quantify [8] - 2696:19, 2715:13, 2752:9, 2752:19, 2757:2, 2757:10, 2757:13, 2794:16 quantifying [1] - 2760:3 quantitative [5] - 2715:4, 2715:22, 2716:2, 2716:15, 2794:25 questions [22] - 2677:10, 2677:12, 2711:8, 2716:3, 2731:22, 2740:6, 2742:8, 2749:8,</p>				

<p>2751:12, 2751:22, 2752:3, 2753:13, 2794:8, 2795:3, 2812:3, 2848:19, 2871:24, 2876:23, 2889:7, 2890:9, 2893:3, 2899:25 quickly [1] - 2868:17 quit [1] - 2686:4 quite [14] - 2687:17, 2688:4, 2696:20, 2731:12, 2779:6, 2803:16, 2819:11, 2820:22, 2852:1, 2852:11, 2860:8, 2888:24, 2891:9, 2899:9 quo [1] - 2780:14 quote [5] - 2683:2, 2683:3, 2808:6, 2825:16, 2897:8 Qureshi [3] - 2717:3, 2721:8, 2724:12 QURESHI [13] - 2675:18, 2677:3, 2677:6, 2677:17, 2677:20, 2690:9, 2690:15, 2691:15, 2691:20, 2724:2, 2739:1, 2740:10, 2744:11</p>	<p>2741:4, 2781:19 Reach [1] - 2813:1 reached [1] - 2741:13 reaches [2] - 2738:21, 2739:20 reaching [1] - 2780:8 read [22] - 2679:11, 2683:6, 2692:22, 2726:11, 2729:3, 2731:21, 2742:22, 2742:25, 2743:1, 2755:8, 2756:13, 2807:7, 2809:25, 2813:20, 2818:4, 2818:14, 2829:17, 2831:12, 2831:16, 2837:9, 2903:4 reading [7] - 2691:7, 2692:21, 2729:7, 2780:8, 2800:4, 2813:14, 2813:15 reads [6] - 2751:18, 2804:3, 2861:16, 2868:6, 2872:2, 2896:6 ready [1] - 2875:13 real [5] - 2714:5, 2792:10, 2792:11, 2792:15, 2856:8 real-world [1] - 2856:8 realize [1] - 2700:15 realizes [1] - 2792:14 really [19] - 2680:21, 2681:17, 2685:25, 2688:3, 2688:24, 2694:5, 2699:19, 2700:9, 2700:13, 2701:13, 2714:12, 2746:14, 2781:8, 2807:9, 2810:22, 2822:25, 2840:3, 2858:5, 2865:13 reason [8] - 2685:18, 2786:23, 2791:17, 2806:4, 2820:20, 2839:25, 2900:19 reasons [3] - 2804:6, 2852:16, 2860:10 received [2] - 2844:7, 2860:22 Recent [1] - 2731:15 recent [3] - 2770:19, 2770:20, 2856:9 recently [1] - 2733:24 recently-deposited [1] - 2733:24 recess [2] - 2744:17, 2906:3 Recess [3] - 2744:19, 2795:10, 2875:1</p>	<p>Reclamation [1] - 2852:15 reclamation [1] - 2853:24 recognize [3] - 2704:10, 2746:20, 2761:5 recognized [1] - 2710:12 recollection [1] - 2800:3 recommendation [1] - 2776:14 recommendations [5] - 2705:2, 2705:20, 2776:15, 2900:22, 2904:6 recommended [2] - 2692:24, 2758:7 recommending [3] - 2772:5, 2772:8, 2772:14 reconnect [1] - 2689:22 reconnecting [1] - 2700:7 reconnection [2] - 2700:12, 2701:21 record [5] - 2728:8, 2729:6, 2795:17, 2796:3, 2797:9 records [2] - 2685:15, 2802:19 recover [3] - 2694:4, 2742:4, 2742:5 recovered [2] - 2687:20, 2689:10 recovering [5] - 2687:8, 2689:9, 2695:11, 2701:23, 2711:6 recovery [11] - 2688:25, 2693:18, 2694:10, 2700:10, 2701:4, 2706:11, 2707:1, 2710:18, 2731:25, 2732:2, 2742:2 recreate [1] - 2896:4 recreation [1] - 2894:12 recreational [1] - 2893:17 recross [1] - 2714:16 Recross [1] - 2676:2 RECROSS [2] - 2714:18, 2898:2 RECROSS- EXAMINATION [2] -</p>	<p>red [4] - 2690:25, 2768:10, 2823:22, 2883:20 redirect [5] - 2718:15, 2729:21, 2730:12, 2738:9, 2740:8 Redirect [1] - 2676:2 REDIRECT [3] - 2677:5, 2740:9, 2848:23 reduce [13] - 2776:6, 2776:10, 2807:18, 2815:11, 2815:24, 2830:1, 2842:8, 2851:11, 2867:16, 2869:10, 2869:14, 2881:11, 2902:5 reduced [13] - 2693:7, 2693:14, 2696:2, 2696:3, 2696:18, 2715:10, 2715:15, 2771:5, 2771:11, 2771:15, 2772:3, 2772:4, 2871:20 reduces [4] - 2828:4, 2828:5, 2842:17, 2842:19 reducing [7] - 2778:17, 2779:20, 2859:15, 2868:22, 2880:19, 2886:16, 2903:8 reduction [46] - 2696:16, 2696:17, 2715:9, 2716:20, 2757:25, 2758:1, 2759:9, 2759:13, 2760:9, 2761:16, 2761:21, 2768:15, 2768:19, 2769:1, 2769:5, 2771:10, 2774:7, 2776:19, 2778:23, 2781:5, 2788:2, 2788:3, 2788:13, 2788:15, 2788:23, 2791:14, 2793:21, 2797:6, 2799:24, 2801:13, 2801:15, 2802:25, 2813:25, 2842:13, 2842:21, 2858:11, 2879:15, 2879:24, 2880:13, 2881:4, 2883:7, 2883:12, 2883:24, 2884:23, 2889:10, 2905:15 reductions [13] - 2696:5, 2709:19, 2763:2, 2765:24, 2787:18,</p>	<p>2787:24, 2798:5, 2803:25, 2841:24, 2859:19, 2866:20, 2883:13 refer [7] - 2704:2, 2705:23, 2708:3, 2728:16, 2818:1, 2839:13, 2868:11 reference [6] - 2679:14, 2691:24, 2692:3, 2692:12, 2692:15, 2730:1 Referenced [1] - 2676:8 referenced [1] - 2691:13 references [1] - 2691:16 referencing [2] - 2730:8, 2790:6 referred [4] - 2678:13, 2679:20, 2889:3, 2892:25 referring [12] - 2692:14, 2704:1, 2760:20, 2775:17, 2786:16, 2789:20, 2803:4, 2819:17, 2841:12, 2858:8, 2870:9, 2890:13 refers [3] - 2704:3, 2744:5, 2872:6 reflect [2] - 2722:14, 2872:8 reflected [2] - 2740:19, 2830:18 reflecting [2] - 2755:15, 2839:8 reflection [1] - 2725:10 reflects [3] - 2800:13, 2844:15, 2898:17 reframe [1] - 2757:8 refresh [2] - 2800:1, 2800:3 refuge [2] - 2852:22, 2853:5 refused [1] - 2899:17 regain [2] - 2693:3, 2693:19 regard [6] - 2711:17, 2716:13, 2760:6, 2806:23, 2892:18, 2898:20 regarding [3] - 2677:10, 2711:16, 2759:25 regime [9] - 2692:8, 2694:3, 2694:9, 2702:10, 2713:12,</p>
R				
<p>rain [1] - 2867:3 rain-fed [1] - 2867:3 rainfall [1] - 2765:16 raise [3] - 2726:23, 2745:5, 2875:21 raised [1] - 2811:10 raises [2] - 2827:8, 2828:2 RALPH [1] - 2675:11 ran [5] - 2686:3, 2759:12, 2760:8, 2761:8, 2821:20 range [11] - 2712:1, 2712:5, 2771:25, 2825:10, 2841:11, 2874:19, 2874:23, 2892:13, 2893:11, 2897:17, 2903:9 rank [1] - 2814:7 rate [2] - 2680:20, 2692:1 rather [1] - 2733:24 re [1] - 2686:17 re-excavate [1] - 2686:17 reach [3] - 2741:3,</p>	<p>2741:4, 2781:19 Reach [1] - 2813:1 reached [1] - 2741:13 reaches [2] - 2738:21, 2739:20 reaching [1] - 2780:8 read [22] - 2679:11, 2683:6, 2692:22, 2726:11, 2729:3, 2731:21, 2742:22, 2742:25, 2743:1, 2755:8, 2756:13, 2807:7, 2809:25, 2813:20, 2818:4, 2818:14, 2829:17, 2831:12, 2831:16, 2837:9, 2903:4 reading [7] - 2691:7, 2692:21, 2729:7, 2780:8, 2800:4, 2813:14, 2813:15 reads [6] - 2751:18, 2804:3, 2861:16, 2868:6, 2872:2, 2896:6 ready [1] - 2875:13 real [5] - 2714:5, 2792:10, 2792:11, 2792:15, 2856:8 real-world [1] - 2856:8 realize [1] - 2700:15 realizes [1] - 2792:14 really [19] - 2680:21, 2681:17, 2685:25, 2688:3, 2688:24, 2694:5, 2699:19, 2700:9, 2700:13, 2701:13, 2714:12, 2746:14, 2781:8, 2807:9, 2810:22, 2822:25, 2840:3, 2858:5, 2865:13 reason [8] - 2685:18, 2786:23, 2791:17, 2806:4, 2820:20, 2839:25, 2900:19 reasons [3] - 2804:6, 2852:16, 2860:10 received [2] - 2844:7, 2860:22 Recent [1] - 2731:15 recent [3] - 2770:19, 2770:20, 2856:9 recently [1] - 2733:24 recently-deposited [1] - 2733:24 recess [2] - 2744:17, 2906:3 Recess [3] - 2744:19, 2795:10, 2875:1</p>	<p>Reclamation [1] - 2852:15 reclamation [1] - 2853:24 recognize [3] - 2704:10, 2746:20, 2761:5 recognized [1] - 2710:12 recollection [1] - 2800:3 recommendation [1] - 2776:14 recommendations [5] - 2705:2, 2705:20, 2776:15, 2900:22, 2904:6 recommended [2] - 2692:24, 2758:7 recommending [3] - 2772:5, 2772:8, 2772:14 reconnect [1] - 2689:22 reconnecting [1] - 2700:7 reconnection [2] - 2700:12, 2701:21 record [5] - 2728:8, 2729:6, 2795:17, 2796:3, 2797:9 records [2] - 2685:15, 2802:19 recover [3] - 2694:4, 2742:4, 2742:5 recovered [2] - 2687:20, 2689:10 recovering [5] - 2687:8, 2689:9, 2695:11, 2701:23, 2711:6 recovery [11] - 2688:25, 2693:18, 2694:10, 2700:10, 2701:4, 2706:11, 2707:1, 2710:18, 2731:25, 2732:2, 2742:2 recreate [1] - 2896:4 recreation [1] - 2894:12 recreational [1] - 2893:17 recross [1] - 2714:16 Recross [1] - 2676:2 RECROSS [2] - 2714:18, 2898:2 RECROSS- EXAMINATION [2] -</p>	<p>red [4] - 2690:25, 2768:10, 2823:22, 2883:20 redirect [5] - 2718:15, 2729:21, 2730:12, 2738:9, 2740:8 Redirect [1] - 2676:2 REDIRECT [3] - 2677:5, 2740:9, 2848:23 reduce [13] - 2776:6, 2776:10, 2807:18, 2815:11, 2815:24, 2830:1, 2842:8, 2851:11, 2867:16, 2869:10, 2869:14, 2881:11, 2902:5 reduced [13] - 2693:7, 2693:14, 2696:2, 2696:3, 2696:18, 2715:10, 2715:15, 2771:5, 2771:11, 2771:15, 2772:3, 2772:4, 2871:20 reduces [4] - 2828:4, 2828:5, 2842:17, 2842:19 reducing [7] - 2778:17, 2779:20, 2859:15, 2868:22, 2880:19, 2886:16, 2903:8 reduction [46] - 2696:16, 2696:17, 2715:9, 2716:20, 2757:25, 2758:1, 2759:9, 2759:13, 2760:9, 2761:16, 2761:21, 2768:15, 2768:19, 2769:1, 2769:5, 2771:10, 2774:7, 2776:19, 2778:23, 2781:5, 2788:2, 2788:3, 2788:13, 2788:15, 2788:23, 2791:14, 2793:21, 2797:6, 2799:24, 2801:13, 2801:15, 2802:25, 2813:25, 2842:13, 2842:21, 2858:11, 2879:15, 2879:24, 2880:13, 2881:4, 2883:7, 2883:12, 2883:24, 2884:23, 2889:10, 2905:15 reductions [13] - 2696:5, 2709:19, 2763:2, 2765:24, 2787:18,</p>	<p>2787:24, 2798:5, 2803:25, 2841:24, 2859:19, 2866:20, 2883:13 refer [7] - 2704:2, 2705:23, 2708:3, 2728:16, 2818:1, 2839:13, 2868:11 reference [6] - 2679:14, 2691:24, 2692:3, 2692:12, 2692:15, 2730:1 Referenced [1] - 2676:8 referenced [1] - 2691:13 references [1] - 2691:16 referencing [2] - 2730:8, 2790:6 referred [4] - 2678:13, 2679:20, 2889:3, 2892:25 referring [12] - 2692:14, 2704:1, 2760:20, 2775:17, 2786:16, 2789:20, 2803:4, 2819:17, 2841:12, 2858:8, 2870:9, 2890:13 refers [3] - 2704:3, 2744:5, 2872:6 reflect [2] - 2722:14, 2872:8 reflected [2] - 2740:19, 2830:18 reflecting [2] - 2755:15, 2839:8 reflection [1] - 2725:10 reflects [3] - 2800:13, 2844:15, 2898:17 reframe [1] - 2757:8 refresh [2] - 2800:1, 2800:3 refuge [2] - 2852:22, 2853:5 refused [1] - 2899:17 regain [2] - 2693:3, 2693:19 regard [6] - 2711:17, 2716:13, 2760:6, 2806:23, 2892:18, 2898:20 regarding [3] - 2677:10, 2711:16, 2759:25 regime [9] - 2692:8, 2694:3, 2694:9, 2702:10, 2713:12,</p>

<p>2814:5, 2817:3, 2817:20, 2817:22 region [1] - 2752:15 regional [4] - 2678:12, 2678:19, 2680:13, 2680:23 regional-scale [2] - 2678:12, 2678:19 regionally [1] - 2826:19 regulated [2] - 2816:15, 2817:15 REIGSTAD [1] - 2675:22 rejected [3] - 2846:11, 2846:16, 2846:20 relate [2] - 2692:18, 2861:18 related [6] - 2800:10, 2817:13, 2851:5, 2869:8, 2872:6, 2882:4 relates [3] - 2683:5, 2697:3, 2826:10 relating [1] - 2750:24 relation [1] - 2701:19 relationship [3] - 2694:25, 2741:12, 2842:2 relative [3] - 2715:5, 2715:22, 2778:18 relatively [3] - 2680:16, 2686:8, 2728:17 relevant [2] - 2720:6, 2889:15 reliable [1] - 2894:15 reliably [1] - 2750:22 relied [1] - 2898:24 Relief [2] - 2777:15, 2890:14 relief [1] - 2729:4 relies [4] - 2708:25, 2719:15, 2719:16, 2847:4 rely [3] - 2684:11, 2720:1, 2848:11 remain [3] - 2694:1, 2731:11, 2731:12 remained [1] - 2779:14 remaining [2] - 2711:3, 2727:21 remarkable [1] - 2699:19 remedied [1] - 2706:20 Remedy [1] - 2888:21 remedy [6] - 2757:20, 2757:23, 2759:11,</p>	<p>2760:8, 2761:8, 2905:9 remember [12] - 2698:12, 2723:2, 2749:25, 2779:6, 2796:21, 2796:22, 2802:7, 2817:8, 2864:8, 2866:22, 2893:2, 2898:7 remind [1] - 2685:22 removal [3] - 2866:6, 2866:9, 2866:13 remove [3] - 2702:14, 2703:5, 2710:24 removed [1] - 2703:3 removing [3] - 2699:15, 2702:17, 2705:7 renarrow [1] - 2741:6 repaid [1] - 2829:4 repeat [1] - 2849:4 repeated [1] - 2687:5 replace [1] - 2863:21 report [16] - 2678:1, 2678:9, 2679:3, 2680:7, 2696:11, 2696:14, 2697:25, 2698:1, 2698:9, 2698:22, 2699:2, 2699:6, 2699:12, 2700:3, 2700:8, 2700:9, 2703:8, 2703:18, 2705:2, 2708:17, 2708:20, 2708:21, 2708:24, 2709:3, 2710:1, 2710:5, 2710:8, 2710:13, 2711:20, 2711:23, 2714:21, 2714:25, 2716:1, 2716:19, 2718:8, 2719:9, 2719:17, 2720:21, 2720:25, 2721:1, 2721:2, 2721:11, 2721:16, 2721:25, 2722:12, 2722:19, 2723:4, 2723:9, 2723:21, 2724:7, 2724:25, 2725:4, 2725:9, 2726:16, 2728:10, 2728:15, 2730:1, 2733:7, 2734:4, 2735:9, 2735:19, 2737:18, 2738:17, 2738:18, 2738:23, 2739:12, 2739:17, 2739:22, 2740:3, 2740:13, 2740:20, 2740:21, 2740:2</p>	<p>2741:9, 2741:12, 2741:16, 2741:18, 2743:3, 2749:25, 2759:25, 2760:14, 2762:2, 2762:7, 2762:10, 2762:23, 2763:25, 2764:2, 2764:5, 2764:7, 2765:9, 2765:12, 2767:14, 2767:19, 2770:17, 2770:23, 2773:21, 2774:5, 2774:7, 2778:17, 2779:3, 2779:9, 2780:7, 2781:10, 2782:24, 2783:25, 2784:21, 2784:23, 2787:17, 2787:23, 2789:6, 2791:9, 2792:1, 2792:21, 2794:7, 2798:13, 2798:16, 2798:23, 2799:16, 2803:18, 2803:22, 2804:11, 2804:13, 2804:18, 2804:22, 2805:7, 2805:15, 2805:23, 2805:25, 2808:17, 2808:20, 2811:14, 2813:16, 2818:7, 2819:12, 2821:1, 2834:4, 2834:9, 2836:2, 2837:1, 2838:13, 2838:16, 2838:25, 2839:1, 2840:18, 2840:22, 2844:1, 2846:10, 2863:25, 2865:15, 2872:16, 2873:8, 2873:9, 2873:10, 2874:11, 2874:12, 2897:16, 2899:10, 2899:13, 2905:18 reported [12] - 2703:10, 2727:2, 2727:14, 2727:20, 2729:13, 2753:4, 2791:25, 2792:5, 2792:8, 2792:17, 2819:9, 2819:17 Reporter [1] - 2907:16 reporting [4] - 2730:5, 2749:25, 2839:3, 2840:19 reports [21] - 2715:16, 2719:23, 2730:4, 2730:8, 2730:9, 2730:22, 2730:23, 2740:16, 2746:13, 2746:21, 2746:15, 2746:21, 2746:15</p>	<p>2790:16, 2805:2, 2832:21, 2839:10, 2840:5, 2843:16, 2859:14, 2874:20 representative [1] - 2723:6 Representatives [2] - 2718:10, 2718:13 represented [2] - 2706:1, 2767:24 represents [2] - 2742:1, 2855:11 Republican [6] - 2850:10, 2854:22, 2855:1, 2855:3, 2855:10, 2886:5 request [2] - 2724:2, 2855:24 requested [1] - 2718:8 require [1] - 2700:13 required [6] - 2687:5, 2694:15, 2702:21, 2712:19, 2742:4, 2873:2 requires [2] - 2702:5, 2886:17 research [1] - 2724:19 Research [1] - 2903:19 researcher [1] - 2832:3 Reserve [2] - 2867:22, 2868:2 reservoir [3] - 2681:5, 2847:18, 2848:15 reservoirs [3] - 2677:11, 2681:3, 2681:4 residences [1] - 2890:1 residential [3] - 2862:23, 2882:12, 2889:24 residents [5] - 2752:2, 2793:5, 2794:17, 2873:17, 2873:23 resolution [1] - 2718:9 resolved [1] - 2707:3 Resource [2] - 2855:19, 2894:2 resource [6] - 2705:9, 2815:22, 2815:23, 2849:14, 2862:25, 2894:7 resources [14] - 2744:25, 2752:3, 2752:14, 2753:5, 2849:8, 2849:12, 2849:17, 2849:19, 2896:1,</p>	<p>2896:2, 2904:9, 2904:12, 2904:15 Resources [1] - 2855:9 respect [5] - 2753:20, 2850:14, 2858:4, 2861:1, 2886:24 respondents [2] - 2793:19, 2795:3 responding [2] - 2677:9, 2888:4 response [2] - 2796:8, 2889:6 responses [1] - 2887:6 responsibilities [1] - 2721:24 responsibility [2] - 2715:13, 2855:6 responsible [1] - 2721:22 rest [3] - 2726:12, 2743:17, 2898:15 restoration [11] - 2685:1, 2689:12, 2690:4, 2694:15, 2694:16, 2694:24, 2695:2, 2697:13, 2699:3, 2705:21, 2741:2 restore [4] - 2684:18, 2697:11, 2705:12, 2713:11 restored [1] - 2696:25 restoring [1] - 2699:7 restriction [2] - 2867:5, 2869:10 restrictions [3] - 2771:21, 2794:1, 2794:9 result [11] - 2712:10, 2717:17, 2741:7, 2750:16, 2759:12, 2798:6, 2833:20, 2844:16, 2873:3, 2880:8, 2880:13 resulted [1] - 2839:20 resulting [1] - 2905:3 results [4] - 2695:20, 2867:23, 2879:25, 2888:11 retained [1] - 2746:24 retired [1] - 2852:21 retirement [1] - 2867:24 return [3] - 2778:4, 2833:7, 2833:21 returned [2] - 2698:10, 2833:11 returns [1] - 2835:1</p>
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<p>revealing [1] - 2806:19 revenue [1] - 2750:15 reversing [1] - 2695:18 review [16] - 2678:5, 2679:10, 2680:2, 2681:7, 2682:22, 2685:13, 2690:24, 2700:21, 2702:15, 2707:5, 2722:3, 2722:4, 2722:6, 2722:10, 2763:8, 2763:18 reviewed [6] - 2678:7, 2708:17, 2739:23, 2846:11, 2846:20, 2847:10 revisions [1] - 2856:11 revisit [1] - 2888:2 Rhone [1] - 2713:22 rights [7] - 2816:8, 2816:11, 2817:4, 2852:21, 2854:3, 2866:24, 2885:9 riparian [11] - 2688:12, 2729:17, 2816:4, 2816:11, 2816:15, 2816:18, 2816:23, 2817:1, 2817:3, 2817:15, 2853:17 rise [1] - 2878:12 risk [8] - 2827:11, 2827:13, 2828:4, 2828:5, 2828:9, 2828:12, 2828:16 River [35] - 2678:24, 2681:12, 2682:9, 2697:14, 2698:3, 2705:12, 2711:12, 2711:14, 2713:2, 2713:19, 2713:20, 2713:22, 2714:4, 2716:21, 2718:16, 2719:19, 2720:22, 2721:12, 2736:21, 2736:23, 2738:21, 2850:10, 2850:11, 2851:15, 2854:1, 2854:11, 2854:22, 2855:1, 2855:3, 2855:10, 2886:5, 2896:22, 2901:15, 2902:19, 2903:22 river [119] - 2679:17, 2679:25, 2681:19, 2682:11, 2685:12, 2686:9, 2686:23,</p>	<p>2686:25, 2687:20, 2687:25, 2688:2, 2688:11, 2689:9, 2689:10, 2689:11, 2689:15, 2689:18, 2692:9, 2692:19, 2693:1, 2693:5, 2693:13, 2693:14, 2693:16, 2693:18, 2694:4, 2694:11, 2694:18, 2694:24, 2695:4, 2695:6, 2695:10, 2695:24, 2695:25, 2696:4, 2696:6, 2696:12, 2696:17, 2696:18, 2697:16, 2697:18, 2697:23, 2698:7, 2698:10, 2698:19, 2699:18, 2700:11, 2701:2, 2701:7, 2701:23, 2702:1, 2702:6, 2702:7, 2702:10, 2705:21, 2706:12, 2707:2, 2707:21, 2708:7, 2708:9, 2710:2, 2710:3, 2710:14, 2711:15, 2712:12, 2712:22, 2712:24, 2713:6, 2714:22, 2715:5, 2715:8, 2715:9, 2715:19, 2719:11, 2721:23, 2722:21, 2726:20, 2726:23, 2727:16, 2727:22, 2729:10, 2731:1, 2731:24, 2732:1, 2732:7, 2732:17, 2732:19, 2733:5, 2734:14, 2734:16, 2734:23, 2735:3, 2735:5, 2736:8, 2736:24, 2737:3, 2737:10, 2737:14, 2737:15, 2737:16, 2741:3, 2741:5, 2741:20, 2741:25, 2742:2, 2742:4, 2742:5, 2744:5, 2810:10, 2814:23, 2851:6, 2851:12, 2869:14, 2884:5, 2887:5, 2895:5 river's [1] - 2699:25 riverbanks [1] - 2688:14 riverbed [7] - 2686:9, 2686:12, 2686:1ⁿ, 2687:8, 2687:23,</p>	<p>2729:9, 2741:7 riverine [2] - 2735:7, 2744:1 riverkeeper [1] - 2698:19 Riverkeepers [1] - 2725:4 Rivers [12] - 2678:4, 2697:4, 2697:9, 2697:15, 2697:17, 2697:19, 2698:10, 2714:21, 2718:9, 2719:17, 2720:21, 2725:8 rivers [12] - 2684:16, 2684:19, 2694:5, 2697:12, 2697:20, 2713:1, 2713:24, 2714:3, 2743:18, 2744:6, 2858:9 RMR [2] - 2675:14, 2907:15 road [6] - 2820:22, 2820:23, 2820:24, 2821:4, 2832:5, 2846:1 roads [1] - 2821:17 robots [1] - 2864:16 role [4] - 2748:12, 2778:1, 2797:10, 2847:13 room [1] - 2864:4 roots [2] - 2707:15, 2707:17 rotation [3] - 2861:17, 2861:18, 2869:9 rotations [1] - 2854:19 roughly [2] - 2692:23, 2785:23 round [2] - 2880:11, 2880:12 routine [1] - 2829:22 routinely [2] - 2756:1, 2873:6 row [2] - 2784:18, 2813:1 rude [1] - 2900:5 rule [1] - 2729:2 Run [2] - 2703:2, 2705:14 run [6] - 2686:7, 2713:9, 2713:11, 2821:23, 2847:3, 2870:22 running [1] - 2761:16 runoff [1] - 2765:16</p>	<p>2713:19 salinity [2] - 2759:5, 2759:13 salmon [4] - 2713:7, 2713:11, 2851:7, 2851:13 San [8] - 2713:2, 2713:4, 2713:8, 2713:16, 2713:18, 2856:13, 2856:17, 2856:18 sand [25] - 2680:8, 2681:1, 2686:15, 2687:9, 2687:13, 2687:25, 2688:17, 2689:5, 2703:13, 2704:18, 2705:8, 2712:9, 2726:19, 2726:24, 2727:5, 2727:6, 2727:9, 2727:11, 2727:15, 2727:22, 2732:7, 2733:11, 2733:14, 2733:23 Sand [2] - 2735:14, 2735:17 sandy [1] - 2686:13 satellite [3] - 2857:12, 2857:17, 2888:14 satellites [4] - 2857:14, 2857:23, 2904:16, 2904:24 save [6] - 2683:25, 2794:14, 2813:15, 2857:1, 2864:25, 2869:13 saved [2] - 2847:23, 2848:3 saving [1] - 2684:2 savings [13] - 2683:22, 2684:4, 2770:14, 2774:23, 2775:3, 2775:14, 2776:1, 2782:4, 2783:8, 2806:13, 2807:24, 2808:12, 2873:2 saw [7] - 2680:19, 2763:11, 2763:15, 2808:22, 2821:9, 2821:16, 2836:12 sawmills [2] - 2680:9 scale [17] - 2678:12, 2678:19, 2678:22, 2678:25, 2680:4, 2680:11, 2680:22, 2685:19, 2686:1, 2689:14, 2689:21, 2731:5, 2731:7, 2731:10,</p>	<p>2852:6, 2867:21 scenario [22] - 2757:20, 2757:23, 2759:12, 2760:8, 2761:9, 2761:17, 2763:22, 2764:12, 2765:2, 2765:5, 2765:11, 2766:3, 2773:8, 2776:5, 2779:13, 2785:1, 2785:18, 2786:2, 2793:23, 2806:1, 2842:21 scenarios [22] - 2762:19, 2763:3, 2763:5, 2764:6, 2764:10, 2772:9, 2774:6, 2774:22, 2775:11, 2776:16, 2788:6, 2796:19, 2797:3, 2804:19, 2807:17, 2807:21, 2812:9, 2842:17, 2844:19, 2891:10, 2899:4, 2902:9 scheme [1] - 2885:18 Science [2] - 2831:1, 2896:22 scientific [2] - 2741:1, 2894:16 scientifically [1] - 2705:20 scientifically-based [1] - 2705:20 scientists [1] - 2708:22 scoot [1] - 2747:12 scope [2] - 2708:25, 2716:19 Scyphers [2] - 2796:6, 2796:8 se [1] - 2682:19 season [5] - 2826:17, 2826:20, 2832:6, 2863:10 seated [1] - 2745:12 second [26] - 2696:23, 2733:17, 2756:13, 2759:22, 2759:23, 2763:25, 2764:7, 2765:10, 2774:6, 2774:7, 2777:18, 2795:21, 2805:15, 2805:22, 2805:25, 2807:7, 2818:4, 2818:5, 2818:10, 2838:13, 2838:16, 2839:1, 2840:5, 2844:1, 2865:14, 2880:19</p>
--	---	---	--	---

S

THE REPORTING GROUP

Mason & Lockhart

<p>Secretary [5] - 2677:25, 2717:1, 2717:23, 2718:5, 2895:1</p> <p>section [16] - 2724:24, 2725:16, 2726:7, 2728:1, 2728:23, 2731:15, 2735:10, 2735:19, 2735:25, 2737:20, 2739:14, 2739:15, 2739:23, 2740:18, 2799:7, 2864:1</p> <p>sections [3] - 2677:16, 2679:9, 2741:11</p> <p>sector [12] - 2798:21, 2801:17, 2803:6, 2803:14, 2803:16, 2804:7, 2841:23, 2854:9, 2857:2, 2857:5, 2889:23</p> <p>sectors [1] - 2801:24</p> <p>secure [1] - 2829:7</p> <p>Sediment [2] - 2725:17, 2725:23</p> <p>sediment [11] - 2699:15, 2702:14, 2702:18, 2703:6, 2710:21, 2712:17, 2712:20, 2730:16, 2731:6, 2731:10, 2735:22</p> <p>see [76] - 2688:10, 2695:17, 2698:20, 2704:18, 2706:10, 2710:25, 2725:16, 2728:25, 2732:11, 2732:12, 2733:7, 2733:18, 2734:11, 2736:2, 2736:6, 2736:9, 2737:20, 2738:3, 2756:15, 2761:9, 2762:5, 2764:12, 2768:1, 2771:1, 2777:15, 2777:22, 2785:5, 2792:19, 2795:13, 2798:3, 2800:20, 2809:9, 2809:11, 2809:17, 2809:19, 2810:12, 2810:17, 2810:21, 2813:2, 2820:23, 2820:24, 2821:11, 2829:25, 2834:12, 2837:5, 2839:11, 2839:18, 2840:18, 2845:13, 2860:17, 2865:3, 2865:19, 2866:2,</p>	<p>2866:5, 2866:7, 2866:12, 2868:6, 2869:3, 2869:23, 2871:21, 2876:5, 2878:9, 2878:10, 2878:25, 2879:7, 2886:13, 2886:25, 2887:4, 2887:22, 2888:3, 2890:22, 2892:9, 2897:9, 2897:14, 2898:8, 2904:24</p> <p>seeing [3] - 2711:5, 2738:7, 2820:16</p> <p>seeking [1] - 2778:4</p> <p>seem [1] - 2903:11</p> <p>segregated [1] - 2816:8</p> <p>selection [1] - 2846:8</p> <p>self [6] - 2692:10, 2694:6, 2701:3, 2701:25, 2702:4, 2702:5</p> <p>self-healing [6] - 2692:10, 2694:6, 2701:3, 2701:25, 2702:4, 2702:5</p> <p>senior [1] - 2854:3</p> <p>sense [8] - 2706:23, 2752:10, 2752:20, 2844:16, 2855:13, 2856:7, 2859:17, 2903:16</p> <p>sentence [22] - 2679:24, 2680:5, 2709:18, 2725:19, 2726:12, 2726:13, 2727:19, 2730:10, 2735:20, 2737:24, 2804:3, 2809:25, 2811:13, 2813:17, 2818:4, 2818:5, 2818:10, 2818:21, 2839:16, 2865:17, 2897:7, 2897:8</p> <p>sentences [3] - 2679:11, 2741:10, 2897:6</p> <p>separate [1] - 2724:16</p> <p>series [3] - 2757:18, 2797:12, 2874:13</p> <p>serious [1] - 2709:17</p> <p>serve [2] - 2679:1, 2680:12</p> <p>served [1] - 2679:22</p> <p>Service [4] - 2690:17, 2703:10, 2704:12, 2705:6</p> <p>service [7] - 2790:1, 2790:8, 2790:24</p>	<p>2791:1, 2834:11, 2835:6</p> <p>Service's [1] - 2692:13</p> <p>serviced [1] - 2889:17</p> <p>services [2] - 2893:11, 2893:24</p> <p>Session [1] - 2717:14</p> <p>set [10] - 2693:21, 2705:17, 2748:7, 2776:14, 2776:16, 2782:19, 2839:8, 2855:8, 2888:1</p> <p>sets [2] - 2773:25, 2843:12</p> <p>setting [2] - 2694:12, 2887:19</p> <p>settled [1] - 2854:4</p> <p>settlement [1] - 2713:14</p> <p>Settlement [1] - 2854:10</p> <p>several [5] - 2691:12, 2852:7, 2865:18, 2876:14, 2876:15</p> <p>severe [4] - 2719:18, 2806:5, 2890:23, 2891:3</p> <p>shade [1] - 2767:17</p> <p>shall [2] - 2745:8, 2745:9</p> <p>shift [1] - 2812:7</p> <p>ships [1] - 2682:20</p> <p>shoal [1] - 2687:4</p> <p>shoaling [1] - 2688:3</p> <p>short [4] - 2718:20, 2728:18, 2871:8, 2875:8</p> <p>shortcut [1] - 2737:11</p> <p>shot [1] - 2732:17</p> <p>show [13] - 2678:10, 2690:7, 2696:1, 2706:7, 2736:22, 2802:19, 2819:7, 2820:8, 2823:4, 2824:4, 2850:18, 2879:17, 2879:23</p> <p>showed [4] - 2711:23, 2714:25, 2760:10, 2885:6</p> <p>showing [8] - 2686:22, 2695:7, 2732:25, 2741:19, 2768:10, 2880:2, 2882:15, 2883:11</p> <p>shown [10] - 2680:25, 2684:10, 2716:25, 2722:8, 2733:11, 2768:21, 2769:12, 2821:15, 2871:1,</p>	<p>shows [8] - 2683:19, 2707:17, 2732:18, 2761:15, 2762:19, 2823:23, 2834:10, 2883:5</p> <p>shrubs [1] - 2874:4</p> <p>shrunk [1] - 2771:7</p> <p>shut [1] - 2866:25</p> <p>side [3] - 2819:12, 2843:19, 2881:10</p> <p>significance [1] - 2679:14</p> <p>significant [10] - 2708:12, 2709:23, 2711:1, 2792:16, 2810:10, 2810:19, 2842:21, 2876:13, 2876:19, 2892:18</p> <p>signs [1] - 2695:7</p> <p>Silicon [1] - 2856:19</p> <p>similar [7] - 2725:3, 2728:5, 2838:12, 2851:14, 2851:22, 2855:3, 2868:1</p> <p>similarly [1] - 2856:15</p> <p>similarly-generic [1] - 2856:15</p> <p>simple [2] - 2776:21, 2861:6</p> <p>simply [7] - 2682:19, 2691:15, 2691:23, 2701:5, 2710:6, 2740:21, 2795:17</p> <p>simulated [1] - 2692:17</p> <p>simulation [2] - 2821:20, 2821:23</p> <p>single [15] - 2719:10, 2728:21, 2746:22, 2785:10, 2786:21, 2787:5, 2787:11, 2788:8, 2800:21, 2816:23, 2830:15, 2831:2, 2831:6, 2832:9, 2889:25</p> <p>single-family [1] - 2889:25</p> <p>single-year [1] - 2800:21</p> <p>sit [4] - 2804:8, 2884:12, 2884:13, 2897:25</p> <p>site [1] - 2732:13</p> <p>sites [2] - 2698:20, 2896:4</p> <p>situation [3] - 2753:21, 2817:16, 2852:12</p> <p>situations [4] - 2850:2,</p>	<p>2851:23, 2887:18</p> <p>six [3] - 2774:21, 2775:1, 2775:10</p> <p>size [3] - 2852:22, 2876:10, 2876:19</p> <p>sized [1] - 2852:11</p> <p>skip [1] - 2832:17</p> <p>sleeve [3] - 2746:18, 2765:7, 2774:4</p> <p>slide [4] - 2708:1, 2759:23, 2898:6, 2898:8</p> <p>slides [3] - 2706:24, 2707:5, 2707:11</p> <p>slightly [1] - 2697:2</p> <p>slipped [1] - 2795:13</p> <p>Slough [11] - 2703:7, 2703:13, 2704:17, 2704:19, 2711:11, 2735:25, 2736:5, 2736:8, 2736:11, 2736:17, 2736:18</p> <p>slough [7] - 2703:19, 2707:17, 2712:7, 2727:3, 2729:11, 2730:15, 2736:4</p> <p>sloughs [30] - 2688:25, 2689:1, 2689:4, 2689:23, 2693:6, 2693:13, 2695:14, 2696:23, 2702:14, 2702:18, 2707:20, 2711:8, 2711:10, 2711:11, 2711:13, 2711:18, 2711:19, 2711:21, 2711:25, 2712:4, 2712:5, 2712:14, 2712:16, 2712:21, 2727:7, 2727:10, 2727:11, 2727:17, 2729:24, 2731:4</p> <p>slowly [1] - 2747:22</p> <p>small [7] - 2689:14, 2689:21, 2699:14, 2731:7, 2758:1, 2869:6, 2876:6</p> <p>small-scale [2] - 2689:14, 2689:21</p> <p>smaller [5] - 2680:11, 2731:13, 2762:24, 2876:16, 2889:24</p> <p>Smith [7] - 2733:6, 2749:4, 2751:7, 2754:5, 2767:6, 2770:5, 2811:24</p> <p>sneaked [1] - 2795:14</p> <p>socially [1] - 2756:7</p> <p>soil [9] - 2814:4, 2814:19, 2814:20,</p>
---	---	--	---	---

2814:25, 2815:25,
2823:24, 2824:3,
2857:24, 2862:13
Soil [1] - 2903:25
solemnly [1] - 2745:7
someone [3] -
2758:10, 2804:7,
2815:16
sometime [1] -
2824:19
sometimes [4] -
2766:5, 2784:13,
2845:6, 2894:10
somewhat [4] -
2719:20, 2851:14,
2876:16, 2876:17
somewhere [3] -
2759:12, 2791:7,
2825:9
sorry [29] - 2680:9,
2693:10, 2704:7,
2713:24, 2732:24,
2751:16, 2759:22,
2761:6, 2767:11,
2776:15, 2780:17,
2786:18, 2790:10,
2790:11, 2791:10,
2795:12, 2818:15,
2823:18, 2832:21,
2844:23, 2853:10,
2861:24, 2862:1,
2862:2, 2862:17,
2868:8, 2870:14,
2883:4, 2901:11
sort [8] - 2678:10,
2683:7, 2689:13,
2698:20, 2779:16,
2815:17, 2850:23,
2852:10
sounds [3] - 2758:5,
2802:4, 2802:22
source [3] - 2727:22,
2735:22, 2773:23
sources [3] - 2870:24,
2889:18, 2904:11
south [2] - 2734:14,
2902:3
southwest [1] -
2826:1
soybeans [2] -
2861:19, 2861:24
space [2] - 2702:8,
2842:25
speaking [1] -
2747:22
SPECIAL [72] -
2675:11, 2677:2,
2677:4, 2677:19,
2691:19, 2714:16,
2726:3, 2726:6,

2726:9, 2739:7,
2740:8, 2742:10,
2742:15, 2742:18,
2742:22, 2743:2,
2743:8, 2743:11,
2743:16, 2743:21,
2743:24, 2744:7,
2744:13, 2744:16,
2744:22, 2745:21,
2746:6, 2782:16,
2795:7, 2795:14,
2796:11, 2796:13,
2796:15, 2820:11,
2848:21, 2853:8,
2853:11, 2865:9,
2875:7, 2875:13,
2875:20, 2875:25,
2878:17, 2878:20,
2884:16, 2895:12,
2898:1, 2900:1,
2900:3, 2900:11,
2900:14, 2901:2,
2901:11, 2901:20,
2902:11, 2902:18,
2902:22, 2903:2,
2903:13, 2903:17,
2903:21, 2903:24,
2904:3, 2904:8,
2904:14, 2904:20,
2904:25, 2905:8,
2905:19, 2905:22,
2905:24, 2906:2
species [6] - 2708:6,
2729:17, 2760:21,
2852:25, 2853:2,
2893:19
specific [13] -
2684:18, 2745:1,
2753:21, 2758:6,
2768:25, 2793:23,
2795:3, 2812:13,
2819:19, 2856:22,
2856:25, 2858:20,
2859:25
specifically [6] -
2683:11, 2685:5,
2755:5, 2846:11,
2873:13, 2901:10
specify [2] - 2732:22,
2861:4
spell [1] - 2745:14
spelled [2] - 2737:9,
2745:18
spend [2] - 2868:5,
2896:3
spent [2] - 2677:9,
2752:15
Spoil [1] - 2735:10
spoil [3] - 2731:12,
2732:13, 2735:2

spoils [7] - 2727:16,
2727:21, 2730:25,
2732:18, 2733:12,
2733:15, 2733:23
spoken [3] - 2819:8,
2819:11, 2819:16
spots [1] - 2687:2
spraying [1] - 2820:22
sprink [1] - 2709:20
Springs [2] - 2703:2,
2705:14
stability [1] - 2829:1
stabilization [1] -
2695:13
stabilize [1] - 2827:1
stabilized [3] -
2688:15, 2688:20,
2827:23
stable [1] - 2688:23
STACEY [1] - 2675:18
stage [4] - 2696:17,
2715:9, 2748:7,
2854:5
stagnant [1] - 2707:23
Stakeholder [1] -
2870:11
Stakeholders [4] -
2690:18, 2743:12,
2902:23, 2903:5
stand [5] - 2741:15,
2753:1, 2790:6,
2816:19, 2840:25
stand-alone [1] -
2816:19
standard [1] - 2756:6
standing [1] - 2729:2
stapled [1] - 2746:17
stars [1] - 2732:13
start [11] - 2780:13,
2807:5, 2815:4,
2849:2, 2851:4,
2853:22, 2856:24,
2857:2, 2860:12,
2879:19
started [6] - 2686:2,
2740:14, 2744:1,
2821:2, 2851:3,
2852:20
starting [7] - 2685:24,
2695:19, 2731:19,
2778:20, 2779:17,
2780:9, 2797:25
starts [2] - 2725:19,
2737:25
state [8] - 2743:9,
2745:14, 2816:15,
2816:18, 2816:23,
2817:1, 2894:22,
2903:15

2675:6
State [39] - 2675:15,
2675:17, 2675:20,
2693:17, 2693:21,
2693:24, 2694:13,
2694:19, 2698:23,
2702:20, 2702:23,
2705:11, 2724:13,
2724:18, 2726:17,
2727:20, 2727:23,
2728:9, 2729:8,
2730:5, 2730:12,
2730:19, 2732:1,
2740:23, 2752:14,
2772:19, 2797:1,
2815:12, 2855:2,
2855:6, 2855:8,
2855:16, 2855:21,
2855:24, 2857:6,
2874:14, 2887:3,
2895:4, 2907:3
statement [9] -
2709:15, 2753:20,
2760:19, 2762:10,
2762:18, 2763:4,
2809:17, 2813:21,
2895:15
states [9] - 2681:9,
2681:16, 2710:25,
2816:4, 2816:7,
2816:10, 2816:11,
2885:18
States [5] - 2690:17,
2697:19, 2718:2,
2718:12, 2850:5
STATES [1] - 2675:1
stating [1] - 2798:3
station [1] - 2734:10
statistically [1] -
2876:13
statistics [2] - 2876:8,
2895:7
status [1] - 2780:14
stay [1] - 2687:12
stayed [1] - 2780:25
steadily [3] - 2835:9,
2835:12, 2835:20
stenographic [1] -
2907:5
steps [2] - 2693:17,
2705:11
Steverson [1] - 2895:1
stick [4] - 2690:7,
2773:7, 2804:15,
2817:25
sticking [2] - 2836:20,
2837:1
still [16] - 2708:12,
2711:4, 2723:22,
2675:6

2731:2, 2731:3,
2731:4, 2735:16,
2735:17, 2749:10,
2770:25, 2773:3,
2792:6, 2868:25
stock [1] - 2832:7
stop [2] - 2825:21,
2851:25
stopped [3] - 2694:13,
2712:15, 2881:4
stopping [1] - 2688:19
strategy [1] - 2903:12
stream [9] - 2776:25,
2793:6, 2842:12,
2842:13, 2851:5,
2852:23, 2852:24,
2858:12, 2887:4
streamflow [34] -
2762:21, 2765:3,
2769:22, 2775:15,
2776:1, 2776:9,
2776:10, 2776:17,
2776:24, 2778:20,
2779:19, 2780:8,
2780:15, 2781:2,
2781:11, 2781:16,
2781:19, 2782:23,
2784:6, 2785:7,
2796:20, 2797:11,
2805:8, 2806:12,
2830:3, 2842:9,
2842:17, 2842:20,
2842:22, 2843:6,
2844:5, 2844:12,
2848:15, 2905:3
streamflows [8] -
2755:13, 2755:19,
2755:24, 2833:12,
2841:25, 2844:21,
2847:22, 2881:20
streams [3] - 2682:12,
2682:18, 2702:19
Street [1] - 2675:12
stress [1] - 2707:24
stretch [1] - 2732:19
stretches [1] - 2901:3
striped [1] - 2699:18
Stripling [1] - 2903:18
strong [2] - 2700:5,
2741:1
strongly [1] - 2700:16
struck [1] - 2895:20
students [1] - 2893:24
studied [2] - 2712:25,
2865:5
study [11] - 2684:13,
2685:13, 2708:15,
2714:2, 2723:22,
2740:14, 2740:25,
2830:15, 2831:2,

<p>2831:23, 2849:15 stuff [1] - 2700:14 Sturek [2] - 2782:18, 2782:19 subheading [1] - 2866:17 subject [1] - 2815:22 Submerged [1] - 2708:2 submerged [1] - 2708:4 submit [1] - 2678:9 submitted [4] - 2726:16, 2739:17, 2762:8, 2764:6 subscribe [1] - 2907:10 subsequent [2] - 2680:5, 2698:11 subsidized [1] - 2877:18 substance [1] - 2697:7 substantial [7] - 2756:20, 2759:9, 2760:6, 2760:18, 2761:22, 2808:7, 2809:1 substantially [1] - 2890:22 substrate [2] - 2688:21, 2688:23 subtract [1] - 2781:13 successful [2] - 2851:20, 2867:14 suffer [1] - 2708:10 suffered [1] - 2695:5 sufficient [2] - 2693:1, 2810:8 sufficiently [1] - 2701:24 suggested [3] - 2769:16, 2860:13, 2865:18 suggesting [6] - 2702:1, 2769:14, 2796:23, 2797:2, 2843:18, 2854:13 suggestion [2] - 2689:7, 2695:3 suggests [1] - 2717:5 suite [1] - 2886:18 sum [3] - 2774:22, 2801:8, 2883:7 Sumatra [3] - 2734:10, 2734:15, 2734:22 summarized [2] - 2730:23, 2763:3 summarizing [1] - 2730:3</p>	<p>Summary [1] - 2870:11 summary [1] - 2725:10 summer [14] - 2698:17, 2709:20, 2740:14, 2762:21, 2765:3, 2769:22, 2775:15, 2776:1, 2776:9, 2776:17, 2785:7, 2869:16, 2882:3, 2889:21 summertime [3] - 2881:2, 2881:15, 2882:1 sums [1] - 2775:25 sun [1] - 2869:16 Sunding [86] - 2676:4, 2744:24, 2745:17, 2745:24, 2746:9, 2746:20, 2746:24, 2747:10, 2747:24, 2748:22, 2749:8, 2749:21, 2750:8, 2751:6, 2752:1, 2752:16, 2753:22, 2754:13, 2755:3, 2755:9, 2756:1, 2758:16, 2759:7, 2763:19, 2764:21, 2766:1, 2767:11, 2769:13, 2769:20, 2770:10, 2771:13, 2772:2, 2774:4, 2776:1, 2778:22, 2780:21, 2782:22, 2786:1, 2787:4, 2787:15, 2790:16, 2791:22, 2792:24, 2794:16, 2795:19, 2796:18, 2797:15, 2799:7, 2803:21, 2804:13, 2807:9, 2810:5, 2811:15, 2812:3, 2812:7, 2812:25, 2813:14, 2817:25, 2818:9, 2819:15, 2820:5, 2820:15, 2821:6, 2823:3, 2823:14, 2825:15, 2827:17, 2828:11, 2829:23, 2832:2, 2832:17, 2835:15, 2835:18, 2836:2, 2841:2, 2845:2, 2847:13, 2848:13, 2848:25, 2875:16, 2888:20, 2888:21, 2898:4, 2898:12, 2899:4</p>	<p>2899:15 Sunding's [2] - 2746:14, 2773:24 supplementing [1] - 2848:15 supply [3] - 2853:25, 2856:12, 2889:20 support [3] - 2794:11, 2799:14, 2853:5 Supreme [4] - 2738:14, 2772:14, 2777:18, 2832:10 SUPREME [1] - 2675:1 surface [8] - 2734:8, 2735:1, 2735:2, 2735:6, 2870:2, 2870:5, 2870:24, 2889:18 surgery [3] - 2701:12, 2701:16, 2701:22 surplus [2] - 2788:5, 2789:20 surprise [1] - 2763:24 survey [19] - 2688:3, 2737:25, 2752:1, 2752:8, 2752:19, 2793:14, 2793:19, 2794:7, 2795:2, 2796:7, 2873:16, 2873:22, 2895:17, 2895:19, 2896:11, 2898:13, 2898:14, 2898:20, 2898:21 Survey [1] - 2688:10 sustain [1] - 2810:9 sustainable [1] - 2850:7 Sustainable [2] - 2743:13, 2902:24 swam [1] - 2713:8 swamp [1] - 2696:7 swamps [1] - 2729:18 swear [1] - 2745:7 Sweetwater [2] - 2703:2, 2705:14 Swift [5] - 2703:7, 2703:13, 2704:17, 2704:19, 2711:10 switch [4] - 2773:6, 2869:18, 2870:15, 2870:16 switching [3] - 2790:13, 2870:20, 2870:22 sworn [3] - 2755:12, 2756:22, 2898:17 system [15] - 2679:25, 2701:16, 2712:12,</p>	<p>2817:13, 2821:8, 2862:19, 2869:16, 2871:14, 2871:18, 2877:5, 2880:7, 2880:9, 2880:11 systemic [5] - 2689:18, 2689:25, 2699:9, 2699:25, 2700:1 systems [3] - 2712:24, 2714:8, 2889:17</p>	<p style="text-align: center;">T</p> <p>tab [18] - 2692:6, 2697:5, 2705:24, 2708:14, 2755:3, 2758:12, 2759:22, 2762:4, 2767:10, 2767:12, 2777:13, 2779:10, 2798:25, 2799:5, 2834:5, 2888:19, 2890:4, 2890:8 table [50] - 2683:13, 2683:19, 2760:4, 2760:14, 2761:18, 2762:13, 2762:19, 2762:24, 2768:12, 2768:21, 2774:4, 2784:10, 2785:15, 2799:19, 2800:13, 2801:21, 2803:3, 2804:16, 2812:16, 2812:23, 2834:7, 2834:9, 2836:2, 2837:4, 2837:10, 2838:19, 2840:17, 2841:2, 2841:9, 2844:11, 2858:22, 2859:5, 2859:6, 2859:8, 2860:1, 2860:16, 2862:8, 2865:22, 2865:25, 2866:17, 2868:15, 2878:6, 2882:24, 2882:25, 2892:2 tables [9] - 2746:21, 2807:21, 2840:6, 2858:17, 2858:25, 2859:1, 2859:2, 2883:10, 2885:2 tablet [2] - 2878:9, 2878:10 Taiwan [1] - 2713:24 talks [1] - 2719:17 Tallahassee [1] - 2698:13 tallied [1] - 2801:12 tally [1] - 2766:18,</p>	<p>target [3] - 2780:8, 2781:19, 2814:10 targeting [1] - 2776:19 teach [2] - 2893:20, 2894:14 teaching [1] - 2878:21 team [19] - 2694:22, 2721:2, 2723:11, 2724:25, 2725:11, 2725:12, 2726:16, 2727:2, 2727:14, 2727:20, 2727:23, 2728:8, 2729:8, 2731:25, 2734:13, 2739:15, 2739:17, 2743:7, 2783:22 technical [2] - 2691:8, 2691:13 Ted [3] - 2706:2, 2718:25, 2721:19 teeth [1] - 2864:5 temporal [1] - 2881:24 temporarily [1] - 2867:9 temporary [5] - 2860:6, 2866:6, 2866:9, 2866:23, 2881:12 tend [4] - 2694:17, 2876:11, 2876:15, 2876:17 tended [1] - 2687:4 tending [1] - 2727:10 term [8] - 2709:19, 2733:24, 2837:25, 2856:11, 2856:19, 2858:10, 2871:11, 2884:1 terminology [2] - 2806:9, 2813:8 terms [14] - 2684:5, 2688:25, 2711:2, 2748:3, 2798:17, 2800:8, 2814:7, 2850:7, 2861:2, 2863:9, 2873:19, 2888:10, 2891:18, 2903:14 test [1] - 2808:25 testified [10] - 2706:15, 2731:24, 2738:9, 2753:5, 2755:16, 2763:20, 2846:4, 2855:1, 2904:9, 2904:15 testify [2] - 2796:5, 2854:25 testifying [2] - 2748:6, 2889:6 testimony [97] -</p>
--	---	--	---	--	--

2677:15, 2682:4, 2691:18, 2692:5, 2720:14, 2721:5, 2722:6, 2722:10, 2723:1, 2724:17, 2738:14, 2741:14, 2741:15, 2742:19, 2745:7, 2745:25, 2746:14, 2750:9, 2752:13, 2755:2, 2755:12, 2755:18, 2756:11, 2756:22, 2759:1, 2759:8, 2759:11, 2761:15, 2763:8, 2763:11, 2763:13, 2770:15, 2770:16, 2770:21, 2771:4, 2771:24, 2772:17, 2774:18, 2775:16, 2778:16, 2781:18, 2784:4, 2784:21, 2785:16, 2788:21, 2789:3, 2789:17, 2790:12, 2791:10, 2791:12, 2792:1, 2792:12, 2792:18, 2794:3, 2795:23, 2796:2, 2796:9, 2797:19, 2797:20, 2798:11, 2798:13, 2798:19, 2803:22, 2806:25, 2807:1, 2807:11, 2807:22, 2808:5, 2808:13, 2808:14, 2808:23, 2812:17, 2812:23, 2818:2, 2818:9, 2823:15, 2825:18, 2829:17, 2839:11, 2839:16, 2840:9, 2840:22, 2841:3, 2841:18, 2842:4, 2842:6, 2844:6, 2850:17, 2855:15, 2859:18, 2883:22, 2892:1, 2895:7, 2898:17, 2898:24, 2899:7 Texas [2] - 2803:15, 2850:11 text [6] - 2706:7, 2837:9, 2895:16, 2895:18, 2895:19, 2895:21 Thailand [2] - 2713:24, 2713:25 THE [44] - 2675:1, 2742:14, 2742:17, 2742:21, 2742:24, 2743:4, 2743:10, 2743:14, 2743:20,	2743:23, 2744:3, 2744:15, 2745:5, 2745:11, 2745:12, 2745:16, 2853:10, 2853:14, 2878:19, 2878:21, 2878:25, 2879:6, 2879:10, 2900:10, 2900:13, 2900:25, 2901:4, 2901:13, 2901:24, 2902:14, 2902:21, 2902:25, 2903:4, 2903:16, 2903:20, 2903:23, 2904:2, 2904:7, 2904:12, 2904:17, 2904:23, 2905:2, 2905:11, 2906:1 theme [1] - 2859:13 themselves [5] - 2694:21, 2702:24, 2707:3, 2817:5, 2817:14 therefore [2] - 2824:6, 2884:6 thinking [3] - 2776:22, 2888:8, 2891:12 thinks [2] - 2822:19, 2822:20 third [7] - 2723:14, 2774:8, 2774:15, 2785:14, 2797:25, 2812:17, 2859:8 thoughts [1] - 2885:1 thousand [21] - 2712:3, 2757:7, 2759:13, 2759:19, 2762:20, 2763:1, 2763:5, 2779:20, 2780:10, 2781:13, 2781:25, 2782:5, 2785:8, 2786:4, 2843:21, 2852:7, 2859:9, 2874:13, 2876:15, 2899:5 thousands [2] - 2693:21, 2693:22 threat [1] - 2697:23 three [22] - 2703:1, 2733:4, 2746:15, 2764:5, 2771:3, 2774:3, 2775:6, 2781:11, 2782:25, 2783:5, 2783:19, 2788:7, 2800:22, 2802:13, 2804:23, 2855:9, 2858:16, 2858:25, 2859:2, 2861:20, 2872:14, 2883:8	three-page [4] - 2774:3, 2782:25, 2804:23, 2858:16 three-time [1] - 2802:13 three-year [2] - 2783:5, 2800:22 threeridge [3] - 2738:5, 2738:19, 2739:19 throughout [7] - 2695:9, 2712:4, 2770:1, 2859:21, 2861:22, 2862:3, 2879:22 tidal [2] - 2734:14, 2735:6 tides [1] - 2734:25 tied [2] - 2782:22, 2816:12 timber [3] - 2680:9, 2680:25, 2893:15 titled [3] - 2860:17, 2870:10, 2888:21 today [9] - 2677:12, 2692:17, 2700:16, 2706:11, 2710:17, 2729:14, 2898:12, 2898:16 together [4] - 2682:11, 2743:6, 2840:6, 2894:8 ton [1] - 2683:22 took [6] - 2741:10, 2805:19, 2856:24, 2857:10, 2857:20, 2904:3 tools [2] - 2685:4, 2851:15 top [6] - 2709:18, 2733:9, 2782:5, 2809:19, 2834:20, 2871:3 topic [2] - 2690:7, 2697:3 topics [1] - 2742:12 Torak [3] - 2846:12, 2846:20, 2847:3 Total [1] - 2888:21 total [18] - 2743:3, 2749:19, 2767:2, 2768:1, 2772:25, 2776:16, 2785:18, 2786:13, 2815:20, 2834:21, 2835:3, 2837:6, 2844:17, 2882:22, 2883:7, 2889:19, 2905:7, 2905:9	totally [1] - 2826:5 totals [1] - 2892:8 touched [1] - 2841:8 tougher [1] - 2887:25 toward [1] - 2895:25 track [1] - 2795:20 tracking [2] - 2751:1, 2779:16 trade [5] - 2747:19, 2747:24, 2815:13, 2817:13, 2817:14 trading [3] - 2816:24, 2817:2, 2817:5 transactions [2] - 2874:6, 2874:8 transcript [8] - 2722:14, 2748:19, 2751:17, 2752:17, 2754:2, 2763:11, 2846:24, 2907:5 TRANSCRIPT [1] - 2675:9 transcripts [1] - 2763:17 transfer [2] - 2816:20, 2817:6 transferring [2] - 2869:24, 2870:5 transfers [1] - 2758:3 transition [1] - 2829:10 translate [3] - 2797:5, 2841:24, 2887:11 transport [1] - 2684:1 transported [1] - 2683:17 trauma [1] - 2701:16 treatment [1] - 2871:15 tree [3] - 2729:17, 2732:25, 2733:1 tree-line [2] - 2732:25, 2733:1 trees [8] - 2707:15, 2707:16, 2729:20, 2750:24, 2759:25, 2760:11, 2760:17, 2760:20 tremendous [2] - 2694:6, 2714:10 tri [2] - 2743:9, 2903:15 tri-state [2] - 2743:9, 2903:15 trial [13] - 2750:9, 2763:9, 2790:12, 2797:20, 2798:19, 2825:14, 2839:25, 2840:22, 2841:3, 2887:14, 2887:14,	2899:2, 2899:7 tributaries [3] - 2699:16, 2713:23, 2858:9 tributary [3] - 2699:17, 2699:22, 2702:19 tricks [1] - 2747:19 tried [6] - 2734:20, 2783:8, 2850:17, 2850:18, 2857:5, 2859:13 Trinity [1] - 2713:19 tripped [1] - 2800:25 trouble [1] - 2862:12 true [23] - 2715:7, 2718:13, 2724:18, 2726:25, 2729:14, 2729:25, 2747:5, 2752:11, 2752:12, 2754:16, 2756:4, 2771:16, 2772:13, 2784:4, 2785:22, 2792:16, 2792:21, 2808:17, 2811:11, 2819:11, 2825:1, 2828:18, 2829:8 Trust [1] - 2894:24 truth [4] - 2745:9, 2745:10, 2748:25 try [7] - 2686:17, 2691:3, 2701:1, 2715:18, 2779:22, 2814:9, 2888:22 trying [14] - 2684:16, 2748:7, 2779:8, 2780:20, 2787:2, 2813:15, 2860:2, 2868:11, 2872:8, 2883:4, 2899:11, 2900:5, 2900:7, 2901:5 tucked [1] - 2774:3 tupelo [7] - 2696:8, 2696:9, 2729:20, 2759:25, 2760:10, 2760:17, 2760:20 tupelos [2] - 2729:22, 2760:24 turf [1] - 2870:22 turn [33] - 2682:2, 2702:12, 2734:3, 2735:8, 2737:17, 2749:3, 2751:5, 2752:16, 2754:2, 2755:1, 2756:12, 2761:4, 2762:1, 2770:3, 2773:14, 2777:13, 2777:14, 2779:8, 2779:9, 2783:17, 2797:18,
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<p>2809:3, 2809:9, 2809:23, 2811:15, 2815:11, 2819:14, 2823:14, 2827:17, 2856:22, 2859:24, 2890:3, 2890:7 turned [1] - 2874:16 turning [1] - 2833:4 twice [3] - 2776:18, 2809:20, 2853:17 two [33] - 2682:12, 2713:6, 2713:7, 2716:2, 2732:10, 2732:16, 2732:21, 2735:24, 2737:6, 2746:15, 2771:17, 2784:16, 2784:18, 2795:16, 2827:25, 2828:2, 2835:7, 2839:5, 2839:10, 2840:3, 2840:7, 2841:10, 2841:13, 2842:16, 2843:12, 2844:11, 2850:17, 2859:1, 2887:16, 2897:6, 2901:3 type [20] - 2685:13, 2761:21, 2788:11, 2789:9, 2814:17, 2814:20, 2814:25, 2815:1, 2815:3, 2815:25, 2823:24, 2838:13, 2862:13, 2867:1, 2868:3, 2881:7, 2884:10, 2884:24, 2897:19 types [8] - 2684:12, 2708:10, 2788:6, 2792:2, 2814:4, 2851:1, 2891:24, 2893:19 typical [1] - 2875:5 typically [1] - 2684:11</p>	<p>2775:15, 2776:5, 2777:12, 2801:9, 2805:17, 2814:4, 2815:2, 2824:24, 2841:9, 2844:18, 2852:17, 2855:18, 2861:11, 2863:25, 2866:17, 2868:14, 2880:10, 2880:12, 2880:16, 2888:19 underlying [4] - 2689:15, 2689:25, 2831:22, 2874:22 undertake [3] - 2694:23, 2873:18, 2873:24 undertaken [12] - 2677:13, 2680:4, 2702:16, 2702:20, 2705:11, 2705:16, 2754:13, 2784:11, 2784:12, 2852:14, 2872:10, 2904:18 undertaking [1] - 2740:24 undertook [1] - 2702:23 underwatered [1] - 2825:4 underwatering [4] - 2823:6, 2824:6, 2824:18, 2824:24 undeveloped [1] - 2694:1 unemployed [1] - 2803:8 unfortunately [2] - 2707:8, 2743:10 unit [2] - 2820:21, 2821:3 UNITED [1] - 2675:1 United [5] - 2690:17, 2697:19, 2718:2, 2718:12, 2850:5 University [7] - 2694:23, 2698:5, 2705:19, 2724:20, 2830:7, 2832:3, 2896:23 unless [2] - 2701:23, 2795:25 Unpermitted [1] - 2860:17 unwinding [1] - 2852:6 up [71] - 2681:12, 2681:23, 2683:15, 2686:10, 2686:23, 2687:24, 2698:13, 2702:25, 2707:1</p>	<p>2711:24, 2715:20, 2733:6, 2734:25, 2739:10, 2745:13, 2747:12, 2759:8, 2762:24, 2763:4, 2764:12, 2766:18, 2767:7, 2768:9, 2768:19, 2771:3, 2772:21, 2774:22, 2775:13, 2775:22, 2775:25, 2776:16, 2778:10, 2780:12, 2782:19, 2788:15, 2790:5, 2796:19, 2801:4, 2801:8, 2801:12, 2802:2, 2825:14, 2827:6, 2842:3, 2843:21, 2845:12, 2846:24, 2855:8, 2855:12, 2857:12, 2857:21, 2858:15, 2861:12, 2862:13, 2863:20, 2866:12, 2871:3, 2877:10, 2877:16, 2878:8, 2878:18, 2879:15, 2882:10, 2882:18, 2882:19, 2883:11, 2887:13, 2888:24, 2893:9, 2896:13, 2899:6 updated [1] - 2728:9 upfront [1] - 2877:6 upper [4] - 2854:6, 2901:16, 2901:17, 2902:1 Upper [2] - 2900:23, 2901:10 upstream [1] - 2710:2 upstream [20] - 2679:6, 2681:16, 2682:13, 2682:18, 2682:21, 2685:20, 2686:25, 2696:3, 2696:5, 2696:12, 2696:19, 2710:9, 2710:25, 2713:8, 2715:10, 2715:11, 2715:15, 2716:20, 2717:9, 2810:17 urban [15] - 2679:17, 2793:8, 2837:22, 2860:4, 2871:14, 2873:23, 2874:1, 2874:17, 2880:9, 2880:20, 2881:18, 2887:10, 2889:17, 2889:21, 2902:1 usable [1] - 2681:11</p>	<p>2765:17, 2773:7, 2774:23, 2793:21, 2836:6, 2851:8, 2856:21, 2883:12, 2883:25 USDA [5] - 2857:13, 2857:14, 2858:1, 2876:7, 2904:18 useful [1] - 2709:25 user [2] - 2814:25, 2833:10 users [11] - 2817:2, 2838:9, 2854:8, 2855:13, 2861:10, 2862:25, 2869:24, 2870:3, 2870:6, 2887:10 uses [5] - 2777:20, 2830:14, 2846:13, 2850:3, 2856:6 USGS [5] - 2692:1, 2711:20, 2730:4, 2730:22, 2730:23 utilities [2] - 2837:23, 2864:7 utility [1] - 2874:3</p>	<p>vary [2] - 2826:19, 2891:7 varying [1] - 2747:6 vast [2] - 2696:7, 2824:4 vegetation [3] - 2688:12, 2708:4, 2741:21 Vegetation [1] - 2708:2 verbatim [1] - 2813:20 verifiable [1] - 2886:9 verification [2] - 2886:18, 2888:13 verifying [1] - 2888:11 versions [2] - 2840:7 versus [8] - 2695:24, 2703:22, 2716:16, 2716:17, 2780:22, 2780:23, 2842:20 Versus [1] - 2888:21 vertical [1] - 2823:22 vertically [2] - 2733:6, 2882:20 video [5] - 2749:6, 2751:10, 2754:7, 2770:8, 2812:1 view [9] - 2714:5, 2719:2, 2755:9, 2755:22, 2808:9, 2818:23, 2825:24, 2831:25, 2869:13 virtually [1] - 2811:2 visit [1] - 2698:18 visits [1] - 2698:24 vitae [1] - 2832:14 vocabulary [1] - 2743:25 voice [1] - 2878:18 VOLUME [1] - 2675:5 volume [1] - 2904:9</p>
V				
<p>Valley [6] - 2853:18, 2853:22, 2854:3, 2856:19, 2886:4, 2888:6 valuation [1] - 2894:10 value [21] - 2699:5, 2749:16, 2749:20, 2750:1, 2794:17, 2794:19, 2804:12, 2844:24, 2846:14, 2847:5, 2869:18, 2870:16, 2870:21, 2877:21, 2883:9, 2893:10, 2893:18, 2894:19, 2894:25, 2896:8 valued [1] - 2893:1 values [5] - 2845:22, 2846:8, 2848:16, 2894:11 van [1] - 2675:18 variables [2] - 2753:17, 2754:15 varies [5] - 2826:15, 2826:17, 2827:5, 2842:25, 2889:23 various [6] - 2711:18, 2796:19, 2799:12, 2841:4, 2854:18, 2883:21</p>				
W				
<p>wait [3] - 2811:21, 2812:20, 2819:22 walk [3] - 2679:8, 2723:4, 2864:4 walls [1] - 2686:16 wants [1] - 2817:17 War [4] - 2677:25, 2717:1, 2717:23, 2718:5 wash [2] - 2732:7, 2874:4 wasteful [6] - 2819:2, 2819:9, 2819:13, 2819:18, 2820:16, 2820:20 wasting [3] - 2818:22,</p>				

<p>2822:12, 2862:25 watching [1] - 2893:16 water [191] - 2686:8, 2690:1, 2690:5, 2695:15, 2696:4, 2699:17, 2699:20, 2699:21, 2707:22, 2708:5, 2709:11, 2709:15, 2709:22, 2710:15, 2730:16, 2734:8, 2736:25, 2745:3, 2745:16, 2748:4, 2748:17, 2752:11, 2752:21, 2754:21, 2756:18, 2757:25, 2766:11, 2769:15, 2769:18, 2771:20, 2774:23, 2776:2, 2776:6, 2776:23, 2777:4, 2777:20, 2778:5, 2778:25, 2787:24, 2788:4, 2788:14, 2788:23, 2789:17, 2789:25, 2791:15, 2793:6, 2793:21, 2794:2, 2794:4, 2794:9, 2794:11, 2794:14, 2798:6, 2799:25, 2803:8, 2804:8, 2807:24, 2808:12, 2814:3, 2814:17, 2815:18, 2815:20, 2815:21, 2815:24, 2816:8, 2816:11, 2816:12, 2816:20, 2816:24, 2817:4, 2817:10, 2818:19, 2818:23, 2818:24, 2820:22, 2822:12, 2823:1, 2826:8, 2826:9, 2826:10, 2833:10, 2833:14, 2833:17, 2833:18, 2834:10, 2834:13, 2835:9, 2835:19, 2836:10, 2836:13, 2836:17, 2836:21, 2837:7, 2837:13, 2837:22, 2839:17, 2840:1, 2840:8, 2840:12, 2842:7, 2848:3, 2848:7, 2849:12, 2849:19, 2850:3, 2851:8, 2851:12, 2852:19, 2852:23, 2852:24, 2853:5, 2853:25, 2854:3, 2854:7, 2854:15,</p>	<p>2854:17, 2855:12, 2856:11, 2856:12, 2857:1, 2857:21, 2858:4, 2858:12, 2858:13, 2862:14, 2862:24, 2863:3, 2863:20, 2864:8, 2865:1, 2865:6, 2868:22, 2868:24, 2869:1, 2869:14, 2869:16, 2869:17, 2869:24, 2870:2, 2870:6, 2870:24, 2871:13, 2871:15, 2871:16, 2871:18, 2873:19, 2874:2, 2874:3, 2877:5, 2877:10, 2880:9, 2880:15, 2881:1, 2881:4, 2881:14, 2881:18, 2881:25, 2882:2, 2882:3, 2882:13, 2883:3, 2884:5, 2885:11, 2885:24, 2886:21, 2888:6, 2888:8, 2888:14, 2889:18, 2889:20, 2889:22, 2890:23, 2891:2, 2891:7, 2891:9, 2891:13, 2891:14, 2891:15, 2891:17, 2891:19, 2891:25, 2892:17, 2897:13, 2901:7, 2901:14, 2902:1, 2902:3 Water [5] - 2728:24, 2743:13, 2856:15, 2902:24, 2903:25 watering [13] - 2794:1, 2819:2, 2819:9, 2819:18, 2820:16, 2821:3, 2822:6, 2871:19, 2873:14, 2873:18, 2874:9, 2880:21, 2905:15 waters [1] - 2880:24 waterway [1] - 2683:3 ways [7] - 2683:16, 2737:6, 2755:13, 2755:20, 2755:23, 2856:25, 2864:25 week [2] - 2846:21, 2897:6 welcome [3] - 2679:11, 2795:15, 2900:12 welfare [15] - 2757:14, 2790:7, 2790:21, 2790:23, 2791:3</p>	<p>2792:3, 2792:5, 2792:9, 2792:25, 2793:4, 2793:10, 2793:13, 2873:3, 2873:12, 2873:15 well-known [1] - 2713:4 Wells [2] - 2830:7, 2830:25 wells [7] - 2830:11, 2831:5, 2831:10, 2831:12, 2831:15, 2832:1, 2857:9 wells's [1] - 2831:19 wet [4] - 2811:10, 2890:16, 2891:8, 2891:20 wet-year [1] - 2811:10 Wetlands [1] - 2868:1 wetted [2] - 2860:23, 2860:25 whatnot [3] - 2696:10, 2837:19, 2871:17 whereas [3] - 2735:6, 2816:11, 2842:11 WHEREOF [1] - 2907:10 white [3] - 2690:12, 2759:17, 2761:5 White [1] - 2761:1 white's [1] - 2761:20 whole [9] - 2679:5, 2724:24, 2741:11, 2745:9, 2771:25, 2821:2, 2832:12, 2838:8, 2874:19 wide [4] - 2694:8, 2712:1, 2858:2, 2897:17 widened [1] - 2688:8 widening [2] - 2728:14, 2729:9 width [3] - 2732:25, 2733:1, 2734:2 wildlife [2] - 2852:22, 2853:5 Wildlife [24] - 2690:17, 2692:13, 2698:6, 2703:10, 2704:12, 2705:6, 2720:10, 2721:17, 2721:20, 2722:2, 2722:5, 2722:20, 2723:5, 2726:17, 2727:3, 2727:15, 2730:6, 2735:9, 2735:20, 2738:18, 2738:24, 2739:18, 2740:3, 2741:24</p>	<p>2873:24 willingness [1] - 2794:10 willows [1] - 2688:12 Wilson [1] - 2761:1 WINE [1] - 2675:17 wipe [1] - 2862:5 withdraw [1] - 2716:9 withdrawal [7] - 2833:17, 2833:21, 2837:16, 2837:17, 2837:20, 2861:3, 2861:10 withdrawals [3] - 2834:19, 2834:21, 2835:4 withdrawn [1] - 2833:10 WITNESS [42] - 2742:14, 2742:17, 2742:21, 2742:24, 2743:4, 2743:10, 2743:14, 2743:20, 2743:23, 2744:3, 2744:15, 2745:11, 2745:16, 2853:10, 2853:14, 2878:19, 2878:21, 2878:25, 2879:6, 2879:10, 2900:10, 2900:13, 2900:25, 2901:4, 2901:13, 2901:24, 2902:14, 2902:21, 2902:25, 2903:4, 2903:16, 2903:20, 2903:23, 2904:2, 2904:7, 2904:12, 2904:17, 2904:23, 2905:2, 2905:11, 2906:1, 2907:10 Witness [1] - 2676:2 witness [9] - 2691:7, 2691:9, 2724:3, 2739:1, 2739:6, 2745:20, 2865:8, 2881:6, 2881:16 witnesses [1] - 2796:5 word [8] - 2690:21, 2744:4, 2775:20, 2823:11, 2835:12, 2853:13, 2853:17, 2858:7 words [2] - 2887:16, 2898:16 workers [2] - 2803:20, 2803:23 works [3] - 2721:19, 2814:13, 2867:22 world [3] - 2714:3, 2894:5</p>	<p>worldwide [1] - 2743:18 worthwhile [2] - 2734:21, 2894:17 write [7] - 2692:7, 2725:7, 2730:7, 2734:18, 2739:13, 2742:19, 2790:15 writes [1] - 2832:8 writing [2] - 2778:1, 2904:5 written [26] - 2718:19, 2721:4, 2722:25, 2723:10, 2723:11, 2755:1, 2770:20, 2770:25, 2771:4, 2773:10, 2774:9, 2774:17, 2774:18, 2778:3, 2786:20, 2789:2, 2795:22, 2796:2, 2798:19, 2803:22, 2806:25, 2807:11, 2818:9, 2823:15, 2830:7, 2832:24 wrote [6] - 2703:8, 2739:15, 2739:23, 2780:7, 2781:10, 2811:13</p>
				X
				<p>XI [1] - 2675:5</p>
				Y
				<p>year [110] - 2678:8, 2685:25, 2686:8, 2686:13, 2687:7, 2687:15, 2688:15, 2697:17, 2697:19, 2697:21, 2713:8, 2713:15, 2723:22, 2724:8, 2727:2, 2727:15, 2728:9, 2729:13, 2729:14, 2730:12, 2730:20, 2731:25, 2739:18, 2768:15, 2783:4, 2783:5, 2783:7, 2783:10, 2783:25, 2784:7, 2784:11, 2784:17, 2784:20, 2785:2, 2785:11, 2786:9, 2786:21, 2787:1, 2787:5, 2787:6, 2787:8, 2787:12, 2788:8, 2788:9, 2788:12, 2789:11, 2791:3, 2792:4, 2800:21,</p>

2800:22, 2801:1,
 2801:6, 2801:9,
 2802:12, 2802:16,
 2803:24, 2805:8,
 2805:12, 2805:20,
 2806:1, 2806:15,
 2807:10, 2807:24,
 2808:12, 2808:16,
 2808:20, 2811:10,
 2814:17, 2815:3,
 2823:25, 2826:15,
 2826:24, 2827:5,
 2828:13, 2830:3,
 2830:4, 2837:7,
 2841:9, 2841:14,
 2844:18, 2857:11,
 2860:23, 2863:21,
 2867:25, 2879:18,
 2879:19, 2879:22,
 2880:11, 2880:12,
 2882:5, 2882:10,
 2882:11, 2883:14,
 2885:21, 2887:8,
 2890:16, 2890:19,
 2890:21, 2890:23,
 2891:3, 2891:4,
 2891:20, 2891:21,
 2892:9, 2892:12,
 2892:14, 2892:16
years [56] - 2686:5,
 2686:21, 2688:10,
 2698:11, 2708:11,
 2708:25, 2709:1,
 2719:5, 2719:15,
 2719:16, 2756:21,
 2756:25, 2757:9,
 2760:12, 2760:18,
 2767:3, 2783:8,
 2783:11, 2783:19,
 2783:20, 2784:12,
 2784:14, 2784:16,
 2784:18, 2787:9,
 2807:19, 2808:3,
 2808:4, 2808:8,
 2809:2, 2809:3,
 2810:7, 2810:18,
 2811:4, 2811:8,
 2825:8, 2826:24,
 2827:9, 2827:11,
 2828:2, 2828:3,
 2828:4, 2828:16,
 2835:10, 2835:21,
 2851:8, 2860:6,
 2863:17, 2876:8,
 2889:12, 2891:8,
 2891:25, 2892:6,
 2893:25, 2894:8
years' [1] - 2737:13
yesterday [17] -
 2677:9, 2678:17,
 2680:18, 2686:21,

2687:4, 2688:7,
 2689:7, 2692:7,
 2695:3, 2705:25,
 2711:9, 2714:20,
 2728:6, 2731:9,
 2734:21, 2735:17,
 2766:22
yield [6] - 2827:4,
 2827:6, 2828:12,
 2829:1, 2868:25,
 2878:2
yields [7] - 2826:23,
 2827:8, 2827:11,
 2828:3, 2828:5,
 2828:20, 2877:23
yourself [5] - 2680:2,
 2681:8, 2700:22,
 2745:13, 2809:25

Z

ZACHARY [1] -
 2675:21
zero [5] - 2695:4,
 2789:3, 2789:14,
 2792:5, 2792:21